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Small Scale Forestry in a Changing World

Opportunities and Challenges and the Role of Extension and Technology Transfer

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Organization of private forest owners in Serbia and Bosnia-Herzegovina: socio-economical characteristics and political indicators

Mersudin Avdibegović[1], Dragan Nonić[2], John C. Bliss[3], Milan Mataruga[4], Nenad Petrović[5], Vojislav Milijić[6], Bruno Marić[7]

Abstract

Although creating an interests organizations of private forest owners may be an efficient policy instrument for improving small-scale forest management, private forests in Serbia and Bosnia-Herzegovina are still heavily controlled by public forest administration. This paper analyses the influencing factors and possibilities for organizing private forest owners into their interest associations. The basic socio-economical characteristics of private forest owners are presented (based on quantitative door-to-door surveys of randomly selected private forest owners) as well as organisational perspectives of small-scale forestry development (based on qualitative in-depth interviews of selected forest policy decision makers). The private forest owners in Serbia and Bosnia-Herzegovina live mainly in rural areas and belong to poor and lower educated segment of the population. The most private forest owners hold small-scale properties, often fragmented into several parcels. Private forests are mainly used for domestic fuel wood while the other benefits are of minor importance. The majority of the private forest owners are ready to cooperate among each other and they expect independent interest associations to promote their interests. The preconditions for the formation of private forest owners' associations are quite favourable as the majority of private forest owners are ready to join such an organisation voluntarily under the certain conditions. In both countries, but particularly in Bosnia-Herzegovina, there is a critical mass of entrepreneurial forest owners who support an association of private forest owners. Compulsory membership is

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strongly supported in Bosnia-Herzegovina, while private forest owners in Serbia are quite reserved about this issue.

Key words: small-scale forestry, private forest owners' associations, forest policy
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1 INTRODUCTION

The share of private forests in Bosnia-Herzegovina (hereinafter: B-H) is 19% of total forest area (Avdibegović 2006). In Serbia this percentage is much higher and amounts 52% (Medarević and Banković 2008). Private forests in Serbia and B-H are important natural resource offering different ecological, social and economical benefits to the society and their owners. Together with extensive agriculture, private forests are prevailing factor for development of many rural areas in these countries. Still, private forest owners are mostly not organised in interest associations. One can be astonished by this fact as many European countries have long tradition and positive experiences in organizing private forest owners. Specific social and political conditions as well as relatively long period of planned economy created very powerful public forest administration which implements forest policy measures in both, private and public forests. The great number of private forest owners in combination with small and fragmented forest estates makes the owners believe that their property is not worth much. Thus, private forest ownership issues have been neglected by both, policy decision makers and private forest owners, the fact which is clearly reflected in relatively modest growing stock and annual increment in private forests comparing to state forests.

There is a strong need for socio-political research of private forest ownership problems in countries in transition; particularly having in mind ongoing processes such as privatisation, denationalisation and restitution which might bring this issue quite high in political discussions. The two-year (2007-2009) research project, called PRIFORT, supported by the Austrian Ministry of Agriculture and Forestry, Environment and Water Management in concurrence with the European Forest Institute (EFI), focuses on B-H, Croatia, Macedonia and Serbia with the main objective to reveal the preconditions for the formation of independent interest associations of private forest owners in these countries. As Serbia and B-H share the common socio-political heritage as well as similar development of forest ownership pattern, the comparative analysis of the data from these two countries is presented in this paper. The data could not be obtained without the support of a large number of institutions and their representatives in public forest administration, state forest enterprises, NGOs and forest education and research

institutions. The authors' gratitude goes particularly to professor Peter Glück who was formally PRIFORT project coordinator but at the same time the leading scientist and professional advisor for other participants in the project. Without his dedication and expertise, PRIFORT project would not be completed in a way as it was.

2 METHODS

The interests of private forest owners in Serbia and B-H are not articulated through their interest organizations at the national level. This fact is in contrary with pluralistic group theory according to which interest groups are organised reflection of the society with the various interests of its members (Truman 1951). The issue can be illuminated by applying the Theory of collective action (Olson 1965) which starts from the assumption that activities of organized interest groups result in common benefits or "collective good" for individual members. In this sense, any individual forest owner benefits from the performance of association, even if he/she is not a member of the association. As the number of private forest owners in Serbia and B-H is large, the individual owners behave quite rationally if they do not join the association because they enjoy the benefits anyway. Since the most of the private forest owners argue that due to large number of other private forest owners, their membership does not matter, the voluntary formation of interest association has almost no chance.

In order to get more information about the attitudes of both, private forest owners and forest policy decision makers towards the formation of private forest owners' interest associations, to investigate the preconditions for their formation in a light of interest group theories but also to understand socio-economical characteristics of private forest owners in Serbia and B-H, two different methods of social research have been applied: quantitative door-to-door survey of randomly selected private forest owners (Neuman 2006, Malhotra 2007) and qualitative depth-interviews of consciously selected forest policy decision makers (Miles and Huberman 1994, Glück and Mayer 1996, Silverman 1997, Denzin and Lincoln 2000). The common questionnaire for the survey of private forest owners covers several aspects of the interest group theories drawn from the literature review. In addition, questions on sociological, economical and institutional aspects of private forest owners as well as their attitudes towards private forest owners' interest associations were raised. The random samples at the national level were drawn from overlapping municipalities of highest percentage of forest area and highest share of private forests, based on the data from National Forest Inventories. Eight highest ranked municipalities were identified in Serbia (Svrljig, Knjaževac, Bor, Bela Palanka, Dimitrovgrad, Čajetina, Ljubovija and Gornji Milanovac) and nine in B-H (Berkovići, Ljubinje, Kneževo, Milići, Krupa na Uni, Sapna, Široki Brijeg, Stari Grad and Goražde). In both countries, 35 settlements in these municipalities and within each settlement 10 respondents were randomly selected, yielding a sample size of 350 respondents in total for each country. Close cooperation with local forest administration officials in the field has helped identifying private forest owners in each settlement. The appropriate sample size was computed according to the adequate formula (Malhotra 2007 *ibid*.). The data analysis comprised frequency distributions, cross-tabulation, correlation analysis, cluster analysis, factor analysis and non-parametric tests. Qualitative (in-depth) interviews, designed to understand the attitudes of forest policy decision makers towards the formation of private forest owners' interest associations, were unstructured and nondirective where open questions prevail. The respondents were representatives of institutions which may influence the formation of private forest owners' interest associations (Ministries responsible for forestry, timber trade and commerce, nature conservation, state forest company, private forest owners' associations, Chamber of trade and commerce, environmental NGOs, main political parties, association of forest professionals, hunting association, research institutions etc.). The data analysis was based on the common interview protocol. The most important statements of the respondents were emphasized and representative statements for quotation were specified. In the next phase (generalizing analysis) it was tried to reduce the data by search for commonalities and differences. For this purpose a data display (matrix of topics) has proved useful. It enables the researchers to group types of respondents (e.g. advocates, indifferent, opponents) for further explanation.

3 RESULTS

Roughly two thirds of the respondents in B-H own less than 1 hectare of private forests, so the extremely small-scale estates characterize the private forest ownership pattern in this country. In Serbia, roughly one quarter of the respondents own private forests with the acreage less than 1 hectare (Figure 1.). Only 10% of the respondents in B-H own more than 5 hectares while in Serbia 13% own more than 7 hectares. In addition, private forest ownership in both countries is highly fragmented. Only one quarter of private forest owners in B-H own consolidated forests (forest within one parcel) while two-thirds of private forests are fragmented into 2-4 parcels. Almost 90% of the respondents in Serbia indicate that their forests are fragmented (the average number of individual parcels is 6) while the average size of individual parcel in Serbia is 0,6 ha. The private forest sector in both countries is characterised by a high fragmentation of properties as well as large number of parcels and owners. According to Nonić et al. (2006) *"this unfavourable* *development was fostered by the 1953 Law about Land Maximum and also by the Law on Inheritance which provided for division of forest parcels in smaller pieces without any limitations in minimum areas”*.

In both countries, the percentage of high forests in private ownership is quite low (15-20%) while coppice prevailing. Furthermore, the biggest portion of private forests are either mixed or broadleaved. The percentage of coniferous forests is significantly higher in B-H (13%) comparing to Serbia (only 2%).

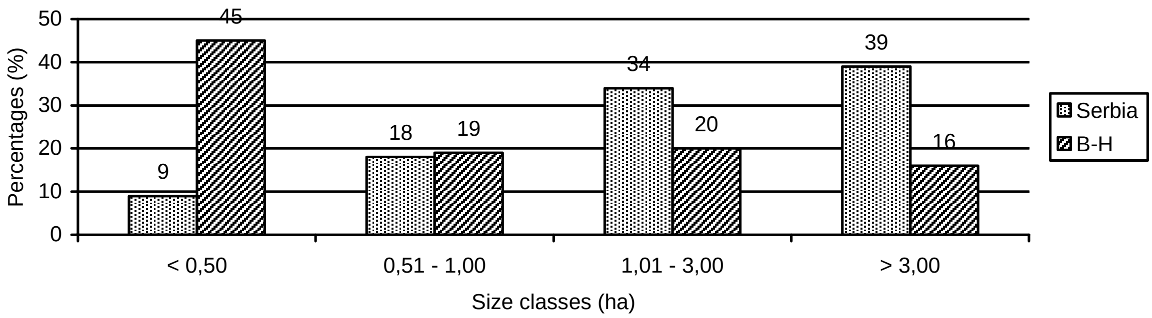

Figure 1: Number of private forest owners in Serbia and Bosnia-Herzegovina according to size classes

Private forest owners in both countries are mainly male. This is probably the consequence of socio-cultural characteristics in Balkan countries where women still rarely share formal ownership rights (particularly on land) with their husbands. The majority of private forest owners are elder people (in B-H one quarter of the respondents are more than 61 while in Serbia almost two-thirds of the respondents are more than 50 years old). Almost 60% of respondents in B-H do not own their forest individually; they usually share it with their closest relatives. Most of the respondents in Serbia are individual owners, while 38% share their properties with parents or other family members. Private forests in both countries are treated as family heritage as they are inherited from ancestors. They are rarely the subject of trade (only 5% of private forest owners in B-H and 1% in Serbia sold their forests during the last decade) and in the most cases will be left to the children of current owners.

Only 3% of private forest owners in B-H live in settlements with more than 5.000 inhabitants. In Serbia, 74% of the respondents live in settlements with less than thousand inhabitants; only 9% live in settlements with more than 20.000 inhabitants. The average distance between owners’ residence and their forest in B-H is less than 4 kilometres while the majority of private forest estates in both countries are within a distance of 5 kilometres. Less than 10% of the respondents in Serbia have their forest on distance over than 20 km from their residence. Private forest owners in both countries belong to rural population which clearly refers to the important role of private forests for economic development of rural areas.

The majority of the respondents belong to low income population (pensioners, manual workers, farmers and unemployed). Only 3% of private forest owners in B-H and 6% in Serbia have college or university education. The majority of the respondents in both countries have either vocational or high school qualifications. In B-H almost one third of private forest owners have only elementary school qualifications or even no formal education at all.

Roughly half of private forest owners in both countries still regard their forests as a gain for their families. The forest's contribution to the household income depends on whether timber is designed for sale or domestic use. In general, the contribution from timber sale is negligible. For one quarter of private forest owners in B-H, fuel wood for domestic use is very important for the household budget. This percentage is double more in Serbia where the average volume of wood harvested in individual private forests amounts 15 m^3 annually. The predominant use of private forests in both countries is fuel wood for domestic purposes. Only 20% of private forest owners are market-oriented by selling either fuel wood or saw logs. Other types of use such as nature conservation, tourism and production of non wood forest products are of minor importance in both countries.

The readiness for cooperation with other private forest owners depends very much on the type of activities. The highest readiness for cooperation relates to forest road construction/maintenance while cooperation in other activities (joint selling forest products, sharing forest management planning costs, sharing harvesting equipment etc.) are not so pronounced (Avdibegović et al. 2010).

Only 20% of the respondents in both countries consider their interests are currently appropriately represented. This explains why the majority of private forest owners in B-H, included in this survey, miss an interest association to support/advice them in managing their forests and lobbying in favour of their interests. Regarding to B-H, the correlation analysis points out that population in smaller settlements and poorer private forest owners express a stronger lack of support from interest associations in both, management and lobbying activities. As concerns advice in forest management as well as interest representation at the national level by lobbying in favour of private forest owner, about 50% of the respondents in Serbia miss an interest organisation of private forest owners. These are mainly those who consider their forest as a gain. The level of private forest owners' understanding of the interest associations' mission, objectives and perspectives is encouraging. The majority of the respondents find the support of the members as the main objective of an association. They also understand that associations should provide different types of services for efficient forest management and represent the members' interests by lobbying different public institutions. The most desired services/support expected from private forest owners' associations are the construction/maintenance of forest roads, advice in silviculture/harvesting, information about legal regulations, preparation of necessary documentation for getting subsidies and information about timber market. Other services, such as forest management training and strengthening entrepreneurship are not pronounced. As concerns lobbying activities expected from private forest owners' associations, the activities such as provision of subsidies, tax breaks/exemptions, acceleration of the restitution process, solving forest land register problems and reformulation of forest legislation are the most desired ones in both countries.

The results show that none of the interviewees in B-H and only 1% in Serbia is a member of private forest owners' interest associations. However, the majority of the respondents in both countries would be prepared to become a member of associations at the voluntarily basis if some economic advantages would be obtained and if associations had positive performances in the previous period. The low level of trust in the public forest administration is underlined by the fact that one third of the respondents in B-H would join the association if they are independent from public forest administration. The lack of interest associations to support private forest owners is emphasized by the fact that one half of the interviewees in B-H are ready to engage themselves in the establishment of such associations. This readiness is not so pronounced in Serbia; only one quarter of the respondents is prepared to participate in the formation of a private forest owners' interest organisation, while two thirds are not prepared to engage themselves. In both countries, those who miss associations for support in forest management and lobbying activities are more ready to play an active role in their establishment.

There is a significant difference between two countries in terms of private forest owners' opinion related to obligatory membership in private forest associations (Figure 2.). Almost two thirds of the interviewees in B-H agree with the idea that obligatory membership in private forest owners' interest associations should be forced by legislation for all private forest owners. The strongest supporters of obligatory membership in B-H are those respondents who miss private forest owners' associations in terms of forest management and representation of their interests. Most of the respondents in Serbia refuse compulsory membership in a private forest owners' interest organisation. In both countries, the supporters of obligatory membership are ready to engage themselves in interest associations' establishment

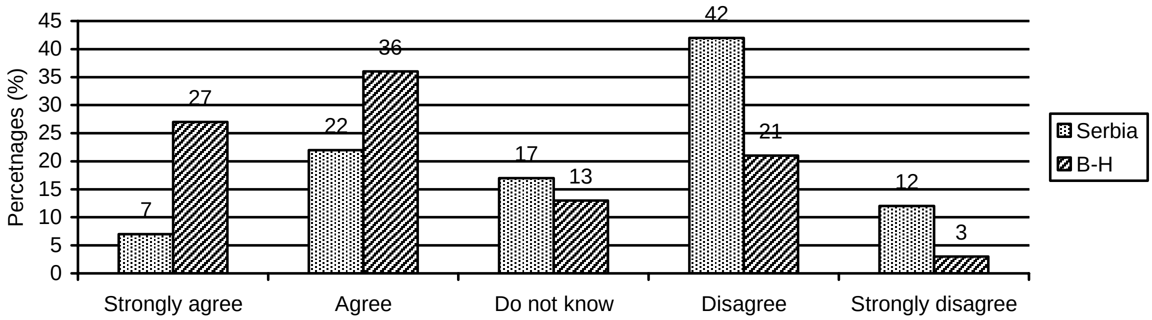

Figure 2: Support of obligatory membership in a private forest owners' association in Serbia and Bosnia-Herzegovina

Cluster analysis in both countries revealed three homogeneous subgroups of private forest owners, called "drivers", "supporters" and "free riders". The biggest cluster of private forest owners in B-H consists of "drivers" and comprises 55% of the interviewees. They strongly plead for an association of private forest owners, they are ready to be engaged in their establishment and support obligatory membership. These are the owners with the relatively largest forest estates who use their forests mainly for domestic purposes, in particular for fuel wood consumption. The readiness for cooperation with other forest owners is expressed in all aspects. The second cluster, called "supporters", consists of 25% of respondents covered by this survey. The majority of them expresses a moderate need for an interest association of private forest owners and is moderately prepared to engage themselves in their formation. Still, they support obligatory membership in private forest owners' interest associations. They own relatively small properties (0,67 ha on average) and find their forests neither a gain nor a burden. The cooperation with other forest owners is desired in road construction/maintenance only. The smallest cluster ("free riders") includes 20% of the interviewees. They do not see a need for establishing of private forest owners' associations. Thus, they disagree with obligatory membership in such associations and express low readiness to play an active role in their establishment. They own the smallest forest properties (0,5 ha on average) and usually do not use them at all. To strengthen the results of cluster analysis, the factor analysis is applied to identify the underlying factors which explain the pattern of variability among the respondents. The following five factors explain about 70% of variability: (1) readiness of private forest owners for mutual cooperation, (2) need for an interest association to support private forest owners in forest management and lobbying for their interests, (3) economic importance of private forests in terms of contributions to total household income, (4) amount of domestic fuel wood consumption and (5) level of private forest owners' education.

Cluster analysis in Serbia identified almost equal size of three relatively homogeneous subgroups of private forest owners. The cluster "drivers" consists of 31% of the respondents. They miss a private forest owners' interest association and expect all possible services from them. Half of them are ready to engage themselves in the formation of an association but only one quarter supports the idea of obligatory membership. They own the largest forest properties; more than one half of them own forest properties larger than 3 ha, but most of them do not want to cooperate with other owners, apart from forest road construction and maintenance. The respondents from this cluster in most cases have high school or university education. Roughly one third (35%) of the respondents are classified as "supporters". About 60% of them express a need for interest association. Comparing to "drivers", they express lower readiness for an active engagement in the establishment of an association (36%). On the other hand, more than half of them support the idea of obligatory membership. They possess 1-3 ha of forests and are ready to cooperate with other forest owners in sharing harvesting equipment and road construction and maintenance. The respondents from this cluster have mainly high school qualification. The remaining third (34%) of the respondents belong to the homogeneous subgroup called "free riders". The majority of them do not express a need for private forest owners' associations; they do not want to be actively involved in their formation (93%) and are against obligatory membership (70%). The lower school qualification prevails. Factor analysis identified the following four basic factors, which explain almost 63% of variability: (1) readiness of private forest owners for mutual cooperation, (2) amount of domestic consumption of timber and fuel wood, (3) need for an interest association to support private forest owners in forest management and lobbying for their interests and (4) whether forest property is a gain or a burden to forest owners.

In order to understand the attitudes towards the formation of private forest owners' interest associations, the focused interviews with the representatives of forest policy decision makers (ministries responsible for forestry and nature protection, public forest administration, public forest companies, private forest owners' associations, chambers of trade, hunters and forestry professionals associations, forest research institutions, private forestry enterprises and political parties) were conducted. After the analysis of the answers, the respondents were grouped as advocates, indifferent or opponents, according to their attitudes towards the formation of private forest owners' interest associations.

The representatives of forest policy decision makers in both countries unanimously support the formation of independent interest associations of private forest owners in order to articulate their interests and represent them in forest policy processes. Still, some obstacles for establishing independent associations (e.g. negative experiences with agriculture cooperatives during the period of socialism, lack of knowledge and initial means, huge number of private forest owners with different interests etc.) were identified. As concerns the membership, the majority of the respondents in Serbia believe that creating a voluntary forest owners' associations might be the most appropriate approach to strengthen the interests of private forest owners. The potential incentives for successful voluntary associations such as training of private owners, an adequate subsidies and initial support for the establishment of associations are also identified. In B-H, the representatives of forest science and public forest administration at all levels do not believe that voluntary membership is a realistic option while the representatives of political parties (both, right and left ones) as well as the representatives of private forest owners' associations have the opposite opinion. The fact that private forest owners represent a huge and quite diverse group of individuals with different interests is the strongest argument against voluntary membership. On the other hand, the advocates of voluntary membership in private forest owners' associations believe it is possible if there are a favourable institutional/legislative framework and an adequate support by the public forest administration. The majority of the representatives of forest policy decision makers in B-H (public forest administration, public forest enterprises, political parties, forest science institutions, associations of forestry and wood processing professionals) support the idea of compulsory membership in private forest owners' associations and find it possible. They argue this is the modality to establish a strong public-private partnership, to offer equal possibilities to all private owners in B-H and to secure their active role in forest policy processes. However, there are some serious obstacles for compulsory membership, such as mentality/psychological barriers, poor understanding of the concept among private forest owners and lack of political willingness among those parliamentary parties that count on rural population votes. There are also a lot of preconditions for obligatory membership that are identified through the interviews with the representatives of forest policy actors. These are as follows: free of charge membership, pilot projects in order to evaluate impacts of such an approach and implementation of strong education programs for private forest owners. There is a big difference in the respondents' opinions about the issue of compulsory membership in Serbia. Although the representatives of the majority of institutions (public forest administration, public forest enterprise, political parties and forest science) agree that "there is a possibility of establishing such an association if the lawmaker decides to do so" and this may strengthen the position of private forest owners in forest policy discussions, they claim that "such a solution will demand the formation of a new institution". The mentality, possible refusal of imposed obligations and bad experiences with similar institutions are identified as the major obstacles for compulsory membership in Serbia.

4 DISCUSSION

High fragmentation of forest properties, large number of forest parcels and forest property shared among family members are the basic characteristics of private forest properties in Serbia and B-H. The small-scale ownership pattern together with unfavourable silvicultural characteristics determines relatively poor economic potentials of private forests in both countries. Significant percentage of estates with more than one owner as well as high fragmentation imply "forest management communities" as the reasonable approach for sustainable private forest management. Although the majority of private forests have no distinctive economic position in the timber market (producing mainly fuel wood for domestic use), economic interests of private forest owners still prevail. The entrepreneurial spirit of those owners, who count on their forests as an important source of household income, might be a favourable precondition for their active involvement in the formation of interest associations. The cluster analysis in both countries revealed three homogeneous subgroups of private forest owners among which so called "drivers" (who support the formation of an interest association and express readiness to be engaged in their establishment) amount significant portion of the interviewees.

There is a strong need for an institution endowed with a clear mandate and sufficient capacities to advise private forest owners in managing their forests and lobbying for their interests. This is underlined by the fact that the majority of private forest owners believe that their interests are not appropriately represented. Of course, the formation of an interest association needs specific preconditions due to the large number of private forest owners with different characteristics and interests. Limited financial and human resources of private forest owners seriously undermine the successful establishment of voluntary interest organisations, unless they get support from the public forest administration.

The forest policy actors in both countries support the formation of independent interest associations of private forest owners in order to articulate their interests in forest policy processes. The absence of interest associations of private forest owners is recognised by the representatives of public forest administration as an obstacle for the implementation of a consistent forest policy in private forests. By establishing interest associations, they believe a dialogue based on partnership between private forest owners and public forest administration can be established. Still, a lot of obstacles for establishing interest associations of private forest owners such as different and heterogeneous interests among private forest owners, lack of information on advantages of associations and negative experiences with agricultural cooperatives during the previous socialism period are identified. Obviously, there is a declared political will to support the formation of interest associations but it is not sufficient for the voluntary formation of independent private forest owners' interest organisations.

There is a critical mass of private forest owners in B-H who are ready to engage themselves in the establishment of such associations and support the idea of compulsory membership. They believe that obligatory membership will increase political power of private forest owners and better promote their interests. Besides, the majority of forest policy decision makers recognised mandatory membership as a promising approach to improve the situation in B-H private forestry. As concerns Serbia, the most of forest owners are not prepared to engage themselves in the establishment of private forest owners' associations and they are against of obligatory membership. Almost all respondents consider that the best option for private forest owners' associations is a voluntary approach, but they claim that this can be done only if some selective financial initiatives are provided as a precondition. Still, the most of the representatives of forest policy decision makers agree that even an obligatory membership approach for private forest owners' associations is possible and applicable under Serbian circumstances. Those in favour of this solution claim that an obligatory approach can be convenient because it provides an opportunity for representing all forest owners, and the owners' voice will be much stronger. Nevertheless, the main opponents of the obligatory approach are the representatives of local forest owners' associations, which are against all forced solutions and additional expenses. Such a result is probably the result of bad historical experiences with obligatory cooperatives from the period of socialism.

The crucial challenge in organizing the interest organisations of private forest owners is how to find an appropriate balance between governmental control and encouragement of private initiatives. This study shows positive attitudes of policy decision-makers towards shifting from state control to collective initiatives. They understand that the new forms of partnership management involving forest owners and public forest administration would promote sharing rights/responsibilities but also help private forest owners to get around problems of exclusion. There is empirical evidence that the attitudes of forest policy makers in B-H and Serbia have changed in favor of private forest owners' association. The formation of private forest owners' associations certainly brings about a new distribution of power in the forest political arena and might increase accountability, responsiveness and legitimacy of forestry in these countries but much still depends on the ruling policy makers to devolve responsibility to private forest owners' associations (Glück et al. 2010).

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Knowledge transfer and forestry extension in privately-owned forests in Catalonia (NE Spain): the model of the Forest Ownership Centre

Teresa Baiges[1], Juan Luis Abián, Teresa Cervera

Abstract

The Forest Ownership Centre (*Centre de la Propietat Forestal*; CPF) is the referential administration in the promotion of the management of private forests in Catalonia in accordance with the Catalan Forestry Law (1988). Private forest estates account for 76.9 % of the total forested area of Catalonia (approx. 2 million hectares). The CPF stands as a "bridge-type" forest administration where public servants, researchers and forest owners can find a common working platform. One of the main objectives of the CPF is the promotion and improvement of forest management practices and forest products through actions of advice and knowledge transfer.

Since 2004 the CPF has implemented two main schemes in which to frame its extension and technology transfer actions: The Knowledge Transfer and Innovation Plan (PITT), and the Programme for the extension and monitoring of forest management. After 5 years, an evaluation of both schemes has been undertaken. This evaluation has highlighted the importance of the Collaborative Innovation Model implemented, which is based upon a "Network of Experimental and Example Forest Sites" (NEEFS). It has also shown the success of using optimization measures to improve knowledge uptake for forest owners, namely clearly established forestry mediators and, the use of few and clear transfer instruments.

Key words: Forest management plans, forest owners, small-scale forestry, forestry innovation
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1 INTRODUCTION

1.1 FORESTS AND FORESTRY IN CATALONIA

Catalonia is a federal region of Spain located in the Northeast of the Iberian Peninsula (40º34´ to 42º26 N and 0º10´ to 3º10 E). It hosts 7.000.000 inhabitants and has Barcelona as the main city. It is administrated by the autonomous government of Catalonia (G*eneralitat de Catalunya*) which has full competences on forest management.

Figure 1: Location of Catalonia in Europe

With the exception of the south-western plains of the Ebro basin, Catalonia is a highly mountainous region, with the Pyrenean ranges in the North, and the Littoral ranges limiting the Mediterranean cost. The dominant climate is Mediterranean with a wide array of local microclimates depending on the altitude, continentality and topography. These two facts – difficult topography and Mediterranean climate – shape the Catalan forestry sector.

Forest surface in Catalonia accounts for almost 2.000.000 hectares, 1.5 million of which are covered by trees. Forestry areas cover 60 % of the total area of the country, a percentage comparable to that of the most forested countries in Europe (Finland, 73,9 %; Sweden 66,9 %; FAO, 2009). Despite this, two main factors must be considered: i) 40 % of the tree-covered area has been incorporated in the last 30 years due to depopulation of the rural areas, this meaning unmanaged high-tree-density young stands or scrubland; and ii) most of the forest communities are Mediterranean forests. This - which could be considered as wealth due to the scarce presence of large stands of this kind of forests in the Mediterranean basin – implies as well low productivity and, consequently, no (or inadequate) management. Both aspects lead to a high wildfire risk.

Because of this, the promotion of (sustainable) forest management is seen in Catalonia as the unavoidable previous step if forests are to be conserved. Thus, for the last 20 years, all governmental efforts have been directed to incentivise and support forest management. This promotion is becoming more and more urgent in a scenario of low profitability of productive forestry and increasing demand for social (and ecological) uses of forests.

Forestry in Catalonia can only be understood under the multifunctional forestry paradigm, which relies both, in multiple forest products (mainly timber, cork and biomass for energy, but also pinions and mushrooms) and forest services (mainly recreation and conservation, but also water cycle regulation and carbon storage). Moreover, silviculture in Catalonia has to compulsory integrate risk management issues (above all fire risk, together with an enhancing risk of drought and extreme events forecasted under a climate change scenario) as well as biodiversity conservation issues.

In a region such as Catalonia, where private forest estates account for 76.9 % of the total forested area, this paradigm shift (from *traditional* productive silviculture to a more complex multifunctional silviculture) can only be achieved with the intimate collaboration - and understanding - between the public administration and the forest owners, especially when the economic context is as negative as the present one.

1.2 THE BACKGROUND: A MODEL OF CO-RESPONSIBILITY BETWEEN FOREST OWNERS AND PUBLIC ADMINISTRATION

The concept of co-responsibility between forest owners and public administration for the management of the Catalan forests, became already manifest in the negotiation process for the Catalan Forestry Law (1988), in which forest owners played a relevant role. The model for co-responsibility was the route to follow and the agreed formula for doing this was built upon two basic pillars: i) the creation of a new governmental forestry body: the Forest Ownership Centre – inspired by the French model – in which stakeholders participation is guaranteed by a governing council that provides forest owners with majority representation, and ii) the promotion of forest management planning, via the incentivised production of Forest Management Plans (IOF), understood as an agreement between the forest owner and the community.

1.2.1 The Forest Ownership Centre

The Forest Ownership Centre (*Centre de la Propietat Forestal*; CPF) is nowadays the referential administration in the promotion of the management of private forests in Catalonia in accordance with the Catalan Forestry Law. It was set up in 1988, as a body governed by public law with its own legal identity, first attached to the Catalan Ministry of Agriculture and, later on, to the Ministry of Environment. The CPF stands as a "bridge-type" forest administration where public servants, researchers and forest owners can find a common working platform. It has competences on regulating, managing and providing support for private forest owners. One of the main objectives of the CPF is the promotion and improvement of forest management practices and forest products through actions of advice and knowledge transfer.

The functions of the CPF, as stated by law, are:

- Encouraging sustainable forest management by means of forest planning instruments and advising on the practical application of specialised knowledge of forestry.
- Providing technical and financial support for the drawing up of Technical Forest Management Plans (IOF) and other planning instruments.
- Calling for, processing and making final decisions on applications for subsidies for sustainable forest management, designing plans and projects for forestry work, supervising the recovery of areas affected by disasters, and taking out insurance policies for forest fire and civil liability.
- Promoting forestry practices and technology transfer in the sector.

1.2.2 The Forest Management plans (IOF)

The Forest Management Plans were designed as a planning tool to favour sustainability of forest management at forest estate level, which, in turn, could be very effective in facilitating the implementation of government forest policies throughout the region.

Their production is voluntary for the forest owners, but holding a forest management plan provides the forest owner with various benefits (box 1) which makes them attractive.

Table 1: Benefits of holding a IOF for the forest owner.

Benefits regarding forest management	**Tax and financial advantages**
IOFs provide better knowledge of the possibilities of the forest estate. Decision making is rationalised. They help the forest owner to consider the estate's development in the medium and long term. They set objectives from a multi-functional view-point. They make it possible to assess economic potential of woodland areas.	Holding an IOF gives applicants priority when requesting subsidies. Holding an IOF gives entitlement to a number of tax advantages: - Exemption of the *Personal Income Tax* (IRPF) and the *Property Tax* (IBI); - 95 % of the valuation of the estate is excluded from the assessment of the *Inheritance Tax*; - Subsidies are excluded from taxable income.

1.3 THE NEED FOR A STEP FURTHER IN INNOVATION AND EXTENSION

From the creation of the CPF and the setting up of the IOFs, forest planning at estate level has gone through very different stages. The first stage, from 1988 to the mid-nineties was a true "extension stage" with the training and informing of owners, CPF technicians, and outsider forestry technicians, on the role of the CPF and the new model of Forest Management Plans.

The second stage, from the mid-nineties to the year 2000, was the "growth stage" with a significant increase in approved plans, accentuated by the agreement to plan the restoration of the forest estates burnt in the big wildfires of Central Catalonia in 1994 and 1998, through the production of Forest Management Plans.

In the beginning of the 2000 first decade, a new stage was initiated, in which the IOF model was consolidated as an underpinning instrument for private forest management planning in Catalonia. For this consolidation to succeed, two main factors were inextricable: i) The 1999 Law on the Forest Ownership Centre came into force, which gave it a great deal of administrative autonomy, transformed it into a public company and delegate it full administrative powers over private forests and promotion measures, and ii) the CAP policy

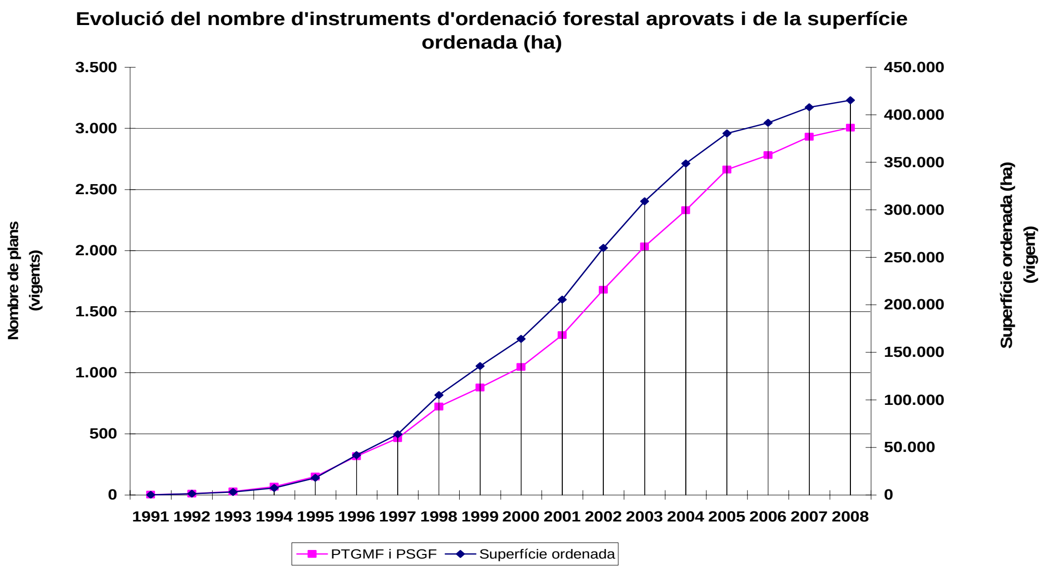

Figure 2: Evolution of the number of approved forest planning instruments and of the area planned with a IOF (hectares), at December, 31st, 2008.

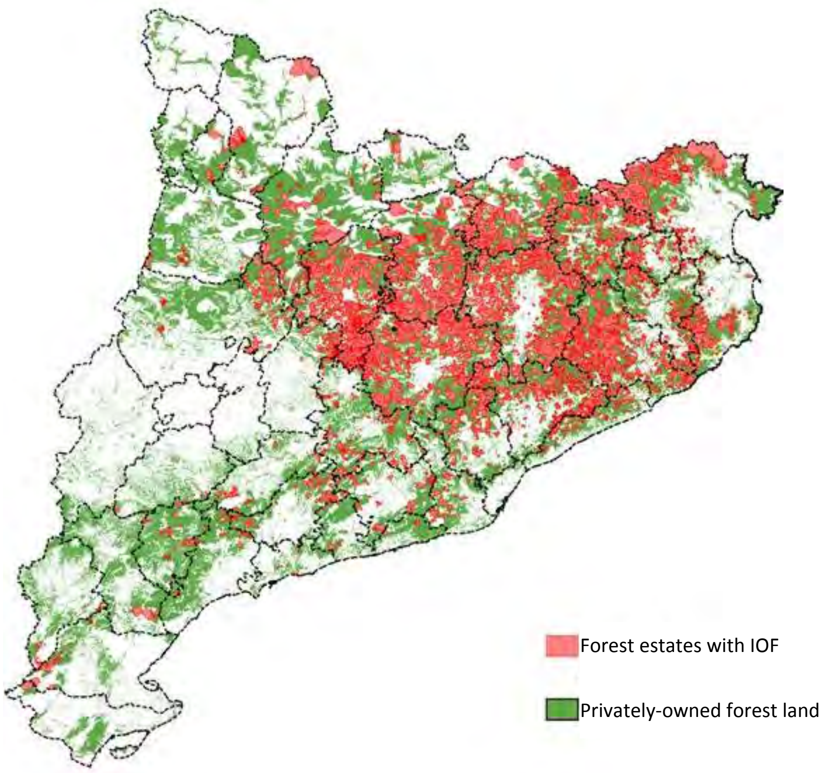

Figure 3: Map of private forest area planned with a Forest Planning Instrument (IOF), at December, 31st, 2008

In these years, over 2.000 IOF were approved, representing 250.000 hectares (20 % of the private forest surface). These figures are notable considering that all planning efforts were made in the absence of a level of intermediate planning to provide technical direction and coordinate with other planning instruments (fire prevention, landscape, hidrology…).

Nonetheless – and despite the number of forest technicians in the CPF had grown from 3, in 1990, to 37 in 2003 - this rapid growth brought as well a concentration in "ordinary work" (approval and follow-up of IOF and grants' management), which lead to less resources being allocated to innovation, advice and knowledge transfer activities. At the same time, concern was growing on the real implementation of the IOFs in the territory after they were approved.

In 2004, with the aim to promote better implementation of the IOFs on the territory and better adaptation of innovative silviculture practices, the CPF decided to structure its extension and technology transfer actions through the implementation of two new schemes:

I. The Knowledge Transfer and Innovation Plan (PITT), and
II. The Programme for the monitoring of forest management

In this paper, we describe the two schemes and report main results and findings obtained in the first 5 years after their implementation.

2 METHODOLOGY AND MAIN RESULTS

The special characteristics of the forestry sector (long-term products, production of non-marketable services from which the sector cannot benefit, etc.) make it dependant, on an external R+D+I system. Plus, the size of the Catalan logging companies and sawmills – often too small to invest in research –, the existing restrictions of use and the low degree of association, hinder the definition and financing of forest research by the sector. Property size and working time devoted to forestry have already been highlighted as the two biggest constraints for innovation in small-scale forest holdings (Rametsteiner and Bauer, 2005).

Because of this, in the Catalan forestry sector, the 3 existing actors in the process of Information, Knowledge and Technology (IKT) Transfer - the IKT creators, the IKT disseminators and the IKT users – are clearly separated and can be easily identified (fig. 4).

Due to its special structure and its extensionist vocation, the CPF could be clearly identified as a disseminator and an innovation facilitator, although its service portfolio is wide enough to allow space for it to be and IKT creator as well, specially when it comes to planning instruments and support technologies for forest management planning as well as to forestry statistics.

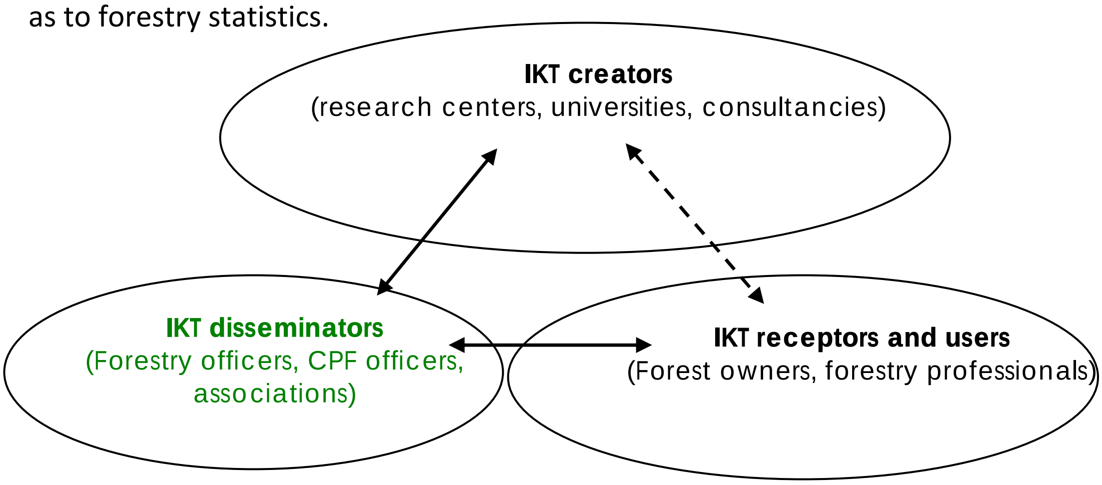

Figure 4: Diagram of the forestry IKT transfer process in Catalonia and the actors involved

This function of "connection" is specific to the CPF and has been recognised and demanded by all parts, something that we wanted to take advantage of with the implementation of the Innovation Plan and the Programme for the extension and forest monitoring described blow.

2.1 THE TARGETED USERS

The targeted users of the two schemes implemented are the forest owners and the forest professionals, this latest seen as well as a means of innovation diffusion.

The number of forest owners in Catalonia has been estimated in 264.747 (Farrero and Baiges, 2009) of whom 11.932 (4,5 %) have holdings of over 25 hectares (corresponding to 1.000.000 hectares; 70 % of the private forest area). Of them, more than 3.000 have a IOF, accounting for 450.000 hectares. Over 220.000 forest owners have holdings of less than 5 hectares.

A rough classification of the forest owners in Catalonia was done based on the insights gained in the studies on forest owners' motivations, conducted in Denmark (Boon and Melby, 2007) and central Europe (Rametsteiner and Bauer, 2005). Three main focus groups were identified:

1. The big production- oriented forest owner

2. The small part-time classical forest owner

3. The absent /indifferent forest owner

We assumed that the majority of forest owners in groups 1 and 2 have holdings bigger than 25 hectares (probably higher in group 1). Regarding forestry planning, we assume that the majority of group 1 has an IOF, while in group 2 only some have an IOF, and in group 3, very few of them have.

For disseminating innovation, groups 1 and 2 were targeted (the "active" forest owners), although no difference was made between them. For the extension programme, the targeted users were those in group 1 and 2 that were within an area selected for being the most "productive" one (see chapter 3).

Motivating the absent/indifferent forest owners was not considered in the two schemes detailed here.

2.2 THE KNOWLEDGE TRANSFER AND INNOVATION PLAN

Because of the sector structure described above, we believed that the Centre's PITT should inextricably be based on the theory of **Collaborative Innovation**, which is defined as "an externally focused approach to innovation and problem solving, that relies on harnessing the resources and capabilities of external actors to amplify or enhance innovation speed and innovation outcomes" (Nambisan, 2008). One key element of this process is the mutual learning amongst all actors and the collective innovation in the identification and solution of problems.

Planning and first outline of the plan was done by the CPF Knowledge Transfer Unit - which was especially created for this purpose - but the final Plan was closed after a participative process involving two stages:

- Internal participation. Personnel of the CPF could discuss both the structure and the contents of the Plan, through a series of meetings with the heads of the different Units. All the forestry professionals working in the CPF were consulted via e-mail.
- External participation. Two levels of participation were set: collaboration of innovation public bodies was sought to define the plan structure, and forestry experts were approached to define the plan contents.

As shown in table 2, the level of external participation differs regarding the different phases of the plan (planning, implementation and evaluation). The control over the plan is always in CPFs hands, keeping in mind that the CPF governing council provides the forest owners with majority representation.

Table 2: Degree of external participation in the different phases of the Innovation Plan

		Degree of external participation - +			
		Information	**Consultancy**	**Collaboration (Agreement/Contract)**	**Control**
Phases of the Plan	**Planning**		Experts Commission - Forest owners - Forest technicians - Forest research Innovation public bodies		CPF (with the approval of the governing council)
	Implement.	All public (CPF yearly report)	Forestry sector Forest research	Research Centres Consultancies Forestry companies Forestry professionals Forest owners' associations	CPF (with the approval of the governing council)
	Evaluation		Experts Commission Innovation public bodies		CPF

The Technology Transfer and Innovation Plan of the CPF (PITT) was approved in February, 2004, with a lifespan of 6 years.

Three programs were set up to instrument the PITT collaborative actions: i) Promotion of need's oriented research, ii) knowledge transfer actions; and iii) the Network of Experimental and Example Forest Sites (NEEFS).

2.2.1 Promotion of need's oriented research

The first step was to clearly identify users' problems to be solved by the IKT creators. The ordinary work of the CPF on the territory allows for a lot of contact with forest owners and external professionals and so CPF technicians are quite aware of the needs and problems that the users face. Nonetheless, in order to better identify user's research needs and common problems to be solved, we thought it necessary to establish some further mechanism. Thus, representatives of the main stakeholders groups (4 research centres, 2 forestry professional associations, 1 logging association and 3 forest owners associations) were summoned to form the so-called "Experts Commission". The first participatory meeting was held on December the 4th 2003, to draw a first outline of the "research priority topics". A second meeting for evaluation was held on June, 2007.

Selected research topics in the first meeting were fixed for the lifespan of the Plan. The concrete research actions (projects) to be undertaken each year had to fit in these topics, and they could be proposed by the CPF itself, by the research centres or by the forest owners though the ordinary communication channels with the CPF. A list of accepted projects was produced at the beginning of each year by the CPF.

Research promoted by the CPF could be carried out by public research centres (CTFC, CREAF, others), universities or private consultancies. The CPF finances all the research and is the intellectual owner of the findings. In the case of the public centres and Universities, the legal relationship between them and the CPF is done through formal agreements. In the case of private consultancies, an open call is made where at least three applications have to be evaluated. Relationships with external partners are one-on-one type. Projects are contracted in an annual basis for it eases all the administrative procedures compared to pluriannual projects.

During the period 2004-2009, 44 projects have been commissioned to different IKT creators, which accounts for a mean of 7 projects per year. Regarding the budget only 55 % of the approved budget was finally executed, showing the existing difficulties in maintaining the R+D+I budget in the whole of the CPF budget.

Table 3: Number of projects and investment (€) per priority area. Period 2004-2009

Priority area	TOTAL (€)	%	Projects	%
Planning and forestry	**627.040**	44	**10**	23
Productive functions	**341.960**	24	**16**	36
Forest health and vitality	**164.157**	12	**7**	16
Biodiversity	**163.450**	11	**5**	11
Multi-functionality	**36.937**	3	**2**	5
Forest Technology	**79.300**	6	**4**	9
TOTAL	**1.412.820**	**100**	**44**	**100**

48 % of the projects (63,2 % of the budget) were carried out by the Technological Forestry Centre of Catalonia (CTFC). The CTFC is the referential public institution for applied forestry research in Catalonia which has a particular portfolio of services covering both research and consultancy services. Private consultancies were the second IKT creator with 20 % of the projects and 16 % of the budget).

Table 4: Number of projects and investment (€) per IKT creator. Period 2004-2009

IKT creator	TOTAL	%	BUDGET (€)	%
CTFC	**21**	**48**	892.970	63,2
CREAF	**4**	**9**	107.270	7,6
IRTA	**4**	**9**	91.000	6,5
UNIVERSITIES	**4**	**9**	83.980	5,9
CONSULTANCIES	**9**	**20**	226.200	16
CPF	**2**	**5**	11.400	0,8
TOTAL	**44**	100	**1.412.820**	100

2.2.2 Knowledge Transfer actions

Before the implementation of the PITT, the CPF used already different means of IKT dissemination, mainly publications and technical visits, but they were far too diverse and had no continuity in time. After an evaluation of the previous work and a literature review we decided to concentrate the innovation diffusion efforts on:

- Two technical publications: fact sheets (peer-revised) and guides/handbooks.
- Study/demonstrative visits (mainly based on the "good examples" developed through the NEEFS, see below).
- The CPF Journal "Silvicultura".
- The CPF website
- Forest extension professionals (internal and external)

Regarding publications, there are more than 4000 subscribers to the "Silvicultura" journal and 182 to the technical fact sheets (started in 2007). Guides and handbooks are distributed to those that demand them (approx. around 500).

Forest extension professionals are a key element - as explained below in "the extension and monitoring programme" - and are considered both a target and a diffusion channel. External forest extensionists are approached through the same means as forest owners. . In Catalonia, external forestry consultancies are not financially supported by the government (as they are in agriculture) but they are offered specialised courses. Internal forest extensionists are informed through internal meetings and courses.

Although many forest owners belong to an organisational affiliation we decided not to use them as a priority mean of communication. We collaborate with them through their diffusion means (i.e organising study visits) but still, we wanted to disseminate all results from the research promoted by the CPF through our own channels, as we wanted the users to perceive them as the "official channels".

Internet resources require an active attitude from the forest owner, which we believe is not generalized. Nonetheless, main research outputs (reports and publications) are set online in the CPF website. Mass media were considered only useful to raise awareness towards a topic, but very limited to change behaviours and attitudes and, thus, they were not used for the purpose of the Plan.

Table 5: Total number of transfer actions carried out by the CPF. Period 2004-2009.

	KIND OF ACTIVITY	NUMBER
Publications	**Technical fact sheets**	**3**
	Handbooks/guides	**7**
	Papers in the CPF-journal "*Silvicultura*"	**12**
	Papers in other journals	**2**
	Courses/lectures	**6**
Communications	**Technical field trips**	**8**
	Communications in Congresses	**13**
	External informative meetings	**1**

2.2.3 Network of Experimental and Example Forest Sites (NEEFS)

The use of "good examples" was envisaged as a key mean of communication, following the *innovation diffusion theory* (Rogers, 1995 quoted in Boon and Meilby, 2007), which stresses, as well, the role of persuading leaders to promote positive attitudes towards an innovation. Rogers argues that in forestry societies, where the users' profile is similar and suspicious to innovations, the number of leaders must be higher, including those not in the elite. The rationale for selling the innovation must be its compatibility with the established rules.

Based on these three reasons we established the network of Experimental and Example Forest Sites in private forest holdings, which has become one of the plan's basic features. It constitutes a platform for experimentation and demonstrating innovative practices in forestry and silviculture, while keeping them realistic (economically and technically) as well as being a channel for communication between owners, government and researchers.

The Network was first started involving only forest owners and CPF forest professionals (fig. 1.1 and 1.2), but we soon realised the drawbacks of this model: the following up was too time demanding; to obtain sound results the design of the network had to fulfil the statistical research demands; and to enrich the results and its applicability required stronger involvement of all stakeholders, including external researchers.

So, although we kept the first two networks, we started new ones with the collaboration of a third part (research centre, university, fire research specialists, etc). Nowadays the CPF has set up 6 thematic networks, involving more than 40 private forest states (fig.).

1. Tree regeneration:
   1.1 Successive thinning (CPF)
   1.2 Clear-cutting in rows (CPF)
   1.3 Clear-cutting in groups (CPF-UdL)
2. SFM for fire prevention (CPF-GRAF)
3. Broadleaved tree plantations for quality timber (CPF-CTFC)
4. Silvopastoral systems (CPF-CTFC)

Figure 6: Distribution in the territory of the Experimental and Example Forest sites at December, 31st, 2009

One key point for the success of the network is the selection of forest sites, not only from a technical point of view, but especially from the knowledge transfer point of view: the forest owner must be motivated and active, better if it's a leader in the area, and, the forest site must be easily accessible. The formal relationship with the forest owner is done through an authorisation. Annual reports are sent to all forest owners involved.

2.3 THE PROGRAMME FOR THE EXTENSION AND MONITORING OF FOREST MANAGEMENT

CPF forest extensionists were considered a key extension element that deserved a special treatment. After a pilot project carried out in 2003, the advantages of integrating the *extensionist* and the *forestry officer* in the same forestry professional were highlighted, especially if attached to an specific given area. Thus, in 2004, the new role of "Forestry Technical Adviser" (ATF) was created and, with it, a Programme for the extension and monitoring of forest management was designed.

The specific objectives of the monitoring Programme were:

- To offer advice to forest owners in any issue related to forestry, but especially those related to the correct implementation of forestry actions planned in the IOFs.
- To validate the model of the IOF and the real scope of their implementation.
- To manage in an integrated manner all the tasks related to the functions given to the CPF, by means of the ATFs.
- To acquire knowledge on the forestry companies network in the different areas under the Programme.
- To validate the regional forest certification system under the PEFC scheme.

Due to personnel constraints, the implementation of the monitoring Programme was restricted to the 60 % of all planned area[2], meaning a global working area of 244.356 ha, selected for being the area with the highest forestry activity. The elected area comprised 80 % of the whole timber production in private land - *Pinus sylvestris* (39%), *P. nigra* (24%) *P. halepensis* (11 %); *Fagus sylvatica*, *Populus sp*. and *Castanea sativa* (all together 2-3 %) -, 67 % of the firewood production (*Quercus sp*) and 46 % of the cork production (*Quercus suber*). Altogether represents a value of 22,3 M euros.

The area under the monitoring Programme was divided into 9 sectors, which were defined depending on work loads and forest similarity, irrespective of the existing administrative limits (counties). The final election criteria for fixing the limits of the sectors were:

- Amount of privately-owned forest area
- Amount of privately-owned forest area with an IOF.
- Number of IOFs
- Number of grant applications in the last 5 years
- Accessibility: highways and main roads

Figure 7 shows the distribution of the sectors. The average working area of the sectors (corresponding to the privately owned forest area) was 55.696 hectares, 48,7 % of which, had an approved IOF. Each sector had one forestry professional (ATF) attached, which was to be the only forestry mediator for all the forest owners in that given area and was responsible for all matters related to forestry (management plans, grants, advice,…).

2 At December, 31st, 2008, the private forest area with an IOF was 415.416 hectares (28 % of the total privately owned area in Catalonia). The total number of IOF in force was 2.786.

During the period 2004-2008, an average of 136 advising actions per year were carried out in the whole area under the Programme, 51 % of which were related to timber logging, 22 % to construction of new roads, 6,6 % to forest health issues and 9,5 % to construction of new agricultural fields. Within the global number of actions undertaken by the ATFs the advising actions represented 20 % of the actions.

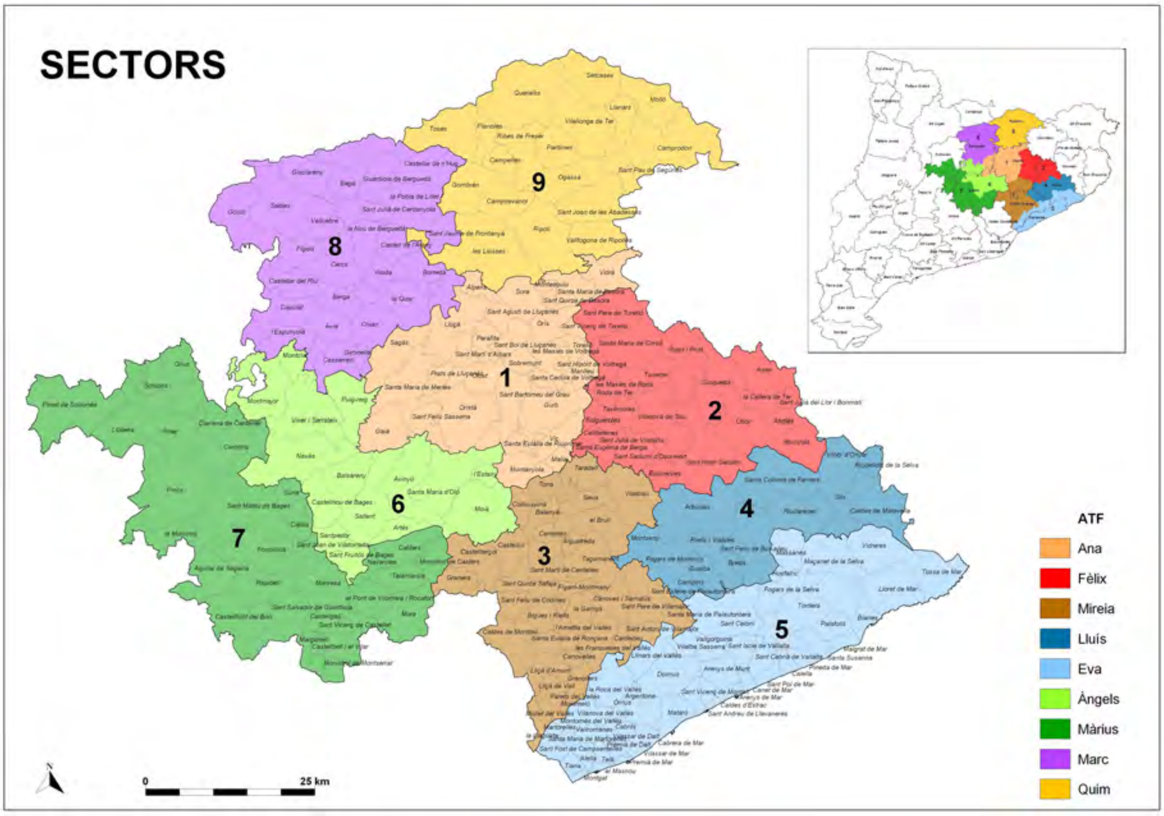

Figure 7: Distribution of the 9 sectors under the monitoring Programme in Catalonia.

4 DISCUSSION

4.1 THE COLLABORATIVE INNOVATION MODEL

The potential of the collaborative innovation model has been well-demonstrated in the private sector in recent years and it is being increasingly used by Government agencies (Nambisan, 2008). The implementation of the Collaborative innovation theory in the CPF has shown its potentialities but there is still a long way to go. Quoting Baur & Kradi (2001): “institutionalising participatory research requires much more than the mere creation of participatory mechanisms. It is dependent on a rather deep change in strategy and approach, thinking and behaviour, and of management tools”.

For collaborative innovation to be real, it is necessary to allocate an open space of potential services and products to be explored together with the users (Nambisan, 2008). A good example of this is the successful development of the project ORGEST (*Definition of multifunctional silviculture itineraries for different tree species*) where a real collaboration between users, researchers and forest officers has been achieved, mainly because the output of the project belonged to one of the strategic guidelines of the CPF (improving forest planning) and expertise from users was regarded as a crucial input.

To enhance this, it is necessary that the innovation plan activities are fully integrated within the institution strategy. Priority areas must be redefined according to the CPF strategy and an extra effort should be made to identify concrete research topics (not broad areas) together with the users. Also, internal participation of professionals from other areas of the CPF has to be enhanced. Some mechanisms have already been established (participation in the plan design and follow up, information in the CPF intranet, suggestion mailbox, annual meeting for proposals, etc.) but, so far, none of them has managed to succeed. The CPF should stress the role – demanded by all stakeholders – of "digesting" the forestry research developed in Catalonia and transferring it to the users and should integrate this role in the institution strategy.

Regarding external collaboration, the CPF has gained considerable experience in one-on-one relationships with external partners, in designing and implementing both research projects and diffusion activities. Nonetheless, there is still a lot of scope to explore in dealing with a wider network of partners. The fruitful meetings of the "Experts commission" reinforce this idea. Many stakeholders demanded these meetings to be set in a yearly basis as there are no other opportunities where researchers, forest owners' representatives and forest officers could meet in the same room to look for solutions to common problems.

The example of the network of experimental and example forest sites (NEEFS) is a good platform for collaborative projects. One of its biggest highlights is that it can facilitate cooperation, both vertical (between forest owners, researchers, and forest officers) and horizontal (between forest owners). According to Rametsteiner and Bauer (2007), cooperation between different forest owners is envisaged as being the most positive factor for innovation. Nonetheless, this model has, as well, drawbacks. Firstly, it is difficult to ensure its continuous follow-up in time. Secondly, the relation with the forest owners has to be continuously fed in order to be fruitful, and finally, the relation with the research centres and the agreement conditions must be very clear so that no "intellectual property" issues arise.

4.2 THE MEANS FOR KNOWLEDGE TRANSFER

The targeted public of the plan were primarily forest owners in group 1 (big production oriented forest owners) and group 2 (small part-time classical forest owners) and forestry professionals.

Regarding technical publications (fact sheets and guides) their low demand (less that 500) may mean that they probably appeal more to forestry professionals and motivated forest owners in group 1. Nonetheless, the return provided by these users is very positive in terms of the reliability of the product.

Probably, it would be useful to have another publication especially designed for those part-time foresters (group 2) that require an easier (less “technical”) mean of communication to inspire them to start or revise their forestry practices.

In the following years, we believe the NEEFS will provide a lot of scope for developing knowledge transfer activities (especially to enrich the technical study visits) towards forest owners and professionals, as already shown by the oldest networks.

In order to optimise and rationalise the knowledge transfer, more effort should be put in the coordination with other extensionist agents (mainly forest owners’ associations and research centres). The collaborative design of new knowledge transfer activities such as seminars, a forestry week, shared website, etc…, involving a network of partners should also be enhanced.

Diffusion of the new knowledge obtained through the innovation projects developed to the scientific world has been numerous (13 communications in 5 congresses) which shows the potential of this kind of research from the scientific side as well.

4.3 THE ROLE OF EXTENSIONISTS

After 5 years of implementation, a SWOT analysis of the “Programme for the extension and monitoring of forest management” was carried out. The outcomes of this analysis (table 6) – together with feedback received through the “Experts Commission” - show having a clearly identifiable forest mediator with the administration (to whom they can phone any time!), is seen by the forest owner, as a real advantage. The CPF extensionists are seen by the forest owners as ambassadors and interpreters of the policy guidelines and new forestry knowledge more than “authority” forest officers. The possible incompatibility between these two functions was a true concern when the Programme was designed.

Table 6: Strengths and weaknesses of the "Programme for the extension and monitoring of forest management"

Strengths	Weaknesses
For the forest owner, there is only one forest mediator, clearly identifiable. It helps acquiring knowledge of the territory, regarding forest stands and forestry sector structures (companies, prices, methodologies applied, etc.). Following up of he IOF provides knowledge on their real implementation. Visiting the forest works, allows for advising on the best way to implement them.	It is difficult to implement the Programme to the rest of the region because the CPF cannot support more forestry technicians, and also because the CPF is centralised in one base in Barcelona which makes the model very time-consuming. To have all the technicians attached to a very concrete area for a long time can be risky for they can lose the global perspective.

One of the main strengths of the Programme is that allows acquiring knowledge on the particular territory where the forest extensionist works (on forestry companies, prices, methodologies applied, etc.), which is a key point in order to establish rapport and build trust with users. Building trust, establishing rapport and learning about the user's environment are three of the seven successful strategies related to Extensionists identified by Johnson *et al.* (2007).

Another successful strategy identified by Johnson is receiving in-service training and leadership development. This is one point that the CPF has to clearly improve especially when it comes to training on the research conducted by the CPF itself. Thus, although the role of the CPF extensionists have been very successful in terms of advising on sustainable forestry practices, it has been little useful for transferring innovations.

Finally, regarding organisational reasons, three aspects aroused: i) the areas designed should fit to administrative limits to allow better information management, ii) the work loads were too high so they had to be redistributed, and iii) the fact that the CPF is territorially centralised is a drawback for it is too time-consuming affecting the Programme's efficiency.

4.4 A LOOK TO THE FUTURE

In order to assimilate the new theory of innovation in the CPF, the *framework for network-based collaborative innovation* defined in Nambisan (2008) could be a good starting point. It gives recommendations on how government agencies can partner with varied externals actors depending on the type of problem-solving role they play in each occasion: innovation integrator, innovation seeker, innovation champion and innovation catalyst.

Meanwhile, new ways of improving both programs are already being explored:

- the creation of a web-based interface platform with two objectives: to facilitate forest owners management of their own forests and to provide, at the same time, reliable data to inform forest management decisions.
- the improvement of the NEEFS members' communication - with a private pre-registration intranet in the CPF website to enhance horizontal cooperation for innovation between forest holdings.
- the participation in European cooperation projects to ensure financing for the follow up of the NEEFS and improve the outcomes.
- the promotion of Collaborative Forest management and the dynamisation of non-active forest areas, to approach forest owners in group 3 (those absent/indifferent) and to enhance horizontal cooperation as well.
- Capacity building of the CPF extensionists by training on innovation issues, improving the internal documentation service and providing them with IT means for teleworking.

5 CONCLUSIONS

The results of the investigation carried out by Rametsteiner and Bauer in Central Europe (2005) show that explicit innovation policies, strategies and programmes that provide systematically innovation support, do not exist for the forestry sector. Catalonia is not an exception. Moreover, in Catalonia forestry policies in general are very vaguely defined and they are given little financial support - only 23 % of the planned operations in the first General Forest Policy Plan (GPFP) of Catalonia 1994-2004 were carried out while the new GPFP is at approval stage since 2006 -.

Nonetheless, the CPF believed it was important to take on concrete action without delay, despite the risk of making errors. The experience regarding the innovation and extension schemes implemented proves this belief was right. After 5 years of their implementation the importance of the Collaborative Innovation Model implemented, has been highlighted, mainly through the strength of the "Network of Experimental and Example Forest Sites" (NEEFS. It has also shown the success of using optimization measures to improve knowledge uptake for forest owners, namely clearly established forestry mediators and, the use of few and clear transfer instruments.

While their impact in the sector is yet to be analyzed, it is already tangible that both programmes have allowed framing the innovation and extension activities into a logical framework that has enhanced their efficacy and efficiency.

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Agroforestry: it's environmental contribution in mitigating climate change in Kalinga Province, Philippines

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Abstract

Agroforestry as a practice in Kalinga Province, Philippines is a tradition that passed from generations to generations and became a way of life to the people of Kalinga. Various agroforestry systems in Kalinga province evidently contributed to the household economy of the farmers while indirectly contributing to forest cover restoration and in mitigating global climate change.

The Agroforestry farming systems in Kalinga represent various crop combinations of farm enterprise, cropping system, livestock, fisheries, forestry, poultry and the resources available to the farmers to raise them for food and for profit. Agroforestry components interact with each other and to their environment without dislocating the ecological and socio-economic balance while attempting to make a profit or provide food for the farmer and the farmer's family. The traditional multistory agroforestry farming system noted to be the most widely adopted agroforestry farming systems in the province of Kalinga with various crop combinations and it diverge from farms of the tribes and the location of the farm as to aspect and altitude.

The upper canopy is composed of light-demanding species and the lower strata composed of diverse agronomic crops that provide food for the day-to-day needs of the people. The diversity index varied as to farm location, altitude, and exposure respectively.

Agroforestry system is a potential carbon sink that absorb CO_2 and has the capacity to accumulate carbon and release oxygen. The investigation showed that carbon storage varies from site, altitudinal zonation and crop diversity.

Key words: traditional agroforestry, crop diversity, diversity index, carbon stock, carbon storage
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1 INTRODUCTION

Kalinga province is a mountainous area in the Cordillera Administrative Region of the Republic of the Philippines with diverse tribal or indigenous cultural communities. These groups practiced agroforestry farming systems which were developed by the tribes themselves. Agroforestry is an age-old practice and considered as an effective land-use management system that combines the production of woody perennials, agricultural crops, animals and other components. The system aimed to increase sustainable production however, in so doing, the farmers also contributed in arresting carbon emissions in the nearby communities.

It is a common observation that as day pass-by, environmental quality decreases. The quality of the air and water continues to decline that leads imbalances of the environment. In some areas, the used to be wet season becomes dry season, prolonged drought/rainy days that sometimes causes flash floods and other environmental catastrophes. This scenario continues to worsen due to the huge possession and use of greater number of vehicles, erection of big factories and industries and continuous burning of domestic and agricultural wastes. The continued depletion of the Philippine forest cover also contributed to warming of the environment. However, with the various forests cover restoration programs of the Department of Environment and Natural Resources (DENR), this scenario could be minimized as it increases the number of plants that will assimilate the unregulated carbon production by vehicles and other anthropogenic activities. The most recent IPCC (2001) assessment report concludes that there is strong evidence that human activities have affected the world's climate. Schimell *et al* (1996) reported that the rise in global temperatures has been attributed to emission of greenhouse gasses, notably CO_2.

It is a common knowledge that green plants absorb carbon dioxide for their normal growth and development. In the Philippine context, the Philippine forest ecosystems have been a sink of carbon. From the 1500s to the modern era, it is estimated that deforestation has contributed 3.7 Gt C to the atmosphere (Lasco, 1998). Of this amount, 70% (2.6 Gt) was released this century alone. However, present land-use cover also absorbs carbon through regenerating forests and planted trees. The vast areas of degraded land in the Philippines in fact offer great potential for carbon sequestration through rehabilitation activities such as reforestation and agroforestry. In the last five years, several studies have investigated the carbon stocks of forest ecosystems and other land cover types in the Philippines (Lasco *et al* 2001; Lasco *et al* 2000). It is in this context that this study was conducted to determine the carbon density stored in the different AF systems in Kalinga province Philippines.

2 METHOD

Preliminary survey was conducted to determine the existence of agroforestry farming systems in the different municipalities in Kalinga. Primary information was obtained from key informants (project in-charge or individual farmers) from government or non-government organizations (GOs or NGOs) through personal interviews. Field visits were also employed to gather first-hand information. The secondary information on the other hand, was obtained from the reports/records of GOs and NGOs involved in the practice of agroforestry.

Allometric equation was used in determining the amount of carbon stored in each AF farming system. Sample plants were randomly chosen following the simple random sampling technique and the corresponding total height and diameter at breast height (dbh) were taken. Selected sample plants were classified based on tree classification sizes such as sapling with dbh of 5.09cm to 10.16cm, pole (10.17cm to 20.32cm) and timber (20.33cm and up). All trees with dbh less than 5.09cm within the stands were deliberately discarded to maintain uniformity of tree species per stand. The data gathered was organized and analyzed by frequency count.

3 RESULTS AND DISCUSSION

Results showed that the traditional multistory agroforestry farming system is abundantly practiced in the province and characterized by at least two vertical canopy layers that are established either natural or artificial means. As described by Lasco (1992), the multistory system of agroforestry seems to mimic the structure of a tropical rainforest with its attendant advantages. The upper canopy is composed of light-demanding species while the lower strata composed of diverse agronomic crops that provide food for the day-to-day needs of the farmers' family. Most of the upper canopy layer was composed of coffee species, citrus species, mango, coconut, rain tree, bagalunga, narra and mix forest tree species.

In the upper municipalities of the Province, the homestead garden multistory system was also very evident in the farmers' house lot. The system is described as a sources of foods, fruits, vegetables, lumber and many others products for the farmers consumption. Usually, the constructed houses are of semi-permanent type and the surroundings or their backyard area are planted with diverse woody crops, animals and cash crops

(Marten 1986, Juo 1989). The area is characterized by complete internal recycling of nutrients and organic matter. Plant species are maintained in ecological balance with livestock to meet human needs on a family farm and also contribute to the income of the farm family. Normally, the area around the house or garden at the backyard is planted in wide assorted crops that require no purchased inputs and only a low level of management. Observation showed that the home garden multistory system comprises as many as 5 to 10 economic plant species which corroborates to the findings of Okigbo and Greenland 1976, Okigbo 1980, and Marten 1986.

The animal component in the home garden multistory system is grown freely around the house and feeding was irregularly given to the animals. The manure of the animals are scattered elsewhere while the litters from the woody vegetation and agricultural crops decomposed naturally and served as organic fertilizers of the garden. The description of the said agroforestry farming systems and its corresponding biomass and carbon stock are as follows:

3.1 INDIGENOUS MULTISTORY SYSTEM

a. Coffee-based multistory system

Coffee plants served as the main woody perennial and as shade component of the agroforestry system. Taro and other shade loving crop species are found in the lower strata of the farming system. This practice is very evident in the upper municipalities of Kalinga. On the average, this system was able to produce a biomass of 619.55kg/yr and a carbon density of 278.80kg/yr.

b. Fruit Tree-based multistory system

Various fruit tree species served as nurse crops to shade loving crops. Fruit tree species are planted in rows while cash crops are planted in between rows of the fruit trees until the fruit trees closes its canopy. When the crown of the fruit trees is closed, the farmers plant some shade loving plant species such as yam and other climbing vines for the family sources of food and income. It was calculated that there were around 450.73kg/ha of above-ground biomass and a carbon density in the stand of 175.78kg/ha.

c. Forest tree species + coffee multistory system

Coffee plantations are established within the natural stands of various forest tree species such as rain tree, narra, bagalunga, dapdap, and other forest tree crops that served as the nurse crop for coffee species. As practiced, the forest tree species are allowed to grow and developed together with the coffee stands. The observation showed that there was greater increase in coffee bean yield planted with nurse crop as compared to open sun coffee stands (Barcellano, 2005). The yield of shaded coffee is better than those in sun coffee areas as practiced in the traditional production system in Ethiopia (www.asic-cafe.org./pdf/abstract/PA604.pdf). Among the various nurse crops used for coffee plantations, the coffee bean yield under narra stands produced better quality and aroma as compared to other nurse crops used. The high yield can be attributed to litterfall production and decomposition and soil organic matter accumulation. Also, the coffee stands with narra as nurse crop showed the highest yield compared to the other nurse crops due to its ability to produce more litter and faster decomposition rate aside from being a nitrogen fixing plants (Dula, 2007; Barcellano, 2005).

Thinning and pruning of rain tree stands was also practiced by some farmers to give more light to the coffee stands especially during the flowering stage. As observed, the presence of nurse crops to coffee stands has a direct and indirect effect on the coffee bean yield. Taller nurse crops produces more litters for the replenishment of soil organic matter needed for the coffee plants. It was noticed that the average above ground biomass was 718.78 kg/yr and a carbon density of 345.85kg/yr.

3.2 RICE TERRACES-FOREST SYSTEM (GINUFAT-PAYAW AGROFORESTRY SYSTEM)

Rice terraces are constructed while maintaining the forest component in the upper portion of the terraces. Usually, the forest provide water supply for the paddies.

3.3 AGRISILVICULTURE SYSTEMS

Agricultural crops are planted in between the woody components of the agroforestry farm. As observed, corn, cereals and leguminous crops are usually planted under the woody plants. As practiced by the farmers, the waste after harvesting the agricultural crops are placed in some corner of the farm until it decompose and use as organic fertilizer of the woody plants and for the agronomic crops during farming season. The above-ground biomass was noted to have 315.93kg/ha and a carbon density of 115.38kg/ha.

3.4 AGROSILVOPASTURE SYSTEMS

In this agroforestry farming system, the three (3) major components of agroforestry are present at the same time in the farm. As observed, most of the tree components are planted along the boundaries of the farm while the annual crops are planted in the area. The animal component on the other hand, is allowed to graze in a controlled manner along the boundary beneath the woody plants. After harvesting the annual plants in the farm, the animals will graze freely in the farm. There are also instances that some of the woody components are planted within the hearth of the farm where the faunal component of the farm grazed and live free under the woody plants. The waste of the animals are left in the farm and served as organic fertilizer of the farm.

The woody component provides shades for the animals and also contributed to the micro-climate amelioration of the farm. It contained an average of 68.96kg/ha above-ground biomass and a carbon density of 39.23kg/ha. The fowls also used the woody plants for them to stay and sleep at night.

3.5 AQUA-AGRISILVICULTURAL SYSTEMS

Fish, agricultural and fruit tree species are the crops maintained in the area. Tilapia is the main fish species while the agricultural crops and fruit trees are planted in the dikes. Aquatic plant (kangkong) is the main plant in the ponds. The woody component composed of 23.72kg/ha above-ground biomass and a carbon density of 19.23kg/ha.

4 CONCLUSIONS

Various agroforestry farming system had been a practice in the province for so many years. The system contributed much to the sources of family income aside from the fresh fruits and meat that it can provide to the farmers. The component of the agroforestry farming system in Kalinga is diverse and unique. The uniqueness is due to its crop combination and it differs from site. Aside from the income that the farmer derived from the farm, the agroforestry farm is a potential carbon sink and the farmer indirectly contributed to the global climate change mitigation.

5 RECOMMENDATIONS

There is a need to have a deeper understanding of the various agroforestry systems in Kalinga to determine its sustainability status. Parameters such as ecological, technological, socioeconomic and yield dimensions shall be use in determining its current sustainability status based on its biophysical components (biodiversity, edaphic, climatic, and physiographic factors using modern technology.

Since agroforestry practice is closely linked to the rural areas, it is vital that an effort be made to educate and inform the people, to give them an understanding of the value of, and prerequisites for, success with the new planting techniques.

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Does forest certification make a difference? – An analysis of non industrial private forestry in Sweden

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Abstract

In the footsteps of national and international environmental debates, and an increasing consumer pressure for sustainable wood and paper products, the Swedish forest land is increasingly becoming certified according to one or more of the schemes developed since early 1990ties. Almost 11 million ha, mainly in state and company owned forest land, are certified according to the Forest Stewardship Council (FSC) standard. On non-industrial private forest (NIPF) land the competing Programme for Endorsement of Forest Certification Schemes PEFC, now covering approximately 7.7 million ha certified forests. This paper focuses on NIPF; raising the questions of whom do certify their forest, and in what way this has influenced their management behavior. The forest owners were categorize with respect to forest certification or not, and female or male, self-active or not, resident or not within these two categories. Irrespective of the forest certification as an consequence of a special management behavior or not, an analysis was conducted to verify if forest owner of a certificated management units and not certificated management units respectively have any characteristic in common. Differences in degree of forest certification, with respect to the size of the management units, gender, self-active and resident, has also been analyzed. Silvicultural and cutting treatments performed on the management units have been categorized compared to forest certification or not. At the conference results regarding activities performed at the forest management units and the private forest owner attitude to forest certification or not will be performed, with respect to different categories of forest owners.

Key words: consecutive data, forest certification, forestry activity, private forest owner
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New opportunities for small scale forestry extension and technology transfer under the climate regime: a study of government initiatives in Central India

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Abstract

The state of Chhattisgarh is a remote Central Indian state with a high Indigenous Population. The local population has small holdings of 2-5 hactares. Due to paucity of irrigation facility a large population still depends on rain-fed agriculture and therefore most of the agricultural area lies fallow for nearly eight months in a year. Moreover, a large part of the holding is unfit for agricultural crop. Thus, a great opportunity exists in putting these large areas under tree crop if proper extension methodologies are adopted. The state of Chhattisgarh has adopted the Joint forest management approach for forest conservation and development and nearly 8000 JFM committees have been formed all over the state. These committees have been allotted 200-500 hacs of forest areas. The Government has also taken a conscious decision to distribute 100% of the Profit accrued from plantation crop under Rehabilitation schemes to the JFM committees

This also opens up a large scope for encouraging small scale forestry on these degraded forest areas which will not only increase forest cover but also satisfy both fuelwood and economic demands of the local population through distribution of profits as per government decisions.

The recent emphasis on CDM projects especially on bundling of small projects has also given ample scope for CDM projects being developed by bundling of several small private and JFM Plantation Projects. The state government has launched the Agro-forestry Policy this year to provide both technology and help in project formulation to attract institutional finances for such projects.

Prakash Industries Limited, a private sector entrepreneur, has provided the way forward by developing a CDM Project under the UNFCCC parameters that is under a very advance stage of registration. The Forest Department has now embarked upon a extension methodology to conduct a series of training camps for training of JFM society members

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and local farmers to undertake plantations and develop CDM projects under the current approved methodologies by the UNFCCC. These training camps will develop spearhead teams to facilitate the local communities. It is also envisaged to have tie-ups with the Banks for Institutional finances for this effort.

Key words: trees on private holdings, CDM bundling projects, REDD & REDD PLUS approach, joint forest management, technology transfer, forestry extension, India
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1 INTRODUCTION

The state of Chhattisgarh, lying between 17 ^{0} 46 ' N to 24 ^{0} 6 ' N latitude and 80 ^{0} 15 ' E to 84 ^{0} 51 ' E longitude, has about 44 percent of its geographical area (135,224 sq. km) under forests The total forest area is 59,772.40 sq kms. These forests of the state are classified into reserve, protected and un-demarcated forests. The total areas under the three categories are

Table 1

R.F.	**P.F.**	**Un-demarcated PF**	**Total**
25,78,216.70	24,03,610.00	9,95,413.30	59,77,240.00

Chhattisgarh provides catchment to at least four main river systems, i.e., Mahanadi, Godavari, Narmada and Ganges. Major rivers of the state are Mahanadi, Indravati, Hasdeo, Sheonath, Arpa and Ib. The climate of the state is generally sub-humid with an annual rainfall ranging from 1200 to 1500 mm.The forests of the state fall under two major forest types, i.e., Tropical Moist deciduous forest and the Tropical Dry deciduous forest. Sal (*Shorea robusta*) and Teak (*Tectona grandis*) are the two major tree species in the state. Other notable overwood species are Bija (*Pterocarpus marsupium*), Saja (*Terminalia tomentosa*), Dhawra (*Anogeissus latifolia*), Mahua (*Madhuca indica*), Tendu (*Diospyros melanoxylon*) etc. Amla (*Embilica officinalis*), Karra (*Cleistanthus collinus*) and bamboo (*Dendrocalamus strictus*) constitute a significant chunk of middle canopy of the state's forests.

2 JOINT FOREST MANAGEMENT

Transforming the public forest management system to enable greater community participation is a complex and challenging task. This can be achieved not only with facilitating legal and administrative changes but more essentially by ensuring the local population is made aware of these initiatives and are encouraged to participate collectively in actually implementing this approach to forest Management. The local population will participate only if they know that the empowerment changes are for their benefit and the effort is towards making them participate not as paid wage earners but as shareholders in the usufruct sharing mechanisms that are proposed. In short, there should be a feeling of ownership in the masses and then only they will whole heartedly participate in the decentralized approach to forest governance.

The movement was started way back in 1995, under the JFM resolution of the erstwhile Government of Madhya Pradesh, under which the present state of Chhattisgarh was placed at that time. The Participatory forest Management resolution was a culmination of the National Forest Policy, 1988 initiative, to introduce and formalize the participatory approaches in the forestry sector.

In order to empower the local communities further, a new forest policy was put into place with the formation of the new state, carved out of the erstwhile state of Madhya Pradesh, in November 2000. The prime objective of this forest policy was to unlock the vast array of forest resources on sustainable basis for enhanced well-being of local people by converting these open access resources (OAR) into community controlled, prioritized, protected and managed resources. The abundant potential of people living in rural and forest areas is being tapped to begin a process of transition from user-centered government managed approach to multi-stakeholder, community based approach. The objective behind this new approach is to empower local communities and make them stakeholders of the forests and not simply user of its products at the mercy of the forest department. This approach has addressed a range of forest management goals, including forest protection and poverty alleviation or economic benefits to community living in/near forests.

The Central Indian State of Chhattisgarh, has put in place such a mechanism by establishing institutions called Village Forest Committees (VFCs), Village Forest Protection Committees (VFPCs) to carry forth this movement. These CBOs have become the grassroots institutions, which hold the key to forest protection and management in the state. The details of the JFM committees established in the state and the forest areas covered till December 2009 are:

Chhattsgarh State: Joint Forest Management at a Glance

Total Number of JFM committees	7887
Total forest area covered	33190 sq kms

Percentage of total forest area	55.52 %
Total members of the committees	2.763 million
Females	1.436 million
Males	1.327 million
Schedule tribes	0.471 million
Schedule Castes	1.521 million
Others	0.771 million

After the formation of the new state of Chhattisgarh in November, 2000, the JFM approach was further strengthened and a new Joint Forest Management resolution was adopted by the forest department in 2002. This resolution had the following salient features -

- Every family of the JFM committees will be entitled to receive Nistar forest produces subject to their availability.
- ll the forest committees shall be eligible to get 100% of the various forest produce obtained from time to time, from mechanical thinning & cleaning of rehabilitated area and cleaning of bamboo clumps in degraded forests as per the prescriptions of micro-plan/working plan, on payment of expenditure incurred on harvesting.
- Forest produces equivalent to 15% value of the amount calculated by (of timber/bamboo) deducting the expenditure (of timber /bamboo) incurred on harvesting from the total value of forest produce or cash equivalent to that, shall be given to F.P.C.
- Forest produces equivalent to 30% value, calculated by deducting the expenditure incurred on harvesting (of timber/bamboo) from the total value of timber/bamboo obtained on final felling in plantation/rehabilitation of degraded forests, as equivalent to that value, shall be given to village forest committee.
- An appeal can be made against forest officer’s order to the union constituted or in the absence of union to territorial conservator with in one month from date of passing of such an order.

There has been an immense response to the above policy changes and over the years the following amounts have been disbursed to these committees as under:

Table 2

Year	Number of Committees	Amount distributed (in million INR)	Disbursement year
2000-01	219	30.80	2003-04
2001-02	358	61.30	2003-04
2002-03	446	82.90	2003-04
2003-04	313	82.00	2004-05
2004-05	415	90.10	2005-06
2005-06	395	97.60	2006-07
2006-07	512	139.30	2007-08
2007-08	391	271.90	2008-09
Total	**3049**	**855.90**	

The committees have been greatly empowered and their members who are mostly indigenous people have now been greatly facilitated by the participatory approach of the forest department and have now become partners in the conservation, protection and development of the forests.

Another major facilitation and empowerment of the local population has come through the implementation of the Forest Rights Act, 2006. The state of Chhattisgarh has been the premier state in its implementation and has distributed 1,04,787 forest rights certificates to the local indigenous people for a total area of 1,17,581 hactares. The state government has also initiated steps to develop the areas allotted to the local people with approach roads development, development of irrigation and other infrastructural facilities.

Yet, inspite of all the good initiatives of the state government, the continued deforestation is a major challenge to forests and livelihood security of the dependent population. The continuously receding understory due to regular fires and intense biotic pressures is also having a major impact on the productivity of NTFPs and medicinal plants- a major source of income to the local inhabitants.

3 METHOD

The answer to these problem can well lie by exploiting the CDM approach under the UNFCCC. This can be done through a collective synergies among sustainable Livelihoods of forest dependent people, the Kyoto Protocol, the Convention on Biological Diversity and other international instruments. Land-management actions that enhance the uptake of Carbon-di-oxide or reduce its emissions have the potential to remove a significant amount of CO_2 from the atmosphere if the trees are harvested, accompanied by regeneration of the area and sequestered carbon is locked through non-destructive (non-CO_2 emitting) use of such wood.

Evidence is now emerging that agro-forestry systems are promising management practices to increase above-ground and soil carbon stocks to mitigate greenhouse gas emissions. The C sequestration potential of tropical agro-forestry systems in recent studies is estimated between 12 and 228 Mg/ha, with a median value of 95 Mg/ha. Therefore, based on the global estimates of the area suitable for the agro-forestry (585–1215 X 106 ha), 1.1–2.2 Pg C could be stored in the terrestrial ecosystems over the next 50 years.

Using agro-forestry systems as carbon sinks, and by designing a suitable emissions trading system, the Kyoto Protocol provides a new source of financial support for protection and management of biological diversity as well as provide a mechanism for the use of wastelands in the possession of these local inhabitants in the state of Chhattisgarh and which are now in their possession after the implementation of the Forest Rights Act can be easily converted to greenlots through afforestation and take advantage of the new Bundling approach. For CDM projects under the Kyoto Protocol

3.1 WASTELAND AGROFORESTRY PROJECT DEVELOPED BY PRAKASH INDUSTRIES, CHHATTISGARH

The path has been shown by the Prakash Industries Limited (PIL), Chhattisgarh while, persuading its group of associate companies, led to an innovative idea of greening the Wastelands, to check the gradually mounting pressures of Global warming; Urbanization and the Population explosion and consequently shrinking of the productivity of our land resources. The company has developed Wasteland agroforestry plantation systems as carbon sinks

The Companies have got together to develop India's first - Reforestation project on the revenue Wastelands of the State of Chhattisgarh (India) (Validation registration code – RA-VAL-CCB-010935 &; the Web address as:
http://www.climate-standards.org/projects/index.html).

The project began in 2002 and will have duration of 20 years. The total area of the project is 282 hectares of the privately - owned tree plantation sites located in Rano; Rano – II; Pendraven; Saleh and Lara, in the districts of Durg; Rajnandgaon and Raigarh of Chhattisgarh state (India).

The project extol a Gold level - Climate, Community and, Biodiversity Alliance (CCBA) Validation norms the verification of which, is recently substantiated (June 29, 2009 to

June 22, 2014) by an internationally accredited & US based agency - M/s. Rainforests Alliance (RA). Further more the project has also been validated by an international accredited agency – M/s. TUV NORD and submitted to UNFCCC (United Nations Framework Convention on Climate Change) for registration, to be on its way as the World's foremost project in its owncategory with the CCBA & the CDM Registrations.

The local farmers' community is also being benefited from the PILs' project

- The project educates about the use of (for instance) improved fallows and hedgerows intercropping strategies &; the Diversifying farm production systems that provide tree products.
- Supplying fodder supplements that increase milk production for dairy cattle.
- Increasing wood energy availability to families from lopped branches.
- Contributing to incomes among small-scale farmers

The project is capable of generating 8000 - 10000 LCERs per annum. As per a project statistics, by the end of the last growing season (2008) from the period of its inception, the same has already generated 229856 Man days of rural employment opportunities; 429.09 MT fodder for the cattle; 585.53 MT fuel wood for the rural house holds besides ample in tangible benefit(s) of Wasteland agroforestry plantation systems as carbon sinks

4 DISCUSSIONS

Understanding the Carbon Markets under the CDM Approach

The following are the eligible activities in compliance market:

Similarly the eligible activities in voluntary market are:

In order to understand it better let us understand some key terms involved in the CDM Carbon market and Carbon Trading:

UNFCCC

The United Nations Framework Convention on Climate Change (UNFCCC or FCCC) is an international environmental treaty produced at the United Nations Conference on Environment and Development (UNCED), informally known as the Earth Summit, held in Rio de Janeiro from 3 to 14 June 1992. The treaty is aimed at stabilizing greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system.

CDM

Clean Development Mechanism (CDM). The CDM allows emission-reduction (or emission removal) projects in developing countries to earn certified emission reduction (CER) credits, each equivalent to one tonne of $\mathbf{CO_2}$. These CERs can be traded and sold, and used by industrialized countries to a meet a part of their emission reduction targets under the Kyoto Protocol. The mechanism stimulates sustainable development and emission reductions, while giving industrialized countries some flexibility in how they meet their emission reduction limitation targets.

Greenhouse gases

Greenhouses gasses, such as carbon dioxide, are gasses in the earth's atmosphere that trap thermal energy and contribute to the greenhouse effect. The greenhouse effect is a natural phenomenon where gases in the earth’s atmosphere trap warmth, almost like a blanket. Although a certain amount of greenhouse gases are a natural part of our environment, indeed they keep us alive, too much makes the blanket so thick that the earth’s temperature rises. This is known as global warming. The most common greenhouse gases are carbon dioxide, methane, water vapour, nitrous oxide, and hydroflourocarbons, perflourocarbons, and sulphur hexafluoride.

$\mathbf{CO_2}$e

Carbon Dioxide equivalent ($\mathbf{CO_2}$e) is the internationally recognised measure of greenhouse gas emissions. It converts the six greenhouse gases covered by the Kyoto Protocol into carbon dioxide equivalents in order to reduce ambiguity over what gas is being referred to and in what amount.

Reforestation

This refers to the restoration and recreation of woodland and forest areas that once existed but were removed or destroyed. Reforestation not only provides a major carbon sink but also provides other benefits including pollution control, watershed management and also wildlife habitat.

Deforestation

Deforestation is the clearance of naturally occurring forests by the processes of logging and/or burning of trees in a forested area. There are several reasons deforestation occurs: trees or derived charcoal can be sold as a commodity and used by humans, while cleared land is used as pasture plantations of commodities and human settlement. The removal of trees without sufficient reforestation has resulted in damage to habitat, biodiversity loss and aridity. It has adverse impacts on bio sequestration of atmospheric carbon dioxide . Deforested regions typically incur significant adverse soil erosion and frequently degrade into wasteland.

Sequester

CO_2 sequestration is the long term storage of carbon dioxide or other forms of carbon in soil or vegetation through biological processes for the mitigation of global warming.

VER

Verified Emission Reductions (VERs) are carbon credits generated in the voluntary carbon market. Examples of VER are Voluntary Carbon Units (VCU) under the Voluntary Carbon Standard and VERs from the Voluntary Gold Standard (VGS). One VER is equal to one tonne of CO_2e.

EUAs

Under the **European Union Emission Trading Scheme** (EU ETS), one tonne of CO_2e is known a European Union Allowance (EUA). It represents the right, to emit the equivalent of one metric ton of carbon dioxide.

Certified Emission Reductions (CERs):

are Carbon Credits issued by the Clean Development Mechanism (CDM) Executive Board for emission reductions achieved by CDM projects and verified by a DOE under the rules of the Kyoto Protocol. One CER is equal to one tonne of CO_2e.

Primary CERs:

are the CERs are which are issued to the project by UNFCCC through the issuance process of UNFCCC and bought from the project developer

**Secondary C
ERs:**

this refers to CERs which are offered with a guarantee of delivery by a rated entity such as a bank or fund. As all project and delivery risk is borne by this entity, as opposed to a standard 'off take contract' with a project, secondary market CERs often command a higher price than those bought directly from a project.

Primary CERs command a lower price than Secondary CERs & EUAs

REDD

REDD stands for **Reducing Emissions from Deforestation and Forest Degradation** (REDD). REDD mechanisms use market/financial incentives to reduce the emission of greenhouse gases from deforestation and forest degradation While initially excluded from the land use, land-use change and forestry sector within the UNFCCC Clean Development Mechanism it is suspected to be part of the successor to the Kyoto Protocol REDD credits offer the opportunity to utilize funding from developed countries to reduce deforestation in developing countries.

Considering that approximately 17% of greenhouse gas emissions originate from deforestation and forest degradation, it is increasingly accepted that mitigation of climate change will not be achieved without the inclusion of forests in an international regime.

REDD activities are undertaken by national or local governments, NGOs, the private sector, or any combination of these. A number of NGOs, development agencies, research institutes and international organizations support developing countries that wish to engage in REDD activities. The World Bank's Forest Carbon Partnership Facility, the UN-REDD Programme, Norway's International Climate and Forests Initiative are such examples. The genuine actors of REDD, however, will be the populations whose livelihoods derive from forests. Indigenous Peoples and forest-dependent communities will be the front liners of REDD, and the success of REDD activities will largely depend on their engagement.

REDD-plus

The Bali Action Plan calls for:

"Policy approaches and positive incentives on issues relating to reducing emissions from deforestation and forest degradation in developing countries; and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries**"** The above paragraph is referred to as **REDD-plus**

The Process of CDM Projects can best be understood by the following figure:

5 CONCLUSIONS AND RESULTS

How the Forest departmental activities can be brought under the purview of the CDM technologies:

The forest department in Chhattisgarh has now a well established Joint Forest Management network with nearly 8000 Committees. Each of these committees has an forest area of 200-500 hacs that has been given to it for conservation, protection and development. Besides, most of these committees are in fringe forest villages that have their own grazing lands and other community wastelands that can be easily taken up for plantations. Even the private holdings of the farmers are not productive for agricultural purposes and can be converted to agroforestry systems through an extensive education and extension programme fully supported by financial incentives for taking tree crops on these wastelands and private holdings. These can be covered under the new '***Bundling approach'*** under the CDM that gives liberty to bundle several small projects and considers it as one project for claiming credits under the CDM.

The new REDD and REDD Plus Approach also gives the Government an opportunity to take the credit of the long term conservation of the forest areas allotted to the JFM committees and help the local communities to at last get the benefit of their long term conservation efforts.

Thus, the efforts that need to be done by the forest department can be summarized below

1. AFFORESTATION & REFORESTATION

> Expanding forest ecosystems, to the Rev. / SHG / Panchayat land (s) etc

> Industrial forestry i.e. minimizing the commercial pressure (s) on Forests

> Traditional integrated agro-forestry systems with local communities and introduction of improved forestry crops in these systems

2. AVOIDING INTRA & INTER DEPARTMENTAL DEFORESTATION AND DEGRADATION AND TAKING CREDIT OF THE NEW REDD PLUS APPROACH FOR WELL CONSERVED AREAS UNDER JFM

(REDD - Reducing Emissions from Deforestation and Forest Degradation &; REDD – plus: REDD with conservation)

> Avoiding Degradation of forests for fuel wood

> Halting conversion / clearing of forests into agricultural landscapes, mineral extraction or hydro reservoirs

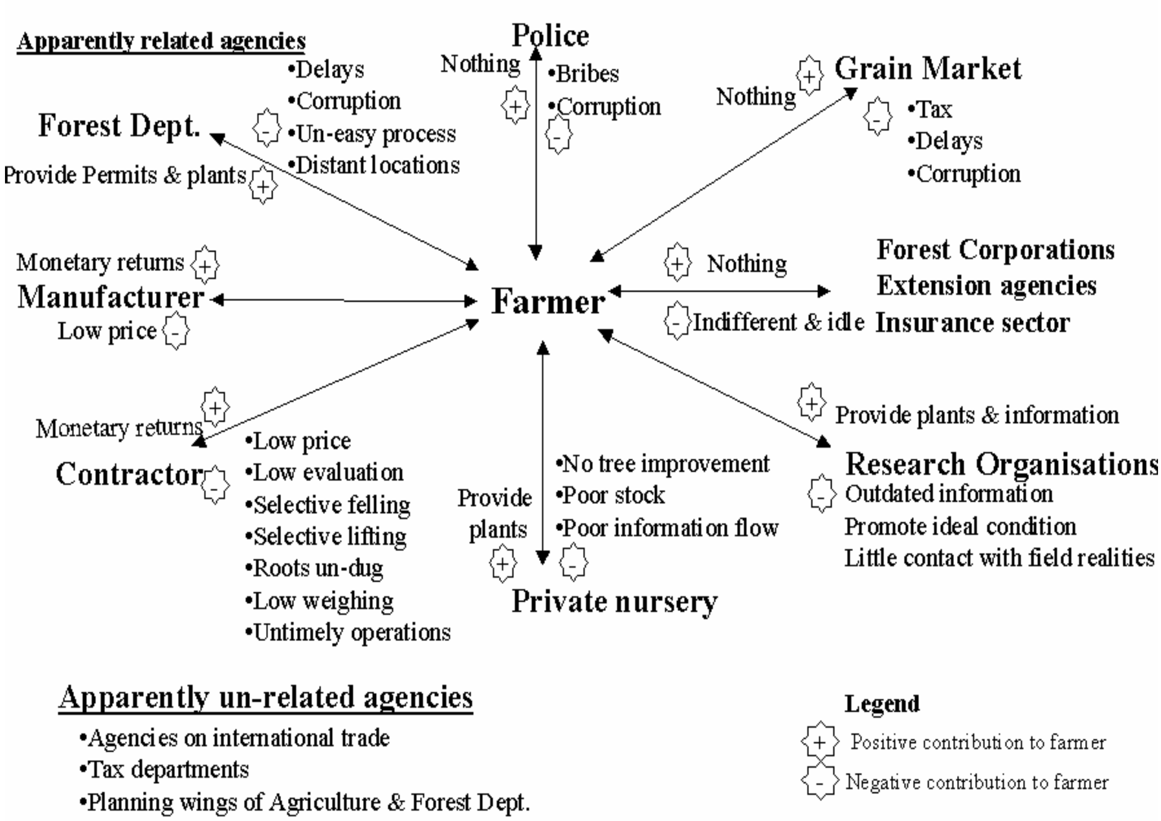
> Declaration of protected areas – Carbon conservation AREAS

3. FOREST BIOMASS CARBON AS ENERGY SOURCE

> The displacement of fossil fuels through Solar, Hydel and bio-fuels/ bio- electricity through the network of JFM committees that can in themselves be eligible for CDM credits

Besides the above if the present approach has to succeed, it needs an integrated approach in which the local indigenous farmer will be the focus of all efforts by different agencies both government and non-government. The negative contributions by these agencies will have to be counteracted through improved positive contributions.

The approach is summarized below:



In order to bring about a clearly visible change in the adoption of CDM approaches in the forestry sector the following hurdles will also have to be overcome:

- Large scale promotion of Tree farming culture among the masses
- Make an independent, clear and facilitatory integrated Policy on Tree farming Agroforestry
- Segregate Tree farming from the rules and bye laws of the Forests, as a whole
- Initiate mass scale awareness campaign regarding promotion of Carbon Trading in the Wasteland plantation Projects
- Prioritize Agroforestry / the Tree farming species and ensure large scale production and easy availability to masses
- Ensure efficient and smooth Marketing of Agroforestry Produce
- Amend specific Rules to support Agroforestry
- Promote Value Addition of Wood from Plantations
- Ensure proper Bank finance at low interest rates for Projects on Agroforestry/ Farm Forestry

- Form a Nodal Agency for coordination of efforts of all involved agencies to give proper thrust to this sector and a single window system should be established to facilitate farmers and committees attracted to take advantage of the CDM approach in Agroforestry.
- Research & Extension Activities be up-scaled for development of Agroforestry

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Gender issue in Slovenian forestry

Nevenka Bogataj[1]

Abstract

A pilot study presented covers lack of knowledge about female role in Slovenian forestry. Triangulation based qualitative study was performed in the period 2006-2009. The target public were two gender defined groups, who at least part of their life dedicated to forest: female foresters (FF) and female forest owners (FFO). They have common characteristics but also large differences, therefore the text focuses to FF only.

FF are an example of minority in a service based society, thus they are vulnerable to the unstable job market. Their characteristics are studied from both, quantitative and qualitative point of view. They consciously and independently decided for their study. Their refuse of prejudices when entering forestry is paid later - shares from student status to employed in forestry or getting a leading position decline. The most of FF are satisfied in horizontal ties among colleagues, however they report on tough vertical promotion. Jobs availability, accessibility of information/knowledge/projects is therefore sometimes distributed according to the social acceptability and not according to the professional weight. It is tricky to make women visible as cultural patterns remain, therefore our finding that gender is an issue in Slovenian forestry will probably remain unchanged.

Key words: sustainability, forestry, Slovenia, female forest professionals, female forest owners
FDC: 682-055.2=111

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TELE: Tools for Engaging Landowners Effectively

Brett Butler[1], Mary Tyrrell, Purnima Chawla, Ravi Singh

Abstract

Today it is generally acknowledged that conventional agriculture causes a number of environmental and socio-economic problems. To overcome these, a paradigm change in widespread agricultural practices would be necessary. Despite the fact that alternative land-use practices already exist, only a minority of farmers apply them.

In Ireland a forestry scheme was implemented in 1996 encouraging farmers to diversify their land-use into sustainable forestry. But in the period from 1996 to 2006 only about 48% of the targeted area of farmland was planted with trees. Surveys and economic studies conducted to date have not definitively explained why farmers did not respond to the scheme as expected.

In order to understand the decision-making process of farmers regarding different land-use possibilities, this study will use a multi-strategy approach. Firstly, using a qualitative study, farmers from different farming systems will be interviewed to ascertain the factors influencing their decision-making process. This will be undertaken using semi-structured interviews as well as focus groups. Secondly, a quantitative study will examine the extent to which the factors identified by farmers in the qualitative study are reflected in the wider farming community. This strategy will ensure that the findings are grounded in the social reality of individual farmers and at the same time reveal phenomena with an influence on the wider farming community.

The study will attempt to explain the poor outcome of the farm forestry scheme in Ireland. The understanding of the factors in the decision-making process will assist in predicting farmers' reaction to new policies. It may also influence the design of new policy environments enabling more farmers to take up alternative land-uses. These can then contribute to solving environmental and socio-economic problems. The poster presented in June 2010 will present the preliminary results of the qualitative study.

Key words: communications, social marketing, family forest owners, United States, National Woodland Owner Survey
FDC: 682(73)=111

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Opportunities and challenges of chainsaw milling in the Congo Basin

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Abstract

Over the last two decades, in the Congo Basin, the implementation of forest policy reforms has focussed on the regulation of large-scale logging concessions, while small-scale logging activities, carried out mostly with chainsaws, and sourcing the domestic or regional market, have been sidelined by official policy. As a consequence, chainsaw milling developed largely as an informal activity, has been poorly researched in recent decades and its dynamics and impacts on rural livelihoods, as well as its timber production, remain largely unknown to concerned ministries and are not included in national and international statistics. We found that chainsaw milling, albeit largely informal and illegal, contributes about 1.2m cubic meters of processed products to the domestic markets of considered countries, which is equivalent to the production of the formal, large-scale, industrial forestry sector. Also, chainsaw milling has positive economic impacts on the livelihoods options of many thousands of citizens living in rural areas, with annual financial gains larger than €40m in Cameroon and Gabon. Nonetheless, because of its informal nature, chainsaw milling not only does not contribute to the formal revenues of the State, but also engender corrupt practices that contribute about €10m to the private gains of civil servants. The adoption of legal frameworks adapted to the current needs of the timber domestic market is a necessary (technical) first step towards the professionalisation and formalisation of the sector, but a clear (political) step by concerned governments towards the sanctioning of corrupt practices by civil servants is also badly needed.

Key words: Central Africa, chainsaw milling, Congo Basin, domestic timber consumption, informal sector, timber
FDC: 7:682(672.4)=111

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1 INTRODUCTION

Forest management in the Congo Basin takes place in a context of widespread poverty. It is estimated that over 73% of people in the region are below the poverty line (de Wasseige *et al.* 2009), with the majority living in rural areas where the forest is predominant. Indeed, over the last two decades, forest policies have also been used as a powerful lever to try reducing poverty among the population, while contributing to the development of the States' economies and to the management of biodiversity.

All forestry codes in the region require a management plan to sustainably manage timber resources, primarily within large areas granted to industrial logging companies as long-term forest concessions, but also in protected areas such as national parks. Over the last decade, remarkable progress has been made in the field of forest management. All over the region, about 36.4 million ha have been allocated as 256 timber concessions, and from zero ha in 2000, the region had in 2008 over 11.3 million ha of forest concessions managed in accordance with officially approved management plans (de Wasseige *et al.* 2009). These forests are located in four countries: Cameroon, Congo, Gabon and CAR, but a major change is also underway in DRC, which represent the largest forest surface of the region. There, 65 concessions (about 9.7 million ha) that are presently only legally granted to logging companies, will have to develop management plans within four years, thus almost doubling the total managed surface of the region. Also forest certification has been evolving rapidly during the past three years. Starting from zero hectare at the beginning of 2006, FSC certified forest area amounted to about 4 million ha in 2010, divided among Cameroon (640,000 ha), Congo (2m ha) and Gabon (1.3 million ha).

In 2007, the formal, large-scale, industrial forestry sector in Central Africa produced nearly 8.4 million cubic meters of timber. Gabon, with nearly 3.4 million cubic meters is the largest producer, followed by Cameroon (about 2.3 million cubic meters). The smallest producer is DRC, with 310,000 cubic meters of formal timber production (de Wasseige *et al.* 2009). Unprocessed logs are, by volume, the most important type of products that the forest sector in Central Africa exports to international markets. Gabon has been for many years also the largest exporter of logs – nearly 53% of exported logs in 2007 – but its role is likely to change in the following years as a log-export ban has been adopted in January 2010. The second largest exported timber product is sawnwood. Cameroon, with a partial log-export ban adopted in 1999, is the largest exporter of sawnwood, mostly to the European Union.

Last in a long list of efforts to better regulate and manage forestry operations in the Congo Basin, the Forest Law Enforcement, Governance and Trade (FLEGT) Action Plan of the EU was adopted in 2004, with the objective to guarantee that only timber of legal origin is imported into the EU market. In order to do so, bilateral trade agreements (Voluntary Partnership Agreements – VPAs) are negotiated and eventually signed between timber producing countries and the EU. In the region, Congo and Cameroon have already signed VPAs (in 2009 and 2010, respectively), and have thus committed to implement audited traceability systems in their forestry sectors.

There is no doubt, thus, that the forest legal frameworks in the Congo Basin improved a lot in recent decades, and that many processes focussing on the effective implementation of those frameworks produced positive impacts. Nonetheless, the vast majority of policy reforms targeted the large-scale, industrial, export-oriented forestry operations, while neglecting the small-scale, chainsaw timber production, which is mostly sold on the domestic timber markets but also exported to the regional one (Plouvier *et al.* 2002; Wunder 2003). Small-scale logging titles that authorise rural citizens to harvest few trees for their personal, non-commercial, needs, are indeed included in all the legal frameworks of the region, but they are generally not adapted to the current needs and dynamics of chainsaw logging, and they remain largely unused by chainsaw loggers. As a consequence of the neglect, and despite its importance, the domestic timber sector remains largely informal and its production, as well as its economic, ecological and social impacts, remains unknown to the national ministries and unaccounted for in national and international statistics.

In Cameroon, the amount of wood illegally harvested by individuals or small enterprises and mostly sold on the informal domestic market was roughly estimated at about 170,000 cubic meters (Round-Wood Equivalent, RWE) in 1993 (Lumet *et al.* 1993), then at about 250,000 cubic meters in 1996 (Enviro-Protect 1997) and at about 700,000 cubic meters RWE in 2000 (MINEFI 2000). Few years later, Plouvier *et al*. (2002) analysed several markets in Yaoundé and Douala and estimated the national production of chainsaw loggers at about 1 million cubic meters RWE, of which about 10% entered the official export market through the Port of Douala, and the rest (900,000 cubic meters RWE processed into about 300,000 cubic meters of sawn wood) was consumed locally. Although such recent estimates of the informal timber sector are not available in other countries of the region, several indications show that it is not negligible.

In Gabon, for instance, rural citizens still use 'family logging authorisations', albeit abolished by the 2001 forest code, to harvest and trade timber around their villages. If we add the fact that many people have been employed by the forestry sector as sawyers, fellers, prospectors, and have thus acquired the necessary skills, rural Gabon offers a large operational capability and availability of resources for the production of informal timber. The law allows small-scale operators to apply for legal logging authorisations, but the administration has been very slow to implement the granting of such titles, and only in mid-2009 the first requests were reviewed by the administration. But the use of these timber permits is still very poorly documented in rural areas, except for some case studies (e.g. Boevinger 2008). Overall, however, there is no data on the urban markets of timber, except the 2007 census of lumber yards in Libreville, the capital city, currently being updated.

In DRC, the management of forest resources is done in a socio-economic and political post-conflict situation, which makes it delicate and peculiar. The last decade, characterized by widespread insecurity, has prompted the vast majority of people to turn to subsistence and informal activities (Debroux *et al.* 2007). The forest sector is no exception to the rule, and the volume of logs produced by the informal sector is inherently difficult to quantify. Nonetheless, it is very important in DRC, as evidenced by the number of rafts that can be seen on the rivers, sawnwood planks that can be found in many markets, or logs cut by ax visible in Kinshasa. Djiré (2003) estimated that artisanal loggers produce between 1.5 and 2.4 million cubic meters, i.e. between 5 and 8 times the official industrial timber production.

In the Republic of Congo, the law allows for 'special permits' to be asked by small-scale loggers to exploit timber and non-timber forest products. In the case of timber, special permits allow the harvesting of 3 trees for domestic purposes and 5 trees for commercial one. The latter is issued only in areas where people face the difficulty of obtaining supplies of industrial scraps. The difficulty of acquiring this permit, however, especially in rural areas, push many operators to remain in the informal sector, against which the administration has established checkpoints and mobilised patrol teams. The informal timber market in Brazzaville seems to have declined considerably after the intensive activity observed in the early 90s (Ampolo 2005). However, except a few case studies carried out in the batéké highlands, no data at the national level confirm or refute this finding.

Overall, thus, given the lack of information on chainsaw milling in the Congo Basin, as well as on its social, economic, and ecological dynamics, it is imperative to conduct systematic studies for an effective reform of the forest sector. This is the objective of this paper, that shows the preliminary results of an on-going research started in 2008 in four Central African countries, namely Cameroon, the Republic of Congo, Democratic Republic of Congo and Gabon.

The next section briefly introduce the methods used for the research. Next, results are presented and discussed, while the last section concludes.

2 METHODS

The informal use of timber in Central Africa takes various forms. It largely sources the national timber markets, thus meeting domestic demand, but it can partly be exported. In addition, concerned trade generally focuses on sawnwood but can at times include logs, as it may be the case in Gabon and DRC. We decided to focus our attention only on sawn products sold on domestic markets, which are sourced all over the region using both legally produced timber, such as scraps from industrial sawmills or regularly attributed small-scale logging titles, and illegally produced timber, such as the vast majority of the chainsaw production.

For this, a similar approach was adopted in the four countries, following a three steps approach. First, a weekly monitoring of a sample of outlets located in all districts of the main cities. The flow of wood sold and purchased in each counter is recorded in a comprehensive manner one day a week. They are then extrapolated to other days of the week, then to the total number of outlets selling timber in the concerned city. Second, a weekly monitoring (day and night) of timber flows entering the cities, following the same frequency and the same method of extrapolation. Third, surveys in the rural areas with informal sawyers, and within cities with timber sellers, to analyse their activities and quantify their costs and margins.

Table 1 summarizes the implementation of these surveys in four selected countries. Surveys started between March and November 2008 and are still on-going.

Table 1: Sampled cities and outlets

	Cameroon	Congo	Gabon	DRC
	Bertoua, Douala, Yaoundé, Limbe, Kumba	Brazzaville, Pointe Noire	Libreville	Kinshasa
# Outlets	882	127	210	200
# Outlets followed	177	77	30	20
# Supply routes followed			6	
# Surveys in rural areas	340		212	

3 RESULTS AND DISCUSSION

3.1 HARVESTING AND PROCESSING

In addition to tracking data on consumption of lumber in urban markets, about 550 surveys were conducted in rural Cameroon and Gabon to better appreciate the dynamics of upstream operations. In Cameroon, such surveys were conducted in 48 municipalities while they were administered in four departments bordering Libreville in Gabon.

In general, it appears that the operation is a profitable business. On average in Cameroon, profits for chainsaw loggers are about €11.8 per cubic meter, while operating costs are at about €33.8 per cubic meter of roundwood. The profit rate is about 35%. In Gabon, the profit is around €20.2 per cubic meter, with operating costs estimated at around €37.1 per cubic meter roundwood. The profit margin exceeds 50%. Given the total volume of sawnwood sold on the domestic market, the financial gain generated by the informal sector is estimated around €39m per year for Cameroon and €2.4m for Gabon.

It may be useful however to distinguish different modes of operation and / or marketing of sawnwood in rural areas. There exist, in fact, a significant difference between on the one hand, semi-professional sawyers moving out of urban centers with clear orders for timber species and products, and on the other hand, rural loggers in need of cash who harvest timber without a prior idea of their final customer.

If the difference between these two marketing methods is negligible in Gabon, it is very important in Cameroon. Semi-professionals loggers, with better equipment and especially good coverage in terms of financial needs and political sponsors, produce a financial margin of about €18.2 per cubic meter, while the margin of freelance rural sawyers tends to zero. The latter are frequently subjected to external pressures, including the seizure of all their wood, which reduces their average profits. In addition, many of these independent loggers are forced to continue their work to repay debts incurred during previous operations and because they have defaulted to sell their wood seized by the authorities.

All in all, chainsaw milling provides financial contributions to rural economies which are largely ignored. In fact, a number of costs incurred by sawyer in the locations where harvesting occurs, make up the largest part of the annual revenues of rural people living close to harvesting sites. In Cameroon, for example, almost 50% of the operating costs are made up of payments to the local workforce (e.g. help-sawyer, carriers, assistant prospector) while 7% of the total cost is the remuneration of the customary owner of the felled tree. In Gabon wages make up 55% of the total cost, although compensation to the customary owner lower than in Cameroon (Figure 1).

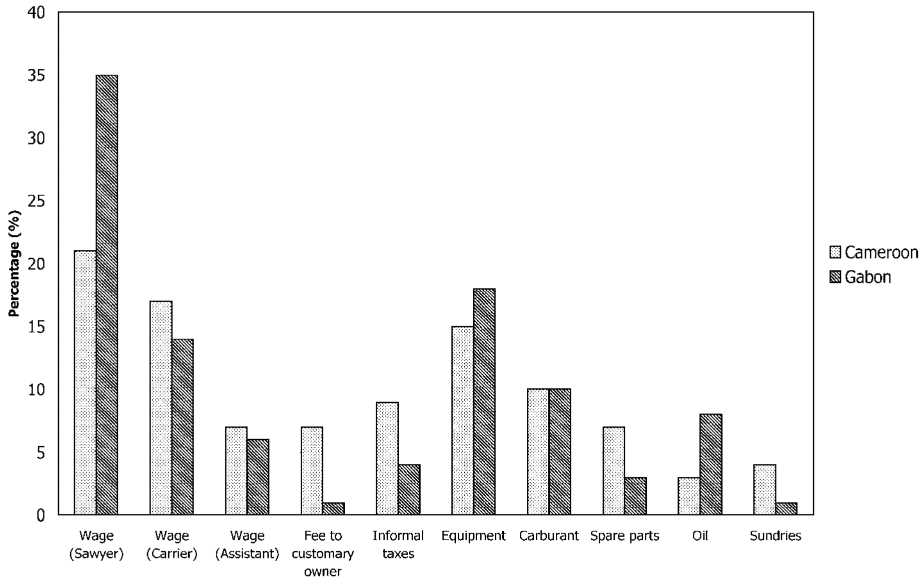

Figure 1: Costs of chainsaw millers (percentage of total costs)

The informal use of timber is a source of income also for actors outside the village economy, as government officials and local elites, mostly through informal payments required to allow the smooth development of activities by chainsaw loggers and timber sellers. These payments are on average about 4% of total operating cost in Gabon, and 9% in Cameroon (Figure 1). This may represent a small transaction cost for chainsaw millers, given the overall positive impact of harvesting activities on the village economies. However, informal payments may also be considered as revenue losses by the State, and if they are extrapolated to the overall volume of informal production, those losses results in about €10m in Cameroon and Gabon to €1.8m.

Table 2: List of problems reported by chainsaw millers and timber sellers

	Gabon	Cameroun
Administrative hassles	41%	71%
Technical (mechanical) problems	17%	13%
Difficulty in accessing a legal title	13%	10%
Abuse of power (businessmen, client, worker)	10%	41%
Lack of infrastructures	8%	11%
Relations with customary owners	5%	22%
Lack of capital	3%	7%
Rarity of the resource	2%	11%

Indeed, when asked about the most important problems encountered in carrying out their activities, chainsaw millers and timber sellers list administrative harassment and abuses of power by various authorities on top of their lists (Table 2).

There are roughly the same concerns in Cameroon and Gabon, ranging from technical issues to problems related to establishing effective trade networks. Importantly, Table 2 also shows that only a small fraction of interviewees (13 and 10 percent in Gabon and Cameroon) list the difficulty in accessing a legal title as a problem. Thus, not only the vast majority of chainsaw millers harvest without a legal title (in Cameroon, about 85% of all interviewees admit to have never used a legal timber authorisation during their career), but the lack of the latter is clearly not even a major concern for operators in both countries. This may indicate that, if one agrees to play by the rules of well established informal networks, illegal timber harvesting and laundering through official channels is not a very difficult task.

3.2 TIMBER SALES

The estimates presented below for Cameroon and Gabon are based on 12 months data collection, while estimates for Congo and DRC are based on 6 months data collection extrapolated to the year.

In Cameroon, average annual sales, estimated over the period July 2008 – June 2009, total about 990,000 cubic meters of sawn timber. Total consumption is estimated at about 860,000 cubic meters, as about 130,000 cubic meters are sold from markets to other markets before reaching the final user. Timber sold is largely sourced from chainsaw milling operations in the forest. Nonetheless, about 27 percent of sold products is sourced from industrial sawmills, with varying degrees among cities. These data corroborate past estimates of industrial sourcing for the local market, which ranged between 10–40% (ONF-International *et al.* 2002; Plouvier *et al.* 2002).

Timber sold on the market and sourced directly from chainsaw milling operations in the Cameroonian's NPFD is thus estimated at about 662,000 cubic meters. This suggests a twofold increase from 2002 values (300,000 cubic meters of sawn timber) estimated by Plouvier *et al*. (2002) for the entire country. Most notably, domestic timber sales are larger than the industrial production and exports of sawn timber, which has been decreasing in recent years, from 580,000 cubic meters in 2008 to 360,000 cubic meters in 2009 (MINFOF 2008; 2009).

In Gabon, the amount of lumber consumed in Libreville is about 70,000 cubic meters per year. This estimate is supported both by figures of outlets' sales and by monitoring the flow of supplies to the city by roads and waterways. Compared to the total official industrial production, at about 3.3m cubic meters in 2007 (de Wasseige *et al.* 2009), the informal sector production remains more modest than in Cameroon. Yet it represents about 23 percent of the industrial production and exports of sawnwood, at about 300,000 cubic meters in 2007. Also, the ratio of timber consumption per habitant in Gabon (about 1.5m inhabitants) and in Cameroon (about 19m inhabitants) is very similar.

Preliminary data collected in the Republic of Congo show annual timber sales at about 78,000 cubic meters. Formal national production was about 1.3m cubic meters in 2007, with about 210,000 cubic meters of sawnwood exported. The small-scale, informal production thus represents about 35 percent of industrial production. The ratio of timber consumption per habitant in Congo (3.6m inhabitants) is about half those of Cameroon and Gabon.

Finally, preliminary estimates for the DRC show that the city of Kinshasa alone could consume a volume of informal sawnwood of about 350,000 cubic meters per year. Official figures show that industrial sawnwood exports amounted to about 30,000 cubic meters in 2007. Although official figures are notoriously incomplete in DRC, with much of the production and exports taking place in the East and North of the country only partially recorded by official statistics, collected data in Kinshasa show that the informal timber production may largely be above the formal one.

Overall, data show that chainsaw timber production, albeit largely informal and, often, illegal, in the Congo Basin is much more important than the attention given to it in the regulatory frameworks suggests. In Cameroon and the DRC, but also to a lesser extent in Gabon and Congo, its volumes and dynamics call for a renewed vision to be adopted on forest policies that, to date, put primary emphasis on regulation of the timber sector through control of large-scale, industrial, forest concessions.

The informal timber sector also provides thousands of jobs in the different countries considered. In Pointe Noire, Brazzaville and Libreville, approximately 1,000 people derive their income directly from timber sales, while in the cities sampled in Cameroon, about 4,000 people sell timber. These estimates only consider the last, and easiest to quantify, part of the chain that goes from harvesting to transport to selling. But they do not include the thousands of jobs provided in rural areas as harvesters, carriers, holders, and many other. In Cameroon alone, the total number of people employed by chainsaw milling is estimated at about 45,000, about 4 times the number of direct jobs provided by the industrial timber sector (MINEFI 2006).

3.3 PRODUCTS, SPECIES AND PRICES

Timber species required by the domestic markets are not fundamentally different from those produced by the industrial sector for the international market. In Congo, for example, bahia (*Mitragyna ciliata*), bilinga (*Nauclea diderrichii*), moabi (*Baillonnella toxisperma*), okoumé (*Aucoumea klaineana*), niové (*Staudtia kamerunensis*) and sapelli (*Entandrophragma cylindricum*) cover large part of total sales, while in Gabon okoumé is largely dominant. Overall, about 90 percent of sales concern products largely used for building and infrastructure, such as planks, formwork and rafters.

In Cameroon, where the longest and more complete time series are available, data show that planks alone represent about 41% of all timber sourced from chainsaw milling and about 56% of timber sourced from industrial scraps, while the five most harvested species cover about 70 percent of total sales. Ayous (*Triplochyton scleroxylon*) is the most used species (35 percent of total sales), followed by movingui (*Distemonanthus benthamianus*), iroko (*Milicia excelsa*), sapelli and bilinga. While the vast majority of ayous and bilinga is sourced from chainsaw milling, about half of all other species is sourced from industrial scraps.

Selling prices vary with the quality, type and origin of product, as well as the timber species. In Cameroon, average prices for planks and formworks of ayous (21% of total sales) reach about €26 and €24 per cubic meter RWE (Table 3).

Table 3: Selling prices of the most used products per species

A. Source	B. Product	C. Species	D. Sales (%)	E. Selling price (€/m3 RWE)	F. FOB price (€/m3 RWE 2009, Cameroon)	G. E/F (%)
Chainsaw milling	Plank	Ayous	4.7	26	140	18
	Formwork	Ayous	16.3	24	140	17

The prices of products sold on the domestic market (column E, Table 3) are on average about 80 percent lower for timber sourced from chainsaw milling than the FOB prices – linked to the international market – applied for the industry in Cameroon (columns F and G, Table 3). Several reasons may justify such differences. First and foremost, the quality of the final product required by the international market is higher, and specifications stricter. Also, domestic timber is not charged with formal taxes –stumpage, sawmill entry, export –, and production costs are thus lower than industrial ones. Prices may also be lower because there is much more competition on the domestic market, with thousands of chainsaw loggers able to source the market, than on the industrial one, where only a handful of logging companies specialise on few products and species. Also, access to timber is much cheaper for chainsaw loggers, as lack of information of customary owners vis-à-vis the industrial timber sector in particular and the international timber market more generally, makes it possible for chainsaw loggers to pay very low prices for valuable tree species.

Lack of information is certainly an advantage for both chainsaw loggers and timber traders, because it results in lower costs to access the resource, but it raises the issue of a precious resource being sold well below its average market value. This may increase waste and result in a sub-optimal use of the forest.

4 CONCLUSION

The role of chainsaw lumber production in the forestry sectors of the countries of the Congo Basin has generally been neglected by official policy and under-researched. Overall, there has been a trend for chainsaw, or small-scale, lumbering to develop in parallel with the industrial timber sector, although the lack of adapted legal frameworks and widespread vested interests forced it to develop as an informal activity.

As a consequence, data about the sector, as well as about its impacts on rural and national economies, are more often than not excluded from official statistics.

This paper argues there exist a lot of opportunities for chainsaw milling in the Congo Basin. Preliminary results show that the domestic timber market has been booming in recent years, with an overall annual production – about 1.2m cubic meters of processed products – similar to the industrial one, and important impacts on local economies, rural livelihoods, and governance.

The challenges ahead, however, in order to professionalise, formalise and improve the sector's contribution to the formal national economies, are many. Results show that public policies and national strategies have not been developed to drive the sector through a formal, transparent, and equitable growth, forcing thousands of people to produce and sell illegal timber, because of the lack of a legal framework where to develop their activities, and also because many vested interests challenge the development of a national formal timber market.

The development of long-term strategies, thus, as well as public policies concerned with the domestic timber sector are badly needed all over the Congo Basin. First and foremost, they should aim at improving the working environment of chainsaw loggers, with the development of *ad hoc* legal frameworks adapted more on the needs of local actors than those of the central administrations. In that sense, the adoption and decentralised distribution of logging authorisations is a necessary first step. Second, reform should aim at professionalising chainsaw millers, while concurrently providing workable incentive schemes for civil servants, in order to decrease current corrupt practices. Coupled with incentive schemes, though, an effort is also urgently required by the concerned governments to issue and implement effective sanctions for civil servants that participate in corrupt practices, in order for the overall governance of the sector to be improved.

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Small-scale forestry and non-wood forest products enterprise development for poverty alleviation in Central Africa

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Abstract

The results provided in this paper are from a three-year multi-partnership project titled ''mobilisation and capacity building for small and medium enterprises involved in non-wood forest products (NWFP) value chains in Central Africa'', funded by the European Union and implemented by the Food and Agriculture Organisation of the United Nations (FAO) and its partners, the Centre for International Forestry Research (CIFOR), the World Agroforestry Centre (ICRAF), and the Netherlands Development Organisation (SNV), under the overall patronage of the Central African Forestry Commission (COMIFAC). Using the Market Analysis and Development (MA&D) approach, it was found that rural communities prefer certain non-wood forest products (NWFP) for increasing their incomes in the region. Various NWFP were cited and ranked as the forest products with greatest opportunities for development at the community level. The most important NWFPs selected by village community groups varied among regions within and beyond national boundaries for the countries studied. The most important NWFPs in Cameroon included *Gnetum* spp., *Irvingia* spp., *Acacia* spp., honey and *Dacryodes edulis* while in the Democratic Republic of Congo (DRC) the most important products were *Gnetum* spp., *Dacryodes edulis,* honey and caterpillars, depending on the site. Opportunities for increasing village household incomes, the provision of household forest foods, the simplicity of NWFP operations, low capital outlays, fewer entry barriers and portability of products from inaccessible terrains were among the perceived justifications for NWFP development. The paper suggests that the promotion of NWFPs through small-scale forestry could form an important entry point for poverty alleviation in Central African villages. Poverty alleviation is highly feasible when the most preferred forest products are promoted through market development, sensitisation, trainings/exchanges/extensions, domestication, overall institutional strengthening including enhancing forest producer organisations following a proper participatory diagnosis of a number of context-specific social, economic, technological, institutional and marketing constraints.

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Key words: Congo Basin, small and medium forest enterprise development, Market Analysis and Development, Non wood forest products, local preferences, small-scale forestry
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1 INTRODUCTION

Since the adoption of the Millennium Development Goals (MDG) in 2000, progress towards poverty reduction has been skewed against rural people in many developing countries with over 800 thousand people still living on less that US$1 per day (IFAD, 2005). This is particularly true for forest dependent households in the central African sub-region, where some countries still have an annual per capita income of less than US$ 200. For households with access to forest resources, empirical research shows that the valorisation of NWFP can enable households and small and medium scale forest enterprises to improve their economic well-being leading to overall poverty reduction (Macqueen, 2007; Warner, 2007; Tieguhong and Ndoye, 2006; Shreckenberg, 2003; Sonne, 2001; Arnold and Ruiz-Perez, 1998; Ndoye *et al*. 2007, 1997; Ndoye, 1995). However, harvesting forest products to reduce poverty can be hindered by several factors including poor management skills, lack of access to credit, exploitation of harvesters by buyers, poor market information, poor organisation, and absence of a favourable policy and legal frameworks (Tieguhong *et al*., 2009, 2006; Tiveau, 2008; Nair, 2007; Ndoye and Tieguhong, 2004; Ames, 1998).

The findings provided in this paper form part of a three-year multi-partnership project aimed at mobilising and building capacities of small and medium forest enterprises (SMFE) involved in the value chains of non-wood forest products (NWFP) in Central Africa. The goal of the project is to significantly contribute to poverty reduction in rural areas by increasing revenues while ensuring the sustainable management of the resource base in two countries – Cameroon and the Democratic Republic of Congo (DRC). The project is implemented by the Food and Agriculture Organisation of the United Nations (FAO) and its partners, the Centre for International Forestry Research (CIFOR), the World Agroforestry Centre (ICRAF) and the Netherlands Development Organisation (SNV), under the overall patronage of the Central African Forestry Commission (COMIFAC). The four specific objectives of the project are: (1) Capacity building of SMFE in seven sites (four in Cameroon and three in DRC); (2) Develop the value chains of priority NWFP to increase the profits of actors in a more equitable market environment; (3) Improve the sustainable management of the products through the promotion of better harvesting techniques and domestication; and (4) Improve the legal and institutional frameworks governing the

NWFP sector in Central Africa. The analysis provided in this paper dwells on specific objective two with the market analysis and development (MA&D) approach used as the main methodology towards the realisation of the findings.

2 METHODOLOGY

The Goal of Market Analysis and Development (MA&D) is to assist community based organizations and other stakeholders in developing income-generating enterprises while managing their natural resources in sustainable way. It systematically includes social and environmental concerns alongside the consideration of technological, commercial and financial aspects of a product (Lecup and Nicholson, 2009). It therefore enables people to identify potential products and develop markets that will provide income and benefits without degrading their resource base. Thus, it provides the opportunity to reconcile resource conservation and the fight against poverty through capacity building of small forestry enterprises. The MA&D approach is conducted in three phases and each of which is divided into a series of steps.

Phase one consists of identifying the potential enterprises, making inventory of existing resources and products, identifying products already providing income to local people, and eliminating non-viable products. Local people determine the economic objectives of developing enterprises in given products and field training to this effect are conducted at the onset of the process. Thus, the main result obtained at this phase is a list of all NWFP that would be evaluated in the second phase, interested groups and members for each product are documented, and possible social/institutional, environmental and technical attributes related to each product are discussed and understood by all.

The second phase of MA&D is comprised of selecting the most promising products, identifying potential markets and discussing the means of marketing. In this phase, participants gather information for analysing the feasibility of shortlisted products (coming from phase 1) and decide –based on this additional market information - on the most viable products that can be developed as basis of an enterprise. Important to recall is that the product selection always will take in account the four enterprise development criteria (economic, environment, social and technological). Scores on main criteria and sub-criteria for selecting products vary from 20% (indicating the criteria was not very important for the product) to 100% (indicating very high importance).

Phase III involves a series of workshops in targeted communities aimed at developing enterprise development plans (EDPs) for groups identified during phase II. This involves the provision of technical assistance to groups on the acquisition of legal status/framework for their groups/enterprises, development, restitution and/or finalisation of the elaboration of EDPs, establish the enterprise action plan to be able to implement the EDPs, which have clearly identified the targeted markets for the chosen products. These action plans need to be regularly updated, taking in account the changing market realities. Once the planning is over, a pilot phase for the selected enterprises will start, in which specific capacity development takes place based on the identified needs of each enterprise. This can go from improving business and organizational skills to very specific technical trainings for value adding purposes.

3 RESULTS

3.1 PRODUCT SELECTION

In the DRC, 22, 30, and 56 NWFPs were inventoried in Phase I in the provinces of Kinshasa, Bas Congo and Equateur. At the end of Phase II, only 9%, 10% and 11% of the products respectively were selected. In Cameroon, 12, 13, and 53 NWFPs were inventoried in Phase I but 42%, 77% and 25% respectively were selected in Phase II (Figure 1).

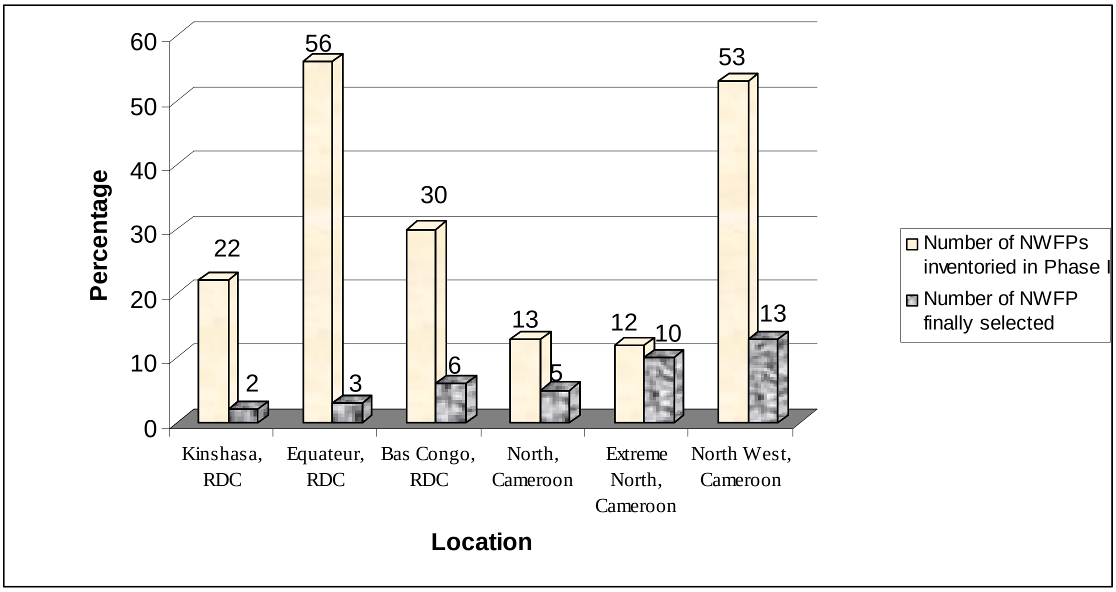

Figure 1: Number of NWFP inventoried and selected in Phases I and II of Market Analysis and Development (MA&D)

Table 1: Characteristics of scoring (%) exercise by product and by country

Country	Product	N	Minimum	Maximum	Sum	Mean	Std
Cameroon	Oil/shea butter (*Vitellaria paradoxa*)	112	20	100	6580	58.75	29.69
	Bush onion	33	20	100	2220	67.27	25.41
	Bush mango (*Irvingia* spp.)	33	20	100	1580	47.88	29.13
	Cafe Quinkilibat	15	20	100	920	61.33	27.74
	Djansang (*Ricinodendron heudelotii*)	34	20	100	1940	57.06	32.71
	Leaves of balanites (*Balanites aegyptiaca*)	83	20	100	4140	49.88	24.47
	Leave/powder of Baobab (*Adansonia digitata*)	83	20	100	4220	50.84	22.37
	Fruit of anacarde (*Anacardium accidental*)	17	20	100	1020	60.00	30.82
	Fruit/Juice of Baobab	66	20	100	3260	49.39	23.59
	Fruit/Jus of tamarin (*Tamarindus indica*)	82	20	100	3900	47.56	21.69
	Gensing	21	20	100	1200	57.14	31.17
	Desert dates	45	20	100	2900	64.44	29.81
	Honey	84	20	100	5600	66.67	28.17
	Neem oil (*Azadirachta indica*)	110	20	100	7240	65.82	30.81
	Jatropha	63	20	100	3060	48.57	27.99
	Voacanga africana	105	20	100	7480	71.24	29.08
	Total 1	986	20	100	57260	58.07	28.58
DRC	Caterpillars	60	20	100	3580	59.67	31.35
	Gnetum spp.	200	20	100	12540	62.70	31.75
	Honey	140	20	100	7540	53.86	30.71
	Kola (*Cola* spp.)	20	20	100	1080	54.00	35.00
	Thatch	60	20	100	2680	44.67	29.31
	Raphia	96	20	100	4060	57.00	28.49
	Rattan	40	20	100	2700	67.50	29.24
	Safou (*Dacryodes edulis*)	58	20	100	3020	52.07	28.02
	Total 2	674	20	100	37200	55.19	31.38
Total		1660	20	100	94460	56.90	29.78

Scores given to various products varied from 20% to 100% with a mean of 58% (SD=28%) in Cameroon and 57% (SD=30%) in DRC. The MA&D approach facilitated the selection of key NWFPs including honey, bush mango (*Irvingia* spp.), *Prunus africana* and gum Arabic (*Acacia* spp.) in Cameroon and honey, safou (*Dacryodes edulis*) and fumbwa (*Gnetum* spp.) in the Democratic Republic of Congo (RDC). It also allowed for the selection of other

NWFPs with the dual potential of reducing poverty and conserving forest resources (Table 1).

Table 2: Characteristics of criteria and variables for non-wood forest products selection

Criteria	Variable	N	Minimum	Maximum	Sum	Mean	Std
Resources management/ Environment	Spatial availability	91	20	100	6380	70.11	25.71
	Seasonal availability	90	20	100	6300	70.00	24.22
	Rotation from planting to harvest	14	60	100	1120	80.00	15.69
	Impact of harvest on environment	91	20	100	6680	73.41	29.37
	Impact of harvest on resource	74	20	100	4740	64.05	27.69
	Species regeneration potentials	88	20	100	6040	68.64	26.40
	Total 1	448	20	100	31260	69.78	26.52
Market/ Economy	Competition	68	20	100	4780	70.29	28.81
	Demand	51	20	100	4080	80.00	24.33
	Raw material availability	14	60	100	1180	84.29	17.85
	Profit margins	86	20	100	5780	67.21	22.94
	Obstacles/constraints	91	20	100	6300	69.23	25.53
	Marketing potentials	71	20	100	5220	73.52	24.33
	Product quantity	18	40	100	1220	67.78	24.87
	Total 2	399	20	100	28560	71.58	25.23
Science and Technology	Adaptability of rural entrepreneurs to transformation techniques	72	20	40	1680	23.33	7.51
	Adaptability of site to transformation technique	71	20	40	2080	29.30	10.05
	State of infrastructure	90	20	40	2020	22.44	6.59
	Availability of human resources	90	20	40	2100	23.33	7.50
	Expertise of labour	90	20	40	2280	25.33	8.89
	Total 3	413	20	40	10160	24.60	8.43
Social/ Institutional	Direct benefits to community	90	20	60	4040	44.89	13.84
	Contribution to household revenue	73	20	100	5020	68.77	27.69
	Contribution to employment	91	20	100	5600	61.54	25.51
	Experience with product	54	20	100	3380	62.59	30.11
	Gender impacts	90	20	100	6240	74.49	26.19
	Restriction to consumption	2	80	80	240	80.00	0.00
	Total 4	400	100	100	24720	100.00	0.00
Total		1660	20	100	94460	56.90	29.78

The final selection of the most promising NWFP for the establishment and development of enterprises was based on four enterprise development factors including market/economic, social, environmental and technological considerations (Table 2).

Statistically significant differences were observed among the criteria for selecting NWFP at the 5% level. Scores varied from a minimum of 20% to a maximum of 100% with mean of 56.9% (SD=29.8%). A multiple comparison test showed that the most important criteria for selecting NWFP by the producers were the market/economy and the management of the resources/environment. Social/institutional factors were the second most important followed by factors of science and technology (Figure 2; Appendix 1). Between-country variation in the criteria for selecting NWFP was not significant, at a 5% level (F=3.752; α=0.053).

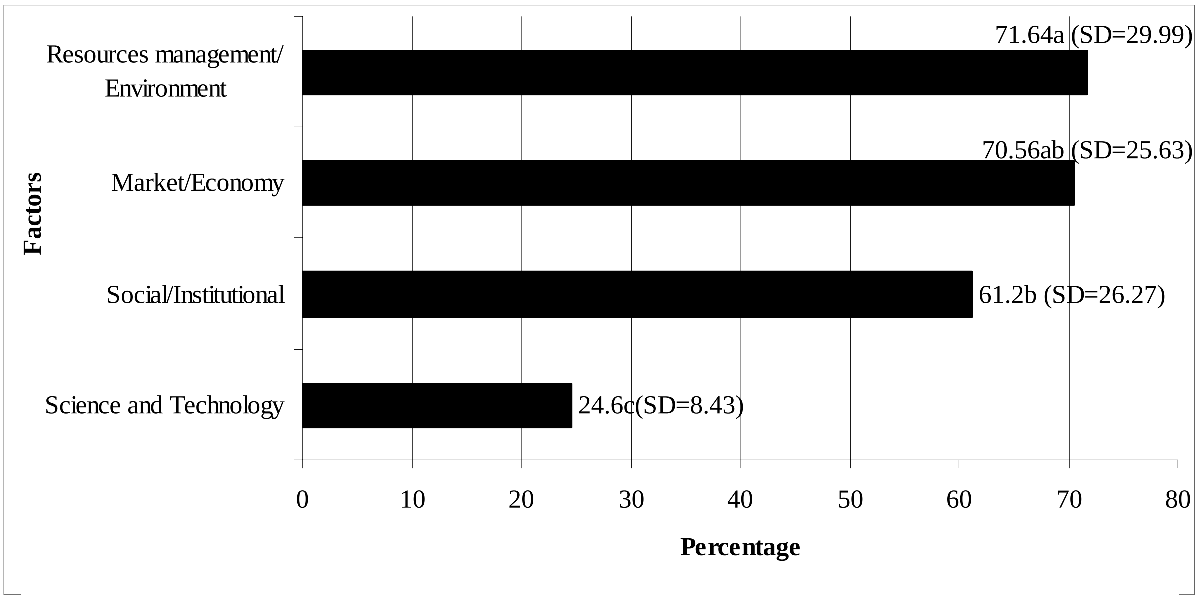

Figure 2: Mean scores for factors used in selecting NWFP for enterprise development (Means with the same letter symbols are not statistically different at 5% level)

3.2 BUILDING CAPACITY THROUGH TRAINING

In six of the seven project sites in Cameroon and DRC, 14 local non-governmental organisations (NGOs) were trained on enterprise development modules (six in Cameroon and eight in DRC) using the Market Development and Analysis (MA&D) approach. The trained NGOs further trained community groups in 87 villages (Table 3).

The number of groups trained per village varied from 1-10 (Mean=2.63; SD=1.73), totaling 233 groups (83 in Cameroon and 150 in DRC). These groups had a total membership of 3515 people (1126 in Cameroon and 2389 people in DRC) with membership ranging from 7-150 persons/group (mean=4.04 persons; SD=30.35 persons) (Table 4). However, significant variation was observed among countries in terms of total membership and the number of women engaged per group. An Anova test showed that the total number of groups and the total number of women per group varied significantly between the countries (*P<0.05*) with more women per group in Cameroon than in DRC. The overall total number of members per group and total males per group did not vary significantly between the countries (Appendix 2).

Table 3: Number of NGOs, groups trained and villages involved in MA&D by region and country

Country	Regions	Name of NGO	Number of NGOs	Number of Villages	Sum Groups trained	Number of people trained
Cameroon	Extreme North	GICPRO3LOCAUX, GREEN SAFE	2	7	28	308,00
	North	GIC Narral	1	4	8	185,00
	Northwest	BERWODEVCOP, COMINSUD, FAP	3	11	47	633,00
DRC	Bas Congo	ADEI/NSIONI, Gradic/Boma, Graed/Boma	3	23	63	1101,00
	Equateur	ASJT, CODAFE, UDPIL	3	22	56	730,00
	Kinshasa/Kisantu	Levain des Masses	1	10	20	377,00
	Kinshasa/Mbanza Ngungu	Nguizani/plateforme	1	10	11	181,00
Total			14	87	233	3515,00

Table 4: Characteristics of total membership of groups trained by region, gender and country

Country	Regions	Gender	Min	Max	Mean	Sum	Std Dev
Cameroon	Extreme North	Total	14,00	80,00	44,00	308,00	22,41
		Men	0,00	11,00	3,43	24,00	3,87
		Women	13,00	77,00	40,57	284,00	22,28
	North	Total	23,00	87,00	46,25	185,00	28,37
		Men	5,00	19,00	9,75	39,00	6,40
		Women	14,00	81,00	36,50	146,00	30,18
	Northwest	Total	32,00	150,00	57,55	633,00	32,38
		Men	20,00	60,00	34,27	377,00	13,96
		Women	6,00	90,00	23,27	256,00	23,16
	Total Cameroon		14,00	150,00	51,18	1126,00	28,30
DRC	Bas Congo	Total	12,00	109,00	47,87	1101,00	32,15
		Men	6,00	79,00	31,00	713,00	19,34
		Women	2,00	61,00	17,30	398,00	15,88
	Equateur	Total	7,00	122,00	33,18	730,00	34,74
		Men	5,00	84,00	21,68	477,00	22,64
		Women	0,00	38,00	11,50	253,00	13,19
	Kinshasa/Kisantu	Total	17,00	82,00	37,70	377,00	20,93
		Men	0,00	57,00	24,00	240,00	15,66
		Women	4,00	39,00	13,70	137,00	11,55
	Kinshasa/Mbanza Ngungu	Total	11,00	31,00	18,10	181,00	6,06
		Men	8,00	25,00	14,10	141,00	4,70
		Women	1,00	7,00	4,00	40,00	2,31
	Total (Democratic Republic of Congo)		7,00	122,00	36,75	2389,00	30,35
	Grand Total		7,00	150,00	40,40	3515,00	30,35

An analysis of the distribution of groups by types of NWFP showed that both in Cameroon and DRC, each group was interested in developing the value chain of one or more NWFP.

A cross-table analysis between groups within regions and the NWFP of interest showed that for the 83 interest groups in Cameroon, 56%, 34% and 10% were in the Northwest, Extreme North and North regions respectively. For DRC, among the 150 NWFP interest groups, 42%, 37%, 13% and 8% were respectively in the provinces of Bas Congo, Equateur, Kinshasa/Kisantu and Kinshasa/Mbanza Ngungu. Categorising interest groups by specific NWFP showed than in Cameroon, 25%, 22%, 18% and 8% of the groups were interested in neem oil (*Azadirachta indica*), bushmango (*Irvingia* spp.), voacanga (*Voacanga africana*) and honey respectively while the remaining 17% of groups were interested in other NWFP such as Djansang (*Ricinodendron heudelotii*), leaves of baobab (*Adansonia digitata*) and balanites (*Balanites aegyptiaca*), and shea butter from (*Vitellaria paradoxa*). In DRC, honey and *Gnetum* spp. each commanded the interest of 30% of the 150 interest groups while safou (*Dacryodes edulis*) and thatch were of interest to 19% and 9% respectively. The remaining 12% of the interest groups were vastly interested in other NWFP such as rattan, caterpillar and marathaceae leaves. Honey was the only product identified to be of interest to groups in both Cameroon and DRC (Table 5).

3.3 ENTERPRISE DEVELOPMENT PLANS (EDPS)

With regards to the support for realising enterprise development plans, a total of 62 plans have already been finalised for community groups in Cameroon (27 in Northwest and 35 in North and Extreme North Regions), where the MA&D approach was employed. These groups are awaiting financial and technical support to implement their EDPs and access to micro-credits in financial institutions. In DRC, the process is going steadily, but at a slower pace.

4 DISCUSSION

The results provided in this paper are vivid testimonies to the possible role of NWFP based enterprises in providing employment and economic opportunities for local and marginalized groups of people in Central Africa, particularly groups that mostly operate informally and with low capital outlays. The Commission for Africa (2005) reiterated that poverty reduction through growth requires a focus on the indigenous private sector, which in Africa is composed of a myriad of micro, small and medium enterprises involved in the gathering and selling of NWFPs in forested regions. This is not far-fetched or unrealistic assumption. For example, elsewhere in Africa, Tiveau (2008), observed that collective action through sales in unions as encouraged by a CIFOR-managed project (Achieving the Millennium Development Goals in African Dry Forests) in Burkina Faso helped to improve the income of gum Arabic harvesters, especially women, from 60 US

Table 5: Number of groups by products and regions in Cameroon and Democratic Republic of Congo

Products	Cameroon				DRC					Grand Total
	Extreme North	North	Northwest	Total	Bas Congo	Equateur	Kinshasa/Kisantu	Kinshasa/ Mbanza Ngungu	Total	
Honey			7	7	26		10	9	45	52
Gnetum spp.				0	21	24			45	45
Thatch, Straw, Rush				0		13			13	13
Maranthaceae				0		2			2	2
Rattan				0		9			9	9
Safou (*Dacryodes edulis*)				0	16		10	2	28	28
Leaves/fruits of Baobab (*Adansonia digitata*)		3		3					0	3
Shea butter		3		3					0	3
Neem oil (*Azadirachta indica*)	20	1		21					0	21
Balanites grains/ leaves	6			6					0	6
Fruits of Anacarde (*Anacardium occidental*)		1		1					0	1
Juice of *Tamarindus indica*	1			1					0	1
Grains and leaves of Quinkélibat	1			1					0	1
Caterpillars				0		8			8	8
Voacanga africana			15	15					0	15
Jatropha caucus			1	1					0	1
Bush mango (*Irvingia* spp.)			14	14					0	14
Bushmango, njansang, Bush pepper			4	4					0	4
Njansang, bush pepper			3	3					0	3
Njansang, country onion			3	3					0	3
Total	28	8	47	83	63	56	20	11	150	233

cents to US$1, with production gains from two tons to 12 tons in the Yagha Province. Moreover, NWFP based enterprises are gender sensitive with numerous economic and subsistence opportunities for women, as confirmed by other researches conducted in Burkina Faso, Zambia and Ethiopia (Tiveau, 2008). However, the fact that more women are involved in NWFP enterprises in Cameroon than in the DRC could be associated with a higher level of political stability in Cameroon with less violence against women in remote forested areas rather than with a lack of interest.

Giving that the selection of NWFP for the development of small forest enterprises is constrained by a number of factors suggests the need to properly examine and understand those factors before intervening in the development of the sector (Nair, 2007; Warner, 2007). Choices are informed by management and economic factors with the availability of the resources playing a leading role. Traveling longer distances and a greater investment of energy in obtaining unit products all suggest increasing pressure on natural stock and diminishing resources as products become more commercialised (Nair, 2007). These call for better management techniques of existing resources, the need to expand production niches through domestication, and possibly to reduce waste on exploitation and use of available resources (Tieguhong *et al*., 2009). From the analysis provided in this paper, social/institutional factors are important in accessing resources and gaining access to markets. The MA&D approach clearly highlights the need for dealers to form groups and to legalise their structures. Science and technology in the NWFP sector is still poorly understood and broadly unavailable in Central Africa. Nonetheless, the need for R&D for value addition is obvious, as is the need to improve productivity, quality, reliability of supply, appropriate financing mechanisms, and institutional strengthening in the process of enabling local people to earn more from NWFP.

Based on this analysis, it can be concluded that progress on the economic empowerment of marginalised groups, greater positive livelihoods opportunities and poverty reduction impacts of the NWFP sector in Central Africa can be achieved given consistent financial supports in larger geographical areas on capacity building for small and medium scale forest enterprises involved in the production, processing and commercialisation of NWFP. This can partly come from scaling up the current MA&D approach and creating or supporting the development of producer groups as well as creating enabling institutional/financial environments for small businesses. Support to effective marketing arrangements such as group sales and the supply of market information in rural areas needs greater support and expansion beyond the current project sites. All of these actions will require increased funds from interested donors and the countries of the sub-region.

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APPENDICES

Appendix 1: ANOVA and multiple comparison tests for the criteria for selecting NWFP

ANOVA

Variable score

	Somme des carrés	ddl	Moyenne des carrés	F	Signification
Inter-groupes	597893.216	3	199297.739	378.053	.000
Intra-groupes	872991.363	1656	527.169		
Total	1470884.6	1659			

Comparaisons multiples

Variable dépendante: Variable score
Games-Howell

(I) Criteria	(J) Criteria	Différence de moyennes (I-J)	Erreur standard	Signification	Intervalle de confiance à 95% Borne inférieure	Borne supérieure
Resources management/Environment	Market/Economy	10.4364	3.30194	.077	-.7692	21.6420
	Science and Technology	47.0359*	3.29565	.000	36.2686	57.8032
	Social/Institutional	1.0808	3.20164	.994	-9.8733	12.0349
Market/Economy	Resources management/Environment	-10.4364	3.30194	.077	-21.6420	.7692
	Science and Technology	36.5995*	1.61070	.000	33.0480	40.1510
	Social/Institutional	-9.3556*	1.40838	.000	-13.4711	-5.2400
Science and Technology	Resources management/Environment	-47.0359*	3.29565	.000	-57.8032	-36.2686
	Market/Economy	-36.5995*	1.61070	.000	-40.1510	-33.0480
	Social/Institutional	-45.9551*	1.39358	.000	-48.5302	-43.3799
Social/Institutional	Resources management/Environment	-1.0808	3.20164	.994	-12.0349	9.8733
	Market/Economy	9.3556*	1.40838	.000	5.2400	13.4711
	Science and Technology	45.9551*	1.39358	.000	43.3799	48.5302

*. La différence de moyennes est significative au niveau .05.

Appendix 2: ANOVA on the differences between countries in terms of total number of groups, membership and gender

ANOVA

		Somme des carrés	ddl	Moyenne des carrés	F	Signification
Total number of groups	Inter-groupes	38,305	1	38,305	14,805	,000
	Intra-groupes	219,925	85	2,587		
	Total	258,230	86			
Total number of members	Inter-groupes	3421,585	1	3421,585	3,838	,053
	Intra-groupes	75783,334	85	891,569		
	Total	79204,920	86			
Total number of men	Inter-groupes	285,712	1	285,712	,800	,374
	Intra-groupes	30375,138	85	357,355		
	Total	30660,851	86			
Total number of women	Inter-groupes	5591,093	1	5591,093	19,611	,000
	Intra-groupes	24233,827	85	285,104		
	Total	29824,920	86			

Impacts of climate change on small-scale plantations in Australia

Geoff Cockfield, Tek Narayan Maraseni[1]

Abstract

Both a greenhouse gas emissions trading scheme and the alternative of direct incentives for forestry sinks could contribute to an expansion of small-scale forestry in Australia and elsewhere. Demand for forestry sinks is however dependent on the integrity and severity of any emissions trading scheme, or the generosity of direct incentives, and the rate at which emitters substitute other inputs and technologies for those that result in greenhouse gases. The inclination to supply forest sinks depends on production costs, including transaction costs, preferences for non-forest land uses and returns from timber.

We consider all these factors in developing a model of decision-making in relation to small-scale forestry and then use that model to consider possible changes in plantation locations in Australia. Based on land use competition from urbanisation and agriculture and the price of carbon, there is a prima facie case for expecting that there will be some increase in small-scale plantations in Australia. When considering all of the demand and supply factors there are however good reasons to be cautious and in this paper we explain why.

Key words: climate changes, plantations, Australia
FDC: 111.83:682(94)=111

1 INTRODUCTION

From 1996, there has been a deliberate effort to increase the area of plantations in Australia so as to reduce the previous reliance on native forest production and to provide environmental co-benefits (Centre for International Economics, 1997; National Farm Forestry Roundtable, 2000). It was expected that farm (small-scale) forestry could comprise up to 12 percent of the target of the 2020 target of 3.3m hectares (ha) with some of the new plantations established in inland agricultural areas (Centre for International Economics, 1997). Despite subsequent efforts to stimulate activity through the provision of information, advice and example plantations (Donaldson and Gorrie,

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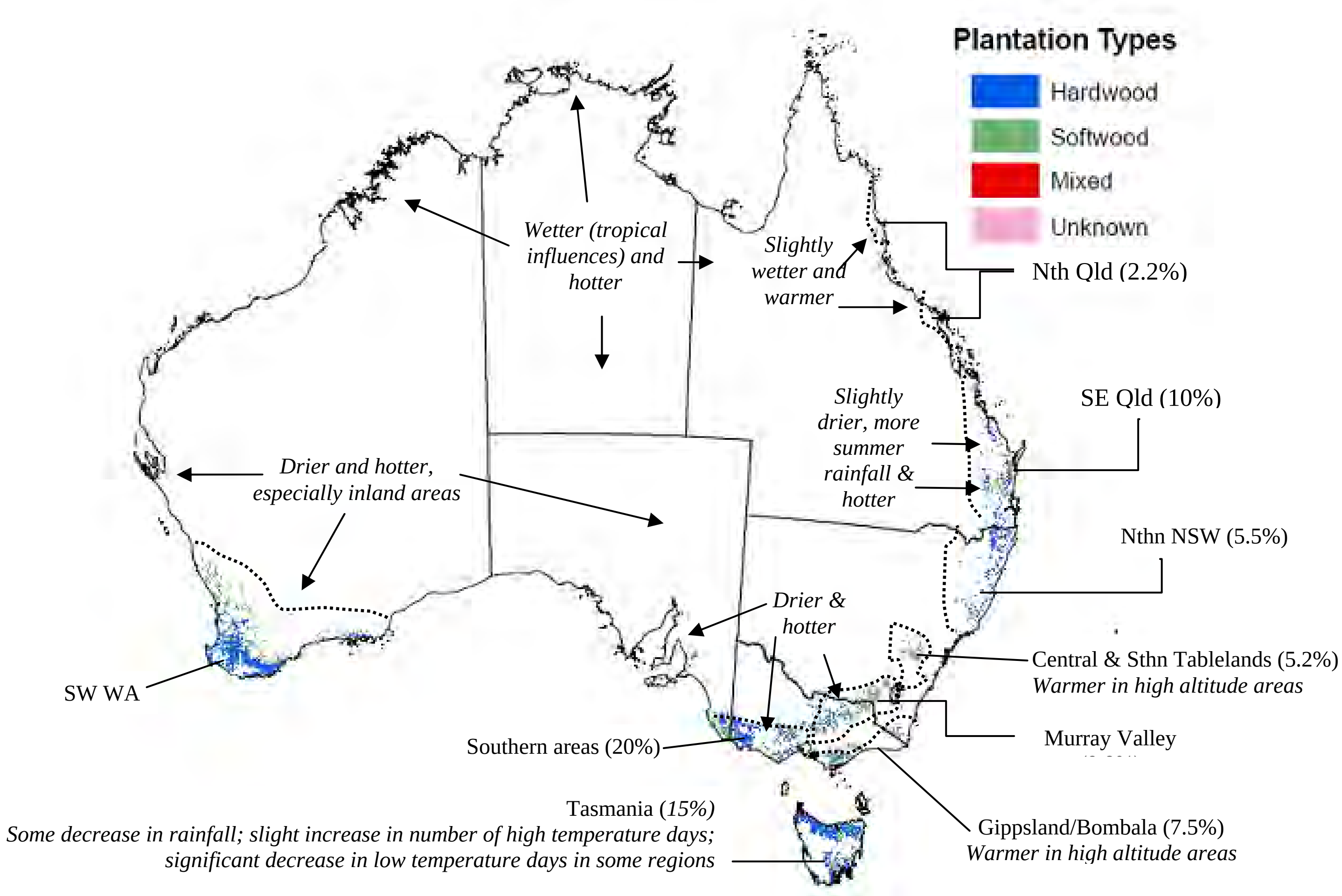
1996; Donaldson, 2001), small-scale forestry remains a minor part of the national estate largely confined to the recognised industrial-scale plantation zones in the higher rainfall areas (see Figure 1) (Wood *et al.*, 2001; Bureau of Rural Sciences, 2009).

It might be anticipated that climate change will further discourage the expansion of plantations, given the expected reduction in winter rainfall in Australia and generally higher temperatures, especially in inland areas (University of the Sunshine Coast and CLIMsystems Ltd, 2009) but it may also result in an incentive to establish plantations. In the late 1990s, there was some interest in promoting farm-based forestry through schemes that would 'bundle' the environmental services from plantations to generate additional income for forest owners (see for example Hassall and Associates, 1999; State Forests of NSW and Commonwealth Bank, 1999; van Bueren, 2001; Binning *et al.*, 2002; Buffier and The Allen Consulting Group, 2002) but with no major government scheme to purchase environmental services from forestry, such as the one that operates in Cost Rica (Pagiola *et al.*, 2002) and no regulatory requirements for resource users to purchase environmental offsets, no such scheme eventuated. The Australian Government's proposed Carbon Pollution Reduction Scheme (CPRS) is such a scheme that could create some demand for forest-based sequestration from new plantations.

This paper proposes a model of plantation establishment decision-making, summarised in Figure 2 that includes the direct and indirect impacts of climate change. The purpose is to develop a framework for future research on decision-making that includes those impacts. The paper starts with a brief discussion of demand (bottom right of Figure 2 and shaded blue) for wood and biomass. There is then some discussion of supply, especially considering the impact of climate change on the global supply of timber. We then consider the impact of climate change on growth rates (top right) and therefore preferred locations in Australia and the possibly enhanced competition for land uses (soils in Figure 2) that results.

The second section of the paper is a discussion of the policy variables, of which the main one is presumed to be the proposed CPRS. This discussion starts with a brief review of CPRS plantation establishment scenarios developed by the Australian Bureau of Agricultural and Resources Economics (Lawson *et al.*, 2008; Burns *et al.*, 2009). It is then argued that the demand for carbon sequestration will be a function of the policy design (top centre of Figure 2) in combination with the form of



Sources: Bureau of Rural Sciences 2006; CLIMsystems Ltd 2009

Figure 1: *Major Australian plantation regions and broad indicators from climate scenarios (proportion of national estate brackets)*

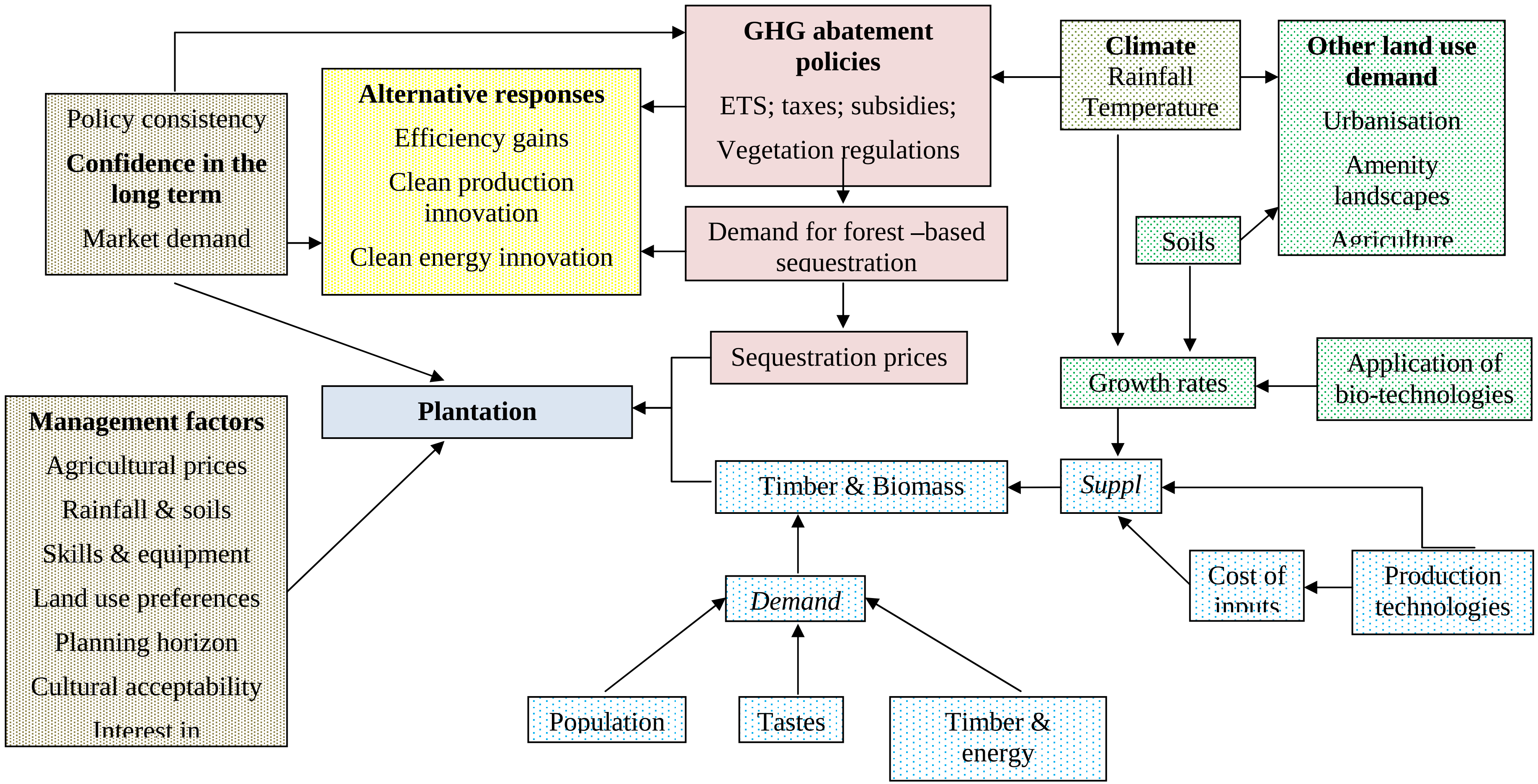


Figure 3: *Plantation establishment decision-making with greenhouse gas abatement policies*

responses that emitters choose. In relation to property-level decision-making three factors are considered: landholder attitudes to government policy-making; attitudes to conservation; and the type of landholder, these being important variables identified in previous studies (see for example Harrison et al., 1996; Herbohn et al., 2005; Emtage et al., 2007). For the general parameters of climate change, scenarios for 2030 and 2070 were taken from the median of an ensemble of 21 climate models (University of the Sunshine Coast and CLIMsystems Ltd, 2009), used to inform the Forest Vulnerability Assessment, commissioned by the National Climate Change Adaptation Research Facility, of which this work was part. From this, it is assumed for this discussion that there will be a reduction in winter rainfall in Australia and an increase in predominantly summer rainfall in the north-western and north-central regions (see Figure 1). There will generally be higher temperatures, especially in the inland areas and fewer low temperature (frost) days, especially in the higher-altitude and far southern areas.

2 MARKET AND PRODUCTION VARIABLES

Starting with demand for timber and biomass (bottom centre Figure 2), we assume that mainstream demand trends for timber are largely unaffected by climate change. That is, climate change has no impact on preferences in building materials or pulp products. There may however be an increasing demand for biomass for energy production, given for example the Australian target of 20 percent of renewable energy by 2020. There is some small-scale experimentation with particular eucalypts (notably types of mallee) grown under coppicing systems for bio-fuels (Wu *et al.*, 2008) but Australia starts from a very low base with bio-fuels accounting for only 0.45 percent of fuel and bio-electricity is only 0.7 of the total generated (O'Connell *et al.*, 2009). Perhaps a more immediate outcome will be greater efforts to use waste from timber and pulp production to add value to those enterprises.

In relation to the supply side and growth rates in particular, Booth and Jovanovic (2005) suggest that there will be minor changes in the preferred ranges of most commercial plantation species by 2030 with increasing restrictions for some species by 2070. On the other hand Battaglia *et al.* (2009) conclude that, with warmer conditions, some plantation species might be able to grow better in parts of Tasmania and in the higher altitude parts of Gippsland and southern NSW (see Figure 1). With less certainty in the modelling, Battaglia *et al.* (2009) also suggest that this might be the case for the far south-west of Western Australia (SW WA in Figure 1), where soils are fertile and deep and for parts of the southern plantation zone. In addition, a possible offsetting effect of climate change is that increased levels of CO_2 could contribute to increased tree growth rates by stimulating photosynthetic activity and increasing the water use efficiency of plants. Our colleagues who investigated the biophysical impacts of climate change on forests concluded that there is evidence from overseas and Australia that in particular cases increased levels of CO_2 could result in increased growth rates, but this might be limited to the most fertile soils (Work Package 2, 2010).

With hotter and drier conditions, holding other factors constant for the moment, the tendency over the long-term (towards and beyond 2070) would then be for plantations in the major zones of south-west Western Australia and the southern and Murray Valley areas to contract towards the more favourable climatic conditions (nearer the sea or higher altitudes) and better soils. This would however, likely lead to a general increase in the cost of production because of competition for land for agricultural, urban and lifestyle uses. In Australia more than 85 percent of the population live within 50 km of the coast, as at 2006 (Hugo, 2008) and predominantly the populated areas are on the coastal side of the major plantation areas. Then there is the 'tree change' movement, whereby people move to semi-rural areas near the coast or in near-inland higher altitude areas (Hugo, 2008), which includes the major plantation zones. Further to that, in some areas such as southern Victoria, recent decreases in rainfall have seen crop production increase in what were formerly pastoral areas toi create additional competition, with industrial-scale plantations, for land (Barr, 2008; Schirmer *et al.*, 2008).

Plantations might be competitive with agriculture if there is decline in agricultural productivity. For example, Cline (2007 cited in Australian Bureau of Agricultural and Resources Economics, 2007) suggests that Australian agricultural productivity will decrease by 17 percent, the second greatest decline of a suite of developed and developing countries and regions. This does exclude carbon fertilization effects and adaptation measures, such as crop varieties with differing growing periods (see for example Peng and Parton, 2008 in regard to wheat). Gunasekera *et al.* (2008) propose that while the rate of increase of agricultural productivity might decline it could still be positive. Studies from other countries (see for example Alcamo *et al.*, 1997; Alig *et al.*, 2002; Sohngen, 2008) have examined the combined effects of climate change on agriculture and forestry and suggest that there will be little substantial change in overall land use shares, given CO_2 effects on crops and demand for food. In Australia, even if overall production declines because of dry conditions in the inland cropping zones, this will only exacerbate the competition for 'soils' (see Figure 2) within the current plantation zones where cropping will become increasingly possible as water-logging becomes less of a problem.

On the other hand, little conversion of crop land to plantations and hotter conditions might suggest an overall decrease in timber supply and therefore higher prices but many studies have concluded that global timber production is instead likely to increase (Sohngen *et al.*, 2001; Schjolden, 2004; Boisvenue *et al.*, 2006; Sohngen, 2008). Boisvenue *et al.* (2006) reviewed global literature on forest productivity and concluded that climatic change seemed to have a generally positive impact on forest productivity where water is not limited. Perez-Garcia *et al*. (1997) and Sohngen and Sedjo (2004) predicted increased timber supplies and falling timber prices. There will be regional differences. Irland *et al.* (2001) conclude that forest production could decline during this century in the Southern U.S. and increase in the Northern U.S. Sohngen *et al.* (2001) show that tropical and sub-tropical regions may become relatively more productive, since timber rotation ages are shorter in tropical and sub-tropical regions than in temperate and boreal regions so producers in the tropics and sub-tropics can quickly take advantage of the gains from climate change.

There are two factors that may lead to an increase in the area under timber production. First, some of the northern cold areas may become more hospitable for forestry, so the potential area expands without any necessary reduction in agriculture. For example, Schjolden (2004) estimates that with 0.5° C warming more than 3.1 m ha of land in Norway, currently above tree line will become forested and with a 1° C warming this would increase to 5.5 m ha. Second, if most countries adopt some form of emissions pricing, then there be an increase in demand for sequestration, which may encourage additional afforestation. Tavoni *et al.* (2007), for example, estimated that there will be an additional 500 m ha of land that will be forested in 2050 compared to the (2007) baseline and approximately 1 billion hectares additional to the current baseline by the end of 2100. The net change in forests relative to today would then be 600 m ha (after deducting an expected 400 million hectare of losses) by the end of the century. Hence we argue that while timber production in Australia may decline, there may be no offsetting increase in timber prices and land costs may increase. Therefore, it may come down to demand for sequestration to induce additional plantings.

3 POLICY VARIABLES

There are two sets of policy variables, one relating to the design of a scheme and the other relating to attitudes to that scheme (see Figure 2). Since late 2007, the Australian Government has been committed to reducing Australia's GHG emissions by 5-25 percent, based on 5 percent unconditional and 25 percent if the world agrees to a global deal to stabilise levels of GHGs in the atmosphere at 450 ppm CO_2e (or lower) by 2020, and 60 percent below 2000 levels by 2050. In attempting to meet these targets the Australian Government proposed in 2009 a Carbon Pollution Reduction Scheme (CPRS). The legislation to enact this scheme did not pass through the Australian Parliament but the CPRS remains the Government's preferred abatement program should agreement be secured. The CPRS as revised for the parliamentary debates is therefore used to illustrate the potential impact of a carbon price on plantation establishment. The other major Australian political parties (the Liberal and National Parties Coalition) have promised to provide incentives to establish forest sinks, though with a general qualifier that such sinks would not be established on prime agricultural land.

The proposed CPRS was to include over 75 percent of Australia's GHG emissions (Department of Climate Change, 2010), which is relatively wide coverage. Reforestation[1] activities are proposed to be eligible from the beginning of a CPRS. Four carbon pools were to be considered: aboveground biomass, belowground biomass, dead wood and litter but soil C won't be included (Department of Climate Change, 2009a). Managers can have forests for harvest (both short and long rotations) and/or environmental plantings with the latter getting a higher emissions unit value than the former (Department of Climate Change, 2009b). There is also a tax incentive for carbon sink forests under tax legislation, though only the plantation cost is tax deductable (Department of Climate Change, 2010). The owner can clear forests at any time but would need to hand back any emissions units they had received to cover the emissions that are released back into the atmosphere. This obligation will remain in place for 100 years (Department of Climate Change, 2009b). Nonetheless, such a scheme could still encourage plantations, since the early payments for sequestration would somewhat offset the initial establishment costs and then the payback occurs when timber income is imminent.

The Australian Bureau of Agricultural and Resource Economics (Lawson *et al.*, 2008; Burns *et al.*, 2009) generated three afforestation scenarios based on differing reduction targets, as summarised in Table 1. The assumptions include: no other regulatory interventions in regard to land use; net present value as the financial indicator of land use choice; a discount rate of seven percent; and a terminal biomass potential for all trees at 45 years of age. With no payments for environmental services (PES) or any other policy intervention, it is estimated that the area of timber plantations would increase over 40

1 'Reforestation' is defined as forests established by people since 1990 on land that was clear of forest on 31 December 1989. Australia's definition of a forest for Kyoto Protocol purposes is: a forest of trees with a potential height of at least two metres and crown cover of at least 20 per cent; and in patches greater than 0.2 hectare in area.

years to about 611,000 ha, or an additional 0.1 percent of agricultural land. With a target of 5 percent reductions, a starting price of approximately $20 per tonne (carbon equivalent) of sequestration in 2010, increasing at 4 percent per year (Lawson *et al.*, 2008), there is an increase in both timber and environmental plantations establishment rates. Environmental plantings are assumed to attract a higher payment rate because they would grow to maximum sequestration potential and there would be no release, assumed to be 100 percent, of carbon at harvest.

Table 1: *Area of agricultural land economically competitive for forestry 2050 (Source: From Burns et al, 2009, p. 12)*

Scenario	**Timber plantations ‘000 ha**	**Environmental plantations ‘000 ha**	**Forested area as proportion of farmland %**
No PES	611	0	0.1
CPRS-5	3047	2740	1.4
CPRS-15	4514	21,812	6.2

Planting rates are assumed to accelerate from 2030 with the higher price for sequestration being driven by fewer credits being available, since the CPRS is a cap and trade system, with the cap decreasing over time. The new timber plantations are projected as being overwhelmingly within the current plantation regions, especially in the southern region, Tasmania and near Adelaide, currently a relatively small plantation zone (Lawson *et al.*, 2008, p. 19). This would mainly displace the grazing rather than cropping. With a higher abatement target (CPRS 15), the starting price is $29/tonne, increasing at four percent per year. This would lead to a big increase in environmental plantings and these would be overwhelmingly in central NSW and Queensland (Lawson *et al.*, 2008, p. 20), inland from the plantation zones of Figure 1, displacing extensive grazing activity.

The intention here is not to take these results literally or to critique the modelling, which is necessarily general and reliant on a range of assumptions subject to considerable regional variation. For a start, in an effort to get the CPRS accepted, the starting price was lowered to $10/tonne and additional exemptions were granted, both of which would decrease the returns to forest owners. Site suitability and the availability of processing infrastructure were not considered (Bellamy, 2009) and no transaction costs for monitoring and verifying carbon credits were included, and these might be relatively high (per ha) for small-scale producers. The point of reviewing the first such attempt to anticipate the impact of pricing greenhouse gas emissions on forest establishment was to show the potential incentive and some of the tendencies in relation to new plantings.

As an example, we compared the estimated returns from carbon sequestration over 30 years for a site at Dorrigo, in the higher altitude part of the northern NSW plantation zone. The assumptions were a $10/t starting price for sequestration with a four percent annual price increase and a seven percent discount rate, the latter two being assumptions used in the ABARE modelling. The tree scenarios were generated from case studies from the FullCAM model (Richards and Evans, 2005). Under the CPRS, FullCAM was to be the standard model for estimating sequestration rates, though this would have been most likely to have been a later version than the one used here, which has relatively limited data. Over 30 years, from planting to the harvest of both the slash pine and *eucalyptus grandis* and a little way into the second plantation cycle. This simple example suggests that sequestration returns are somewhat similar to a standard gross margins estimate for a beef production enterprise and that environmental plantings gain a financial advantage with regard to sequestration over the longer time, as the carbon release from harvesting takes effect.

Table 2: *Sequestration value of different species at Dorrigo, Northern NSW (Sources: FullCAM model (Richards and Evans, 2005); *Beef enterprise gross margins (NSW Department of Industry and Investment, 2010)*

	Returns $/ha Annualised NPV	
Land Use	**30 years**	**36 years**
Slash pine	$175	$176
E. Grandis	$178	$179
Environmental plantings	$222	$282
Growing out steers*	$190-224	$190-224

Nonetheless, in the medium term, the plantations with timber production could have some financial advantage over some forms of agriculture, where the timber production yields a positive NPV, which is certainly not always the case in the more marginal areas (see for example Cockfield, 2005; Venn, 2005). Indeed Cockfield (2005) has shown, for sites just inland from the south east Queensland plantation zone (Figure 1) that the NPVs for plantations based solely on timber are almost always negative, though is highly site dependent. Hence, outside the current recognised plantation zones, sequestration payments will need to comfortably exceed the financial performance of current land uses. Even if this was the case, there are two final sets of policy variables to be considered.

There are the responses of landholders to an emissions trading scheme itself, as opposed to just the sequestration prices on offer and the responses of those producers of greenhouse gases who are within the scope of an emissions trading system (ETS) such as the CPRS (top left of Figure 2). In particular, their demand for substitutes to forest-based sequestration needs to be considered.

Emitters may choose alternatives such as production efficiency gains, adopting alternative energy sources, buying credits from others or perhaps buying geo-sequestration, if that was to be developed as an approved offset. The adoption of substitutes to forest-based sequestration depends on permit prices and various technological innovations. Figure 3 is a hypothetical illustration of how the original trajectory of increasing greenhouse gas emissions might be accommodated. In this scenario, without intervention, GHG emissions would keep increasing at about 1 percent per year over 70 years of an emissions trading scheme. Initially demand for sequestration would be low as producers purchased permits and assessed their options. As permits became scarcer and more costly, producers would start to seek emissions reductions through internal efficiency and/or an increasing demand for sequestration. In the longer term, new technologies would be introduced and there would be a switch to renewable energy.

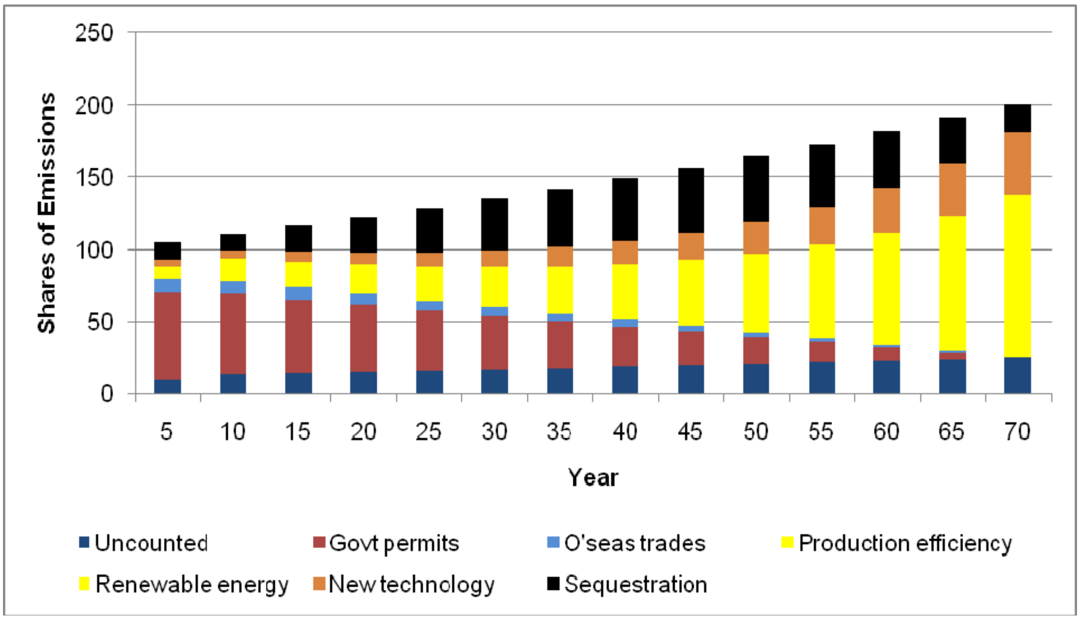


***Figure 3:** Hypothetical changes in emissions shares*

The second set of responses to any policy change is that of the potential forest owners, which in the case of small-scale forestry is assumed to be landholders. Studies of attitudes to small-scale forestry have shown that lack of profitability is considered by landholders, especially those more dependent on agriculture for income, to be a barrier to establishing plantations (Harrison *et al.*, 1996; Cockfield, 2005; Herbohn *et al.*, 2005; Emtage *et al.*, 2007). Hence, at face value, additional payments for sequestration, especially starting immediately after establishment, might offset some of these concerns. The problem may be that there will be limited faith in a scheme seen to depend on government decisions. Some of these same studies have shown that one of the highest rated barriers to establishing plantations is concern that government regulation will prevent the realisation of timber returns (Cockfield, 2005; Herbohn *et al.*, 2005). Previously this was fuelled by regulatory restrictions on clearing and logging but there could be scepticism about governments' likely constancy to an ETS over 50 years.

On the other hand these studies also show that one of the main reasons for establishing plantations is the environmental and aesthetic benefits (Harrison *et al.*, 1996; Cockfield, 2005; Herbohn *et al.*, 2005; Emtage *et al.*, 2007), though the environmental drivers are more apparent amongst people with a lower dependency on agriculture (Cockfield, 2005) and more specifically, those who tend to be 'lifestyle' landholders rather than commercial farmers (Emtage *et al.*, 2007). The larger-scale commercial crop farmers see forestry as a possibility on unused parts of the farm but are reluctant to give up the flexibility of land use that goes with annual crop and livestock production (Cockfield, 2005). Hence, areas which might be first brought into consideration for new plantations include lifestyle properties, low-intensity grazing areas and unused parts of crop farms, where the landowner is open to considering the environmental benefits of forestry and is not hostile to government interventions in land use.

4 CONCLUSIONS

The objective of this paper was to bring together knowledge of climate change impacts, policy responses and landholder behaviour to start to develop a model of landholder plantation decisions under an emissions trading scheme. A scheme such as the CPRS does have the potential to induce land use change to both timber and environmental plantations, though some caution is required. Timber plantations are not generally profitable outside the higher rainfall areas of Australia and there is no expectation of an increase in timber prices above long-term trends, so the major determinants of land use change will be the sequestration price and the confidence of the potential forest owner in the certainty of payments over a long period. There is unlikely to be any great increase in the area of timber plantations inland of the current plantation zones. Inside the zones and on the better soils, sequestration prices are the equivalent of a bonus above timber returns, forest owners can afford to risk some policy uncertainty, perhaps considering it as an offset to higher land prices.

Second, and specifically in relation to small-scale forestry the current plantation zones will have an increasing number of lifestyle landowners within them and this group has been shown to be more pre-disposed to consider plantations than other categories of landholders. Where land is more marginal, in terms of moisture availability and fertility, timber plantations are more likely to become less rather than more profitable and so environmental plantings, especially those that provide co-benefits such as habitat and salinity control, will come into consideration as predicted by the ABARE modelling.

These are however, early and tentative conclusions and more detailed analyses are needed to forecast the impacts of emissions pricing on land use change in Australia. First, the demand for forest-based sequestration needs more consideration to anticipate what abatement choices emitters will make. Once an ETS is in place and emitters accept that it is likely to stay there for the long term, then they will make more permanent changes to production methods, which may in turn reduce demand for forest-based sequestration. There could also be other policy decisions that change sequestration demand, for example a major shift to nuclear energy would dramatically change the market. Second, there needs to be more geographically specific financial analyses, to capture growth rates, appropriate species, establishment costs and the returns from competing land uses, the latter being highly variable across regions and business types. Third, there would need to be some revisiting of the attitude studies to specifically gauge likely responses to an ETS. Finally there could be an enhanced fire risk that would come from a hotter and drier climate and more trees in vulnerable landscapes and this may need further consideration.

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Determining the state of knowledge of private forest landowners regarding global climate change and the impacts to western forests: a needs assessment

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Abstract

Family forest landowners control over 60% of the private forest land in the United States. Little is known regarding the level of knowledge and understanding family forestland owners have regarding global climate change (GCC) and the potential impacts on how they manage their forests. A needs assessment is currently underway to determine the perceptions, understanding, and educational needs of private forest landowners in the Pacific Northwest (PNW) regarding the impacts of global climate change (GCC) on western forests. When asked what they knew of climate change and their questions and/or concerns regarding the issue almost all of the participants expressed frustration over deciphering what they considered the “good science” from the “bad science”. They felt overwhelmed by the complexities of the issue and were uncertain as to how to determine the validity of the scientific information they received. With regards to their specific questions about climate change and the kind of information they would like to receive a few topics were common in most groups including, information on carbon credits, recommendations on what to plant now to prepare for the future, impacts of climate change on local conditions, and help deciphering the available science and determining what is valid and credible. During discussions, it was clear that for many participants this was an emotionally-charged issue and a political one as well. The issues and concerns surfacing from the discussions indicate that when designing educational programs on climate change it may be necessary to view it as a controversial issue and understand that strong feelings regarding climate change might serve as a barrier for some individuals to participate.

Key words: private forests landowners, climate changes
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1 INTRODUCTION

Family forest landowners control over 60% of the private forest land in the United States (Butler 2008). In the Pacific Northwest (PNW) family owned forestlands make up more than 3,200,000 hectares (USDA Forest Service 2006). Little is known regarding the level of knowledge and understanding family forestland owners have regarding global climate change (GCC) and the potential impacts on how they manage their forests. The impacts of GCC on ecosystem functions such as stream flows, fire regimes, wildlife habitat, and vegetation types are of increasing concern for state and federal land managers. Private forest landowners in the PNW and elsewhere are beginning to face the same challenges as public land managers with regards to changing forest conditions. However, the degree to which private landowners are prepared to respond effectively is unknown.

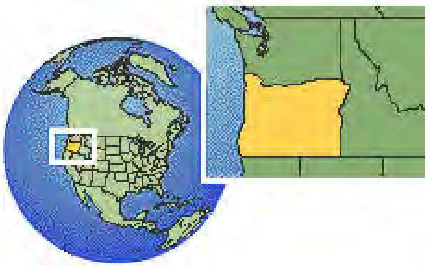
Extension educators and researchers from the states of Washington, Idaho, and Oregon performed a needs assessment to inform the development of a regional extension and technology transfer program addressing GCC relative to family forest landowners in the PNW. This assessment provides the information necessary to design and implement effective education and outreach programs for family forest landowners in the West that will facilitate sustainable forest management practices under changing forest conditions. Objectives are as follows: determine the perceptions, understanding, and educational needs of private forest landowners in the Pacific and Inland Northwest regarding the impacts of global climate change (GCC) on western forests; determine participant attitudes towards GCC as an issue directly affecting them; determine participant attitudes towards GCC as an issue directly affecting their property.

2 STUDY DESIGN AND METHODS

Family forest landowner needs were assessed through a series of focused group discussions held throughout the PNW region (figure 1). These discussions were constructed using a double-layer design which allows for comparisons between geographic locations (table 1). Layer 1 is geographic region, and layer 2 is sub regional, related to general forest type involving all the states within the Pacific Northwest Region. Layer 1 segregations follow these characteristics: Pacific coastal forests, Inland northwest forests, Northern Rockies, Alaska boreal forests. Layer 2 is divided east to west and/or north to south. Three (3) focused group discussions were scheduled to be conducted at three different locations within each of the eight study areas for a total of 24 different groups.

Alaska

Washington



Oregon

Idaho

Figure 1: Pacific Northwest (PNW) states that are included in the study.

As of this writing, a total of 14 focused discussions have been completed for Washington, Idaho, and Oregon. Alaska will be completed in fall of 2010. Each group consisted of six to twelve family forest landowners solicited from the immediate area where the workshops were held. All workshops were video-taped and audio recorded with the participants' consent and audio recordings were transcribed verbatim.

Table 1: Double layer design

Layer 1	Layer 2	# groups/region (# completed)
Pacific Coast	Western Washington	3 (2)
	Western Oregon	3 (2)
Inland Northwest	Eastern Washington	3 (1)
	Eastern Oregon	3 (3)
Northern Rockies	Central Idaho	3 (3)
	Northern Idaho	3 (3)
Boreal	Interior Alaska	3 (0)
	Coastal Alaska	3 (0)

The questioning route was intended to reveal participant level of knowledge and attitudes regarding global climate change and the potential impacts to their forests. Questions are purposely open-ended and are sequential (table 2).

Table 2: Questioning route and sequence

Opening question:	1. Tell us about your forest
Introductory questions:	2. Where do you get your information about climate change?
	3. How do you assess the validity of the information you receive about climate change?
Transition questions:	4. How do you think climate change may or may not impact your forest?
	5. What are you doing differently on your forest (if anything) as a result of anticipated climate change?
Key questions:	6. What are your major questions about climate change?
	7. What form would you like to get information about climate change?
	8. Do you have any further questions or comments?

3 RESULTS

The assessment is ongoing and should be completed by fall of 2010 so only initial findings will be presented here. However, we feel that we can begin to address a few of the themes emerging from the discussions to date. All participants were family forest owners that had taken part in forestry education programs through Cooperative Extension within one of the target states; Washington, Idaho, or Oregon. No demographic information was collected from participants other than the number of hectares owned, which ranged from 5 to over 2,000 hectares, and the length of the ownership, which was a median of 21 years.

Participants were asked to identify the source(s) of their climate change information. Most common were newspapers, radio and television, periodicals from land management agencies such as the US Forest Service, the internet, and popular articles. In Oregon, the state climatologist was often mentioned as a source for climate change information, but was viewed with suspicion by some participants. Some participants actively sought out information on climate change while others obtained their information passively.

When asked what they knew of climate change and their questions and/or concerns regarding the issue almost all of the participants expressed frustration over deciphering what they considered the "good science" from the "bad science". They felt overwhelmed by the complexities of the issue and were uncertain as to how to determine the validity of the scientific information they received:

> "How does the layman determine what is peer reviewed or not?" —*Landowner, northeast Oregon*

While a certain amount of uncertainty was recognized by most participants as being endemic in the sciences, many felt that the degree of uncertainty surrounding climate change was unacceptable, especially given the perceived implications to forest policy and management:

> "I'm more worried about political decisions that may arise without solid scientific evidence; the fear that we might lose our place and leadership in the world. I'm more concerned about the threat of climate change than about climate change itself." —*Landowner, central Oregon*

> "I am concerned about impacts of climate change policy on my forest. The stresses I see [in my forest] may be related to climate change, but I'm unsure – Is climate change the next spotted owl issue? Do we need to lock everything up? Sure things are changing, but are we being forced to lock up and do nothing?" — *Landowner, southwest Washington*

> "My question is, will we be as affected by the climate change as we will by the regulations..regulations tied to climate change? We might not see any change on the ground but we'll have to change the way we do business."—*Landowner, North Idaho*

Many participants remarked on the amount of conflicting and confusing information they received on the topic of climate change. When asked how they determine the credibility or validity of the information they receive there was a fair amount of skepticism among those who commented:

> "Follow the money! Even science gets grants to address what is popular, so I don't trust a lot of the literature that comes out."—*Landowner, southeast Oregon*

> "I consider myself a skeptic…the way I base my judgment on [global warming] is following the money. Everything is revolving around money, and if it DOES revolve around money, I discredit that immediately."— *Landowner, North Idaho*

> *"How do we determine validity of data? What data? Provide me with the data to decide."*—Landowner, northwest Oregon

Most participants were not managing their forests any differently in anticipation of climate change influences, though some had experimented with not native trees (e.g. redwoods in NW Oregon) . Managing for a healthy and resilient forest was considered the best strategy regardless of what changes, if any, climate change might bring to their forests. With regards to their specific questions about climate change and the kind of information they would like to receive, a few topics were common in most groups and they include; information on carbon credits, recommendations on what to plant now to prepare for the future, impacts of climate change on local conditions, climate change compared to local historic climate swings, help deciphering the available science and determining what is valid and credible, best practices for sequestering carbon, and what can be done to mitigate climate change on an individual property:

> "How would few degrees temp change impact species locally?"—*Landowner eastern Washington*

> "Should we be doing something different? We are managing for 20-500 years, but should be doing anything with regards to long term?"— *Landowner eastern Washington*

> *"Assuming cap & trade, we will need education on what to do."* —Landowner northeast Oregon

4 DISCUSSION

Conformation bias was exhibited by many of the participants in our discussions. In this case conformation bias is defined as "the unwitting selectivity in the acquisition and use of evidence" (Nickerson 1998). This is a commonly seen phenomenon when dealing with scientific communication (Nickerson 1998; Shome and Marx 2009). Confirmation bias is often a factor when there are significant uncertainties associated with the science, such as that with climate change (Marx et al. 2007) However, when the scientific information comes from competing interests or sources perceived as untrustworthy, individuals are often more receptive to that information they feel is the most relevant, salient, and credible, and best supports their own viewpoints (Cash et al. 2002). Better understanding of scientific information can often be achieved when scientific uncertainties are addressed, especially with regards to how individuals process these uncertainties, whether it is an analytical or experiential process (Marx et al. 2007). Research suggests that approaching discussions around climate change may be more effective if communications are designed to “create, recall and highlight relevant personal experience”, (Marx et al. 2007). For example, the use of scenarios, narratives, and analogies may be more engaging then statistics and probabilities.

As stated earlier, this project is currently in progress; the results presented here are preliminary. During discussions, it was clear that for many participants this was an emotionally-charged issue and a political one as well. The issues and concerns surfacing from the discussions indicate that when designing educational programs on climate change it may be necessary to view it first as a controversial issue. Strong feelings regarding climate change might serve as a barrier for some individuals to participate. Certainly if an individual has no interest in a subject or does not feel the topic is a relevant one, then he/she should not be pressured to participate. The results from these preliminary discussions suggest that there is interest by participants to acquire clarifying information regarding climate change and forest management, however, the source of this information, to whom it is delivered, and in what way must be looked at very carefully.

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An analysis of the costs and benefits of various carbon forestry development options in the Asia-Pacific region

Paul Dargusch[1]

Abstract

This paper presents a cost-benefit analysis of a range of carbon forestry options in the Asia-Pacific region (in particular, Australia, the South Pacific Islands, Papua New Guinea, Indonesia and the Philippines). A number of carbon forestry development options are analyzed, including large-scale industrial monoculture plantings, bioenergy developments, natural forest conservation schemes and small-scale community-orientated land conservation plantings. The financial, ecological and social benefits of each option are discussed. Implications for climate change mitigation policy as far as it concerns land use and land use change and forestry are discussed. The importance of matching carbon forestry-related policies to appropriate regional scales is highlighted. Recommendations are made for how carbon forestry policy can be designed to optimize minimizing the financial cost of greenhouse gas emissions abatement (offsetting) and maximizing social and ecological benefits of better forest management (across afforestation, reforestation and natural forests).

Key words: emissions trading, climate change mitigation
FDC: 111.83+65(5)=111

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The harvesting behavior of Irish private forest owners and the suitability of the private estate for thinning

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Abstract

The Irish government plans to increase the forest cover from 10% to 17% by the year 2030, resulting in the annual timber supply increasing from 2 million m^3 to 10 million m^3. Private afforestation is targeted to account for 70% of the area planted and generous financial incentives are available to encourage private landowners to plant. The projections for timber supply assume that private forests will be managed and harvested in a similar way to State forests. This study set out to determine the harvesting intentions of private forest owners and to assess whether their forests are silviculturally suited for thinning. A survey of 120 private forest owners who had afforested land since 1981 was conducted in 2007. Three-quarters of respondents planned to thin their forests. The suitability of the area that they planned to thin was assessed taking account of access, ground conditions and windthrow risk. Only one-half of this area was found to be suitable for thinning with poor ground conditions and/or excessive roading requirements the main constraints. The results raise questions as to whether the timber production targets as laid down in Government policy will be achieved.

Key words: afforestation, harvesting, private forest, forest management, Ireland
FDC: 913/4:682(417)=111

1 INTRODUCTION

A major afforestation programme has been on-going in Ireland since 1981. Over 18,000 landowners have afforested 212,000 ha, which accounts for 70% of the area afforested during that period and 30% of the total forest area. Almost all these landowners were engaging in forestry for the first time. The afforestation programme has been supported through financial subsidies in the form of establishment grants (introduced in 1981) and annual premium payments (introduced in 1990) which are made available to landowners who wish to afforest. Premium payments were introduced to compensate landowners for

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income losses arising from afforestation. The subsidies were co-funded by the EU and the Irish government until 2006; they are currently entirely financed using national funds. The rationale for supporting the afforestation programme was outlined in the Government's strategic plan for the development of the forestry sector in Ireland, published in 1996. In the strategy, the case for continued investment in forestry was made primarily on the basis of the target size for the industry, i.e. critical mass, which was defined as "the scale of timber production large enough to make true competition and the operation of market forces possible and to support a range of processing industries" (DAFF, 1996, p. 2) and was set at a minimum of 10 million m^3 per annum. Annual timber production at the time the strategy was published was just over 2 million m^3, less than 5% of which was harvested in private forests. The plan laid out afforestation targets of 25,000 ha per annum to the year 2000 and 20,000 ha per annum thereafter to the year 2030 (which would lead to forestry accounting for 17% of the land cover).

To achieve critical mass, it was assumed that private plantations would be managed and harvested in a similar way to State plantations. Standard practice within State forests is that thinning occurs for the first time when the crop (conifer) is aged between 14 and 24 years (Forest Service, 2007) and continues thereafter at regular intervals until clearfelling occurs when the stand is 45-50 years. However, there is evidence that non-industrial private forest owners do not always manage their stands in a similar way to public or other private forest owners (Herbohn, 2006). It was in this context that this study was initiated to determine:

- the objective of private forest owners for their forests;
- the harvesting intentions of forest owners;
- the suitability of the private estate for thinning.

2 METHODS

A survey of a random sample of private forest owners was conducted during the summer of 2007. The sample was drawn from the Forest Service database of landowners who had applied for grant-aid to support afforestation during the period 1981 to 2006. During this period, little if any afforestation was undertaken without grant-aid, hence the database effectively represents the population of landowners who afforested during the period (Forest Service, 2009). The database was divided in two; the first section comprises the names of those that had received grant-aid under the initial afforestation programme from 1981 to 1989, known as the Western Package (WP) scheme (1,860 records accounting for 20,517 ha), while the second section included those who had planted thereafter under the Common Agricultural Policy (CAP) scheme (16,239 records accounting for 198,584 ha). Under Data Protection Legislation, the Forest Service was required to conduct the sampling regime for the purpose of maintaining client anonymity. A random sample of 1,000 owners, selected proportionately from each scheme, was invited to take part in the survey and over 380 agreed to do so and from these a random sample of 120 forest owners (25 WP; 95 CAP) was selected for survey.

A detailed questionnaire was completed by each owner during face-to-face interviews. It included questions regarding the owners' objectives, their plans to thin their forests, their involvement in extension activities as well their awareness of silvicultural processes involved in forest management. This paper focuses on the owners' objectives and their thinning plans.

A silvicultural audit of the forests owned by those surveyed was also conducted, the full results of which can be found in Maguire et al. (2010). As part of this silvicultural audit, the suitability of the owners' forests, for thinning, was assessed by taking account of three site and stand variables. These had been identified in the Irish Thinning Protocol (Forestry Development Association, undated) as key factors determining a stand's suitability for thinning. Forests were first classified subjectively according to the ground conditions on the site, i.e. good, average, or poor-very poor ground conditions. This classification was used as an indicator as to whether a machine could extract timber on the site. The forests were further classified according to access, i.e. whether there was good or poor road access. Forests classed as having poor access were those requiring roads to be constructed at a density in excess of 20 m/ha. The Forest Service provides grants for roading but the maximum density that will attract funding is 20 m/ha. Densities in excess of this level were considered not economically viable, Finally the silvicultural suitability of the forest for thinning was estimated by assessing windthrow risk using Ní Dhubháin et al.'s (2009) windthrow risk model. This model takes into account top height, soil type, altitude, location and whether the stand has been thinned. Stands were classified according to three levels of risk:

1. Low – probability of windthrow < 11%;
2. Medium - probability of windthrow ≥11% but < 50%;
3. High - probability of windthrow ≥50%.

Stands on sites which had good to average ground conditions, good road access and where the risk of windthrow was less than 50% were considered suited for thinning.

3 RESULTS

3.1 THE FORESTS

The respondents owned, on average, 8.8 ha of forests (Table 1). The older forests, i.e. those planted between 1981 and 1990 were most commonly pure Sitka spruce (*Picea sitchensis (Bong.) Carr*) plantations. Broadleaved species and mixed conifer-broadleaf stands were more common in younger plantations (Maguire et al., 2010).

Table 1: Size distribution of forests.

Area	ha	%
0 – 1.9	22	2
2 - 4.9	129	12
5 – 8.9	190	18
9 – 13.9	132	13
14 – 19.9	201	19
20 – 29.9	150	15
30 – 49.9	150	15
50+	61	6
Total	1035	100
Mean	8.8	

Almost half (46%) of the area owned by respondents was classed as having good ground conditions; a further 28% was classed as having average ground conditions; in the remaining area ground conditions were poor.

Table 2: Windthrow risk in forests.

Probability of windthrow occurring (%)	ha	%
0 – 10	743	72
11 – 20	36	3
21 – 30	108	10
31 – 40	53	5
41 – 50	78	8
51 – 60	8	1
61 – 70	0	0
71 – 80	9	1
81 – 90	0	0
91 – 100	0	0
Total	1035	100

Many of the forests established under the afforestation programme are located in inaccessible parts of farms. This is reflected in the finding that 96% of forests were considered to have inadequate access for timber extraction. An assessment of the roading requirements indicated that 69% of the forest area surveyed needed roading at a density in excess of 20 m/ha to facilitate extraction.

The risk of windthrow was low in much of the forest area with almost three-quarters of it classed as having less than a 10% chance of experiencing windblow (Table 2).

3.2 THE OWNERS

Three-quarters of those surveyed were farmers (full-time, part-time or retired). Less than one-fifth were younger than 45 years. The owners were asked their reasons for planting trees. The most common reasons given were to use up poor ground, to avail of grants and premiums and for investment reasons (Table 3). Respondents were asked whether they would have planted trees if financial subsidies were not available; 62% said they would not; 26% would have planted anyway, the remaining 12% were unsure.

Table 3: Respondents' reasons for afforestation.

Objective	Primary		Secondary		Tertiary	
	n	%	n	%	n	%
Use up poor land	69	57	14	12	7	6
Avail of grants and premiums	15	12	22	18	3	2
Investment/pension plan	13	11	14	12	11	9
Enhance landscape	2	2	8	6	4	3
Leave something behind	0	0	0	0	13	11
Amenity and recreation	2	2	3	2	5	4
Shelter	2	2	2	2	1	1
Land fragmented	4	3	2	2	1	1
Unable to farm/reduced labour	3	2	0	0	2	2
Other	10	9	6	5	8	7
None	0	0	49	41	65	54
Total	120	100	120	100	120	100

3.3 OBJECTIVES

The primary objective of most forest owners was to produce timber from their woods (Table 4). Forty-nine percent of forest owners had multiple objectives.

Not all of those with timber production objectives plan to sell their timber rather they plan to use it on the farm (16% of all respondents) for firewood, fence posts or wood chip, or otherwise remain unsure as to what they will use the timber for (27% of all respondents).

Table 4: Respondents' objectives for their forest.

	Primary		Secondary		Tertiary	
Objective	n	%	n	%	n	%
Produce timber for sale	54	45.0	2	1.5	1	1.0
Produce timber for own use	6	5.0	9	8.0	1	1.0
Produce timber (unsure about use)	23	19.5	1	1.0	3	2.5
Enhance landscape	6	5.0	12	10.0	1	1.0
Pass on to family member	4	3.0	11	9.5	3	2.5
Provide recreation	2	1.5	5	4.0	5	4.0
Don't know	12	10.0	5	4.0	2	1.5
Provide shelter	2	1.5	6	5.0	1	1.0
Other (i.e. sell forest)	8	7.0	4	3.0	1	1.0
Help biodiversity	1	1.0	4	3.0	3	2.5
Use for hunting	0	0.0	0	0.0	2	1.5
Nothing	2	1.5	61	51.0	97	80.5
Total	120	100.0	120	100.0	120	100.0

3.4 THINNING INTENTIONS AND SUITABILITY FOR THINNING

Almost three-quarters of all forest owners surveyed planned to thin their forests in the future, while a further 16% did not (Table 5). The suitability of the stands owned by the respondents, for thinning, was assessed. First, the area owned by those planning to thin was considered. Based on the criteria outlined in the methods, only one-half (53%) of this area was classed as "suitable" for thinning. This equated to only 49% of those planning to thin correctly assessing their stands as being suitable for thinning. Of those that were unsure as to whether they would thin their stands, only 22% of their forest area was suited for thinning. Of the final group of respondents, i.e. those who did not plan to thin their stands, almost one third of the area they owned was suited for thinning. In choosing not to thin their stands, 74% made the correct silvicultural decision.

Table 5: The silvicultural suitability of owner's harvesting intention

	% of respondent s (n=120)	Area owned (ha)	Area suitable for thinning (ha)	% who made correct decision
Plan to thin	72	854	441	49
Unsure	12	74	22	-
Will not thin	16	106	30	74
Total	100	1035	493	-

4 DISCUSSION

The key objective of the afforestation programme in Ireland is the generation of a critical mass of timber, according to the principles of sustainable forest management. This emphasis on timber production is reflected in the rules and regulations surrounding the afforestation programme, including guidelines regarding species selection, plantation layout and management that successful applicants must follow. Furthermore, sites for which grant-aid is paid must be "capable of producing a commercial sawlog crop of wood" (Forest Service, 2003, p. 19). Routine inspections of grant-aided forests are conducted so as to ensure these guidelines are adhered to. Thus those in receipt of grant-aid should be in no doubt that timber production is expected to be one of their objectives, if not the main objective. It is surprising therefore that 17% of those surveyed did not give timber production as an objective for their woods. Furthermore, a sizeable proportion of those planning to produce timber do not have plans to sell their produce, rather they plan to use it on the farm (16%) for firewood, fence posts or wood chip, or otherwise remain unsure as to what they will use the timber for (27%). These results raise concerns as to whether the planned timber production, envisaged in the Government's strategy for forestry, will be realized.

Many studies of forest owners have focused on their objectives and have used these as an indicator of forest management (Ní Dhubháin et al., 2007). However, objectives do not always coincide with actions for this reason, owners were asked their harvesting plans focusing specifically on thinning. Almost all of those with timber production as an objective planned to thin their stands. Surprisingly, more than half (63%) of those who did not have timber production as an objective also planned to thin their stands. It is likely that these owners were removing trees to enhance the landscape and biodiversity values of their forests. This finding highlights that using owners stated objectives alone, as an indicator of their future "forestry" behavior, can be very misleading.

The decision to thin a stand is not only determined by owners' objectives but is also influenced by economics and site conditions. In Ireland, harvesting is, in almost all cases, carried out mechanically and the timber extracted by forwarder to roadside. Windthrow risk is a major consideration when the decision to thin is made, and sites where crop stability is inherently poor are not usually considered safe to thin. In an effort to predict timber supply from private forests an assessment of the suitability of the forests owned by those surveyed for thinning was conducted. This analysis only took into account two factors, i.e. can the stands be thinned and should the stands be thinned. Access and ground conditions were the two factors chosen to determine whether stands "could" be thinned. Crop stability, post thinning, was the sole factor considered when determining "should" a stand be thinned. Furthermore, assumptions were made regarding levels of factors. For example, the "good" and "bad" access categories were based on the maximum density that attracts forest road construction funding from the Forest Service. Similarly, a subjective decision was made by the authors that where the risk of windthrow, post thinning, was less than 50%, according to the Irish Windthrow Risk Model (Ní Dhubháin et al. 2009), the risk was classed as low or medium. Others might consider a lower threshold more appropriate.

Taking the assumptions outlined above into account the results showed that only one-half (i.e. 441 ha) of the area respondents plan to thin was suitable for thinning. A further 22 ha of forest, owned by those unsure as to whether they will thin, was suitable for thinning while 30 ha owned by those planning not to thin was suitable for thinning. The main constraints were:

- poor ground conditions – 22% of the area owners plan to thin was classed as having poor ground conditions. These areas were composed of peaty and gley soil types which have inherently poor drainage capacity. Remediation works within this category are unlikely;
- unfeasible roading network – 27% of the area owners plan to thin was classed has having poor road infrastructure, which was considered economically unfeasible to improve.

The findings above are sensitive to the choice of factors, i.e. crop stability, sites access and ground conditions. Economics is also another factor (Forest Service, 2007) when making the decision to thin and in Ireland the average private plantation size is 8.8 ha which means the volumes removed, especially in the early thinning operations, will be small. This combined with the often poor quality of the material means that the first thinning operation tends to be unprofitable. Almost all of those who had decided not to thin, but where the stands were classed as suitable for thinning, owned forests of less than 5 ha. Thus economics was likely to be a factor in their decision. On the other hand, 67% of those planning to thin, owned forests with areas less than the national average (8.8 ha). Finding a contractor willing to undertake the harvesting on such small-sized plantations will prove challenging and raises the question as to whether these stands will actually be thinned.

Limitations to the study

The main limitation to the study is that only those forest owners who agreed to take part in the study were included. Thus the sample was self-selected. The response rate of 38% was relatively high compared to previous studies (e.g. Ní Dhubháin and Greene, 2009). However, due to restrictions associated with the Freedom of Information Act it was not possible to obtain any details on non-respondents. These aspects should be taken into consideration if making inference to the population of forest owners in Ireland.

Conclusion

The Government and the EU have invested a considerable amount in the afforestation programme with the aim of producing a viable forest and timber industry. The results from this study suggest that the timber production targets will not be met for a number of reasons linked to owners' objectives, their plans for their timber output and the silvicultural suitability of their stands for thinning.

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The sustainable woods network: a collaborative community supporting small scale forest operations by extending the reach of locally-owned enterprises into the marketplace

Colin Donohue[1], Scott Bagley[2]

Abstract

With the emergence of the "buy local" movement in agriculture, and green building standards that encourage local and regional sourcing of materials, the stage has been set in the US for "green consumers" to focus their purchasing power on locally produced wood. But given the consolidated nature of mainstream media outlets, the marketing messages that consumers receive on TV and in magazines are overwhelmingly from the large producers, particularly large corporations. Small family-owned wood businesses are largely unable to compete for consumers' attention. Potentially sympathetic consumers and "green builders" are often unable to even find local wood producers, many of whom may be just a few miles away. Building supply channels are consolidated through big distributors. Consumers cannot connect with small producers, as much of their product information comes from mass market advertising. The increased "mind share" that the Internet has been gaining, however, has created unique openings for wood producers selling products derived from small scale local value-adding wood operations.

Theoretically the Internet is equally "accessible" to all companies – you put up a web site, and customers can find you just like they find any other business. But in reality larger companies still dominate the "search rankings". Large firms spend money on search engine optimization (SEO) and are able to gain higher placement in search rankings.

The USA-based National Network of Forest Practitioners (NNFP) has initiated a program that facilitates greater "local to local" linkages between SSF entrepreneurs and consumers, with the Sustainable Wood Network (SWN) as the centerpiece of this effort. Located at www.sustainablewoods.com, the SWN is a portal that aggregates small producers on one site to facilitate better placement in the search engines. This paper will provide an overview of this innovative system for supporting SFF entrepreneurs.

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Key words: Community, small scale forest, enterprises
FDC 944:682=111

1 INTRODUCTION

With the emergence of the “buy local” movement in agriculture and the LEED (Leadership in Energy Efficiency and Design) green building standard that encourages local and regional sourcing of materials the stage has been set for “green consumers” to focus their purchasing power on locally produced wood.

But given the consolidated nature of mainstream media outlets, the marketing messages that consumers get on TV and in magazines are largely from the large producers, particularly large corporations pushing out “green” brands.

Small family owned wood businesses are largely unable to compete for consumers attention.

Interested consumers and “green builders” are often unable to even find local wood producers, many of whom may be just a few miles away. Building supply channels are consolidated through big distributors and individual consumers cannot connect with small producers as much of their product information comes from “mass market” advertising.

With the increased “mind share” the Internet has been gaining, however, there are unique “openings” for small wood producers.

Theoretically the Internet is equally “accessible” to all companies. You put up a web site, and customers can find you just like they find any other business. But in reality larger companies still dominate the “search rankings”. Large firms spend money on search engine optimization (SEO) and are able to gain higher placement in search rankings.

NNFP has initiated a program that facilitates greater “local to local” linkages between wood producers and consumers. The centerpiece of this effort is the Sustainable Wood Network (SWN). Located at www.sustainablewoods.com, the SWN is a portal that aggregates dozens of small producers (eventually hundreds or thousands) on one site to facilitate better placement in the search engines.

Builders or consumers looking for products in their local areas may search for “certified wood flooring Virginia”. If the do they will find a screen full of large companies, some of which are not even selling certified wood. With the SWN the goal is to appear in the search rankings in the top screen or two. Once a customer finds the site, they can tailor their search to find other products in their home state and products which are green certified.

To maximize the effectiveness of the portal, NNFP has also undertaken a suite of capacity building and support services to help small wood firms effectively participate in web marketing and Search Engine Optimization.

2 SEARCH ENGINE OPTIMIZATION AND WEB MARKETING

For those that may be unfamiliar with web marketing, one of the best ways to increase traffic and sales on sites is Search Engine Optimization (SEO). Because a large percentage (in 2002 it was 85% [1]) of web traffic comes from searches with Google and other search engines, it is critical for businesses, especially those that hope to acquire new customers from the web, to gain higher placement in searches their prospective customers are conducting.

Given that 62% of customers never go past the first page of search results[2] it is critical that businesses find keywords they can effectively compete for, and conduct activities that get their sites higher in the search rankings.

While many of the techniques of SEO are free of cost, and the information about them is freely available, few producers are aware of them and very few undertake them without training and support.

Search Engines, such as Google, have special formulae that they use to evaluate where sites are placed in the "pecking order". These formulae include several elements, and rankings can be improved by:

- Ensuring that key words that Search Engines are able to "see" important words on the site (EG text is not displayed as images or otherwise inadvertently "hidden")
- Ensuring that key words appear in the "high level" portions of the site (EG as H1 "headlines" instead of just text)
- Increasing quality incoming links. Google, and others, look for these incoming links when evaluating the importance of a site.
- Making sure there is "fresh" content. The more often a site is updated with new text, photos, or other content the more Google sees it as a desirable site for viewers
- Tailoring keywords. If a site describes things in jargon that the average customer will not search for its keywords are useless. For example, if a producer builds

"casework" but a consumer is looking for "shelves" or "drawers" it is important that the site includes this term.

There are numerous ways to increase web traffic using blogs, social media sites (Facebook, Twitter), etc., but these are "next steps" after one does the initial optimization.

3 METHODS

Many small wood businesses do not have web sites, or have sites that cost them money to develop but which do not yield results in terms of traffic and sales. This project focused mostly on businesses that had invested in web sites but were not using them effectively. Additional support was provided to businesses to establish new sites but this was of secondary emphasis

The goals of the program were to:

- Increase capacity, among wood producers, to understand and undertake web marketing and Search Engine Optimization activities
- Increase traffic to small wood producers' sites by providing supporting infrastructure

Activities undertaken were to:

- Conduct trainings, live and on-line group trainings on web basics and search engine optimization
- Provide one-on-one site assistance via web screen sharing and phone
- Provide low cost "Web On-ramp" sites for businesses without sites
- Create a portal that can serve as a conduit for web traffic to smaller businesses, and provide a "boost" in search rankings

In person trainings were held in Brattleboro Vermont, Olympia Washington, Steelville Missouri, and several locations in the Northeastern US. These included group trainings (EG at the two day group workshop in Brattleboro) and through individual consultations (EG individual technical assistance sessions in Steelville and Olympia.

Web based training was conducted via the Adobe Connect software platform (using a conference call for audio rather than VOIP as many participants lacked equipment for VOIP (headphones, microphones)).

One on one assistance for firms typically consisted of use of the "screen sharing" feature of Adobe Connect and conference call. This system allowed our staff and clients to "look at the screen together" and talk through what they were seeing, point out important features, etc.

The Sustainable Woods Network portal (www.sustainablewoods.com) was established, and initial recruitment for the site was conducted. To promote the site, and generate interest in members products, booth spaces were secured at Green Build, the foremost green building show in the US, drawing thousands of architects and builders, and Green Festival, a prominent green consumer show that drew 25,000 people in Washington DC.

4 RESULTS

Despite having invested thousands of dollars (USD) in their sites, very few producers had any information about their web traffic. Despite there being free statistics program (such as Google Analytics) which provide highly detailed information on who is using the site, where they came from, and what they are looking at, very few companies used this information.

In fact, most companies were not aware such programs existed!

Small but important improvements were made to producers' sites that allowed them to more effectively capture traffic and retain customer attention.

In addition, some surprising benefits were found. Through establishing web statistics tracking on one client's site, and assisting with interpretation of that data, we discovered a "Trojan horse" that had hijacked the site and was using it for spamming purposes! In that case the client has paid thousands of dollars for a site that was actually a liability to their business.

We found the screen sharing and one-on-one web meeting format to be extremely productive relative to cost. Our resource person in Montana (notoriously expensive and laborious to travel from) was able to quickly and easily set up individual consultation meetings without travel, and the screen sharing technique allowed far greater clarity than any amount of phone or email communication.

The portal site was established in Spring of 2010. Prior to its completion, early versions of the site were marketed at Green Build, and Green Festival. Consumer interest in the site was high, with 119 consumers and architects signing up for the site promotion mailing list at Green Festival alone! Initial attention was also generated through an article on Treehugger.com, one of the top green blogs with over a million visitors per month.

One result from the web portal process is that even with supporting services the divide between techno-philic and techno-phobic producers is deep. The producers that gravitate toward the use of the web immediately found the site useful and also found the user interface to be easy to use and efficient. Techno-phobic producers, who probably could most benefit from the portal's web prominence, were resistant to the user interface and did not perceive as much benefit as their counterparts.

Overall the biggest finding of our work is that for web support services to be effective there needs to be increased web marketing literacy. If producers do not understand the benefits of cultivating "quality incoming links" (EG the improvement of their search rankings) they will not conduct the follow-up "free" marketing activities that can really multiply the effect of the support services they receive.

Because of limited resources, project staff adopted a "pull through" approach to prioritization. Clients who were more ready to adopt techniques that they were learning received higher levels of support services. For web development projects, clients that did not convey text and photos to staff were de-prioritized in favor of the more responsive clients. In the future, it would be desirable to have resources to spend more time with the techno-phobic clients, but the model of success provided by the more active clients should prove a key inspiration to these more reluctant clients.

5 CONCLUSIONS AND NEXT STEPS

While collaboration among small producers on the Sustainable Woods Network was achieved, there are significant unrealized opportunities in inter-linking of producers' web sites.

Producers gained knowledge and capacity to improve their own sites, as well as additional traffic from their site improvements and initial exposure through the portal.

The next steps will be to increase traffic to the portal, increase membership in the portal, and facilitate a process by which producers will be supported and incentivized to exchange links between sites for mutual promotion. In addition the Sustainable Woods portal will be expanded to include a blog to which producers can contribute stories of their work, and a video section which will highlight key issues relating to urban consumers' purchasing decisions (EG the importance of local wood, the conservation benefits of local wood vs. bamboo, etc.).

In addition to expanding the existing portal, the data architecture for the portal will be used as a template for creation of other local wood sites, likely in New Mexico, possibly in Pennsylvania. The local sites will be tools for local "wood nets" to use on state or substate levels. By using common data architecture the sites will facilitate listings on one site being more easily be ported into other sites (EG the New Mexico producers could enter their information once and appear both on the New Mexico site and the national site). By perfecting these portal sites and making capacity building trainings available to local/state partners we anticipate significant increases in overall web marketing literacy and traffic to producers' sites.

NOTES

http://www.marketingfind.com/articles/effective_keyword_selection_seo_tips.html

http://www.iprospect.com/about/whitepaper_seuserbehavior_apr06.htm

A multi-strategy approach to explain farmers' uptake of afforestation schemes

Stefanie Duesberg[1], Á. Ní Dhubháin, D. O'Connor

Abstract

Today it is generally acknowledged that conventional agriculture causes a number of environmental and socio-economic problems. To overcome these, a paradigm change in widespread agricultural practices would be necessary. Despite the fact that alternative land-use practices already exist, only a minority of farmers apply them.

In Ireland a forestry scheme was implemented in 1996 encouraging farmers to diversify their land-use into sustainable forestry. But in the period from 1996 to 2006 only about 48% of the targeted area of farmland was planted with trees. Surveys and economic studies conducted to date have not definitively explained why farmers did not respond to the scheme as expected.

In order to understand the decision-making process of farmers regarding different land-use possibilities, this study will use a multi-strategy approach. Firstly, using a qualitative study, farmers from different farming systems will be interviewed to ascertain the factors influencing their decision-making process. This will be undertaken using semi-structured interviews as well as focus groups. Secondly, a quantitative study will examine the extent to which the factors identified by farmers in the qualitative study are reflected in the wider farming community. This strategy will ensure that the findings are grounded in the social reality of individual farmers and at the same time reveal phenomena with an influence on the wider farming community.

The study will attempt to explain the poor outcome of the farm forestry scheme in Ireland. The understanding of the factors in the decision-making process will assist in predicting farmers' reaction to new policies. It may also influence the design of new policy environments enabling more farmers to take up alternative land-uses. These can then contribute to solving environmental and socio-economic problems. The poster presented in June 2010 will present the preliminary results of the qualitative study.

Key words: farming, forestry, land-use, policy, decision-making, multi-strategy approach
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Extension preferences of lifestyle landholders for vegetation management in the Wet Tropics region of Queensland Australia

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Abstract

This paper examines the unique needs of extension programs designed to improve vegetation management activities of landholders in the 'lifestyle' and hobby farm sector in northern Australia. A series of surveys were undertaken using self-administered questionnaires and interviews between 2007 and 2010 to examine these issues, landholders experience with extension programs and their preferences for such programs. Responses to the postal survey confirmed the findings of previous studies, and found a clear split in the attitudes of lifestyle landholders between those professing high levels of interest and concern for the need to improve environmental management and those who did not recognize this as an important issue. While the first, more interested group reported greater levels of active management of their vegetation areas, neither group had a great interest in producing timber from their properties or had high levels of participation in formal planning or training activities. The results of the interviews with the landholders suggest they will need to be targeted in a different manner to 'commercial' scale landholders. Preferences are for greater levels of written material compared to commercial landholders, allowing greater flexibility for these landholders to manage their off-property commitments with land management activities. Targeting of information to coincide with property transfers, the development of integrated communication plans including the use of mass media and development of simplified property management planning processes are some of the strategies recommended to improve the level of active management of vegetation by lifestyle landholders.

Key words: forest management, private forests, Australia
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1 INTRODUCTION

Globally, privately owned forests (both planted and native) are important and highly valued components of rural and urban fringe landscapes. In many parts of the developed world where private forest ownership is significant (for example North America, Nordic and other European countries, Japan) there is a growing body of evidence of urbanisation influencing the ownership, size and management of private forest holdings. The result is an increasing emergence of new small-scale forest owners, often from urban-based backgrounds and with varying forest management-related values, attitudes and objectives, and levels of relevant knowledge, capacity and needs. Some recent European and American studies investigating this phenomenon have revealed that landholders with small forest parcels are increasingly focused on managing these natural resources for environmental, aesthetic and recreational values and uses, although commercial and subsistence objectives remain significant (for example Kline et al., 2000; Erickson et al., 2002; Creighton et al., 2004; Pivoriunas and Lazdinis, 2004; Wiersum et al. 2005; Hogl et al., 2005; Toivonen et al., 2005; Ingemarson et al., 2006; Boon and Meilby 2007; Butler et al. 2007; Van Herzele and Van Gossum, 2008).

The above-noted trends are also evident in many parts of Australia, as traditional boundaries and distinctions between rural and urban areas have become increasingly blurred over previous decades (Aslin, 2006). There are on-going demands for land for suburban growth, rural residential and lifestyle block development, and a wide range of ecosystem services (Aslin, 2006) including the hinterland parts of coastal Queensland's central and northern cities (Burnley and Murphy 2004).

The diversity of the new landholders now residing in, and continuing to be attracted to the popular peri-urban and amenity landscapes throughout Australia is well known. They have been variously described as counter-urbanites, hobby farmers, peri-urban landholders, sea changers, tree changers, down-shifters, rural residential households, absentee landholders, and more recently 'rural lifestyle landholders' (Fisher, 2003; Burnley and Murphy, 2004; Gurran et al., 2005; Aslin, 2006). However, it is now recognized that in many locations there is currently a limited understanding about many aspects of this group, including their social profiles; their land and environmental (i.e. NRM) management knowledge levels, values, attitudes, actions, motivations and barriers; and related information and supportive measure needs and preferences (for example DAFF, 2003; NRMSEQ, 2004; Dwyer and Childs, 2004; Hodges, 2005; Buckley et al., 2006; Holmes, 2006; Mackenzie et al., 2006; Maller et al., 2007; Morrison et al., 2008). Many important research issues and questions are still to be adequately addressed in this field (for example see Maller et al. 2007).

The effectiveness and uptake of NRM communication and assistance strategies can be limited in these landscapes. Researchers have described that the usefulness of any extension strategy is highly dependent upon the governing agencies and planning bodies matching their programs to the requirements, attitudes, values and context of the targeted landholders (for example Byron and Boutland, 1987; Chamala, 1987; Stewart and Reid, 1994; Emtage et al., 2001, 2006, 2007; Commerford and Binney, 2004; Mackenzie et al., 2006; Boon and Meilby 2007; Butler et al. 2007; Hollier and Reid, 2007; Morrison et al., 2008).

Developing targeted support implies the need to understand the management objectives, actions, experiences, constraints, desired outcomes; and related values, attitudes, perceptions, knowledge levels, and on-going needs and preferences of the targeted landholders. Kotler and Lee (2008: 117) argue that using market segmentation to aid programs designed to improve social welfare or the biophysical environment provides a number of advantages, including increased effectiveness (i.e. increased adoption of desired behaviours, increased awareness about a topic and changed beliefs) and increased efficiencies through provision of information with which to develop strategies and allocate scarce resources.

Landholders' past behaviour and level of interest in various possible goals for forest management, forms of psychographic and behavioural variables as defined by Kotler and Lee (2008: 120), were used to develop a landholder typology with the aim of improving forest management by non-industrial or 'family' forest owners in the United States (Butler *et al.* 2007). In Australia Morrison et al. (2008) used cluster analysis with multiple criteria to examine the 'market' for market-based incentive programs for NRM in six regions. Of the five groups they identified, two were dominated by 'lifestyle' landholders including:

- '*Smaller, disconnected hobby* farmers: landholders who primarily manage their property as a lifestyle block and do not earn any income from it who have the smallest average property size and the lowest level of connectedness with outside agencies; and
- *High-end, community-minded hobby farmers*: landholders that have high levels of trust, high degree of perceived environmental responsibility, high family incomes and education levels. They were further typified as being well-connected in the community and as having high levels of trust in outside agencies.

The paper describes the results of surveys of landowners' vegetation management practices and attitudes in the Wet Tropics region of Queensland Australia, focusing on small-holder 'lifestyle' landholders. It explores their activities related to land management, including their adoption of currently recommended management practices and the use of supportive measures offered through various organizations. The second part of the paper briefly describes the methods used to collect and analyse the data. The third section describes the results of the surveys, while the final section discusses the implications for improving the efficacy of support measures and in guiding the future development and delivery of vegetation management policies to small-acreage landholders.

2 METHODS

The data presented in this paper was collected using a mail based survey of rural landholders in the Wet Tropics NRM region (Emtage and Reghenzani 2008) and a series of case studies. The mail based survey was undertaken in 2007-8 with questionnaire sent to a random selection of 1,600 landholders whose properties were greater than 2 ha in area[3]. The questionnaire covered a range of topics, including

- Characteristics of landholders and their holdings;
- Perceived importance of eighteen potential NRM issues;
- Perception of rural development issues in the region;
- View of neighbours and sustainability issues;
- Goals for property management;
- Property planning and participation in training;
- Trust of organisations;
- Usefulness of information sources; and
- Native vegetation management practices and attitudes.

The responses to the survey were analysed and reported to examine the diversity of landholders' attitudes and practices in several ways. Sets of profiles were developed for groups of landholders with differing primary purposes for property ownership and involvement in different enterprises (Emtage and Herbohn 2009). Next a typology of landholders was developed based on social marketing principles (following Butler et al. 2007, see also Kotler and Lee 2008) using indices of landholders 'interest' in NRM issues and 'engagement' in recommended NRM practices (reported in Emtage 2009). The

3 Details about this survey are provided in a number of reports prepared for the Reef and Rainforest Research Centre available at www.rrrc.org.au/publications/search_program_9.html

clustering of landholders was undertaken using indices based on items that could apply to any landholder regardless of their land use practices (e.g. the preparation of property plans, participation in training courses, degree of importance attached to NRM issues on their property and in the region). Separate indices of engagement and interest were also calculated for landholders' engagement and interest in vegetation management.

Information for the case studies was gathered using a semi-structured written questionnaire, together with on-site interviews with twenty landholders chosen randomly from properties of less than twenty hectares throughout the target region (The Wet Tropics of Far North Queensland)[4]. Interviews were conducted in two, one-week periods in December 2009 and in February 2010 on similar topics to those covered in the postal survey.

The geographic distribution of the postal survey and case studies is shown in Figure 1.

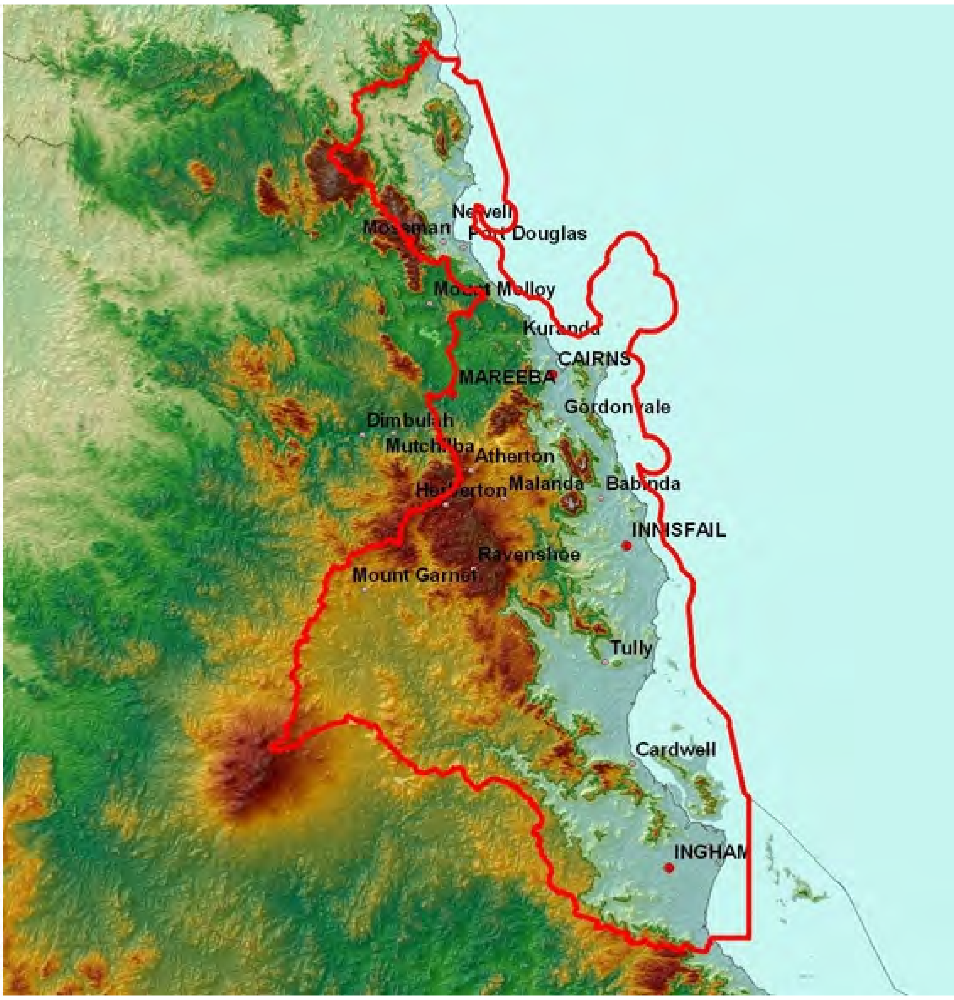

Figure 2 The study area: The Wet Tropics of Far North Queensland Source: (DERM 2009)

4 Details of methods used available in Maczkowiack et al. (in press)

3 RESULTS

Approximately 320 usable responses were received to the mail based survey from a range of landholders, including 96 that listed their primary purpose for property ownership as either having a 'hobby or lifestyle farm' or used their property for 'residential' or 'conservation' purposes (Table 1).

Table 1: Land area owned by primary purpose for land ownership

Primary purpose	Proportion of sample (%)	N	Total size of landholding (ha) Mean	Std. Error	Median	RSE Area
Agriculture	60	183	1268.3	619.54	113.5	49%
Conservation	7	21	42.5	12.23	20	29%
Hobby/lifestyle farm	14	42	21.4	5.30	7.4	25%
Residential	16	47	7.9	1.66	3.6	21%
Other	3	8	43.5	14.76	31.7	34%

The cluster groups differ in terms of the proportions with various primary reasons for landownership and property sizes (Table 2). Members of three groups (numbers two, three and five) are predominantly involved in agriculture. Less than 50% of the members of the remaining groups are involved in agriculture as a commercial land use activity. Each of the groups except group three have members with properties of less than 20ha in area, and all have some members with property areas of greater than 200ha.

Table 2: Proportion of cluster group members with various primary purposes for land ownership.

Cluster group	Primary purpose for landownership (%)				
	Agriculture	**Conservation**	**Hobby/ lifestyle farm**	**Residential**	**Other**
1	40	15	23	22	
2	72	8	10	8	
3	94	3	3		
4	49	3	18	24	6
5	90	7		3	
All respondents	**60**	**7**	**14**	**16**	**3**

Pearson chi square value = 71.120, d.f. = 16, sig. < 0.000. Twelve cells (48%) have an expected count less than 5.

The socio-economic characteristics of the cluster groups are presented in Table 3 and their attitudes in Table 4. This paper concentrates on the two groups dominated by 'lifestyle' landholders, groups one and four.

Table 3: Summary of differences in socio-economic characteristics between landholder groups

	1	2	3	4	5	All respondents	Post hoc tests
Land size (mean ha)	56	334	2,815	94	3,321	723	1,4 < 2,3,5; 3 > 2
Land size (median ha)	18	85	155	26	128	55	
Proportion with some cropping land (%)	28	57	74	26	66	42	#p < 0.000
Average time working on property per week (hrs)	25	42	53	27	49	35	1, 4 < 2, 3, 5
Made a profit 2006/7 (%)	22	54	69	27	54	38	#p < 0.000
Proportion of total income from property (%)	16	47	64	23	53	32	1, 4 < 2, 3, 5
Number of people that live on property	3	4	4	2	6	3	1, 4 < 5; 2 > 4;
Number of people supported by property	1	3	4	2	6	3	1 < 2, 3; 3 > 1, 4.
Time lived on current property (yrs)	15	27	33	19	35	23	1 < 2, 3, 5; 4 < 3, 5.
Female (%)	32	11	9	34	18	25	# p = 0.001
Have attended a short course (%)	8	51	92	11	86	35	# p < 0.000
Involved in Government NRM program last 5 years (%)	6	32	47	0	59	18	# p < 0.000
Have a written property plan or a business plan (%)	6	46	74	5	67	26	# p < 0.000
Carried out pest control (%)	56	60	88	39	62	55	# p < 0.000
Carried out weed control (%)	93	94	100	82	93	90	# p = 0.015
Proportion of property under native vegetation (%)	54	36	15	54	24	44	1, 4 > 3, 5.
Encouraged regrowth (%)	75	64	53	43	79	59	# p < 0.000
Have a map of remnant forest (%)	18	40	24	13	52	25	# p < 0.000
Gather NTFP's on property [a]	29	15	0	13	22	16	# p = 0.024
Proportion of members involved in Landcare groups	31	32	26	8	74	26	# p < 0.000
Proportion of members involved in catchment or sub-regional NRM group	16	11	24	4	64	15	# p < 0.000
Proportion of members involved in industry groups	21	52	82	27	68	40	# p < 0.000

tests used Pearsons chi-square
[a] NTFP = Non-timber forest product (e.g. flowers, seeds, grasses etc)

*Table 4: Summary of differences in attitude scales between landholder groups**

	1	2	3	4	5	All respondents	Post-hoc tests
Property natural resource management issues scales [a]							
Soil health	1.4	1.5	1.4	1	1.6	1.3	2 > 4.
Environmental health	**1.6**	1.2	1.1	**1**	1.7	1.2	1 > 2, 4; 5 > 4.
Pests and weeds	2.6	2.7	3.1	2.2	3.1	2.6	3, 5 > 4.
Regional development issues [a]							
Viability of agriculture	3.2	3.8	4.1	2.8	3.9	3.4	3 > 1, 4; 5, 2, 3 > 4
Decline in community services	2.9	2.4	2.5	2.1	2.6	2.4	1 > 4.
Lack of environmental health	**2.4**	1.7	1.3	**1.1**	2.1	1.6	2, 3, 4 < 1; 3 < 5; 4 < 1, 2, 5
Property management goals [a]							
Build business	3.4	4.1	4.4	3.0	4.1	3.5	1 < 3; 2, 3, 5 > 4;
Improve environment	**4.6**	4.2	3.7	**3.4**	4.5	3.9	1, 2, 5 > 3, 4; 1 > 2
Keep in family	4.2	4.0	3.8	3.6	4.1	3.9	1 > 4.
Property management intentions [b]							
Expand business	-0.7	-0.5	-0.4	-1	0	-0.6	5 > 4.
Sell property	-0.8	-0.5	-0.2	-0.4	-0.7	-0.5	n.s.
Information sources [a]							
Enterprise information	1.8	2.5	3	1.4	3	2	1 < 3, 5; 2 > 4; 3 > 1, 4; 2, 3, 5 > 4.
Finance and family	3	3.4	3.6	2.4	3.6	3	2, 3, 5 > 4.
Environment groups	**3**	2.4	2	**1.1**	3.7	2.1	1 > 3, 4; 4 < 2, 3, 4, 5; 5 > 1, 2, 3, 4.
Media sources	**3.3**	3.2	3	**2.4**	3.4	2.9	4 < 1, 2, 3, 5.
Trust in others [c]							
Productivity groups	1.6	1.8	2	1.4	2.1	1.7	3, 5 > 4.
Government general	1.7	1.6	1.5	1.5	1.7	1.6	n.s
State government	**1.9**	1.7	1.4	**1.6**	1.9	1.7	1, 5 > 3; 1 > 4.
Neighbours	2.3	2.4	2.2	2.3	2.4	2.3	n.s.
Environment groups	**2.3**	1.9	1.5	**1.5**	2.2	1.8	1, 5 > 2, 3, 4; 2 > 3, 4.
Vegetation management attitudes [d]							
Prefer to clear forest	**-0.9**	-0.3	0.2	**-0.2**	-0.4	-0.4	1 < 2, 3, 4;
Management resource difficulties	0.5	0.4	0.6	0.4	0.6	0.5	n.s.
Management information available	0.1	0.5	0.3	0.1	0.6	0.3	n.s.
Timber production possible	-0.3	0.2	0	0.4	0.1	-0.2	n.s.
Aesthetics and value decreased	-1.3	-1.1	-0.3	-0.8	-1.2	-1	3 > 1, 2, 4, 5.

*See Emtage and Herbohn (2009) for details of how the scales were developed. [a] Scale scores range from 1 = not important to 5 = very important; [b] Scale scores range from -2 = very unlikely to 2 = very likely; [c] Scale scores range from 1 = low trust to 3 = high trust; [d] Scale scores range from -2 = strongly disagree to 2 = strongly agree

3.1 CHARACTERISTICS OF THE LANDOWNERS

The analysis of the responses to the postal survey revealed that while all rural landholders are generally older than the population average, there were no differences in the average age of those with 'lifestyle' landholdings and those with 'commercial' landholdings. There were some demographic differences between these two groups, with 'lifestyle' landholders being more likely to be female and have higher levels of formal education than 'commercial' landholders (Table 5). There were also significant differences between these two basic groups of landholders in terms of the time they had lived in the local district, on rural properties and on their current property with 'lifestyle' landholders generally having less experience in their local district and on rural properties than commercial landholders.

There are few differences in socio-economic characteristics between the two 'lifestyle' dominated groups aside from differences in education levels, participation in 'environmental' (Landcare and catchment management) and special interest groups. Those in group one have the highest level of graduate and post graduate education and those in group four the lowest. Participation in social groups is higher among group one members than group four members.

Table 5: Proportion of landholders with various levels of formal education by cluster group.

Cluster group	Education level (%)				
	Primary	Secondary Year 10	Secondary Year 12	Diploma or Degree	Postgraduate Degree
1	3.2	23.8	23.8	31.7	17.5
2	23.2	32.2	16.1	21.4	7.1
3	5.6	33.3	19.4	36.1	5.6
4	10.9	33.7	23.5	26.9	5.0
5	10.7	21.4	17.9	39.3	10.7
All respondents	**10.9**	**30.2**	**21.2**	**29.1**	**8.6**

Pearsons chi-square = 27.02, d.f. = 16, p = 0.041.

3.2 DIFFERENCES IN VEGETATION MANAGEMENT BETWEEN LANDHOLDER 'TYPES'

There is significant variation in the proportion of landholdings under native vegetation between the cluster groups (Table 3). The groups with the lowest proportions of land under native vegetation are those with the highest proportions of 'agricultural' landholders (i.e. Groups 2, 3 and 5). There was no difference in the proportion of the landholding under native vegetation between the two 'lifestyle' groups.

Group 1 members had the higher levels vegetation management activities and group 4 had the lowest levels of engagement for vegetation management activities (Table 3).Other differences were identified between groups for the activities 'use forest areas for recreation' and 'maintain walking tracks' that were significant at the 10% confidence level ($p < 0.10$) but not at the 5% level.

Owners vary greatly in their underlying approach to managing native bushland (and agricultural pursuits). Thirty percent reported exercising moderate to intensive levels of personal, physical intervention to construct or maintain native bushland areas as shown in Table 6.

Table 6: The degree of active management intervention applied to the native vegetation

Degree of management intervention – Native veg.	**None**	**Low level**	**Moderate**	**Intensive**
No of properties	6	8	4	2

The case study investigations revealed that during the tenure of the sampled landholders there has been a general increase in the total area under native vegetation on each of the properties. The estimated aggregate proportion of the properties' areas under bushland has changed from 39% to 44% during the owners' tenure.

In the postal survey respondents were asked to indicate their level of agreement with a series of statements relating to issues affecting vegetation management. The relatively high score of Group 4 in terms of their level of agreement with the 'prefer to clear forest' and 'aesthetics and value decreased' scales, contrasts with the members of Group 1 who had the highest level of disagreement with these scales (Table 4).

3.3 MOTIVATIONS FOR OWNING AND RESIDING ON RURAL PROPERTIES

The single strongest theme evident among case study respondents was the satisfaction they obtain from residing on their *idyllic* rural or bushland lifestyle property. 'Amenity' provided by the presence of native vegetation plays a significant role in providing this, as indicated by the frequency of mentions of a 'desirable climate or other amenity value' and 'connection with nature' in Table 7. The idea of having the property to allow people their 'independence', privacy, solitude and a place of retreat were given high importance by people interviewed for the case studies. In addition to the physical characteristics of a locality and property, other aspects of rural residential lifestyle were also identified as important to the owners during the case studies including absence of road traffic congestion, social values associated with small communities and ease of access to infrastructure and services offered by urban centres. Other reasons offered by participants include seeking a return to the rural life they are familiar with from earlier life experience, or that they find urban life 'claustrophobic'. Having a place of retreat from the pace of work is also a common theme, as is the strong need among many respondents to live in proximity to (and harmony with) nature.

Table 7: Motivations for adopting a rural residential lifestyle from the case studies

Motivates for small-acreage lifestyle at this location*	**Solitude/ Privacy**	**Create distance from past life**	**Desirable climate/ or other amenity value**	**Continue pattern of living in agricultural-rural areas**	**Retreat from daily vocational busyness**	**Connection with nature, conservation, biodiversity ideology**	**Social connection to the region**	**Commercial agric factors**
Number in each category	7	2	14	9	10	10	8	1

*May be more than a single motivation

3.4 OWNERS' ATTITUDES TOWARDS ENVIRONMENTAL ISSUES

All case study participants expressed a passionate interest in environmental issues (e.g. biodiversity, conservation, aversion to the use of chemicals). The importance of vegetation management to 'lifestyle' landholders (and many 'commercial' landholders) is also illustrated by their responses to questions in the postal survey about their goals for property management (Table 4). The goals to 'improve the environment' and 'keep the property in the family' were the highest rated on average by these landholders (Table 4), but there were significant differences between group one and group four members in these ratings, group one giving the highest ratings of all groups and group four the lowest.

The range of factors considered by respondents to affect the region's environment is shown in Table 8. The consequences of tourism and a greater population was commonly mentioned as a source of observed changes and perceived threats to the local environment. Another common threat was the prevalence and continuing incursion of weeds and feral animals.

All case study participants were keenly aware of environmental issues and most were able to verbalise a comprehensive definition of biodiversity. Several limited their definition to on-farm practices. A strong interest and concern for the environment was apparent among all respondents, a factor that predisposes their receptivity to NRM incentive programs (Morrison *et al.* 2008). Several landholders (those with commercial or hobby farm activities) were of the view that the ‘politically correct’ preference for native ecosystems over agriculture is misguided, leading to economic loss, Australia’s future dependence on imported foods, and environmental degradation.

Table 8: Changes and threats perceived to exist to the local environment

Changes & threats	Increased human population and tourism	Weeds and feral animals	Agric chemicals	Climate change	Tree clearing	Fire	Stock access to waterways	Impact on aquifers	Mono-cultures	A weak agriculture sector
Times cited	10	11	5	4	3	3	5	1	7	5

*May have more than a single concern

While the majority expressed an attitude of cooperation in achieving cross-boundary environmental goals, there was also an undercurrent of scepticism – perhaps in recognition that their own and their neighbours’ desire for independence may obstruct that goal – as evidenced in Table 9.

Table 9: Attitudes towards and practice of cross-boundary cooperation

Cross- boundary cooperation	Willingness to cooperate	Instances of cooperation	Tension concerning management practised on neighbouring properties	Neutral
No of properties	12	3	4	7

3.5 THE CONCEPT OF LIFE-STAGE PHASES IN LANDOWNERS’ MANAGEMENT ACTIVITIES

The case studies revealed that at the time of purchasing the property, landowners start with at least a generalised vision of how they would develop it to suit their underlying attitudes, goals and objectives. Upon purchase of the property, they refine and prioritise their plans, then work with vigour to implement them. After a period (that may be several years), when the bulk of the development work they visualised has been accomplished, the owners’ active management input is reduced. The pattern of passionate early land management activity followed by a ‘maintenance’ phase applies equally to those seeking to engage in small-scale farming and to those who seek to restore the native environment or a blend of both. Several of the case study owners (in their seventies and eighties) reported that they will soon take steps to sell their properties.

3.6 SPECIFIC IMPEDIMENTS TO ADOPTING RECOMMENDED MANAGEMENT PRACTICES

There appears to be a general willingness of owners to improve their vegetation management, an attitude which is an important determinant of NRM program success (Morrison *et al.* 2008). However, notwithstanding this willingness and a strong environmental stewardship ethic, numerous other constraining factors relating to awareness and personal circumstances may still impede CRP adoption.

Data relating to the openness of respondents to adopt CRPs relating to native vegetation, and the specific personal impediments they experience in doing so was classified and is presented in Table 10. The table shows that seven respondents are quite open to the prospect of expanding the area of bushland on their properties. The remaining thirteen properties either already have a very high proportion of bushland with no further expansion feasible, or bushland expansion is plainly inconsistent with the respondents' goals (notably hobby farm activities). However, three of the thirteen would consider riparian or corridor plantings and a total of sixteen are open to considering other CRPs provided they are consistent with their circumstances.

Table 10: Owners' characteristics and circumstances in relation to impediments to adoption of currently recommended practices (CRPs)

Property and personal circumstances indicate:			Personal impediments to CRP adoption			
1 An openness to CRP of increasing total area of bushland *	2 An openness to CRP of riparian and corridor plantings	3 An openness to native veg CRPs if customised to circumstances	4 Life-stage (or owner-ship phase)	5 Financial	6 Health-energy	7 Time
Number of cases						
7	10	16	3	9	5	9

* Remaining cases already have near 100% bushland and exotic trees (eight cases), or increased areas of bushland are inconsistent with owners' goals of hobby farming (five cases)

A personal impediment to adoption of native vegetation management felt by three respondents is that they are late in their ownership phase (looking to soon sell their properties). One of the respondents, the commercial farmer, does not want native vegetation on the subject property at all (their adjoining land parcels are forested). Nine of the twenty respondents experience financial impediments to CRP adoption. Factors related to the respondents' health and energy were impediments in six cases. Nine respondents cited insufficient time to perform land management work (these have external full-time employment). In addition, some respondents' plans have been natural disasters such as Cyclone Larry (March 2006) that affected properties located in the southern coastal and southern Tablelands regions. In other instances, owners realise that the goals they had visualised at purchase were too ambitious, and have 'downsized' their aspirations.

3.7 RESPONDENTS' PERCEPTIONS OF ORGANISATIONAL PROGRAMS

A keen interest in the land, the environment and a non-urban lifestyle appeared to be a pre-existing characteristic among all the case study participants, with none attributing their ideologies and practices to the influence of public organisations. Responses to the postal survey indicate that less than 5% of 'lifestyle' landholders had participated in a government NRM program and less than 10% had attended any sort of training course relating to land management or prepared a property plan (compared to approximately 50% of 'commercial landholders). Tableland respondents indicated a limited awareness of both government and non-government environmental support programs and only a few of the case study landholders were active in those organisations. Actual use of and involvement in support agencies is even more sparse, spasmodic and short-term, as shown in Table 11, typically limited to receiving a limited number of seedling trees.

Table 11: Past use of support programs by case study landholders

Utilised support programs	**None**	**TREAT**	**Any other agency**
No of properties	13	3	5

Notwithstanding landholders' favorable attitudes towards assistance, as shown in Table 12, the vast majority expressed little need for more *information* – all feel that they would be competent to access information about land management if they felt a need.

Table 12: Attitudes towards support programs

Attitudes towards support programs	Unfavourable	Neutral	Favourable
No of properties	3	5	12

Some case study participants expressed an interest in obtaining more information about current *programs*. Half considered current programs to be adequate, and thirty-five percent would like programs to be better targeted to their particular needs. Although more than half the case study participants offered no opinion about specific features of a support program, several strongly argued for ensuring that:

- Application processes are simple
- That the size of projects correspond to the capability of the landholder to subsequently manage them
- Financial incentives are contingent on results

The following impediments to participating in support programs were identified during the case studies:

- Preferring to be independent of 'hand-outs'
- Insufficient information is available on support programs that may be available
- Aversion to onerous application procedures
- Projects may apply only to larger properties
- The size of projects' focus may be beyond the ability of the landowners to subsequently manage, e.g. the owners' time and energy (age factor) and their financial resources limit the size of projects in which they can be interested
- For some, all that is required is advice, encouragement and information on technical matters. For others, physical items such as an auger or water cart would be useful
- Several respondents suggested that financial support be paid on results – satisfactory establishment, weed control and maturity to ensure continuance

4 DISCUSSION

The results of the postal survey and case studies of 'lifestyle' landholders confirm a number of observations that have been made about these landholders relative to other rural landholders in regards to their demographic characteristics, history of and motivations for property ownership, and their low levels of participation in NRM programs, property planning and training activities. The results also highlight the diversity among this sector of landholders which implies that varied strategies are required to attract and sustain their interest in improved forest management activities. The landholders that were identified as members of group 1 in this study are similar in characteristics to the 'high minded hobby farmers' described by Morrison et al. 2008 in

Australia and the 'retreatists' group of Barr (1996), as well as the 'recreationist' and 'idealistic' groups described by various European authors (reviewed by Boon et al. 2004, and Selter et al. 2009). The members of group 4 on the other hand are similar to the 'smaller, disconnected hobby farmers' described by Morrison and others (2008) and the 'passive, disinterested owners' in the European studies reviewed by Selter and others (2009). Neither type of landholder in the Wet Tropics region has had a great deal of interaction with government programs, training or property planning. Securing greater involvement in public or group programs would be difficult to achieve from the members of group four but may be achieved with members of group one.

The research findings reported here have a number of implications for the design and delivery of assistance programs to lifestyle landholders. Supporting self-learning of lifestyle landholders appears to be one means to reach these landholders given the importance they attach to privacy and independence, their generally high education levels and time constraints. Targeting timing of support to property transfer points would appear to also be important. Lifestyle properties have higher turn-over rates than 'commercial' landholdings and this is the point at which people are generally most motivated and seeking information. A number of lifestyle landholders were of the opinion that government NRM programs are meant for landholders with large properties which may prevent many from applying in the first place. Providing a summary of which groups are active in their region, which government programs are available and details of key references for forest management to property buyers at the time of purchase could assist the independent learning process. A set of guidelines for best practice vegetation management has been drafted for the region and is currently being finalized.

Even if landholders are provided with information about vegetation management at the time of property purchase, the issue of raising their awareness about new assistance programs remains. The study revealed that lifestyle landholders rely on different sources of information to 'commercial' landholders to assist their land management decision making. Greater use of the mainstream media should be considered as a means of reaching these landholders as they typically do not pay attention to 'industry' or 'enterprise' information sources which can be used to effectively target many of the 'commercial' landholders. The next step needed to develop an effective communication program is to draft such a program and seek feedback from the targeted audience as discussed by Butler et al. (2007) and Langer (2009).

Apart from the desire to simplify assistance program requirements, which is a factor commonly mentioned by rural landholders in reference to such programs, there was a strong demand for programs to be flexible to match the values and resources of lifestyle landholders. There was also a general willingness to accept that incentive or assistance payments should be linked to the success or otherwise of the project. Both these recommendations could potentially increase the 'transaction' costs for those agencies administering the programs. In respect to monitoring the outcomes of projects, continued development of 'monitoring toolkits' such as that produced by Kanowski et al. (??) could assist landholders in self-assessment of their projects reducing some of the burden from the managing agency and at the same time, in conjunction with the best practice guidelines, helping to keep projects from failing in the first place.

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Tree growing by smallholder farmers in the Ethiopian Highlands

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Abstract

Past afforestation programs launched to promote private and community woodlots in rural Ethiopia have not been based on a clear understanding of the incentives and constraints of smallholder farmers. This paper investigates differences between tree-growing and non-tree-growing farm households in one highland region of the country and identifies factors influencing farmers' tree-growing decisions from a farming systems perspective. The analysis is based on a survey of 150 household heads in the mixed *enset-coffee-cereal-livestock* farming system of Sodo Zuriya *wereda* in southern Ethiopia. A logistic regression model was employed to analyze the determinants of the farmers' initial decision of growing trees. Using the tree-growing household data, a linear regression model was employed to identify determinants of the extent of tree growing once the farmer has decided to grow trees. Relative to non-tree-growing households, tree-growing households are found to have larger family sizes, larger landholdings, larger livestock herds, higher food crop productivity and higher income. Gender of the household head, size and productivity of landholding, household income, proximity to a road, and tenure security are significant determinants of farmers' tree-growing decisions. Female-headed households were less likely to grow trees and also owned significantly fewer trees per household than male-headed households. The impact of landholding size was consistently positive on farmers' initial tree growing decisions as well as on the number of trees grown. A positive perception of land tenure security was also positively and significantly associated with the number of trees planted. These results suggest the need for appropriate policies and extension programs that address the needs of female farmers, improving the productivity of land, and strengthening the security of tenure in order to encourage tree growing by smallholder farmers.

Key words: Ethiopian Highlands, farm systems, land tenure, afforestation
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1 INTRODUCTION

Studies made on tree planting/agroforestry adoption in Asia, Africa, and Latin America identify a number of biophysical and socio-economic factors that influence smallholder farmers' tree growing decisions on their farms. Those factors include agro-ecological characteristics, landholding size, farming practices, cultural influences, changes in rural economy, perceived effects of trees on crops, access to market, and external interventions including policies and extension services (Bannister and Nair, 2003; Gilmour, 1995; Warner, 1995; Salam, *et. al.*, 2000; Scherr, 1995a; Viswanath, *et. al.*, 2000).

Since the mid-1970s, Ethiopian forestry authorities have been promoting tree planting to meet national needs of fuel wood, to conserve soil and water, and to arrest deforestation. Massive state and community afforestation programs and extension activities were launched in the 1970's and 1980's recognizing the importance of growing trees outside of forestlands. In the past few years, attempts have been made to promote small scale private tree planting by smallholder farmers mainly by supplying seedlings freely or at subsidized prices from government nurseries considering availability of seedlings as the main encouraging factor for farmers' tree planting.

The interventions pursued have been based on a simplistic view that all farmers everywhere should plant more trees without understanding the resource constraints and economic incentives farm households have for growing trees (Admassie, 2000). Failure to understand farmers' choices has bewildered the success of the afforestation efforts aimed at improving rural livelihoods (Achalu, 2004). As Arnold and Dewees (1998) point out, "by comparison with what is known about the crop and livestock components of agriculture, very little is known about the constraints farmers face that limit their potential to develop tree resources within their farming system." A successful pursuit of rural development interventions that involve tree production on farms require a clear understanding of the farmers' incentives and livelihood strategies within the socioeconomic and policy environment they are operating.

Sodo Zuriya is an area that had a vast natural forest cover until the turn of the 20th century. Presently, scattered natural forests and state owned plantations cover about 11% of the land in the *wereda*. Farmers plant eucalypt and maintain some naturally regenerated trees on farms as part of their farming system. They keep some indigenous broad-leaved trees such as *Cordia* and *Millettia* species as shade in the *enset*-coffee gardens.

This paper presents the characteristic differences between tree-growing and non-tree-growing farm households and the factors that influence their decisions to grow trees in the mixed *enset*[3]*-coffee-cereal-livestock* farming system of Sodo Zuriya *woreda*[4] in the southern highlands of Ethiopia.

1.1 OBJECTIVE OF THE RESEARCH

The main objective of this study is to analyze and model the determinants of smallholder farmers' tree growing decisions in the Ethiopian highlands from a farming systems and socio-economic perspectives. The specific objectives are:

- To identify characteristic features of tree-growing and non-tree growing farm households
- To study the relationships between household and farm characteristics and the institutional factors that explain the patterns of on-farm tree production
- To contribute to appropriate rural development and forest policy formulation and extension interventions.

1.2 HYPOTHESES

Based on review of theoretical and empirical literature, we hypothesize the following.

a) Tree-planting and non-planting households differ significantly from each other in household and farm characteristics.
b) Female-headed households plant more trees than male-headed households.
c) Tenure security, as measured by individual rights to landholding, leads to greater incentive for farm tree growing.

3 Enset (Ensete ventricosum, family. Musaceae) is a widely cultivated perennial crop in the mixed farming systems of southern and southwestern Ethiopia serving as staple food for about 15 million people.
4 Woreda (somewhat equivalent to a county) is the 4th tier in the administrative structure of Ethiopia after Federal, Regional State, and Zone.

2 STUDY AREA, DATA AND METHODS

2.1 STUDY AREA

Sodo Zuriya *woreda* is located in the Wolaita administrative zone of the Southern Nations, Nationalities and Peoples Regional State (SNNPRS) of Ethiopia. The total area of the *wereda* covers 481 square kilometers. With an average population density of about 511 persons per sq. km, Sodo Zuriya is one of the most densely populated areas in the country. Poverty and environmental degradation are prevalent in the area. Wolaita, including Sodo Zuriya, is an area that is hit by recurrent food deficits mainly because of erratic rainfall, fragmentation of landholding, and poor production technology. The geographic location of study site is presented in Figure 1.

Sodo Zuriya is characterized by moderate to cool sub-humid highland (EEA/EEPRI, 2002). About 95 percent of the land in Sodo Zuriya lies in the *woina dega* (mid-altitude between 1500 and 2500 masl) and *dega* (high altitude above 2500 masl) climatic zones. These are climatic zones that are suitable for human and animal habitation and for crop cultivation. The average annual rainfall is about 1200 mm usually dispersed over several months a year. The dominant soil types are vertisols and Nitosols (Pound and Jonfa, 2005). These soils are highly weathered, moderately fertile characterized by high concentrations of nutrients and organic matter in the top few centimeters of the soil horizon. They are well drained, but are vulnerable to erosion and leaching.

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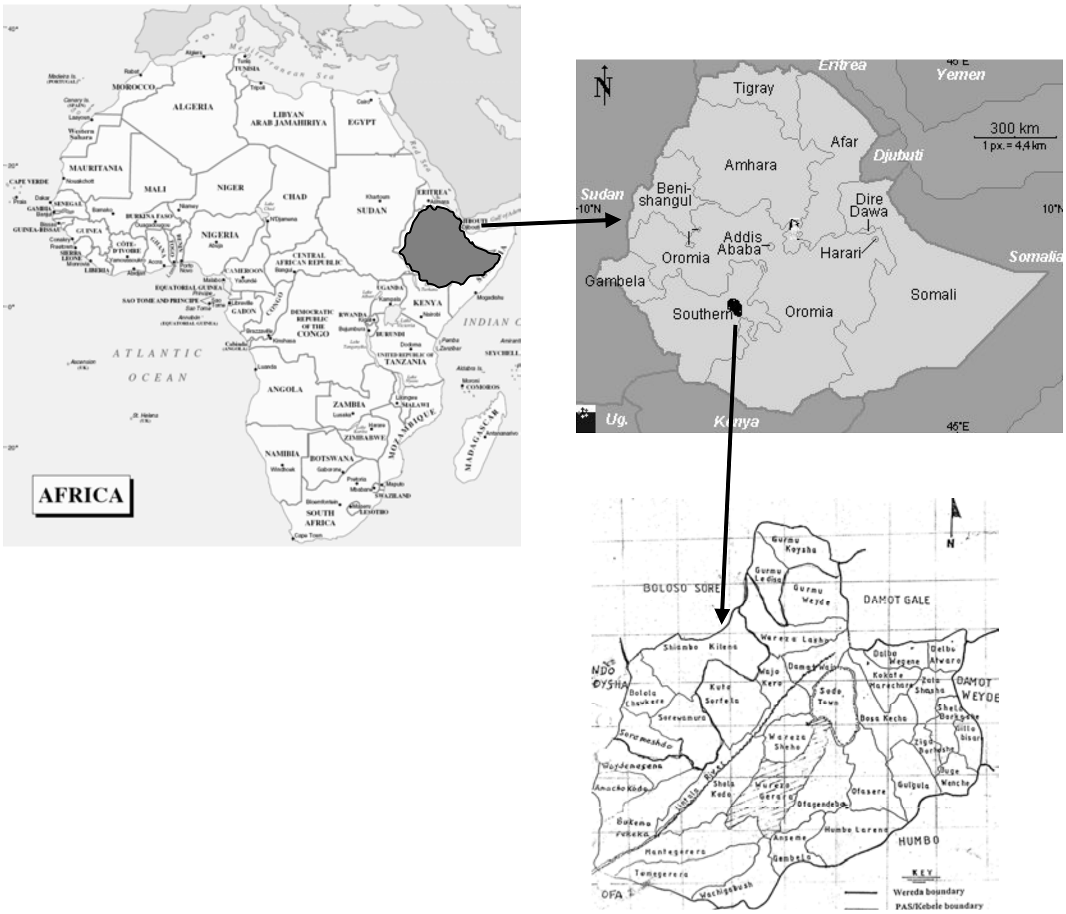

Figure 1: Geographical location of Sodo Zuriya wereda.

The farming system in Sodo Zuriya broadly represents a mixed crop-livestock production. More specifically, it is *enset-coffee-cereal-livestock* system (Getahun, 1980) that combines annual and perennial crops with livestock production. Crop production, both for subsistence and cash generation, is the major activity of this system, with livestock playing a supportive role. The main annual and perennial crops grown include *enset*, coffee, cereals (predominantly maize), root crops, vegetables, fruit trees, and other cash crops. Household food security is the main factor that influences farmers' decisions on crop diversity in Wolaita (Elias, 2003). Farmers plant diverse crops as a coping strategy for possible failures in one crop or another. The typical household land use exhibits a spatial pattern in which homes are ringed with *enset*, coffee, fruit trees and spices. Farmers plant these crops closer to their houses for ease of fertilization with manure and household refuse. Outer fields are occupied by grains, root crops, grazing fields, and woodlots (Figure 2 and Figure 3).

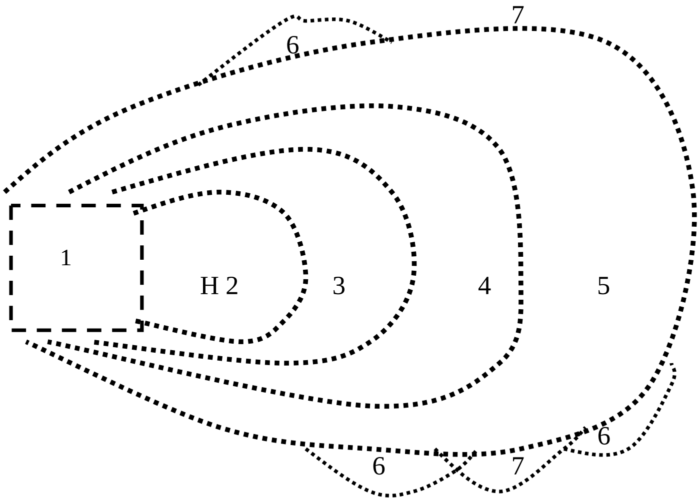

Figure 2: Diagram of typical land use pattern in Wolaita (Source: Pound and Jonfa, 2005; Dea, 1997)[5].

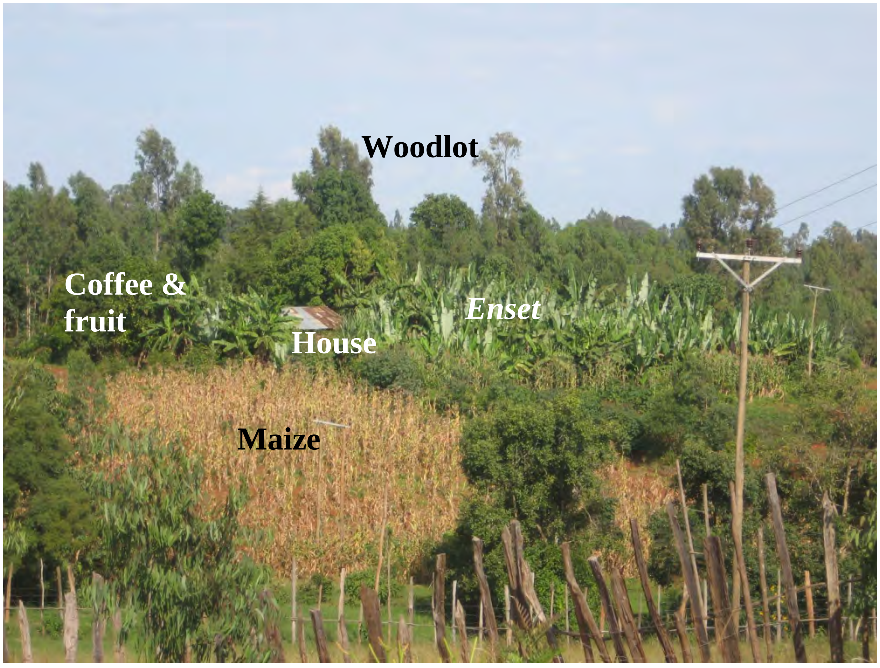

Figure 3: A typical land use pattern in Sodo Zuriya. (Photo by first author, 2007)

2.2 METHODS OF DATA COLLECTION AND ANALYSIS

Data was collected from 150 randomly selected households using a structured questionnaire survey as the primary method of investigation. In order to represent the

5 1. Front yard: place for social gatherings (also used for grazing); 2. House yard: place where house is built; 3. a plot where women grow spices; 4. back yard or garden area: where most important crops (enset, coffee, and maize) are grown; 5. the larger field where various grains, root crops, and others are grown; 6. grass land: a plot which is used for grazing, tethering and cut-and-carry grass; 7. wood lot: outermost plot where eucalyptus and other trees are grown. It also demarcates the boundary of the holding.

population with sufficient accuracy and to infer the sample results to the population, the target sample households were selected in a two-stage random sampling process. In the first stage, 10 primary sampling units, in this case, peasant associations (PAs), were randomly selected among a total of 30 PAs found in the study site. In the second stage, the households in the selected peasant associations were stratified into male-headed and female-headed households. This stratification was necessary in order to analyze possible gender-based differences in farm tree growing. Individual household units were randomly selected from each stratum. A reconnaissance survey of the study site indicated that 14% of rural households were female-headed in the *wereda*. Hence, 108 male-headed and 42 female-headed households were sampled using proportionate sampling relative to sizes of each stratum in the population. Household heads were the primary respondents for the interview based on the presumption that the head makes production and consumption decisions and has the widest information regarding the farm management and the household activities. The survey was carried out in July-August, 2007 with revisits of some households in early October, 2007. Focus group interviews and direct personal observation were also used in order to enrich the investigation with relevant qualitative information.

The data was coded and entered into excel data file. Initial data exploration using graphic analysis indicated presence of outlying observations in the data set. Using studentized residual criterion, four observations were identified with multivariate outliers and were, therefore, removed from the data set. A Goldfeld-Quandt test of initial ordinary least squares regressions (OLS) of the tree-growers data also revealed presence of heteroscedasticity (non-constant residual variances) across observations. To remedy this problem, weighted least squares (WLS) procedure was applied in the subsequent data analysis.

The determinants of the farmers' tree-growing decisions were analyzed using a two-stage regression approach. The models estimated included: (1) the probability of a households' choice to grow trees using a binary dependent variable of 1 if the farmer has trees and 0 otherwise given a set of explanatory variables [section 3.2.(a)]; and (2) the determinants of extent of growing trees as measured by the number of trees grown per household once the farmer has made the decision to grow trees [section 3.2.(b)]. In the first model, all the surveyed households were included in the analysis. In the second model, only the tree-growing households were included. The first model was estimated using a binary logit regression and the second using weighted least squares method. The statistical package SAS 9.1 for windows was used for the analysis.

3 CONCEPTUAL FRAMEWORK AND MODEL SPECIFICATION

3.1 CONCEPTUAL FRAMEWORK

A wide range of factors that influence smallholder farmers' decision on farm tree planting/agroforestry adoption are identified in the literature (Bannister and Nair, 2003; Pattanayak, *et. al*., 2003; Adesina and Chianu, 2002; Salam, *et. al*., 2000; Viswanath, *et. al*., 2000; Gilmour, 1995; Scherr, 1995a; Warner, 1995). These factors are grouped into those that relate to characteristics specific to farmers and farms, economic factors, institutional and policy factors, and biophysical (agro-ecological) factors.

Age, gender, and education of the household head and other adult members of the family are believed to influence preferences of smallholder farmers in production and consumption decisions (Pattanyak, *et. al*., 2003). The farm experience and education (both formal education and informal training) of the farmer are important characteristics that influence decisions made in farm tree planting (Adesina and Chianu, 2002). More important is also the perceived risk in the agricultural production system (Mahapatra and Mitchell, 2001; Bannister and Nair, 2003). Farmers' risk assessment of farm tree planting often arises from tenure insecurity and production failures. Where farmers perceive uncertainties in land and tree tenure, they do not show interest in investing in multi-year crops such as trees (Bannister and Nair, 2003; Warner, 1995).

Important farm characteristics/resource endowments include size of landholding, labor availability, total household income, livestock, and distance to market. The level of diversification of the production system is an important factor influencing farm tree management decisions (Mahapatra and Michel, 2001). Resource endowments measure the resources available to the farm household (land, labor, livestock, and savings) for adopting new farm technologies such as tree planting (Pattanyak, *et. al*., 2003), or for maintaining traditional farm practices. The trade-off between agricultural production and tree growth is an important factor in the farmers' allocation of family land and labor. Land size could be a crucial factor in this trade-off as it limits the number of trees that land-poor farmers can tolerate to grow close to their food crops in view of the possible competition and shade effects of trees. Since tree planting is not as labor intensive as other agricultural production activities, farmers whose main source of income is non-agricultural are more likely to plant trees on farms (Salam, *et. al*. 2000). Generally, resource endowments are likely to be positively correlated with probability of farm tree planting.

Economic factors that influence the decisions of smallholder farmers include availability of markets for outputs as well as inputs, the level of input and product prices, and potential income losses or gains. These factors are primarily about market incentives that explicitly lower and/or increase benefits from adopting a technology or crop. A market factor that is expected to increase the net benefits associated with the technology or crop is likely to be a positive influence on adoption.

Institutional and policy factors include land and tree tenure security, the organization of overall rural development and forestry system, extension services, and information sources. Perceived tenure insecurity can have a profound bearing on how farmers make use of their land in terms of short-term and long-term crops and investment in land improvements. Place and Hazell (1993) hypothesize that farmers are more likely to improve land in which they have a long-term interest, both in terms of their rights to cultivate the land on a continuous basis and to dispose of the land in ways that provide adequate compensation for the value of any investments.

Based on the above review of theories and findings from related studies, thirteen explanatory variables were selected for the empirical analysis of the determinants of the farmers' decisions on farm tree production. Description of the selected variables and their expected effects are summarized in the subsequent sections.

3.2 MODEL SPECIFICATION

3.2.1 Estimation of the probability of growing trees

To quantify the factors influencing the farmers' choice to grow trees or not, a binary logistic regression approach was adopted. Logistic regression analysis is a well established approach in empirical studies focused on finding the determinants of adoption/investment decisions in agricultural technology, agroforestry, and tree planting (Mercer, *et. al*., 2005; Tadesse and Belay, 2004; Gobin, *et. al*., 2002; Neupane, *et.al*., 2002; Salam, *et. al*., 2000; Thacher, *et. al*., 1997).

Following Mercer, *et. al*. (2005), Afifi, *et. al*. (2004), Neupane, *et. al*. (2002), and Salam, *et. al*. (2000), let T_i represent a dichotomous variable that equals 1 if farmer grows trees and 0 if not. The probability of the choice to grow trees, $Pr(T_i = 1)$, or not $Pr(T_i = 0)$ is then derived as follows:

The probability of choice to grow trees is

$$P = Pr(Ti = 1) = \frac{1}{1+e^{-(\beta_0 + \beta_1 X_{1i} + \ldots + \beta_k X_{ki})}} = \frac{e^{(\beta_0 + \beta_1 X_{1i} + \ldots + \beta_k X_{ki})}}{1+e^{(\beta_0 + \beta_1 X_{1i} + \ldots + \beta_k X_{ki})}} \qquad [1]$$

Similarly, the probability of choice not to grow trees, Pr(Ti = 0) = 1-Prob(Ti = 1) = $\frac{1}{1+e^{(\beta_0+\beta_1 X_{1i}+\ldots+\beta_k X_{ki})}}$ [2]

Dividing [*1*] by [*2*], we get

$$\frac{\Pr(Ti=1)}{\Pr(Ti=0)}=\frac{Pi}{1-Pi}=e^{(\beta_0+\beta_1 X_{1i}+\ldots+\beta_k X_{ki})} \qquad [3]$$

Taking the log in both sides of Eq. [*3*], results

$$ln[\frac{\Pr(Ti=1)}{1-\Pr(Ti=0)}]=\beta_0+\beta_1 X_{1i}+\ldots+\beta_k X_{ki} \qquad [4]$$

where subscript *i* denotes the i^{th} observation in the sample, *Pr* is the probability of the outcome, β_0 is the intercept term, and β_1, β_2, . . ., β_k are the coefficients associated with each explanatory variable $X_1, X_2, \ldots, X_k$.

The data obtained from all respondents (146 households, including both tree growers and non-tree-growers) were considered in the model. The explanatory variables (X_i) included in the model were gender of the household head (GENDER), number of years the farmer resided on present landholding (FRESID), family size (FSIZE), participation of household head in short training in agricultural/natural resources management (TRAIN), size of landholding in hectares (LSIZE), number of parcels of land (NPLOT), size of livestock herd owned in tropical livestock unit (TLU), agricultural productivity defined as total annual output per hectare (CRPYIELD), farmer's engagement in off-farm work (OFFWORK), annual gross income from farm and off-farm activities (GROSSINC), distance of household from nearest accessible road in kilometers (ROADDIST), renting and/or sharecropping additional land from other farmers (RENT), and farmer's perception of land tenure security (LSECUR). GENDER, TRAIN, OFFWORK, RENT, and LSECUR are categorical variables. The dependent variable used in the logistic analysis was whether or not the farmer grew trees (FTREE) where FTREE=1 if household had trees and 0 otherwise.

Given the above explanatory variables, the general form of Eq. [4] was rewritten as follows to represent the likelihood of growing trees by sampled farm households in the two study sites.

$$\ln[\frac{\Pr(Ti=1)}{1-\Pr(Ti=0)}]=\beta_0+\beta_1 GENDER+\beta_2 FRESID+\beta_3 FSIZE+\beta_4 TRAIN+$$
$$\beta_5 LSIZE+\beta_6 NPLOT+\beta_7 TLU+\beta_8 CRPYIELD+\beta_9 OFFWORK+\beta_{10} GROSSINC+$$
$$\beta_{11} ROADDIST+\beta_{12} RENT+\beta_{13} LSECUR \qquad [5]$$

3.2.2 Determinants of the extent of growing trees

The dichotomous probability model in 3.2 (a) above only tells whether a farm household was likely to grow trees or not given a set of explanatory variables that are hypothesized to influence the initial decision of the household. It does not indicate what factors influence the farmer's decision to grow fewer or larger numbers of trees once the farmer has decided to grow trees. Therefore, a linear regression model was employed to analyze the determinants of extent of tree growing per household. In this case, number of trees grown per household by the tree-growing households (N=110) was used as the dependent variable. To remedy the problem of heteroscedasticity revealed by a Goldfeld-Quandt test in the exploratory analysis of the data, a weighted least squares (WLS) procedure was applied. Eq. [6] shows our ordinary least squares (OLS) regression model.

$$Y_i = \beta_0 + \beta_1 X_{1i} + \ldots + \beta_k X_{ki} + \varepsilon_i \qquad [6]$$

where, Y_i is number of trees (NTREE) grown by household i for i = 1, 2, . . . , n; X_1 to X_k are the explanatory variables; β_0 is the intercept term, β_1 to β_k are the coefficients associated with each explanatory variable X_1 to X_k; ε is the error term; and n is number of observations.

The WLS model is Eq. 6 transformed as follows,

$$\frac{Y_i}{\hat{\sigma}_i} = \beta_0 \frac{1}{\hat{\sigma}_i} + \beta_1 \frac{X_{1i}}{\hat{\sigma}_i} + \ldots + \beta_k \frac{X_{ki}}{\hat{\sigma}_i} + \frac{u_i}{\hat{\sigma}_i} \qquad [7]$$

The general form of Eq. [7] for the weighted regression was rewritten as Eq. [8].

$$\begin{aligned} NTREE = \beta_0 + \beta_1 GENDER + \beta_2 FRESID + \beta_3 FSIZE + \beta_4 TRAIN + \\ \beta_5 LSIZE + \beta_6 NPLOT + \beta_7 TLU + \beta_8 CRPYIELD + \beta_9 OFFWORK + \\ \beta_{10} GROSSINC + \beta_{11} ROADDIST + \beta_{12} RENT + \beta_{13} LSECUR \end{aligned} \qquad [8]$$

4 RESULTS AND DISCUSSION

4.1 DESCRIPTIVE STATISTICS

Table 1 presents the characteristics of the surveyed households. The first 13 variables are the explanatory variables and the last two are the dependent variables used in the empirical analysis of this study. Mean comparisons of sampled tree-growing and non-tree-growing households are presented in the table. A *t*-test was used to test for equality of means of tree-growing and non-tree-growing households. The *t*-test showed that there were significant differences between mean values of tree-growing and non-tree-growing households in half of the characteristic variables analyzed (indicated with asterisks in Table 1). The tree-growing households had bigger family size, owned more land, and had their land distributed over larger number of plots. The tree-growers also owned larger livestock herds, earned more annual gross income, and had higher crop productivity per unit of land than the non-tree-growers.

Although the differences were not statistically significant, the proportions of tree-growing households that rented and/or sharecropped land and those that perceived the land tenure system as secure were also higher than the non-tree-growing ones. The proportions of tree-growing households that received training and those that were engaged in off-farm work were less than the non-tree-growing ones. Tree-growing households were also located relatively far from an accessible road.

Table 1: Descriptive statistics of surveyed tree-growing and non-tree-growing households in Sodo Zuriya

Variable description	Tree-growers (N=110)		Non-tree-growers (N=36)	
	Mean	St. Dev.	Mean	St. Dev.
Independent variables				
% of female-headed household	0.11		0.25	
Number of years on present landholding**	20.90	5.83	23.36	7.03
Family size (number)*	6.31	2.35	5.61	1.71
% of household heads trained	16		22	
Landholding/household (Ha)***	0.62	0.39	0.40	0.22
Number of plots**	1.39	0.65	1.17	0.45
Livestock herd (in TLU) ***	2.50	1.90	1.61	1.46
Crop productivity (quintal[6]/ha/year) ***	16.65	18.30	10.96	7.35
% of off-farm working households	52		67	
Annual gross income (BIRR)[7] *	4,099	3,004	3,264	2,086
Distance from a road (km)	2.43	2.52	2.03	2.15
% of land renters and/or sharecroppers	30		25	
% of farmers that perceived the land tenure as secure	53		47	

Variables in which sample households of Basona Werena have significant differences from those of Sodo Zuriya: *** = at 0.01 level of significance; ** = at 0.05 level; * = at 0.10 level.

6 1 quintal=100kg.
7 1 Birr = 0.1053 US$

4.2 DETERMINANTS OF FARMERS' DECISION TO GROW TREES

4.2.1 Estimation of the probability of growing trees: Logistic regression results

Table 2 presents the results of the maximum likelihood estimation of the logit regression model (column 2) indicating the important variables that influence the farmers' initial decisions to grow trees. The table also shows the weighted least squares (column 4) regression estimations that influence the numbers of trees per household once the farmer The result suggests that the logistic model relating the farmers' choice to grow trees (FTREE) to the various explanatory variables is well specified. The overall model chi-square values (*χ2)* of 32.65 was significant at less than 0.001 level of significance. This implies that the explanatory variables, considered collectively, do influence the farmers' decision to grow trees.

The McFadden's (pseudo)[8] R^2 value is 0.2002. About 82.2% of the responses were predicted correctly. The pseudo R^2 value and the correctly predicted percentage of the data suggest that the estimated model fits the data reasonably well. Most signs for independent variables are intuitively credible, indicating higher or lower likelihoods of growing trees as expected.

The effects of the independent variables on the log odds of growing trees are reported as odds ratios alongside the parameter estimates (*β*). For the independent variables that have continuous values, the odds ratios (e^{β}) represent the amounts by which the odds favoring the decision to grow trees (FTREE = 1) changes for a change in those independent variables. For categorical variables, the odds ratio represents the odds favoring the decision to grow trees if an event is 1 instead of 0. In all cases, it is assumed that values of all other independent variables remain constant.

Of the 13 variables included in the model, gender of the household head (GENDER), the number of years the household head resided and farmed on present landholding (FRESID), farmer's participation in training (TRAIN), size of landholding (LSIZE), and agricultural productivity per unit of land (CRPYIELD) were found to be significant in explaining the farmers' decision to grow trees.

Female-headed households were less likely to grow trees than male-headed households and the difference was statistically significant. The negative coefficient and the odds ratio

8 McFadden's (Pseudo) R2 is computed as R2 = (ln Lo – ln Lm)/ln Lo, where Lo and Lm are the numerical values of the log likelihood for the logistic models when only the intercept term is included and when all the desired variables are included, respectively.

showed that female-headed households were 0.35 times less likely to grow trees than male-headed households. The negative sign was contrary to what was hypothesized *apriori*. Female-headed households generally had lower literacy and less male labor than male-headed households which might explain why they were less likely to grow trees. It may also be a reflection of the agricultural division of labor (a cultural factor) that exists in the study area and elsewhere in the country, and the marginalization of women in past land ownership rights. The result confirms what female focus group discussants pointed out, namely, that obtaining tree seedlings from suppliers and managing field crops such as trees had largely been men's tasks. Women in Sodo Zuriya were mostly engaged in the management of livestock and home gardens in which *enset* is the predominant crop. As elsewhere in sub-Saharan Africa, women farmers in Ethiopia had also been marginalized from agriculture extension service (Dejene, 1989; Frank, 1999) which tended to be geared towards male farmers.

Table 2: Maximum likelihood estimates from logistic regression model for choice to grow trees and linear regression (WLS) results for extent of tree of tree growing

Independent variable	Logistic Regression		Weighted least squares (WLS) coefficients	Expected
	Coefficient	Odds Ratio		
INTERCEPT	0.9587		135.629	
GENDER (1=Fem)	-1.0448*	0.352	-766.846*	+
FRESID	-0.0911***	0.913	-12.952	+
FSIZE	0.0235	1.024	-5.565	+
TRAIN	-1.0315*	0.356	-13.128	+
LSIZE	2.2985**	9.959	934.124***	+
NPLOT	0.3372	1.401	202.448	?
TLU	0.1755	1.192	-17.891	-
CRPYIELD	0.0339*	1.035	-3.351	+
OFFWORK	-0.3047	0.737	86.747	+
GROSSINC	-0.00004	1.000	0.1387***	+
ROADDIST	0.0353	1.036	-81.791*	-
RENT	0.4081	1.504	288.403	+
LSECUR	0.3024	1.353	601.338***	+
N	146		110	
-2 Log L	130.443			
Likelihood ratio test	32.65 (0.0019)			
McFadden's R^2	0.2002			
% correctly predicted	82.2			
F (Pr > F)			3.85 (<.0001)	
R^2			0.3425	
Adjusted R^2			0.2535	

Significant variables at 0.01 (***), 0.05 (**) and 0.10 (*) levels of significance.

The number of years that farmers resided and farmed on their present landholding (FRESID) was negatively and significantly related to the likelihood of growing trees. The negative sign of the coefficient implies that increasing the number of years that household heads resided and farmed on their present landholding by 10 years decreases the likelihood of growing trees by a factor of 0.40. This negative impact of FRESID might be explained by the higher rating of the production and marketing risks anticipated in tree production than in food crop production and marketing which household heads with longer farm experience reported. Household heads that resided and farmed on their current landholding for a longer period were more likely to engage more in non-tree production activities that they perceive are less risky. Older farmers are viewed as less flexible, more risk averse, and less willing to engage in innovative farm technology (Thacher, *et. al*, 1997).

Contrary to our expectation, the effect of training was negatively related to the likelihood of growing trees. The odds ratio indicate that tree planting was 0.36 times less likely by trained farmers than by non-trained farmers. Training often serves to transmit specific information needed for a particular type of work and to shape attitudes, beliefs and habits. We, therefore, expect training to be positively associated with the likelihood of growing trees. One possible explanation for the negative relationship of training to the farmers' likelihood of growing trees might be attributed to the specific type of the training (tree cultivation or other agricultural disciplines) in which most trained farmers participated. Our survey questionnaire did not include a question to solicit the specific area of training.

Size of landholding (LSIZE) had positive and significant impact on the likelihood of growing trees. The positive sign of the coefficient implies that increasing the size of landholding by 2 hectares increases the probability of growing trees by a factor of 99.186. The average landholding size per household in Sodo Zuriya (0.56 hectare) is one of the smallest in the country. According to an estimate by EEA/EEPRI (2002), this landholding size is the absolute minimum a household needs in order to attain food security in the *enset*-based farming system of southern Ethiopia. Hence, we expect the marginal effect of increasing land size per household on the probability of growing trees to be substantially high in areas such as Sodo Zuriya where shortage of land is acute. The positive effect of landholding size is consistent with the findings of Darr and Uirbrig (2004) in Laos, Emtage and Suh (2004) in the Philippines, and Salam, *et. al*. (2000) in Bangladesh. When land becomes scarce, the overriding need to produce food takes precedence over the long-term value of trees thereby implying a decreasing likelihood of growing trees with decreasing size of landholding.

Farmers with higher crop productivity per unit area of land were significantly more likely to grow trees. The positive sign of the coefficient implies that increasing the productivity of land by 2 quintals per hectare increases the probability of growing trees by a factor of 1.070. Better land productivity implies that households can produce the food and other agricultural products they need on a relatively smaller size of land and can thus have some extra land which they can devote for growing trees.

4.2.2 Determinants of number of trees grown by tree-growing households: Linear regression results

The result from the weighted least square regression (column 4 of Table 2 above) suggested that gender of the household head (GENDER), size of landholding (LSIZE), annual gross income (GROSSINC), distance from roads (ROADDIST)and farmers' perception of land tenure security (LSECUR) showed significant impacts on extent of tree growing as measured by number of trees grown per household. The signs of coefficients of the significant variables indicated that once the farmers have decided to grow trees, then households with bigger landholding and higher annual income were more likely to grow larger numbers of trees per household. Similarly, households who perceived the land tenure system as secure were also likely to grow more trees. On the other hand, households with female heads and those located far from roads were likely to grow fewer numbers of trees per household.

As expected, size of landholding (LSIZE) was positively and significantly related with number of trees grown per household. Coefficients from WLS regressions indicate that, all other factors being the same, a one hectare increase in landholding will likely increase the number of trees per household by 934.1. The impact of landholding size was consistently positive and significant in both the farmers' initial decision to grow trees as well on the number of trees grown once the farmer has decided to grow trees. Trees take agricultural space which otherwise could have been used for food crop production. Adoption of tree components thus depends on available land size. Larger landholdings provide households enough space to produce both food and more trees. It also increases the household's capacity to take risks for diversifying farm crops including long-term term crops such as trees.

Annual total gross income of farm households was positively associated with number of trees grown per household. Coefficients from WLS regressions indicate that, all other factors being the same, a Birr100 increase in the annual gross income of households will likely increase the number of trees per household by about 13.8. Generally higher household income is expected to increase the risk-bearing capacity of smallholder farmers' decision making and the willingness to wait for the returns from long term investment such as trees (Sood, 2006; Mahapatra and Mitchell, 2001; FAO, 1986). Hence, higher household income is expected to increase the likelihood of the farmers' decision to grow more trees per household. One of the main objectives for smallholder farmers to grow trees on farms is to meet their household demand for fuel and construction wood. Following the economic theories of demand and substitution effects of income, the positive sign of the income variable on number of trees grown indicates that wood is a normal good for the farm communities of the study site and that wood consumption increases as household income increases.

Distance of a household from nearest accessible road (ROADDIST) was significantly and negatively related with the number of trees grown per household. All other factors being the same, a 1 kilometer increase in the distance of households from an accessible road will likely decrease the number of trees grown per household by about 81.8. Hence, farm households that are located closer to roads are expected to grow more number of trees not just for household consumption, but for sale as well.

Farmers' perception of existing land tenure security (LSECUR) was positively and significantly related with the number of trees grown per household. The sign was as expected. Coefficients from WLS regressions indicate that, all other factors being the same, farmers who perceived the existing land tenure as secure were likely to grow about 601.3 more trees per household than those who perceived the land tenure as insecure.

5 CONCLUSIONS AND POLICY IMPLICATIONS

This study sheds light on the status of tree farming in the *enset-coffee-cereal-livestock* farming systems of a highland *woreda* of Ethiopia, and identifies the major factors that influence farmers' tree growing decisions. The results have important implications for the formulation of policies and programs targeted to promotion of farm tree production by smallholder farmers. The study highlights four major findings.

First, a large majority of farmers (75%) grow trees on farms. Eucalyptus is the predominant tree species grown, accounting for 88% of the standing trees. Nearly all of the trees were established by deliberately planting seedlings in fields and around homesteads with only a few indigenous trees.

Second, tree-growing households have higher human capital, higher physical assets, and higher income than non-tree-growing households.

Third, our study identified variables that were strong determinants of the farmers' tree-growing decisions. They included gender of the household head, farmers' training, size of landholding, crop productivity, household income, and proximity to a road, and tenure security.

Fourth, gender of the household head and size of landholding determined both the farmers' decision to grow trees and the number of trees grown. The signs were consistently negative for gender of the household and consistently positive for size of landholding. Training and crop productivity per unit of land were significant determinants of the farmers' initial decision to grow trees but were not so on number of trees grown. In the latter case, in addition to gender of the household head and landholding size, the other important determinants were gross income, distance to roads, and land tenure security.

These findings point to important policy issues on which future agricultural extension and rural development interventions need to focus in order to improve the smallholder livelihoods in general and to promote farm tree production in particular.

- We found that female-headed households were less likely to grow trees than male-headed households, and female-headed households owned significantly fewer trees per household. In addition to being asset-poor and less literate, the cultural division of labor and the property inheritance rights of women in Sodo Zuriya appear to be restrictive to women's participation in farm tree growing. More gender-targeted interventions would be important for increasing women farmers' agricultural productivity and their participation in farm tree planting. The recent federal and regional rural land administration and land use proclamations clearly ensure the land rights of women. To ensure effectiveness, this provision must be properly implemented.
- The impact of landholding size was consistently positive and significant on the farmers' initial tree growing decision as well as on number of trees grown. A positive perception of land tenure security was also positively and significantly associated with number of trees planted. In order to reduce further fragmentation of individual landholding and to increase land that can be made available to tree planting, the population growth rate of the country has to be reduced through the implementation of the national population policy that was enacted in 1993.
- Crop productivity per unit of land had a positive and significant impact on the farmers' initial decision of growing trees. High crop productivity of land enables farmers to produce the food crops they need on a relatively smaller land parcel and thereby to release part of their land for tree planting. It is also obvious that increasing land productivity will increase household income which is an important

factor in the farmers' ability to bear risks and to wait for long-term returns from investment in trees. Therefore, the agricultural extension system should design appropriate packages that will help increase the productivity of existing landholdings.

- Tenure insecurity can be an impediment for long-term investment in land by poor farmers. Although land still remains under state ownership, the recent federal and regional rural land administration and land use proclamations appear to give better tenure security. The policies entitle rural landholders to land use rights for indefinite period of time, rights for compensation in cases of expropriation, rights for inheritance, and rights for a holding certificate. These policy provisions need to be followed up with concrete implementation on the ground.
- It is generally believed that training brings positive attitudes and improves skills. With the average schooling of household heads in the study site being less than 3 years of primary education, training in specific techniques is necessary to develop the farmers' knowledge, skills and attitudes in tree cultivation.
- Distance of households to accessible road was negatively and significantly associated with number of trees grown per household. As more farmers get aware of market opportunities and tend to expand the extent of their tree planting for sale, proximity to roads is likely to be very crucial. Improving rural road networks is crucial for farmers to make well informed production decisions and to exploit the market opportunities of tree production.

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Forest management planning in small scale forestry: Forest property plan (FPP) and owners' attitudes

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Abstract

We analysed 1) private forest owners' perception of availability and usefulness of the information in forest management planning, 2) their attitude to introducing the forest property plan (FPP) into the concept of forest management planning. We used face-to-face interviews (N=380) and postal surveys (N=100) of randomly selected forest owners in three forest management regions in Slovenia in 2004 and 2009/2010. Each owner was classified into group M (1.00-4.90 ha), L (5.0-14.9 ha), XL (15.0-30.0 ha) or XXL (>30.0 ha) according to the size of his forest land. We tested the differences in owners' perception of availability and usefulness of the information in forest management planning and their attitudes to FPP with non-parametrical tests (χ^2 test, Kruskal-Wallis test, Mann-Whitney U test). Owners consider the information who to contact to, when they want to cut, the information about the forest protection, the information about the allowable cut, about the exact parcel borders and about the sylvicultural measures to be the most relevant for management. The most irrelevant information is about the possibilities for machine harvesting. Forest owners are missing the information about the possible cut for each individual parcel the most, followed by the information about the borders of their parcels, they would like to be informed more about the possibilities and costs of constructing the forest traffic infrastructure. In the current management planning they miss the evaluation of the profitability of management, too. 43% share the opinion, that FPP might be useful for the management, but 71% would not share the costs for the elaboration. Owners possessing more than 30 ha of forest land should be targeted in the introducing FPP in the future. In forest management planning more attention should be paid to information about forest owners' needs, goals and the perspectives of management in spite of too detailed inventory of forests.

Key words: forest management planning, management plan, private forest owners, survey
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1 INTRODUCTION

Forest management planning has long tradition in Slovenia. Forest management plans are made for all forest area, irrespective of ownership. In the process of forest management planning numerous information about the state of the forests and management are collected. Most of the information needed for forest management is provided through Slovenia Forest Service (SFS). Due to specific ownership situation, i.e. small scale management, small and spatially dispersed parcels, different information needs for various types of forest owners, the present information system in forest management planning only partially meets the versatile needs of different types of forest owners. So far, no feedback from forest owners about the advantages and disadvantages of current forest management planning concept has been systematically collected or analysed. No detailed analyses about the usefulness and information sufficiency of the present forest information system from forest owners' perspective have been done yet, nor the analyses of the key missing information needed by forest owners by management in their forests. Few studies searched the possibilities to improve the management also by adapting the current management concept (Gašperšič, 1985; Bončina 2003), but none of the studies before focused on owners' attitudes to forest management planning concept. Many authors (e.g. Bončina et al., 2004; Mori, 2004; ZGS, 2004) emphasize that the participation of forest owners in management planning is insufficient and should be intensified. The analysis of forest owners participation in the past (ZGS, 2004; Zagorac and Breznikar, 2004) showed that in small scale forestry the interests were particularly low, on the other hand the lack of information about the forest owners (e. g. from surveys) needed for more efficient participative planning is also pointed out (Zagorac and Breznikar, 2004). Up to now, efforts to improve the participation of owners and management in small scale forestry were focused to improvement of existent communication of public forest service (Zagorac and Breznikar, 2004) or improvement of management plans and setting a joint management (Mori, 2004). All these efforts put the strategic connotation of small scale management somehow in the rear; the questions like, for what purpose to manage or what would be the perspective of management in those forests if any, remained aside.

The idea of modern forest property plan as a new supportive instrument for strategic and operative planning at the level of forest owner is relatively recent (Bončina 2003, Papler-Lampe et al. 2004, Ficko et al., 2005, Mori 2004, 2005), even though most of the management plans for private forest estates from the end of 19th century have all the characteristics of strategic and operative planning for the properties. Forest property plan (FPP), which concept and possibilities of including it in to forest planning was described by

Ficko et al. (2005), is an operative and strategic instrument of forest management planning in private forests. FPP's aim is to help the owner's to manage his property and support him in business oriented activities. It emphasizes private interests while taking all public interests into account.

Main objectives of the paper are 1) to analyse the availability and usefulness of the present information in forest management planning for forest owners and to identify the missing information, 2) to analyse the attitude of forest owners to introducing the forest property plan (FPP) into the concept of forest management planning.

2 METHODS

The paper analyse the answers from face-to-face interviews (N=380) and postal surveys (N=100) of randomly selected forest owners in three forest management regions (FMR) in Slovenia: FMR Kranj (N=201), FMR Slovenj Gradec (N=179) and FMR Bled (N=100) (Figure 1).

All three management regions lie in the northern part of Slovenia; differ among each other in natural, socio-economic conditions and management tradition. In all three regions forests cover more than 66%. In FMR Bled Mountain beech forests on carbonate bedrock (European forest category 7 (EFC 7)) prevail, in FMR Kranj Beech forests on non-carbonate ground prevail (EFC 6), in FMR Slovenj Gradec beside EFC 6 also the Alpine coniferous forests (EFC 3). In all three management regions private forests prevail (in FMR Kranj 82 % of private forests, in FMR Slovenj Gradec 72 % and in FMR Bled 53 %, respectively). The management conditions are most favourable in FMR Slovenj Gradec, where average private property reaches 7.6 ha of forest land, the average number of tracts per owner is the smallest and the property often consists of only one bigger tract, as a result of traditional self-sufficiency of farms living from wood production (Forest management plan Slovenj Gradec, 2001). In FMR Bled, average private property reaches 3.6 ha, divided in many parts (Mertelj et. al., 2005). Because of particularly small properties, management restrictions due to nature protection in Triglav national park and better opportunities for living from tourism the owners are less attached to their properties. The attitude of forest owners to their properties is most versatile in FMR Kranj. In lowlands the forests were pushed aside for agriculture and industry, while in sub-montane south and northern part of the region, where forest cover is higher, the importance of forests rise (Perdan in Štempihar, 1986).

Figure 1: Study areas

The face-to-face interviews had been done from 2009 to 2010 (FMR Kranj and FMR Slovenj Gradec) and the postal survey in 2004 (FMR Bled). The research was limited to landowners holding at least 1 ha of forest land (N=480), each landowner was classified into one of the four property size groups according to the size of his forest land: M (1.0-4.9 ha), L (5.0-14.9 ha), XL (15.0-30.0 ha), XXL (>30.0 ha).

The survey design consists of three main parts. Forest owners were asked about; A.) General characteristics about the forest property, B.) Forest management and C.) Attitude to forest property plan (FPP).

The following questions from total of 37 were extracted from the questionnaire for the purpose of this research:

How would you estimate your forest management in term of wood exploitation? The following answers were to choose: a) optimal management; b) under exploitation; c) over exploitation; and d) not sure, not defined.

How do you consider the sufficiency of the information you have for the management in your forest? The following answers were available: a) I have all or almost all information I need for management; b) I do not know, I can not decide; c) I do not have all information.

Table 1: Profile of private forest owners surveyed

Property size group		M	L	XL	XXL	Total
Sample size		128	123	117	112	480
Male/Female ratio		2.6 : 1	3.7 : 1	5.9 : 1	5.2 : 1	3.9 :1
Mean age (St. Dev.)		62 (14)	55 (14)	57 (14)	55 (14)	57 (14)
Socio-economical type (%)	Full time farmers	23.8	28.7	38.5	59.8	37.1
	Spare time farmers	46.0	64.8	59.0	38.4	52.2
	Non farmers	30.2	6.6	2.6	1.8	10.7
Formal education level*		3.6	3.7	3.8	3.8	3.7
Average number of tracts		1.8	2.4	2.1	2.3	2.1
Average annual cut (m^3/ha/year)		2.3	3.4	3.5	3.6	3.5
Share of absentee owners (%)		15.6	12.2	9.4	9.8	11.9
Share of owners not familiar to Slovenia Forest Service (SFS) or without cooperation (%)		28.0	6.9	5.0	1.0	9.5

*Weighted mean calculated from the following 7 levels: 1 <8 years, 2 primary school (8 years), 3 high school undergraduate, 4 vocational school, 5 high school graduate, 6 higher proffesional studies, 7 college.

How would you rank the information availability and their usefulness for the forest management you practise in your forest (The availability of 19 different information must be assed either as a) not available, b) partly available or c) fully available. Usefulness of each information was ranked from totally useless (rank 1) to most useful (rank 5).

Have you ever heard about the FPP? Yes or no.

Do you consider that private forest property plan might be anyhow useful for your forest management? a) It would be useful; b) It would not be useful; c) I do not know, I can not decide.

Would you share the costs for the elaboration of the FPP for your property? Yes or no.

How much (in €) would you be prepared to contribute to the elaboration of the FPP for your forests? Forest owners were encouraged to propose the amount freely.

Descriptive statistics were used in analysing the characteristics of respondents' answers and non-parametric tests (χ^2 test, Mann-Whitney U test, hereinafter MW U test, Kruskal-Wallis test, hereinafter KW test) to test the significance of differences in availability and usefulness of the management information between property size groups and to test the differences in their attitudes to FPP. All statistical analysis was carried out in the SPSS 16.0.

The relationship between the average availability and average usefulness of all present information in forest management for forest owners was calculated with Spearman rank correlation, curve estimation was used to present the relationship. In order to avaluate and quantify the missing information, the simple difference (D) between average availability and average usefulness was calculated for each information. The availability was previously scaled from nominal attributes “not available”, “partly available” or “fully available” to continuous 0-1 interval, the usefulness was also scaled from ordinal ranking to continuous 0-1 interval.

The highest D values mean the highest disproportion in availability and usefulness of information (the lowest differences indicate the missing information, the highest differences indicate irrelevant information).

3 RESULTS

3.1 MANAGEMENT EFFICIENCY AND THE LACK OF INFORMATION

68.8% of forest owners are convinced they manage their forests optimal, that there is no need to increase or decrease the current cut. Among the smallest forest owners (size group M) the share of those thinking this way is the lowest; near one third of them is aware of inappropriate management. In the same time, 10.2% of forest owners from group M were not able to asses the management efficiency. Only 2.1% of interviewed share the opinion, they should decrease the current cut, the share of these is the highest in size group XXL, where the average annual cut is the highest (table 1, table 2).

Table 2: Owners perception of forest management efficiency

Property size group	Optimal management (%)	Underexploited (%)	Overexploited (%)	Not defined (%)	Total (%)
M	57.5	30.7	1.6	10.2	100.0
L	76.2	20.5	1.6	1.6	100.0
XL	70.1	27.4	0.9	1.7	100.0
XXL	72.3	22.3	4.5	0.9	100.0
Total	68.8	25.3	2.1	3.8	100.0

84.5% of forest owners share the opinion, that they have sufficient information needed for forest management, but we found significant differences in owners’ attitudes to information sufficiency among size groups. Forest owners possessing the largest forest properties, think they have all or almost all information they need for management more frequently than the owners possessing less. Owners, having less than 5 ha of forests are most strongly convinced, that they are poor informed, as much as 16% in this size group do not know or can not decide whether the management information provided are sufficient or even do not manage at all (figure 2).

How do you consider the sufficiency of the information you have for the management in your forest?

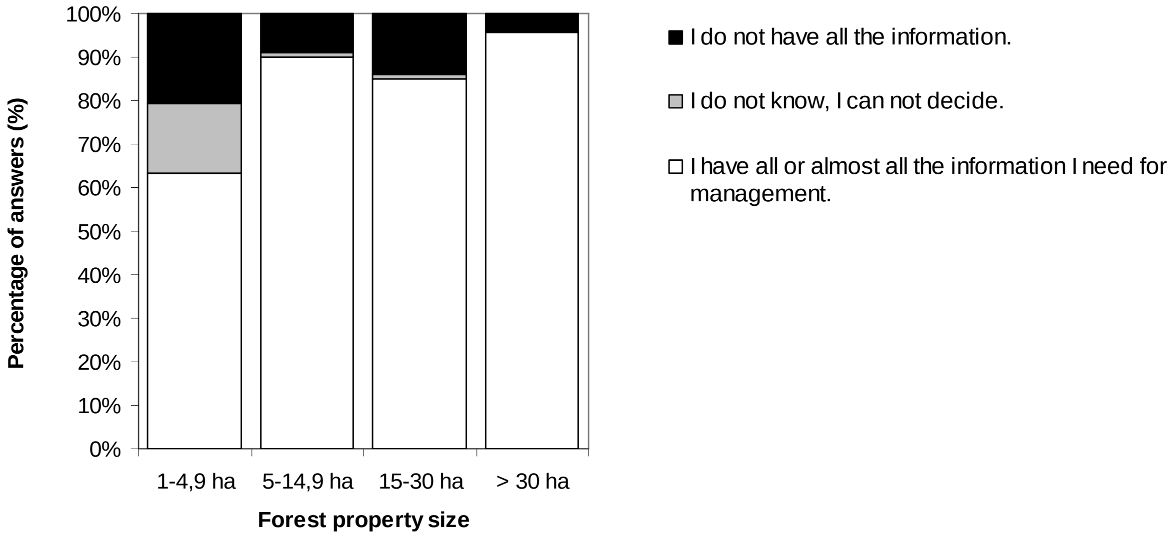

Figure 2: Information sufficiency for management in forest

The forest owners are most frequently informed about who to contact to, when they want to cut (96% of positive answers), about the allowable cut in their forest (88%), about the locations of parcels (87%), about the forest protection (84%), about the sylvicultural measures (72%). Only the minority of owners is informed about the options for machine harvesting and realization opportunities nearby their property (10% of positive answers), about the current market prices of forest land (12%), about the game species and their population densities (19%) and about the possibilities of constructing the forest traffic infrastructure (roads, skidding trails etc.) and the economic consequences for their forest property (29%). Other information are partially available or the opinion about the availability is not uniform; 42% of owners know the possible cut for each parcel individually, almost the same percentage (40%) share the opposite opinion. The profitability of management is available to only 24% of owners, while 44% do not know anything about their profitability of forest management. Which are the local companies or private entrepreneurs offering services of cut, skidding, buying or transporting the wood is also unknown to almost half of the owners.

3.2 INFORMATION RELEVANCY

Owners consider the following information to be the most useful for forest management (ranked in the order of usefulness): 1)who to contact to, when they want to cut, 2) information about the forest protection and bark beetles prevention, 3) about the allowable cut in their forest, 4) about the exact parcel borders, 5) about the sylvicultural measures. The most irrelevant information from the owners' perspectives is information about the options for machine harvesting and realization opportunities nearby the property (86% of interviewed consider this information as useless information or information of low importance). More than half of owners also do not consider the current market prices of forest land to be relevant for forest management, while the evaluation of information about the game species and their population densities is not so black and white; it is useful for one third and useless for another third. All other management information available is considered to be useful.

Hence, we found a positive relationship between usefulness and availability of information needed for forest management (Spearman rank correlation R=0.914, p<0.05). The usefulness of information is logarithmically related to availability (figure 3); the more the information is available, the logarithmically more it is considered to be useful (R^2= 0.86), which lead us to a conclusion that in general forest owners are sufficiently and relevantly equipped for management.

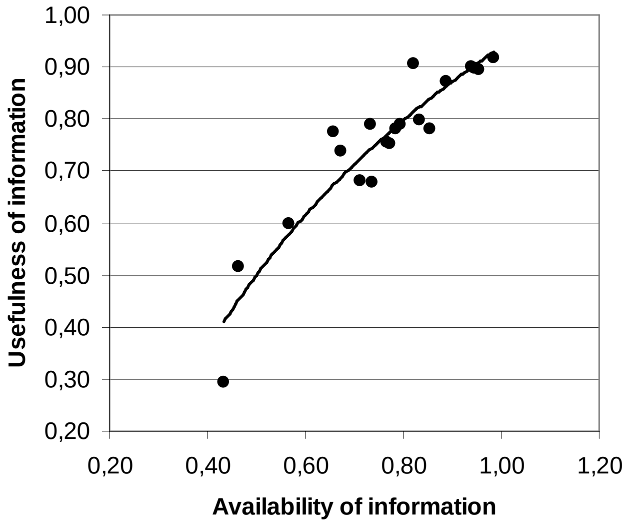

Figure 3: The relation of usefulness to availability of information needed for forest management

Forest owners are missing the information about the possible cut for each individual parcel the most (D=-0.12), followed by the information about the borders of their parcels (D=-0.09), they would like to be informed more about the possibilities and costs of constructing the forest traffic infrastructure (D=-0.07), in the current management planning they miss the evaluation of the profitability of management, too (D=-0.05). Surprisingly, we found that some information which are not widely available are even less valuable: Forest owners take the information about the options for machine harvesting and realization opportunities nearby their property as the most irrelevant information for management (D=0.14), information about the wood tailoring or contact information of public forest service are also less useful than available (D=0.07).

The decisions about the relevancy of the information partially depend on forest property size. Between forest property size groups, we found significant differences in average availability for 14 information and significant differences in average usefulness for 10 information (from 19 listed) (table 3).

Table 3: Significance of differences in average availability and usefullness of information needed for forest management among forest property size groups (KW tests for 19 information; p showed)

Information about the…	Availability of information	Usefulness of information
…expected costs of cut and forwarding	,000	,102
…profitability of management	,000	,068
…local companies or private entrepreneurs offering services of cut, skidding, buying or transporting the wood	,005	,236
…options for machine harvesting and realization opportunities nearby my property	,279	,070
…wood tailoring	,000	,000
…wood sale market and wood prices	,000	,000
…possible cut for each individual parcel	,343	,000
…about the sylvicultural measures	,000	,008
…forest protection and bark beetles prevention	,000	,010
…the current market prices of forest land	,263	,000
…borders of my parcels	,028	,254
…locations of my parcels	,206	,409
…possibilities and costs of constructing the forest traffic infrastructure	,000	,000
…rights and duties of forest possession	,007	,395
…public rights in my property (free access, non-commercial non-wood goods)	,064	,802
…game species and their population densities	,000	,002
…management restrictions due to nature protection	,002	,011
…allowable cut in my forest	,011	,009
…who to contact to, when I want to cut	,017	,296

Owners possessing more forest are convinced they have more available information, they rank the usefulness of the information provided higher than owners possessing less forest (table 4). When we compared two extremes among small scale forest owners - the largest (group XXL) and the smallest (group M), we found significant higher ($p<0.05$) ranking of the usefulness in group XXL for the following information: about the wood sale market and wood prices (MW U test, z= -4.184), about the current market prices of forest land (MW U test, z= -4.113), about the possibilities and costs of constructing the forest traffic infrastructure (MW U test, z= -3.926), about the possible cut for each individual parcel (MW U test, z= -3.461), about the game species and their population densities (MW U test, z= -3.376), about the wood tailoring (MW U test, z= -2.437), about the sylvicultural measures (MW U test, z= -2.356), they are more aware of management restrictions due to nature protection (MW U test, z= -2.276). We did not find significant differences in ranking the usefulness for other management information.

Table 4: Differences in average availability and usefulness of management information in property size groups

	a) Availability of information*			
	M	L	XL	XXL
M		-1,19%	-1,13%	-1,61%
L	-,89%		,06%	-,42%
XL	-1,02%	-,13%		-,48%
XXL	-1,43%	-,53%	-,41%	

	b) Usefulness of information*			
	M	L	XL	XXL
M		-,42%	-,41%	-,51%
L	,03%		,01%	-,09%
XL	-,28%	-,31%		-,10%
XXL	-,13%	-,16%	,15%	

a) *Above the diagonal, differences in average percentage of fully available information are shown, below the diagonal differences in average percentage of not available information are shown.
b) *Above the diagonal, differences in average percentage of most useful information are shown, below the diagonal differences in average percentage of totally useless information are shown.

3.3 ATTITUDE TOWARDS FPP

Most of the forest owners have never heard about the forest property plan (FPP); in 2004, 11.3% were familiar to FPP in FMR Bled, in 2009 13.9% in FMR Kranj and 14.0% in FMR Slovenj Gradec. Forest owners possessing more than 30 ha of forest land are significantly better informed about the FPP than all other forest owners in all management regions ($\chi^2_{0.05}(3)=22.6$, $p<0.000$). The acquaintance to FPP of those, who possess less than 30 ha of forest land, is negligible; only 9.2%, while the acquaintance to FPP in group XXL reaches 37.0%.

204 or 42.9% of interviewed share the opinion, that FPP might be anyhow useful for their management. On the other hand, 71% would not share the costs for the elaboration of the FPP. Willingness to share the costs for the elaboration of FPP rises with forest property size. Those who possess over 30 ha of forest land are willing to pay 2.5 times more than those having less than 5 ha of forest land. Most often, 40 € were bided (mode),

median of offers in size group XXL (231€) is significantly higher than median of offers in other size groups (69€) (MW U = 340, p<0.008).

4 DISCUSSION

Among current management problems in small scale private forests in Slovenia absence of management or low management interest among forest owners are of greatest concern (Diaci and Grecs, 2003), which is quite similar in other European countries, too (Wiersum et al, 2005). The reasons for poor management in small scale private forests are different; in Slovenia unfavourable ownership situation of small scale private forests is particularly emphasized (Medved, 2003), most of the owners are not economic dependent on forests, we should also consider changes in social and economic situation in last decades and re-organisation of forestry sector since 1990 to be relevant. The foreign examples (e.g. Bachmann, 2001) also show that forestry sector has undergone important changes.

Factors influencing the forestry sector are only partially controllable by forestry sector itself, moreover, we should be aware that poor or insufficient forest management in small forest properties is only partially controllable; and positive changes are often long-term. In this study we focused to relatively non-homogenous part of private owners (1 ha to over 30 ha of forest land), where the economic benefits are probably not of the primary importance. More detailed analyses of management and ownership objectives would probably stratify the owners in more types. Despite all this, we were trying to find reasons for poor or insufficient forest management in small forest properties also due to the lack of relevant information needed for management and / or absence of usable management plan.

Generally, we found some contradictories between owners' and expert's perception of forest management problems (Bončina, 2003) in small scale properties. High majority of interviewed share opinion, that they manage their forests in an optimal way. The share of those, thinking them they underexploit is remarkably low; 25.3% on average, when compared to realisation of allowable cut in private forests (Poročilo Zavoda…, 2009).

The false perception of proper management among the smallest forest landowners could be explained by high share of non-farmers, high share of absentee landowners, which do never do their work in forests at all or do not work in their forests by themselves and their low cooperation with Slovenia Forest Service (SFS) (table 1). All these reasons might have contributed among others to have only few information they need for management which has lead consequently to poor management or even absence of management. Low usefulness of available information, which the smallest landowners expressed, is thus only a consequence of their lack of knowledge and management interest and not a consequence of inappropriate management planning (Jacobson, 2002).

On the other hand, we found strong positive relationship between the information availability and their usefulness (figure 3), meaning that information provided are in general considered to be most useful for management, too. Information provided by SFS (e.g. who to contact to when cut wants to be done, information about the allowable cut, information about the setting of forest traffic infrastructure, information about the silvicultural and protection measures etc.) were considered to be most available and useful meaning that the Slovenia Forest Service supply relevant and useful information also for small scale forest owners. Despite that, we found some disproportion in the availability of information and needs. The following information should be paid more attention to when planning in private forests: the information about the available cut for each parcel, which is the most desirable information for forest owners, the information about the borders of their forest property and the information about the profitability of the forest property. Most of them could be provided by SFS only by improving the current state of communication of local foresters (e.g. more detailed and diversified planning when needed, assuring the support in decision making and keeping the initiative of good management and planning practises), while other information can not be supplied within the public forest service (e.g. information about the borders of the forest property, information about the profitability of the forest property).

Most of the information needed in small scale management could be collected and presented in a new instrument, FPP. FPP's aim is to supply forest owners' individual based management perspectives assuring the public interests are respected. Despite low current familiarity to FPP and only moderate belief of its positive effect to forest management, which reflected from our survey, numerous examples of good practises preparing and using FPP are already available (e.g. Papler-Lampe, 1994; Jerovšek, 2004; Čadež, 2004; Mori, 2004; Hvala, 2010). Moreover, we might assume that favour of FPP as a new instrument of forest management planning is biased to non-favour. The behaviour of forest owners could be labelled as reserve or traditional. This attitude is furthermore reflected in a decision whether to financially participate to elaborating FPP or not; the share of those willing to participate in elaborating FPP dropped substantially, when they were asked to suggest the value of FPP in euros. On the other hand, Bell et al. (1994) report that landowner's attitudes and knowledge may be more influential in a decision to participate in something than monetary incentives. Paraphrasing that, we could conclude that favouring FPP could not be reflected through the money the forest owners are ready to contribute to the costs for FPP elaboration, but rather through their individual attitude to forest property and current knowledge about the forest management. Furthermore, diverse amounts ranging from 5€ to 1000 € which were suggested by forest owners, mean that the importance of FPP is highly individual dependent and that money is not of primary importance for deciding whether to support FPP and consequently improve the management or not. Hence, the individual owners' favour of FPP should be considered in a more broad sense; not as positive or negative, leading us directly to decision where FPP should be popularized, but rather as likelihood that FPP has more perspectives here and not there.

In this sense, some general guidelines for further introducing FPP into practise could be summarized from the survey analysis. We clearly found that owners possessing more forests are better informed; they rate the importance of currently available management information higher, they are more familiar to FPP and they are ready to share the costs for the elaboration of FPP with higher amounts. In the introducing FPP in the future, we should pay more attention to owners having over 30 ha of forest land. Here the strategic and operational planning at the level of owner's forest property in a form of FPP is reasonable and might contribute to higher intensity of management in small scale properties. Still, the introduction of FPP into the concept of forest management planning should be individual based and not formal (Ficko et al., 2005).

5 CONCLUSION

Forest management planning in Slovenia is detailed but rather uniform despite different management interests. Intensive and uniform management planning is reflected also in numerous and very detailed information about the state of the forests and past management. All the information are collected and stored in the Forest Information System of SFS irrespective of ownership or management intensity. This analysis showed that information, obtained in the forest management planning process of public forest service, is relevant also for forest owners. Despite many advantages of current management planning concept, we can highlight two proposals, which could contribute to more rational and efficient management planning in private forests:

1) Uniform management planning is not optimal from the point of usefulness of the management plans and costs for their elaboration. In the next time, the management planning should be diversified. The operative planning should be more individually adapted to real management conditions and interests; one of the instruments in the level of operative planning could be FPP (Ficko et al, 2005; Mertelj et al., 2005).

2) The second proposal concerns the acquisition of the information. Different characteristics of forest owners, their goals and management intensity dictate adapted acquisition of the information. More attention should be paid to information about forest owners' needs, goals and the perspectives of management in their properties but less to inventory of forests.

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Windthrow management – individual approach to small forest estates

Tomaž Gerl[1], Jurij Beguš[2]

Abstract

The case study focuses on a successful damage management of a large-scale windthrow in the Gornji Grad municipality. In July 2008, a devastating windstorm affected about 800 ha of forest in the broader area of the Upper Savinja Valley. Subsequently, over 150.000 m^3 of timber had to be cut and removed. Around 80 % of damaged or destroyed forest stands belonged to small-scale forest owners. Consequently, as many as 134 owners suffered damage, whilst some of them lost almost the entire growing stock. For the purpose of damage management the following activities were carried out: damage assessment, extension for safe work, decision about logging techniques, repair and reconstruction of the existing as well as construction of supplementary forest infrastructure, professional counselling and acting as agents for forest owners in order to help them receive governmental subsidies. Various methods of logging were practised, according to natural conditions and owners' possibilities. Proper distribution of governmental funds ensured that the allotted money was spent efficiently and where most needed. Since the damaged area consisted of many small-scale woodlots, the general guideline for damage management was to organise all forest owners to deal with the issue by joint effort, at the same time considering each one's individual situation, the degree of damage suffered as well as technical capacities

Key words: damage management, windthrow, extension, small forest estates
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A BRIEF DESCRIPTION OF THE NATURAL DISASTER

TIME, LOCATION, EXTENT AND COURSE OF THE WINDTHROW

The catastrophic windstorm took place on the 13th July 2008 and affected several parts of Slovenia. Turbulent wind that lasted between 10 and 15 minutes resulted in massive windthrow, which was concentrated on the slopes of both sides of the mountain pass

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Črnivec at the altitude between 600 and 1200 metres. This case study is focused on the eastern side of the Črnivec Pass, which lies within the broader area of the Upper Savinja Valley. Whilst the major part of the Upper Savinja Valley wasn't significantly damaged, the examined location alone suffered vast damage. The area of the affected forest amounted to 700 hectares, out of which nearly 200 ha were virtually bared to the ground (ZGS-OE Nazarje, 2008). Another 200 ha of forest were damaged to the degree that a complete regeneration was inevitable. The rest of the affected forest was damaged only partly, so that the forest stands could still have been preserved for certain period and immediate regeneration was not necessary.

The windthrow affected older, even-aged, uniform spruce stands solely, whilst younger and more diverse stands hardly took any damage. In the examined area, the total quantity of destroyed growing stock amounted to 148,000 gross cubic metres. Most of the trees were uprooted, especially in heavily damaged or destroyed forest stands, whereas broken trees were found mainly in moderately or less damaged parts of the forest.

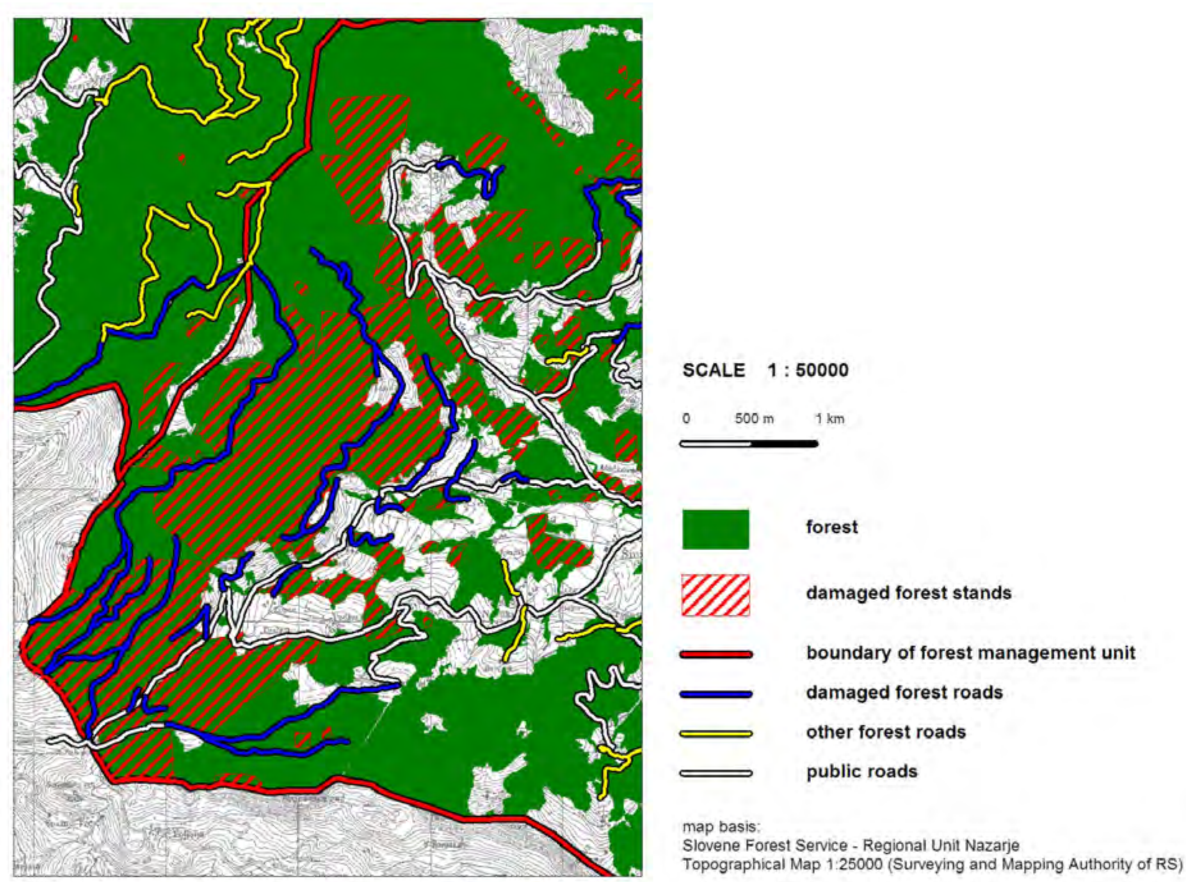

Fig. 1: Location of the most damaged forest

OWNERSHIP

Considering the ownership, the damaged forest could be divided into two categories: small private forest estates versus one large estate owned by the Catholic Church. In terms of damage there was no significant difference between the categories. However in terms of technical and financial possibilities for damage treatment as well as in terms of the economic impact on the owners, the difference was essential. Thus selective approach to planning treatment activities was justified.

MAJOR PROBLEMS RESULTING FROM THE WINDTHROW

The problems fell into three major groups: technical problems concerning proper and timely logging of massive amount of timber (including the issue of work safety), social and economic problems of the owners and finally the issue of protection of the residual stands from pests, predominantly spruce bark beetle. All these problems had to be dealt with instantly.

a) Most of the damaged forest stands were concentrated within only one forest district – the Tirosek. The planned maximum annual cut for this district amounts to 13,700 gross cubic metres of timber, whilst normally the actual annual cut doesn't exceed 10,000 m^3 (ZGS-OE Nazarje, 2004). However, the windthrow caused over 13 times more timber to be logged in an area of just a little more than one quarter of the district. Already a brief survey showed that treatment measures would request joint efforts of many foresters and all forest owners concerned. It was also evident that the existing forest infrastructure in the present condition would not be sufficient for transporting such amount of timber. Consequently, after the initial clearing, a thorough repair, reconstruction as well as supplementary constructions were inevitable. Finally, a question arose how to design forest regeneration in the way not to create future even-aged uniform stands on large scale, which had proved to be very poorly resistant against natural disasters.

b) Social, i.e. economic problems touched especially those owners who had lost the great portion of their growing stock. The necessity of instant logging and selling negatively affected the price of timber, which had already been decreased by lower quality of the assortments. On the other hand, the contractors (logging companies) were in position, which allowed them to offer higher prices for their service than normally. Although momentarily the owners did obtain an increased income from the timber sold, they would inevitably face a substantial loss of income in future decades. Thus the income reduction might have even endangered the existence of those farms that depended predominantly on timber production.

c) The enormous number of uprooted, broken or otherwise damaged spruce trees formed an ideal potential for a quick progress of bark beetle populations. That had to be prevented by radical protection and prevention measures as well as quick removal of the damaged trees. In the initial stage, the population growth took the expected course and so the number of inhabited spruce trees in the nearby residual stands even tripled in the second half of the year. However, the population growth became far less intensive in the next year, so that by the end of 2009 the total amount of attacked growing stock increased only by additional 40 percent (ZGS-OE Nazarje, 2010).

DETAILED SURVEY OF DAMAGE AS THE BASIS FOR ADEQUATE TREATMENT MEASURES

THREE CATEGORIES OF DAMAGED STANDS

The size and extent of damage to forest stands were the key factors determining selection of adequate logging technologies and regeneration strategy. Considering the degree of damage, the affected stands were divided into three categories: partly damaged stands with the growing stock reduction below 50%, destroyed stands, which had lost between 50 and 90 percent of growing stock and bare areas, where nearly all trees had been destroyed (ZGS-OE Nazarje, 2008). Most of the stands (46%) fell into the first category, although they were substantially damaged too. In order to prevent creation of too large areas of even-aged young forest, a general agreement was achieved not to promote any regeneration of partly damaged stands unless absolutely necessary. The shares of the other two categories were similar, around 27% each, which meant that in the following years, regeneration would be going on in an area of almost 380 hectares.

Spatial distribution of damaged forest stands shows that small forest owners were affected to a greater extent than the Church estate. Only 111 out of 705 ha of damaged stands belonged to the Church. Moreover, the major part of the third category, i.e. bared areas, primarily belonged to small estates as well.

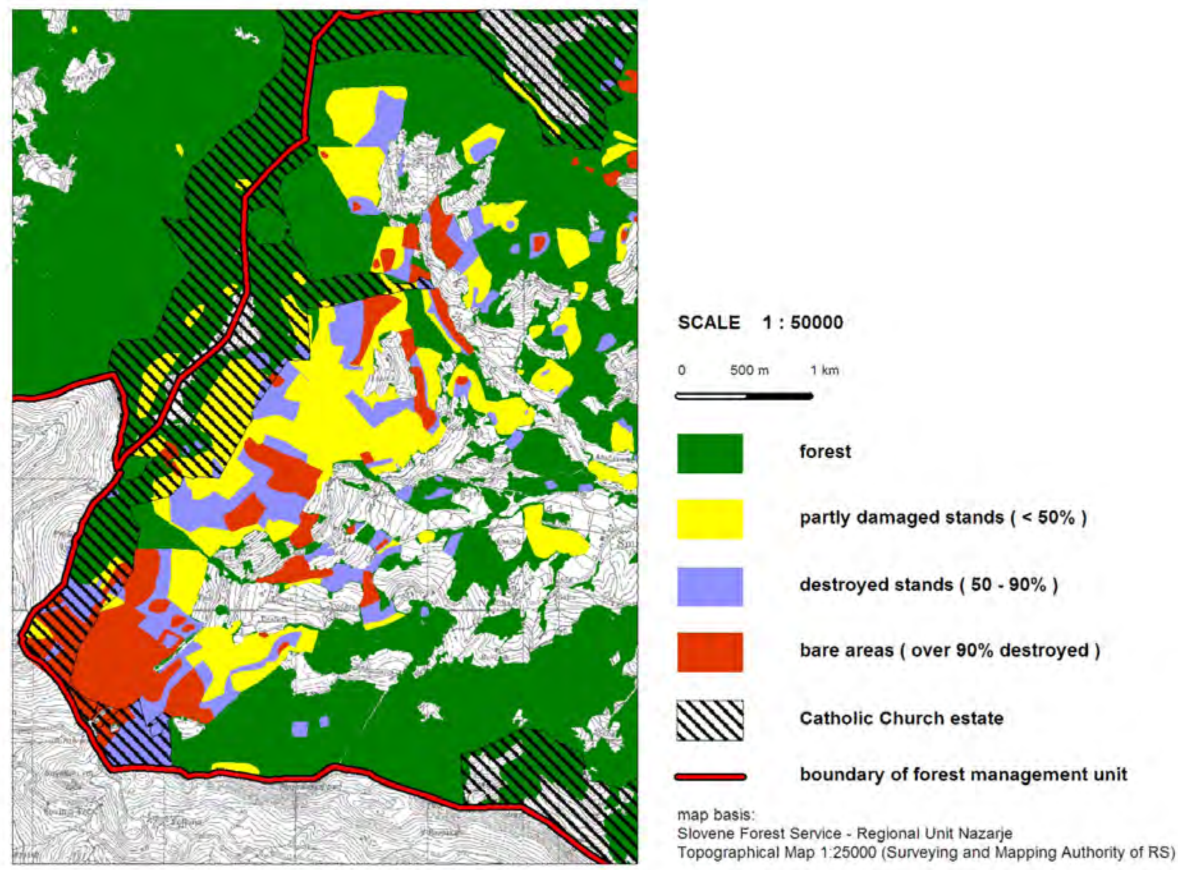

Fig. 2: Spatial distribution of the damaged stands

DAMAGE ON FOREST INFRASTRUCTURE – ROADS AND SKID TRAILS

The storm caused virtually all forest roads and skid trails in the area to be blocked with fallen trees, whilst 39 km of forest roads and 35 km of skid trails were also directly damaged by meteoric waters or minor landslips. This damage could be described as primary, i.e. caused directly by the storm. However, throughout the entire time until the final completion of all works, forest infrastructure was suffering additional, secondary damage as well. It was caused by incessant transport of heavy timber trucks and logging machinery in almost every weather conditions. This secondary damage had been well anticipated and taken into account when making road maintenance plan (ZGS-OE Nazarje, 2008).

DAMAGE TREATMENT ACTIVITIES

LOGGING

The choice of proper equipment and methods of cutting and transporting depended on several factors. In the case of heavier windthrow, mechanised cutting is generally preferred (Stathers et al., 1994), because it is the most cost effective and the safest logging technology. However, there were several factors that put limits to the application of heavy machines in this case: terrain features, soil characteristics (the degree of resistance to compaction and erosion) and also financial abilities of the owners that allowed them (or not) to make contracts with adequately equipped forest enterprises. In short, there were technical, environmental and economic limits to machine cutting. At

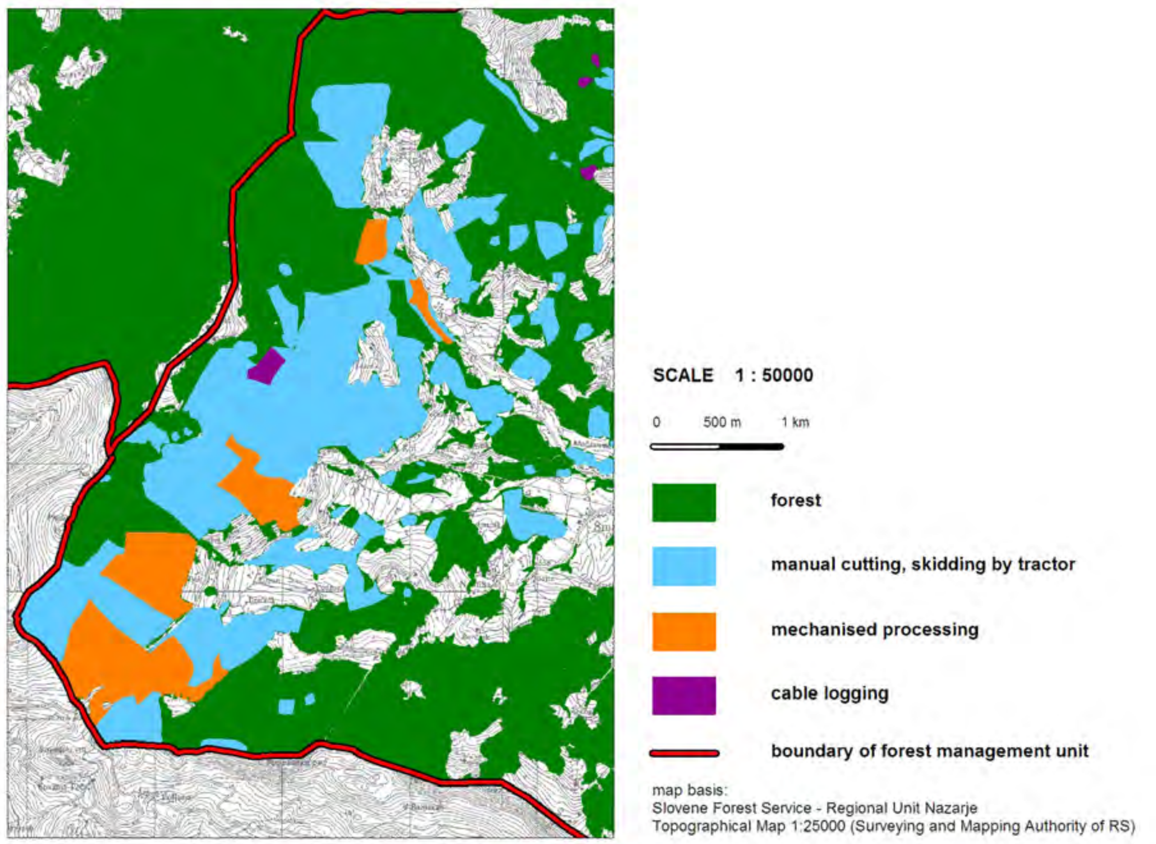

Fig. 3: Logging technology

the same time, nearly all forest owners in the area had been sufficiently equipped and trained for forest work, which enabled them to carry out most of the activities in their forests by themselves and thus cut the costs considerably. Also neighbourly solidarity was an important factor, which helped the owners to accomplish all the work in time. Because of these reasons, the combination of manual cutting and skidding by adapted tractors was prevailing. Such logging method was practised in over 80% of the examined area, whilst mechanised cutting eventually took place only in the area of some 120 ha where the stands had been most severely destroyed. Even in that case, a combined method of transporting logs by forwarders and skidding them by tractors was being practised. Nevertheless, in the terms of timber amount, the share of mechanised cutting was considerably higher – over 42% (ZGS-OE Nazarje, 2010). Regardless of relatively large volume of timber processed by machine cutting and forwarding, damage caused on forest soil by heavy machinery was tolerable. The expression “tolerable” means that soil compaction was not significant and did not increase erosion or hinder natural regeneration. Any significant damage on residual trees hasn’t been spotted either.

ENSURING ACCESSIBILITY – CLEARING, RECONSTRUCTION, REPAIR AND SUPPLEMENT OF FOREST ROADS AND SKID TRAILS

In order to ensure satisfactory conditions for timber transport, a set of activities were necessary. After the phase of clearing, it became obvious that the existing forest infrastructure would be insufficient by far for enormously increased transport. Thus extensive reconstructions were carried out on almost every forest road in the area. The aims of the reconstructions were to achieve: adequate dimensions, necessary carrying capacity and sufficient drainage (Odenthal-Kahabka, 2005). Initially, all three mentioned elements of the roads had failed to meet the estimated requirements for heavy transport. The roads were widened by approximately 1 metre and drainage was cleared, repaired and supplemented where necessary. Finally, gravelling together with re-surfacing and compaction were carried out with the purpose to ensure improved carrying capacity. In such way, over 66 kilometres of forest roads were thoroughly reconstructed. To minimise the secondary damage, some extra maintenance was included in the regular annual road maintenance plan. These measures consisted mainly of supplementary gravelling, re-surfacing and prompt clearing the drainage ditches of totally 110 km of forest roads.

The network of skid trails had been sufficient for ordinary forest management. However, because of the windthrow, certain remoter areas became inaccessible through combination of steep terrain and numerous broken trees, therefore new trails had to be constructed. The total length of newly constructed skid trails amounted to 11 kilometres, whilst nearly 100 km of the existing trails were cleared and repaired (ZGS-OE Nazarje, 2008).

FOREST PEST CONTROL

High possibility of drastic increase of spruce bark beetle population called for urgent measures. Already in the same year, 50 pheromone traps (Theysohn® window-slot traps) were placed in the vicinity of the residual damaged spruce stands. In order to control the populations of both leading spruce pests *Ips typographus* and *Pityogenes chalcographus*, each trap contained two pheromone baits: Pheroprax® and Chalcoprax®. In the following year, additional 25 traps were set and the pheromone baits were replaced three times during the year (ZGS-OE Nazarje, 2010). The traps were supplemented with some 100 breeding spruce logs. In the first year, breeding logs were not needed, because the uprooted and broken spruce trees could have well played such a role (Faccoli and Buffo, 2004). Therefore the main task of the first year was either timely removal of the colonised logs or on-site debarking where transport was hindered. However, in that year pest control didn't work out quite as planned, so that bark beetle populations increased significantly. This became evident by the end of the year through the amount of the attacked timber. Its ratio in the nearby stands rose to as much as 3 : 1 in comparison with the first half of the year. Additional measures in 2009 considerably retarded further expansion of the populations, so that the overall loss of growing stock didn't increase much more. It indicates that the population growth might have been brought to a halt. Nevertheless, it is too soon to make the final judgement now, because the possibility of rapid population growth is still very present. Whilst bark beetle control measures planned for the year 2010 remain unchanged, their efficiency could only be evaluated at the end of the year and corresponding measures will follow. The amount of attacked growing stock in 2010 may give an answer about efficiency of the measures.

FOREST REGENERATION AND PROTECTION

The area of destroyed forest totalled 380 ha. It consisted of heavily damaged remains of forest stands and completely bare areas. Immediate artificial afforestation of such a vast area would not be either economically viable or ecologically appropriate (Odenthal-Kahabka, 2005). Besides, artificial regeneration brings about a longer series of actions of which planting is just the first stage. Therefore it is very risky, both in terms of biological and economic aspects. Last but not least, artificial regeneration may lead to extensive even-aged homogenous forest stands, poorly resistant to various biotic and abiotic factors (Ward and Worthley, 2003). In a very unfortunate case, even a calamity of the current size could reoccur. For these reasons, a decision was taken that regeneration should primarily be based on the natural potentials of the site and residual trees. Basically natural regeneration would be only partly assisted by enrichment planting of both economically important spruce and ecologically desired deciduous species. The reasons to justify enrichment planting would be preventing soil erosion and reducing the impact on visual appeal of the landscape. Such decision was also agreed on by the owners.

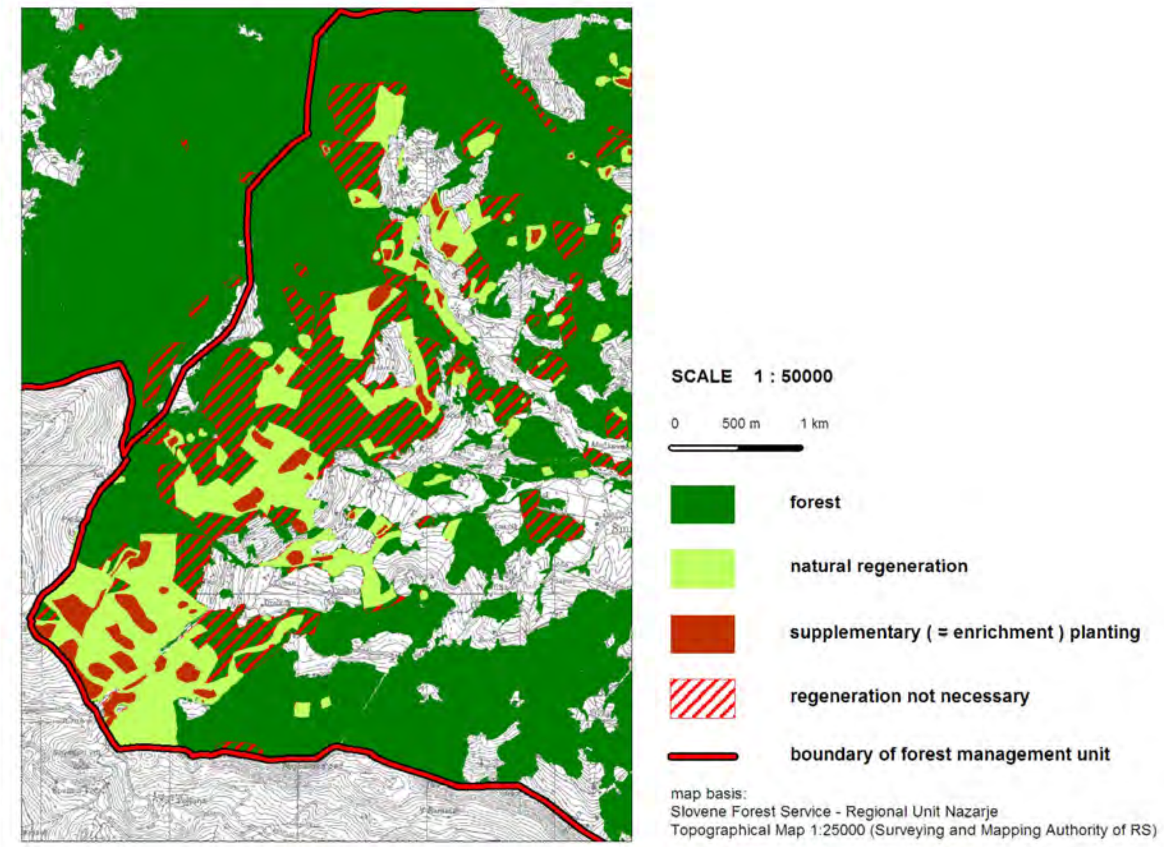

Fig. 4: Forest regeneration

Eventually, the enrichment planting was planned in about 20% of the total regeneration area, concretely 70 ha. Priority was given to erosive terrain and locations in the vicinity of some more exposed corridors such as public roads or hiking routes (ZGS-OE Nazarje, 2008). The first stage was carried out in spring 2009, when about 57,000 seedlings were planted on nearly 28 ha; an approximate density of 2000 pieces per hectare. The share of spruce was 65%, whilst the rest were mainly deciduous species (predominantly Sycamore Maple) supplemented with a thousand seedlings of European Larch (ZGS-OE Nazarje, 2010). Weeding and protection from browse damage by herbivores were appropriately implemented through individual protection of seedlings with rigid tubes or non-toxic chemical repellents. The entire planting is supposed to be completed until the end of 2011 (ZGS-OE Nazarje, 2008).

UTILIZATION OF CERTAIN INFORMATION CHANNELS IN THE CASE OF THE WINDTHROW

The treatment of the windthrow was a great challenge also with respect to extension activities of the SFS. We faced many different situations, each of which demanded a particular approach and actions. Where were these challenges?

- Quick reaction and skidding of the broken trees
- Warning about danger at work with broken trees
- Warnings about the dangers of visiting the damaged forests
- Mutual connection of forest owners for more effective and safer realisation of works
- Information about different contractors of forest works
- Preparation of treatment plans and possibilities of state support
- Public information
- Reconstruction and construction of new forest communications
- Reparation of forest roads

We used different information channels among which the most important were direct contacts with forest owners. Besides that we took great advantage of mass media, we organised several extension activities dealing with safe work in the forest and we published useful information on the SFS web site.

The fact that the windthrow happened in summer when the media had no other important news was the cause that we could take advantage of them to a great extent. On the other hand, we must not pass over the fact that the tragedy was the kind of an event, which strongly supports the modern concept of the media, which look mostly for sensationalistic information in a negative and tragic sense. Immediately after the event we informed the public and the politics about the first evaluation of damage, we warned about dangers at work in the specific conditions and about the dangers for the curios visitors of the damaged forests. That was of great importance, because a lot of damage that occurred in the nearest vicinity of the public roads quickly caused the affected forest to become a first class tourist attraction. Over-inquisitive and curios observation could have brought to unwanted and even tragic consequences.

Later on, we used the media to pass information to forest owners and to warn them not to carry out forest work on their own if they were not skilled enough for it, but rather to leave doing the work to those who were adequately equipped and had the corresponding knowledge. We also invited the media to attend the courses organised for forest owners, all with the intention to spread the information to broad public. Beside the television, which was the most active and best represented media, we also prepared several radio transmissions and newspaper articles. Let us mention Internet as a special media that we used to offer information about work contractors (because of the public character of the forestry service and because of possible reproaches about certain privileged contractors everybody was given the chance to publish their addresses on the SFS web site).

In every case of a natural disaster, not just this one, SFS organises demonstrations of safe work for dealing with the broken trees. In the mentioned case we organised 6 courses, most of them immediately after the catastrophe and on locations where conditions were the worst. As a part of these courses, beside safe working techniques, we also suggested the participants who were not skilled enough for such works to make contracts with the others, especially professional logging companies. Such courses are certainly much more informative for the participants than media but their attainment is far smaller and thus the information reaches a considerably smaller circle of the target public.

Fig. 5: Demonstrations of safe work for dealing with the broken trees

THE RESULTS OF DAMAGE TREATMENT TWO YEARS AFTER THE STORM

Almost two years after the catastrophic storm, it is possible to say that generally, the treatment project has succeeded beyond the initial expectations. A number of factors contributed to such result. The first necessary precondition was to relocate all the available foresters from other forest districts. Due to summer holidays, some foresters were temporarily absent exactly in those few days after the calamity, which were most crucial for timely beginning of treatment activities. Therefore participation of virtually all available foresters from the regional unit was necessary.

Immediately after the preliminary damage assessment, it was most important to contact all the affected forest owners individually and provide them with professional assistance. Initially the prospects seemed so gloomy that the general atmosphere was at the point of despair. Quick action and personal contacts helped the owners to overcome the fear that they would be left alone. Only in such way it was possible to build a sort of "solidarity community" (Odenthal-Kahabka, 2005) and to achieve that most of the owners enthusiastically put all their efforts into damage treatment.

Once the treatment activities had been on their way, much energy was shifted to building public relations and to arouse attention and understanding of broad public as well as policy makers. That was achieved through mass media both on local and national level, personal contacts with responsible persons of the government and local communities, press conferences, on-site visits, etc.

Because of persuasive appeal to public and political authorities, sufficient subsidies from the state's budget became available. The subsidies were appropriately canalised to logging, forest infrastructure and forest regeneration. Distribution of the funds based on the results of detailed damage assessment as well as individual situation of the owners considering their technical and financial possibilities to cope with damage treatment. Consequently, all broken and damaged trees were timely cut and transported away. The trees fallen through almost continuous subsequent "endemic windthrow" have been quickly cut and removed too. An endemic windthrow often occurs as the consequence of a catastrophe of larger proportions that had previously reduced mechanical resisting forces and vitality of the residual trees (Stathers et al., 1994). For this reason, over 10,000 m^3 of growing stock has been lost since then (ZGS-OE Nazarje, 2010). Moreover, it was of utmost importance that no serious accident at work should occur throughout the process, largely due to the application of mechanised cutting in the most difficult situations.

Sufficient governmental funds enabled forest infrastructure to be timely repaired and reconstructed, so that timber transport wasn't seriously hindered in any stage of damage treatment. All the roads were being promptly maintained to the degree that they are now in better condition than before the storm.

Forest regeneration remains perhaps the most questionable issue. Generally, forest regeneration is the matter of time and patience rather than some extensive, costly measures (Odenthal-Kahabka, 2005) and in this respect, the examined area has very high natural potentials. Besides, forest stands resulting from natural regeneration are usually more diverse, structured and resistant against various potential threats (Ward and Worthley, 2003). Finally, even the owners themselves haven't showed any special enthusiasm for planting. Yet, their attitude seems to result more from practical reasons than from ecological awareness. Namely, almost all small-scale forest owners are farmers too, and the most appropriate time for planting coincides with the season of intensive farming works. They simply cannot be motivated to put aside an urgent work in the field for the purpose of just assisting natural regeneration in the forest. And even once doing so, they are by no means motivated to plant deciduous species, which are economically disadvantageous in comparison with spruce. It appears that only sufficient financial subsidies by the government can stimulate individual owners to participate in planting activities. On the other hand, there is a strong public pressure to take a pro-active approach, sometimes even in contradiction to economic or environmental considerations. In such situation, the decision to apply artificial afforestation on a limited scale was perhaps a reasonable compromise between the interests of the owners and the expectation of the public.

It is possible to draw some general conclusions from the experience with the windthrow of 2008. The key factors of successful management seem to be as follows: a personal approach to all forest owners with careful consideration of their individual situation and an intensive appeal on the public as well as on the authorities who may (or may not) be willing to provide financial support. In the delicate process of influencing public opinion, foresters must preserve their competence also by avoiding imprudent actions or statements. In order to gain public sympathy, it is sometimes inevitable to make compromises, although they may lead to a certain decline from professional approach. In such case, rather than being too particular, the total gain and loss should be considered. Finally, the highest priority should be given to work safety. The risk resulting from manual cutting and skidding can be lowered by application of mechanised timber processing where possible.

In all respects mentioned so far, the discussed damage management can be considered successful. However, not enough attention was paid to collective bargaining with logging companies and timber dealers. That was partly because of lack of experience, but mostly due to being overburdened with other urgent duties. Premature contracts and hasty timber selling enabled logging companies to make unfair profits. In such cases, it is very important to put more effort into informing the owners about timber market conditions and protecting them from being easy prey to various profiteers.

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GIS technology as a path to restoration: mapping longleaf pine forests

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Abstract

The longleaf pine (*Pinus palustris* Mill.) ecosystem that once covered the southeastern landscape of the United States has been decimated to only a small percentage of the millions of hectares it historically dominated. There has been a surge of interest in longleaf pine restoration over the past decade with momentum continuing to build today. This restoration movement in the longleaf pine community emphasizes restoring functional longleaf pine ecosystems across its historic range. Preserving, enhancing, and restoring functional longleaf pine ecosystems has the potential to increase suitable threatened and endangered species habitat for target species such as the red-cockaded woodpecker (*Picoides borealis*), gopher tortoise (*Gopherus polyphemus*), eastern indigo snake (*Drymarchon corias couperi*), and flatwoods salamander (*Ambystoma cingulatum*), but this requires the restoration of longleaf ecosystems on both public and private lands, where the majority of the land is privately owned. Efforts to restore the ecosystem across the different types of landownership are driven by multitude of factors including but not limited to restoring the natural ecosystem, growing high quality wood products, producing non-timber commodities like grazing and pine straw, aesthetics, and increasing threatened and endangered species habitat, which has created a need for dynamic planning tools to capture and facilitate these efforts. Without a suitable conservation planning tool and map showing the extent and condition of existing longleaf pine forests across all types of land ownership, these various restoration efforts continue in a scattered approach across the historic range, where the impact of the restoring functioning landscape scale longleaf pine ecosystems continues to be an unknown.

The purpose of this study is to create a GIS database of existing spatial data about longleaf pine which will provide a baseline of knowledge and aid conservation and restoration efforts. The Longleaf Alliance, Inc., a non-profit organization focusing on longleaf pine restoration, is working in coordination with numerous partners on an effort to develop a GIS database of existing longleaf pine stand data. The GIS database was created by collecting and compiling existing available spatial data about longleaf pine

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stands using the best available technology. Sources include natural and planted stands from all types of land ownership (public and private), old growth stands, and known populations of target species like red-cockaded woodpeckers and gopher tortoises. This GIS database helps assess the extent and condition of available spatial data on longleaf pine forests, which provides a building block in the restoration of the longleaf pine ecosystem. The database will serve as an effective conservation tool by targeting areas of high ecological potential and thereby maximizing the impact of restoration dollars. Among the various utilities of this database are the abilities to identify areas that lack spatial data about longleaf pine stands, to develop potential ways to prioritize likely restoration focal areas and/or corridors, and to serve as an educational tool to promote longleaf restoration.

Key words: *Pinus palustris, longleaf pine, endangered species, geographic information systems, private lands management, technology transfer*
FDC: *53+166.6=111*

Private forests and equitable regulation

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Abstract

The sustainability of forested ecosystems often requires cross-boundary management at large spatial scales. This can be difficult, however, in landscapes where forests are primarily under small-scale, private ownership. Consequently, in many areas of the world private forest practices are governmentally regulated to promote more consistent cross-boundary management outcomes and better protection of large-scale ecological integrity. In this study 109 stakeholders throughout the State of Washington, USA were interviewed to learn their perspectives about processes and effects of private forest regulation. The State of Washington is widely recognized for its long-established and comprehensive forest regulatory policies and thus provides an excellent study area for this topic. Interviewees included private forest owners, forest policy advisors, regulatory agency employees, and representatives from forest ownership organizations and forest industry trade groups. The study relied upon the inductive, qualitative 'grounded theory' research method which enables the development of a complex, nuanced body of data well suited to the exploration of a complex subject such as this one. The results revealed an important and often poorly recognized outcome of private forest regulatory policy: regulation rarely affects all private forest owners similarly. Instead, the burdens and advantages of regulation tend to be very unevenly distributed within this key stakeholder group. The study identified three phenomena producing these inequitable outcomes: 1. Natural landscape variability, 2. Oversights in policy design, and 3. disparate interests and goals among forest owners. This paper analyzes these causes, identifies solution pathways, and discusses implications for policymakers.

Key words: private forest, regulation
FDC: 682:903=111

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INTRODUCTION

Worldwide, there is increasing interest in governmentally regulating private forests (Maini 2003:14; Teeter *et al.* 2003). This poses social, legal, and political challenges even more complex than those associated with the regulation of public forests, because on private forests the public right to a healthy environment must be blended with the individual rights of the forest property owners (Kilgore 2004).

In the United States, primary responsibility for private forest regulation rests with the states. Related resources such as air, water, and threatened and endangered species, however, are additionally subject to overarching federal regulations. Many states, including Washington, became more proactive about regulating private forests to avoid resource degradation that could trigger additional and more restrictive federal rules (Dana and Fairfax 1980). The states have employed diverse strategies, creating little consistency in the structure or scope of regulation (Kilgore *et al.* 2003).

A similar lack of standardized policy may be observed in many other regions worldwide. The learning curve for policymakers is correspondingly steep. To help shed light on this complex issue, this study examined how regulatory outcomes are perceived by a knowledgeable group of forest stakeholders directly involved in designing, administering, and implementing a comprehensive forest policy system in the State of Washington, USA. The study produced an important finding: Many types of forest regulations can result in a substantially unequal distribution of regulatory impacts among forest owners. Policymakers seeking a socially equitable outcome can expect the need to mitigate this problem. This paper analyzes causes of this inequality and discusses potential solutions and policymaking implications.

2 RELATED LITERATURE

Although large-spatial-scale, cross-boundary ecosystem management is widely conceded to be ecologically important (Kohm *et al.* 1997, Kimmins 1997), significant and continued social challenges can be expected (Belin 2005, Blomquist and Schlager 2005). When regulating private forests, a public asserts a right to expect certain outcomes from private landowners (Schelhas 2003, Singer 2000). Relevant public and private rights, however, are often poorly defined and integrated (Ostermeier and Keele 2003). Courts within the United States have taken a fragmented approach toward cases testing public versus private environmental rights. There is little consistent legal precedent to guide policymakers in developing socially sustainable regulation (Meltz *et al.* 1999).

Regulatory systems and institutions are highly complex and can become functionally ineffectual. They may fail to fit the problem they are intended to address, match the scale of the issue or setting, or interlink appropriately with other, related policy systems and institutions (Young 2002). Furthermore, political systems and property lines are founded upon arbitrary legal boundaries rather than natural ecosystem boundaries. Blending them can be problematic (O'Leary *et al.* 1999). Many positive environmental outcomes of regulation typically accrue to both the public and the private landowners, but without foresighted policy design the social burden for achieving those outcomes may fall disproportionately upon the landowners (Meltz *et al.* 1999).

Some scholars believe societies may need to reexamine traditional concepts of ownership and entitlement to achieve long-term, socially equitable environmental protection (Geisler *et al.* 2000; Hanna *et al.* 1996). The State of Washington has succeeded in instituting rigorous private forest management standards without needing to modify established landownership conventions, but public "access", "withdrawal", and "collective choice" rights pertaining to private lands are clearly undergoing continual reassessment (Ostrom and Schlager 1996:131). This is evidenced by the State's increasingly comprehensive regulations, which embody McKean's conclusion that "…it is appropriate to think of forests as a complex of many commodities with attributes of both common-pool and public goods" (Gibson *et al.* 2000:7).

Although these and other authors have analyzed regulatory effects upon various stakeholder groups or disparate outcomes *between* stakeholder groups, few have focused on the fact that a forest regulation may produce individually unequal outcomes *among* forest owners. With the exception of the work of Zobrist *et al.* on the effects of Washington's riparian regulations, this study is believed to be among the first in the United States (Zobrist and Lippke 2005; Zobrist *et al.* 2004).

There is, however, a body of literature that describes how the diverse personal circumstances of private forest owners may induce dissimilar *non-regulatory* outcomes among them. Private forest owners have a broad range of personal backgrounds, and these affect their management goals and outcomes (Birch 1996, Blatner and Greene 1989, Butler and Leatherberry 2004). John Bliss found that Wisconsin's forest owners generally chose their management goals based upon personal interests rather than external incentives such as foresters, forest tax laws, or cost-sharing programs (Bliss 1988). Finley *et al.* found "…a strong association between interest in [cross-boundary] cooperation and profiling variables such as age, affluence, personal values, and attitudes" of forest owners (2006: 10).

This study found that such differences in personal circumstances, backgrounds, and management goals can also affect a forest owner's *regulatory* outcomes. The individual impact of a regulation is linked in part to how that regulation relates to a landowner's experience, goals, and objectives, and to the unique physiography of that owner's forestland.

3 RESEARCH METHOD

The study area included the entire State of Washington. Private forests comprise approximately 42 percent of the state's 22 million forestland acres, and are integral to its culture and economy. Approximately 31 percent of the private forests are industrial and 69 percent are non-industrial. The industrial sector consists of about 60 ownerships. The non-industrial ownerships number over 90,000 (WA-DNR 2001, Erickson and Rinehart 2005.)

In 1946, Washington became the first state in the US to regulate private forests. It has remained in the vanguard of policy innovation, developing an unusually collaborative and comprehensive policy system (Creighton and Baumgartner 2005, Smith 1007). This system's combined elements of broad scope, long duration, collaboration, and innovation made it an excellent 'field laboratory' for this study. Washington's stakeholders offer an unusual depth of experience and insight pertaining to forest regulatory outcomes.

The study employed the qualitative 'grounded theory' research method (Glaser and Strauss 1999, Clarke 2005). In 'grounded theory' studies, analytical insights and new theory emerge inductively through the data, in contrast to deductive studies wherein data is tested against previous theories and predetermined hypotheses. The sample population is selected purposively rather than randomly or statistically, and designed to capture the full diversity of stakeholder viewpoints (Strauss and Corbin 1990). Sample size is therefore determined by the complexity of the subject and the diversity of the relevant population, rather than the numeric size or distribution of the population.

Data for this study were collected through 109 in-depth, one-on-one, loosely guided interviews. Most lasted at least two hours. Interviewees included non-industrial forest owners, industrial forest owners, representatives from Native American tribes, natural resource consultants, policy advisors, state and federal land management agency employees, and members of special interest groups. Interviewees were asked to discuss: their role(s) in natural resource management; overall impressions of the concept of private forest regulation; perceptions regarding public and private roles in relation to private forest protection; impressions of Washington's specific policy instruments;

impressions of familiar governmental entities charged with administering policy, and their sources of information regarding forest management and protection. Forest owners were additionally asked to discuss their management objectives; successes and challenges in meeting those objectives; and how they perceived the role of their property within the larger ecosystem.

Interview responses were progressively sorted, categorized, and analyzed for emergent patterns and themes. These were confirmed with further interviews until no new information or patterns emerged. Although 'grounded theory' study results are not suitable for statistical analysis, this method produces a richer and more fully-developed picture of the study subject than can be obtained through quantitative surveys or questionnaires.

4 RESULTS

Across all stakeholder groups, many interviewees described an emerging awareness that regulation affects private forest owners in previously unexpected ways. In particular, many described examples wherein regulatory impacts were highly dissimilar from one property to another, resulting in comparative advantages and disadvantages among owners. These dissimilarities were a source of frustration for many forest owners, and a matter of escalating concern among many professionals working with them. The causes of these inequitable regulatory outcomes fell into three broad categories: 1. Natural landscape variability, 2. Policy design, and 3. Variability in landowner goals and circumstances.

4.1 INEQUITABLE CONSEQUENCES RESULTING FROM NATURAL LANDSCAPE VARIABILITY

Many regulations are designed to protect specialized habitats or unusually sensitive resources. Because no two properties are alike, the extent to which such a regulation affects a landowner is largely dependent upon the coincidental distribution of that particular resource upon the owner's land. Common examples of this anomaly pertained to the naturally irregular distribution of threatened and endangered species habitats, and/or riparian zones. In Washington, these habitats are subject to a network of state and federal regulations that are more complicated, more rigorous, and more likely to be inequitable than certain other types of regulations.

Landowners with sensitive species habitats often had to substantially alter their forest practices to provide required protection. By contrast, owners without such species experienced little or no impact from the same regulation(s). As one consultant explained, "The last thing most landowners want is to find something like a spotted owl [*Strix occidentalis caurina,* a species requiring a large radius of protected habitat around each nest site]. It puts them at a real disadvantage compared to their neighbors who don't have threatened or endangered species."

Restrictions on riparian timber harvest also commonly caused highly variable impacts. Riparian regulations affect only properties with water resources; properties without such resources are essentially unaffected. Furthermore, in Washington the width of the required protected area is determined by a complex matrix of ecological parameters including the size of the riparian resource plus the average mature height of indiginous timber species. Larger streams require a wider protection zone than do smaller streams, and riparian areas where a taller species naturally occurs require a wider protection zone than in a forest type with relatively shorter species.

Regulatory impacts trended upward over time as scientific understanding of a resource improved, especially if social and environmental pressures upon that resource continued to push it toward diminished resilience. This evolution was particularly challenging for forest owners who purchased their land during an earlier, less restrictive regulatory phase and later found they unexpectedly must cope with more restrictive, and often expensive, regulations. One landowner explained, "These new riparian regulations have just been a nightmare. We're really limited in what we can harvest on our place now, even though my wife's family has been here for generations and we've always managed the place sustainable. We were pretty stunned when we found out about these new regulations." Then, pointing toward an adjacent, upland property with no riparian resources, he continued, "Our neighbors have hardly been affected at all, though. They can still pretty much log their whole place. It doesn't seem fair."

By contrast, forest owners often found it easier to adapt to other forest regulations that affect all properties more similarly. Examples included post-harvest stocking levels (e.g. WAC 222-34-010(2), or the requirement to retain a fixed minimum number of post-harvest wildlife reserve trees (e.g. WAC 222-30-11(b). These types of rules characteristically 'blanket' an ecosystem evenly, and are less likely to produce stricter or more lenient rules for one forest owner than another. Every owner in the area is subject to the same requirement. As one owner concluded, "I don't have as much problem with the upland harvest regulations. I wish they weren't so strict, but at least all of us [owners] are in the same boat."

4.2 INEQUITABLE CONSEQUENCES RESULTING FROM POLICY DESIGN:

Dissimilar outcomes among forest owners also occurred because of the manner in which individual policies are constructed, or because of the manner in which they do, or do not, interlink with other policies. In some instances policy designers simply overlooked this probability. The unintended regulatory consequences weren't apparent until the policy was implemented. For example, policy advisors said few had anticipated a need to consider how forest regulations compare with regulations for other rural land uses such as agriculture. This oversight, however, was producing a new source of inequitable regulatory outcomes because forest owners are required to protect certain ecological parameters much more rigorously than are agricultural, industrial, or urban property owners.

For example, forest owners with fish-bearing streams were required to design all of their stream-crossing structures to permit easy fish passage. Other types of landowners, as well as city and county governments, were not. This not only created a financial disadvantage for forest owners, it also created the conundrum of inhibiting fish from reaching the protected and ecologically functional forested riparian habitats because downstream agricultural, industrial, and urban landowners were not required to enable fish passage. One exasperated forest owner said, "I don't mind doing my share of environmental protection. But it sure looks to me like I'm being required to do <u>more</u> than my share. What about these other guys?"

Numerous other inconsistencies occur. Some forest owners and consultants claimed that such regulatory discrepancies can sway landowners to de-emphasize forestry in favor of other land uses. They told stories of forest owners who had decided to stop growing mature, biodiverse forest in favor of monocultural crops of Christmas trees. By converting to a Christmas tree crop, their forest land could be-rezoned as agricultural land and therefore subject to the much less restrictive agriculture regulations and more favorable tax base. Other interviewees told of forest owners who had substantially thinned their forest overstory to favor understory vegetation, thus increasing their capacity to graze livestock and gain an agricultural zoning classification.

In some instances, interviewees perceived the likelihood of inequitable regulatory consequences, but believed the merits of a particular policy outweighed this problem. They believed negative social consequences should be handled through mitigation strategies rather than a policy revision. In particular, many believed the presence of a threatened or endangered species implies such a need for urgency that ecological requirements should appropriately take precedence. Social inequities could be alleviated through some form of assistance to affected landowners, leaving the 'teeth' of the regulation intact.

Some policy advisors and administrators believed forest owners bear an unreasonable share of the social burden of environmental protection. Others, however, defended the forest regulations, saying that although regulatory equity was important, it was also important to ensure ecological protection where possible. "The fact that we can't protect an entire ecosystem doesn't mean that we shouldn't protect the parts that we can", said one. Said another, "Urban areas are already a loss, and the agricultural lobby is so powerful that we can't do much to improve biodiversity on farms. If we don't focus on protecting forests, we won't have anything left at all."

4.3 INEQUITABLE CONSEQUENCES LINKED TO FOREST OWNER GOALS

Simply put, the manner in which a forest owner is affected by a regulation depends in part upon the forest owner's management goals. For example, in the State of Washington, forest owners must sign a 'non-conversion' moratorium before undertaking a timber harvest. The owner must agree to refrain from selling or converting their property to any use not associated with timber growing for six years after the harvest. Some owners said they were not materially affected by this rule because they had no desire to sell their land. Others, however, felt the effects of the moratorium keenly because it constrained them from using their land for other purposes that they wished to prioritize over growing timber.

Other examples abound. Among the most common were those related to regulations restricting timber harvest. Some forest owners said they were greatly affected by, and some were greatly resentful of, such regulations. By contrast, others who had long practiced sustainable forestry said the same regulations required only minimal changes to their accustomed practices and that their primary negative outcome was the new expense of the required plans and permits. Still others who had no intention of actively managing or harvesting their timber said they experienced little or no impact from harvest regulations.

The State's requirements for detailed and fairly sophisticated planning documents and project permits were also causing inequities among forest owners. The necessary permits and plans typically require professional expertise. They have the desirable outcome of helping ensure that standards of environmental protection are met, but also a negative outcome of making the process of forest management less accessible for some forest owners than for others. Among these interviewees, it was clear that such requirements favor industrial forest owners who typically have professionals on staff, and those non-industrial forest owners with professional resource management backgrounds or the financial ability to hire consultants. State foresters sometimes guide a forest owner who cannot afford a consultant, but the intent of most of the regulatory programs is that the forest owner, not the State government, is responsible for preparing the pertinent applications and reports for any forest practices they wish to undertake. As one agency leader said, "We're charged with managing resources for the interests of the entire public. If we single out some owners for special assistance, we're being unfair to the others."

Consequently, forest owners without consultants often felt daunted by the State's permitting requirements. Many interviewees warned that this unanticipated problem is deterring some forest owners from undertaking environmentally beneficial activities to maintain forest health and habitat quality. Such projects are often expensive and/or produce insufficient from extracted resources to offset professional consulting costs.

5 DISCUSSION

Since all inequitable outcomes cannot be prevented, it may often be appropriate to mitigate them when they occur. Policymakers should expect that each of the three causes of inequitable regulatory outcomes will present a different set of challenges in terms of finding solutions:

5.1 SOLUTION PATHWAYS FOR INEQUITABLE CONSEQUENCES ARISING FROM NATURAL LANDSCAPE VARIABILITY

Landscape variability is fundamental to any natural environment and cannot be "designed away". The challenge, then, is to fairly disperse the rights and responsibilities pertaining to conservation among the affected public and private stakeholders (Ostermeier and Keele 2003), and avoid allowing the regulatory process to unduly "take" or require a disproportionate contribution from any individual (Meltz *et al.* 1999). A policy protecting a resource that naturally occurs unevenly across a landscape – such as endangered species or riparian habitats – will never affect all owners equally, simply because such resources do not and cannot occur similarly from one property to another. Consequently, when dealing with these types of resources, policymakers are likely to be limited to "back-end", post-regulatory mitigation strategies, scaled to the individual or small-group level, and focused toward the subset of forest owners who are disproportionately affected.

An array of familiar policy instruments can be readily adapted as solutions. These include cost-sharing programs, conservation easement payments, stewardship recognition programs, and fee or regulation waivers for landowners who are proactive about environmental protection. Many of these instruments were originally developed as "incentives" to encourage improved stewardship in locales where conservation efforts are not mandatory. They are just as applicable to the task of reducing disproportionate or inequitable impacts where conservation is compulsory – i.e. regulated. These strategies spread the responsibility for conservation more evenly between the landowner and the public, and can mitigate certain unequal costs or burdens associated with environmental protection.

5.2 SOLUTION PATHWAYS FOR INEQUITABLE CONSEQUENCES ARISING FROM POLICY DESIGN

Here the potential array of solutions is more fluid and varied, because policymakers may work from the "front-end" of the policy design process, as well as from its "back-end" phases of implementation or mitigation. The source of the problem – policy design – is also the source of the solution. Policy design flaws can be "designed away". In some cases, an entire policy structure can be reworked to better "fit" its desired environmental and social outcomes. It can also be "scaled" to better accommodate consideration of outcomes at the individual owner level. Elements of "vertical interplay", such as linkages between inter-related federal and state policies, and "horizontal interplay", such as disparities in environmental protection standards between land use zoning designations, may be brought into greater harmony as needed (Young 2002).

The fact that policymakers have here a larger pool of solutions does not, however, imply that the task is easier. Policymakers and stakeholders alike may be reluctant to undertake a revision – policymakers because of the complexity and public expense of the process, and stakeholders because they are wary that potential changes may not support their interests. Policy analysts contend it is sometimes easier to attach a mitigation or 'stopgap" measure to a policy rather than develop the "collaborative capacity" (Weber *et al.* 2005) required to fundamentally restructure the policy itself. Policymakers thus often make a strategic decision to avoid a full-scale policy remediation (Fiorino 1993: 169,192).

A number of the more experienced policy advisors interviewed in this study advocated the mitigation approach because it can be applied on a case-by-case basis, providing relief to disproportionately affected forest owners without reducing overall environmental protection. This can, however, add yet another layer of complexity to a regulatory structure. Mitigation measures focused at the case-by-case landowner level create an additional and costly administrative workload. Nonetheless, they can often provide the most easily implemented solution for retrofitting a policy, providing improved social outcomes without reducing the ecological rigor of the overarching law.

5.3 SOLUTION PATHWAYS FOR INEQUITABLE OUTCOMES ARISING FROM DISSIMILAR LANDOWNER GOALS

Not all forest owners will feel undue effects from a regulation, if that regulation does not interfere with their prior interests or management objectives. The affected subset of landowners can be expected to differ with each type of regulatory policy. The group affected by a riparian policy may be quite different from the group affected by a policy pertaining to an upland wildlife species, for example. Policymakers therefore need only focus on a subset of forest owners – those whose management objectives are disproportionately restricted by the particular regulation in question. The fact that policymakers will rarely need to provide mitigation measures for the total number of landowners helps reduce the scope and complexity of strategies necessary for dealing with inequitable regulatory outcomes.

Inversely, if policymakers fail to recognize the subset of forest owners genuinely needing relief, the oversight may contribute to a variety of problematic consequences. As one high-ranking agency employee cautioned, “this type of error can lead to a whole array of ‘perverse incentives’, like discouraged forest owners, non-compliance with regulations, and more willingness to sell or convert forestlands”. It is helpful that policymakers can rely on policy tools similar to those that can be used where disproportionate outcomes are due to landscape variability or oversights in policy design. Here again, familiar strategies such as conservation easements, cost-sharing, or opportunities for alternative management prescriptions can be adapted to mitigate problematic social outcomes.

There is substantial overlap between these three primary causes of inequitable regulatory outcomes among forest owners. Their combined effects may produce an almost infinite variety of scenarios. For example, endangered species regulations may substantially constrain a variety of management activities, but if a property owner is a wildlife enthusiast that outcome may be viewed as a welcome opportunity to benefit wildlife rather than as a restriction. By contrast, a tree farmer who relies upon sustainable resource extraction as a livelihood and whose healthy forest has attracted sensitive species may be greatly encumbered by the same regulation. The challenge for policymakers is to identify the subset(s) of landowners who may be experiencing a genuinely disproportionate burden as a result of regulation, and then tailor remedial strategies that improve social equitability while still adequately protecting the ecosystem.

6 CONCLUSION

This study revealed that many forest regulations, regardless how carefully designed, may not affect all forest owners equitably. Even well-designed policies may produce unequal outcomes due to landscape variability and/or the personal circumstances of the landowners. There is no reason to believe that this problem of is peculiar to the State of Washington. It is just as likely to occur in other locales simply because some primary causes of the problem – landscape variability, complexities of policy design, and dissimilar circumstances among individual land ownerships – are generic, rather than particular to any specific setting. *This does not, however, imply that the regulation of private forests is inherently problematic or untenable.* It is worth noting that virtually every interviewee supported the overarching concept of regulation. Most viewed it as a necessary part of any strategy for achieving long-term forest health and sustainability. Their debate was not whether to regulate, but how.

6.1 IMPLICATIONS FOR POLICYMAKERS

First, as the trend toward increasing regulation of private forests continues, it is ecologically and politically risky to ignore the problem of unequal regulatory outcomes among forest owners. Private ownerships control a majority of the forests in the United States. They have substantial cumulative influence over ecological outcomes. If policymakers fail to recognize and mitigate disproportionate regulatory impacts among forest owners, there is reason to expect a growing incidence of unintended negative ecological and political consequences. These include unwillingness on the part of disaffected landowners to provide publicly desired levels of ecological protection, and reduced support for the concept of public intervention in private resource management.

Second, if mitigation strategies are to be effective, they must be ‘user-friendly.’ Programs requiring complicated application processes or documentation beyond the financial or other capabilities of the average forest owner provide few real solutions. Indeed, such requirements actually add to the problem of inequitable regulatory outcomes rather than alleviating it, because they place the mitigation opportunities within reach of only a relatively privileged few of the legitimately eligible landowners. Policymakers may find it advisable to provide for governmental support in order to make a mitigation program more equally accessible to all.

Third, even when employing a relatively familiar and tested policy tool such as a conservation easement, policymakers may need to incorporate some means of filtering out illegitimate users. Some types of mitigation programs can be vulnerable to applicants who apply for public compensation to ‘refrain’ from management activities they would never have actually undertaken. An appropriate filtering technique could be as simple as a requiring all applicants to present a business plan or stewardship plan documenting the landowner's prior intent and interest in actively managing that resource. In the US, funds for stewardship planning are widely available to forest owners through governmental programs. Consequently, a requirement for this particular type of proof of intent would be unlikely to create an unreasonable or unequal burden for any owner, yet could serve as a means of deterring frivolous claims and substantiating legitimate ones.

Fourth, fiscal compensation to landowners is likely to be an important mitigation tool simply because so many regulatory outcomes cause landowners to incur opportunity costs. Compensatory payment is not, however, the only effective mitigation strategy. In some situations other alternatives may suit, and present the significant advantage of reducing taxpayer costs. Potential models include Washington's Alternate Plan option and Idaho's regulatory waiver option which allow landowners to vary from established regulations and develop site-appropriate, innovative, yet still environmentally responsible resource management strategies. Less tangible incentives such as programs honoring good stewardship could also be effective.

Lastly, ecologically sustainable forests can best be achieved through socially sustainable policies. Forest owners are a policymaker's most potentially efficient and logical allies for achieving sustainable environmental stewardship on private forests. Consequently, creating policies responsive to the circumstances of forest owners may in many ways be as relevant as creating policies responsive to the conditions of the forests.

This study found inequitable regulatory consequences to be a common but remediable outcome among Washington's private forest owners. As one forest owner concluded, "Nearly everyone wants resource protection. The biggest question is just finding a way that we all share the burden." Understanding the causes of unintended and inequitable regulatory consequences is a good first step.

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A political ecology approach to understanding competing forest resource claims in the Ethiopian highlands

Kathleen Guillozet[1], John C. Bliss

Abstract

Diminishing natural forest resources and changes in access to local forests have accompanied broader economic, political and social change in many communities in the global South. Competing claims over forest resources complicate the management of small scale forestry enterprises in many parts of the world, often leading to conflict. We present a political ecology approach for analyzing such claims, and illustrate with a case in the southern Ethiopian highlands. We examine how access to forest resources is negotiated between a rural community and a private forest enterprise within the context of national and global discourses on environmental crisis and poverty. This research follows a case study approach using data from household interviews, historical and government documents, participatory mapping, and field vegetation measurements. We describe the utility of a political ecology approach for understanding complex relationships between actors in the context of forest resource management. A political ecology perspective questions the primacy of expert-driven debates, acknowledges the uncertainty inherent in large scale historical assessments of natural resource degradation and calls for more historically and geographically grounded analyses of human-environment relationships. Econometric approaches dominate resource management policy discourses in many parts of the global South. A political ecology approach should provide complementary insights, and enhance our understanding of competing resource claims and effective management approaches for small-scale forestry enterprises in poor rural communities.

Key words: political ecology, resource conflict, rural communities, small-scale forest enterprise
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1 INTRODUCTION

In this paper we describe the utility of a political ecology approach for understanding conflicts between communities and forestry enterprises in the global South. We draw upon field research in Southern Ethiopia to describe how an understanding of history, environmental change and political economy can shed light on human conflicts over resource rights. The challenges of understanding and fairly managing competing resource claims are complex and require an understanding of a range of issues in a diverse set of fields. Political ecology can serve as a framework to help resource managers learn about these issues and identify the questions most relevant to the circumstances at hand.

2 WHAT IS POLITICAL ECOLOGY?

Political ecology is an interdisciplinary approach to investigating problems, issues or questions that pertain to human-environment relationships. Political ecology is defined as the "fusing of biogeographical processes with broadly social ones" (Zimmerer 2000, 153) and it often emphasizes power relations, probes areas of uncertainty in dominant discourses, and provides historically and geographically-oriented analyses. Political ecology approaches are commonly grounded in field research (Rocheleau 2008) and provide an analytical tool referred to by Walker (2006) as *radical empiricism*. The role of political economic forces in shaping ecological realities and in reinforcing centralized power relations is a prevalent theme in political ecology research (e.g. Dea and Scoones 2003; Gould, Schnaiberg, and Weinberg 1998; Klooster 2006; McCarthy 2004). Political ecology studies that emphasize history address "how and why [society-nature]…relations have changed (or not changed) over time and space, and the significance of those interpretations for improving social justice and nature conservation" (Offen 2004, 21).

Political ecology research tends to either de-emphasize or critique environmental crisis narratives that are commonly used to characterize the plight of poor resource-based communities in the global South. Researchers argue that these narratives employ warnings of overpopulation, extreme poverty, food insecurity and social upheaval to describe biophysical conditions and justify interventions by a wide range of contemporary actors including foreign and domestic governments, NGOs and multilateral development banks (Leach and Mearns 1996; Atlani-Duault 2005; Escobar 1995). Influenced by critiques of capitalism and colonialism, researchers have advanced critical assessments of rural development strategies and environmental crisis narratives in Africa. These critical assessments provide a counter to dominant development discourses by highlighting discrepancies between crisis narratives and on - the - ground realities.

2.1 RELEVANCE TO SMALL-SCALE FORESTRY

Small-scale forestry can serve as a means for promoting both economic growth and environmental conservation in the global South. Resource managers often face a number of challenges in successfully implementing forestry operations because they hold conceptions about resource rights that differ from those of local communities. Poor resource-based communities who depend on forests for income generation and subsistence needs often live on the boundaries of forested areas in the global South. Population growth and poverty are commonly invoked to explain encroachment into forested areas, and yet these factors may not adequately describe existing circumstances. We use data collected from a case study in Southern Ethiopia to illustrate the range of issues that can affect communities and small-scale forestry enterprises.

3 A POLITICAL ECOLOGY OF ARSI FOREST

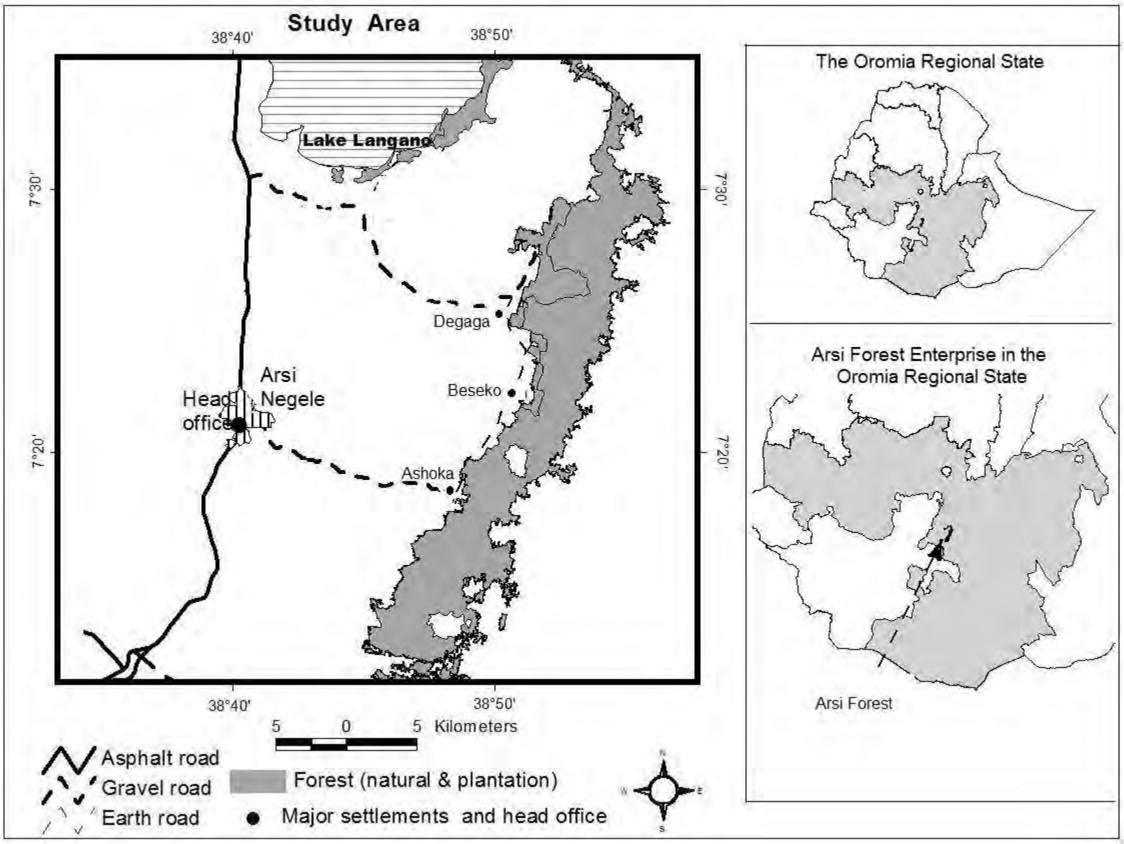
3.1 NATIONAL CONTEXT

Ethiopia has experienced three periods of dramatic political and economic change in a span of fewer than 40 years (Marcus 2002). Policies that favor agricultural production systems over pastoral systems have gradually gained primacy and have driven both voluntary and forced human migration, leading to radical shifts in social relations and land use patterns (Melaku 2003; Marcus 2002; Hagmann and Mulugeta 2008). Shifting livelihoods affect social systems and may undermine traditional institutions for conflict resolution (Beyene 2009; Rubenson 1991). A focus on reversing human-driven environmental degradation has been central to the rhetoric and policies espoused by Ethiopian governments for over five decades (Yeraswork 2000) and is prevalent at national, regional and local levels (Keeley and Scoones 2000).

3.2 ARSI FOREST ENTERPRISE

The Arsi Forest Enterprise is a public forestry enterprise with a mandate to develop a commercially-viable industrial forest, to process lumber and other wood products for domestic and export markets and to protect and conserve natural forests in the Oromia Regional State (Didha 2006). The Forest Enterprise is subdivided into separate management units, one of which is known as Arsi Forest Enterprise, with jurisdiction over Ashoka, the forest area that is the subject of this study (see Map 1). The Arsi forest is classified as “upper wet broad leaved Afro-montane rainforest” (Aalbaek and Kide 1993) and is located in a transition area between these two traditional agro-ecological zones, the *Weina Dega* (temperate, cool sub-humid highlands) located between1500-2300 meters in elevation and averaging 800-1200 mm of rain per year and the *Dega* (cool and humid highlands) located between 2300-3200 meters in elevation and averaging 900-2200 mm of precipitation per year (FEWSNET 2006).

Map 1: Arsi Forest Enterprise Headquarters and Forestlands (Source: Modified from Wondo Genet GIS Department, 2008)



The limited capacity of government agencies in the global South to effectively implement policy and enforce boundaries of protected natural areas has been discussed widely (Brandon 1995; Naughton-Treves, Holland, and Brandon 2005). In many cases, strong national policies are partnered with weak regional and local institutions of enforcement (Birdsall 2007; Melaku 2003). Gaps between policy and practice and changing values over natural resources at higher levels of political and economic power have likely contributed to conflict at local levels. In some instances, enforcement capacity is remarkably strong, but contradicting rules undermine the capacity of institutions to manage resources in cooperation with communities.

Led by a team of Swedish foresters in the 1970's and 1980's, a long term management plan for the natural forest areas currently under the jurisdiction of the Arsi Forest Enterprise called for the conversion of natural forest area to plantation forest via a strategy of clear felling and replanting (MoA 1990). Despite a national forest policy that forbade timber felling in natural forests (see Table 1), local rules actively encouraged the felling of large indigenous trees including *Podocarpus* and *Juniperus* by local community members in order to facilitate conversion of natural forest to plantation forest. These types of irregularities can lead to misunderstandings between resource managers and communities concerning rules and their enforcement.

A 1973 document describing forestry activities in the Chilalo Awraja (an administrative unit during Haile Selassie's reign) outlined forest development goals in the Arsi Enterprise area. These included the conversion of "the whole forest production area (5,000 ha.) from natural forest to plantation forest within the same period" and "to develop the remaining 3,000 ha. located on steep hills as a nature and game reserve" (Poulsen 1973, 31). In order to maintain fiscal solvency, reforestation laws were sometimes disregarded by the government entity (CADU) charged with managing the forest. Poulsen describes how "In the event [of financial difficulties] we had instead to boost timber sales and to clear bigger areas than we could reafforest" (30). These inconsistencies contributed to a climate of uncertainty with respect to natural forest management.

Table 1: Arsi Forest Enterprise Land Area Change: 1980's-2010 (Sources: (MoA 1990), (Didha 2006)**)*

Land Cover (ha)	**Forest Boundary Demarcation**			
	Pre-1990*	**1990***	**1999****	**2010**
Disturbed natural forest		17,223	15,280	TBD
Bush, bamboo thicket, woodland		21, 043	0	TBD
Open land (homesteads)		53,112	0	TBD
Plantation		6,791	6,104	TBD
Total project area	101,602	98,169	21,384	TBD

Ethiopian land ownership and political regimes have changed three times over the past forty years, with impacts on community access to forest resources. Formal attempts to establish the boundaries of the Arsi forest area have been carried out three times over the past twenty years (See Table 1). Conflicts with local communities over homestead and farm encroachment have arisen during each demarcation, and the management agency response each time has been to reduce the size of the natural forest area by varying degrees to accommodate farm encroachment. This response is rooted largely in three values that have dominated in Ethiopia since the time of the Derg (the military government which overthrew the emperor in 1974): 1.) the desire to minimize conflict between peasant smallholders and government officials; 2.) the belief that all Ethiopian people have a right to farm and 3.) The persistence of a "subsistence ethic" which maintains that all people have a right to use common resources in order to meet basic subsistence needs.

The most recent demarcation work in the Arsi forest began in November 2009 and remains ongoing. Demarcation work is conducted by a team of people from the Forest Enterprise, the kebele (local government body), peasant association (PA), Ministry of Agriculture, and Department of Environment and Development. The team informs the PA in advance of its arrival, and farmers whose land falls within the forest area meet to discuss the boundaries. Large trees or other landmarks are found and marked by cutting the bark and painting the exposed area. GPS points are taken and further discussions and meetings are arranged. Follow-up visits may involve house and fence demolition, additional data collection and meetings.

In March 2010, demolition of encroaching farms and fences had been completed in one PA and Forest Enterprise guards and day laborers were returning to the site for a pre-announced work party. A group of 43 guards and day laborers, five managerial staff and six members of the Ethiopian military arrived at the site and began to cut brush and small trees in preparation for tree planting on the illegally-cleared areas. An estimated 2000 members of the local PA descended upon them with sticks, rocks and traditional spears. They verbally threatened the FE employees and many were beaten. The workers ran into the forest and made their way back to office headquarters on foot. One man was hospitalized and many sustained broken bones, cuts and other injuries including the loss of an ear. The fact that no one was more seriously injured indicates that the community was trying to express its contempt over the demarcation proceedings rather than kill anyone. Positive strides have been made since the incident and concessions are being worked out for those members of the PA who have no alternative lands or income sources.

The Arsi Forest Enterprise is implementing a range of programs and policies to ameliorate the conflict over forest access described above. First and foremost, they have slowed forestry activities to focus on community-level meetings in order to allow community members to express their opinions. They are working with local political leaders to identify suitable areas for farm resettlement, collaborating with banks to provide small loans to people to engage in alternative businesses, and increasing local opportunities for community members to engage in day labor. They have also recently convened groups of young people for tours to a nearby community- managed forest ecotourism project in the hopes of spurring economic ventures that preserve forestlands.

4 POLITICAL ECOLOGY AND SMALL-SCALE FORESTRY

What lessons for small-scale community forest managers might be derived from taking a political ecology approach to analyzing local resource challenges and conflicts? Table Two outlines six elements of a political ecology approach, illustrates each with observations from Ethiopia and the Arsi Forest Enterprise in particular, and poses related questions that are relevant to small-scale forestry in the global South. The six elements are drawn from the extensive literature in political ecology, and, while not comprehensive, they convey the most common themes encountered in the literature. The questions relating to small-scale forestry are intended to stimulate thought and discussion about how this theoretical perspective might inform and enrich the field of small-scale, community forestry.

Fundamental to political ecology is a concern with the distribution of economic and political power, and how power relations affect natural resource use, management, exploitation and conservation. Following this perspective, the observer continually asks "Who benefits from these relationships? Who bears the costs of these policies?" and related questions. Secondly, a political ecology perspective is grounded in the social and environmental history of the particular area and phenomena under study. Analysis of a contemporary policy, relationship or conflict cannot be fully understood apart from its historical context. Third, the political ecologist compares and contrasts the dominant narratives of those in positions of power as well as those who are powerless. How do these different actors view their world and explain their predicaments? What values, prejudices, assumptions, and predispositions are embedded in these narratives? How do the narratives inform policies and strategies? Fourth, a political ecology approach attempts to understand how local phenomena and relationships are embedded in regional, national, and global scales of interaction. Rather than viewing the actions of local actors as strictly local phenomena, the attempt is made to identify how local acts are influenced by extra-local powers, markets, policies, and so forth. Finally, political ecology provides a useful framework for dissecting and analyzing the roots of conflict over resources.

While we have focused here on an example from the global South, we believe that a political ecology approach may be applicable to small-scale forestry research wherever it is undertaken. Our observation is that much of the existing literature on small-scale forestry suffers for the lack of a robust theoretical framework. We hope this brief exploration of the topic stimulates thought and discussion of potential applications of political ecology to the field of small-scale forestry.

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Table 2: Elements of a political ecology approach as illustrated by Arsi Forest Enterprise, and their relevance to small-scale forestry.

Political Ecology Elements	**Illustration from Arsi Forest Enterprise, Ethiopia**	**Questions related to Small-scale Forestry**
1. Power Relations	Top-down hierarchy Highly unequal distribution of wealth Centralized control of forests Official regulation and protection, tolerated local exploitation	How do economic and power relations delimit scope and opportunity for small-scale forestry? How to negotiate contradictions between sanctioned and actual forest use by communities?
2. Social History	Feudalism Imperial control of forest resources DERG conversion of natural forests to plantations for State benefit. Population growth, resettlement into area during 1970's and 1980's Development of Private Forest Enterprises e.g. Arsi	How do historical precedents inform contemporary community – forestry relations? How do changing demographics and forest management regimes affect resource conflicts and enforcement of forest policy?
3.Environmental History	Loss of 79% of forest cover from 1930's to present Shift in forest composition Forest encroachment, limited regeneration, soil loss, declining wildlife populations	How to manage increasing community livelihood needs with declining forest capacity? What opportunities exist to diffuse demand or develop alternatives for ecosystem services and products?
4. Discourse/ Political Narratives	Elites view the poor as agents of environmental degradation Communities see few economic alternatives Both see deleterious effects of climate change	What are the political origins and consequences of disparate forest degradation discourses? How does "expert" discourse limit range of potential solutions?
5. Connection to Local/Global Markets	Plantation forests generate income for the State High demand for fuelwood in local urban markets for alcohol distillation and home energy use	Who benefits from formal and informal timber and fuelwood markets? Who is disbenefited? How can resources be managed to meet long term market demands and increase benefits to local communities?
6. Conflicts Over Access	Boundary demarcation results in violent resistance by community members Inconsistent enforcement exacerbates ethnic tensions	How can small scale forestry enterprises work with communities to avoid conflict while meeting statutory obligations?

Small-scale forestry – is it simply a smaller version of Industrial (Large-scale) multiple use forestry?

John Herbohn[1]

Abstract

This paper explores the question of whether small-scale forestry is simply a scaled-down form of industrial forestry. The nature of small-scale forestry is first explored, including a discussion of the types of forest activities that generally classified under this term. The motivation of large scale forestry is then outlined followed by a detailed discussion of the motivations of small-scale foresters are discussed and compared with those of industrial foresters. It is argued that the profit motive is the primary objective with industrial forestry and that this results in environmental and social considerations being regarded as constraints moderating the maximisiation of profit. The resulting 'multiple-use' industrial forestry is the result of external forces on the firm. In contrast, small-scale forestry has multiple objectives, encompassing a range of social, environmental and economic objectives which are unique to each small-scale forester. The nature of small-scale forestry is shaped not only by external forces, but also 'internal' forces associated with the beliefs, desires, personal circumstances and motivations of the small-scale foresters.

Key words: Small-scale forestry, industrial forestry, profit
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INTRODUCTION - WHAT IS SMALL-SCALE FORESTRY?

No universally accepted definition exists for small-scale forestry. Small-scale forestry encompasses a range of forestry systems or terms applied in different ways in different countries. Harrison et al. (2002) in the first article of the first issue of Small-scale Forest Economics, Management and Policy gave a concise overview of the concepts of small-scale forestry in various countries. In this overview, various alternative terms for small-scale forestry were identified. For instance, Non-industrial Private Forestry (NIPF) is the term commonly adopted for small-scale forests in the USA, although the use of family and

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farm forestry is commonly used in some states. In Europe, a variety of terms are used to describe various forms of small-scale forestry including non-industrial forestry and family forestry. Terms such as 'farm woodlands', 'farm forests' and 'privately owned forests' are also used. In Japan, there is a long history of 'family owned forests'. In Australia the term 'farm forestry' is commonly used, although 'agroforestry' has gained some popularity in some quarters as there is a push to incorporate forestry into the farm business. The term farm forestry is also commonly used in New Zealand. In many Asian countries such as the Philippines and Indonesia, the use of terms such as 'smallholder tree farmer', 'smallholder forestry' is common.

Small-scale forestry can have a significant economic importance at an aggregate level. In Nordic countries, small-scale foresters own approximately 60-70% of forest land. For instance, in Finland, there are in excess of 600,000 family forest owners, controlling 62% of the forest area (Lillandt, 2001). In the US, NIPF accounts for 59% of the total timberlands in the US and contributes nearly 50% of the timber production (Zhai and Harrison 2000).

Harrison et al. (2002) note that in most developing countries, community forestry is more aligned with small-scale forestry than with industrial forestry. Community forestry areas are usually small relative to the areas of the equivalent type managed under industrial forestry (e.g. plantations or native forest areas). Importantly multiple use management is strong in both community and smallholder forestry. For these reasons, community forestry is often considered to fall under the umbrella of small-scale forestry, and this is the case for articles considered for *Small-scale Forest Economics, Management and Policy*.

This paper explores further what makes small-scale forestry different to industrial forestry. The first section discusses the motivations for industrial forestry in terms of wealth maximisation. A detailed discussion is then undertaken about how small-scale forestry differs from industrial forestry. The paper then concludes by briefly outlining a conceptual model to explain the difference between small-scale and large-scale multi-purpose forestry. In paper, the terms industrial forestry and large-scale forestry are used interchangeably.

THE MOTIVATIONS FOR INDUSTRIAL FORESTRY

For companies, the goal of the firm is generally considered to be wealth maximisation and is measured by net present value (NPV) of future cash flows associated with a project (e.g. Dayandra *et al.* 2002). Discounted cash flow analysis is used to calculate NPV. Land

Expectation Value (LEV) – in effect the NPV of an infinite chain of tree rotations – provides another useful financial performance criterion, particularly when the objective is to compare species with different rotation lengths. Importantly, LEV represents the maximum amount that an investor could pay for land for plantation establishment and still return a positive NPV for the plantation investment.

In the case of industrial forestry companies the profit maximisation motive effectively translates into maximising the value of their plantation estate. Decisions about what species to grow, what areas are planted, the management regime and harvest scheduling are all made on the basis of maximising the value of the firm to investors.

This is not to say that industrial forestry companies do not consider environmental and social impacts of their plantation estate. However, social and environmental considerations can be viewed as constraints to a company's operations in order for it to commence or continue its activities. For instance, a company may set aside areas for permanent conservation along creek banks or to leave a certain number of large habitat trees. Sometimes these environmental decisions are regulated, at other times a company will voluntarily make the decision. In either case, the company's primary responsibility remains to be one of wealth maximisation for its shareholders.

CHARACTERISTICS OF SMALL-SCALE FORESTRY

The following sections discuss some of the ways in which small-scale forestry differs from industrial forestry. In structuring this discussion, we taken the approach of working through the production cycle from when a small-scale forester decides to plant trees through to the harvest and sale.

GETTING INVOLVED IN SMALL-SCALE FORESTRY

Industrial forestry companies make a rational decision based on financial analysis to either purchase existing forest land or to create a new forest estate. The basis of this decision is largely that of the criteria of the investment returning a positive NPV based on expected timber income. Sometimes other factors such as expectations of increased land values may also be considered as part of the evaluation process. In contrast small-scale foresters may acquire forest land or decide to plant trees for many reasons.

Acquisition through Inheritance

In countries with a long history of small-scale forestry, which is particularly the case in Europe and Japan, current owners often have inherited their forests. The inheritance laws vary widely between countries however, with sometimes the entire estate being kept together and passed onto one family member. In other cases, the inheritance laws dictate that the estate is spread between the spouse and children.

The fact that small-scale forests are not acquired through a direct cash transaction may have a strong influence on the way that the forests are managed and viewed by the owners. In cases where there is a strong family connection with the land and the forest on it, the forest is often highly valued. In some ways the forest may be viewed as being an integral part of the family history, with one generation growing up in the forest, raising their own children and then wishing to give their children the same experience and so on. In such cases, timber production may be a very small component of the forest and any revenue regarded as a means of paying the holding costs. There are also increasing numbers of people who inherit small-scale forests who are absentee owners based in cities. These absentee landowners are increasing in number and often do not have the capacity not will to manage their forests for timber production. In these cases, there is often little connection with the forest. In countries such as Norway, these absentee landholders present many challenges to the management of the private forest resource (Barstad pers. comm.).

Creating New Forests

Once again, the decision for industrial foresters to plant new forest areas is largely a financial decision. The species considered are usually those for which there are well established silviculture, improved genetic stock, ready markets and well established silviculture. The impact of discount rates on the NPV of the project also means that there is a strong bias towards species with a shorter rotation period. In the case of small-scale foresters, the motivations for creating new forests are highly variable, with financial motivations being only one of many possible motivations. For instance in sub-tropical and tropical north Queensland, many landholders establish plantations for mainly environmental reasons with economic reasons being considered least important (Herbohn *et al.* 2005)

Selecting Species

Small-scale foresters select species for a number of non-financial reasons. In Europe, small-scale foresters are much more likely to choose slower growing broad leaf species than softwoods for a variety of reasons. Aesthetic considerations are often important, especially when the trees are being planted on a farmland which the owner occupies or when the forests are an integral part of a farm stay operation such as is common in the Black Forest Region in Germany. It is also common for farm foresters to want to plant trees that also enhance biodiversity and small-scale foresters are much more likely to plant mixtures of species, particularly natives. Many farm foresters also like to experiment with untried species, as is the case with native rainforest species in the tropical and subtropical areas of Australia (Maczkowiack *et al*. 2008).

MANAGING FORESTS FOR TIMBER PRODUCTION

Small-scale foresters can vary markedly in the way in which they manage their forests. In some cases, the silviculture practices they adopt are similar to those adopted in industrial forestry. There is however a number of important constraints and differences in motivation that can result in large differences between the way industrial and small faced by small-scale foresters manage their resource.

Time constraints

Lack of time often constrains or restricts the timing and intensity of silviculture by small-scale foresters. For small-scale foresters resident near their forests, there are often competing agricultural and other activities which are either necessary or generate higher immediate levels of financial or personal benefits. For instance, many owners need to undertake as a priority other farm activities such as cropping, tending cattle or managing farm stay operations. In addition, many resident landholders have off-farm employment which restricts the time available to spend on managing their forests. There are also an increasing number of landholders who are resident some distance from their forests, often in major cities. In these cases, there are additional time constraints in terms of travel time to the forest.

Lack of skills and financial capability

Large forestry companies employ specialist foresters to manage their forests – with the level of expenditure on forest management activities being determined by the activities generating a positive NPV. In contrast due to the high up front costs and long wait for eventual returns, many small-scale foresters lack the financial resources to apply financially optimal management practices to the forests. Also small-scale foresters lack the technical knowledge to undertake the work themselves. In part this can be offset by advice from government forestry extension staff, although funding for these programs appears to be under increasing pressure in many countries. Silviculture operations in industrial plantations are either undertaken by staff employed directly by the corporation or on a contract basis. Often small-scale foresters do not have the financial capacity to afford such operations. The net result of lack of skills and the lack of financial capability to fund operation is that silviculture in small-scale forests is often below the quality and intensity usually applied in industrial forests. This however is not always the case, with some landholders seeing silviculture activities as a form of recreation, and the result is a very intensively managed forest.

The lack of training and appreciation of the need for good silviculture can also lead to poor management decisions. For instance, many smallholder tree farmers in the Philippines do not thin their tree farms because they believe that more stems translate directly into greater returns and that thinning to waste means loosing money associated with the past expenditure on the seedlings. If smallholders do thin, it is common for them to select the better trees as these are of higher immediate value, thus leaving the trees with poorer form and growth. In addition, lack of technical expertise can lead to pruning practices that make the tree susceptible to disease and insect attach or in the delay or failure to prune even though doing so would increase the NPV of the stand – these mistakes or oversights are seldom made by managers of industrial forestry estates.

Higher Importance Attached to Non-timber Benefits

There is ample evidence in the literature that small-scale foresters value non-timber values of their forests much higher than the timber production functions. These attitudes have important implications for the way in which forests are managed. Owners may value use and non-use functions such as recreation, wild food collection and ecological functions so highly that they manage their forests entirely for these benefits with timber production being considered a secondary or even incompatible use. In this case ‘management’ may in fact translate into ‘no management’. No management may also result from a low value being placed on the forest land, such as is sometimes the case when city-based owners have inherited forest in which they have no interest.

HARVEST DECISIONS AND TIMBER MARKETING

Infrequent harvests and lack of market awareness

The sale of timber by many small-scale foresters is made infrequently. Even in the case of active small-scale foresters with larger holders, such as many in the Black Forest region in Germany, many only sell timber every 5 or 10 years. In the case of many other smaller growers, the sale of timber may occur only once or twice in their lifetime. This means that they are operating in markets that they have little or no understanding and experience – thus opening up the opportunity for sub-optimal decisions leading to lower prices. Industrial forestry companies on the other hand are very aware of both current and future market trends. They often have developed long term relationships both vertically and sometimes laterally within the timber supply chain. In addition, large scale forestry brings economies of scale and market power which small-scale foresters lack. To some extent small-scale foresters can achieve similar relationships and economies of scale through cooperation. Metsaliito Cooperative in Finland is an example of how small-scale foresters can aggregate their activities. Metsaliito has 131,000 members who together own 48% of the private forests in Finland. The forest owners revenue from their wood sales to the cooperative amount to almost EUR 500 million annually (Metsäliitto Cooperative 2006).

Suboptimal harvest decisions and the forest as a bank account

Survey evidence suggests that many smallholders make the decision to sell based on other factors than maximising economic returns. Under conditions, higher timber prices would meant that a forest owner would increase their harvest in order to capitalise on the higher demand i.e. an increase in price results in an increase in supply. With small scale foresters, this normal reaction to increases supply does not always occur. In Sweden it has suggested that farmers harvest enough timber to purchase a volvo (or other major expenditure) and then stop – which means that higher prices could actually lead to a reduction in the amount of timber harvested (Johansson and Lofgreen 1985). The 'Volvo effect' has been well documented and typifies how many small-scale foresters see their forests as a bank account that can be accessed when they need to make a large purchase or fall on hard times.

This 'bank account' view of forests appears to be widespread and extending well beyond Scandanavia. For instance, forester owners in Japan may harvest one or two very high value trees –sometimes 300 – 400 years old – to support the education of a child, purchase a car or when a daughter intends to marry. In Australia, farm foresters often see the trees they plant as creating a bank account for their retirement or adding to the value of their property which they can realise at a later date (Mackzowiack et al. 2008).

There is an emerging literature which deals with the decision processes associated with the harvesting of timber from small-scale forests. In this literature recognition is given to the fact that the motivations for holding forests is varied and that income (and the related stumpage price) is only one part of the mix. For instance, Pukkala *et al.* 2003 used a utility maximising approach to predict harvests from private forests in Finland based on different management goals – economic security, timber sales, recreation and nature values. Similarly, Fina et al. (2001) has suggested that amenities and mature forest stocks may reduce a debt-burdened landholders willingness to accept lower reservation prices (and cut sooner) because there are additional benefits to holding forest stock and carrying the debt further into the future.

Industry Organisation and Role in Rural Development

There are often substantial differences in the organisation of forest industries based around industrial and small-scale foresters. Industrial forestry companies have large estates that can be managed in a coordinated manner. By its very nature, small-scale forestry results in a scattered estate under control of many individuals. The invariable heterogeneity of the owners, their motivations and the sometimes variably quality of the resource they control, can pose significant problems for effective industry organisation. This can be for both processors and producers. There also appears to be evidence that small-scale forestry can have different social, economic and environmental impacts on a region.

A CONCEPTUAL MODEL

The preceding discussion has illustrated that small-scale forestry is different in many ways to large-scale industrial forestry. These differences manifest themselves in many ways – ranging from the manner and motivations for small-scale foresters to acquire and hold onto their forests, through to the way in which the forests are managed and in making of harvesting decisions.

A model to explain the difference between small-scale and large forestry is proposed. This model posits that profit motive is the primary objective with industrial forestry and which results in environmental and social considerations being regarded as constraints moderating the maximisiation of profit. The resulting ‘multiple-use’ industrial forestry is the result of external forces on the firm. In contrast, small-scale forestry has multiple objectives, encompassing a range of social, environmental and economic objectives which are unique to each small-scale forester. The nature of small-scale forestry is shaped not only by external forces, but also 'internal' forces associated with the beliefs, desires, personal circumstances and motivations of the small-scale foresters.

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The changing roles professional development program

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Abstract

As populations and urbanization expand in the Southern United States, human influences on forests and other natural areas are increasing. As a result, natural resource professionals are faced with complex challenges, such as managing smaller forest parcels for multiple benefits, and wildfire prevention and management in the wildland-urban interface (areas where urban development and vegetation intermingle), but often do not possess the skills or tools to meet these new challenges. The Changing Roles Professional Development Program, developed by the U.S. Forest Service-InterfaceSouth, the University of Florida, and the Southern Group of State Foresters, provides state and federal natural resource agencies and other organizations in the southern United States and nationwide a set of resources to address these new challenges.

A team of agencies and authors from across the southern United States developed Changing Roles for federal and state agency in-service training workshops. The program consists of four modules: (1) wildland-urban interface issues and connections, (2) managing interface forests, (3) land-use planning and policy, and (4) communicating with interface residents and leaders.

Each module includes a trainer's guide, exercises, fact sheets, and presentations. Additional resources include case studies, a resource list, a DVD, the Changing Roles listserve and quarterly e-bulletin, evaluation questions, and an online webinar series. The resources can be modified and used in a variety of combinations to create a two-hour, two-day, or two-week training program, and anything in between.

Key words: training workshop, education, small scale forestry, management
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1 INTRODUCTION

The South is one of the fastest growing regions in the United States, with an estimated population increase of 1.5 million people each year and 65 of the top 100 fastest growing counties in the nation. The southern U.S. also consistently has the highest number of wildfires per year of any region in the United States. Some of those fires are quite large, as in the case of the 1998 Florida wildfires. These wildfires brought the challenges of working and living in the wildland-urban interface (WUI) to the forefront for the U.S. Forest Service (FS) and other natural resource agencies across the southern U.S. Shortly after these fires, the FS Chief conducted a review of the South and identified the WUI as an area on which to focus research and information efforts.

In response, the Forest Service conducted an assessment of the wildland-urban interface in the South. This assessment, titled *Human Influences on Forest Ecosystems: the Southern Wildland-Urban Interface Assessment* (Macie and Hermansen 2002), demonstrated that a range of professionals—from urban planners to natural resource managers—need access to new information, technology, training, and skills that will help them meet the challenges of working and living in the interface. The assessment also served as the foundation for the establishment of InterfaceSouth (formally known as the Southern Center for WUI Research and Information) in 2002 in Gainesville, Florida.

InterfaceSouth and its sister center, Urban Forestry South, are collectively known as the Centers for Urban and Interface Forestry, the technology transfer component of the Southern Research Station research work unit (SRS-4952) "Integrating Human and Natural Systems in Urban and Urbanizing Environments" (www.humanandnaturalsystems.org). InterfaceSouth focuses on a range of issues related to the urbanization of southern forests, including fire, climate change, ecosystem goods and services, natural disasters and more.

InterfaceSouth's main technology transfer objectives are to: (1) develop a variety of products based on information from unit research and partners, such as publications (newsletters, fact sheets, general technical reports) and web-based technologies (websites, webinars, decision support systems, videos, on-line trainings); (2) deliver and exchange information and products through a variety of methods (websites, electronic listserves, e-newsletters, social media technologies, and conferences); (3) provide technical assistance and support related to urban and interface forestry issues to communities; and (4) provide natural resource professional development training opportunities (in-person workshops, distance continuing education webinars, and on-line courses).

2 ADDRESSING PROFESSIONAL DEVELOPMENT NEEDS: CHANGING ROLES

InterfaceSouth, the University of Florida, and the Southern Group of State Foresters developed the Changing Roles Professional Development Program to address the training needs identified in the Southern Wildland-Urban Interface Assessment. The focus groups that were conducted as a part of the assessment revealed that natural resource professionals felt unprepared to tackle the complex challenges associated with managing resources in a rapidly changing landscape (Monroe, Bowers, and Hermansen 2003).

The target audience for this program is natural resource professionals in the southern United States, including professionals from state forestry agencies, cooperative extension, other state and federal agencies, and non-governmental organizations.

Changing Roles consists of four modules, each of which includes a trainer's guide, exercises, fact sheets, and presentations. The modules are extremely flexible and can be modified and used in a variety of combinations to create training programs of variable lengths to address the training needs of each agency/organization. The four module topics are:

1. Wildland-urban interface issues and connections—This module introduces participants to key wildland-urban interface issues and how they are interconnected and gives reasons why natural resource agencies should focus on interface issues.
2. Managing interface forests—This module provides tools and knowledge for effectively managing fragmented forests in the WUI and includes information about characteristics of interface landowners; practicing silviculture at the interface; small-scale harvesting systems; managing for wildlife, fire, and visual and recreational amenities; enterprise opportunities for landowners; and forest cooperatives.
3. Land-use planning and policy — This module explains land-use decision-making tools, the role of natural resource professionals in the decision-making and land-use planning process, and how natural resource professionals can get involved.
4. Communicating with interface residents and leaders—This module discusses key tips for effective communication with WUI residents and community leaders, beginning with the need to understand the audience, strategies for effectively sharing information and planning programs, and working to resolve conflict and support changes in behavior.

Additional resources include case studies, a resource list, evaluation questions, and the Changing Roles listserve and quarterly e-bulletin. The resource list includes publications, videos, potential guest speakers and field trips, and other materials that trainers can use to enhance their programs.

In addition, the U.S. Fish and Wildlife Service produced a video, *When Nature is at Your Doorstep,* to introduce training participants to WUI issues from Module 1 and can be used as an outreach tool for resource professionals working with interface residents and local leaders.

The interactive exercises provide a variety of activities including icebreakers, discussion questions, and worksheets that help training participants further explore and apply what they have learned. The exercises can be modified to suit the group size, a number of learning formats are provided, and there are exercises for various group sizes, time allowances, and objectives.

Fact sheets outline important points, strategies, and information about various topics related to each module. They are typically two to four pages and are useful as handouts for training participants. Fact sheets can be used with a wide range of audiences and trainers can use them for additional background material in preparation for trainings.

The case studies provide examples of interface issues, challenges, and success stories from across the southern United States. Case studies help participants imagine a new way of solving problems. Given the frustration with wildland-urban interface issues, these success stories from across the region have been an important part of training programs. Discussion questions are included to facilitate deeper understanding and encourage dialogue.

After the completion of a workshop, trainers can submit and send an evaluation form to InterfaceSouth so that we can continually improve the program. There are also a number of evaluation questions that can be used before and after the training to measure concepts learned by participants as a result of the program. Suggested questions are also provided for a follow-up survey that agencies may wish to conduct several months after the training activity.

All of the program resources are available in the Changing Roles section of the InterfaceSouth website (www.interfacesouth.org/changingroles), as well as new materials including example agendas, planning guides, handouts, PowerPoint presentations, field trip ideas and new exercises. Adaptable files of the exercise handouts and worksheet are available on the website and trainers can customize the exercises to meet their training objectives. A Changing Roles listserve currently has over 300 subscribers, through which a quarterly e-bulletin, called the "*Changing Roles Update*", is distributed. The Update includes a special feature, trainer spotlight, highlighted Changing Roles activities, and recent website additions.

3 THE PHILOSOPHY

Many of the *Changing Roles* materials incorporate communication and behavior-change techniques. Not only are we aiming to change the behaviors of the participants to work more effectively in the interface, but we are also potentially changing the behaviors of trainers and agencies. The following guidelines were used to develop each module:

- Trainers need accurate and current information supported by documentation. We provide fact sheets with citations, background information in the trainer guides, and an additional reference. They may not be familiar with wildland-urban interface issues.
- Trainers need a variety of tools to give them options for presenting information. Presentations, fact sheets, and background information are provided.
- Trainers need to be able to adapt and revise materials to meet their audiences' needs. Most of the activities or concepts can be used in any order; many are adaptable so that examples and issues can be revised as need be. Handouts for exercises are provided in MS Word® files to make it easier for trainers to create their own versions. The website encourages trainers to share their adaptations with others and provides some examples.
- Participants have a variety of learning styles. Exercises incorporate the Experiential Learning Cycle and suggest a number of styles of interaction for learners.
- Participants learn from each other. Case studies and exercises provide discussion questions to help trainers engage participants in meaningful conversation.
- New skills are learned through practice in comfortable environments. Many of the exercises give participants a chance to try new ways of working in the interface during training workshops.
- Clear directions and icons utilized in the training materials help those trainers who are looking for a cookbook of presentations, materials, and activities that they can use without much preparation.

- Adaptable presentations and materials available on the website make the program flexible for trainers who want to invest more time customizing their trainings to meet local needs.
- Experts reviewed each module for accuracy and applicability across the region. Pilot tests of the materials were performed with students and natural resource professionals who helped improve the directions and the flow of the exercises.

4 THE BENEFITS

Trainers have commented that they believe Changing Roles training can help natural resource management agencies adapt to changes currently underway in urbanizing areas, including changes in landowner perceptions and values and in land-use. In more rural areas, Changing Roles can help prepare professionals to be pro-active as they see development beginning to occur in wildland areas. Changing Roles can also help agencies by encouraging increased collaboration, which is vitally important during times of reduced funding and limited program capacity. Additionally, natural resource professionals can broaden their contribution to a sustainable future for forests, wildlife, and people by addressing the needs of new audiences, such as community leaders and planners.

Changing Roles can be integrated into existing training programs and the training materials are user-friendly, flexible and can be tailored to meet each agency's training needs. Additionally, the knowledge and skills gained can be integrated into current activities and projects. Participants can also earn continuing forestry education credits through the Society of American Foresters.

> With forest industry leaving Texas, large tracts of land are being sold and often fragmented. Urban citizens are also moving outside the city limits to where it is more affordable and they can own small tracts of land. As a result … the forestry profession is quickly changing. Traditional forestry still exists in Texas and yet at the same time there is a need to provide services to this new landowner to ensure that there are healthy forests in the future for Texans. The Changing Roles materials directly address these issues and provide natural resource professional the tools needed to contend with the changing face of forestry. Since training 85 members of our personnel in December, "Changing Roles" has become a common phrase in our agency that means addressing these challenges.
>
> April 2007 Changing Roles evaluation respondent

5 RECENT EXAMPLES

Two train-the trainer workshops were conducted, the first in February 2006 in Atlanta, GA shortly after the program was developed, and the second in Conroe, TX in April 2009. These workshops introduced the training materials, explained their purpose, and demonstrated ways to use the materials to about 100 total participants. Since these train-the-trainer workshops, resource agencies have used the Changing Roles materials in a variety of ways, such as the following:

- The Kentucky Division of Forestry led three one-day multi-agency Changing Roles trainings in August 2009, with participation by approximately 130 speakers and participants. Trainings were held in three different regions of the state to increase participant accessibility. A multi-agency steering committee planned and designed the workshop to ensure that the training was relevant for all agencies and regions involved.
- The South Carolina Forestry Commission (SCFC) held a half-day workshop in June 2009 with over 40 participants from SCFC and Clemson University extension. In this workshop, exercises and local case studies were used to: introduce, prioritize, and identify solutions to WUI issues affecting forest management in South Carolina; identify the role that foresters can play in addressing WUI challenges; and illustrate the importance of working with residents and community leaders to address land-use policy and planning issues, such as ordinances that affect forest management.
- The Texas Forest Service staff and Stephen F. Austin State University (SFA) faculty worked together to incorporate Changing Roles curriculum into SFA's Summer 2009 Field Station course for undergraduate Forestry students. Students attended field trips, participated in exercises, and heard numerous specialists discuss WUI issues in Texas such as water quality, prescribed fire, small-scale harvesting, and managing endangered and nuisance species.
- The Texas Forest Expo, an annual three day event designed to teach landowners new and innovative ways to protect their families, properties, and communities from wildfire, evolved from a Changing Roles workshop. The Expo aims to teach people how to sustain their forests, trees and natural resources. The event includes vendor and exhibitor booths, classes, and activities for children.

6 NEW METHODS AND TOPICS

Webinars are becoming an increasingly popular mode of teaching and learning in an age of restricted travel and shrinking budgets. Webinars allow participants to learn right from the comfort and convenience of their office.InterfaceSouth offered the first Changing Roles Webinar Series in the fall 2009. This 4-part series consisted of live, interactive, online educational events that targeted a subset of concepts and skills found in the Changing Roles modules. Collectively, the sessions addressed opportunities and challenges in the WUI related to forest management, land-use policy and planning decision making, and communication skills for working with interface residents and leaders. A second series is planned for fall 2010 based on recommendations from participants in the first webinar series.

Additionally a new module is under development that will help resource professionals better understand emerging issues in the wildland-urban interface and identify new approaches and tools to address these issues. Some specific topics that will be included in this new module are:

(1) An ecosystem goods and services approach to market-based conservation - This section will examine the ecosystem goods and services that forests provide and the relationships between goods and services, human activities, and human wellbeing. It will also explore how natural resource managers can incorporate ecosystem goods and services into forest planning and management on smaller-parcels of land in urbanizing areas, and how the use of an ecosystem services approach can provide incentive for landowners to sustainably manage and continue to own forest land.

(2) Small-*scale forestry* **-**This section will include alternative methods for costing a forestry operation at smaller scales, marketing strategies, examples of value-added processing, sample templates for contracts and business plans, and resources on entrepreneurship.

(3) Climate change **-**This section will examine how forests can mitigate climate change, identify potential effects of climate change on ecosystems and the goods and services they provide, outline a “Toolbox Approach” to managing for climate change in an urbanizing context, and highlight specific tools and models that can inform management and decision-making

(4) Ecological restoration at multiple scales **-** Ecological restoration efforts in the wildland-urban interface occur at different scales and include both ecological and social goals. This section will highlight principles for guiding the implementation of restoration projects and approaches and tools applicable for restoration at different scales.

5) Social Responsibility **-** This section will explore environmental justice issues, help resource professionals reflect upon their own values, explore the basis for decision-making, provide guidelines for making ethical decisions on environmental issues, and present the use of partnerships as a tool to encourage pooling of resources and increase representation and visibility in the decision-making process.

7 CONCLUSION

The Changing Roles: WUI Professional Development Program is a highly flexible set of training tools and resources that can be used in programs of one hour or one week, inserted into existing programs or designed to stand alone. Activities and information can be reorganized and designed to focus on interface issues, skill building, or geographic areas. Individual exercises, handouts, and slide presentations can be modified. The more skilled the trainers, the more flexible the program is. Changing Roles is not an established curriculum with preordained lectures and activities for each day. The wildland-urban interface in the southern United States is not so consistent, predictable, and static to support anything other than a flexible, adaptable, resource.

Changing Roles was designed to help resource agencies train their staff and other professionals to address increasingly complex and urgent issues in the wildland-urban interface. The title of the program recognizes that the roles of natural resource professionals are indeed changing as we aim to keep abreast of the rapidly changing landscape.

Changing Roles empowers resource agencies to build their own capacity and to work with others in multi-agency teams in the interface. Changing Roles is a growing and changing program that will, in the coming years, continue to evolve and develop in ways that help natural resource professionals and others face interface issues and challenges.

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The role of ecosystem services in small scale forestry: landowner attitudes, public policy, and market-based alternatives

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Abstract

Enhancing the management of small ownerships has become more critical than ever, due to the increasing rate of parcelization and a growing demand on all forest ownerships for an expanding range of products and values. A number of barriers hinder active management of these forests, however, including the difficulty of applying traditional management activities on small tracts; the landscape-scale nature of many of the values associated with forestland; multiple, and often conflicting ownership goals; and policies which have been designed primarily for large ownerships. Ecosystem services (ES) offer a new value of forested ecosystems that may enhance the prospects of managing small forests collaboratively for landscape-scale goods and services. This paper discusses the unique characteristics of ES that offer this opportunity and presents the results of two recent efforts: 1) assessing landowner interest in providing ES under a range of policy scenarios, and 2) evaluating the utility of various existing and proposed policy and market alternatives for small scale forestry and ES. Landowner interest was evaluated through a series of surveys conducted in Tennessee by the author and a review of similar studies globally. The policy and market evaluation consists of reviewing the literature concerning landowner collaboration as well as examining the alternatives offered to enhance ES provision on private lands. The analysis is focused on identifying key advantages and disadvantages of each policy or market alternative for small scale forestry, potential modifications that could enhance the utility of each alternative for small scale forestry, and likelihood of success.

Key words: ecosystem services, small scale forestry, landowners, public policy
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1 INTRODUCTION

Forests traditionally have been considered primarily as a source of timber and other wood products. Ecosystem services have remained undervalued, if not ignored, by most landowners and policy makers until recently when several researchers began evaluating their value (Costanza et al. 1997, Loomis et al. 2000; Knoche and Lupi 2007; Richmond et al. 2007). Costanza et al. (1997) estimated the total value of all global ecosystem services as $33 trillion annually, with global forest ecosystem providing at $4.7 trillion of the total. Similarly, Krieger (2001) estimated an annual value of $63.6 billion from services of nearly 210 million forest hectares in the United States.

The supply of forest ecosystem services is particularly difficult to assess on privately owned land. Not surprisingly, prior research has revealed that property rights deter private landowner participation in ecosystem management schemes (Rickenbach et al. 1998). Even though private industrial forest landowners may focus their management on timber products for which markets exist, recent studies have shown that a majority of private forest landowners (PFLs) in the United States are interested in non-timber benefits such as aesthetic enjoyment, privacy, closeness to nature (Blatner et al. 1991; Butler and Leatherberry 2006). As current ownership surveys reveal,

PFL owners may value non-timber goods and services more than economic returns from timber products. However, intergenerational transfer of forest assets and increasing demand of rural lands for urban development may result in ineffective management or loss of forestland in the long run (Best 2004). The USDA Forest Service, for example, estimated that more than 17 million hectares of private forests in the U.S., 11 % of the total area, is at risk of conversion to development within the next two decades (Stein et al. 2005). Increasing human pressure and continuous development of forestland will affect both the quality and quantity of ecosystem services from existing forestlands. Although landowners may manage forests for non-timber benefits and ecosystem services due to personal beliefs and motivations (Salmon et al. 2006; Butler and Leatherberry 2006; Majumdar et al. 2008), providing appropriate incentives may further ensure sustainable supply of those services and encourage other landowners who are currently less interested in ecosystem services (Goldman et al. 2007).

In order to establish formal markets for ecosystem services, buyers and sellers of the services must exist. With tighter environmental regulatory mechanisms, the increasing popularity of voluntary pollution reduction schemes among industries, and a growing public awareness of environmental issues, energy companies, developers, and the general public may be willing to pay for these services. Private forest landowners may be willing sellers of such services, provided financial incentives are available. Identifying landowners interested in managing their forest for non-timber benefits will be critical if effective strategies are to be developed to encourage landowners to supply the desired ecosystem services. While previous studies regarding ecosystem services have been focused on estimating the total economic value of all or a portion of such services (Costanza et al. 1997; Loomis et al. 2000; Knoche and Lupi 2007), none of the studies with some notable exceptions (Olenick et al. 2005; Church and Ravenscroft 2008) have examined landowner perspectives on providing the services.

This paper presents an overview of recent efforts to assess PFL interest in providing ecosystem services and alternative strategies available to encourage cross boundary collaboration (CBC) to provide ecosystem services on a landscape scale. The PFL component will focus on a study conducted in the U.S., specifically Tennessee, as well as the results of similar studies elsewhere. We then describe some of the primary alternatives offered to encourage CBC and conclude with an evaluation of the alternatives and research needs.

2 METHODS

Tennessee Landowner Study

The study involved PFLs in the 16-county area of the Cumberland Plateau of Tennessee in the southern U.S. to assess their interest in and perceived barriers to managing for ecosystem services. The Plateau is one of the world's "largest, temperate hardwood plateau systems" and has remained remote and largely undeveloped until recently because of the rugged terrain (TNC, 2008). The Nature Conservancy (2008) estimates the Plateau supports more than 2000 species of plants and the largest number of cave invertebrates in the world. A questionnaire was mailed to more than 1,700 PFLs in 2007 using the Total Design Method (Dillman 2000). Survey questions addressed ownership objectives and management characteristics, level of interest in managing for selected ecosystem services, preferences for different financial incentive mechanisms and land use restrictions, and demographics. Of the original survey population, 246 names were eliminated due to bad addresses, death, or having sold the land. A total of 695 completed surveys were returned, for an overall return rate of 39 %. Because some of the surveys contained incomplete information for this analysis, a total of 592 surveys were used in the analysis.

Following Salmon et al. (2006), we segmented the NIPF landowners in the area using K-means cluster analysis and then examined the characteristics of landowners in each segment. K-means cluster analysis uses a classification algorithm to classify individual observations into meaningful groups. It allows one to specify the number of clusters (K), and the algorithm classifies individual observations into these clusters (Weinstein 1987). The sociodemographic, forest, and management characteristics were examined for each of the landowner segments detected by the cluster analysis. In addition, cluster-wise preference for different financial incentives in managing forestland for ecosystem service was evaluated. We also analyzed their relative perspectives on different land use restriction issues that might prevent them from accepting incentives. Finally, we assessed landowner preferences for information sources regarding forestland management for ecosystem services.

CBC Alternatives

The review of alternative mechanisms to encourage CBC was accomplished primarily through a review of the literature related to forest management collaboration for timber products, and more recently for non-timber goods and services. Interviews with managers who have been involved in such efforts and the authors' own experience were utilized as well. The review will be presented for two primary categories of alternatives: forest cooperatives and financial incentives. While this is not an exhaustive list, these are the two most often proposed options to enhance ecosystem service provision on private lands.

3 RESULTS

Tennessee Landowner Study

While selecting the *a priori* number of clusters is rather subjective, a 3-means clustering produced the clearest division between three different segments of landowners. Following Salmon et al. (2006) we used an iterative process and compared the segmentation results for k = 2, 3, 4, 5, ...10, and found that meaningful as well as intuitively justifiable classification was found when we classified the landowners into 3 segments (k = 3). The average responses of landowners in each segment are presented in Table 1. We also performed a One-Way ANOVA test to check whether the mean responses among three groups differed statistically (Moore and McCabe 2003). For mean responses of landowner segments to each type of ecosystem service, computed F-statistic in Table 1 rejected the null hypothesis that all means are equal, confirming that the difference among those groups is statistically significant.

The first segment included 255 landowners (43 %) who had the highest level of interest in managing their forest for all types of ecosystem services. This segment was defined as 'probable managers' because the landowners' probability of managing land for selected ecosystem services was high. The second segment included 244 landowners (41 %), who expressed some interest in all ecosystem services, but did not indicate strong interest in any specific service. This group was defined as 'potential managers'. The third segment included 93 landowners (16%t), whose levels of interest were little or none, and was hence defined as 'unlikely managers'.

Table 1: Mean responses of forest landowners to indicate their interest in managing for ecosystem services by landowners segments and ANOVA results of difference in means among segments

Ecosystem services				F- Statistic
	Probable Managers	Potential Managers	Unlikely Managers	
Enhancing wildlife habitat for hunting	3	3	1	88.82*
Protecting water quality	4	3	2	344.02*
Storing carbon to reduce global warming	4	3	2	376.45*
Maintaining forest cover for aesthetics	4	3	2	427.37*
Protecting rare and endangered species	4	3	1	637.52*
Enhancing habitat for birds	4	3	2	562.20*

1 = no interest, 2 = slight interest, 3 = some interest, 4 = high interest
* = significance of statistics at <0.001

Overall, water quality protection was the most common ecosystem service cited by all three groups. Even though various types of ecosystem services considered in this study could be produced jointly, more landowners were interested in ecosystem services such as water quality or carbon storage than utilitarian services such as wildlife hunting. A significant number of landowners in two of the three categories were strongly interested in managing for ecosystem services such as storing carbon, protecting endangered species, maintaining aesthetic forest cover, and enhancing avian habitat.

The primary focus of this paper is to evaluate how PFLs react to various incentive structures and restrictions related to ecosystem service provision. The results presented below are focused on these topics. The survey asked respondents to indicate their preference for three different types of incentives: property tax incentives, payments from private individuals or companies, and payments from government. Seventy-one percent of the landowners in the probable managers segment indicated that a property tax incentive would be "very" or "extremely" useful in managing for ecosystem services

(Table 2). Fifty-six percent of the probable managers indicated that payments from the government would be “very” or “extremely” useful, whereas payments from private individual or companies was considered “very” or “extremely” useful by nearly one-half (49 %). Potential managers held similar rankings on the incentives, with the property tax incentive the only incentive favored by more than half of these landowners. The data indicate a consistent preference of landowners for these three types of incentives, regardless of their level of interest in providing ecosystem services. The largest number of landowners in all three segments ranked the property tax incentive first, followed by payments from the government and payments from the private individuals and companies. This might be attributed to the fact that a property tax incentive is the simplest and most easily administered payment mechanism, and one in which most landowners are familiar. Landowners preferred payments from government to private individuals, perhaps due to the uncertainty and legal and liability issues they might experience in private transactions. Compared with other segments, the unlikely managers segment had a higher proportion of landowners indicating that all of those incentives would be either only slightly useful or not useful at all (51% ranked property tax incentives as “not useful or slightly useful; 66% responded similarly about payments from private and 67% about government payments). Although the questionnaire provided an opportunity to specify alternative incentives they would find useful, no respondents offered such an alternative.

Table 2: Landowner preferences for financial incentives by segment

Incentives	Probable Managers (percent)					Potential Managers (percent)					Unlikely Managers (percent)				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
Property tax incentives	6	7	16	24	47	8	10	27	32	23	26	25	16	20	13
Payments from private individuals or companies	30	8	14	17	32	25	14	31	17	12	46	20	15	11	8
Payments from government	20	9	15	18	38	22	15	30	19	14	41	26	10	13	10

1 = not useful, 2 = slightly useful, 3 = moderately useful, 4 = very useful, 5 = extremely useful

Landowners also were questioned regarding their willingness to accept land use restrictions associated with incentives. Examples include government cost share programs to protect water quality preventing property development, and a carbon offset contract with a private company limiting timber removals. Landowners responded differently by segment to the questions regarding restrictions (Table 3). The majority of landowners (nearly 75 %) in each segment indicated that allowing public access to their land would prevent them from accepting incentives. This is consistent with our observation in landowners' segmentation that relatively fewer probable or potential managers were interested in providing hunting, which requires access to the property. The results reveal that landowners were less likely to participate in ecosystem services schemes that would require public access to their land or prohibit new construction in their land. Compared to the other two segments, probable managers were more likely to accept restrictions that limit development opportunities (31 %) and harvesting (40 %). Roughly the same proportion of landowners in all segments was unsure about the impact of restrictions.

Table 3: Restrictions affecting landowner decision to accept financial incentives

Restrictions	Probable Managers (percent)			Potential Managers (percent)			Unlikely Managers (percent)		
	Prevent	Encourage	Unsure	Prevent	Encourage	Unsure	Prevent	Encourage	Unsure
Allow public access	73	7	20	77	4	19	75	5	20
Limit development	40	31	29	55	21	24	60	17	23
Limit timber harvesting	32	40	28	45	28	27	57	16	27
Prohibit new buildings	53	18	29	64	10	26	65	15	20

CBC Alternatives

Whether organizational, individual, or informational, boundaries have the potential to create barriers. Whether it is through legal authority, emotional attachment, or biological proclivity, people simultaneously maintain and defend many boundaries (Brunson 1998). Barriers are built and perpetuated through lack of understanding, myopic vision, or an unwillingness to cross boundaries (Wall 1998). It is the existence of these barriers which complicate efforts to manage resources at scales larger than individual ownership. Processes indicative of healthy ecosystems do not start or stop at individual property or administrative boundaries.

Those who seek to develop cooperation programs are tasked with pulling down the barriers that retard cross-boundary stewardship. Such programs are faced with a tall order. They must find ways to resolve potential conflict between territorial self-interests and community cooperation (Brunson 1998). They need to maintain the integrity of the individual property while allowing the flow of information, management, and ecosystem components. In essence, they must find ways to increase the permeability of boundaries (Brunson 1998).

Examining the feasibility of CBC has lead to several studies directed at PFL ownership objectives, characteristics, and approaches for fostering participation in cross-boundary management programs. In a study in Franklin County, Massachusetts in the U.S., researchers found that PFLs had favorable attitudes toward an ecosystem-based approach to management (Rickenbach et al. 1998). They noted the high priority PFLs in the study placed on privacy. The researchers raised questions as to how this priority on privacy would affect willingness to participate in cross-boundary management. A study across 11 states found PFLs were interested in ecosystem-based management in general; however, strong concerns regarding private property rights may make them less receptive to cooperation programs that call for power sharing (Brunson et al. 1996). A common finding across studies is the need for PFLs to see examples of such programs before committing to them, and a need for a better understanding of ecosystem-level impacts of individual activities (Sinclair and Knuth 2000; Raedeke et al. 2001; Stevens et al. 1999; Klosowski et al. 2001; Finley et al. 2006). Overall, PFL response has been favorable to the notion of managing land in harmony with broader scale ecosystem processes.

Incidental ownership, perception of unimportance, very few formal management agendas, and lack of harvesting intentions have been cited as obstacles to cross-boundary cooperation (Birch 1997; Kendra 2003; DeCoster 1998). Lack of time and satisfaction with the way things are (Finley et al. 2006; Williams and Ellefson 1997), a need for assurances that timber and land values would be preserved, and flexibility of management (Jacobson et al. 2000) also affected PFLs' willingness to participate in cooperation programs. Additionally, results from the multi-regional study indicate PFLs are seeking balance between right to harvest goods and an obligation to protect the forest environment for future generations (Brunson et al. 1996).

A review of the aforementioned studies indicates some steps necessary for developing effective programs for encouraging PFLs to cooperate across ownership boundaries. Cross-boundary cooperation will require individuals to be willing to cede some control to the larger partnership. Resolving potential conflicts between self-interests and cooperative interests will be important (Brunson 1998). Building a decision process by which participants can clarify and secure common interests is one way of working toward a resolution of these conflicts. Finley et al. (2006) identify definition of interests in cross-boundary management as the first step in developing working relationships among PFLs. They identify developing schemes to garner PFL support for such programs as the next step (Finley et al. 2006). In his review of international cooperatives, Kittredge (2005) identified the need for a catalyst to inspire interest, and for the program to be locality relevant. One way this has been done is through local government involvement. However, Campbell and Kittredge (1996) found it critical for local communities to drive the adoption and implementation of programs.

Forest Cooperatives

While relatively unsuccessful in the U.S., forestland cooperatives have met with success globally. Kittredge (2005) examines forest cooperatives in 19 countries with temperate climates and developed economies. He classified organizational goals, structure, and types of cooperation into four groups: information cooperation; equipment cooperation; financial cooperation; and management cooperation. Information cooperation involves the exchange of information, techniques, experiences, and advice between landowners. Equipment cooperation, like its name implies, involves sharing machinery and equipment for harvests and road construction. Financial cooperation is organized around collective marketing of forest products. In each of these three groupings, forest landowners manage their forests independent of one another. The final classification, management cooperation, involves the cooperative management of forestland both spatially and temporally using integrated management plans (Kittredge 2005). He found virtually no examples of this final category, with the possible exception of Landcare groups in Australia.

Renewed interest in forest cooperatives within the U.S. is a result of increasing forest parcelization, fragmentation, and the shifting focus toward ecosystem management philosophies. The majority of U.S. forests are privately owned. Between 1978 and 1994, the amount of private forestland in tracts less than 40 hectares, with the largest increase of 115% in tracts 4-20 hectares, while large forestland tracts decreased (Birch 1996). The number of PFLs is increasing faster than population growth. DeCoster (1998) estimates 38% of all private forestland will be in parcels smaller than 40 hectares by 2010. This increased parcelization of forestlands presents challenges to resource professionals. Namely, how can these smaller ownerships simultaneously meet the objectives of PFLs, society’s need for wood products, and healthy ecosystem functions (Finley et al. 2006)?

When private forests are managed in a piecemeal fashion, as is often the case, actions are likely to be ineffectual at the level of the ecosystem. Greater cooperation among private landowners is required when management units are defined ecologically and not politically (Cortner and Moote 1999). It is generally believed forest fragmentation – physical isolation of forested areas – does not have to be a foregone conclusion of parcelization. Cooperation among neighboring landowners regarding forest management can help resource managers overcome the challenges created by the patchwork of land ownerships, which represent distinct management objectives. Cross-boundary cooperation is defined as occurring when adjacent ownerships jointly undertake forest management to achieve common goals (Bergmann and Bliss 2004).

Incentives

Government technical, educational, and financial forestry assistance programs have been designed to promote various forest management practices by PFLs. Cost-share programs are popular with landowners because they reduce initial investment costs for certain management practices (Kluender et al. 1999). However, studies examining if cost-share monies take the place of other available capital have had mixed results (Wear and Greis 2002). Esseks et al. (2000) found that 22% of surveyed landowners would have implemented management objectives without cost-share funds. Other studies found that PFLs in some states were not likely to use cost-share incentives when primary motivations for owning the land were for water, wildlife, and natural beauty (Kluender et al. 1999; Wear and Greis 2002).

Several market-based incentives have been developed with the emerging markets for ecosystem services, although with few applications to CBC. Most have been geared toward specific ecosystem services that are linked to carbon sequestration or water quality. Studies show that direct payments are being made to landowners for adopting some specified landuses (Pagiola 2002). For example, forest landowners can trade their carbon sequestration capacity with emitting industries in the area. In British Columbia, a newly established carbon market is creating opportunities for forest landowners to derive income from the sale of carbon emission services (Bull et al. 2002). In addition, some formal commercial platforms have recently been established in the U.S. and elsewhere to facilitate marketing of carbon permits. Those include Chicago Climate Exchange (CCX), Regional Greenhouse Gas Initiative (RGGI), and European Climate Exchange. Aggregators working on local levels collect the carbon-offset credit of numerous landowners, and then sell these to interested companies in such market platforms.

Similar trading schemes can be developed with real estate developers, who are required to compensate for wetland losses due to housing expansion. Landowner incentives in such cases could be in the form of subsidized property taxes or other tax exemptions on land producing such services. Current examples include preferential or use-value taxation of property and annual payments for the retirement of ecologically fragile land via several federal programs. Similar payment mechanisms that directly pay forest landowners have recently been designed. An example would be the ecosystem strategy New York City's water utilities have adopted to protect water quality. Instead of investing billions of dollars in filtration plants, it is providing landowners incentives to preserve forestland in the Catskill Watershed. Recently, the Seattle's public utilities have attempted protection of the Cedar River and the Tolt River Watersheds by making land purchases (Robbins, 2005). Despite these initiatives, most of the market-based incentives currently in practice are still in their infancy (Pagiola et al. 2002).

One new incentive option for encouraging cross-boundary cooperation is an agglomeration bonus. An agglomeration bonus pays an extra bonus for every hectare that a landowner enrolls in conservation programs that borders areas in other ownerships that have been enrolled in the program. This provides incentives for landowners to voluntarily create contiguous reserves across boundaries (Parkhurst et al. 2002). Later experiments have refined the approach to also include various subsidies and penalties to encourage particular patterns on the landscape (Parkhurst and Shogren 2007). The researchers found that individuals were able to coordinate and achieve contiguous land patterns across boundaries. These experiments were performed in a lab using computers, and may not transfer as seamlessly as we would hope to actual field experiences. However, the potential exists to modify existing cost-share and other financial incentive programs to include agglomeration bonuses, as a way to encourage cross-boundary cooperation for multiple management objectives.

4 DISCUSSION

The survey of forest landowners on the Cumberland Plateau of Tennessee assessed the landowner perspective on managing forestland for selected ecosystem services. The findings from this study have several implications in forestry, land use planning, and ecosystem management. First, only a specific group of landowners were interested in managing their land for ecosystem services. While several ecosystem services could be jointly produced in a forestland, landowners were more interested in certain type of services than others. Moreover, our study identified three distinct segments of forest landowners, according to their level of interest. Landowners of the probable manager segment were overwhelmingly interested in managing their land for any type of ecosystem services, and could be approached by the professionals interested in promoting the supply of particular services. Similarly, potential managers could be the targets of a second stage. Raising the interest of landowners of this segment would be important in the long-run, because a perpetual supply of ecosystem services would require a landscape approach, where a vast number of landowners protect a sizable amount of forests to produce various ecosystem services.

Second, property tax breaks were the preferred financial incentive to landowners. Additionally, landowners preferred payments for ecosystem services from the government to that from private individuals. Third, landowner willingness to supply ecosystem services is influenced by the type of land use restrictions they would face under various incentives. In particular, not many landowners would be inclined to manage for ecosystem services if it required public access to their property or prohibited new buildings on their land. Conversely, the majority of owners would accept incentives to produce ecosystem services even if it limits timber harvesting or prevents them from developing their land. With this in mind, the area might experience a limited supply of certain ecosystem services such as wildland recreation or hunting, which requires public access, but a comparatively better supply of services such as carbon storage and water quality protection.

The diverse values and management objectives of multiple forest landowners, which accompany parcelization, contribute to complex landscape conditions and make landscape-level management difficult. No CBC program is likely to ever achieve 100% voluntary participation, whether as a result of human nature, diversity of attitudes, or the independence of PFLs. Top-down regulatory approaches are unlikely to succeed because of high implementation costs and the complicating factor of property rights. Conflicting management objectives pose a barrier to cross-boundary cooperation; however, it is the common ground among PFLs that provides the basis for cooperation. As forest parcelization increases and private forestlands are expected to provide increasing amounts of the nation’s timber supply, recognition and promotion of the common ground is vital. Promoting cross-boundary management in a way that is relevant to PFLs is critical to creating and sustaining interest in cross-boundary cooperation programs.

Given the concerns of PFLs regarding private property rights and timber and land values, information of how cooperating can be personally beneficial is needed. While many PFLs indicate favorable attitudes toward ecosystem-based management, long-term benefits of ecosystem health or community stability might not be as meaningful as enhanced monetary returns, improved recreational benefits or other tangible outcomes. Finally, providing spatial information (GIS) enables owners to see how their parcels fit into the landscape mosaic. This visual information may help to emphasize how individual landowner’s management objectives affect the larger landscape. Before spinning their wheels trying to get PFLs to participate in cross-boundary management, it may first be necessary for resource professionals to demonstrate to PFLs that small-forested parcels collectively represent a valuable forest resource.

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Improving the consultation model for forest planning: a design-based study

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Abstract

In this study the approach of design-based research (DBR) was used to reasonably improve the extension practice of forest management planning. DBR equals here to the process of progressive refinement, where a well-formulated instructional design is iteratively tested, evaluated, and revised in order to respond to real-life and theoretical questions. DBR was conducted in close collaboration between researchers and forest professionals, and empirical experiences were collected from real-life meetings between 13 forest owners in turn and a professional forest planner.

Altogether three testing cycles were conducted. Justified modifications to the extension instructions for forest planners were made after the first cycle, which revealed tacit knowledge and good practices of the planner. The most visible modification was the decision to send the plan to the owner beforehand. The aim here was to enable the owner to acquaint himself with the plan, and thus enhance communication during the meetings. After the second empirical testing round, observations focused on the significance of all the planner's pre-contacts in framing the meeting. As the last modification to the extension instructions, the planner was advised to present the owner available options concerning the planning process.

The interactive design-based process was fruitful to improve the instructions. Firstly, the essential invisible good practices were included in the instructions. Secondly, the shared reflecting of data in feedback meetings made new ideas for improving the process to emerge. However, it is noticeable that implementation of the new instructions needs further development. There are still interesting research questions to be studied about communication and mutual learning in forestry consultation meetings.

Key words: communication, feedback, forest management planning, video data
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1 INTRODUCTION

Productivist management of natural resources has been challenged in western countries by societal value diversification (Inglehart 1997) and the concept of post-productivism (Mather et al. 2006). Simultaneously, the traditional approaches and tools of communicating with private forest landowners have been challenged by urbanized lifestyles (Ziegenspeck et al. 2004, Wild-Eck et al. 2006, Hujala & Tikkanen 2008). These pressures for change are showing a way towards new and improved forest-related extension procedures. One established activity to be enhanced is forest management planning, which is the object of this study. Recent studies have investigated plans' effect on forest owners' forest management behaviour (e.g. Niskanen 2005, Størdal et al. 2008), or considered interactive methods for better supporting owners' decision-making (e.g. Leskinen et al. 2009, Pykäläinen & Kurttila 2009). These studies should be complemented with an empirical enquiry into real-life action in order to learn about and enhance the practical communication. Such approaches can be found in numerous studies of classroom learning (e.g. Kumpulainen & Wray 2002), medical conversations (e.g. Jones 2003) and agricultural advisory situations (e.g. Waldenström 2001, Bergeå 2007), but not in forest research branch so far.

The study at hand aims at improving the extension practice of forest management planning in Finland by investigating the real-life behaviour of practical actors. The communication between the forest planner and the forest owner is on the focus of analysis. Interaction of participants (a planner and a forest owner) during extension meetings is studied with attention paid to the owner's participation in the conversation along the planning process. A more communicative planning is assumed to promote customer-orientation and incorporation of multiple values in planning (see Hujala et al. 2008).

In this study the approach of design-based research (DBR; see Design-Based Research Collective 2003) was used to reasonably change the instructions for extension in forest planning processes. DBR equals to *a process of progressive refinement*, where a well-formulated instructional design is iteratively tested, evaluated, and revised in order to respond to real-life and theoretical questions (Collins et al. 2004). DBR takes the multidisciplinary research to an authentic environment to find out together with practitioners what works there (Bereiter 2002, Collins et al. 2004, Hämäläinen 2008). Here the prime question was how to instruct and advise forest planners to better serve their clients, i.e. forest owners, via planning-related communication.

2 DATA AND METHODS

2.1 CONTEXT OF THE STUDY

Up to date, the forest planning system of family forests in Finland consists of Regional Forest Inventories (RFIs), and holding-level Forest Management Plans (FMPs), which are compiled from RFI data. FMP is a cost-share product: the state subsidizes RFI, which leads to a reduced price for forest owners. Along with the RFI fieldwork, a treatment suggestion is determined for each forest stand. A FMP contains stand wise data as well as information about incomes and costs and a summary of the growing stock, growth, cuttings, silvicultural operations and biotypes having special importance for nature conservation. Figures and thematic maps illustrate the data. Extension may occur in any phase of the planning process: marketing, field trip, compiling the plan, and delivery. FMPs are voluntary for forest owners in the Finnish system. (Nuutinen 2006, Hokajärvi et al. 2009.)

2.2 DATA AND ANALYSIS

The extension instructions for forest management planning in Finnish Regional Forestry Centres were used here as the base for refinement through DBR. Three cycles of data gathering were conducted. The cycles included total of 13 genuine extension meetings between a professional planner and a forest owner. To reach variety in planning situations, owners with varying backgrounds and levels of forestry experience were subjectively selected as participants.

The data were collected in 2007–2008, yielding altogether over 20 hours of video recordings. After each data gathering cycle, the FMP meetings were evaluated and the extension design was improved in a reflective feedback meeting between the planner, a planning expert and the researcher group (comprising forest and educational research specialists). The evaluation was based on video recordings of the extension meetings as well as interviews of each owner and the planner before and after each FMP meeting.

The three participating researchers went first independently through the data and identified important findings, which were then negotiated and placed as themes on the agenda of the feedback meeting. In the meeting, the planner's and planning expert's views were inquired and the themes were further elaborated to reach common understanding about the conclusions. After the third cycle the final suggestion for the improved instructions was formulated. The duration of the three feedback meetings (October 2007, February 2008, and November 2008) was altogether 7 hours 2 minutes:

the first meeting was 3:06, 2nd 1:59 and 3rd 1:57. The recordings of the feedback meetings were used to restore and condense the discussed themes as the results of this study.

3 RESULTS: IMPROVEMENT OF PRACTICE

The instructions of the minimum requirements for extension in forest management planning were redesigned. The essential part of the instructions appears in Table 1. The instructions are called "minimum requirements" to point out the minimun standard for extension in a private forest planning process. There is variation how the planner actually conducts the extension during planning (Hokajärvi et al. 2009). The division of forest owners into two groups (customer segmentation) is included in these instructions. The segmentation facilitates the planner to decide how a) to respond to the customer's needs and b) how to use the material and models developed for Forestry Centres as extension support. The segmentation has two groups: 1) forest owners who do not yet know their forests very well (named 'forest wannabe-knowers') and 2) forest owners who already know their forests and are familiar with forestry (named 'forest knowers'). However, the instructions are quite similar to both groups (Table 1).

Table 1: The preliminary instructions for extension along with forest management planning (Forestry Centres and Forestry Development Centre Tapio, 12.2.2007).

1. Phone-call or e-mail to the forest owner before the field inventory → information about the objectives and wishes of the owner.
2a. ('forest wannabe-knowers') Contact with the owner after the field investigation or during it (a field trip, max 4 hours) → information for constructing the plan. If the forest owner does not want a field trip it may be replaced with a personal meeting or a phone-call. […] 2b. ('forest knowers') Call or meet the owner after the field investigation and arrange the delivery meeting and possible extension meeting (max 4 hours).
3. The forest management plan is delivered in a personal meeting at the owner's home or in the planner's office. […] If a personal meeting is not possible or the owner does not want it, the plan may be snail mailed and the owner may be contacted by phone afterwards.

In the first feedback meeting the first five FMP meetings were discussed: opinions of the planner and observations of the researchers as well as ideas about how to develop the planning practice were shared. This was followed by a summarization and suggestions for changes to be realized on the next data cycle. The concrete questions were how to enhance the communication in the FMP meetings and how to make the planning process more customer-oriented.

At first the summary acknowledged good practices of the planner, which were invisible in the instructions (tacit knowledge). The planner usually wrote a descriptive summary of two or three main forestry development issues into the plan that included no numbers.

The key points braced the planner himself for the meeting, guided the course of the meeting, and were also recapped in the end of the extension meeting. A checklist for guiding the general structure of the meeting was suggested. It could include some general things like ensuring owner's understanding of special notions and remembering to leave time for owner's questions and feedback, but also specific issues of the holding at hand. It was to be followed broadly.

The second subject of the summary was enhancing customer-orientation. The meeting place seemed significant. The experience of the planner was that there was usually more discussion at the owner's home than in the planner's office, but most important was that the owner could choose the venue. To give options to the owner was also one topic discussed. It would mean more information about e.g. optional treatments and consequences of alternative decisions. It was concluded to send the plan to the owner beforehand so that the owner would have time to acquaint himself with the plan, and thus enhance communication during the meetings. This was the most visible modification of practice after the first cycle.

Table 2: The instructions of extension along with forest management planning after the first cycle (Design I).

1.	Contact the forest owner before the field inventory; get information about owner's objectives and wishes. Discuss the timetable and meetings of the planning process.
2.	Arrange the first personal meeting with the owner. The owner may choose the meeting place; possibly a field trip. Draft of the plan is sent to the owner at least a week before the meeting. The owner can acquaint himself with the plan. Emphasise that it is possible to make changes to the plan after the meeting. (If the forest investigation has been done before contacting the owner, phase 1. and 2. may be combined).
3.	Page 'Key issues of developing forestry in the holding' guides the progress of the extension meeting. Question and listen to the opinions and wishes of the forest owner. A checklist for the meeting is made and can be used to ensure the incorporation of the important points of the meeting and the listening the owner.
4.	Mail the final plan or visit the owner to deliver it (simultaneously with the optional material and information agreed in the previous meeting).

It was agreed that the segmentation for 'forest knowers' and 'forest wannabe-knowers' was a quite rough division. The customer-orientation is strengthened, if the segmentation is guiding the planner to approach different owners as a continuum. However, the planner's estimate was that at the both ends of the distribution there are 10-20 % of forest owners who could be classified as those who know nearly nothing of their forests and those who know a lot. Both groups need special services. Furthermore most of the customers are in between these two ends to whom no big variations were required – just sensitivity by planners. Since the segmentation guides the planner only slightly and is quite a new practice, it was not modified. The instructions to be tested on the second cycle were called Design I, and they appear in Table 2.

After the second data cycle observations focused on the significance of the pre-contacts of the planner in framing the delivery meeting: what kind of contacts had occurred before the meeting? In two cases there had been a plan-compiling meeting by the computer in the planner's office, where optional forest treatments were discussed. This was written down to the instructions as an option for the owners. It was also decided that these meetings would be recorded in the third data cycle.

The most significant modification after the first cycle i.e. to send the draft of the plan in advance was tested in each case. The planner assessed that in this round there had been more specific questions and the owners had been more aware and 'awake' in meetings. The researchers could also verify from the video data the more enhanced communicative character of the meetings. This was agreed to be a successful improvement. The draft was defined as an actual plan which allowed modifications after the meeting. This was told (to the owner) in the covering letter. This meant no extra work for the planner, possibly just adjustments to a few pages. The meeting place did seem to matter: there was more discussion at owner's place (and in the forest) than in the office. The checklist was found useful when preparing to the extension meeting. In the end of meeting it is important to check that the owner's questions are replied to. There is a load of information but all cannot be included, which calls for sensitiveness of the planner.

Table 3: The instructions of extension along with forest management planning after the second cycle (DesignII).

1.	Contact the forest owner before the field inventory. Inquire after the objectives and wishes of the owner. Document them. Introduce the possibilities to participate in the planning process (a field trip/ joining to compile the plan/ a delivery extension meeting). Discuss about the timetable of the planning process, the owner's wishes concerning the timetable and participating in the process. Make a preliminary agreement on the timetable and participation.
2.	Conversational field trip or the owner joining the compiling meeting after the field investigation and preliminary computing. In the meeting a discussion about the alternatives and possibilities in forestry and treatments as well the objectives and hopes of the owner. Agree on the delivery extension meeting if it is needed.
3.	Delivery extension meeting. The forest owner can choose the meeting place: at his/her home/ the planner's office. The plan is sent to the owner at least a week beforehand. The extension meeting is guided by 1) a page of the plan, where the key issues of developing forestry in the holding are presented, 2) the owner's objectives and wishes (documented in stage 1.), and 3) new questions that the owner now has after having had the draft of the plan for a week. A checklist is made and can be used to ensure the realization the aims of the meeting.

As the last modification the planner was advised to tell the owner the available options concerning the planning process. The options were documented in the instructions (Table 3). It was also decided to focus on the third data cycle on meetings that had not yet been caught (e.g. delivery extension meeting in the forest).

On the third cycle there were three different meetings: the compiling meeting was videotaped and one field trip was videotaped and one voice recorded. The feedback discussion concerned mainly the field trips: The usefulness of field trips in most cases is acknowledged, but the appropriate timing cannot be instructed strictly. No difference between segmentation groups was found. The owner's desire to learn could be a key variable that naturally guides the implementation of the trips.

Table 4: The instructions of extension along with forest management planning after the third cycle (Final Design).

1. Pre-contact i) Inquire the owner's objectives and wishes before the field investigation and document them. ii) Present to the owner the possibilities of how to participate the planning process: a) compiling the plan (especially large holdings), b) a delivery extension meeting and/or c) a field trip. Discuss the timetable of the planning process, owner's hopes concerning it and how to participate in the planning. iii) Make preliminary agreement about the timetable and participation. Use the table of extension models if necessary.
2. Compiling the plan i) When the forest investigation has been completed and tentative calculations are available, the possibilities of the forest are examined and compared with the objectives and wishes of the owner. ii) The owner may take part in compiling the plan (a compiling meeting). At the meeting focus of the discussions is on the options and possibilities of forestry and the objectives and wishes of the owner. iii) Agree on a delivery meeting and/or a field trip.
3. Delivery extension meeting i) Forest owner can choose the meeting place (a field trip/ his/her home /the planner's office). The plan is sent to the owner 1-2 weeks before the meeting. Page '*Key issues of developing forestry in the holding*', the objectives and wishes from phase 1 and the questions arisen during the planning process guide the progress of the extension meeting. ii) A checklist for the meeting can be used to ensure the schedule and collaboration.
4. Post-contact Contact after the delivery meeting is needed if there are plenty of treatments and/or options to consult or if the owner asks for it at the delivery meeting.

Third feedback meeting was also to sum up all the 13 cases. Main points to be documented in the instructions and the segmentation were discussed. The proposal for instructions is in Table 4. It appeared that the segmentation was not serving its purposes in practice. Along with the characteristics of the owner, the quality of the forest was meaningful for the participating planner when choosing the ways and means of extension. Following this line of thought, a table to help choosing the extension model was discussed and sketched (Table 5).

The overall ideas of developing the extension practice and instructions were presented at a training meeting for all the planners of one Forestry Centre. The actors' feedback revealed that suggestions were worthwhile and there was lot of discussion among planners about the instructions as well as their own experiences. Main criticism was towards time resources. Planning area is strongly guiding the planner's work and there should be more resources for more customer-oriented extension work.

Table 5: *A preliminary suggestion to guide the selection of the extension model. The colours refer to the site of the extension meeting: in forest (light green), indoors (light turquoise), both milieus (aqua).*

Features of the forest owner and the forest	**Owners getting to know their forest** (rough estimate about 10 % of owners)	**Owners somewhat familiar with their forest** (rough estimate about 80 % of owners)	**Owners knowing their forest very well, having some special needs** (rough estimate about 10 % of owners)
Well-managed forest and/or clear structure of forest	A field trip concentrating on the basics of forestry	An extension discussion indoors	Comparing alternatives when compiling the plan at computer/indoors
Forest having some sites to take care of and/or some alternative treatments available	A field trip concentrating on motivating the owner on silviculture	A field trip to sites that the planner finds important	A field trip to sites that the owner finds important and discussion concerning compiling the plan
Forest having many sites to take care of and/or a lot of alternative treatments available	A field trip including discussion and motivating delivery meeting	A field trip to sites the planner finds important and activating delivery meeting	Interactive producing of alternative treatment schedules and deciding upon the best plan

4 CONCLUSIONS

The interactive design-based process was fruitful to improve the forestry extension instructions. Firstly, the essential invisible good practices were included in the instructions. Secondly, the shared reflecting of data in the feedback meetings yielded new ideas for improving the process. Third, the positive experience of the improvement steps (mailed draft, checklist) made the planner learn and commit himself to the enhanced practice. Even the minor changes in practice may be essential for improvement. However, it is noticeable that large-scale implementation of the new instructions needs further investigation. There are still interesting research questions to be studied about communication and mutual learning in forestry consultation meetings. DBR or related multidisciplinary research of authentic practice enhances communication between scholars and practitioners and hastens the technology transfer from science to practice.

In this study, only one planner participated as a developing actor. This may have biased some of the experiences and feedback. In further development, the instructions should be tested and improved with a group of planners, which may open the scene for more diverse experiences and also more critical feedback. In addition to specialists of forest planning and educational technology, the research team would benefit from expertise of communication sciences and social psychology.

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An assessment of farm timber value chains in Mount Kenya area, Kenya: lessons learnt and best practices recommended

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Abstract

This paper describes and analyses a sample of value chains of timber sourced from farms in the Mount Kenya area. The research was undertaken in the early 2000s, and the sample of 48 value chains was drawn from a census of 252 businesses in the geographic area. The research methodology and survey tool draw from the methodology of "filiere" analysis. The survey tool includes the technical dimension, (conversion rates and efficiency), the institutional dimension (the identification of direct and indirect actors), and the economic dimension (value added at each stage of the chain). The interviewee was the end user, the timber yard owner or furniture maker. Eight distinct processing stages (possible actions) were identified in the various value chains described by the survey from the farm to the respondent/end user. Chains varied as to how they combined or amalgamated these different stages. Adequate data enable a detailed analysis of 17 of those chains working with *Grevillea robusta*. In this paper comparisons are made between the form and structure of the chains. Suggestions to raise farmer' returns and enhance value chain efficiency are made. These two objectives are not necessarily mutually incompatible. The technical dimension of the farm timber value chains, conversion rates and efficiency are key elements in overall returns and value added. As a result of this research ICRAF has initiated training activities addressing skills upgrading in the handling and processing of farm-produced timber. Future possible scenarios of on farm timber production and conditions required for their viability are presented.

Key words: timber value, Kenya
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1 INTRODUCTION

Wood product markets as incentives for farmers' tree growing have been documented in the global literature for some time (Arnold and Dewees 1997). Arnold (1987) argued that under particular conditions, as farm size declines, production objectives can change from the growing of food to the generation of income, and that the incorporation of trees into farming systems is often a response to this change in production objectives. Farmer's decisions about tree growing are found to be influenced by the advantages to be obtained from them. Important products and services obtained include products such as fruit, timber, fuel, medicine and fodder for home consumption and for sale. Farmers also appreciate the presence of trees in controlling exposure to risk, and in improving the sustainability of the system (Shepherd 1989; Warner 1997).

In the late 1990s tree planting on farms in East Africa was documented (Tyndall 1996, Warner 1997),as providing a range of services such as protection against wind and soil erosion, and to enhance soil fertility, as well as to provide fuelwood and fruit for family consumption. It was noted then that market demand was becoming a "subsidiary factor" encouraging the growing of trees, especially for fruit and poles (Tyndall, 1996). Warner (1997) noted that market influence among tree growers is likely to increase as access to markets improves, as farmers become more aware of income possibilities and as off-farm tree stocks either become more depleted or less accessible due to conservation measures. Moreover, demand for tree products is increasing as population and income increases. It was noted that "government policies were beginning to focus on the small farm as the producer of tree products for the nation, rather than the large commercial plantations or national forest reserves".(Warner, 1997). Dove (1997) documents the shift in tree cover from forests to farms in Pakistan.

In the context of Kenya, Dewees and Saxena (1997) indicated that tree growing may be an attractive land use to those households which have problems of either capital or labour availability. Trees require low levels of capital to establish and maintain, and can provide income for households which might otherwise be excluded from growing cash crops because of lack of access to investment capital, or lack of labour to cultivate more intensive crops. Unlike virtually any other crop, trees can be harvested whenever the household needs for cash are the greatest. Dewees and Saxena (1997) documented an array of land, labour and capital interactions at household level that affect tree planting, and noted that many of those interactions are exogenous to rural afforestation policy and planning processes, and that consequently forest departments and other agencies with rural forestry responsibilities are often entirely unable to influence the most significant factors which bring about the adoption of tree planting practices on farms.

Tropical timber production statistics have in the past only referred to the productivity of pure tree plantation and natural forests (FAO 1999). Nevertheless, in the case of some valuable timber species such as *Cordia Alliodora* in Latin America, a high percentage of the harvested volumes comes from farms, usually from agroforestry systems such as association with pastures, or with perennial crops such as coffee (*Coffea spp*) or cacao (*Theobroma cacao*). However, coffee or cocoa yield reductions, due to competition from trees (light, water, nutrients) (Beer at al 1998) limits the number of mature timber trees to less than 100 per ha. Overall, the potential of agroforestry systems for sustainable land use has long been recognised, but their potential to produce commercial timber has only been reported in a few cases. (Beer et al, 2002) Even fewer cases deal with the industries, often small-scale themselves, that buy timber from farmers

The supply and demand conditions causing increases in smallholder wood production and marketing described above are very much evident in Kenya. In Kenya, due to the enforcement of a logging ban on the forest estate in late 1990s, and the subsequent change in the state of conservation of Mt Kenya forests (Kenya Wildlife Service, 2003), the situation where the farm estate became the primary supplier of timber and poles was reached a number of years earlier than the date predicted (2010) by the Kenya Master Plan (1994).

This research described in this paper undertaken in the early 2000s captures the moment of transition from when the bulk of timber and wood products were sourced from the forest estate and to the period when it was sourced from the agricultural and farm landscapes. Industry and farmers were ill prepared for this sudden and unanticipated transition. By the time this research was undertaken many of the larger mills had closed due to lack of timber from the forests[4]. The research documents the ad hoc market chains that emerged at the time, sourcing timber from the farm estate to the surviving businesses.

The objective of the research is to (1) assess the technical, economic and institutional aspects of those market chains, (2) describe the characteristics of those market chains that provide the best returns to the farmer, and those that provide the best added value

4 One East African Asian operator who took part in the early phases of the research described how the mill he was operating had been in his family since pre-colonial days, and had been operating for nearly 100 years. During the research period his mill was obliged to close due to lack of raw material from forests and plantations, and difficulties in sourcing from farms.

to the business purchasing the wood, usually a furniture maker or a timber yard owner, and (3) assess problems and opportunities for improving the performance of the chains such that smallholders and other market actors can achieve greater benefits. Recommendations both for future research and development programme implementation are made.

2 CONCEPTUAL FRAMEWORK AND RESEARCH HYPOTHESES: BACKGROUND TO THE FILIERE APPROACH, ITS THEORETICAL FOUNDATIONS, OBJECTIVES AND COMPONENTS

Bernstein (1996)[5] in the introduction to his paper notes that the original inspiration of the *filiere* approach (in French industrial economics) was to uncover and analyse price information in the journey of a commodity from raw material to final product, through its various stages of physical transformation (processing, manufacturing), transport, storage and so on. As in the farm timber *chain de*scribed in this paper, this is often expressed as the distribution of the value added of the final product among various activities (and agents) that contributed to its production and realisation. Bernstein combined the *filiere* approach as a research tool with the analysis of social relations and institutions that structure economic life and markets. "In short, a form of analysis informed by political economy (rather than a conventional economics premised on the maximising behaviour of individual agents in ideally competitive markets)" (Bernstein 1996). Drawing on Freud and Dabat's methodology (2000), we assess in this paper a series of farm timber chains in light of their institutional (direct and indirect actors) economic and technical characteristics. Schematics of the chains discussed are included.

Finally, whether and how there are aspects of the functioning and regulation of any given *filiere* that can only be grasped by considering it as a whole, within its broader context.

3 THE HYPOTHESIS OF THE RESEARCH WERE THAT

1. That the *filieres* for sourcing timber from farms are inefficient. Institutional, economic and technical efficiency can be improved, in order to increase returns to actors along the chain and to promote sustainable timber harvesting.

2. That different business categories and chain structures pay farmers different rates per Bf of standing timber. The research seeks to identify which chain structures have highest added value and why.

5 Bernstein, H (1996). The political economy of the maize "*filiere*". *Journal of Peasant Studies Vol 23 no2/3*

3. That communication is poor between farmers and business and that neither understand the others needs.

4. Policies issued by government ministries and local administration with regard to farm timber production lack clarity and in particular are a disincentive to farmers who may consider investing in planting indigenous species. Government policies towards the harvesting and transport of trees grown on farm skew planting towards exotic species.

4 DESCRIPTION OF RESEARCH AREA:

The research area corresponded to the eastern slopes of Mount Kenya. Ecological zones correspond to the gradient of the mountain slopes and its low lying areas: the tea and coffee zones and the the cotton and tobacco zones on the lower gradients. The indigenous species in the mountainous forest are predominately: *Hagenia abyssinica, Juniperus procera, Prunus africana and Vitex kiniensis.* The species in the government plantation estates were *Cupressus lusitanica, Pinus patula, Pinus radiata* and *Eucalyptus* species. At the time of the research the tea zone did not grow trees for curing but relied on supplies from the forest plantation estate. The research was conducted in the agricultural zones where trees were grown in large numbers on farms, these were predominantly the coffee, cotton and tobacco zones. Farm sizes range from 0.4 ha to 0.8 has and are privately owner occupied.(Meru Central District office).

The volumes of trees on farms in the 1990s and early 2000s were largely as a result of social forestry programmes in the 1980s (Shepherd, 1989). During those years, the functional uses of trees were promoted and emphasised.: e.g. soil and water conservation, coffee shading, soil fertility and mulching, firewood for domestic consumption, as well as for compound shade and ornamental decoration. The predominant species planted by farmers, mostly along boundaries, and that was compatible with other agricultural crops (e.g. maize) was *Grevillea robusta* with 76 stems per ha, (Tyndall 1996*)* 155 different species of high value trees have been recorded on farm (Betser et al 1999), with a significant retention of indigenous trees on farm including *Cordia abyssinica, Vitex kiniensis* and *Prunus Africana*. As farm grown trees are often used for both timber and firewood, there are household and gender decision making interfaces between domestic use of trees for firewood (women), and trees used for sale as commercial firewood and timber (men), and the subsequent influences affecting the volume of farm sourced timber available to the market.

5 METHODS

5.1 BUSINESS CENSUS, AND DESIGN OF SAMPLE OF BUSINESSES AND THEIR FILIERE/VALUE CHAINS

Business census

At the outset of this research it was not known how many timber businesses existed in the research area, nor their location, types or principal characteristics. The authors therefore conducted a census of the timber businesses working with timber in the research area. The census enabled the quantification, characterization and description of the timber businesses in the region, and took a period of two months in 2000. Two hundred and forty six (246) businesses were located and identified, and some initial data collected from them. For each of these businesses the following principle characteristics were recorded:

- location;
- the principle activity (type) and size of business;
- tree species utilized and preferred;
- stock of timber and of finished products;
- customers;
- and trends over the last five years or so noted by the respondent in raw material sourcing and product demand.
- size of business was determined by level of capital investment (machinery) and number of employees.

As a result of the census eleven different types of timber related business were identified. Principle among these were (number of each category of business identified during the census, in brackets): sawmills (14); timber yards (30); furniture workshops (168); joinery – doors, window frames etc.(10); furniture show rooms (11); machine shops(2); piece work to order (7); and other (9). This census took place after the closure of the principle sawmills which had been reliant on supply of raw materials from government plantation estate. This was evident in the census results, where no large sawmills or timber yards were identified in the course of the census.

Business sample

The business census enabled the formulation of a stratified sample for further analysis of the supply chains to the businesses. Three parameters were chosen to enable selection of the next stage of the sample: these were;

- type of business;
- size of business (capital investment and number of employees) and
- location of raw material sourcing prior to the logging ban:
- farm; indigenous forest; plantation; and mixed/multiple-sourcing.

Out of the total 246 businesses recorded in the census, a spread of business categories and sizes corresponding to between 15 – 20% from each of the categories of raw material sourcing were selected. The resultant sample structure pertaining to the category of location of raw material sourcing prior to the logging ban emerged as:

- Farm sourcing (7) Forest sourcing (13) Plantation sourcing (7) and Mixed sourcing (14).

This provided a total sample of 43 businesses, equivalent to 20% of the total businesses that were censused. In-depth interviews of these businesses were conducted using a timber business and supply chain questionnaire.

5.2 BUSINESS AND FILIERE/VALUE CHAIN QUESTIONNAIRE DESIGN AND PRE-TEST

The questionnaire used to interview the businesses was developed according to the theory and principles (Bernstein, 1996) of the "*filiere"* approach described in the training modules and field handbooks of Freud and Dabat (2000) Bourgeois and Herrara (1998) respectively (see Box 1).

The core of the questionnaire was designed to gather data of the different stages of the farm timber chains supplying the sampled businesses. A section on business practices was included to enable the comparison of the profitability and sustainability of businesses sourcing timber from farms. The questionnaire also included an open discussion section which allowed for comments on institutional constraints and opportunities as perceived by the respondent.

The *filiere q*uestionnaire originally developed for this research had a standard set of questions concerning technical, institutional and economic aspects for each stage of the supply chain, as had been identified in a preliminary exploratory study by Opanga (2001): **farms**, **primary processing, retailing** and **secondary processing**, and **customer.** However, due to the variety of actors and the complexities of the chains identified during the pre-test, this was found to be unworkable. During the pre-test the homogenous groups of direct actors involved in the supply chains from the farms were identified as:

- **power-saw operators** (felling, cutting crosscutting and in some cases splitting),
- **mobile saw benches** (splitting on site, splitting in town, splitting service)
- **transporters** (loading, off loading, volume and distance of load)
- **saw-millers**, (volume split per week of own sourced and purchased timber; volume of splitting service; side products (off cuts; firewood)
- **timber yards** (volumes incoming, split and out going)
- **furniture workshops**,(incoming volume of raw materials; volume of material per product; no of products sold),
- **customer characterization** (destination, distance, age, econ status, gender, life cycle status, education)

The pre-test enabled the development of a questionnaire with greater specificity for each stage of the timber supply chain. .The pre-test results also indicated the existence of varying degrees of vertical integration[6], with some chains conducting the whole sourcing procedure directly, others subcontracting each stage, with a full range of combinations and options in between. The survey tool/questionnaire therefore had to be flexible enough to take into account these variations.

Board feet was the standard of measurement used to enable a standards of comparison of the product (timber) as it passed along the market chain. This was the approximate standard reference of measurement used by the timber businesses and their suppliers. However, not all actors involved in the supply chain, particularly farmers, power-saw operators or transporters, were familiar or conversant with these measurements. Literature review (Muchiri, 2001), commissioned studies (Box 2) and respondent verifications were conducted concurrently to enable accurate recording of volumes of timber at each stage of the chain. (Box 2)

The structure of the questionnaire also enabled the recording of seasonal variations and volumes of raw materials, sourced and purchased during different supply seasons of the previous year; and business income was estimated from volumes of sales of processed

6 some businesses were found to be combining power saw and mobile saw, and contracting transport; others were combining mobile saw bench and transport, but contracting for power saw operations and loading labour etc.

timber and finished products. It was found that raw material sourcing and sales (see results: Consumers p.x) vary from season and/or month during the year. Supply's fluctuate between high and low season depending on the meteorological season: dry seasons tending to avail higher supply as roads are more accessible and smallholder farmers are seeking cash between cropping seasons, whilst during the rainy season supply diminishes due to lack of accessibility to farms and the presence of standing crops making tree harvesting difficult.

Box 1: Adapted from: Assessment of sawn timber yields (recovery rates) of G. robusta from farmlands in Meru Central district, Kenya by James Oncheiku (2001)

Report enabled standardization of comparable volume measures between standing trees, stages within supply chains, and between supply chains.
For example:
A 32 dbh tree yields the following volume of timber:
Power saw unskilled manpower: 66 Bf
Power saw skilled manpower: 91 Bf

Mobile saw bench unskilled: 59.7 Bf
Mobile saw bench skilled: 103.6 Bf

Each calculation based on the conversion of a total number of nine logs, three logs from each of three trees, by skilled and unskilled operators. Results also demonstrated that an unskilled bench operator can do more damage with a more powerful and faster machine, than an unskilled operator of a power saw. A skilled operator of a mobile bench can virtually double the yield of timber of his unskilled counterparts.

Note: Oncheiku's study was conducted in m3, to enable the application of the results and comparison with the standard volume (board feet) used by those working in the timber trade in the research area his results were converted to board feet. Rates of conversion used between board feet and cubic metres: 1m3 = 423.764 board feet; 1 board foot = 0.002359743 m3; 12 board feet = 1 cubic foot; 35.3147 cu feet = 1 m3

The questionnaire gathered technical, institutional, financial and economic information for each stage of the chain. This enabled the calculation of the transfer price for a standard volume (Bf) of wood (timber) between stages, the net margins at each stage, and added value per standard volume along the supply chain.

6 RESULTS

Of the 43 business interviewed, 17 provided sufficient data to provide a full analysis of the stages of value chain from the farm to the respondent's business . The results are thus based primarily on these businesses. Some qualitative and observational data are from the remaining 21 respondents.

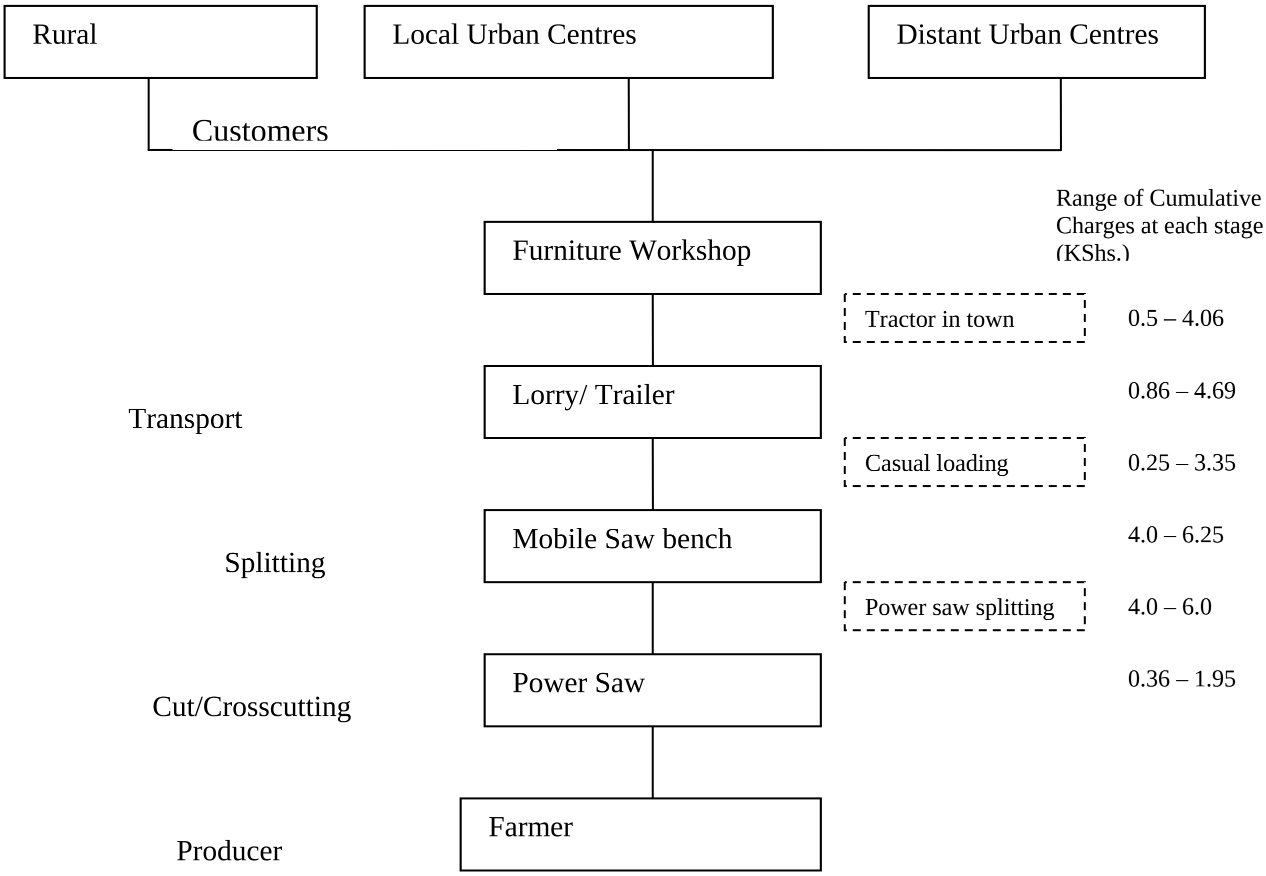
It is noted that full and complete results to the questionnaire were obtained from those businesses who had been, and continued to source from farms or were engaged in "mixed" sourcing. Those who had been sourcing from plantations and forests provided little or no information, perhaps because they were still sourcing wood illegally from these sources. The data presented and discussed below therefore reflect those businesses, who were sourcing from farms and functioning legally.

6.1 INSTITUTIONAL FACTORS

Direct actors were identified during the pre-test of the survey questionnaire (see above). These direct actors were predominantly young working age adult males. Occasionally women owned and coordinated the contracted transport. It was intended to characterise **customers** according to destination, distance, age, economic status, gender, life cycle status, education. However, the only information retained by the businesses was on destination/distance of the product sold.

Consumers were local rural residents, from local towns or from more distance urban centres. The general trend was for consumers from further afield to buy the more expensive (indigenous timber) items, whilst rural residents purchased the cheaper *Grevillea* furniture. Businesses with secure onward sales, either through furniture or construction timber contracts, had more efficient and coherent market chains from the farm than those which did not. It was noted that sales of products vary according to the time of year, for example: construction activities rise in August during annual period of school holidays and civil servant vacations; furniture sales rise in anticipation of festival and wedding seasons: notably when the bonus is paid to tea producers in December, for the Christmas period, and immediately after Ramadan. Demand for school furniture is higher in January at the start of the school year.

For an indicative structure of a market chain which had the highest added value, please refer Box 3. The range of charges paid by the 17 businesses for the principle alternative stages of the are also indicated. The dotted sections indicate either alternative or added stages, that were recorded. In the majority of cases, all direct stages of the "*filiere*" were owned, or contracted for, by the businesses interviewed. The standing tree was purchased on farm, and the timber and by products were owned by the business along the length of the processing chain. The range of farm gate prices paid per BF are indicated in box 4.



Box 3: Structure of market chain providing most added value.

Notes: Power saw, mobile saw bench an tractor in town were alternatives to splitting. Any one market chain would involve only one of these three alternatives. Casual labour loading was sometimes an additional charge to transport, sometimes it was included in the transport charge. Thus the predominant chains adding greatest value to the product are in bold, alternatives or additional stages are indicated by dotted lines. The charges indicate the amount paid for the activity at that stage of the chain. The farm gate price and the final price are not included in Box 3.

The indirect actors were the contracted transporters, agriculture and forestry extension services; the forest department and the local administration (chiefs' offices); the tea and tobacco industry; and the brokers. The forest department and chiefs' offices were responsible for issuing of felling and transport permits of trees from farms. According to the law these provisions only applied to indigenous trees, however the local administration was also applying these arbitrary permits to non-native trees which the farmers had planted. In addition to the costs of travelling to the designated forest department or chief's office, the farmers were often charged a fee for the issuing of a permit that was officially supposed to be issued without charge[7]. Transport permits were

7 The Meru timber pilot project addressed these concerns through a meeting of chiefs of Meru Central District: Njuguna, P. and Carsan, S. *Proceedings of the Forest Department, Chiefs and Farmers Representatives Seminar on Rules and Regulations Governing on Farm Timber Marketing and other Tree*

only applicable for transport beyond the district boundaries. Transport permits only applied to logs and split timber and did not apply to furniture (i.e. timber already converted to furniture). This created a visual anomaly in the survey area, in that though no indigenous timber was on view for sale on the road side, furniture made from indigenous timber was visibly displayed and readily available for purchase.

There existed brokers between the business and the farmers. Some of the brokers were freelance, others were employees of timber businesses, sometimes the business owner conducted this service himself. Due to the difficulty in locating timber for sale on farm, or knowing exactly which farmers had harvestable trees of sufficient quantity, to fill a lorry or tractor load and were willing to sell, brokers played the role of "scout". They would identify groups of farmers in an area, that combined had sufficient quantity of timber to sell to warrant the displacement of transport; negotiate the price and generally "set up the deal" for the business. At no point do brokers handle cash, purchase or own the timber, their role was more that of a service. The research did not interview any brokers directly, and did not establish how either the freelance or business employee brokers were compensated for their work. Scouting for supply and the identification of trees for sale in adjacent farms for the purposes of facilitating group transport, if not conducted, could create a technical bottleneck to the *filiere.* Contrary to the concept of the "undesirable middleman", the role of the broker, and his/her likely impact on enhancing efficiency of the *filiere*, would be something useful to verify through some additional targeted focus group interviews.

Sawmillers associations did exist, but the members had tended to be the larger sawmills who had been sourcing from plantations and forests, and which were in the process of closing down at the time of this survey. Small and medium enterprises were at that time not associated.

6.2 TECHNICAL

6.2.1 Technical

In a quantitative assessment of sawn timber yields Onchieku (2002) found that that a "skilled operator of a mobile bench can double yields". Oncheiku's (2002) field research demonstrated that an unskilled power saw operator was 27% less efficient than a skilled power operator, and an unskilled sawbench operator can generate considerable more waste, being 42% less efficient than a skilled saw bench operator. As the tree and its

Products in Meru Central District.(An activity of the Meru Timber Marketing Programme-FAN/ICRAF/MARD). n.p., 29th March 2001 products are owned the length of the "*filiere*" by the business, the business also carries any losses from poor conversion. It is in the business's interest to improve technical efficiency and conversion rates by both power-saws and tractor mounted bench saws, operating on farm and in town.

In a qualitative sense, many trees both indigenous and exotic had been managed for multiple purposes, pollarded at odd heights and angles, with knots prevalent. Trees, which with better management towards timber as a product, may have been able to provide three logs, only provided one. Timber yields from trees can be improved through better farmer information and training in market and business (sawmillers) expectations. However, farmers may still decide, or be obliged, to manage their trees for multiple household needs.

The data demonstrates that the highest value added per Bf (the difference between price paid to the farmer and the price at which the final processed timber was sold) were with those businesses which had their own transport and which were processing timber using a tractor mounted saw (saw-bench) in town, or processed with a tractor saw-bench on farm. The choice of the equipment and operator used was usually made by the business buying the timber. In some *filiere* both the power-saw and bench are owned by the business, in others one or both stages are procured by contract. In some cases the contracted power-saw operator would in turn have rented the power-saw for the assignment. Power-saws were generally poorly used, and maintained, leading to low conversion rates.

6.2.2 Economic

The range of total sales to businesses was Ksh 414,000 to Ksh 2,748,000 annually depending on type, size, location business practices and market catchment. …

Box 4: The average farm gate price per board foot standing tree: Ksh.

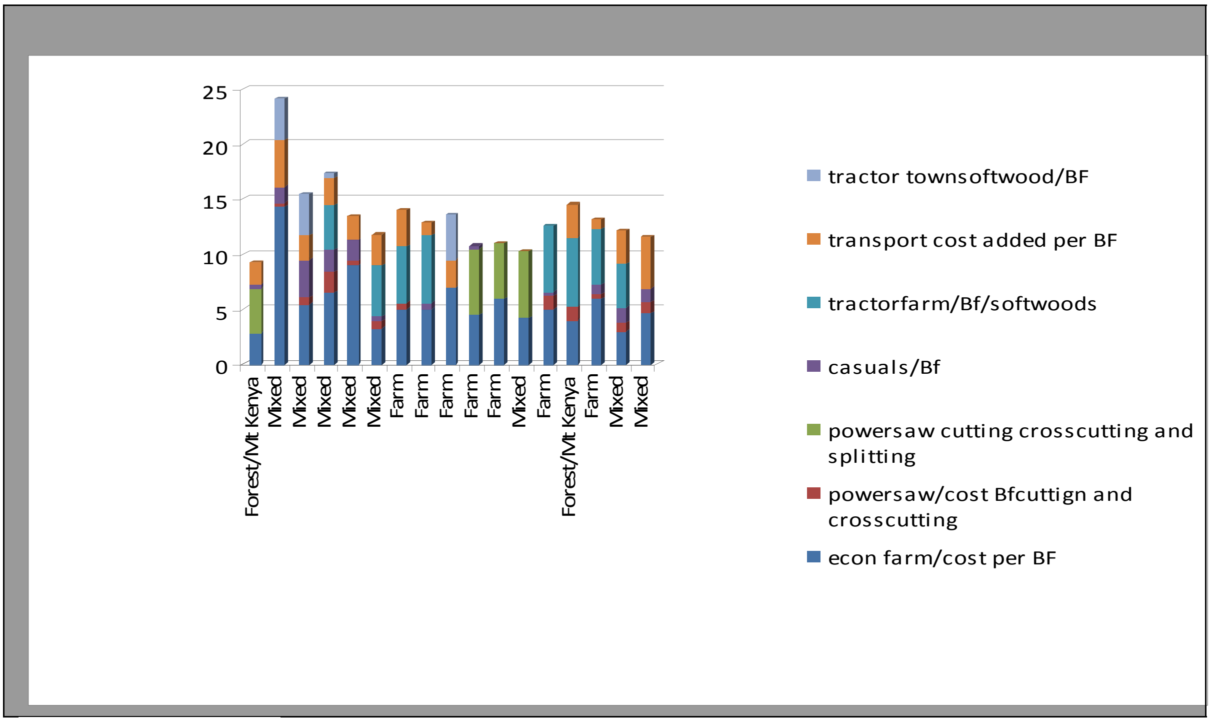
Grevillea robusta Range of prices: 4.45 BF to 10.36 Average price: 5.64 per BF
Average price paid for *Grevillea robusta* by furniture business: 6.42 Ksh per Bf
Average price paid for *Grevillea robusta* by timber yard businesses: 4.94 Ksh per bf

Cordia abyssinica ave price 7.34 bf
Cupressus lusitanica: ave price 9.71 Bf

Furniture business pay more per board foot than timber yards as they are both seeking out better quality timber and with a more finished end product in mind are able to offer better prices. Overall the quality of management of tree will affect the price paid. From open discussions with the business managers, a second factor was if the business had a specific and secure order to meet (e.g. school furniture), the business was willing to pay more to obtain the trees to meet that order.

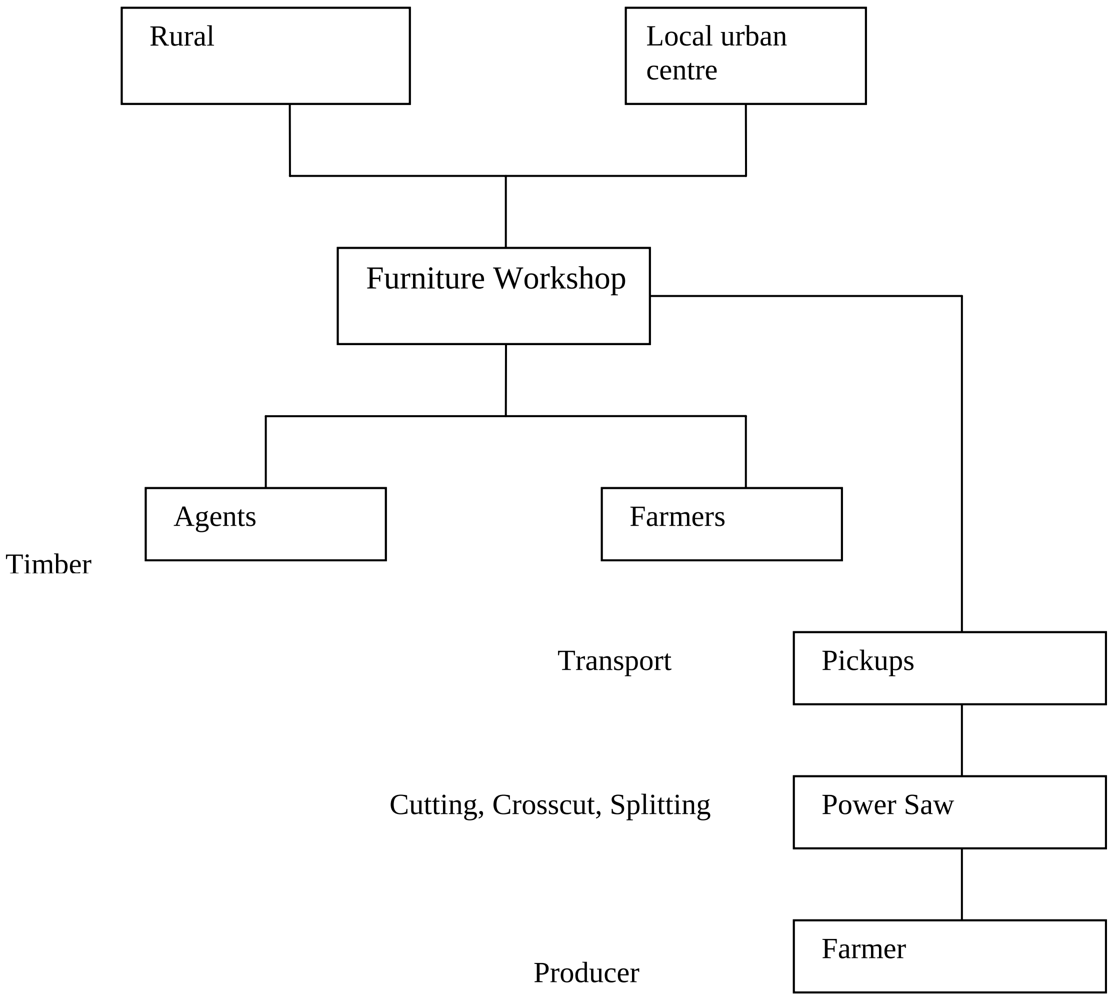
Box 5 presents the proportion of added value for each stage of the chain. The principal comparisons are between splitting with powersaw, mobile (tractor mounted saw bench or a tractor in town. The power saw is evidently the least efficient (Oncheiku 2002), and most expensive method of converting beams to timber The anomalies between the prices charged for tractors in town and the mobile saw bench on farm, are most likely to be linked to the level of supervision and technical expertise of regularly employed staff using the tractor mounted bench in town. There was also informal evidence of “leakage” by the tractor teams working on farms, of certain quantities of timber which could account for the greater costs incurred for conversion per Bf. Tractor teams on farms are less closely monitored and supervised than tractor teams in town. The technical competence) of the team converting the timber, as well as the level of monitoring and supervision are crucial to the economic efficiency and greater timber yields of the chain

Box 5: Bar chart of added value at each stage of 17 chains analysed



Note: Y axis – Ksh per Bf
X axis: former source of wood
Note: econ farm = farm gate price for *Grevillea robusta*

The data and results from the structure of the market chains demonstrated that the more integrated the chain in terms of ownership (please refer box 3), the higher the total added value per Bf. The chain such as that described in Box 6 proved to be ineffective on several counts. It was evident that businesses which were sourcing with this combined agent and farm market chain structure were continuing to source illegally from the forest. The procurement from forest was intermittent and insecure, and no real system from farms was in place. Businesses with weak institutional arrangements (powersaw splitting, poor transport bulking arrangements) as presented in the market chain structure in box 7, had the greatest wastage and lowest added value to timber procured from farms.



Box 6: Inefficient market chain

6.3 SUMMARY OF RESULTS

The common factor of those value chains providing greatest returns to farmers, were those chains where the farmers' timber was sought out by the businesses. They were not chains initiated by the farmers. The external business paid for and brought in power saws, mobile benches or transport to town for splitting. In all cases the initial halving or crosscutting of trees was done by power saw on the farm. The businesses purchasing the timber had onward customers, either via timber sales, their own or another furniture shop. (Box 3.) Field observations indicate that the businesses were buying timber, either from one farm or from a group of farms in close proximity, to complete a tractor or lorry load at one time, thus effecting a level of transport efficiency. Key factors in market chain efficiency were therefore: skilled (as against unskilled) conversion; transport efficiency, and onward customers. All these aspects, whilst assisting the business, also provided the farmer with better per Bf standing timber prices.

By contrast those farmers who were paid the least for their timber, were those who sought out businesses to buy their timbers. In these cases the business were often small, the only transport being either the business or farmers bicycle….on which a single tree was ferried from the farm to the business Typically, the value chain (box 6) only comprised the farmer and the power-saw operator; or farmer, power-saw operator and hired transport. In the value chains paying less per Bf to the farmer, there was no professional processing or sawmilling undertaken. Conversion was solely by power saw, either at the farm or on the site of the furniture shop. Farmers seeking a market for a single tree were at a disadvantage. These were often however, precisely the farmers in a desperate situation requiring to sell a tree for cash to pay costs of a medical emergency, school fees, or arrears on land payments. Small scale furniture businesses without capital investment to produce good quality furniture are also not in the position to offer good prices to farmers for raw material.

Box 7: Results of focus group discussions with a group of farmers and a group of sawmillers:

In July 1999 a focus group discussion was held with a group of farmers and a group of sawmillers in Meru. The notes from these discussions act as a triangulation to the data, field observations and conclusions drawn from the analysis of the 17 value chains in the earlier section of this paper. *Each group were asked to identify the current problems and possible opportunities and solutions to the situation they were facing subsequent to the recently introduced forest logging ban.*
The problems identified by farmers were:

- prices of tree offered were very low;
- lack of tree valuation techniques;
- small farm size meant low tree holding capacity;
- conflicts with neighbours during felling;
- chiefs and forester permits to fell trees;

- poor tree management for the end purpose of timber production,
- wrong practises of pruning, lopping and pollarding;
- lack of tending knowledge (water, pest and disease);
- farmers only sell trees when they are "desperate";
- lack of information on wood utilization options;
- family conflict with regard to tree ownership[8];
- planting location affects value…places that are difficult to harvest, either steep slopes or near buildings affects the price paid,
- transportation of harvested trees.

Solutions proposed by the farmers include:

- prices are better than when saw-millers come to the farms than vice versa;
- the forest department or extensions services to provide guidelines and techniques on volume estimation so that farmers may calculate prices more effectively;
- farmers to form association or society to facilitate market linkages;
- information on commercial and forest department prices to be made available to farmers;
- information was requested on techniques of tree management, species thinning, pruning etc for timber production;
- farmers to solve family conflict and the ownership of trees on their farms;
- agreements with saw-millers as to any damages done to properties e.g. house.
- Once price agreed farmers could commit to felling and bringing logs to a collection points accessible by lorry or tractor. This would not only share transportation costs, but would limit the liability experienced by saw-millers of felling trees near houses or amongst standing crops.

Sawmillers in their focus group noted that:
In general saw-millers had more information than farmers on the valuation of timber trees. The key issues they raised were:
There are problems acquiring logs/trees from farms, both the actual logging and the road network.
There is a need to improve output efficiency; saw-millers estimated recovery rates to be as low as 20%.
There is a need for guaranteed sustainable supply. Current situation leads to outdated machinery (low capital investment) and poor recovery rates. Identify possible avenue for value adding on farm timber (certification as fair trade?). *Grevillea* timber is low in demand due to its "floury" quality and susceptibility to insect attack; Information on better utilisation of *Grevillea* is available in research offices, but needs to be disseminated. Knowledge of existing supply and location of trees/logs on farm is required. For saw-millers used to harvesting allocated blocks from plantations or selective felling in forests, information on supply for farms appears scanty[9].
Saw-millers expressed an interest in training techniques to improve quality during processing; enhanced valuation techniques for more accurate pricing; a more precise idea of end-user requirements, and to explore possibility of cost sharing and linkages between farmers (associations) in addressing transport problems. Possible entry points through already existing

8 this can be either between generations… a father can sell all the trees on a portion of the land before handing it over to his son…or between genders in the same household…the women may have ear marked the tree for domestic firewood or animal fodder. See also World Bank / IFAD / FAO (2008).
9 this request has been partially addressed in subsequent research work: pls refer Holding Anyonge, Carsan and Njuguna 2005 Assessing farm tree supply in Meru. Smallholder timber and firewood marketing in the coffee and cotton/tobacco zones of eastern Mount Kenya

local institutions were mentioned as saw millers associations; soil and water catchment committees, men's water groups[10].

7 DISCUSSION

In an associated biomass and household decision making survey (Holding Anyonge, Carsan and Njuguna 2006) an average number of stems per hectare between the cotton zone (76.96 timber trees per ha) and coffee zone (154.98 stems per ha) was 92.79 stems/ha. The survey noted that almost twice as many trees are sold per household as are felled for domestic use. In the coffee zone: total trees per household felled on average during a period of two years were 58, of which 34 or 58.6% are sold and 24 or 41.4% are for domestic use, whereas in the cotton zone: total trees per household felled on average during a period of two years were 76, of which 52 or 68.4% are sold and 31.6% were for domestic use. Proportionally more trees are sold per household in the cotton zone. The study also noted a shift in choice of planting niches towards boundary planting and woodlots. Thirty species, the majority of them indigenous were indicated by farmers as preferred species for firewood and charcoal. Direct income requirements would be best met by *Grevillea, Eucalypts* and *Cassia siamea*. However, indigenous species such as *Cordia africana* and *Vitex keniensis* are highly valued and evidence strong retention on farm. In this survey an emerging concentration on a narrow range of fast growing exotic species to meet commercial timber and firewood demands was noted. It was also noted that given felling rates reported by trees/volume per ha per year, actual volumes, MAI (mean annual increment) and current planting rates, it was estimated that the yield of trees from farm for firewood and timber would suffice for another three years only.

In a report commissioned by MKEPP in 2008, of a comparable cross section of agro-ecological zones and communities indicated that farmers still continue to plant trees, with 92% of respondents saying they had planted a tree in the last four years. The highest frequency was 20-50 trees (18%), 100-200 trees (16%) and 10 – 20 trees (15%) of respondents. The main uses for trees were recorded as firewood (93%), fruits (79%), timber (78%), poles (64%) charcoal (43%), fodder (28%), herbs (20%), amenity (8%) and honey (5%). There was an average number of 96 trees per hectare over the five catchments surveyed. The MKEPP report also noted that communities are currently using the "standing wood stock" instead of the "interest" and hence no sustainability in harvesting practices. Massive tree planting was recommended. There is however some

10 Note: various types of women's groups, that do exist in the research area, were not mentioned during the focus group discussions; possibly due to low representation of women in these two focus groups, and the gender bias towards men in the commercialization of firewood and the trading of timber.

discrepancy in the recommendations of this report, as the number of stems per ha in a coffee agroforestry systems, to avoid excessive competition with light, water and nutrients should not exceeds 100 stems pr ha (Beer 1998). According to the results of the biomass studies farmers are maintaining close to the maximum number of trees feasible per ha to avoid excessive competition with other farm enterprises. One should recognise the limits to tree planting vis a vis the compatibility with and productivity of other crops in the farming system.

It is evident that since the late 1980s, early 90s as documented in the opening paragraphs of this paper the gradual trend from the service (soil and water conservation) and subsistence characteristics (fruits and firewood) of agroforestry to increasingly commercial components. Amongst these timber and poles have taken a position of increasing importance. Fuelwood is also an increasingly important commercial product. There are several reason for this: it is a by-product of virtually all tree species found on farm, there are less stringent management requirements, there are no harvesting or transport restrictions and there are ready markets in the tea, tobacco industries and catering businesses in the local urban centres. Firewood as a commercial product is of primary interest to farmers.

With regard to the research hypotheses laid out at the beginning of this paper:

- Farmers were not paid market rates for their trees due to a combination of factors: poor management and quality of the timber (pollarding, knots etc.), poor processing and conversion practices, linked to which are weak prices offered by businesses, and lack of pricing and technical knowledge by farmers to enable them to both manage trees for specific products and markets and negotiate prices. Thus, though in theory trees for timber could provide an additional income to farmers, they did not yield the volume nor the price that professionals either in agroforestry or farm forestry may have anticipated.
- The research demonstrated the *ad hoc* nature of the *market chain*, with no two *filiere* being the same, and has through quantitative analysis and qualitative description, as well as accompanying commissioned studies, demonstrated the ways in which these *filiere* can be improved in terms of institutional, economic and technical efficiencies (please refer recommendations below for further details)
- It was shown that furniture businesses pay farmers more Ksh per Bf of standing timber (in this case *Grevillea robusta*) than timber yards or sawmills.

- The structure of the value chains between furniture and timber businesses are virtually the same, with no recorded distinctions between key stages or components of the value chains. Factors contributing to variability in the chains of the three business types, and either contributing to, or detracting from the efficiency of the chains, were similar.
- The key factor in the efficiency of the chains was management and supervision along the length of the chain from the procurement on farm to the business. In the situation at the time the field data and observations were collected, this was best achieved if the business managed and supervised the length of the chain, ownership of the individual stages did not appear to be necessary.
- Illegal harvesting continues to distort market chains. Some businesses continue to use agents to obtain materials from the forests or plantations. Businesses, both furniture and timber yards and sawmills, that sourced form a variety of sources had less efficient value chains. They also paid farmers less for their standing timber. They may have had greater returns to their business as a result of working with illegally harvested indigenous timbers, however no data is available on that aspect of the businesses. The most technical, economic efficient chains, as well as those that paid the farmer more per Bf of standing timber (regardless if they were furniture or timber yard or sawmills) were those sourcing entirely from farm. To support farmers in the timber business, and enhance chain efficiency, greater controls on the harvesting and handling of illegal timber are required.
- Farmers will gain better returns through enhanced knowledge in tree management and prices for their standing timber. (box 7).

To optimise returns to planted trees several specific actions are required.

- Farmers growing trees with a view to marketing timber and/or firewood, to form farm forest or family forest associations for better access to technical (species selection, management, policy and pricing information on their tree products). With greater knowledge and capital, farmers associations may gradually own and manage more stages of the market chain and eventually manage their timber processing businesses.
- Selection of species (including indigenous species) and planting sites on farm to enable the management of the growing tree to meet those markets (Holding Anyonge and Roshetko, 2003). Encouragement of planting of indigenous species,

to reduce poverty, retain farm biodiversity and meet market demand for quality timber. Treatment and promotion of *Grevillea robusta* as a timber for furniture.

- Training of power saw and saw bench operators to improve processing and conversion rates emerged as a core element to improve all the technical and economic efficiency of the market chain. Enhanced efficiency and greater yields would also increase the price paid to farmers. The World Agroforestry Centre and its partners in the research have already started these trainings (Pasiecznik, 2006), however it is recommended that these trainings need to be conducted on a far wider and more systematic scale of operations. Possibly through saw-millers' associations. Greater supervision by business owners of mobile saw bench crews on farm is required.
- Farmers timber and firewood associations, would beneficially include a proportion of women in decision making capacities to ensure gender conscious representation and monitoring in decision making. This is so as to avoid cases such as those where trees on the farm are sold, and women are forced to a monetised market to procure fuelwood for cooking at home.
- Enforcement of existing laws on illegal harvesting from forests and plantations is required. Aa review of those laws associated with the harvesting and transport of trees, timber and furniture is also necessary[11]. A revision of the law to include initiatives such as franking of indigenous timber grown on farm would encourage farmers to grow more indigenous species. To avoid exploitation of farmers by unscrupulous officials, planting of indigenous trees to meet the demands of the local and national timber market, reduce poverty, enhance rural livelihoods and retain biodiversity would only succeed if accompanied by empowerment of farmers and local representative institutions.
- Payments to smallholder farmers in the tropics for stored carbon in their soils and trees is a component of development policies and programmes. Growing timber can be a complementary activity and income, to payments made to farmers in association with planting trees under carbon schemes.

Given the increased protection and focus on service provision, including carbon sequestration of natural forests, farms may have an increasing role in the future in providing those tree and wood products previously provided by forests (The Economist,

11 "Perhaps the most important thing which could be done to support farmer tree cultivation and management would be to remove any institutional blockages (sale and transport of trees) which prevent farmers from freely exercising their talents" Gilmour 1997.

2009).A global satellite survey by Zumar et al (2009) demonstrated that almost half of all farmed landscapes worldwide include significant tree cover. This is the first survey to quantify the extent to which trees are a vital part of agricultural production in all regions of the world. It reveals that on more than 1 billion hectares – which make up 46% of the worlds farmlands and are home to half a billion people – tree cover exceeds 10 per cent. From the satellite maps this is especially evident in the Indian subcontinent, eastern and southern Africa, the sudano - sahelian belt running from West to East Africa, most of continental Europe, central and eastern United States, Central America, Eastern and NE Brazil. In precise figures 10 million square kms of agricultural land have at least 10 per cent tree cover.

The tenure of the land, as well as the tenure of the tree and its products are crucial elements in the planning and decision making of small-scale forestry and agroforestry in the tropics (Gilmour, 1997; Franzel, 2001; World Bank, FAO, IFAD 2008). A complementary step to this survey would be to verify to what extent the trees planted and managed by farmers and farm foresters are on communal land, and to which extent the trees recorded are on private land.

The fastest growing demand for wood products is in the domestic markets of developing countries. These markets could offer significant economic opportunities for small scale agroforestry producers(Scherr,2004). Bertemeu (2008) and Masinpiquena (2008) write that in many countries of South and SE Asia trees planted on farm are becoming the most important source of wood. In the Philippines, forest statistics indicate that since 1999 between 50 per cent and 70 percent of the log production came from planted trees because of mistaken policies in national forests. However, as in other countries, the Philippines government, has not duly acknowledged the importance of timber production by smallholder farmers and their contribution to a sustained wood industry. Existing policies, in fact, act as a disincentive to tree planting and the marketing of farm grown timber. Bertemeu (2008) reports that in the Philippines smallholder farmers can produce large quantities of timber and efficiently supply local and national markets.

Many products from agroforestry trees (fruit, fodder, timber, fuelwood, medicine, nuts, gums and resins) are destined for the market. These informal *filiere* are often the principle source of livelihoods or income for millions of the rural poor in developing countries. (Holding Anyonge, Roshetko 2003, Yuliyanti 2003, Russell D and Franzel S 2004, Akinnifesi 2007). More significant efforts are required by land-use planning, forest and agricultural policy makers to coordinate effectively such that legislation and corruption does not hinder the development of these market initiatives (Nawir et al 2007), including those for farm produced timber. Third party (NGO or advisory services) facilitation may be useful in the first instance to work with communities and nascent farmers associations. Revised and effectively implemented local, regional and national policies, would open pathways (e.g. fair, open and competitive markets (Scherr, 2004)) to enable the rural poor in developing countries to access markets with their farm produced timber and poles.

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Using program theory-driven evaluation in extension: an example using a forestry shortcourse

William G. Hubbard, Lorilee Sandmann

Abstract

Evaluating Extension programs is becoming increasingly critical for a variety of reasons. Decreasing budgets, competition for resources, and increased accountability are driving new approaches to evaluation. Traditional evaluation has focused on end results without an understanding of the processes that go on during and after a social program such as an Extension event. Factors that may influence adoption of behavior or implementation of a practice are often ignored or not investigated. There may be several reasons a practice is or is not implemented following participation in an Extension event. By incorporating the program's theory into the evaluation process, a better understanding of what goes on inside the black box of the program is revealed. This evaluation theory is tested on a 21-hour forestry shortcourse for landowners. Over 675 participants were surveyed five years after participation in the course to gauge how change in knowledge, increased self-directed learning, and personal and contextual factors such as age, income and a number of other factors may have influenced adoption of practice. Results of this study will be reported, and a discussion of program theory-driven evaluation and it's potential as an Extension evaluation framework will be discussed.

Key words: evaluation, program theory-driven evaluation, forestry shortcourse
FDC: 945.34=111

Cross-evaluation of two forest owner typologies: how do motives of ownership and needs of communication interact?

Teppo Hujala[1], Mikko Kurttila[2], Heimo Karppinen[3]

Abstract

In different countries, empirical forest owner typologies have usually served a single purpose with little or no direct connection to other parallel segmentations. The aim of the present study is to investigate the connections between two types of owner classifications. The study uses a subsample of the Finnish Forest Owner 2010 survey data, collected in 2009 (n=2095). The first grouping is based on owners' objectives of forest ownership, while the second grouping focuses on their motivation to communicate with foresters. The former yielded five groups: multi-objective owners (33%), recreationists (22%), self-employed owners (16%), investors (15%), and indifferent owners (14%). The latter, in turn, yielded four groups: studious learners (39%), self-reliant owners (19%), delegators (21%), and deliberate thinkers (22%). Cross-tabulation of these two groupings revealed need for learning-oriented services among multi-objective owners, recreationists and investors. Logically, nearly half of deliberate thinkers were multi-objective owners. Self-employed owners were rather evenly located in decision-making groups, and so were delegators in ownership-objective groups. The largest subgroup of indifferent owners was delegators, while the smallest being deliberate thinkers. The message for policy-makers and service providers is that multi-objective forest ownership may be served with communicative educational services, but the motives of delegators and indifferent owners need more in-depth study. In future, forest-owner-related social science is encouraged to seek further linkages between individual studies and enhance more general societal understanding of family forest owners' decision-making and behavioural patterns.

Key words: customer value, family forest owners, multivariate statistics, survey study
FDC: 682=111

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1 INTRODUCTION

Development of extension services for family forest owners requires knowledge about owners' various motives and customer values. Survey studies suggest (e.g. Salmon et al. 2006) that information delivery or communication services can be modified to fit the needs of discerned customer segments. In different countries, however, the empirical owner typologies have usually served a single purpose with little or no direct connection to other parallel segmentations (Karppinen 2004). Depending on situation, studies have focused on owners' values and objectives, lifestyles, or behaviour (e.g. Boon et al. 2004, Hogl et al. 2005, Kendra & Hull 2005, Ní Dhubháin et al. 2007, Novais & Canadas 2010).

The combination of owners' objectives and decision-making strategies may add to the previous ideas about how to develop forest planning. Therefore, the present study seeks to find out how to combine content and tone in communication services targeted at landowners. The content is derived from the typology based on owners' objectives (Favada et al. 2009), while the tone is derived from the typology based on owners' communication motives (Hujala et al. 2009).

In addition to reporting the respective owner group distributions through fresh data, the analysis will test the following initial hypotheses: i) most of both multi-objective owners and recreationists show either learning or delegating motives; ii) investors and self-employed owners show usually either self-reliant or deliberate motives; and iii) indifferent forest owners show delegating motives. A large family forest owner survey data from Finland serves testing these hypotheses.

2 DATA AND METHODS

2.1 ACQUISITION OF SURVEY DATA

The data comprises a subsample of Finnish Forest Owner 2010 survey, which was collected in 2009. Population was defined as the set of individual- or family-owned forest holdings with more than five hectares of productive forestland in continental Finland (N~300,000 holdings). Among these, a sample of 1,000 holdings was picked up from each of 13 administrative forestry regions (Forestry Centres) using stratified systematic sampling where holdings were ordered by forest area by Forestry Centres. From the whole country, every 24^{th} holding was chosen.

The survey questionnaire included a common part and three varying parts, which were distributed evenly (4,333 each) among the sample. This paper uses the subsample for forest planning, which includes two distinct statement sets, the first for owners' forest ownership objectives (see Karppinen 1998) and the second for their decision-making modes (see Hujala et al. 2009).

The questionnaire was sent in February 2009, followed by a reminder card after a week, and a new questionnaire three weeks later for non-responded owners. The number of valid responses in the subsample was 2,107 (6,318 in the whole survey), and response rate for the subsample was thus 49.2%.

Non-response of the whole survey was analysed by means of comparing the basic characteristics of the respondents with the statistics provided by the Finnish Tax Administration, and conducting a total of 201 non-response interview phone calls. The analysis revealed that farmers were under-represented in the data. Thus case weights were applied taking into account the bias in the area of arable land and place of residence, and also correcting regional representativeness. As a result, the final data represent Finnish family forest holdings rather well.

2.2 GROUPING BASED ON OWNERS' OBJECTIVES

Forest owners' objectives of forest ownership were queried with a 22-item statement set using a 5-point Likert-scale. The statements related to six themes: recreation and leisure, timber growing and timber sales income, forest nature and landscape, economic security, emotional values of forests, and forest as an object of investment. Simple data imputation (Allison 2001) was executed by substituting missing values with value 3 ('cannot tell') in all cases where less than 5 items out of 22 were missing. Consequently, the effective number of observations was 1685.

Principal component analysis (Lewis-Beck 1994, Anderson 2003) was performed to form combined variables describing ownership objectives for further analysis. These three principal components were interpreted based on the highest loadings of the original variables on the component as follows: *economic security and regular sales income*, *non-timber benefits*, and *self-employment opportunities* (Appendix 1). They explained 54% of the total variance.

Respective principal component scores and theory-based initial cluster centres were then used to cluster the owners with k-means-algorithm into five groups as suggested by Favada et al. (2009). Interpretations for each cluster were compiled with the aid of final cluster centre information (Table 1).

2.3 GROUPING BASED ON OWNERS' DECISION-MAKING STRATEGY

Owners' style of decision-making was queried with a 14-item set of statements and a 5-point Likert-scale with an additional 'cannot tell' option. The statements related to learning-oriented communication, trusting forestry professionals, and self-reliant decision-making. Where less than 4 items out of 14 was lacking a Likert-score, data imputation was used to substitute non-responses or 'I can't say' responses with value 3. The effective number of observations was 1529.

As above, principal component analysis was executed. The total variance explained in principal component analysis was 65%, and the three principal components were labeled as *learning*, *trusting*, and *decisiveness* based on the highest loadings (Appendix 2, see also Hujala et al. 2009). In this case the k-means-clustering of observations was performed without theory-based cluster centres. A four-cluster solution proved to be interpretable and the groups were rather equal in size (Table 2).

3 RESULTS

3.1 GROUPINGS

Table 1: Grouping based on ownership's objectives; k-means clustering (n=1685).

Group	**Weighted %**	**Mean of principal component score (standard deviation)**		
		Economic security and regular sales income	**Nontimber benefits**	**Self-employment opportunities**
I Multi-objective owners	**33**	0.827 (0.543)	0.047 (0.712)	0.657 (0.557)
II Recreationists	**22**	-0.726 (0.672)	1.004 (0.537)	-0.163 (0.565)
III Self-employed owners	**16**	-0.998 (0.734)	-0.490 (0.666)	0.811 (0.590)
IV Investors	**15**	0.544 (0.629)	0.288 (0.706)	-1.384 (0.772)
V Indifferent owners	**14**	-0.219 (0.850)	-1.428 (0.671)	-0.710 (0.696)
F-value (df=1680)		515.8	544.7	661.9
P-value<		0.000	0.000	0.000

In cases of both groupings, means and standard deviations of principal component scores are given for each group. Weights have been applied to derive unbiased estimates of the share of owners in each group. In the ownership-objective typology (Table 1), multi-objective owners are the largest group with a share of 33%. Recreationists (22%) seek for nontimber benefits, self-employed owners (16%) value working in their forest, and investors (15%) account for economic security. Indifferent owners (14%) showed no clear pattern of objectives.

In the decision-making typology (Table 2), studious learners are the largest group with the share of 39%, and they value educative communication with forestry experts. Deliberate thinkers (22%) tend to combine their own view with professional opinions and other available data. Delegators (21%) trust experts and are not keen on learning, while self-reliant owners (19%) trust above all their own experiences in decision-making.

Table 2: Grouping based on owners' decision-making style; k-means clustering (n=1529).

Group	**Weighted %**	**Mean of principal component score (standard deviation)**		
		Learning	**Trusting**	**Decisiveness**
1 Studious learners	**39**	0.600 (0.559)	0.068 (0.651)	-0.663 (0.559)
2 Self-reliant owners	**19**	-0.480 (1.054)	-1.423 (0.810)	0.348 (0.820)
3 Delegators	**21**	-1.041 (0.766)	0.719 (0.668)	0.361 (0.719)
4 Deliberate thinkers	**22**	0.324 (0.746)	0.421 (0.662)	1.208 (0.697)
F-value (df=1525)		382.4	565.6	600.2
P-value<		0.000	0.000	0.000

3.2 COMPARING THE TWO GROUPINGS

The above groupings were cross-tabulated to explore the associations between owners' forest ownership objectives and decision-making strategy (Table 3). Total number of observations with valid group membership information for both groupings was 1460.

The largest combined group comprises 15% of owners: those who are simultaneously classified as multi-objective owners and studious learners. This segment of owners thus logically reflects a curious interest in combining different uses of forests. These owners represent multi-faceted view on forest-related issues and would be prone to participate adult educational activities.

One tenth of owners belong to a segment of recreationists who are studious learners. These owners probably emphasize the active utilization of non-timber benefits from their forests. Another 10% of owners belong to a segment that combines multi-objective owners and deliberate thinkers. This segment is apparently rather advanced in forest-related issues: experienced but still ready to ponder between various perspectives and decision alternatives. Fourth largest group (8%) reveals that half of investors are studious learners. Obviously this segment is keen on economic calculations and calculative comparisons of alternatives. Thus, they are eager to learn more about the production possibilities of their forests so that their main objectives could be met better.

A notable finding is that the indifferent owners are reasonably often (36%) located in delegators' group implying that they could often give the decision power to a forestry expert. However, delegators are in general distributed rather evenly to the five ownership-objective groups, although they are rather rare (13%) among multi-objective owners. Self-employed owners are distributed rather evenly into the decision-making groups. This implies that self-employed owners occupy various decision-making strategies. Self-reliant owners, in turn, are typically either multi-objective owners or recreationists (together 58%). These owners want nontimber benefits but are hardly interested on decision aid services.

*Table 3: Cross-tabulation of the two groupings (n=1460). The first number (underlined) in each cell shows how the forest owners in the respective decision-making group are scattered into the ownership-objective groups; the second number (in italics) shows how the owners in the respective ownership-objective group are distributed in the decision-making groups; and the third number (**bolded**) shows the percentage of owners in each cell. The four largest combined groups are highlighted and discussed in the text.*

Decision-making group		**Ownership objective group**					**Total**
		I Multi-objective owners	**II Recreationists**	**III Self-employed owners**	**IV Investors**	**V Indifferent owners**	
1 Studious learners	Row % *Column %* **Total %**	37 *42* **15**	24 *42* **10**	11 *29* **4**	19 *49* **8**	9 *28* **3**	100 *39* **39**
2 Self-reliant owners	Row % *Column %* **Total %**	31 *17* **6**	27 *22* **5**	21 *26* **4**	8 *10* **2**	13 *20* **3**	100 *19* **19**
3 Delegators	Row % *Column %* **Total %**	22 *13* **4**	21 *18* **4**	20 *26* **4**	16 *22* **3**	21 *36* **4**	100 *20* **20**
4 Deliberate thinkers	Row % *Column %* **Total %**	44 *28* **10**	19 *18* **4**	14 *20* **3**	14 *19* **3**	9 *16* **2**	100 *22* **22**
Total	Row % *Column %* **Total %**	34 *100* **34**	23 *100* **23**	15 *100* **15**	15 *100* **15**	12 *100* **12**	100 *100* **100**

4 DISCUSSION

The presented cross-tabulation may offer insights for those who design forest planners' work and/or new decision support services for family forest owners. At least it may assist in marketing communication by giving directions what recreationists or investors, for example, would preferably want from services. However, the result cannot be interpreted as a promise of willingness to pay; the actual demand for specific services should be studied separately in each context with more precise information about the service and its price.

The initial hypotheses presented were mainly supported by the results. Both multi-objective owners and recreationists showed particularly learning motives. Indifferent owners, in turn, showed delegating motives more than other ones. Unexpectedly, investors and self-employed owners showed more often learning motives than self-reliant motives or deliberate thinking. It remains to be seen how marketization and outsourcing of forest work (Westermayer 2006, Ní Dhubháin et al. 2007) progress and alter the motives and service needs of investors and self-employed owners.

According to Kurttila et al. (2010), nearly half of the Finnish forest owners who currently own a valid forest plan can be found from the studious learners' group. In addition, half of the owners who are willing to pay from additional forest planning services after receiving a free forest fact-sheet (containing basic forest resource information from their holding) fall within this group. As 37% of this studious learners' forest owner group are multi-objective owners (Table 3), the planning services should be designed to include elements that are useful for this group. In other words, multi-faceted educational services seem to have the greatest potential among Finnish forest owners.

The other two potential owner segments with particular decision support needs, deliberate thinkers and delegators, have for some reason not found the current forest planning system so useful. These groups show rather low willingness to pay (18%) from additional services, and among the owners who have a valid forest plan, only 17% are deliberate thinkers (Kurttila et al. 2010). Since deliberate thinkers are potentially active members of forest owners' community, and delegators are potential customers of expert services, it would be important to recognize more specific decision support needs of these groups. The present result only indicates that most deliberate thinkers would find either multi-objective or recreational issues important and that delegators have fairly even distribution of topics of interest.

The effort of combining different forest owner typologies proved promising: new knowledge on owners' valuations was generated and can be applied in Finnish context. In addition to empirical co-assessment of different forest owner typologies, also analytical assessment would be beneficial. It is obvious that no single typology will ever serve all the various and emerging purposes in different contexts. However, in the world or globalizing societal phenomena, there is a reason to approach a more unified framework in landowner profiling (see also Emtage et al. 2007). General linkages between owners' values, objectives, lifestyles, service needs, and behaviour could be found by cross-national research efforts (see earlier Nordic example at Nordfjell et al. 2005). At best these steps would show a way towards a Pan-European or Cross-Atlantic forest owner survey system, which would, in turn, guide and support the contextually grounded studies in various family-forested countries.

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***Appendix 1:** Rotated principal component loadings for statements concerning objectives of forest ownership; forest planning subsample of Finnish Forest Owner 2010 study (n=1685). Varimax rotation, loadings under 0.300 suppressed. Bolded figures represent the maximum loading of each statement.*

Sense of statement	Economic security and regular sales income	Nontimber benefits	Self-employment opportunities
Security for old age	**0.814**		
Hedging motives	**0.794**		
Security against inflation	**0.751**		
Funding of investments	**0.689**		
Credibility	**0.684**		
Asset motive	**0.677**		0.355
Regular sales income	**0.611**		0.461
Inheritance	**0.591**	0.328	
Speculative motives	**0.448**		
Aesthetic value		**0.776**	
Solitude and meditation		**0.745**	
Biodiversity		**0.720**	
Nature conservation		**0.699**	
Roots in native locality		**0.636**	
Inherent value	0.320	**0.615**	
Outdoor recreation		**0.613**	0.508
Residential environment		**0.595**	0.501
Berries and mushrooms		**0.558**	0.505
Household timber			**0.661**
Forest work		0.336	**0.587**
Labor income and employment	0.500		**0.570**
Hunting			**0.487**
Eigenvalue	4.717	4.437	2.744
% of variance explained	21.4	20.2	12.5

Appendix 2: *Rotated principal component loadings for statements concerning decision-making strategy; forest planning subsample of Finnish Forest Owner 2010 study (n=1529). Varimax rotation, loadings under 0.300 suppressed. Bolded figures represent the maximum loading of each statement.*

Sense of statement	**Learning**	**Trusting**	**Decisiveness**
I would like to know my forests better	**0.788**		
I want to understand forestry basics better	**0.769**		
I'm interested in getting knowledge on my forests	**0.769**		
More knowledge of forestry to be able to apply it	**0.760**		
Guiding information to support my decision-making	**0.655**	0.400	
An expert knows best		**0.828**	
I strongly trust an expert		**0.824**	
Expert advice help me to spare time in forestry		**0.712**	
I usually decide according to expert advice	0.341	**0.705**	
I find it important to know expert's advice	0.492	**0.554**	
I usually decide without letting advice affect			**0.761**
I decide according to my own experience		-0.380	**0.740**
I already know enough			**0.711**
Guiding information is useless for me			**0.685**
Eigenvalue	3.418	3.179	2.472
% of variance explained	24.4	22.7	17.7

Lifelong learning as a connector and stimulator of sustainable rural development

Marija Imperl[1], Jože Prah[2]

Abstract

In rapidly changing times that are not conducive to the conservation of nature and care for our planet, Slovenia's forests are becoming an increasingly important component of sustainable rural development. Natural riches and cultural heritage in the form of traditional skills and crafts are a priceless treasure and represent a solid basis for the integrated development of a region. To this basis, however, it is vital to add efforts to strengthen social capital and conserve the values of the rural population. Farmers and small forest owners have a key role to play in conjunction with local development institutions, but this role can only be successful if the need for lifelong learning and intergenerational learning and socialisation is recognised. One very successful form of informal learning is the study circle. These gatherings of people from rural areas who share the same goals are reflected in new ideas and projects. Examples of good practice prove that with knowledge exchange among equals on the principles of equality, and with a measure of courage, it is possible to achieve educational and action-related goals that would otherwise be impossible.

Key words: lifelong learning, sustainable development, small forest owner, study circle, knowledge exchange, example of good practice
FDC: 682:611:945.34=111

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Maps of potential redistribution of main tree species due to climate change in Slovenia

Andrej Kobler[1], Lado Kutnar[2]

Abstract

As a complement to the paper titled “Predictions of climate change effects on forest tree species redistribution in Slovenia”, this poster presents the full set of maps showing model-based predictions of potential forest tree distributions in Slovenia for the year 2100, under 3 climate change scenarios. To generate these maps, a quantitative spatial model of growing stock per species for each square kilometer cell in Slovenia has been calibrated by machine learning from empirical data based on the past climate data (monthly & yearly average temperatures T, precipitation R, evapotranspiration E), relief (elevation, slope, exposition) and soil data (FAO soil type). Using the model and the existing predictions of the likely future climate (Environment Agency of Slovenia), we predicted tree species redistributions in Slovenia in the year 2100 under three climatic scenarios: trend scenario (median predicted T, median predicted R, median predicted E), warm scenario (max T, min R, max E), and wet scenario (min T, max R, min E). We predict significant alterations in potential forest stand species composition throughout Slovenia even under the most optimistic (i.e., wet) scenario. At the end of the century, the suitable areas for the 3 structurally most important species (spruce, fir and beech) will be reduced to the mountainous parts of Slovenia. Under the pessimistic (i.e., warm) scenario an almost total decline of fir and spruce is predicted, whereas suitable conditions for beech will only remain available in the alpine parts of NW Slovenia.

Key words: climate change, forest tree species, spatial distribution, prediction
FDC: 111.83=111

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Potential forest change in Slovenia due to climate warming

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Abstract

The global climate change would lead to a readjustment of the tree species composition of forests, which would affect the ecological and economic sustainability of forests. The goal of this study was to study potential decline of the 16 main tree species' growing stock in Slovenia due to the climate change effects. A species-specific multi-target quantitative model of growing stock has been calibrated at the spatial level of 1 by 1 km^2 quadrants by machine learning from empirical data based on the past climate data (monthly & yearly average temperatures T, precipitation R, evapotranspiration E), relief (elevation, slope, exposition) and soil data (FAO soil type). Using the model and the existing predictions of the likely future climate warming (Environmental Agency of Republic of Slovenia), we predicted potential tree species decline in Slovenia until the year 2100 under three climate warming scenarios: the Middle scenario (median predicted T, median predicted R, median predicted E), the Pessimistic scenario (max T, min R, max E), and the Optimistic scenario (min T, max R, min E). We predict significant alterations in potential forest stand species composition in Slovenia even under the Optimistic scenario. At the end of the century, the abundance of the three structurally most important species (*Picea abies, Abies alba* and *Fagus sylvatica*) will potentially be reduced by 54% to 97%, depending on scenario and species.

Key words: climate warming, potential forest tree species decline, modeling, prediction, Slovenia
FDC: 111.83=111

1 INTRODUCTION

Forest ecosystems in Europe are likely to be strongly influenced by climate warming (CW) and other global changes (Shaver et al. 2000, Askeev et al. 2005, Kellomäki and Leinonen 2005, Maracchi et al. 2005, IPCC 2007). Conifers are likely to decrease due to water limitations (Lasch et al. 2002, Lexer et al. 2002, Martínez-Vilalta and Pińol 2002, Freeman et al. 2005, Körner et al. 2005) and higher temperatures (Pretzsch and Dursky 2002).

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Negative impacts of drought on deciduous forests are also possible (Broadmeadow et al. 2005).

The potentially dramatic readjustments of forest tree composition would affect the ecological and economic sustainability of forests, necessitating a more detailed understanding of the potential tree species decline in Slovenia. There have already been two preliminary studies of climate warming (CW) effects on forest- and semi-natural habitats in Slovenia (Kutnar et al 2009). These studies indicated that until 2040 the potential forest vegetation community in Slovenia might be changed on 62% to 82% of all forest sites, depending on the CW scenario, potentially leading to a widespread decline of forests. The aim of this study is to get a better understanding of the potential amount of tree species decline/extinctions for the 16 most frequent forest tree species in Slovenia, under three different CW scenarios, in order to enable a timely adjustment of forest management and forest sylvicultural measures.

2 METHODS

For the 16 most frequent forest tree species in Slovenia (i.e., those exceeding 0.5 % of total forest growing stock) the predictions of species decline due to CW were computed within each species' present-day area of distribution. The predictions were based on an empirical quantitative spatial model of species specific growing stock (GS). For each species, three predictions of GS for the year 2100 were made. These predictions included three CW scenarios, termed the Pessimistic scenario, the Optimistic scenario, and the Middle scenario.

The underlying model yields GS predictions per species at the spatial level of 1 by 1 km^2 quadrants and the final results are the averaged predictions of GS within the present species' areas of distribution. The model was generated by machine learning from empirical training data using an ensemble regression tree technique called random forests (Breiman 2001). The target variables' values of 16077 quadrants were extracted from raster maps of current GS for each species, which were aggregated from the 2008 National forest stand map in scale 1:5000 (Slovenian Forest Service 2008). The explanatory variables for model training were based on raster maps of the following climatic and edaphic factors: the maps of average monthly and yearly precipitation R, temperature T and evapotranspiration E for the period 1970 – 2000 (Environmental Agency of Republic of Slovenia, 2005, 2006a, 2006b), the map of FAO soil types (Centre for Pedology and Environmental Protection 1999), and the maps of the average relief elevation, average relief slope and relief diversity derived from a digital elevation model with resolution of 100 m (Surveying and Mapping Authority of the Republic of Slovenia 2006).

The multi-target random forest model was machine-learned from training data using Clus 2.7 tool, a GNU General Public License software for predictive clustering (Katholieke Universiteit Leuven and Jožef Stefan Institute Ljubljana 2009). The resulting model was validated by a 10-fold crossvalidation. The future (year 2100) GS values for each quadrant were then predicted by feeding into the model the predicted year 2100 values of the climatic factors (Bergant 2007), according to three scenarios, which differ in combining upper or lower bounds or median values of climate predictions. The Optimistic scenario combines the upper value of R and the lower values of T and E, while the Pessimistic scenario uses the lower value of R and the upper values of T and E. The Middle scenario uses the median values for R, T and E.

The final results, i.e., the average GS per species and per scenario, were obtained by averaging the predicted GS values over all quadrants belonging to a species current area of distribution. For comparisons of the predicted and the present GS values we used the modeled present values, not the real present values. Thus the differences between the present and the predicted values were less affected by the errors of the model.

3 RESULTS

The 10-fold cross-validation of the multi-target model of growing stock showed model's Pearson's correlation coefficients to be between 0.64 and 0.88 (i.e., at the spatial level of quadrants). The relative total error of the model (i.e., at the spatial level of a tree species' area of distribution), defined as the difference between the modeled and the actual growing stocks in the year 2000, relative to actual growing stock in 2000, was between -6.7 % and +0.3 % (Table 1).

For each tree species five maps were generated at a spatial resolution of 1 sq. kilometer: two GS distributions for the year 2000 (actual and modeled values), and three predicted GS distributions for the year 2100, according to the three scenarios. Figure 1 shows one example of prediction maps for *Fagus sylvatica*. The current and predicted average growing stocks within each species' area of distribution are shown in Table 2 as absolute values and as relative changes, compared to the modeled absolute values of the year 2000. For the Middle scenario the GS decline of more than 50% was predicted for 7 out of 16 tree species, among those a decline of more than 75% was predicted for *Abies alba, Picea abies, Pinus sylvestris, Larix decidua, Acer pseudoplatanus* and *Fagus sylvatica*. On the other hand, the species that will increase the most include *Robinia pseudacacia,* *Ostrya carpinifolia* and *Pinus nigra* (Table 2, Figure 2). For the Optimistic scenario the GS decline of more than 50% was predicted for 5 out of 16 tree species and a decline of more than 75% was not predicted for any species. For the Pessimistic scenario the GS decline of more than 50% was predicted for 8 out of 16 tree species and a decline of more than 75% was predicted for *Abies alba, Picea abies, Larix decidua, Acer pseudoplatanus* and *Fagus sylvatica*. Some thermophiluous tree species on the other hand will potentially increase their GS. Most significant potential increase (by 97% to 139%, depending on the scenario) is predicted for *Robinia pseudacacia*, followed by *Ostrya carpinifolia* (20% to 103%) and *Pinus nigra* (34% to 75%).

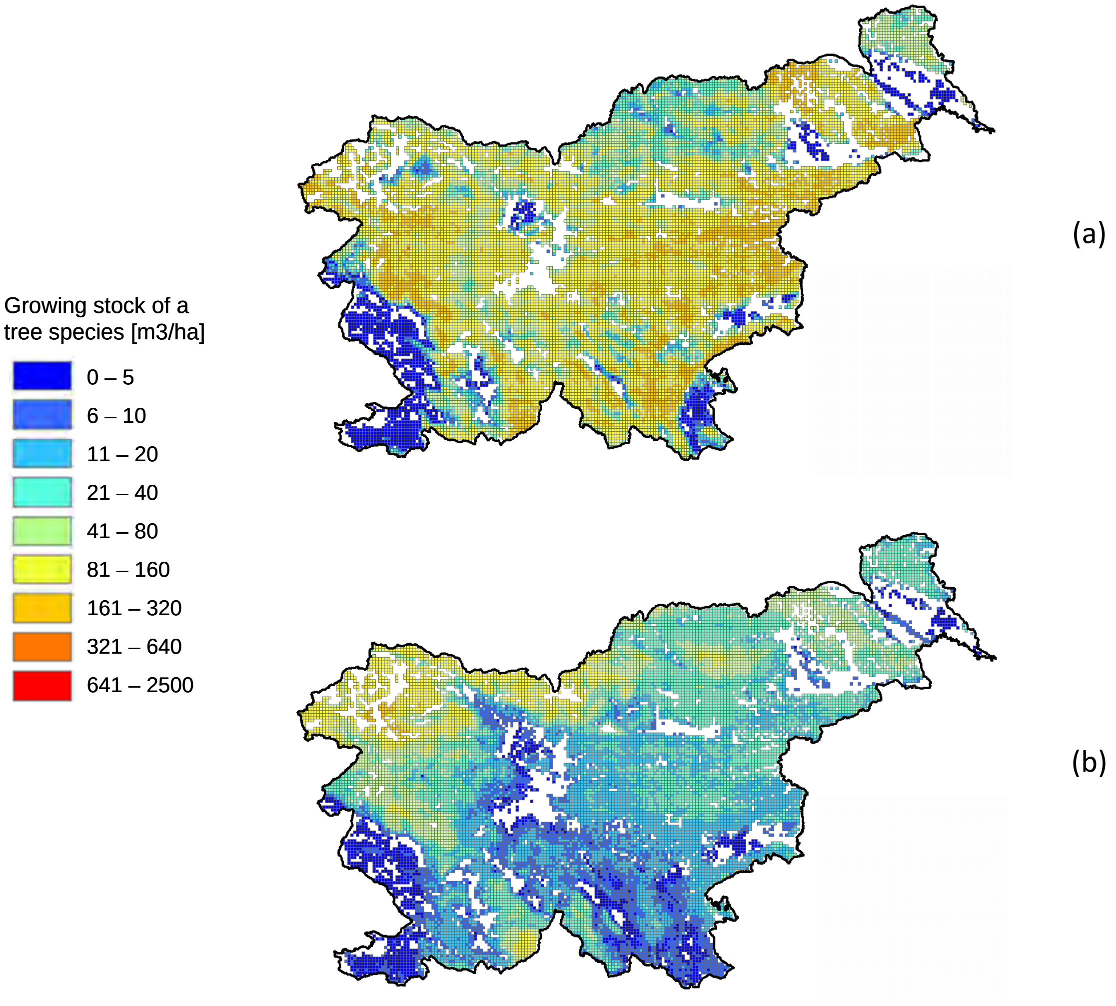

Figure 1: Spatial prediction of growing stock of Fagus sylvatica in Slovenia – a comparison of the present-day distribution (a) and the predicted year 2100 potential distribution, according to the Middle scenario (b). For comparisons of the predicted and the present GS values we used the modeled present values, not the real present values. Thus the differences between the present and the predicted values were less affected by the errors of the model.

Table 1: Accuracy of the model estimated at the spatial level of quadrants by 10-fold cross-validated Pearson's correlation coefficient of the multi-target model of GS (a), and at the spatial level of tree species' areas of distribution estimated as the relative total error of the model, defined for each tree species as the difference between the modeled and the actual growing stocks in the year 2000, relative to actual growing stock in 2000 (b).

Tree species	(a)	(b)
	Pearson's R	Relative total error
Picea abies	0.88	-4.2%
Abies alba	0.85	-2.6%
Pinus sylvestris	0.82	-4.5%
Pinus nigra	0.74	-1.0%
Larix decidua	0.74	-2.9%
Fagus sylvatica	0.82	-5.5%
Quercus petrea	0.79	-3.7%
Quercus robur	0.83	+0.3%
Robinia pseudacacia	0.83	-1.8%
Acer pseudoplatanus	0.73	-6.7%
Fraxinus excelsior	0.67	-5.4%
Tilia sp.	0.64	-3.8%
Carpinus betulus	0.77	-3.6%
Ostrya carpinifolia	0.77	-4.0%
Quercus cerris	0.71	-1.6%
Alnus glutinosa	0.84	-1.2%

Table 2: The current and predicted average growing stocks within each species' area of distribution in Slovenia, as absolute values (a) and as relative changes, compared to the modeled absolute values of the year 2000 (r). For comparisons of the predicted and the present GS values we used the modeled present values, not the real present values. Thus the differences between the present and the predicted values were less affected by the errors of the model.

Tree species	Growing stock [m^3/ha], Relative change of growing stock						
	Year 2000	Year 2100, middle scenario		Year 2100, optimistic scenario		Year 2100, pessimistic scenario	
	(a)	(a)	(r)	(a)	(r)	(a)	(r)
Picea abies	149.6	15.1	-90%	49.9	-67%	5.2	-97%
Abies alba	37.6	3.4	-91%	14.1	-63%	1.0	-97%
Pinus sylvestris	26.9	4.7	-83%	7.6	-72%	7.1	-73%
Pinus nigra	11.9	18.9	+59%	20.9	+75%	15.9	+34%
Larix decidua	5.9	1.2	-80%	2.4	-59%	0.7	-88%
Fagus sylvatica	139.1	32.8	-76%	64.3	-54%	24.8	-82%
Quercus petrea	40.1	26.9	-33%	32.8	-18%	17.8	-56%
Quercus robur	8.8	9.4	+7%	9.2	+4%	14.3	+62%
Robinia pseudacacia	6.7	16.1	+139%	13.3	+97%	13.9	+106%
Acer pseudoplatanus	12.9	2.6	-80%	6.6	-49%	1.5	-88%
Fraxinus excelsior	5.0	3.4	-33%	4.2	-17%	2.2	-55%
Tilia sp.	3.3	3.9	+17%	4.3	+30%	1.8	-47%
Carpinus betulus	18.0	8.2	-55%	9.7	-46%	9.2	-49%
Ostrya carpinifolia	8.0	13.1	+64%	16.1	+103%	9.5	+20%
Quercus cerris	8.5	8.2	-3%	10.2	+20%	6.6	-22%
Alnus glutinosa	5.6	3.9	-31%	3.9	-30%	6.0	+7%

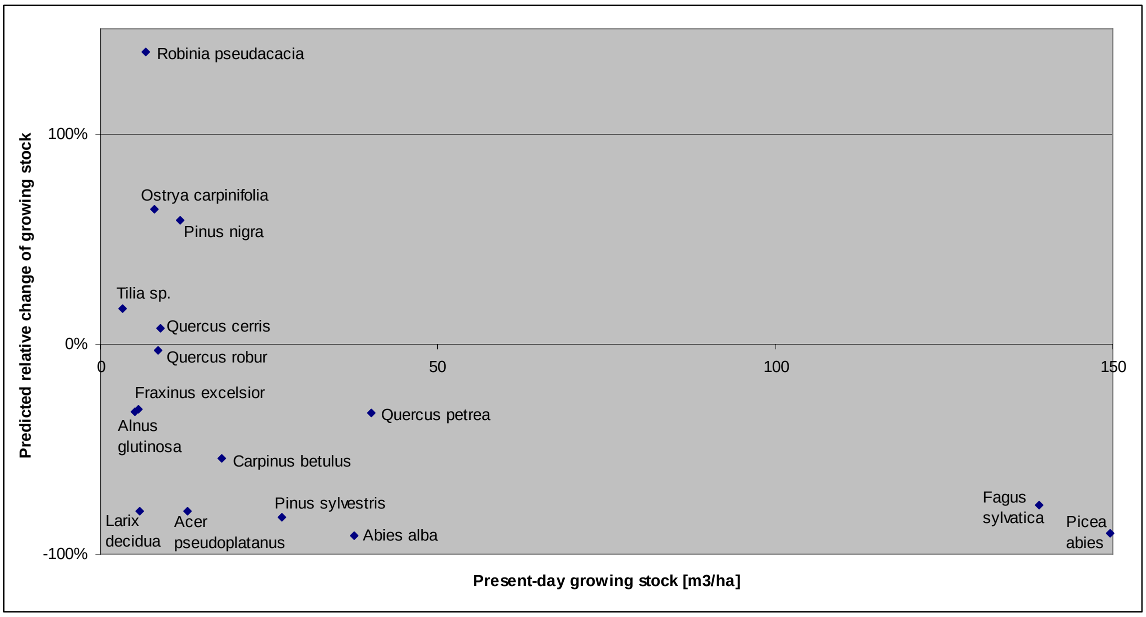

Figure 2: The importance of tree species' decline, relative both to the predicted change of GS until 2100 and to the present-day abundance; the Middle scenario.

4 DISCUSSION AND CONCLUSIONS

We predict significant alterations in potential forest stand species composition in Slovenia even under the Optimistic scenario: at the end of the century, according to our model, the GS of the three structurally most important species (*Picea abies, Abies alba* and *Fagus sylvatica*) will potentially be reduced by 54% to 67%. Under the Pessimistic scenario an almost total decline of *Picea abies* and *Abies alba* (both by 97%) is potentially predicted. Some thermophiluous tree species on the other hand will potentially increase their GS. Most significant potential increase (by 97% to 139%, depending on the scenario) is predicted for *Robinia pseudacacia*, followed by *Ostrya carpinifolia* (20% to 103%) and *Pinus nigra* (34% to 75%). It should be noted that the predicted decline or increase of species' GS also implies a corresponding change of its area of distribution in Slovenia.

Our model is based on the empirical relationship between species' GS as the target variable, and climate, soil, and relief as explanatory variables. Similarly to other empirical distribution models (Zurell et al. 2009), our model is static and does not account for secondary effects of climate warming, including altered inter-species relationships, new pests and altered land use. Comparisons between a niche-based and process-based models reveals that the former tend to predict a stronger level of species extinction than the latter, because the niche-based models do not take phenotypic plasticity and local adaptation into account (Morin and Thuiller 2009). Our predictions of species decline may therefore be considered to be pessimistic rather than optimistic. Nevertheless, the model provides first approximation of potential long-term forest tree species decline due to climate warming in Slovenia. The knowledge of potential fate of the present forests under different climate change scenarios is an urgent issue for decision makers in ecosystem protection and forest management.

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Family forest owners' social networks in timber trade

Katri Korhonen[1], Mikko Kurttila, Teppo Hujala[2]

Abstract

Recent research has recognized that decision making situations of family forest owners are influenced by forest owner's social network. Networks can support forest owners' certainty in decision making, peer-to-peer learning, or owners' social identity. In-depth research about the structure, role and significance of social networks around family forest owners is needed for responding to the owners' needs for services and for improving the efficiency of forest policy instruments.

This paper focuses on Finnish family forest owners' social networks and their structures in a case of timber trade. The study will produce new and previously unexplored information about the size and structure of the participating network. The study defines the number of relationships and their directions in a network as well as contact frequencies and significances of the relationships for forest owners' satisfaction, according to owners' perceptions. The members of forest owner's network can include e.g. timber buyers, forestry advisors, public forest officers, timber cutting entrepreneurs, neighbours or relatives.

A mail questionnaire inquiring after the respondents' latest timber trade was posted to 2100 family forest owners around Finland. Standard methods of ego-centric social network analysis (SNA) will be used to generate a numerical characterization of the social networks that actively affected the owners' latest timber trade.

The results will offer possibilities to form an improved understanding of social networks of family forest owners in timber trade situation. The results will reveal, which organizations or individuals forest owners are relying on and which actors are in contact with forest owners. With the help of the results different actors of forest sector can better select the channels to reach family forest owners in their decision situation. Operative actions of forest organisations (in Finnish case Forestry Centres and Forest Management Associations, for example) can be rationalized by omitting the unnecessary and overlapping actions.

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The preliminary results of the research show that during the timber trade process forest owners have most connections with the timber buyer, with whom the trade was made, or with the Forest Management Association (local advisor). Also the connections to the spouse or other family members are assumed to be dense. We will also examine whether additional connections to a broader network promote satisfaction related to timber trade, which may indicate increased social capital.

Key words: ego-centered network, family forest owners, social network, social network analysis, timber trade
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Tried and true technology transfer: meeting the needs of private landowners for over 60 years on the Escambia Experimental Forest

John S. Kush[1], John C. Gilbert[2], Rebecca J. Barlow[3], William D. Boyer[4]

Abstract

As early as 1840, historians described much of the southeastern United States as predominately upland forests dominated by a single tree species, longleaf pine (*Pinus palustris* Mill.). Stretching from the coastal plain of southern Virginia into eastern Texas, longleaf occurred on nearly 36 million hectares. However, by the turn of the 20th century, much of the original forests had been harvested with little to no regard for what sort of forest would result. In the early 1940's about half of the forestland in the southern United States was in small woodlots. Many of these tracts had been heavily cut over and returns were low from any forestry activity. Landowners needed practical forest management information to help them understand costs and returns if they wanted to intensively manage their land and apply best known practices. In response to the decline of this unique forest type, TR Miller Mill Company and the United States Department of Agriculture Forest Service established the Escambia Experimental Forest in 1947. This 1,215 hectare field laboratory was developed primarily to study problems associated with the management of longleaf pine forests. Due to its central location in the longleaf pine range, 10 km south of Brewton, Alabama, USA, it is well situated for the study of longleaf pine.

Among the many objectives for the Experimental Forest was the establishment of "on the ground" research areas that could then be shown to private landowners illustrating what they could do with a less than optimal stand of longleaf pine to generate an income stream over time with a minimal investment of cash and labor. This continues to be of importance to contemporary landowners as they seek land management information during these difficult economic times. Several surveys have shown that most of these non-industrial private owners are not seeking to maximize growth and yield or economic return but are interested in a range of stewardship objectives which integrate commodity (forest products) values with non- commodity values (wildlife, water, aesthetics etc.).

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Managing for value, not volume has become the new paradigm for these owners. The Escambia Experimental Forest continues to answer this need! Recent outreach, educational, and extension programs and videos by Auburn University's School of Forestry and Wildlife Science, Alabama Cooperative Extension Service, and the Longleaf Alliance are a model for effectively communicating new information, technology, and management options to landowners and managers in what was once a vast longleaf pine range. Alternative revenue streams from non-traditional forest values such as wildlife and hunting leases, pine straw harvesting, agro-forestry, and the current potential for "carbon credits" are providing new opportunities for private owners to manage longleaf pine over longer rotations and for sustaining interest of non-industrial private forest landowners in longleaf pine management.

Key words: demonstration forest, *Pinus palustris*, longleaf pine, outreach education, private landowners, technology transfer
FDC: 565:682+945.33=111

Development of a knowledge transfer network in Quebec and benefits for small-scale woodlot owners

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Abstract

The forests of the province of Quebec are divided into two main land tenure systems. The first consists of forests on public lands, or public forests, while the second consists of privately owned forests, or private woodlots. Forests on public lands account for 92% of the province's forests. The second tenure system applies to private woodlot owners and represents 8% of the province's forests. Close to 130,000 people own 70,000 km^2 of productive forest land. The average area owned by private woodlot owners is less than 50 hectares. The knowledge transfer methods developed by the Canadian Forest Service of Natural Resources Canada in Quebec are designed for those clients and other forest sector stakeholders. The goal of our knowledge transfer is to inform them of what our research scientists have developed and what could be useful for them. To achieve this goal, we have created and tailored many communication activities to meet their needs. Our main activity centres on the creation of a provincial network that helps us transfer information to private landowners and other forest sector stakeholders. We have also developed training and conference programs, publications, technical brochures and Web-link conferences. These tools and activities help us to reach and inform our clients across the province. After using these methods for five years, we can now discuss the success we have achieved with these various activities and the resulting benefits for small-scale woodlot owners.

Key words: knowledge transfer, networks Quebec small-scale forestry, forest owners
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1 INTRODUCTION

The Canadian Forest Service (CFS) is a science-based policy organization within Natural Resources Canada, a Government of Canada department that helps shape the natural resources sector's important contributions to the economy, society and the environment (Canadian Forest Service Website, 2010).

For over a century, the CFS has been conducting research on the health of Canada's forests to ensure that the nation's forest sector needs are met without compromising the ability of future generations to meet their own needs. Today, using scientific data and economic analysis, the CFS plays a leadership role in advancing a new model for the forest sector, focused on two key areas: sustainability and competitiveness.

Made up of scientists, technicians, economists, policy analysts and other dedicated professionals, the CFS develops and shares knowledge about forests and brings together stakeholders to address regional, national and global forest issues. Whether conducting research in the field, performing tests in the laboratory or analyzing information and data, CFS employees are working to ensure a healthy forest and a strong forest sector.

The CFS consists of six centres located across Canada in the provinces of British Columbia, Alberta, Ontario (two), New Brunswick and Quebec.

Quebec's Laurentian Forestry Centre has 170 employees, including about 30 research scientists.

2 DESCRIPTION OF PROJECT AREA

Canada is divided into 10 provinces and 3 territories and covers an area of close to 10 million km^2. The knowledge transfer experiment we will present is taking place in the province of Quebec, which covers an area of 1.7 million km^2, or more than three times the area of France. Quebec is subdivided into 17 administrative regions (Figure 1).

Nearly half of Quebec's territory (761,100 km^2) is forested. The people of Quebec have collective ownership of about 92% of these forests, which are called public forests. The remaining 8% (70,000 km^2), located mainly along the St. Lawrence River, belong to nearly 130,000 owners and are called private woodlots. Quebec's private woodlots are located on highly productive lands near highways and are a source of employment for a large pool of workers. The average area of private woodlots is less than 50 hectares.

Figure 1: Administrative regions of Quebec (Source: Ministère des Ressources naturelles du Québec)

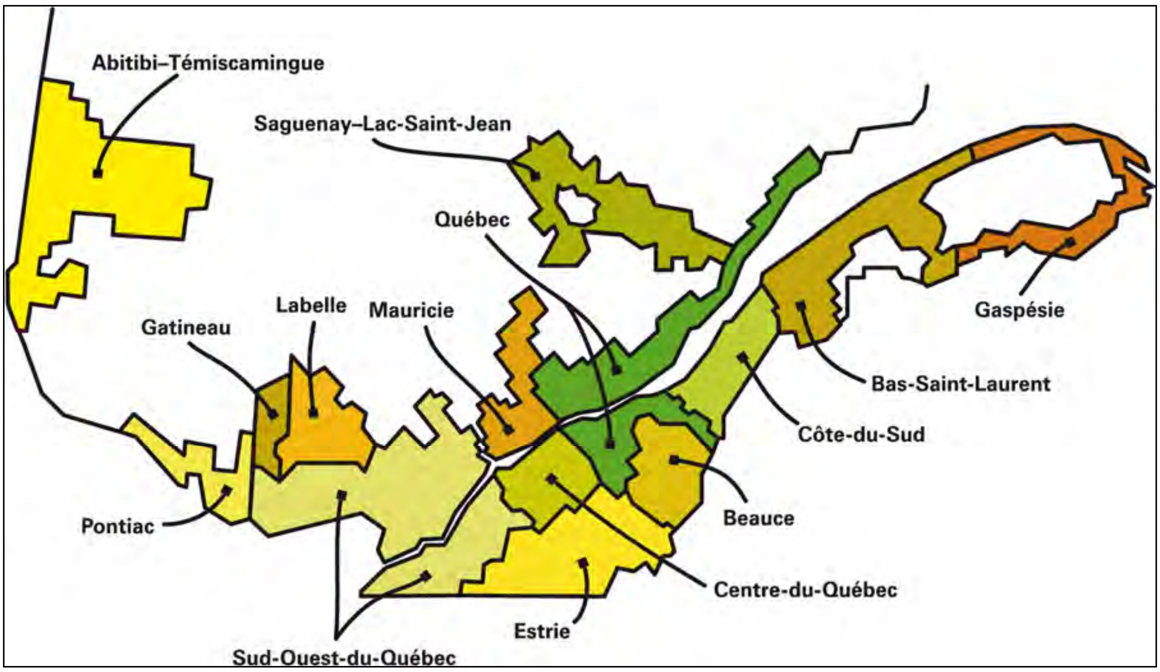

Figure 2: Private woodlots in Quebec (Source: Fédération des producteurs de bois du Québec)

Quebec's forests extend over seven degrees of latitude and cover ten bioclimatic domains, including six in the southern part of the province: Sugar Maple–Bitternut Hickory Domain, Sugar Maple–Basswood Domain, Sugar Maple–Yellow Birch Domain, Balsam Fir–Yellow Birch Domain, Balsam Fir–White Birch Domain and Spruce–Moss Domain. In northern Quebec, there are four bioclimatic domains, in which the forest cover is limited or non-existent: Spruce–Lichen Domain, Forest–Tundra Domain, Shrub–Tundra Domain and Herbaceous–Tundra Domain.

3 PROBLEM

The CFS has only one office for the entire province of Quebec and two knowledge transfer officers to interact with the various forest stakeholders. Before the creation of the new knowledge transfer method, the CFS's knowledge transfer activities were often limited to writing scientific articles (by research scientists), participating in forest industry fairs with a stand, and promoting programs. To promote its activities among regional clients, the CFS had to be innovative, determine what it could offer and develop communications products.

4 DEFINING THE KNOWLEDGE TRANSFER OFFER

In 2003, the CFS developed its new knowledge transfer method (Natural Resources Canada, 2003, internal document) to reach Quebec regions where forest sector stakeholders were expressing a growing interest in science and innovation.

To develop this new method, it was important to take into consideration certain factors on which this project is based, starting with the CFS's key strength, which is to create knowledge that is essential to sustainable forest management. This knowledge is required by the resource manager (Government of Quebec) and by stakeholders, most of whom are based in forest regions (including private woodlot owners). It was also important to have a greater knowledge of stakeholders' needs, which was obtained by developing partnerships with regional organizations. In addition, there were certain proven transfer tools that had to be kept while it was also essential to create new ones.

First, it was necessary to identify the knowledge to be transferred. To do that, individual annual meetings between the knowledge transfer officers and research scientists were introduced. A standard questionnaire was developed in order to collect information during these meetings, which are held near the end of the year and offer an opportunity to take stock of the progress made in research activities in order to identify knowledge transfer deliverables and update research partnerships.

These meetings are followed by the annual planning meeting with management. During this meeting, proposals prepared by the knowledge transfer officers following the meetings with the research scientists are submitted, discussed and amended if necessary in order to draw up the annual knowledge transfer program.

5 NETWORK OF PARTNERS

It was also important to become more familiar with the stakeholders and their needs and to identify potential ways of transferring knowledge that might eventually be incorporated into a network. A decision was therefore made to organize external knowledge transfer activities based on the division of the province into regions because it is in the regions that the CFS has the most to gain in terms of being known, and where media coverage is easiest to obtain.

According to the NIMBY (not in my back yard) principle, people do not want any significant activity introduced into their area that might disturb the tranquility of their neighbourhood, and they therefore pay close attention to any news that may affect them. For this reason, if an activity takes place in their area, they will feel more concerned than if it occurred in a neighbouring region.

The CFS therefore monitored all 17 regions by making particular use of Websites and regional newspapers in order to keep up to date with forest sector issues and regional needs.

Moreover, for the purposes of getting closer to the regions, ascertaining their needs and determining a focus for its activities, the CFS decided to call on regional organizations involved in the transfer of knowledge. In most cases, these organizations are well known and appreciated in their region and they reach a very large number of forest sector stakeholders. They could be used as key spokespersons and transmitters of regional needs and issues related to knowledge transfer and become occasional partners in some projects, such as documentation production and the preparation of symposiums, and serve in a multiplier capacity for the CFS by sharing knowledge and information.

Further to these observations, the CFS set up a provincial network of regional partners. The members of this network are primarily organizations interested in research and development (R&D) as well as knowledge transfer activities. The CFS thus achieved two objectives: (1) to develop in each region collaborative projects with a credible partner so that knowledge created by the CFS can be transferred more effectively to area stakeholders, and (2) to be more informed by having a CFS knowledge transfer officer communicate regularly with these regional partners to ascertain their concerns and needs relative to the forest sector.

6 DEVELOPING KNOWLEDGE TRANSFER TOOLS

To keep in touch with regional partners, knowledge transfer tools were developed, such as popularized publications, organization of events (conferences, symposiums and workshops) and an updated Website, making it possible to reach Quebec's forest sector community and all people interested in forests (Natural Resources Canada, 2004).

The *Branching Out* newsletter, published since 2003, provides popularized information on the projects and activities of Laurentian Forestry Centre (LFC) research scientists. The newsletter, published eight times a year, provides the practical conclusions of their research without dwelling too much on methodology and is intended for forest managers and the general public. To date, 56 issues have been published. They are included in a forest industry magazine (*Le Progrès forestier*), distributed by partners in the regions, and posted on the CFS Website (http://cfs.nrcan.gc.ca/news/source/3/).

Branching out

from the Canadian Forest Service • Laurentian Forestry Centre

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The DNA barcode: a unique identifier for pathogenic forest fungi

In the era of molecular biology, DNA barcoding is being used to fill gaps in taxonomy and confirm findings obtained through traditional approaches based on morphological differences between species. DNA barcodes can be used to correctly identify and classify any kind of living organism.

Forest pathology is the scientific study of forest tree diseases and of methods of controlling diseases that affect forest trees and stands. A forest tree species may become susceptible to disease when a living agent or an environmental stressor, such as drought, causes changes in its growth, morphology or physiology. Living organisms capable of causing disease can be divided into three main categories: fungi, bacteria and viruses. Fungi constitute the largest group of tree pathogens. In the past, the most damaging tree diseases were often caused by exotic fungi with the ability to circumvent the trees' normal defence mechanisms. Dutch elm disease and white pine blister rust are two well-known examples of such diseases.

Researchers at Natural Resources Canada's Canadian Forest Service are working with colleagues at Université Laval and the University of Guelph to increase their understanding of tree diseases and develop methods for preventing their spread. A proper diagnosis is the key to effective control and therefore to minimizing the negative impact of disease on all forest resources.

Natural Resources Canada   Ressources naturelles Canada

Canada

Figure 3: Branching Out

In an evaluation of this publication conducted with several forest engineers and technicians working in privately owned forests, it was revealed that *Branching Out* was read, understood and useful.

In Brief, published four times a year for the forest and scientific community, consists of short articles summarizing scientific articles recently published by LFC research scientists and their associates. Anyone interested in learning more about the topics dealt with in this electronic publication are asked to contact the research scientist concerned directly.

Over 120 scientific articles have been popularized and made available electronically to over 2,000 forest sector professionals in Quebec (http://cfs.nrcan.gc.ca/news/source/4).

The Website includes information on research scientists, research projects and activities, programs, publications and events at the Canadian Forest Service all across the country (http://www.cfs.rncan.gc.ca).

Every year since 2004, the CFS has offered about ten lectures (known as CFS-LFC Lectures) broadcast by Internet (Live Meeting). They are given by LFC research scientists or by guest lecturers. Some 1,000 people attend these lectures free of charge at the Laurentian Forestry Centre (LFC) or watch them by distance hook-up through the Internet. The lectures are broadcast by Internet in response to a request submitted to us by the regions through contacts with the CFS's knowledge transfer officers (http://cfs.nrcan.gc.ca/index/lectures/).

The CFS also holds knowledge transfer symposiums in partnership with the forest sector community in Quebec's regions. The symposiums cover current forest sector issues (climate change, pruning, biological pest control, exotic forest pests, etc.). They are tailored to forest sector professionals and take a popularized approach.

7 BENEFITS FOR PRIVATE WOODLOT OWNERS

Through its network of partners, the CFS effectively meets the expectations of private woodlot owners. The various knowledge transfer methods that have been developed (*Branching Out*, *In Brief*, lectures, etc.) correspond to the various user profiles. In addition, the knowledge transfer officers who interact with the various regions and the research scientists are able to set up activities that help to meet operational requirements more effectively. For example, following an annual planning meeting and in response to a need expressed by woodlot owners in regard to certain pests in plantations (white pine weevil and white pine blister rust), the research scientists organized and held information sessions in the field. This way, the stakeholders had direct access to the research scientists and the research findings.

The activity consisted in bringing the participants together in a room where the research scientists gave popularized theoretical presentations on the white pine weevil and white pine blister rust. Afterwards, the participants travelled through the area, along with the research scientists, to put what they had learned into practice.

Figure 4: CFS research scientist explaining white pine blister rust to a group of forest sector stakeholders

Nearly 130 people in nine regions of Quebec participated in this activity involving the transfer of information on silvicultural techniques for controlling the white pine weevil and white pine blister rust and received training in the techniques to be used for controlling these two pests. The groups of participants consisted mainly of forestry advisers (forestry technicians and forestry engineers) who work primarily in private woodlots. Following this activity, they were able to teach these methods to users and thus provide direct access to research findings.

Forestry advisers working in private woodlots are responsible for overseeing the transfer of knowledge to woodlot owners, and therefore act as agents for change because improving forestry practices may depend on their ability to disseminate appropriate knowledge (Natural Resources Canada, 1994). The CFS helps these forestry advisers carry out their assignments by developing and presenting knowledge transfer tools to forestry advisers, who in turn transfer the knowledge to woodlot owners.

In the evaluation of the white pine weevil and white pine blister rust control activity, it was revealed that for 99% of the respondents the objective of learning about techniques for controlling these pests had been achieved for the most part. Participants increased their knowledge significantly in 65% of cases. Lastly, 98% of the respondents agreed that the CFS should organize similar sessions on other topics in their regions (Natural Resources Canada, 2006).

8 CONCLUSION

The province of Quebec has a vast territory and the CFS only has one regional office and two knowledge transfer officers to communicate research findings to more than 130,000 private woodlot owners and a larger number of forest sector stakeholders across the province. By using the system of administrative regions and developing appropriate knowledge transfer tools, the CFS can more effectively reach most forest sector stakeholders. In fact, the development of a provincial network of knowledge transfer partners makes the work of the CFS knowledge transfer officers easier and it makes possible for the CFS to be present in the various regions by participating in its partners' activities. The knowledge transfer officers are thus able to become familiar with regional problems and act as a link with the CFS research scientists. Because they keep up-to-date with the work conducted by research scientists, the knowledge transfer officers can also suggest activities and tools that meet the needs of stakeholders and help promote CFS research activities. This knowledge transfer process has been in operation for more than five years and is well regarded by both internal and external clients of the CFS. It promotes a positive awareness of CFS activities in Quebec.

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The Swedish forest commons in a rural development context

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Abstract

In the time for privatization of Crown land in the interior of northern Sweden, about 100 years ago, it was decides that approximately half of the privatized Crown land should be set aside as Forest Commons (FC). Today there are 33 such Forest Commons in Sweden, mainly owned by the individual farmers as a share in the specific FC, but jointly managed. The main reasons for this construction was based on the assumption that a FC, managed by professionals, should serve as a role model for the farmers (i.e. shareholders) and thus develop their interest, skills and management practices on their individually owned land. Further, by this construction, fragmentation of land was avoided, the risk of purchase from forest companies minimized, and the authorities could still keep control of how the management was performed. Thus, there are similarities between aims of governance processes' as we see it today and the aims of the governing process behind the establishment of the commons such as the focus on the tuning down of the self interest in favor for the public good. On the other hand, may the FC be looked upon as an attempt from the state to govern; to control the production and returns of the forests belonging to the small and less rich forest owners and further to use them as a tool to make their self-interest shift closer to or refocus towards the public good. Further, in 1983 a state commission on Collectively-Owned Forestland the FC were among the best managed forests in the country' and some researchers claims that the Swedish FC show environmental concern that is in accordance with, or better than that of other forest owners.

Consequently, the Swedish FC can be regarded as interesting examples of "good practices". In this paper, experiences gained from hundred years of existence and adaptation to changing societal conditions and general forestry practices will be presented and discussed in terms of rural development.

Key words: good forestry practice, economical returns, social returns, environmental indicators
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1 INTRODUCTION

1.1 ESTABLISHMENT AND FEATURES OF SWEDISH FOREST COMMONS

In connection with the finalization of the Great Redistribution of Land Holdings in the counties of Kopparberg and Gävleborg, and the delimitation of land in the counties of Västerbotten and Norrbotten, 33 forest commons were established by designating a proportion of each owner's allocated forestland to be managed jointly (SFS 1952). The first commons were established 1861 in the counties of Kopparberg and Gävleborg and the last common areas were established 57 years later in Västerbotten (Liljenäs 1982, Carlsson 1995). During this period, many changes occurred in the general political conditions and forest legislation. At the same time, the forest industry underwent a period of economic and industrial development, whilst the authorities increased restrictions concerning the sharing of benefits from the land tenure reform.

The Swedish forest commons are private forest holdings owned in common and managed jointly. Thus, the owners hold shares in the commons which can be transferred to descendants or sold, but only in association with their private estates. Further, the property rights can be retained after the shareholder has moved away from the community (Berge 2002). During the years since the commons were originally formed, the number of owners has increased considerably and many owners are now non-residents. Today there are about 25 000 shareholders (Carlsson 1999) of approximately 540 000 ha of productive forestland constituting the forest commons. The owners range from private individuals to forest companies and public institutions, although individual ownership generally dominates. In total, a significant proportion (22%) of the forest commons is owned by forest companies and 2% are owners other than individual farmers or non-industrial forest owners (NIPF owners). Of the remaining 410 000 ha belonging to NIPF owners, 46% is owned by non-residents. Thus, a minor proportion of the commons is in the hands of local individuals. However, the ownership conditions vary greatly between the different commons and counties. In the counties of Gävleborg, Kopparberg and Norrbotten, the proportion of forest commons owned by companies is 24-26%, compared to just 6% in Västerbotten. The low proportion of forest company ownership in Västerbotten is probably partly due to these commons being established after 1906, the year which saw the introduction of 'Norrländska bolagsförbudslagen' (SFS 1906a), a law preventing the acquisition of forestland by forest companies and economic cooperatives. The result has been that the extent of the forest companies' forest ownership has remained unchanged in Norrland since the law was introduced.

All forest commons are controlled by the same national laws and regulations, including the Swedish Forestry Act (SFS 1993), which regulates the management of Swedish forests. However, their formal organization and activities are regulated by a specific law, the Forest Commons Law (SFS 1952). Each forest common also has its own set of by-laws, authorized by the County Administration, which regulates the direct management of the common (Carlsson 1995). Management decisions are taken jointly by elected boards and executed by professional foresters. The shareholders' formal rights with respect to decision-making are, in general, proportional to the size of their share. The Forest Commons Law (SFS 1952) and some of the by-laws, however, contain provisions designed to limit the dominance of the larger landowners. Associated with ownership there are hunting and fishing rights.

From the second half of the 19^{th} century, forest management was mainly the province of the Swedish Forestry Service (Domänverket). The Forestry Service controlled the nature of the forests; management practices in the state-owned forests often informed the activities of other forest owners (Enander 2000). In 1934, the supervision of the management of the forests was handed over to the County Forest Boards. Gradually, the authorities' control over the commons decreased, and as a result of the Forest Commons Law (SFS 1952) they attained the independence they have today.

The most important source of income from the forest commons is from the sale of standing or harvested timber. However, some of the forest commons run subsidiary companies, e.g. selling hydroelectric power or processed timber products. The forest commons also hold savings in funds (Ministry of Agriculture 1983) and some have invested in the stock market and various local industries.

With respect to the aims of the Swedish Forest Commons and their achievements, different authors have emphasized different aspects, but they do not contradict each other. A summary of all the goals for these commons, and the means of achieving them, that have been addressed by Liljenäs (1977, 1982, 1983), the Ministry of Agriculture (1983), Stenman (1983), Kardell (1991, 2004), Carlsson (1995, 1999, 2000, 2001), Ericsson (1997) and Pettersson (2003) is presented in Table 1. No ranking of their importance has been attempted, since the aims are closely interconnected.

Table 1: The aims of the Swedish forest commons and advocated means for achieving them

Aims	Means
• To serve as an instrument for improved forest management with the focus on increased, sustained timber production. • To serve as an instrument for sustainable economic support for farmers and the local economy, also to provide a solid basis for taxation and to secure the continued existence of an independent class of farmers. • To support rural development and well-being	• By orderly, planned, scientifically based forest management facilitated by professional foresters, larger production units and the exercise of authority. • By serving as models for the farmers for management of their own forests. • By providing employment. • By preventing forest companies from acquiring the farmers' forestland. • By providing incentives to local agriculture and forestry. • By supporting local common goods

2 OBJECTIVES

The overall objective of the studies this paper based upon was to examine the outcomes of the Swedish forest commons in relation to the intentions and aims expressed by officials and commentators at the time of their establishment, interpreted in the present context, and hence contribute to the understanding of factors that foster the development of local institutions that successfully enhance forest conditions and rural development. Theoretically, the influence and outcome of the introduction of this specific property regime (Swedish forest commons) should ideally be examined by an ex-ante and ex-post comparison. However, for obvious reasons this has not been feasible, as in most cases where social phenomena are studied and policies are evaluated. Therefore, the second best option, between-property regime and between-region comparison, has been applied.

More specifically, the objectives and research design have been: to research and analyse the ways in which Swedish forest commons are organised in relation to aims and governing structures - including forest common property regimes - during different time periods. This aim can be divided into several research questions:

- To examine and compare forests under forest common and other property regimes in terms of current forestry-related variables, as a manifestation of the practical effects of the management regimes that have been applied. (part I)

- To examine if shareholders' harvesting and business activities, and their contributions to the local economy/rural development, are greater than those of non-shareholders, and if the forest commons have served as role models for their shareholders. (part II)
- To examine and compare forests under forest common and other property regimes in terms of biodiversity, by analyzing biodiversity indicators corresponding to the interim targets for enhanced biological diversity. (part III)
- To assess the extent to which three forest commons have contributed to rural development and shareholders' contentedness**.** (part IV)
- To assess the relationship between government and broader governance, by describing and analyzing the interactions between the state (via its bureaucratic bodies) and the Swedish forest commons. (part V)

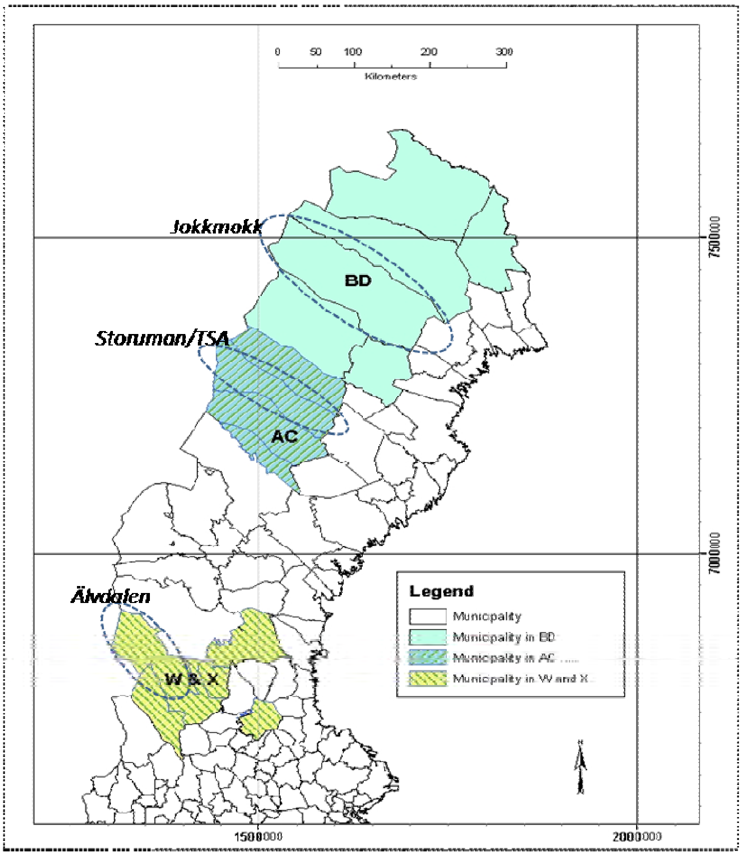

Figure 1: Municipalities with forest commons in the counties of Norrbotten (BD), Västerbotten (AC), Dalarna/Kopparberg (W) and Gävleborg (X). Forest commons that have been the subject of case studies are indicated with an ellipse.

3 FOREST CONDITION AND MANAGEMENT IN SWEDISH FOREST COMMONS

3.1 INTRODUCTION

Since one of the major aims driving the introduction of the forest commons (FCs) was to improve forest management, especially with respect to sustainable timber production, present forest conditions were studied, to obtain indications of the success of this management regime. By assessing and comparing the forest conditions in the FCs with the conditions in forests under other types of property regime in the same regions, the relative impact of introducing this specific regime could be analyzed.

3.2 MATERIAL AND METHODS

Any assessment of the outcome in terms of forest conditions should be based on objectively collected data. Therefore, primary data from the Swedish National Forest Inventory from the years 1998-2002 were used in this study. The quality of data allowed comparisons with sub-divisions down to a regional level, focusing on the forests comprising the Swedish forest commons and surrounding forests. Data on forests in forest commons were assessed and compared to corresponding data for forests owned by non-industrial private forest (NIPF) owners, company forests (those owned by joint-stock companies, either private or public), and forests owned by public bodies (including State-owned forests and forests owned by public institutions such as churches, municipalities and public foundations). Site productivity, age class distribution, degree of maturity of the stands and standing volumes *by age class,* were compared between the four owner categories as well as between and within the three counties and regions considered. Additional data on harvesting ratios (annual harvest/annual increment ratios) were also compiled.

3.3 RESULTS AND DISCUSSION

Generally, the mean site productivities were similar in the counties of Norrbotten and Västerbotten for all types of property regime studied. In the counties of Kopparberg and Gävleborg productivities were significantly higher. The lowest values were found in forest commons of Västerbotten, and both public forests and NIPF forests in Norrbotten.

In the three regions studied, the age distribution among the forests under the different types of property regime was most even in Norrbotten, and the Norrbotten forest commons exhibited the most even age distribution of the examined forest commons. A lack of medium-aged forest was apparent, particularly in Västerbotten, and its forest commons included a very small proportion of young forests. This implies that the

Västerbotten forest commons have a very high proportion of old forests. The distribution of maturity classes provides more specific information on the potential for final felling, thinning and other silvicultural activities. As shown in Table 2, there are large differences in this distribution between property regimes in Norrbotten and Västerbotten, but smaller differences between the counties of Kopparberg and Gävleborg. Three-quarters of the forestland in the Västerbotten forest commons is estimated to be sufficiently mature for final felling, compared to 29% of the forestland belonging to forest companies in Västerbotten.

Standing volumes within each age class provide a better picture of forest conditions and management practices than the overall mean standing volumes. In Västerbotten, forest commons have, with minor exceptions, lower standing volumes for each age class than forests under the other property regimes. Harvesting ratios for the period 1998-2000 indicate that considerably less than the annual increment was harvested in both Västerbotten and Norrbotten forest commons – even less than the ratios in 1975-80 and 1980-1993 presented by Carlsson (1995).

Table 2: Fractions of forestland area (percent) with forest sufficiently mature for final felling, according to property regime and region, 1998-2002 (and 95% confidence interval)

Property regime	Norrbotten	Västerbotten	Kopparberg and Gävleborg
Forest commons	38 ± 9	75 ± 11	42 ± 5
Public forests	51 ± 8	63 ± 11	33 ± 4
Company forests	27 ± 4	29 ± 7	34 ± 3
NIPF	34 ± 5	51 ± 7	39 ± 4

The study reveals conclusively that the forests in the Västerbotten forest commons differ in management status not only from the surrounding forests in Västerbotten, but also from forests in the other forest commons. Although the geographical conditions (site productivity, altitude, and proximity to high mountains) are somewhat less favorable for the forest commons in this area, these factors are not considered to significantly affect the outcome. This interpretation is based on the comparison with Norrbotten public forests and Norrbotten NIPF forests, which also have low mean site productivities, and in the case of the Norrbotten public forests large areas in close proximity to high mountains. However, forests in these areas have a more even age structure than those in the Västerbotten forest commons. Similarly, the proportions of forests that are sufficiently mature for final felling in Norrbotten, and their harvesting ratios, are closer to the standard.

4 COMPARISON OF HARVESTING AND BUSINESS ACTIVITIES OF NON-SHAREHOLDERS AND SHAREHOLDERS IN A FOREST COMMON IN VÄSTERBOTTEN

4.1 INTRODUCTION

The Swedish forest commons are intended to promote local agriculture and forestry, and to serve as models for forestry activities. On this basis, the hypotheses examined in this study were that the shareholders' harvesting and business activities, as well as their contributions to the local economy, are greater than those of non-shareholders. The contributions were assessed and discussed in terms of operating costs, investments, disposable income and direct tax revenue.

In order to address the hypotheses, a comparative study was conducted of the activities of NIPF owners in the municipality of Storuman, where one of the largest forest commons is situated. Storuman was chosen for various reasons, including: the size of the forest common, the fairly balanced distribution of forestland between shareholders and non-shareholders within the municipality, and the fact that only NIPF owners have shares in the forest common (while in most other Swedish forest commons a significant proportion is held by other types of shareholders).

4.2 MATERIAL AND METHODS

The study involved a total of 1583 individuals, defined as NIPFs: 871 residents within the municipality of Storuman and 712 non-residents. Of the total, 901 were shareholders in the TSA. NIPF owners included in the study were selected by using the same data and methods employed by Holmgren *et al*. (2005). Secondary data from Statistics Sweden (SCB) for 2000 were used, including the Total Population Register (TPR), the Register of Real Estate Assessment (FTR), annual income tax returns and excerpts of accounting items from SCB business statistics (SCB 2003). With assistance from SCB, the TPR and the FTR were used to identify each individual who owned agricultural property within the municipality. Forest data were supplied by the District Forestry Board of Storuman (2005a-c) and the Regional Forestry Board of Västerbotten (2000). Shareholders and non-shareholders of the TSA were assessed and compared using the following information from the data sources: forestry production data, sales revenues, operating costs and investments, disposable income and local municipal tax revenues.

4.3 RESULTS AND DISCUSSION

Based on the criteria applied in the sample selection, the shareholders and non-shareholders should have similar potential to practice sustainable forestry across the municipality. Nevertheless, the shareholders displayed lower activity with respect to annual felling. In fact, the harvested volume per hectare was more than three times greater on non-shareholders' individually managed land than on shareholders' individually managed forestland. The harvested levels on shareholders' land were even below the minimum level that could be expected from land classified as productive forestland, i.e. forested land with the potential to produce more than 1 m^3 wood per hectare per year. This was unexpected, since only minor differences in average mean site productivities, to the disadvantage of the shareholders, were found. The differences in timber extraction between shareholders and non-shareholders were also verified by accounted sales revenues.

Table 3: Standing volume and harvested volume on non-industrial private forest (NIPF) owners' land, including shareholders and non-shareholders in the municipality of Storuman in 2000.

Forest category	Mean site productivity (m^3sk/ha/y)	Average standing volume (m^3sk/ha)	Productive forestland (ha)	Harvested volume total (m^3sk)	Harvested volume per hectare (m^3sk/ha)
NIPF non-shareholders	2.7[1]	66[1]	65 000[4]	118 603[2]	1.83
NIPF shareholders	2.5[1]	67[1]	41 600[4]	22 088[2]	0.53
TSA forest common[3]	2.5	58	38 400	21 000	0.55

[1]Source: District Forestry Board of Storuman (Average standing volume and mean site productivity for ö.s.i ("översiktlig skogsinventering") areas) within Storuman Municipality, divided into the parts east and west of the so-called cultivation limit, unpublished, 2005). [2]Source: Estimates based on final felling area in the year 2000 given by the District Forestry Board of Storuman (excerpt for "KOTTEN" for the years 1998-2002, unpublished, 2005), assuming average yields of 120 m^3 sk ha^{-1} for final fellings and thinnings, given that final fellings account for about 88.5% of the total harvested volume (Regional Forestry Board of Västerbotten, 2000) [3]Source: S.son-Wigren (2001) and the TSA management report for the year 2000**.** [4]In total, NIPF owners individually managed 106,600 ha (source: Regional Forestry Board of Västerbotten, 2000).

The method does not allow a separation of income from the two different property types, i.e. individual and jointly managed land. However, the dividend from the forest common was relatively small in comparison to the total sales revenues, thus its influence was considered small. Relating declared timber sales revenues to the area productive forestland, shareholders present less than half of the sales values of the non-shareholders. The expectation was that the forest commons would have a stimulating effect on activities in the shareholders' individually owned and managed forest properties. In addition, the local economy and rural development should have been promoted. Since less activity was found among shareholders, thus generating less tax revenue, these expectations were not fulfilled. In terms of its impact as a role model, there does seem to be more similarities in levels of management activities between forests in TSA and forests individually owned by its shareholders than in forests owned by non-shareholders. However, it seems more likely that the shareholders have had a significant influence on the management practice of the TSA forest common than vice versa.

5 BIOLOGICAL DIVERSITY INDICATORS - A COMPARISON OF SWEDISH FOREST COMMONS AND OTHER FOREST OWNERSHIP CATEGORIES

5.1 INTRODUCTION

At the time of the establishment of the Swedish forest commons, timber production was considered the primary goal. Since 1993, production and environmental goals have been given equal priority. It has been claimed by some common researchers that property regimes similar to traditional commons could favor environmentally desirable outcomes. Thus, given claimed environmental concern among those involved in managing forest commons, and the observations of relatively high proportions of old forest in them (cf. part I), it was hypothesized that the Swedish forest commons could also be environmentally favorable. This hypothesis was tested by analyzing biodiversity indicators corresponding to the interim targets for enhanced biological diversity.

5.2 MATERIAL AND METHODS

Swedish National Forest Inventory (NFI) data related to the interim targets for enhanced biological diversity for the period 2003-2006 were used for analyzing differences between forest commons and other property regime categories regarding: the proportion of forestland with a large deciduous element; the proportion of forest >80 years old with a large (>25%) deciduous element; the volume of dead wood; and the proportion of forest older than 140 years. NFI provides national monitoring data related to progress towards the environmental quality objective Sustainable Forests. The following parameters were also considered to facilitate the interpretation: mean site productivity, standing volume in old forests (> 140 years old), and proportion of 'forest sufficiently mature for final felling', i.e. older than the lowest age for final felling permitted by the legal regulations.

The research area included all productive forestland within each municipality with a forest common, a total land area of 4.78 million ha divided roughly between three counties and regions as follows: the inner parts of the County of Norrbotten (BD; 2.24 M ha), the inner part of the County of Västerbotten (AC; 1.01 M ha) and parts of the Counties of Dalarna (W & X, including a minor part situated in the County of Gästrikland (1.53 M ha). The following owner categories were analyzed in this study: (i) forest commons, (ii) forests owned by NIPF owners, (iii) company forests, and (iv)state forests.

5.3 RESULTS AND DISCUSSION

In BD there was a significantly higher "proportion of forest land with a large deciduous element" in the forest commons than in company and state-owned forests. In both AC and W&X there were no significant differences in this variable between the forest commons and any other categories.

The proportion of forest older than 80 years with a large (>25%) deciduous element appeared to be lower, but not significantly lower, in the commons than in all other categories in both BD and AC. In W&X, however, significant differences in this respect were found between the forest commons and forests owned by both forest companies and the state.

With respect to the volume of dead wood no significant differences between regions were found. However, in both BD and AC the volume of dead wood per hectare was higher in forest commons than in forests owned by NIPFs and companies, but higher still in State-owned forests. In contrast, forest commons in W&X had the lowest volume per hectare of dead wood.

The only significant between-property regime difference in the proportion of forest older than 140 years was found in the AC region, in which it was significantly higher in the forest commons than in forests owned by forest companies.

Examining the status of biodiversity indicators provides no unequivocal results signifying that forestry in the Swedish forest commons has been conducted in ways that have promoted biodiversity more effectively than in forests of other property regimes.

6 INCOME GENERATION, BENEFIT USE AND LOCAL WELL-BEING FROM THREE SWEDISH FOREST COMMONS

6.1 INTRODUCTION

One objective of establishing the Swedish FC was, by forest-related activities, to strengthen the quality of life in the local communities in which they were established. According to Elands and Wiersum (2001), rural development can be characterized as "the process of reaching the desired futures of the countryside" and "to strengthen the livability in rural areas". The aims of this study were to assess how three forest commons have contributed to the rural development in the municipalities in which they were established, and to assess the contentedness with the forest commons among local shareholders.

6.2 MATERIAL AND METHODS

The case study included three selected forest commons: Älvdalen FC in Dalarna, Jokkmokk FC in Norrbotten and Tärna-Stensele FC in Västerbotten. The selection was based on their relative similarities in size and geographical positions within their regions, and variations in their time of establishment, system used for dividend distribution, and mixture of owners (i.e. proportions of forest owned by NIPF, Forest companies etc.).

For the assessment of the extent and use of the dividend FC management plans and reports from each FC for the period 1958-2007 were used. When appropriate, figures were organized into groups according to the purpose they were used for. The figures for the annual dividend have been converted into 2006 values.

Another issue addressed was the contentedness of the resident shareholders in the three FCs. For this, a mail questionnaire aimed to capture the local shareholders' perceptions regarding what the forest commons contribute to them, to the local community, to economic welfare, to the landscape identity and to the environment and nature quality, was sent to local shareholders in the three commons. Only resident shareholders were included in the study in order to maintain the local perspective and to limit the size of the study. In total, about 870 questionnaires were sent out with a return rate of 50 %. Only some of the results from the questionnaire were presented in this paper. The study also included data from Statistics Sweden (SCB) to describe demographic variations during the same period within the municipalities of the three studied FCs.

6.3 RESULTS AND DISCUSSION

The three studied FCs had developed in three different directions; there were differences in both the size and use of the dividend, as well as in contentedness with the FC. Älvdalen FC yielded the largest economic returns to the local shareholders, made the highest contribution to common goods, and had the highest proportion of contented local shareholders. In contrast, the economic contribution was lowest and the shareholders were least contented with the TSA FC. Thus, there seems to be a positive correlation between the value of the economic output to shareholders and contentedness. The amount of the dividend that is distributed to common goods also seems to be correlated with contentedness.

The high profits in Älvdalen are partly due to additional sources of income, besides those from forestry, mainly from hydroelectric power stations and capital investments. In addition, as previously described (Holmgren *et al.*, 2004, paper I), the FCs in Dalarna generally have higher mean site productivity and forestry has been more actively practiced. The higher successfulness in Älvdalen than in the other two FCs may also be related to the settings in which the FCs were established. Älvdalen is in an old cultural setting in which people have a long tradition of cooperating with each other, while TSA on the other hand, was established under coercion and with inherent conflicts between groups of owners.

Table 4: Dividend (million SEK), extent and use in Älvdalen, Jokkmokk and Tärna-Stensele forest commons (TSA), 1958-2007[a]

	1958-1967	1968-1977	1978-1987	1988-1997	1998-2007	*1958-2007*
Älvdalen FC						
Common good	70.1	88.0	57.6	43.0	93.5	*352.1*
Agriculture	14.2	9.7	11.3	16.5	20.8	*72.6*
Forestry	4.2	4.6	21.4	48.3	111.8	*190.3*
Total	*88.5*	*102.3*	*90.3*	*107.8*	*226.1*	*615.0*
Jokkmokk FC						
Cash payment	0.0	23.5	23.2	5.9	23.7	*76.3*
Other	3.1	9.2	9.0	4.3	3.4	*29.0*
Agriculture	18.9	6.1	7.6	3.8	1.7	*38.1*
Forestry	11.2	13.9	26.5	19.2	14.0	*84.8*
Total	*33.2*	*52.7*	*66.3*	*33.2*	*42.8*	*228.2*
Tärna-Stensele FC (TSA)						
Cash payment	22.0	28.0	31.5	23.5	13.2	*118.2*
Total	*22.0*	*28.0*	*31.5*	*23.5*	*13.2*	*118.2*

[a] Sources: Forest management report and annual reports provided by each FC for the period 1958-2007 except for Jokkmokk, in the period 1958-1967, for which the source was Liljenäs (1977)

The distributing systems are also important for rural development. The distribution system of Älvdalen FC is such that the entire dividend stays within the municipality, either for common goods or to subsidize expenses incurred on the shareholders' estates. In contrast, in TSA the cash payments result in the highest proportion of leakage out of the municipality. Thus, it is highly likely that the system used in Älvdalen has promoted rural development more effectively than the system applied in TSA, and for the same reasons, that Jokkmokk is intermediate in this respect. The high proportion of the dividend allocated to common goods in Älvdalen also shows that Älvdalen has succeeded in preserving the old tradition to collaborate.

7 SWEDISH FOREST COMMONS – A MATTER OF GOVERNANCE?

7.1 INTRODUCTION

The Forest Commons may be regarded as a means for the state to control the production and returns from the forests belonging to small and less affluent forest owners. Further, an attempt has been made to use the forests as a tool to realign the self-interest of this group of forest owners more closely to the public good. Forest Commons thus have a contested status, as private lands under public control. This paper examines the extent to which forest commons are currently managed directly by the government, comparing this with the general trend in forest policy towards less prescriptive governance and measures, which often take account of market and participative goals. Building upon a framework presented by Appelstrand (2007), this paper describes the major policy instruments relevant to forest commons from 1861-1996.

7.2 MATERIAL AND METHODS

Methodologically, the study is mainly based on evaluating published peer-reviewed literature and published sources of empirical data, such as FC yearbooks, forest management reports and secondary sources. The study draws upon these sources with a focus on major institutional and legal changes, particularly for the period of institutionalization of the first common forests in 1861, up to and including the suggested revision of the law pertaining to the FCs in 1996. In particular, state investigations and codes of statutes are used. Selection within the material centered on identifying common forest-specific policy instruments, in accordance with the categories of instrument described by Appelstrand (2007).

7.3 RESULTS AND DISCUSSION

Government steering and regulation has been dominant from the establishment of forest commons up to the end of the 1996 study period. Even if the now partly deregulated Forestry Act (1993) controls all FC, they are still subject to the FC law and by-laws regulating their every day activities. In addition, formal control is still exerted by the official County Administration and management is performed jointly through elected boards and executed by professional foresters. The shareholders' formal rights with respect to decision-making are, in general, proportional to the size of their share, but their influence in practice is restricted to the election of the board (cf. Stenman 2009), and the *Act Relating to Collectively Managed Land (*SFS 1952) is still in place.

While a number of provisions of the Forestry Act have been totally or partly abolished, the management of the FC is still regulated according to provisions in the *Act Relating to Collectively Managed Land* and by-laws. Such rules include obligations to follow forest management plans, to have a professional forester in charge of the management and regulations regarding how the economic returns are to be used. Claims by the public on FCs can also be seen as stronger than those on private lands.

There are similarities between the current aims of governance and the aims of government policy behind the establishment of the commons. In both cases there is a focus on reducing self-interest in favor of increasing the public good, and on creating higher participation and involvement by owners in good forest management. However, while according to Lebel *et al.* (2006 p.3) “Good governance” has been associated with participation, representation, deliberation, accountability, empowerment, social justice and organizational features such as multilayered and polycentric; arrangements, these features have not been notable traits in the management of FCs. In addition, the designation of the commons, for instance as being owned in common (opposed to jointly), may have added to alienation of the commons’ owners, as indicated by the discussions on decision-making rights for the commons. In addition, FC shareholders in Dalarna and Norrbotten have acknowledged the legitimacy of the state-induced common framework to a greater extent than their counterparts in Västerbotten.

The results show that during their history the Swedish FCs have been closely associated with state regulatory instruments, policy tools and concepts, but to varying extents in different regions. The variation between different regions may be explained by differences in the historical and social contexts in the regions, as well as diverging motivations for common forests’ owners. These motivations are affected by a potentially very complex institutional environment, local perceptions of commons, owners’ capability and knowledge, as well as broader individual motivations.

We conclude that direct government management remains a dominant influence, with the major legislation pertaining to forest commons dating back to the 1950s. The study identifies regional differences in the ways the commons have been governed; this may help to explain differences in results between commons. However, the outcome of a policy program is also influenced by its actual implementation, in which institutional factors are important. The results suggest the need for further studies of the influence of these factors on policy outcomes.

8 FINAL DISCUSSION AND CONCLUSIONS

In this thesis, the influence of the Swedish forest commons are assessed regarding forest condition (including biodiversity), management, the local economy, and local contentedness. There are various ways to do this. Here, I have followed the recommendations of Agrawal (2001) and Berge (2002) to use a comparative approach considering both successful and unsuccessful common's features. With focus on the outcome of activities in relation to the stated aims, forest commons have been compared with other property regimes. This approach has proved constructive as the heterogeneity among the Swedish forest commons was exposed and our general understanding of enabling features for forest commons amplified.

A key issue raised by the results is why there is such variation between the Swedish forest commons in how they meet their aims?

The results show that during their history the Swedish FCs have been closely associated with state regulatory instruments, policy tools and concepts, but to varying extents in different regions. We may here fall back to the theories of Ostrom (1990), Agrawal (2001) on enabling conditions for robustness. From the studies we find variation between the regions in critical enabling conditions. Most positive results were found in the commons in Dalarna; their forest production was comparable with the other forest owners' production in surrounding forests, environmental indicators showed the same pattern. From the studied case in Dalarna (Älvdalen) we further revealed large contributions from the FC to maintenance of both the social and economic infrastructure and a high contentedness with doing so among the local shareholders. In Älvdalen FC we also found enabling conditions in a higher extent than in for instance the case studied in Västerbotten, the TSA FC. Examples of enabling conditions that is believed to have been is important for the results in Älvdalen was that it is established in an area where; the users are already used to cooperating with each other, share norms, in the past have had successful experiences from commons further where there are homogeneity of identities and interests and few conflicts (Holmbäck 1934, Levander 1953, Veirulf 1937) . It is additionally believed beneficial with overlap between user group residential location and resource location, that the FCs are allowed to organize themselves without external interference and if central government not is undermining local authority. If we compare TSA with Älvdalen, we also find that these conditions in a higher extent apply to Älvdalen then to TSA (c.f. Stenman 2009).

An additional complicatedness in the case of Swedish forest commons could be that, in contrast to many commons worldwide, they are owned in common and not jointly. This means that the number of owners tends to grow proportionally to the growth of the population, as long as the properties are inherited by all of the children of each generation of owners; a factor that according to Olson (1965) adversely affects their success. Further, that the proportion of non-resident owners tends to keep pace with migration from these rural areas, another factor that potentially could have a negative impact, at least from the local perspective. From our results this does not seem to be an issue with a system like the one used in Älvdalen, but have an impact in Västerbotten.

Why did the state choose to apply such strict governing of the FCs in Västerbotten?

From our assessments of the Swedish FCs, the FCs in Västerbotten generally proved comparatively unsuccessful. Neither good resource use is reached nor perceived well-being and contentedness. At the time of establishing the FC in Västerbotten, the state had already imposed strict regulations on the forests. These were for example the Act concerning the disposal of forests in Lapland of Västerbotten, Norrbotten and parts of the county of Kopparberg (SFS, 1866); the Forestry Act (SFS 1903); the Act Relating to Regulation Against the Acquisition of Forestland by Forest Companies and Cooperative Economic Associations (SFS1906 a) and the Revised Act Relating to Delimitation of Land for Lapland in Västerbotten and Norrbotten (SFS 1906 b). Further, shortly after the establishment of the last commons, the regulations concerning the disposal of the dividend in Västerbotten was changed, now allowing cash payments to the shareholders. The revised delimitation regulations (SFS 1906b), reduced the farmers benefits both with respect to the size of the allocated forestland and a larger fraction was kept as a FC. By these changes the motive behind the establishment of the FC (summoned in Table 2), were heavily undermined, especially for Västerbotten. In 1983, the Swedish commission on collectively-owned forestland proposed changes in the Act Relating to Collectively-Owned Forest Lands (SFS 1952). One proposed change was that the profits should be distributed as subsidies, but that shareholders like the state, the church and the municipality not should be eligible to any profit from the FC. The same should be the case for forest companies, if they were not registered within the same municipality as the FC. This proposal supports the original aim for the commons as a means for rural development. Another proposal was that the less successful commons should be divided between the owners. The proposal was turned down and since then little, if any changes have been made in the “Act relating to collectively-owned forest lands” (SFS 1952) on the management of the FC. A central question for the future of these less successful FCs is thus, how to let go of the past and find ways to a more efficient management of the resources in the future? How to, in the context of rural development, find ways to enhance incentives for the FCs to develop innovative processes, to (re)invent the organization at the same time as they consider production, environmental issues but also social issues.

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Small scale forest owners' economic, social and environmental responsibilities – an explorative study

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Abstract

Taking responsibility refers to balancing economic, social, and environmental concerns. However, many stakeholders often have different opinions about the meaning of responsibility. This paper discusses small scale forest owners' responsibilities. This is done from the owner's perspective. Thus, the owner and his family will be in the center. In "next" circle the local community including neighbors and other businesses are put. The "second circle" includes the society en large including the general audience, the government and its forest policy and the forest products industry. The outmost circle consists of other nations and global policies or concerns. Results from an explorative study are reported. Interviews have been made with small scale forest owners, a sawmill owner, local government commissioner, ranger, representative for an environmental organization, buyer of lumber, and citizen. Their views on responsibility will be presented, differences will be highlighted and conflicts that exist between the forest owner's perspective on responsibility and that of stakeholders is also addressed.

Key words: CSR, corporate social responsibility, sustainable, cutting behavior, supply, non-market utilities, local communities
FDC: 611:3:682=111

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Small-scale woodworking technologies to improve quality of life and forest health in rural communities

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Abstract

The increasingly capital-intensive nature of the forest products industry has led to the closing of many small sawmills across the southern United States. In addition, highly productive and capital-intensive logging technologies have replaced labor-intensive but less productive forest operations. As a consequence, landowners in this region who own timber tracts less than 50 acres may find themselves without a market for their timber. To determine how landowners might be able to use small-scale technologies to fill this niche we 1) conducted a nation-wide mail survey of portable sawmill operators to determine how small-scale technologies such as this may be used to improve forest management and quality of life for rural residents, and 2) conducted in-depth follow-up phone interviews with a select number of survey participants to better understand how this technology might be used for community development. As part of this work, we integrated multiple research methods, both quantitative and qualitative to gain a unique perspective of forestry related microenterprises. We have found that most surveyed family forest landowners in Alabama own their property for forest aesthetics, recreation, and wildlife, because they are either unsure of how to manage their property or feel that forestry is not profitable. Portable sawmills have the potential fill a niche market utilizing existing natural resources that may otherwise be neglected, serve as a source of additional income for small-scale private landowners, as well as improve forest health and rural quality of life.

Key words: small-scale forestry, logging technologies, quality of life, rural communities
FDC: 682+360=111

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1 INTRODUCTION

Throughout the United States, forested land occupies over 749 million acres, approximately 71% of which is privately owned (Smith et al. 2004). About 29%, or 214 million acres of forestland is located in the Southern region of the U.S., with over 10% located in the state of Alabama (Smith et al. 2004). The vast abundance of forested areas throughout Alabama, as well residents' reliance on timber for livelihood, led to some parts of Alabama to be considered timber dependent regions (Howze et al. 2003). One characteristic of these timber dependent areas is that residents are often plagued with high rates of poverty among other factors even though the land in the area is often vary valuable (Howze et al. 2003).

To further understand this dynamic, it is necessary to understand private landowner's objectives for land ownership and management. Previous studies suggest that forests may be managed for a variety of reasons, including timber production and other goods and services such as aesthetics, recreational opportunities, wildlife habitat, biodiversity preservation, water quality protection, and carbon sequestration (Newman and Wear 1993, Barlow and Grado 2002, Wear and Greis 2002, Raunikar and Buongiorno 2006, Grado et al. 2009, Stenger et al. 2009). In the past 20 years there have been dramatic shifts in the ownership of private lands as industrial landowners sold their landholdings while non-industrial landowners eagerly purchased land for primarily recreational reasons (Mather 2001, Butler and Leatherberry 2004, Kendra and Hull 2005, Zhang et al. 2005, and Pan et al. 2007).

In recent survey it was determined that Alabama forest landowners own land for a variety of reasons; no longer are these lands set aside for economic reasons alone (Zhou 2010). Statewide, the most important reasons for ownership were to pass land on to heirs, to enjoy beauty or scenery, and for hunting or fishing. All three of the most frequently selected reasons were not directly associated with economic timber production, but instead non-timber issues. When examined by tract size, survey respondents who owned 10-100 acres were more likely to place importance on owning their forest for non-timber activities. In contrast, larger scale landowners who owned parcels that ranged from 101-500 acres were more likely to have timber-oriented objectives (Zhou 2010). Small-scale landowners often state that they do not actively manage their timber because they lack of confidence in forest management practices or they perceive of low returns from timber markets (Egan 1997, Zhou 2010). This lack of management may inadvertently jeopardize the health of their forest (Egan 1997). The need for outreach and education continues to help non-industrial private landowners make informed land management decisions (Zhou 2010).

It is important that members of timber dependent communities identify new and multi-faceted uses for the resources that are readily available to ensure diversity in economic revenue streams, while limiting environmental degradation. Unlike larger harvesting operations that are often ill suited to meeting non-industrial private landowner management objectives, small-scale harvesting and processing systems have the potential to increase forest health as an additional forest land management tool. Likewise utilizing small scale technologies can lead to increased revenue generation, both at an individual level and also filtering throughout local economy - offering potential improvements to local community development. One such technology that may prove to be beneficial is the portable sawmill.

Popular in the late 1800's, portable sawmilling was based on the principle of bringing the mill to the logs at or close to the harvest site. These mills were often referred to as "One Man Farmer's Sawmills", may have been either water or steam powered, and could be dismantled over a period of days by a 6-8 person crew and moved to the next location. Today, portable sawmills are truly "portable" and are easily moved on trailers that are pulled behind pickup trucks. Use of these mills has also evolved with time. It is well understood that portable sawmills can be used for the production of specialty wood products, and other hobby uses by their owners. However, there is also potential for these mills to be used as a fundamental tool to enhance both forest health and aid with additional forest management objectives. Likewise, they can also be used in community development initiatives.

Portable sawmills can be part of small-scale timber harvesting activities that make a positive environmental contribution while optimizing resource utilization, maximizing options, and increasing revenue streams for portable sawmill owners and landowners (Mullins 2007). Small-scale timber harvesting and processing would be the most profitable outside of "mainstream" forestry operations, in niche market areas, at the urban interface, or in areas where large machinery would have the potential to destroy the integrity of the forest. Updegraff and Blinn (2000:37) note that "many landowners are interested in improving their land for aesthetics, recreation, and wildlife and are interested in hiring small-scale equipment operators to thin stands, develop recreation trails, harvest small areas for wildlife, regeneration, etc. to improve their woodlot." The benefits of utilizing small-scale equipment to achieve these desired management objectives include lower capital costs, lower operating costs, the equipment can have multiple uses, and is easier to transport (Updegraff and Blinn 2000).

An additional benefit of portable sawmills as a management tool is in the utilization of trees removed from storm damage, bug damage, salvage, dead trees, selective harvest, thinning, and other forest stand improvements. Mullins (2007) notes, "more importantly, the availability of this new technology provided a tool to profitably turn previously 'useless and worthless' trees into valuable lumber with an initial investment less than the cost of a small tractor. The highly portable mills can be operated by a single operator to produce lumber from logs conventional sawmills cannot or will not accept."

This paper explores how portable sawmills can potentially contribute to improvements in both forest health and the local community. This analysis will discuss opportunities and potential obstacles to adopting the use of portable sawmills as an additional forest management strategy either alone or through cooperative agreements, and why it would be advantageous to develop outreach and education programs for local forestland owners regarding the use of small-scale technologies such as portable sawmills.

2 METHODS

In an effort to collect information on common portable sawmill utilization practices and the potential for use as a tool in forest management strategies, portable sawmill owners who did and did not own forest land were surveyed in a national portable sawmill owner/operator survey, during the summer of 2009. Although the survey addressed several themes, one potential program idea that was explored was the prospect for the development of cooperative agreements between landowners and portable sawmill owners, where a landowner would allow a portable sawmill owner to utilize wood from their land for a fee. Portable sawmill owners were asked questions related to joining into a cooperative agreement as well as land management objectives for milling timber.

An initial postcard was sent to 4946 recipients inquiring as to whether they owned a portable sawmill and if they would be interested in completing our survey. Based on postcard responses, the survey was then sent in July 2009 to 1196 portable sawmill owners who agreed to complete the survey. A follow up postcard reminder was sent in early August 2009, and a second survey was sent in late August 2009. We received 949 completed surveys which yielded a response rate of 79%. A total of 203 responses were obtained from the southern United States, representing 21% of the completed surveys.

During this same period, a separate mail survey was sent to small-scale forest landowners in Alabama regarding their current portable sawmill usage to meet their land management objectives, as well as their interest in joining a cooperative agreement to utilize portable sawmilling as an additional land management strategy. A total of 2570 questionnaires were mailed to these landowners; 197 were returned as undeliverable; and 424 responded back for a response rate of 17.9%.

Follow-up interviews were also conducted throughout the Fall of 2009 with 30 portable sawmill owners in various regions of the country. Approximately 35% of the follow-up interviews were conducted with owners who resided and worked the South. Interviews were conducted via email and/or telephone and lasted between 15-120 minutes, with the average interview lasting approximately 65 minutes. Various data were collected during these interviews, but one theme in particular addressed the potential for a cooperative agreement between the portable sawmill owners and landowners.

3 RESULTS

Portable Sawmill Ownership and Usage as a Land Management Tool

Approximately 64% of respondents from the national portable sawmill owner survey were also small scale forest landowners, and a total of 83% of those surveyed were forestland owners owning both large and/or small tracts. Table 1. displays the acreage owned by this group.

Table 1: Frequency and percent of forestland acres owned by portable sawmill owners in the southern U. S.

Acres	Frequency	Percent
None	34	17%
<10 acres	25	12%
10-25 acres	37	18%
26-40 acres	18	9%
41-55 acres	15	7%
56-70 acres	13	6%
71-85 acres	7	3%
86-100 acres	8	4%
>100 acres	45	22%

These respondents often used portable sawmills in conjunction with various land management techniques. About 52% used their portable sawmill as part of storm damage cleanup, 29% as part of bug damage cleanup, 41% as part of yard cleanup, 62% with their thinning regime, 16% with clear cutting, and 17% were among various other management techniques (Figure 1).

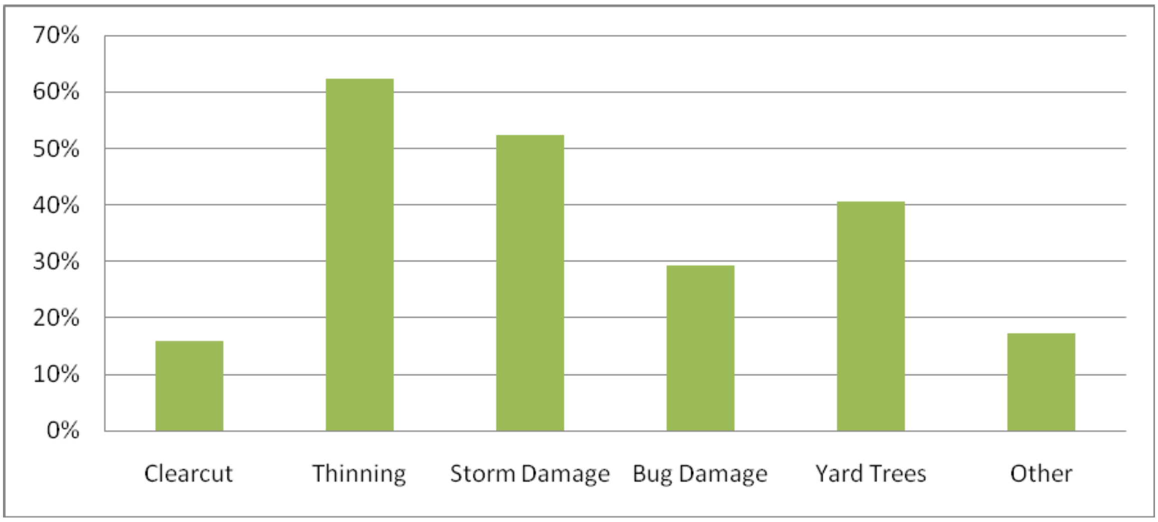

Figure 1: Land management practices utilizing portable sawmills in the southern United States.

Follow-up interviews with portable sawmill owners revealed that they often bought their portable sawmill as a way to decrease the amount of timber waste they were witnessing throughout their communities. A husband and wife team who responded noted, “it is a great satisfaction to create a product from previously discarded material. We rely 100% on salvage.” Another respondent (a building developer/contractor) stated “trees have to come down anyway to build a house and it is nice when the house can be built using part of their own timber. The wood lives on in the house.” One respondent who owns a tree service noted “I love making lumber from logs that would otherwise be chipped for boiler fuel.” Additionally, a respondent who also was an owner of a sawmill and lumber company recounted his business practice as, “logs are taken and milled locally from wood that would be ground for woodchips or cut for firewood.”

Cooperative Agreements

When asked whether they would be interested in joining a forestry based cooperative agreement that specifically involved portable sawmilling, Alabama timberland owners were asked to indicate one of the following; (1) *yes I am already involved in an agreement with a portable sawmill owner, (2) yes I am interested*, or (3) *no I am not interested*. If respondents indicated that they were not interested, they were asked to state why they were not interested.

Approximately 18% of Alabama timberland owners indicated they were interested in joining a cooperative agreement, and one respondent was already involved in this time of agreement. About 82%, or 286 respondents, indicated that they were not interested in a cooperative agreement, with over 30%, indicating the primary reasons for lack of interest (Table 2).

More than half of the respondents, 58%, indicated that they were not interested in cutting timber on their land, but instead were more interested in preserving wildlife, and the integrity of the forest. Approximately 11% of respondents stated they would potentially be interested but they would need more information and could benefit from educational material.

Table 2: Reasons Alabama landowners cited for not being interested in portable sawmill cooperative agreements

Response	Frequency	Percent
I have a mill	3	3%
Too much time involved	4	4%
I am a distant owner	2	2%
I don't want to cut timber/ not interested in timber	52	58%
I am a friend of a sawmill owner	4	4%
I need more information/not sure what to cut	10	11%
I deal with a timber/sawmill company	3	3%
I am generally not interested or see no profit in it	4	4%
I don't want or trust others on my land	6	7%
Other: concern with tree size, timber market, etc	2	2%
	90	100%

Data from portable sawmill owners who reside in several southern states in close traveling proximity to Alabama were analyzed to understand willingness to travel and mill timber from others' land. Approximately 56% of those surveyed in this region were willing to mill timber from other landowners' property, and 47% were interested in joining a co-operative consisting of some type of collaboration between landowners and sawmill owners. This represented a slightly lower percentage when compared to portable sawmill owners' willingness to join a cooperative agreement throughout the entire U.S. (Table 3).

Table 3: Portable sawmill owners' interest in a cooperative agreement with landowners

	Interested	Not Interested
U.S.	49.2%	50.8%
South	47.3%	52.7%

Respondents who were interested in a cooperative agreement were then asked to offer a rough estimate of the percentage of profits they were willing to share with the landowner for the use of their land. The most prominent percentage that portable sawmill owners were willing were share with the landowner was 50% of the profits, with a range of 0-70% (Table 4).

Table 4: Percent of profits portable sawmill owners are willing to share with landowners

Percent of Profits Shared	Number of Respondents	Percentage of Respondents
Less than 10%	3	6%
10-19%	3	6%
20-29%	7	14%
30-39%	8	16%
40-49%	6	12%
50-59%	21	43%
60-69%	1	2%
70-79%	1	2%
80-89%	0	0%
Over 90%	0	0%

Landownership characteristics of portable sawmill owners, such as acreage of land owned, was not a statistically significant factor in their interest in joining into a cooperative agreement. Therefore there was no difference in attitudes toward joining a cooperative agreement between portable sawmill owners who own several acres of forestland and portable sawmill owners who own no forestland at all.

Follow-up interviews with portable sawmill owners showed the possibility of a very high level of interest in cooperative agreements. All of the respondents were very involved with portable sawmilling and used it for a source of income ranging from "a few dollars on the side" to full time employment. The respondents were asked whether they would be interested in a cooperative agreement as a means of obtaining new avenues to get timber to mill. Over 90% of the respondents were highly interested in joining an agreement like this if one were available in their area. Interestingly, there was an increased need to explain the concept of a cooperative agreement in greater detail than allowable in a traditional mail survey. Often this section of the interview went on for several minutes. Those respondents who were interested in a cooperative agreement would also like to see meetings with other portable sawmill owners in their local areas to share ideas and timber sources, as well as arrangements with landowners to mill for money or a supply of timber.

4 DISCUSSION

Portable sawmills are a relatively inexpensive tool ranging in price from a few hundred dollars to several thousand depending on the model and capacity. The average price for a portable sawmill that could be used as a hobby or very small business for the "average landowner" is between $3000-$6000, therefore given the right educational tools landowners have the potential to recuperate the cost of their mill relatively quickly.

Based on this current study there appears to be few Alabama landowners that utilize portable sawmills as part of their overall forest management strategy, and taken at face value their interest appears to be low. However, the landowners surveyed seemed to have limited knowledge of portable sawmills or how it could potentially benefit their forest management objectives. While both large and small-scale landowners have the potential to benefit from the use of portable sawmills as an aid in their land management strategy, small-scale landowners may benefit most. Quite often operating costs associated with harvesting timber on smaller tracts of land are much higher, making timber harvests on these properties less attractive economically to both landowner and logger. In addition, small-scale landowners have limited income generation options available, so utilizing a portable sawmill on smaller tracts of land could create an additional forest management and income-generating avenue that is not available to them in the current market.

Portable sawmills can be used for a variety of functions within the forest in addition to just "cutting timber." However, there seems to be a lack of understanding by landowners in the above cases regarding forest management strategies. They are unaware that it is not essential to damage the integrity of the forest in order to utilize a portable sawmill. As noted above, portable sawmills can be used in forest management - salvaging logs that might be left as "cull trees" in traditional harvesting systems. Portable sawmills are also ideal for using wood removed in small harvest areas. Among some of the strategies currently utilized by portable sawmill owners are creating recreation trails, clearing land for a house/cabin, and storm/bug damage cleanup. It is important that landowners understand that this "waste" could be transformed to lumber and used to build a barn, furniture, and for housing improvements. Multiple uses of portable sawmills themselves as a forest management tool need to be fully understood before full interest in cooperatives can be realized.

Many of the portable sawmill owners in the South that were surveyed/interviewed currently utilize their mills with a variety of land management techniques both on their own land and on others' land, ranging from thinning, to storm cleanup, to utilizing timber that would otherwise be discarded. Their timber uses ranged from classical lumber production to creating finished products within a niche market. These portable sawmill owners, in addition to a great entrepreneurial spirit, also realize the potential of portable sawmills outside of the mainstream of traditional timber and wood utilization. They instead use their mill as an environmental tool to assist in forest management strategies that prevent excess waste of timber that might otherwise be discarded.

Portable sawmill owners who were surveyed also indicated a willingness to travel a fair distance to obtain timber. This willingness, coupled with small landowner land availability in a limited market, could lead to forging potential partnerships or cooperative agreements. A network of portable sawmill owners and landowners could be created via an internet social networking site or other forest-based internet sites. This site could be used as a tool to help locate and pool potential resources and opportunities. Portable sawmill owners and landowners alike could benefit from this partnership economically and could collectively enhance community development, through additional local revenue, new products available to residents, and new social networks forged within the community.

Notably, with respondent interviews a full explanation of portable sawmill usage within a cooperative agreement was often needed in order for respondents to better understand the concept. This demonstrates that there could be a greater interest in forest/portable sawmill based cooperative agreements, but it appears that a general lack of understanding is hindering respondents' initial interest. Specifically, of those who responded to our landowner survey approximately 58% were not interested in a cooperative agreement involving portable sawmilling because they believed that they must harvest their timber, such as clear-cutting for timber production rather than salvaging wood that might otherwise be wasted, to participate.

Previous literature has detailed that portable sawmilling can be used for several purposes outside of "cutting timber," including improving land for aesthetics, recreation such as trails and wildlife purposes, turning otherwise low value trees into valuable lumber, and other environmental strategies such as carbon mitigation tactics (Updegraff and Blinn 2000, Mullins 2007). Multiple use opportunities need to be conveyed to landowners through extension and outreach programs to increase interest if this potentially beneficial avenue is to be explored.

Outreach and education opportunities abound and could come in the form of pamphlets, articles, and demonstrations describing various options for landowners. Assistance could be provided to rural residents to begin a forest-based small business with the timber they process with a portable sawmill. Workshops could facilitate activities such as grant writing assistance, among other small business support. An Internet based social networking site could be developed to forge partnerships between landowners and portable sawmill owners, providing educational resources for both to succeed.

A collaborative arrangement through cooperative agreements among portable sawmill owners and forest landowners could facilitate the development of a small timber market for lumber, an outlet for finished products, and the sale of actual sawyer services. With the abundance of non-industrial private forestland in Alabama coupled with minimal options for small landowners, new forestland management strategies should look to incorporate various techniques, such as utilizing portable sawmills, with these various strategies in mind.

Both landowners and portable sawmill owners alike need information on available resources, programs, and various opportunities available to them. Extension programs need to continue to provide education on various land management strategies; striving to introduce new and unique avenues for local community development, such as portable sawmilling, with the ultimate goal of forging working relationships among community members that will enhance both the integrity of the forest and increase community development.

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Forest owner associations as intermediaries between: forest owners and the wood based industry

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Abstract

About 140 Forest Owner Associations (FOAs) play a key role for the commercialisation of timber produced in small and medium sized forests in Bavaria. In the last years, the FOAs merchandised around 6 Mio cubic metres (cbm) of timber per year. The market forces the FOAs to further enhance. At this point, the project of the Bavarian State Institute of Forestry supports the FOAs efforts to analyse and re-engineer their business processes.

The applied methodology was orientated strictly towards the objectives of the project. Therefore, participation methods of empirical social research were mainly used to analyse and re-engineer the business process management.

The forest owner associations are applying different organizational models. The project found four different models, but only two of them are particularly relevant in the international context: I. Model: Business Manager (BM). A team of Forest Engineers directs the business of a FOA. One engineer officially leads the team of business managers. In fact, the BMs have more or less the same duties and handle all the tasks within a FOA. II. Model: Chief Business Manager and Field Staff. In this Model, generally a Forest Engineer is the Chief Business Manager (CBM) and one or several administration secretaries work in the association´s office. Field staff (FS) are functioning as contact persons between the association and the forest owners. The most important and consequently analysed core process for all FOAs is called “Wood Supply and Marketing”. The analysis showed, that especially the leading BM should delegate less sophisticated working steps to less qualified staff.

Key words: forest owner associations, forest owners, wood industry
FDC: 944:7=111

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1 INTRODUCTION

The forests in Bavaria cover about one third of its land area or 2.56 Mio hectares (ha). The major part of this forest is held by private forest owners. Around 700 000 landlords manage approximately 1.4 Mio ha. Two thirds of the private forest enterprises cover less than 20 ha. Additionally 13.5 % are owned by communities (mainly municipal corporate bodies and the church). The high volume of stocked timber and favourable growing conditions permits the sustainable harvest of about 21 Mio cbm per year. Forest Owner Associations play a key role in the commercialisation of timber produced by private forest owners and communities. In the last years, about 140 FOAs commercialised around 6 Mio cbm of timber per year. The merchandised volume tripled from the year 2000. This performance was only possible, because the former none profitable organizations (incorporated societies) transformed themselves in more professional entities, officially named "societies with economic interests". The wood based sector is changing rapidly: By trend the wood based industry is growing more and more with giant production units with capacities that are often between 500.000 to 1 Mio cbm per year and more. Additionally, the development of new soft- and hardware for supply chain management and new navigation logistic tools as well as the competition from traders in the timber market, forces the FOAs to enhance further. At this point, the project "Mobilization of wood and enhancements of wood supply chains of forest owner associations in Bavaria by customising the business processes to new logistic and information technologies" (named "the project") of the Bavarian State Institute of Forestry is under way. The project supports the FOAs to analyse and re-engineer their business processes. The main objectives of the project were: a) Further development of business processes at FOA level; b) To analyse and to enhance the wood-acquisition in small scale forestry structures; c) Further development of marketing concepts and logistic chains for FOAs.

The main partners of the project were the FOAs and the agencies for agriculture, food and forestry in Bavaria (further on called "agencies"). These agencies work traditionally close together with the FOA and support them especially with extension work for the forest small holders.

2 METHODOLOGY

The applied methodology was orientated strictly at the objectives of the project. Thus, mainly participatory methods of empirical social research were used to analyse and re-engineer the business process management. In detail, the methods were: Written and telephone surveys, interviews with experts, workshops with the partner organizations in different constellations to bring together the participating groups and interested FOA.

The project team used the classical approach of business process management, considering the following four steps:

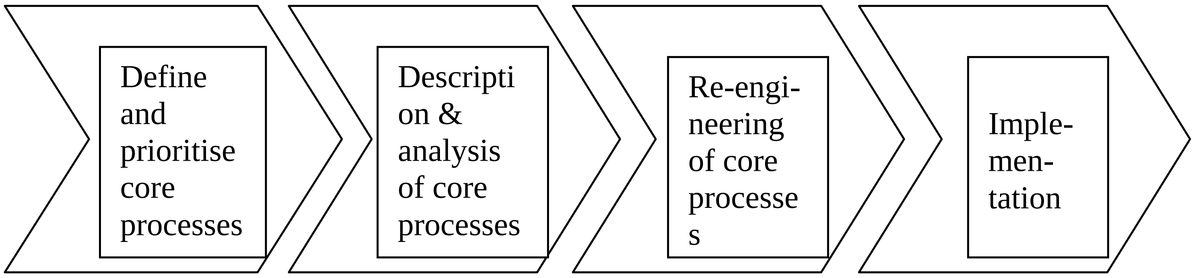


Figure 1: Business Process Management

The analysis of the business processes were done in two steps: 1. Qualitative analysis in workshops and interviews conducted with the participating staff members of the FOA and then documented as well as modelled with the business process management software-tool "ADONIS". 2. Quantitative analysis: The individual staff members of FOA documented their working time used for single working steps within the core business process. The data was processed and grouped for similar organizational forms of FOAs.

The re-engineering or improvement of the core process took place in workshops moderated by the project team and the participants were FOA and agencies for agriculture, food and forestry. In the workshops the project team applied methods like SWOT, or the "Four-Field-Method" (FFM). Within the FFM, the workshop groups elaborate "field by field" a working program, using pin-walls for the four consequent steps: "Actual situation", "target situation", "obstacles/problems" and "solutions". For the implementation, the FOAs are themselves responsible. The project team assists on demand.

3 RESULTS

In general, the Forest Owner Associations in Bavaria or in Germany are registered as incorporated society or as society with economic interests. Seldom, they adapted legal forms as foundations or as limited companies. Most of them have their origin in the seventies and are following the rules of the Federal Forest Act to take advantage of subsidies. The goal of the FOA is to support private forest owners in managing their forest and to alleviate the effects of the small scale ownership. The main tasks of the FOA are to bundle and commercialise timber.

In the project, a total of eight FOA participated. They represent different regions in Bavaria. Regional criteria like dominant tree species (spruce, pine, broad leaf trees) or the mean area managed by a single forest owner influence the business and processes of the FOA.

3.1 ORGANIZATIONAL MODELS

The forest owner associations are applying different organizational models. Four different types were found by the project. Two of them are more relevant, considering also an international approach, a brief introduction:

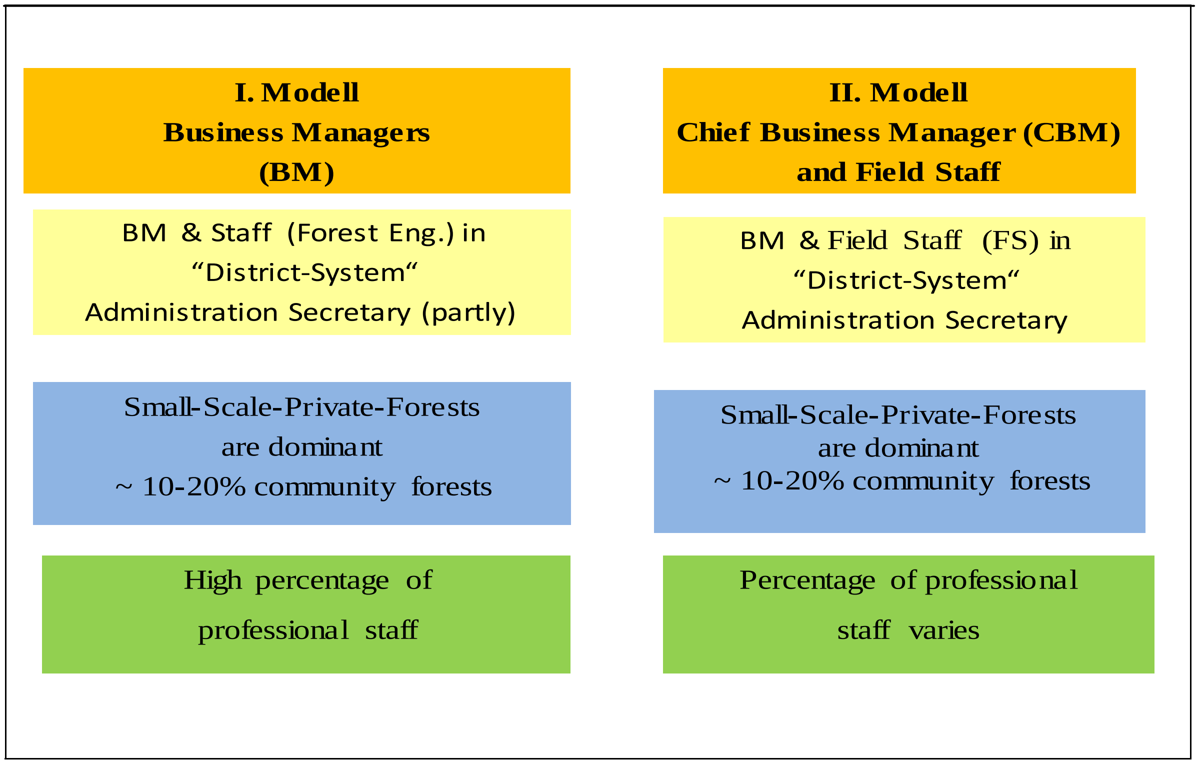


Figure 2: Organizational Models of Forest Owner Associations in Bavaria

3.1.1 Model I: Business Managers (BM)

A team of Forest Engineers (business managers) with degrees from a university or a university for applied science directs the business of the FOA. One engineer officially leads the team of business managers. In fact, the BMs have more or less the same duties and handle all the tasks within the FOA. The official leader often is additionally responsible for the contracts with the wood processing industry and represents the FOA. Eventually, one BM is responsible for the administrative tasks in the office and some of the associations employ administration secretaries in part-time models. The managing tasks in the field are distributed geographically in "forest districts" and equally between the BMs, including the official leading BM.

3.1.2 Model II: Chief Business Manager and Field Staff

In this Model, a Forest Engineer is usually Chief Business Manager (CBM) and one or several administration secretaries work in the association´s office. Field staff (FS) are functioning as contact person between the association and the forest owners. The FS are trained as forest engineers, forest technicians or "woodwards". The woodwards normally have not an official forest education, but some knowledge and often long-term experience in timber grading and measurement. The FS is responsible geographically for districts or functionally for certain duties. Depending on their training level and the applied pay programme within the association, their duties encompass: Acquisition, grading and measurement of timber, advising forest owners, and accompanying complete timber harvesting measures. The field staff has very good knowledge about the forests districts and keeps close contact to the forest owners. The CBM leads the office, additional tasks are: Advising forest owners and dealing with the timber industry for example. The administration secretaries are mainly responsible for accounting, handling measurement and sales list as well as telephone service.

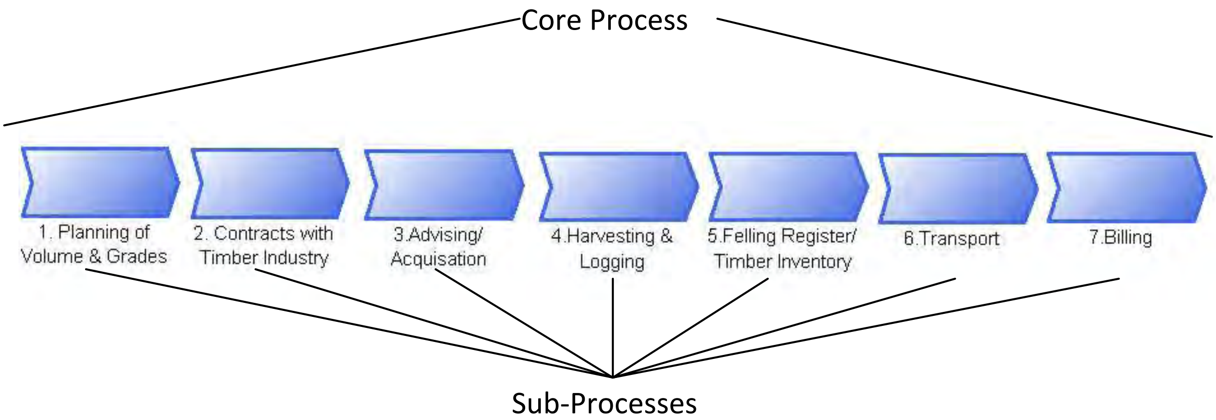
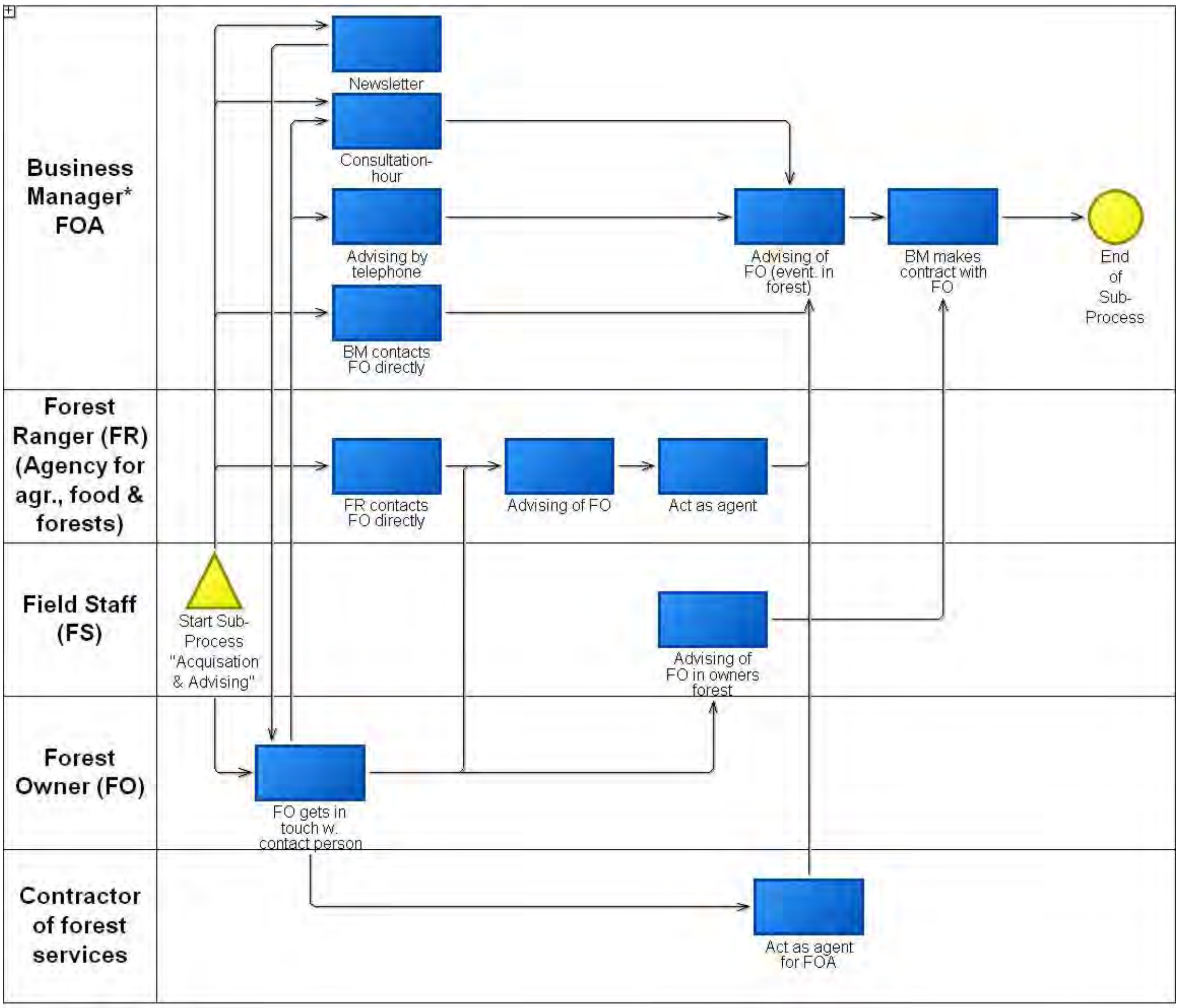


Figure 3: The core process "wood supply and marketing" and its sub-processes

3.2 THE CORE PROCESS "WOOD SUPPLY AND MARKETING"

The most important and consequently analysed core process for all FOA is called "Wood Supply and Marketing". The conducted **qualitative business process analysis** approach has at first the target to visualize the whole process, including the sub-processes and second to elaborate strengths and weaknesses of the processes and/or single working steps. The following figure shows the core business process "Wood Supply and Marketing" and its sub-processes, as it can be found in almost all FOAs.

The example of the subprocess »Acquisation & Advising« demonstrates how the different players are linked and worked together and how the work flow looks like (see figure 4). The figure shows the protagonists and their activities in a time flow. The arrows and symbols demostrate the relationships and connecting points in the process. The forest owners and the staff of the FOAs get in contact with each other in different ways. The main factor, how the forest owner gets in touch with a FOA is mainly determinate by the presence of the »forest protagonists« in the area of the association.



**Leading & Chief Business Manager*

Figure 4: Subprocess »Acquisation & Advising« (simplyfied)

The most imortant contact persons (forest protagonists) for the forest owners are: The field staff and the business manager of the FOAs as well as the forest rangers of the agencies for agriculture, food and forestry, which are usually co-operating with the associations. Besides, the factor »presence«, the degree of popularity and the confidence that the forest owners have in the forest protagonists, define who they will contact. Focussing on the leading BM or the CBM, their activities in this sub-process are the following:

- Informing the members of the association about market details by newsletter
- Consultation-hour
- Advising by telephone
- Personal advising in the owners forest
- Making contracts with the forest owners about timber harvesting/merchandising

Table 1: Distribution of duties in the sub-process »acquisation & advising« for model I &II.

	Modell I: Business Manager (BM)	Modell II: Chief Business Manger (CBM) & Field Staff (FS)
BM/CBM	●	●
Field Staff		●
Administration Secretaries	●	●
Agencies Forest Rangers	●	●
Contractor*	●	

*Contractors of »forest services« somtimes collaborate with the associations

The differences between the models are obvious: In Model I, the business managers are the main protagonists in acquisation & advising, in Model II the field staff is mainly responsible for this duty.

The **quantitative business process analysis** approach followed the qualitative analysis. Because of the small base of participating staff members from different associations and organizational models, a statistic analysis was not meaningful. Nevertheless, the results showed explicit differences between the two models and consequently between the organization and distribution of duties and working steps in the different groups. The participants recorded their process-data for 6 – 12 months. Therefore, every single analysis is highly significant and beneficial for the “test-person” and the association. Furthermore the conclusions are very useful for:

- New- or re-organization of work-flows in single associations or enterprises
- General assumptions and projections, which are of assistance for the interpretation of operating results and organizational developments.

In addition, the study shows that the managers depend exceedingly on the organizational model of their forest owner association, in their daily, weekly and monthly working flows. The results of the quantitative analysis reflect very well the organizational models and the distribution of tasks and responsibilities within the associations.

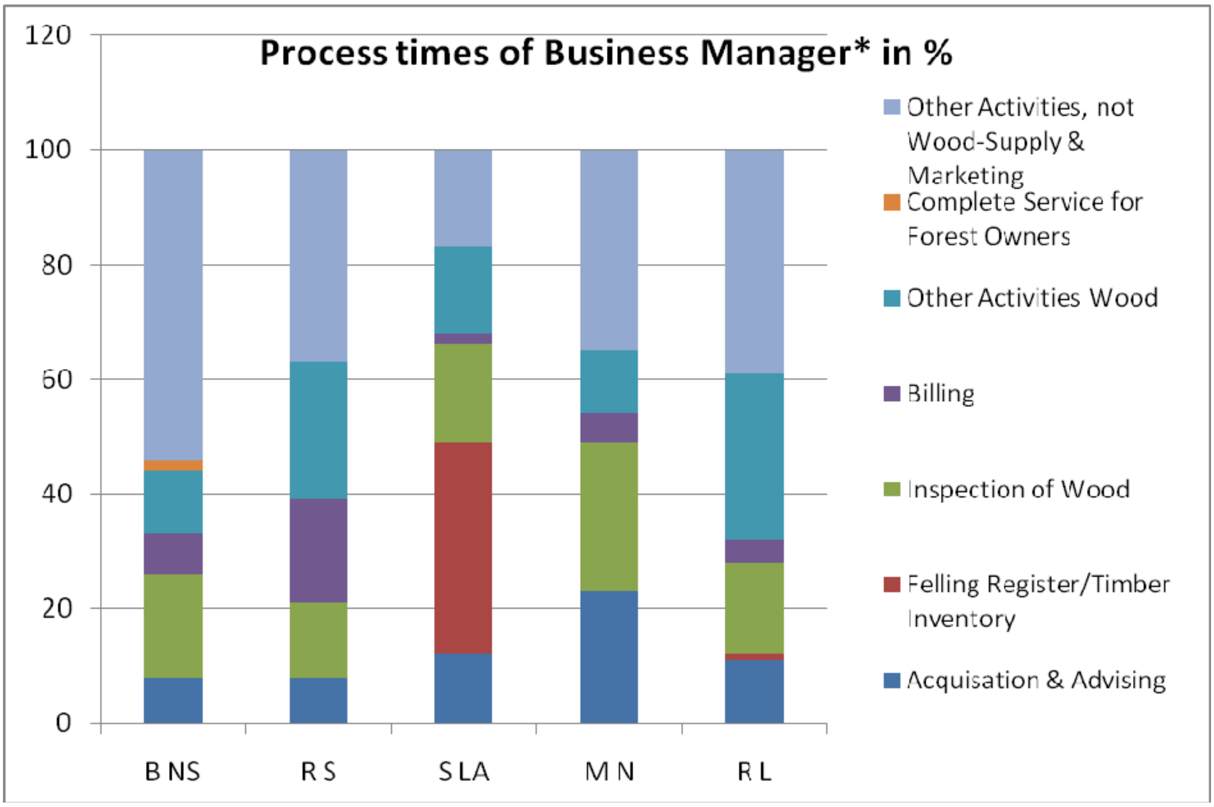
In an example, we focus on the resumed process-times in percent to make them comparable. Figure 5 shows the results for five managers (leading business managers and chief business managers). The general conclusions are as follows:

I. The core process “wood supply and marketing” encompasses about two thirds of the total working hours.

II. If an association does not employ administrative secretaries, the business managers (Model I) execute all tasks. Hence, the well trained forest engineers are using a relatively high percentage of their working time for comparative simple activities and administrative duties. Examples: a) Leading Business Manager »S_LA[2]« for »Felling Register & Timber Inventory« and b) Leading Business Manager »R_S« for »Billing«.

III. If an association adopted Modell II, which is based on a more diffirentiated distribution of working tasks, the Chief Business Manager has more time for duties like »aquisitation and advising«, »market observation«, »customer care« and strategic development of the association.

2 Anonymised because of data privacy



**Respectively Lead/ Chief Business Manager*

Figure 5: Process times of five business managers in percent

4 DISCUSSION

The analysed **organizational models** illustrate advantages and disadvantages. **The model Business Manager** (I) has advantages like the high professionalism of all employees. Therefore, the associations with this model can offer their services with high quality standards at any time at any place within their field of activity. The model is flexible, for example in case of calamities and has a small span of control. The model does offer options for future developments: Acquisition of new members, expansion to the neighbouring areas, merging with smaller associations, investments in logistic and transport and offering complete services to the forest owners. These potential developments could all be realized with the actual highly professional staff. The model I also showed disadvantages: The well trained forest engineers are using relatively much of their working time for comparative simple activities and administrative duties. Therefore, they have only limited capacities to invest time in the designed possible developments. The BMs have to cover huge areas, consequently they use relatively much time for driving. The high qualified staff is cost intensive, this might be a risk in times of declining cash-flows.

The Model II, Chief Business Manager and Field Staff, has some fundamental advantages: a) Fixed tasks and responsibilities, b) divided business process management in function of the staff´s skills, c) administration secretaries disburden the CBM and high qualified field staff from simple routine activities. Thus, the engineers have more flexibility for the further development of the association and d) the model supports team structures within the FOA.

The analysis also showed disadvantages of the model: a) The sucess and further development of associations adopting this model, depends on the qualification and further training of all staff members. The woodwards can be a weak element in this system, as they often show a lack of skills and flexibility to deal with modern IT-systems. b) An association that works mainly with woodwards in the field of silviculural advising, depends on a good cooperation with the agencies for agriculture, food and forestry. c) In some FOAs, the CBM do not sufficiently delegate their tasks to other engineers, to gain time for the strategic development of the association.

Future prospects: The state of professionalism varies highly between the FOAs. Smaller associations without professional leadership will probably struggle to survive in the long run. A solution might be to merge with bigger and more sucessful FOAs. Even the highly professional association have to enhance further, as the study illustrated. In the near future, new IT-tools – for example for navigation in the forest – will be introduced to the market. The logistic partners will sooner or later use this system for easier orientation in the forests. This will change the timber transport sector, as it will be easier to enter this market for »not local« freight forwarding businesses. Additionaly, the actual IT-systems applied by the FOAs will change. Consequently, the associations have to adapt their IT-systems and their business process managements as well. Other activities will be realized, especially sub-processes and activities like: - felling register & timber inventory, - managment of piling sites, - inspection of wood and organization of timber transport. The future of the forest owner associations depends on their capability to adapt to this new developments and the further changing environment in the wood based sector. Moreover, it will be decisive for the associations, if they enhance their wood-acquisition-systems in small scale forestry structures and react in relation to the huge wood processing companies. Additionally, they have to renew their marketing and logistic concepts. An example for a modern and successful commercialization company (in the legal form of a cooperative society) is “in.Silva”. Commercialization companies, who bundle several hundred thousands cbm of timber per year, have a much better position than single FOAs. All these developments and alterations have to go hand in hand with the organizational modification and the re-engineering of the business processes of forest owner associations. This study may have contributed to this development.

Crops, cows or timber? Including carbon values in land use choices

Tek Narayan Maraseni[1], Geoff Cockfield[2]

Abstract

Land use change from forest to non-forest use is a major source of greenhouse gas (GHG) in Australia. From 1996, the Queensland Government provided incentives for landholders to plant pasture and cropping areas with hardwood plantations, however, the long-term viability of timber-alone plantations relative to cropping and livestock production, in the medium to low rainfall areas of SEQ, and elsewhere in Australia, is questionable. Carbon credits resulting from additional carbon sequestration may change the relative profitability of these land uses. The aim of this research was to compare spotted gum (Corymbia citriodora subspecies Variegata) plantations with peanut-maize cultivation and beef pasture in low rainfall areas, incorporating carbon values.

For the case study of three land use systems (cropping, pasture, and plantations in the Kingaroy district of SEQ), production, carbon sequestration and emissions data were supplemented by formal and informal interviews with landholders, agronomists, sawmill staff and government extension personnel. Forest inventory, biomass and soil sampling, and stakeholder interviews were used as sources of primary data. The costs and benefits of all land use systems were converted into monetary terms and discounted to produce net present values. If the comparison of net present values excludes carbon value, cultivation is the most profitable option, followed by pasture and plantations. After the inclusion of carbon, plantations were the most profitable option, followed by pasture and cultivation, depending on assumptions for the carbon equivalent price and the discount rate. The study concludes with recommendations to increase the benefits from plantations.

Key words: spotted gum plantation, carbon values, greenhouse gas emissions, carbon sequestration
FDC: 161.15:111.83=111

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1 INTRODUCTION

Forest clearing has been considered as a stepping stone for development. The process is still continuing in many parts of the world, as people perceive that the natural forest is of less economic value than alternative uses. In Australia, forest has been extensively cleared for cropping and grazing. Although the rate of clearing decreased from 546,000 ha/yr in 1988 to 260,000 ha/yr during 2000 to 2004, it is still higher than the average plantation rates of 72,000 ha/yr during 2003-2008 (AGO, 2000; DAFF, 2009). The emission of GHG from land clearing decreased from 75 M tCO_2e in 1998 to 53.3 M tCO_2e in 2005—12 percent and 9 percent of total national emissions of respective years (DAFF, 2009)—but it is still high compared to other developed regions such as Europe and USA (Van Kooten, 2004). Drivers of clearing include relative economic returns, the availability of low-priced land, immediate profit by crop production, and long-term profit by increased land value (AGO, 2000) and historical attitudes to landscapes. Land was considered wasted unless it was developed. Cleared land was predominantly used for the grazing of livestock but for areas with favourable climatic and topographic factors (including inland south-east Queensland),crop production came to predominate. By the 1980s, increasing costs of production and decreasing commodity prices, especially of the major cereals, created financial pressure for farmers (Zammit *et al*., 2001). This caused a shift in land use from cultivation back to grazed pasture in less productive or degraded cropping land (Zammit *et al.,* 2001, Maraseni *et al.,* 2007a and 2009). Recently, due to increased environmental concerns focusing on land degradation and the risk of dryland salinity, the Queensland government has encouraged farmers to establish hardwood plantations on some degraded ex-cultivation and pasture areas (Brown, 2002).

There are several policies in place to encourage plantation but the major one is '*Plantation for Australia: The 2020 Vision*', which has targeted to increase the national plantation estate to about 3 M ha by the year 2020 (Kirschbaum, 2003). In order to support this target, the Queensland state government committed to increase the plantation estate by 320,000 ha from 1996 to 2020, and already approved a A$30 M plan to increase the area of hardwood plantations, especially of spotted gum (*Corymbia citriodora* subspecies *Variegata*), in south east Queensland (DPI&F, 2004). This initiative was not solely or even primarily a carbon sequestration strategy, but flowed from earlier concerns at the national political level about logging in native forests (Resource Assessment Commission, 1992) and the consequent decision that there was a need to expand the plantation area as a substitute in supply (Commonwealth of Australia, 1995).

While it was recognised that small-scale farm plantations would only be a small part of that total expansion, it was considered that in light of the other social benefits, including carbon sequestration, such plantations should be encouraged (Centre for International Economics, 1997). Since then, several reports have proposed that carbon payments for sequestration could be used to make farm plantations financially attractive (Binning *et al.,* 2002; Buffier, 2002). This is an important consideration, given that timber values alone are unlikely to yield a positive return in medium to low rainfall (600-800 mm/year) areas of SEQ (Venn, 2005).

Australia ratified the Kyoto Protocol in 2007 and committed to implement the Carbon Pollution Reduction Scheme (CPRS) from mid 2011, in which reforestation[3] activities are proposed to be eligible from the beginning of the scheme on a voluntary basis. Setting aside the issues in creating a functional carbon market, this research aims to compare three competing land use systems (peanut-maize cropping system, pastureland and spotted gum plantations[4]) in inland medium to low rainfall region of SEQ, incorporating all three GHGs[5] and tangible values. This article is divided into six sections. The reasons for the popularity of spotted gum are first examined, which is followed by the discussion on CPRS and plantations. The research method is then outlined, followed by results, discussions, conclusions and recommendation.

2 REASONS OF POPULARITY OF SPOTTED GUM

One of the main hardwood species being promoted by government agencies in south-east Queensland is spotted gum. This species accounts for over 60% of the native hardwood volume harvested in Queensland and also is the most prioritised (over 60%) hardwood tree species for plantation in Queensland (Huth *et al*., 2004). There are a number of reasons for its popularity: 1) Over time, large areas of SEQ were World Heritage listed, became National Parks or had tenure restricted. This reduced the supply of native timber including spotted gum, but demand is still increasing by two to three percent every year. 2) Although full rotation plantation data are not available, the early-age performance of spotted gum is encouraging (Huth *et al*., 2004). 3) Preliminary results of the genetic improvement program of spotted gum are promising, the seedlings having vegetative propagative capacity, and frost tolerance and *Ramularia* shoot blight resistance (Lee, 2005). 4) The timber is highly valued for its durability, hardness and pale

3 'Reforestation' is defined as forests established by people since 1990 on land that was clear of forest on 31 December 1989. Australia's definition of a forest for Kyoto Protocol purposes is: a forest of trees with a potential height of at least two meters and crown cover of at least 20%, and in patches greater than 0.2 ha in area.
4 From now on the word ‘plantation’ is used for ‘spotted gum plantation’ and cultivation for “peanut-maize cropping’.
5 In land use systems, three GHGs, CO2, CH4 and N2O are most common. Therefore, the carbon values cover the value from these three GHGs.

colour (Huth *et al.,* 2004). 5) Of the 3.42 M ha of cleared land evaluated for plantation in the South East Queensland Regional Forest Agreement (SEQRFA) region, 2.72 M ha met the slope (<20%) and size (>10 ha) constraint, and 73% of that land was found suitable for spotted gum (Queensland CRA/FRA Steering Committee, 1998).

3 EMISSIONS TRADING AND PLANTATIONS

As a mitigation strategy, the Australian Government is currently committed to reducing Australia's GHG emissions by 5-25 percent (5 percent unconditional and 25 percent if the world agrees to an ambitious global deal to stabilise levels of GHGs in the atmosphere at 450 ppm CO_2e or lower) by 2020 and 60 percent by 2050 below 2000 levels (DCC 2010). To meet these targets the Australian Government proposed a CPRS. It is acknowledged that enactment of this scheme depends on a range of political variables, however the proposal as at late 2009 is used to illustrate the potential impact of a carbon price.

The proposed CPRS addresses over 75 percent of Australia's GHG emissions (DCC, 2010). Reforestation activities are proposed to be eligible from the beginning of a CPRS on a voluntary basis. The government would issue emissions unit to the person that owned the forests. Managers can have harvested (both short and long rotations) or not-for-harvest forest (environmental plantings) but the latter would get higher emissions unit than the former (DCC, 2009). There is also a tax incentive for carbon sink forests under the Income Tax Assessment Act 1997 (DCC, 2010) but Managed Investment Scheme (MIS) are effectively excluded and only the plantation cost is tax deductible (DCC, 2010). The owner can clear forests at any time but would need to hand back any emissions units they had received to cover the emissions that are released back into the atmosphere. This obligation will remain in place for 100 years (DCC, 2009 but such a scheme could still encourage plantations for timber, since the early payments for sequestration somewhat offset the initial establishment costs and then the payback occurs when timber income is imminent.

Generally, it is expected that the inclusion of forestry in CPRS will increase reforestation activities in Australia but the level of increase will depend on many factors such as the price of carbon credits, national and international policy on agriculture, forestry and biofuels, climate change impacts on agricultural production and food prices and future changes in human demands on forest products, as determined by population growth, increases in income, changing human values and consumer preferences. An ABARE analysis (2009b) suggested that by 2050, depending on carbon price, up to 4.5 M ha of agricultural land could be converted into timber plantations and up to 21.8 M ha for environmental plantings (around 6.2 percent of agricultural land). As noted, however, recently government has changed its stance and upgraded its target to 5 percent and 25 percent. In addition ABARE assumed a starting carbon price of \$20/tCO_2e (for 5 percent CPRS scenario) and \$28/tCO_2e (15 percent scenario) would increasing at four percent per year. The Government ended up proposing a starting carbon price of \$10/tCO_2e and intended to allow eligible Australian companies to buy unlimited carbon credits from International markets (DCC, 2010). In early December 2009, the primary carbon credit price from CDM projects was around \$14/tCO_2e and there is an excess supply of carbon credits in global markets as the USA still has not ratified the Kyoto Protocol. 1720 million CER (t CO2e) is expected only from 2006 registered CDM projects by 2012 (UNFCCC, 2010). Other political developments have also undermined carbon prices. For example, carbon prices in Europe dropped to a six-month low after disappointing accord in Copenhagen (BBC News 21 December, 2009). This is mainly because there is no globally binding target and thus the European Union is not willing to increase its emission reduction target to 30 percent by 2020. Moreover, if REDD (reduced emissions from deforestation and forests degradation), which is the most favourable policy for many countries, is accepted in post Kyoto policy, the carbon price may significantly go down again.

4 RESEARCH METHODS

The study area is Kingaroy district of south east Queensland (SEQ) was selected because it: 1) is where plantations are to be encouraged by the Queensland Government; 2) is where both pasture and cropping have been practiced for a long-time; and 3) is in a low to medium rainfall areas of inland SEQ and has Red Ferrosol soils. In inland SEQ, mean monthly rainfall is always lower than mean monthly evaporation (Mills and Schmidt, 2000), and so, soil moisture is the major limiting factor for non-irrigated crops. The Red Ferrosol soils of inland SEQ are considered suitable for different types of crops but due to traditional continuous cultivation practice, yield potential has declined or plateaued (Bell *et al*., 1995; Cotching, 1995; Bell *et al.,* 1997). It was assumed that plantations could be a competitive land use on these soil types, if carbon emissions and mitigation values of all land use systems are considered; particularly as the Red Ferrosol soils are a target area of hardwood plantation by the Queensland Government.

Spotted gum is a trade name of the group of four species: *Corymbia maculata, Corymbia citriodora* subspecies *variegata, Corymbia citriodora* subspecies *citriodora,* and *Corymbia henry,* but the first one, the species of concern in this study, is most popularly known as spotted gum (Larmour *et al*., 2000). Spotted gum is naturally widely distributed in SEQ especially between 25°S to 38°S latitude extending up to 400 km inland and to an altitude of 950 m above sea level (Boland *et al*., 1984). These trees attain heights of 35-45 m with diameter at breast height (DBH) of 1-1.3 m (Boland et al., 1984). This species has high site adaptability, and copes well with soils that have highly variable fertility, annual rainfall >600 mm, moderate frequency of non-severe frost, low to medium salinity and low to moderately high pH (Huth *et al*., 2004). The main grass species under the plantations and pasture were Rhodes grass (Chloris gayana) and the dominant legume species were burr medic (*Medicago polymorpha*) and Siratro (*Macroptilium atropurpureum*). Cattle producers in the study area have adopted a crossbreed of *Bos indicus*, for tick resistance and *Bos Taurus* for meat quality. (C. Marshall, 2005, pers.com., 7 April). Common crop rotations include peanuts and maize alternated each summer.

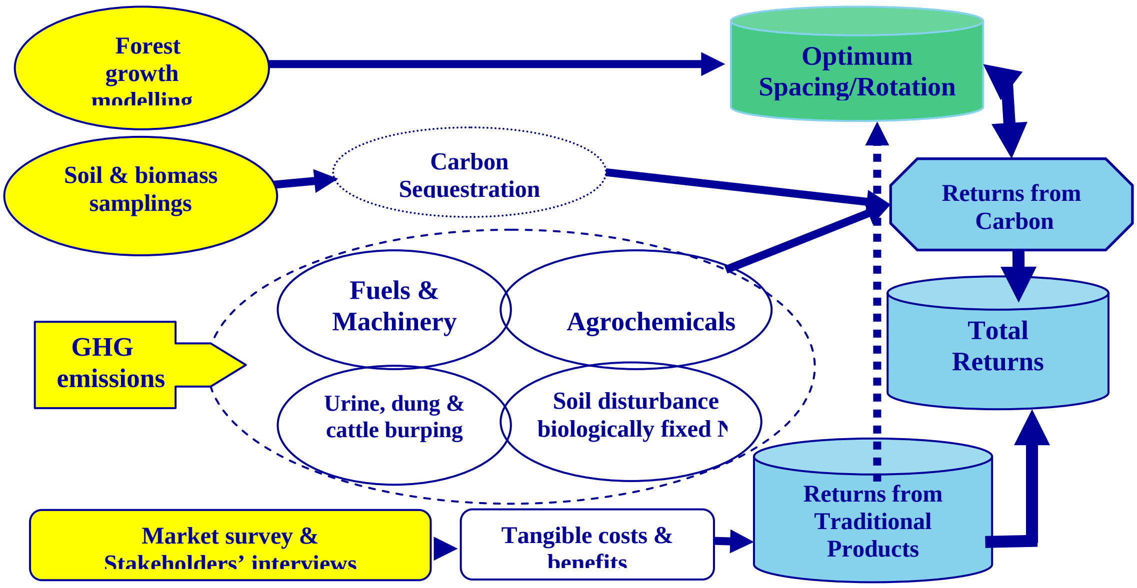

Figure 1: Conceptual framework of the study

This paper focuses on the estimation of: N_2O emissions due to general land use (or soil disturbances), animal excretion and biologically fixed nitrogen; CH_4 emissions due to cattle belching; the optimal rotation age of plantations including stock and carbon values; and from all those the relative profitability of three different land uses. The overall conceptual framework is shown in Figure 1.

4.1 ESTIMATION OF NITROUS OXIDE (N_2O) EMISSIONS

N_2O emissions occur due to the application of nitrogen fertiliser, general land use, animal waste and biologically fixed nitrogen (Dalal *et al.,* 2003). Emissions due to use of N_2O fertiliser is estimated as part of farm inputs and is not discussed here. Micrometerological techniques are used for the continuous measurement of methane (CH_4), carbon dioxide (CO_2) and nitrous oxide (N_2O), but are expensive. Moreover, it requires skill to analyse and interpret the data, so they are not deployed widely (Mitchell and Skjemstad, 2004). Therefore, the most relevant N_2O emissions estimates from past studies were borrowed. The amount of N_2O emissions found were significantly different in different land uses and also varied significantly within the same land use in different management conditions (for detail see Bouwmann, 1994; Bouwman, 1998; Barton *et al.,* 1999 cited in Eckward *et al.,* 2000; Ellington, 1986 cited in Eckward *et al.,* 2000; Eckward *et al*., 2001; Kiese & Butterbach 2002; Dalal *et al.,* 2003). Considering the conditions applied in the research sites, the following nitrogen emissions figures have been used: (1) Pastureland: 2.5 kg N $ha^{-1}yr^{-1}$ (average of 0-5 kg, Barton *et al.,* 1999 cited in Eckward *et al.,* 2000); (2) Plantations: 2.52 kg N $ha^{-1}yr^{-1}$, an average value from Bouwman (1998), Kiese and Butterbach (2002) and Dalal *et al.* (2003).

Animal urine and faeces are also a source of N_2O. We could estimate total N_2O emissions on faeces on the basis of the amount of grass taken by animals and digestibility. However, it is too complicated to find the digestibility of so many different varieties of grasses and legumes. Therefore, we recorded the types and number of cattle grazed, and their grazing days and seasons in that particular land use from a grazing calendar. The amount of nitrogen excreted by different types of cattle in urine and faeces was taken from Nussey (2005) and converted into a common unit (kg CO_2e). For pastureland, the number and types of cattle are assumed to be constant, however, for plantations stocking rates varied with crown cover and thinning. (see Maraseni *et al*. 2009). The average emissions rate is 214.25 kgCO_2e $ha^{-1}yr^{-1}$ (or 214.25 kgCO_2e per year per 0.56 head for pastureland, while in plantations it varies from 109.42 kg CO_2e $ha^{-1}yr^{-1}$ (or 214.25 kgCO_2e per year per 0.286 heads) in the third year to 59.0 kgCO_2e per ha in the year before harvesting year.

For the biological nitrogen fixation (BNF) by peanuts in Australia (see Peoples *et al.,* 1992; Bell *et al.*, 1994; Rochester *et al.,* 1998) the most applicable study is by Peoples *et al.* (1992) for the Kingaroy district. On the basis of their research data, it is predicted that the peanuts in the research site could fix about 44.5 kgNha^{-1} every two years, as they are planted in every alternate year. There are not many studies of BFN in pasture but Armstrong *et al.* (1999) studied the dry matter production and nitrogen fixation of several ley legumes including Siratro for four seasons (1994-97). Siratro accumulated 16160 kg ha^{-1} dry matter and fixed 176 kg N ha^{-1} over the four years. We did stratified random sampling for finding biomass (dry weight) of different grasses and legumes in pasture and plantation and the Siratro ratio was also applied to the estimation of BFN for other legume species. The BFN estimates converted into N_2O equivalent using the IPCC (1996). About 1.25 percent of the BFN was assumed to be emitted into the atmosphere, which was also applicable to the nitrogen from animal excretion.

4.2 ESTIMATION OF METHANE (CH_4) EMISSIONS FROM CATTLE BURPING

There are several studies that may be adopted for the estimation of CH_4 emissions from cattle. However, there are several limitations. For instance, Blaxter and Clapperton (1965) predictive equation needs the dry matter digestibility of the feed at the maintenance level of feed intake and also the level of feeding as a multiple of the maintenance level of feed intake. This was difficult to get, as the pasture had different varieties of grasses and legumes. McCrabb and Hunter (1999) studied a mixture of several grasses, which made it difficult to estimate digestible organic matter in the grasses. Therefore, the types and number of cattle grazed, and their grazing seasons in pasture and plantation were recorded from the grazing calendar. Based on the long-term carrying capacity of pasture and plantations, as discussed in last section, trends of methane emissions in various years were estimated. With the information given in Nussey (2005), the average emissions rate of 773 $kgCO_2e$ $head^{-1}yr^{-1}$ has been used for the long-term modelling in the pastureland, while in pasture, depending on the age and carrying capacity, it varies from 200 $kgCO_2e$ to 395 $kgCO_2e$ ha^{-1}.

4.3 ESTIMATION OF OPTIMAL ROTATION AGE OF PLANTATIONS AND COMPARISON OF PLANTATIONS WITH OTHER LAND USE SYSTEMS

The optimal rotation age is that point at which discounted returns are maximises, which in this case includes carbon values. To estimate carbon value, the total biomass was estimated, including that of the stem, bark, foliage, branches and underground biomass and carbon mass. The most sensitive factor for the biomass of a tree is the density of the stem (Polglase *et al*, 2004), which is calculated by dividing the oven-dry mass of a specimen by its green volume. Density is more strongly correlated with the age than size (Raymond *et al*., 1998; Borough 1993 cited in Polglase *et al*., 2004). Therefore, 'biscuits' were cut from the stem of the spotted gum using a pruning saw and were used to estimate the density for one year (496 kg m^{-3}), four year (613 kg m^{-3}), 11 year (643.8 kg m^{-3}) and 41 year old (802 kg m^{-3}). As the density increases with age, the other density figures at different ages were interpolated from a graph of these four known values. The density of timber after age 41 was assumed to be constant (that is 802 kg m^{-3}).

These densities were used to estimate stem biomass of spotted gum (using density volume and mass relation) in different ages. Once having stem biomass, Polglase *et al.* (2004) was followed for estimation of bark, foliage and branches and total biomass of plantations in different years. The underground biomass is another important part of standing biomass. In general, 25% of the above ground biomass is considered as an underground biomass (IPCC, 1996; Haripriya, 2001; IPCC, 2001; Haripriya, 2003). In Australia, Specht and West (2003) found root shoot ratio of 0.259. Since this research was done for hardwood species in New South Wales, which is relatively nearer to the research site, this figure was used for this study.

Non-linear regression modelling using STSTISTICA software was used to develop forests growth models (for detail methods see Maraseni *et al*., in press; and Maraseni *et al*., 2007a). Stratified Random Sampling (SRS) was used to estimate grass and legume biomass, and the carbon sequestration in the pasture and plantations. The soil samples were taken up to 110cm depth. Amount of particulate matter and surface litters were also estimated using SRS. Chemical analysis of all samples (grass, soils, surface litters, and root, leaf and braches in spotted gum) were analysed using Isoprime Isotope Ratio Mass Spectrometer coupled to Eurovector elemental analyser (for detail methods and data see Maraseni *et al*., 2008). Timeline of land-use change and RothC model was used for predicting soil carbon trends in different land use system. Similarly, GHG emissions due to production, packaging, storage, transportation and applications of all agrochemicals, machinery and fuels were estimated. This also includes N_2O emission due to use of N-fertilisers (for detail methods and data see Maraseni *et al*., 2007b). Likewise, GHG emissions due to: urine, dung and cattle burping; and land use practices; and biologically fixed N were taken from relevant literature. Following IPCC guidelines, all types of GHGs data were converted into standard format (tCO_2e).

Production, carbon sequestration and emissions data were supplemented by formal and informal interviews with landholders, agronomists, sawmill staff and government extension personnel for estimating cost and benefits from timber and beef in plantation, crops and hays in cultivation and beef in pasture. Crop management notes for South Burnett region was cited for triangulating long term average crop related data. Australian Government proposed carbon price of \$10.5/tCO_2e (including transaction cost \$0.5/tCO_2e) was used to estimate GHG emissions/mitigation values for three land use systems in various years. All costs and benefits values, including carbon values, of individual years of three land use systems were discounted to present terms, with 6%

discount rates. From series of yearly NPVs, various types of optimal rotation ages in plantations were determined, and three land use systems were compared for those rotation ages.

5 RESULTS

The biomass of different parts of trees is given in Figure 2. Of the 1000 (ha^{-1}) trees planted, around 200 trees are assumed to have died before age four. In the first thinning, at age four, the total number of trees was down to 400 trees from 800 (ha^{-1}). In the second thinning, at age 10, it was further reduced to 250 (ha^{-1}).

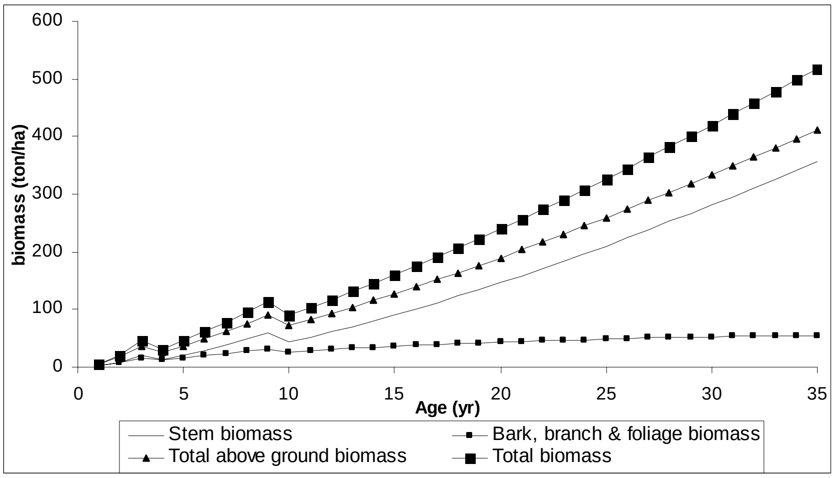

Figure 2: Long-term trends of biomass of the spotted gum plantation in Kingaroy

The biomass of bark, foliage and branch is highly correlated with stem biomass, which in turn depends on density and volume of stem. The biomass of bark, foliage and branches (BFB) is around 12 t in four years and would be 55 t in 35 years. The percentage of BFB biomass to that of stem biomass reduces continuously (78% at age 5, 59% at age 10, 30% at age 20 and 19% at age 30). Similarly, the percentage of stem biomass to the total aboveground biomass would be increasing by age. It would be 56%, 63%, 71%, 77%, 81% and 84% at age 5, 10, 15, 20, 25, 30 years respectively. At the harvesting age, 34 years, the stem biomass would be around 86% of the total aboveground biomass and 68% of the total biomass (both aboveground and belowground). These relationships have important implications because their percentages could be assumed once the stem biomass is known.

5.1 OPTIMAL ROTATION FOR MAXIMUM SUSTAINABLE YIELD (MSY)

The growth model shows that there would be no merchantable logs up to age 13. This is because there would be no merchantable log of an acceptable size of 25cm for the sawmill. Therefore, current annual increment (CAI) and mean annual increment (MAI) curves below age 13 are not shown in the graph (Figure 3). Hence, the effects of the first and second thinning at the age of 4 and 10, which would reduce wood volume, are not shown.

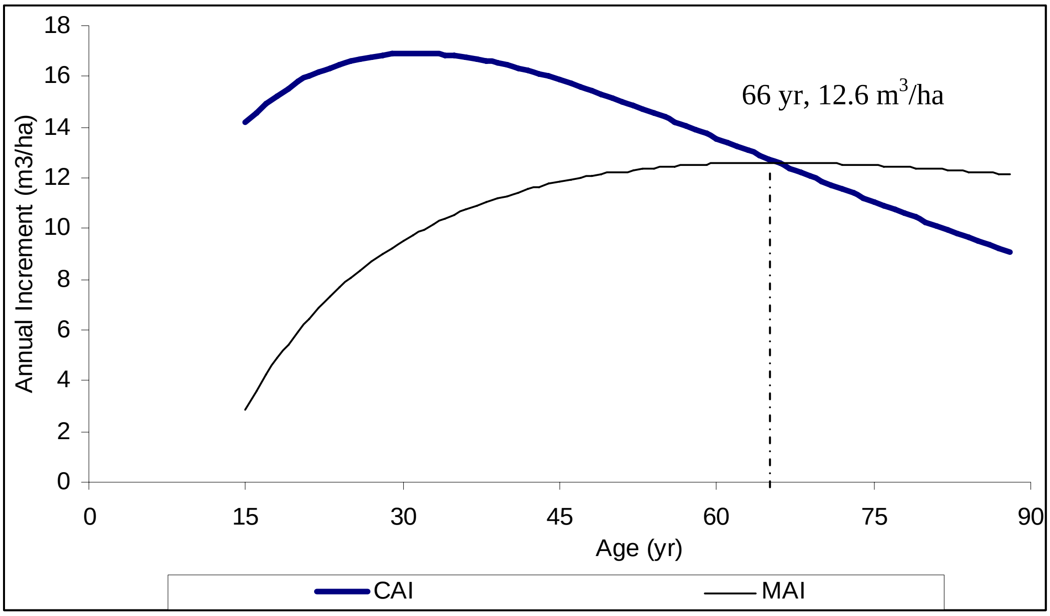

Figure 3: MSY rotation age of plantation in Kingaroy, Queensland

The CAI increased slowly at first[6], and then increased rapidly to the maximum of 16.9 m^3 ha^{-1} at age 31, after which it begins to decline. Theoretically, the CAI could be zero when the total volume approaches the maximum. As we have produced graphs only up to age 88, those points are not shown in the graph. Since MAI is the average volume of all previous years, it increased slowly and even after the culmination of CAI, MAI still continued to rise. At the CAI culmination point (year 31), MAI was around 9.7 m^3ha^{-1}. The MAI increased continuously and approached the maximum (12.6 m^3ha^{-1}) at age 66. This is the age at which CAI=MAI or MAI culminated. After this age, MAI started to decline. Therefore, age 66 is the optimal rotation age, if the objective is to maximise the maximum sustainable yield in terms of log volume. The MSY rotation has no relation to costs and benefits and GHG values, they represent CAI and MAI in physical term not in economic term. Therefore, it is not affected by depreciation rates and the demand and the supply situation of the market.

6 In figure, slowing increasing part is not seen, as the graph start from age 15

5.2 OPTIMAL ROTATION AGE FOR MAXIMUM ECONOMIC YIELD FROM TIMBER

The combined NPVs from timber, stock and carbon values are shown in Figure 4. The critical data for these figures is given in Table 1. When the average DBH of trees approaches around 28 cm at age 14, then there would be a possibility of getting some cash by selling logs. However, since the cost would be higher than the benefit, the NPV from timber would be negative up to age 17 (Figure 4). Age 18 would be the break-even age when NPV of costs and NPV of benefits would be equal. After that the NPV from timber would start rising and approach the maximum (around \$2100 ha^{-1}) at year 31. Therefore, this is the age at which trees need to be cut for maximising timber benefit. After this age, the NPV would start to decline and approach zero at age 58 and therefore would be negative after that age. Both ages, year 18 and year 58, therefore would be the break-even ages.

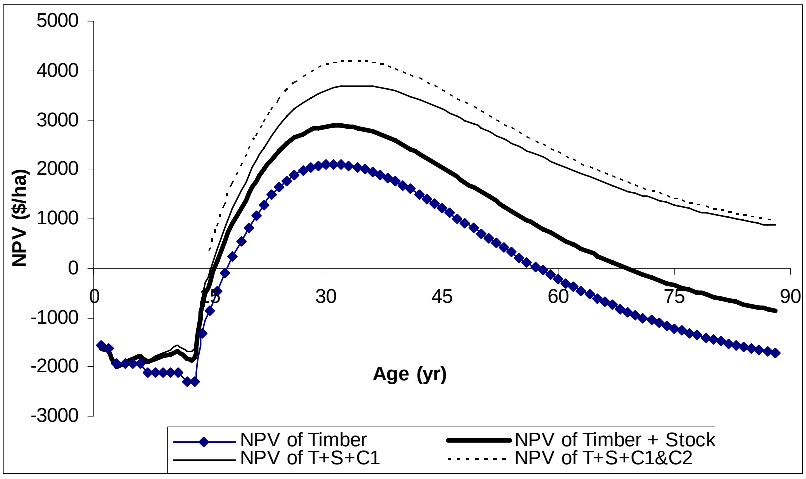

Figure 4: Net present values from timber, stock and carbon

Table 1: Net present value (\$ ha^{-1}) from timber, stock and carbon values in Kingaroy district, Queensland

Age	Timber	Timber & Stock	Timber, Stock & Carbon1	Timber, Stock & Carbon2	NPV from Stock	NPV from C1	NPV from C2	Total gain from C1&C2
Business-as-usual scenario								
30	2091.4	2865.0	3593.7	4102.5	773.6	728.7	508.8	1237.5
31	2099.6	2878.8	3641.5	4144.9	779.2	762.7	503.4	1266.1
32	2093.8	2878.2	3674.4	4171.6	784.4	796.3	497.2	1293.5
33	2075.1	2864.5	3693.8	4184.1	789.3	829.3	490.3	1319.6
34	2045.0	2839.0	3700.8	4184.7	794.0	861.8	483.8	1345.6
35	2004.6	2803.0	3696.7	4171.5	798.4	893.7	474.8	1368.5

5.3 OPTIMAL ROTATION AGE FOR MAXIMUM ECONOMIC RETURN FROM TIMBER AND STOCK

It is discussed that the plantation is managed as a silvipastoral system, with grazing permitted after three years. Because of the high initial costs of plantations, the combined NPV of plantation and stock would remain negative until the 15th year. After this, the combined NPV would be positive and would peak in the 31st year. It would approach zero at year 68 and then remain negative in all years. The range of positive values of NPV from timber and stock would be 16 to 68 years, compared with 18 to 52 years in timber (only). The NPV from beef (pasture) plays a significant role in increasing the range of positive values.

The combined NPV would approach a maximum (\$2878.8 ha^{-1}) at age 31. The NPV gain from stock at this age would be around \$780 ha^{-1}. In fact, the combined NPV falls down due to a reduction in the NPV increasing rate in plantations. Since the combined NPV was maximised at age 31, this is the harvesting age of the plantation, if we consider both timber and stock values.

5.4 OPTIMAL ROTATION AGE FOR MAXIMUM ECONOMIC RETURN FROM TIMBER, STOCK AND CARBON VALUES

As in the combined NPV of plantation and stock, the combined NPV of plantation, stock and carbon would remain negative until the 15th year. However, the amount of NPV would be slightly higher (by \$219 ha^{-1}) than before. The negative NPV until the 15th year was due to the higher initial cost of plantation, and higher emissions from machines, fuels and agrochemicals and the accumulation of lower amounts of soil and biomass carbon. After the 15th year, the combined NPV would continue to be positive and never return to zero even at 100 years. The range of positive NPV values was around 34 years (18 to 52) in timber. It was increased to 52 years (16 to 68) in the timber plus stock case and more than 100 years in the timber plus stock plus carbon case (C1 scenario). The range would be even higher when the C1+C2 scenario is considered. It is worthwhile to discuss here about C1 and C2 scenerios. In C1 scenario, it was assumed that the harvested forest products would emit carbon immediately in the atmosphere after harvesting. In fact, carbon may lock up in ranges of products for a long time (Jaakko Poyry, 2000; Haripriya, 2001). Similarly, the soil carbon may not fall to the level of zero age plantations after harvesting. Thus the C2 scenario assumed that 40% of the gained soil carbon and the harvested product carbon would be locked for another 46 years (for discussions of reasons why 46 years was used see Cacho *et al.,* 2003).

The combined NPV would approach a maximum at age 34 in both C1 and C1+C2 scenarios. It would be around \$3700 ha^{-1} in the C1 scenario and around \$4184 ha^{-1} in the C1+C2 scenario (Figure 4 Table 1). The NPV gain from carbon at this age would be around \$862 in the C1 scenario and \$484 in the C2 scenario. The NPV gain from the C1 scenario would still be increasing after 34 years. However, due to a lower rate of increase in NPV from the timber value, the combined NPV would be pulled down. Therefore, age 34 would be the optimal harvesting age of plantations, if timber, stock and carbon values are considered.

This shows that there is considerable potential for increasing NPV by considering carbon values in plantations. For this to happen, there would need to be an increase in the rotation age from 31 to 34 years.

5.5 COMPARISON OF NPVS FROM DIFFERENT LAND USE SYSTEMS

Since the rotation age of plantation is found to be 34 yr, the comparison of land use systems is based for 34 year (Table 2). Analysis shows that the cultivation, pasture and plantations return \$3579 ha^{-1}, \$3079 ha^{-1} and \$2045 ha^{-1} of NPVs from traditional tangible products in 34 years. Therefore, the cultivation is around 1.75 times more profitable than plantations and around 1.16 times more profitable than pasture. The traditional tangible products, which include peanut, maize and hays in cultivation, stock in pasture and timber in plantations, are the products from what farmers are actually receiving current benefits and making land use decisions. Even after the inclusion of stock value, the plantation would be less preferable than pasture. Cultivation would still be the best option.

Table 2: NPVs (\$ ha^{-1}) from different land use systems in Kingaroy in 34 years

Land uses	Crop	Timber	GHG	Stock	Total
Cultivation	3579	0	-922	0.00	2657
Pasture	0	0	-214	3079	2865
Plantation	0	2045	862	794	3701

5.6 COMPARISON OF NPVS FROM TRADITIONAL TANGIBLE PRODUCTS AND CARBON VALUES

The cultivation and pasture are net sources of GHGs, whereas plantation is a net sink. Cultivation results in the highest emissions of GHG into the atmosphere than pasture. The total NPV lost from GHGs in cultivation (\$922 ha^{-1}) is 4.3 times that in pasture (\$214 ha^{-1}) in 34 years. In contrast, total NPV gain from GHGs in plantations is around \$862 ha^{-1} in 34 years. When we adjust the GHG NPV to the NPV from other sources, the combined NPV in plantations would increase from \$2839 to \$3701 ha^{-1} in 34 years. However, in cultivation it would decrease from \$3579 to \$2657 ha^{-1}, and in pasture it would decrease from \$3079 to \$2865 ha^{-1}. Therefore, after inclusion of GHG values, plantations become the best option and cultivation has the worst position. Pasture still remains in the second best position.

6 DISCUSSION

Farmers may not switch to another land use option unless they believe that the new land use is financially more attractive and/or less risky (Cockfield, 2005). In this regard, further analyses of several scenarios such as changes in yield and prices of all concerned products and discount rates are necessary.

Even if the long-term gross weight gain of live cattle increases from currently used value of 250 kg hd^{-1} to 275 kg hd^{-1}, pasture still cannot compete with plantation. Similarly, even if the long-term peanut yield increases from currently used value of 2 t ha^{-1} to 2.2 t ha^{-1} or maize yield increases from currently used value of 3.5 t ha^{-1} to 4 t ha^{-1}, cultivation will not compete with plantations. However, if the peanut and maize yield increases at the same time and all other variables remain constant, cultivation (NPV \$3900 ha^{-1} in 34 years) will be more attractive than plantations (\$3701 ha^{-1} in 34 years). This is unlikely because as supply increases, prices may decrease, which will reduce the total NPV from cultivation.

If the optimum spacing level (250 trees/ha; see Maraseni et al., in press) or MAI predicted by this model is decreased by 10%, the total NPV from plantations would be only around \$3146 in 34 years. Even with that condition, plantations would be a superior land use options to others. Moreover, global warming will not only affect spotted gum plantations, but will also affect other land use systems. If the MAI decreases in plantation due to climate change, the pasture and cultivation biomass and crops and beef yields will also decrease. This suggests that the plantation will still be in a better position.

In addition, there is a good chance of increasing the NPVs of plantations. In the past, it was thought that the forest products from plantations could be of inferior quality than the product from natural forests and may not get equal market opportunities (Yang and Waugh, 1996). Later research on eucalyptus plantations in different parts of Queensland invalidated this (Leggate *et al.,* 2000). Recently, three case studies in Southeast Queensland found that the well managed forest stand could produce a superior product worth 20 percent more standing value than an average natural stand (Ryan and Taylor, 2001). Therefore, there is a chance of increasing the current NPV in plantations.

Moreover, in this study, the MAI of the spotted gum plantations was modelled from the time series data of the trees planted in 1990. Since then, genetic improvement programs have gained significant achievement (Huth *et al*., 2004; Lee, 2005). This program alone could increase productivity of plantations by 30-50% (Lewty *et al.,* 2001). Because of this comparative advantage of plantations, NPV from plantation could be further increased in the long run.

Even if the long-term average price of peanuts increases from currently used price of \$600 t^{-1} to \$620 t^{-1} and maize price increases from currently used price of \$160 t^{-1} to \$180 t^{-1} at the same time, the cultivation will not be as a profitable as a plantation. However, if price increases to \$630 t^{-1} in peanuts and \$190 t^{-1} in maize at the same time, the cultivation (NPV \$3850 ha^{-1} in 34 years) will be more profitable than for plantations. Similarly, if the peanut yield increases to 2.2 t ha^{-1} and the price increases to \$620 t^{-1} at the same time (or if the maize yield increases to 4 t ha^{-1} and price increases to \$180 t^{-1} at the same time), cultivation will be more profitable (NPV around \$3800 ha^{-1} in both cases) than plantations (NPV \$3701 ha^{-1}). However, the law of demand and supply proves that these mutually inclusive events are unlikely.

Similarly, pasture will not able to compete with plantations even if the live weight beef price increases from currently used price of \$2 kg^{-1} to 2.2 kg^{-1}. Moreover, even if the gross weight gain of beef in 12 month increases from 250kg to 260kg (hd^{-1}) and live weight beef price increases from \$2 kg^{-1} \$2.2 kg^{-1} at the same time and all other things remain the same, the pasture (NPV around \$3340 ha^{-1}) will be less profitable than plantations (\$3951 ha^{-1}). Therefore, although pasture is in the second position by NPV, it never can compete with plantations. This is because an increase in beef price and gross beef weight not only increases the pasture NPV, but it also increases the plantations NPV to some extent, as plantation has a stock component as well.

The price of timber is an important factor for total NPV from plantations. Analysis shows that if the timber price decreases by 10%, the total NPV from plantation will decrease by 12% (from \$3701 ha^{-1} to \$3257 ha^{-1}). Even in that condition, plantations will be more profitable than pasture and cultivation. Price of timber depends on many factors. By 'Vision 2020', Australia is planning to increase the national plantation state, with a major focus on hardwood species, to about three million hectares by the year 2020. As a result, the proportion of hardwood plantations has increased a lot (ABARE, 2009a; DAFF, 2009). Compared to 2002-03, total volume of logs harvested in 2007-2008 in Australia rose by 4.7% to 28.5 M m^3, while the volume of logs harvested from native forests declined by 13%, but the logs harvested from plantation, mainly from hardwood, increased by 14% (ABARE, 2009a). If trends of hardwood plantation remain the same, huge amounts of hardwood will be produced in the country. All of that production will not be consumed in the domestic markets. In those conditions, international markets would have a dominant effect. Moreover, eligibility of forests carbon credits in emissions trading schemes will increase reforestation activities all around the world but the level of increase will depend on many factors such as the price of carbon credits, national and international policy on agriculture, forestry and bio-fuels, climate change impacts on agricultural production and food prices and future changes in human demands on forest products, as determined by population growth, increases in income, changing human values and consumer preferences. Discussion of all those factors is beyond the scope of this paper.

Carbon price is another important factor that affects NPVs of all land use systems. As discussed, due to unexpected outcomes in COP15, the market price of carbon is highly volatile. Carbon price would have a diverse effect on different land use systems. Since cultivation and pasture are net sources of carbon, the decrease in carbon price will increase their NPVs and vice versa (Table 3). However, plantation is a net sink of GHG, and thus increasing carbon price would have positive outcomes. If a plantation is not managed as a silvipastoral system, plantations would be less profitable even at the given carbon price of \$10.5 $t^{-1}CO_2e$. However, if stock value is considered, plantation would be profitable even if the carbon price falls up to \$4.4 $t^{-1}CO_2e$. In the range of \$2.6 to \$4.4 $t^{-1}CO_2e$ carbon price, plantation would be in the second position, below this range plantation would be the least preferred option. The higher the carbon price from \$4.4 $t^{-1}CO_2e$, the more profitable would be the plantation than the other land use systems.

Table 3: NPVs (\$ ha^{-1}) from different land uses with respect to different carbon prices

Land uses	Carbon prices			
	\$2.5 $t^{-1}CO_2e$	\$4.4 $t^{-1}CO_2e$	\$5 $t^{-1}CO_2e$	\$10.5 $t^{-1}CO_2e$
Cultivation	3359	3191	3140	2657
Pasture	3028	2990	2977	2865
Plantation	3024	3192	3241	3701

From analysis, it was found that the average recovery rate of logs is around 43%. After using and reusing, finally, these wood products ended up in landfills. The chemical analysis of buried wood in Australian landfills showed that only up to 3.5% of the carbon in wood products was lost through decomposition in 46 years (Ximenes, 2006 cited in Gardner *et al.,* 2002). Similarly, the soil carbon may not fall to the level of zero age plantations (at the starting of the first rotation plantation) after harvesting. Therefore, if 40% of the gained soil carbon and the harvested product carbon would be locked for another 46 years (C2 Scenario), the net additional NPV gain would be around \$484 in 34 years.

So far, all discussions were based on a 6% discount rate, in which optimal rotation of plantation was found to be 34 years If the discount rate increases to 7%, the optimal rotation of plantation would reduce to 31 years (Table 4). The combined NPVs of plantation, pasture and cultivation in 31 years would be around \$2315 ha^{-1}, \$2492 ha^{-1} and \$2305 ha^{-1}, respectively. Therefore, the plantation and cultivation would be highly competitive to each other for the second position, and the pasture would be marginally better than the others. If the discount rate further increases to 8%, the optimal rotation of plantation would reduce to 29 years. With that discount rate, the total NPV of pasture would be around 1.64 times that of plantation and 1.08 times that of cultivation in 29 years. Increasing discount rates above six percent is not favourable for plantation. In plantations, most of the costs are incurred in the early ages while the benefits from timber come only in the harvesting age. Therefore, benefits are more heavily discounted than costs. Since timber benefit contributes the most to the total plantation benefit, the total NPVs and optimal rotation decreases drastically with increasing discount rates. In the case of pasture and cultivation, all costs and benefits stream since the beginning years. As a result, the effects of discount rates are not that pronounced. The lower the discount rate from six percent the higher the benefit from a plantation compared to other land use systems. Therefore, a six percent discount rate is the threshold for a plantation decision.

Table 4: Effect of discount rates on optimal rotation age of plantation and the NPVs (\$ ha^{-1}) of different land use systems in the given optimal rotation ages

Land use	Crop	Timber	GHGs	Stock	Total
Discount rate 6%, optimal rotation 34 yrs (NPVs in 34 yrs)					
Cultivation	3579	0	-922	0	2657
Pasture	0	0	-214	3079	2865
Plantation	0	2045	862	794	3701
Discount rate 7%, optimal rotation 31 yrs (NPVs in 31 yrs)					
Cultivation	3121	0	-816	0	2305
Pasture	0	0	-194	2687	2493
Plantation	0	990	633	692	2315
Discount rate 8%, optimal rotation 29 yrs (NPVs in 29 yrs)					
Cultivation	2779	0	-735	0	2044
Pasture	0	0	-179	2386	2207
Plantation	0	242	490	610	1342

Higher discount rates from six percent are more favourable for pasture. It would be the first choice for farmers. However, higher discount rates will narrow down the NPV gap between the pasture and cultivation, as the increase in GHG NPV from cultivation is proportionately higher than in pasture at higher discount rates. However, pasture will still be more profitable than cultivation even at a 50% discount rate, and it will be tied (total NPV $293 in 29 yr) with cultivation only at a 60% discount rate.

7 CONCLUSIONS AND RECOMMENDATIONS

This article first find out optimal rotation age of spotted gum plantation, and then compared NPVs from the traditional tangible benefits and carbon in cultivation, pasture and plantation in medium to low rainfall areas in SEQ. The optimal ration ages of plantations for timber value, timber plus stock values and timber plus stock plus carbon values, were found to be 31, 31 and 34 year, respectively. The respective NPVs in given rotation ages were \$2100 ha^{-1} (timber alone at age 31), \$2878.8 ha^{-1} (timber plus stock at age 31), \$3700 ha^{-1} (timber plus stock plus carbon at age 34). This shows that there is a considerable chance of increasing NPV by practicing a silvipastoral system without reducing the rotation age of a plantation. Similarly, there is considerable potential for increasing NPV by considering carbon values in plantations. For this to happen, there would need to be an increase in the rotation age from 31 to 34 years.

If the comparison of NPVs is limited to the traditional tangible benefits (crops and hay in cultivation, beef in pasture and timber in plantation), the cultivation would be the most preferred option followed by pasture and plantation. Even after inclusion of the stock value, plantations could not compete with other land use systems. However, after inclusion of GHG value, with the price of \$10.5 $t^{-1}CO_2e$, plantations are found to be the most preferred option followed by pasture and cultivation. However, carbon price of \$4.4 $t^{-1}CO_2e$ and discount rates of 6% are threshold for plantations. Carbon price less than \$4.4 $t^{-1}CO_2e$ and discount rates above 6% are not favourable for plantation. While seeing the current market prices, getting carbon price lower than \$10.5 $t^{-1}CO_2e$ seems unlikely.

At age 34, stock and carbon values contribute about 44% of the total returns in plantations. Therefore, promotion of plantation as a silvipasture system and inclusion of reforestation activity under carbon trading scheme could change peoples' perception, and there is a good chance of land use transformation.

The findings of this analysis should be interpreted with caution. Although the basic analytical framework used in this study can be applied elsewhere, the results should be applied only to the areas similar to the similar SEQ environment. Also, applying this research under CPRS is not recommended, as agriculture, soil carbons, underground tree biomass and carbon sequestrations in harvested wood products have already been ruled out from CPRS. Even if agriculture is covered, peanut-maize cropping and beef pasture may not come under the CPRS, as CPRS only covers entities with emissions >25 000 t CO_2e/year (DCC, 2008), which is impossible even if a farm is over 5000 ha (Maraseni *et al*., 2010). Assuming that: 1) the CPRS becomes a reality; 2) the CPRS covers all land use systems without any benchmarking and preconditions; 3) there are no emissions intensive trade exposed industry support; and 4) there is no fuel credits support as proposed in the CPRS (DCC, 2010), then this study is able to provide some valuable guidance to all level of stakeholders.

There are four other ways to increase NPV (return) from plantation. First, NPV could be increased by changing current practices of log size utilisation. Currently, logs only up to 25 cm small end diameter are acceptable at the sawmill, as the processing of logs below that size is not profitable (for detail discussions see Maraseni *et al*., 2007b). However, in many parts of the world logs up to 10 cm top diameter are used. The analysis shows that the tapering of spotted gum logs from 10 cm to 25 cm diameter is around 0.97 cm m^{-1} (Maraseni *et al*., 2007b). It means around 0.37 m^3 of log between 10 to 25cm diameters would be lost from each tree of harvestable age. This is equivalent to around 90 m^3 of logs ha^{-1}, with as optimal tree density of 250 ha^{-1} (Maraseni *et al*., 2007b). The tidying-up operation for these residual logs would cost large amounts of time and money, or, they could be burnt and large amounts of sequestered carbon would be emitted into the atmosphere in the form of carbon dioxide. If one could develop some efficient technology to economically use logs of this size, there would be a good chance of increasing the overall timber benefit. This could be achieved with the use of a current portable sawmill at the plantation.

Second, the combined NPV could be increased by managing the residue in a proper way. The current recovery rate of compulsory and optional logs is around 38% and landscape logs are around 48% (Maraseni *et al*., 2007b). On average, around 43% of the logs would transform into timber and 67% would be lost as residues. The modelling shows that the average density of spotted gum trees at harvesting age (34^{th} year) would be around 760 kg m^{-3}, and total volume (ha^{-1}) at that age would be around 350 m^3. Using the simple mathematical relationship of volume and density, it is found that around 178 t (760 × 350 × 0.67/1000=178 t) of residues would be lost from each hectare. If including the 90 m^3 of logs between 25 cm and 10 cm diameter, another 68 t of biomass would be lost. Similarly, due to 25cm size limitation, logs and residues from first and second thinning are not used.

In Australia, coal is the most important source of fossil fuel. Therefore, there is a good chance of getting carbon benefits by replacing coal with these residues. This is more practicable, as Australia has set highly ambitious renewable energy target, 20% of the total energy by 2020. A recent estimate from south-eastern Australia shows that the use of firewood collected from thinnings, slash and other residues in plantations grown for sawlog production lead to a carbon sequestration equivalent of -0.17 kg CO_2kWh^{-1} which compares well with the emissions from non-renewable sources (Paul *et al.,* 2006). If one could use all these residues and thinned products for substitution of coal for energy generation, the benefit would be twofold.

Third, there is a chance of improving the growth rate of trees by launching a genetic improvement program. In Australia, hardwood plantations have just started and they have a very short history. Its increasing demand from local environment and housing markets is recently being realised. As explained, the soil moisture is the most important limiting factor for plant growth and density. By viewing the fast pace of genetic engineering, it is possible to produce drought bearing spotted gum species with a fast growth rate. This process has already been initiated (Lee *et al*., 2001; Huth *et al*, 2004; Lee, 2005). Preliminary results of a genetic improvement program for spotted gum are promising (Lee, 2005). If the genetic improvement program can produce more water efficient spotted gum hybrids with fast growth rates, the timber NPV and combined NPV for timber and carbon could be increased.

Fourth, some value adding could be possible by promoting non-timber uses of spotted gum. Aborigines have traditionally used the leaves of the spotted gum species. With current knowledge, it is used for food additives and perfume, curing food poisoning, acne and athlete's foot caused by microbial activities (Takahashi *et al.*, 2004), controlling leaf cutting ants (Marsaro *et al.,* 2004) and leaf oil (Asante *et al*., 2000). Non-timber benefits also comes from other environmental services if it is planted in right places such as in areas of salinity prone areas.

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Small and medium forest enterprises' challenges and opportunities in South Africa

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Abstract

The South African forestry sector is currently undergoing major transformation including land reform, State resources transfer, broad based black economic empowerment, and new afforestation opportunities predominantly in communal areas. These transformation processes present opportunities for growth and development especially for communities who were disadvantaged in the previous dispensation. One of the implications of such transformation is that in the near future at least more than half of afforested land in South Africa will be under community ownership. In contrary, the very same transformation processes inheritantly present a number of challenges, which communities would face in their business ventures. This paper focuses on exploring such challenges including skills, capacity, finance, extension support and legislative environment to ensure that the forestry business in the country strives and continues at an optimal level.

The paper goes further to assess what government and industry need to put in place as interventions to create an enabling environment for the small and medium forest enterprises (SMFEs). In doing so, the paper also explores amongst others, policy imperatives, institutions, support mechanisms, experiences and lessons learnt from current out-grower schemes and other necessary interventions to build and grow the sector. It then concludes by recommending a number of interventions based on cooperative governance including policy and strategy framework, and programmes to support SMFEs in South Africa.

Key words: forest enterprises, South Africa
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1 INTRODUCTION

The forest sector development in South Africa (SA) dates back to the late 1800s championed by the State, and then, private enterprises later (Mayers *et al.*, 2001). Today the sector command 1.226 million hectares of afforested land, and land with potential for afforestation, predominantly in the rural areas of the country. The Key Issues Paper on Forestry and Poverty (2005) states that more than 74% of the poor live in rural areas, and therefore, the forest sector is best placed to significantly contribute to poverty alleviation amongst others. This potential however has not been fully recognized including participation of small and medium forest enterprises (SMFE)[3].

Huge numbers of SMFE already exist in the world, and rough estimates suggest that they make up 80 – 90 percent of forestry enterprises, and over 50% of forest sector employment in many developing countries (Macqueen, 2008). South Africa is no exception, and hosts roughly more than 90% of the sector enterprises – although the value is pretty small. These include more than 30 000 black small growers, 240 small sawmillers and 300 independent contractors, of which half are black emerging contractors. In addition, the pulp and paper industry has created more than 10 000 income opportunities for waste paper vendors. The Key Issues Paper on Forestry and Poverty (2005) recognizes that the SA forest sector offers significant business opportunities for SMFE.

The democratic dispensation ushered new opportunities for transforming and growing the sector through which the participation and value of SMFE can be enhanced and improved. Both the land reform and the Forest Sector Broad Based Black Economic Empowerment (BBBEE) Charter[4] may result on more than half of the afforested land under communities' ownership. Furthermore, the Charter (2008) project future afforestation around 100 000 hectares, and recognizes that such land is predominantly community owned. Ntsebeza and Hall (2007) states that the settlement and handover of land have become prominent events to celebrate the achievements of post-apartheid SA – among these are redress measures that have taken the form of rural claimants entering co-management agreements for forest resources.

Part of the transformation agenda, which also presents an opportunity for SMFE, in SA is the State forest resources' transfer to communities. The land reform, specifically land

3 In the context of SA, small and medium forest enterprises are defined as businesses with a turnover of less than R5 million (US$0.5 million) and R35 million (US$3.7 million) per annum respectively.
4 It is a cooperative sector value chain economic transformation and growth instrument negotiated and agreed (signed on May 22, 2008) to by both the Government and the Industry linked to BBBEE Act 53 of 2003.

restitution, process has influenced the privatization process of the State owned forests (Genesis, 2005), and hence, the Department of Water Affairs and Forestry (DWAF) together with key stakeholders have embarked on a process of transferring such assets to the rightful land owners or beneficiaries. There is however concerns of whether timber production and processing interventions will remain viable in the long-term (Centre for Development and Enterprise, 2008). Recent reports on land reform challenges facing the agricultural sector are a cause of concern to an extent that threats have been made by the Land Affairs Minister of expropriating land that is not used for production (The Sunday Times, March 22, 2009). Van Zyl *et al.* (2008) points out that when a land reform programme is accompanied by a range of entitlement and support services and sound governance, rural prosperity and productive farming sector can be achieved.

The objective of this paper is to look at some of the key challenges facing SMFE in SA and to present recommendations as possible solutions. The first part of the document dealt with opportunities for SMFEs, and the next section will deal with challenges and how these can be addressed to facilitate optimal realization of their economic opportunities.

2 CHALLENGES FACING SMFE IN THE SOUTH AFRICA

Literature suggests two key principles approaches in forest enterprises' analysis and/or review, and those are (1) fair and equitable sharing of rewards throughout value chain and (2) addressing specific bottle necks to enhance overall performance (Townson, 1995; Arnold, 2006; and Macqueen, 2008). In Indonesia, furniture value chain analysis pointed-out that SMFE may be trapped and be reliable on widely available illegal and unsustainable timber, and identified business development services as a priority mechanism. Closer home wood furniture value chain analysis in SA focused on market system development identified particular options for product and functional upgrade (Kaplinsky *et al*., 2003). Numerous forest sector review and analysis in SA have been undertaken including through the Charter Process, the Genesis Report, the Forest Governance Learning Group – South Africa, and the Key Issues Paper on Forestry and Poverty, and a number of SMFE challenges have been identified – the following will be reflected for the purpose of this paper:

- Extension and advisory support;
- Capacity building and skills development;
- Financial services; and
- Policy and legislative environment.

2.1 EXTENSION AND ADVISORY SUPPORT

Extension is a two-way communication between client and source, it is thus a process involving communication of information from the source to the client who then appropriately apply the information and communicate the results back to the source (Blackburn, 1984. Terblanche (2008) stated that extension got its name from the process of extending agricultural knowledge. It is a proactive approach and focuses on preparing the client for dealing with future problem situations –advices and reactions (based on request) should lead to more skilful and independent future decision-making situations (Terblanche, 2008).

In summary extension is all about helping farmers to help themselves and is an ongoing process. A very important aspect of extension is the diffusion of innovations. Blackburn (1984) concurred that the success of extension programmes is often measured by the degree to which the time lag is reduced to increase the rate of adoption, which refers to the relative speed with which an innovation is adopted by members of a social system. The rate of adoption is influenced by at least four factors namely:

- The type of decision involved;
- The perceived attributes of the innovation;
- The nature of the communication channels; and
- The extent of the extension practitioner‘s effort (Rogers and Schoemaker as cited by Blackburn, 1984).

The SA forest sector does not have a dedicated extension support system. However, in the timber growing sector some initiatives were undertaken by companies partnering with communities to provide these services. The sector comprises of a number of sub-sectors besides timber growing and processing, these include contracting, pole production, charcoal, pulp and paper, sawmilling, woodchipping, chipboard and mining timber. The needs of these sub-sectors coupled with post settlement support of land beneficiaries warrants some mechanism to support SMFE. Timmer (1982) explained extension appropriately by stating that it is a bridge between sciences and government on the one side, and agricultural practice and farming on the other. Timmer (1984) further stated that without this bridge all the tax payer’s money spent on the important work of research institutions will be invested in vein. Actually the capital invested will only yield some output after extension has started its work.

Another important argument for extension is presented by Kirsten *et al.* (1993) when they stated that extension and training plays an important role in determining the success of

Farmer Support Programmes. They further stated that extension was part of the contributing factors to higher maize yields in SA.

The Department of Water Affairs and Forestry initially adopted a model of a Unified Support System. This model was based on the Department providing services to their service providers like local government and provincial departments like Agriculture. This model failed because other government departments had their own mandates and priorities, and that systems and institutions in local government were not fully operational immediately after the democratic dispensation.

An issue of concern for the forest sector is that if the current and future operations in timber production and processing cannot be guaranteed after the land have been transferred to the rightful owners, this could lead to a decline in productivity with resultant job losses which will affect the economy adversely.

Based on the literature review, it is clear that there are benefits that will accrue to land beneficiaries and emerging farmers involved in forestry initiatives – but they need support to sustain such benefits. The question is, therefore, how should a responsive and proactive extension system be structured? The following are some of recommended principles for establishing an effective extension support system:

- Development should be needs based and participation of all role players is essential;
- The development of small scale business development opportunities can be delivered through government agencies directly or by utilizing private sector delivery;
- An even better model can be a partnership between the public service and the private sector. The commercial sector has got a great wealth of skills and knowledge that can be shared with the emerging sector;
- Critical to the extension service is the provision of timely, well-targeted business information (both technical know-how and market intelligence), training and incentives; and
- Funding and material as start up capital will be essential, especially for small enterprises. The traditional funding institutions are most of the time not flexible to the culture, environment and the business opportunities of small enterprises.

2.2 CAPACITY BUILDING AND SKILLS DEVELOPMENT

Forestry is on the national priority list for skills development in the country. An estimated 78% of the workers in the industry are skilled or semi-skilled (Human Sciences Research Council, 2005). When one considers skills requirements for SMFE the percentage number is definitely higher than projected.

Lack of skills to implement forestry enterprise development interventions has been identified in various sources of literature as a crucial constraint to rural development. Ntsebeza and Hall (2007) agreed that for successful implementation of the development function, the state should ensure that adequate skills and technological development are made available to rural communities. The current initiatives that have been undertaken to address skills and capacity issues have been *ad hoc* and informal in nature (Africa Institute for Policy Analysis and Economic Integration, 2009). There is a need for well thought-out and continuous means of support to SMFE in SA.

Through the Skills Development Act, 1995 (Act 97 of 1995) together with other initiatives, government attempted to address the issue of skills development through:

- Joint Initiative on Priority Skills Acquisition Programme (JIPSA);
- Development of learnerships and internships to provide for training in the work place and to give exposure to new entrants to the work environment;
- Programmes conducted by the Forestry Industries Education and Training Authority; and
- Training through community and industry partnerships.

As indicated earlier on, some of these initiatives have been *ad hoc* in nature and not well co-ordinated. There is also the dilemma of having a high number of graduates and diplomats in the country, coupled with a shortage of priority skills. This means there is no alignment of the demand and supply of skills in the country.

A holistic strategy on skills development will entail a review of the school curriculum, youth development services, capacity to emerging producers and link these with technikons and universities (Ntsebeza and Hall, 2007). Another linkage will be for the training of entrepreneurs to be linked with extension services and research stations.

In the context of rural South Africa, most emerging entrepreneurs were not given exposure to the technical and business skills of conducting forestry enterprises successfully. The interdependencies between emerging entrepreneurs and established commercial entities are an important consideration to note when developing a skills development programme in this regard. Formation of partnerships with the private sector could lead to affordable and locally relevant training and extension services for new entrants to the market (Centre for Development and Enterprise, 2008).

In order to take skills development and capacity building forward the following are recommended:

- A holistic strategy which covers all sub-sectors of the forest sector;
- Interventions dealing with provision of skills to take into account issues of skills demand and supply in the sector;
- Partnerships with the private sector to be explored as a means of providing local and tested sources of information;
- Programme design and implementation will need to be stakeholder driven (FGLG-SA, 2009); and
- Training, extension and research need to be linked in order to ensure optimal benefit by the end-users including communities.

2.3 FINANCIAL SERVICES

Few scholars including Bull and Ferguson (2006), and Rametsteiner and Weiss (2006) seem to agree that innovation in forest enterprising is successful when there is strong market pull, high degree of knowledge and entrepreneurial culture. This however needs resources including finance to culminate into sustainable investments. There is an undeniably strong correction between a functional financial sector and economic development (Spencer and Wood, 2005).

In the context of the SA economy, both private and government financial institutions are in abundance and striving. Even in such strong economic context, financial services for SFE, particularly forestry, have predominantly been provided by value chain players (FGLG-SA[5], 2008). For example, credit facilities and other support provided through small timber grower schemes and/or programmes alike. According to Steen *et al.* (2005), buyer – most cases value chain player, and supplier – often small producer relation is a very significant source of credit, technical advice, information and oversight finance for many SFE.

Access to finance by SFE in SA is one of the major challenges to enterprise innovation, and such an attribute is associated with the following:

5 This is an African and Asian focused initiative constituted by eleven countries led and funded through the International Institute for Environment and Development (IIED) by the European Commission (EC).

- Inadequate information about potential SFE that undermines the belief that providing financial services to the group can be profitable and transaction costs and risks can be reduced (Macqueen, 2008);
- Lack of knowledge, capacity, and customised and demand led business planning services to demonstrate and advance SFE readiness to access financial facilities;
- Lack of legally recognised collateral and enforceability on loan repayments (Macqueen, 2008), which are associated with high and inappropriate requirements and criteria;
- Lack of a sector financial product and incentive like scheme and once-off grant respectively to advance access, and minimise cost of capital investment and enhance SFE projects' viability.

Most of these have been looked at, and addressed to some extent by the Industrial Development Corporation (IDC) forestry funding scheme launched in 2006, and lately by the Forest Sector Charter and its' relevant measures including development of a small and medium forest enterprise (SMFE) strategy to address felt needs. The implementation of the Charter as a starting point will hopefully facilitate better access to financial resources and business planning services. For example, there is already advanced discussion between the Department of Water Affairs and Forestry (DWAF) and IDC on a grant-loan funding mechanism for SMFE, which should form part of a broader strategic response once developed on the basis of cooperative governance.

2.4 POLICY AND LEGISLATIVE ENVIRONMENT

According to Macqueen (2008), 'improving legislative environment is critical to a forest sector' due to multiple users, potential resource conflicts and long term nature – especially transparency and secure allocation of resources. There is a number of policies with effect to forestry in SA including macro, forest, land, environment, water and labour (Mayers *et al.*, 2001 and Geller *et al*., 2006). Ideally, all these need to facilitate a striving business environment at varying levels such as economic stability, entrepreneurial friendly context, transparency in demand and supply of services, communication and infrastructure, and access to key information (Wältring, 2006).

There is an element of truth in that differentiating SMFE and large enterprises' issues and impacts could imply loss of strategic synergies. However, according to Macqueen (2008) 'recent analysis shows that on legal, financial and corruption issues, SMFE perceived greater business environment obstacles'. In comparison with large enterprises, SMFE are more likely to strive and grow if such obstacles were removed (Vandenberg, 2005). In principle, legislative reform encompass a wide range of different areas including improving dispute resolution mechanisms, clarifying rights, streamlining corporate governance, fair law enforcement, simplifying administration mechanisms, and strengthening growth and development (Miehlbradt and McVay, 2006). The legislative framework overview reflected here demonstrates how complex reforms need to be and as such require proper approach and organising instruments. Amongst others, these may include stimulating and creating demand for reforms – process and content, and building knowledge and capacity for implementation – institutional (Macqueen, 2008).

2.4.1 Stimulating and creating demand for reforms

The magnitude of policies in SA with effect on the forest sector goes beyond definition and/or boundaries of the sector, and therefore, any meaningful reforms need to be broad in nature. There has been a number of business environment analysis with a particular focus on the legislative context including the National Forest Action Programme in 1997, the Genesis Report in 2005, the Charter Process from 2005 – 2007, the Forest Governance Learning Group in 2006, and the KwaZulu-Natal Forest Sector Initiative in 2008. All of these processes highlighted a number of legislative reforms necessary to enhance and unlock growth, development and competitiveness of the forest sector including the following:

- Streamlining stream flow reduction activity (SFRA) licensing process[6];
- Reducing cost of regulations and/or of doing business by instituting incentives;
- Establishing sector codes of best practices on numerous areas including procurement and management; and
- Designing and instituting forest enterprise development (FED) integrated support mechanisms.

While reform areas have been generally identified and specific changes can be effected – these are by no means reflecting SMFE perspective. There is therefore no basis of breath and depth of needed reforms from SMFE perspective, and this need to be established. In principle, reforms can either be dramatic or less draconian (Macqueen, 2008) – a combination of the two may be much effective. The Charter process identified and

6 Forestry is partly regulated through the National Water Act 36 of 1998 as a SFRA, and has to be licensed before it’s established – this process is therefore very critical for forestry development.

reflects SMFE strategy development as a deliverable, and this should offer space to assess legislative reforms necessary and responsive measures.

2.4.2 Building knowledge and capacity for implementation

In order to create knowledge and capacity for implementation, SMFE strategy development process should consider the following factors:

- Identification of champions and/or agents of change in respective areas that strategy seeks to improve (Macqueen, 2008);
- Any identified champions would need to be party to the strategy development process so that their knowledge and capacity are appraised accordingly;
- The complex nature of reforms reflected above, i.e. cutting at different levels of governance and agencies, means devising cooperative arrangements that may not necessarily and immediately be available (Hobley, 2007); and
- Designing monitoring and evaluation measures to enhance effectiveness and efficiency of any reform process.

An underlying principle for legislative reforms is that greater understanding of key factors, which inhibit or promote SMFE need to be attained and measures put in place if their potential is to be promoted within broader environmental constraints.

3 CONCLUDING REMARKS

In taking forward issues of growth and development of the forest sector in SA, government needs to consider the contribution of the SMFE. It is necessary to analyse the challenges and opportunities provided by this group of the sector, and consolidate this into a statement of intent and strategy in order to maximize its potential. To grow the sector, there is a need to bring communities and SMFE on board – these groups of the sector own most land that is suitable for afforestation and forested land that will be settled through the land reform process.

To chart a way forward; government, industry and labour have signed a Forest Sector BBBEE Charter. This Charter is in essence a commitment and statement of intent which commits the parties to transformation and growth of the sector. It takes into account challenges faced by previously disadvantaged individuals and groups, which constitute a very large section of SMFE. Included in the issues addressed by the Charter are issues of skills, finance, capacity building, ownership and the policy and legislative framework. Having a policy or statement of intent is not adequate in itself, there is a need to establish a mechanism to effect implementation and ensure that the objectives and undertakings in the charter are realized. To establish this mechanism the parties should take the following into consideration:

- One of the objectives should be to provide extension and advisory support services particularly to SMFE;
- The support should include a well thought-out and coordinated training and capacity building interventions;
- Mechanism established for this purpose should be able to lobby and provide appropriate funding for development purposes;
- Options for public private partnerships should be explored and prioritized; and
- Mechanism should be structured on pro-poor principles, lobby for conducive legislative environment and provides incentives for SMFE.

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Evaluation of industrial promoted agroforestry in Andhra Pradesh and Madhya Pradesh, India

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Abstract

In many parts of the world, pulp and paper companies are becoming heavily dependent on private agroforestry schemes. With growing demand for wood fiber and limited commercial land to grow it on, the forest industry is continually turning to private farmers and individuals to contract timber. In order to alleviate this problem, many companies have turned to out-grower schemes to supply wood to the mills. Local farmers now have the opportunity to benefit from company extension and supplies, and in return, the company can guarantee its supply of raw materials.

A recent trend in agriculture is adding trees to farmers' traditional croplands or agroforestry, in which farmers typically select fast growing tree species that can be harvested after only a few years. However, careful consideration of the economics of such conversion is important to farmers in order to make informed decisions to convert their farms to forestry use. Since this is a new practice in many regions of the world, there is little data available, especially to farmers, on the financial feasibility of these agroforestry systems.

This study investigates commercially promoted agroforestry schemes in two states in India. Specifically, this study evaluates the financial feasibility of agroforestry techniques employed by farmers in Andhra Pradesh and Madhya Pradesh, India and examines factors affecting the financial feasibility of agroforestry schemes in these regions.

The data for this study were collected by personal interviews of 47 farmers, in the summer of 2009. To examine the economic feasibility of converting traditional agricultural lands to agroforestry or farm forestry, standard financial criteria were calculated such as Net Present Value (NPV), Benefit-Cost Ratio (BCR), Internal Rate of Return (IRR), Equivalent Annual Income (EAI), and Land Equivalency Value (LEV). Results show that the agroforestry systems adopted by farmers in both regions are profitable at all discount rates applied.

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FDC: 682+907(540)=111

1 INTRODUCTION

In many parts of the world, pulp and paper companies are becoming heavily dependent on private agroforestry schemes. With growing demand for wood fiber and limited commercial land to grow it on, the forest industry is continually turning to private farmers and individuals to contract timber (Saxena, 1992). In India, companies are limited in the amount of land they can own, making large plantations to continually supply a pulp mill impossible. Natural forests as well are under immense pressure, and available timber from them is decreasing with regulatory systems changing. In addition, all natural forests have been designated as ecological conservation zones and no commercial timber harvesting is allowed. This has put a strain on companies, which need large supplies of raw material to operate a mill. In order to alleviate this problem, many companies have turned to out-grower schemes to supply wood to the mills. Local farmers now have the opportunity to benefit from company extension and supplies and return to the company an almost guaranteed supply of raw materials.

According to the FAO (2005), nearly sixty percent of the population in India is heavily dependent on agriculture. Most local farmers produce labor intensive crops, such as rice, wheat, soy, etc., that are highly dependent on world markets, and often see sharp fluctuations in prices. A recent trend in agriculture is adding trees to farmers' traditional croplands. This system is called agroforestry. "Agroforestry is a collective name for land-use systems and technologies where woody perennials (trees, shrubs, palms, etc.) are deliberately used on the same land-management units as agricultural crops and/or animals, in some form of spatial arrangement or temporal sequence. In agroforestry systems there are both ecological and economic interactions between the different components (Lundgren and Raintree, 1982)." This implies that agroforestry involves at least two species of plants, or plants and animals, one of which is a woody perennial, the system has two or more outputs, lasts more than one year and is inherently more complex than a mono-cropping system (Nair, 1993). In practice, farmers typically select fast growing tree species that can be harvested after only a few years and mix these with agricultural crops (Arnold, 1987).

Converting all or some of a farmer's cropland to forestry has many potential benefits ranging from increased income, environmental health, and mutually beneficial growth of all crops through intercropping that can result in even higher realized incomes (Beer, 1987; Pruchapruth, 1996). While farmers have traditionally marketed any trees grown on their property as poles, construction timbers, scaffolding material, and other products, new opportunities are beginning to develop both locally and globally for their wood fiber. Farmers now have improved access to new industries including pulp and paper, biofuels, engineered wood products, furniture, and flooring products. Additionally, many of the traditional agriculture crops produced in India have very intensive labor requirements. The low level of labor required with most farm forestry operations may provide additional time for farmers to concurrently supplement their income from other activities (Arnold, 1987). Other farmers are also converting all of their traditional cropland to forests due to difficult crop markets or incentives from forest products corporations (Bertomeu, 2003; Ceccon, 2005). In India for example, the Indian Tobacco Corporation, Limited (ITC), one of the leading pulp and paper companies in India, works very closely with private farmers to grow the trees required for their mills. ITC estimates the amount of wood needed will nearly triple between 2007 and 2010. This increase will require many thousands of hectares to be planted in plantations and in land converted from agriculture into farm forestry. In 2005, approximately 12,400 hectares were planted in cooperation with ITC and they estimated that by 2008 27,000 hectares would be planted and 100,000 by 2010.

Farmers must have the tools to assess these new opportunities to convert traditional agricultural lands to forestry uses in order to make informed decisions based on their local conditions and to realize potential increases in income. Investments are typically longer term and require larger amounts of capital than other agricultural options. Careful consideration of the economics of such conversion is important to farmers in order to make informed decisions to convert their farms to forestry use. Since this is a new practice in many regions of the world, there is little data available, especially to farmers, on the social, economic and environmental aspects of these agroforestry systems.

In India, specifically the states of Andhra Pradesh and Madhya Pradesh where plantations are being established rapidly and extensively, there is a lack of information on site specific agroforestry schemes. Because of the wide variety in the social, environmental and economic situations of world regions and even within regions, site specific examples must be reported to help local farmers. This study investigates commercially promoted agroforestry schemes in two states in India. The objective of this study is to evaluate the financial feasibility of agroforestry techniques employed by farmers in Andhra Pradesh and Madhya Pradesh, India.

2 METHODS

2.1 SITE SELECTION AND STUDY POPULATION

ITC Bhadrachalam Paperboards Ltd, one of the largest pulp and paper producing companies in India, is a subsidiary company of Indian Tobacco Company (ITC). ITC's mill is located in Sarapaka Village near Bhadrachalam in Khamman District of Andhra Pradesh India. Two regions were selected for this study: Region 1.) Andhra Pradesh, and Region 2.) Madhya Pradesh, India. The region of Andhra Pradesh was selected due to a previous visit and introduction to the management of ITC. The two regions were selected due to ITC involvement in these areas and the levels of activity in eucalyptus planting in conjunction with agroforestry practices. The area of Andhra Pradesh has more farmers involved in eucalyptus planting due to the location of the ITC mill. Much of the state is considered to be in the "core zone" for the mill, being within 250 km. The state of Madhya Pradesh has only recently begun planting of eucalyptus. ITC has expanded its distribution to this region for two main reasons. First the company was interested in developing another mill location, possibly in this state. Also, there is intense competition for the wood product being developed by the farmers. In order to reduce the competition, and therefore ensure more wood coming into the mill, the company has helped to develop the plantations in this area. Farmers from within the state of Andhra Pradesh were selling their wood as pole wood in the state of Madhya Pradesh in order to capitalize on higher prices. The company decided that in order to reduce the loss of resources in this manner, it would be beneficial to develop plantations in Madhya Pradesh to out-compete the farmers in Andhra Pradesh and therefore those farmers would again sell their wood to the mill as pulpwood.

2.2 DATA COLLECTION

Thirty six farmer fields in the core zone surrounding the mill and eleven fields in the Madhya Pradesh state were selected for analysis. The individual fields were selected based on availability of farmers to interview, company contacts and willingness of the farmers to cooperate and, most importantly, the activities the farmers were carrying out in the fields. Farmers who were engaged in agroforestry were targeted to contact. Farmers interviewed in the study were recommended by company personnel.

Personal interviews were carried out to collect the data for the study. Farmers were interviewed about the activities occurring on their farms. Demographic information (education, gender) was collected in order to gain an understanding of the population. Information on land ownership size was gathered to test whether only large or small landowners participated in agroforestry or if there were any differences between land ownership sizes between regions. Information on farming practices for intercrops and trees (rotation age, fertilization, etc.) was collected to better understand the timing of activities on the farms. Costs and revenues associated with these practices were also collected to use in financial analysis. Eucalyptus yields and prices were gathered to use in the financial analysis and for evaluation between regions. All data were taken on a per acre basis.

2.3 ANALYSIS

Summary statistics were calculated for the data collected from the survey. T-Test and Chi-squared tests were conducted to compare means and distributions between the two regions with respect to demographic variables, cost and revenue variables.

Table 1: Cost and revenue estimates used in evaluating financial feasibility of converting traditional croplands into agroforestry in Andhra Pradesh and Madhya Pradesh, India, 2009.

Activity	Region 1		Region 2	
	Value ($/acre)	Year	Value ($/acre)	Year
Intercrop Planting	$219.80	1	$99.40 $106.00 $78.50	1 2 3
Intercrop Harvesting	$367.10	1	$158.90 $379.80 $356.80 $260.40	1 2 3 4
Eucalyptus Planting	$31.90	1	$51.70	1
Plowing	$25.80	1,2,3,4	$0	None
Cultivation	$12.5	1,2,3,4	$0	None
Fertilizer	$20.70	1,2,3,4	$0	None
Irrigation	$32.80	1,2,3,4	$0	None
Farm Yard Manure	$12.50	1,2,3,4	$0	None
Insecticide	$16.70	1	$0	None
Eucalyptus Harvest Revenue	$1,185.75	4	$3,361.70	4

To examine the economic feasibility of converting traditional agricultural lands to agroforestry or farm forestry, standard financial criteria were calculated. Specifically, Net Present Value (NPV), Benefit-Cost Ratio (BCR), Internal Rate of Return (IRR), Equivalent Annual Income (EAI) and Land Equivalency Value (LEV) were calculated. A discount rate of 12% was used for the analysis. In addition, a sensitivity analysis was conducted by using other discount rates, specifically 6, 12 and 15%. These higher discount rates were used in the economic analysis because the study was conducted in a developing country where poorer farmers are less able to delay consumption and have a higher time preference (Schroeder, 1993)

The schedule of activities assumed for a rotation was based on the recommended practices by ITC. Mean values for the activities were used from farmer responses collected from the survey (Table 1). Company estimates for pulp yield were used for both regions.

3 RESULTS

3.1 DEMOGRAPHIC CHARACTERISTICS OF FARMERS

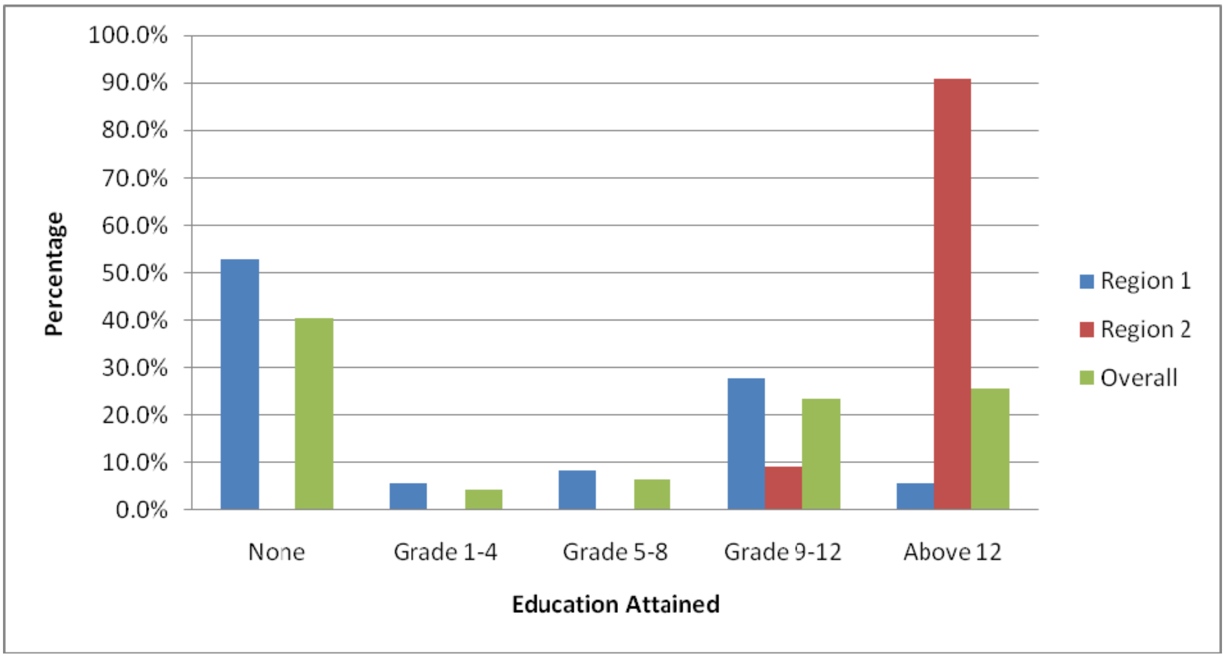

Figure 1: Distribution of farmer by education, Andhra Pradesh and Madhya Pradesh, India, 2009.
**Statistically significant at .05 level using Chi-Square test.*

Overall, most of farmers (40%) interviewed received no formal education (Figure 1). This is not surprising since most farmers involved in agriculture in India are rural, poorly educated subsistence farmers. Tribal farmers also make up a significant proportion of the farmers in India. These individuals are often isolated from larger villages where schools are available, and have neither the money nor the means to go to school.

In region 1 the largest percentage was in the no education group, with 52.8%. Again, this is not surprising given the characteristics of the farmers in this region. Many of the farmers in this region are concentrated around the company mill. The area is very rural and an agricultural production region. The next highest percentage was in the grade 9-12 group, with 27.8%. This group is mainly the farmers closest to the mill town, where there are more opportunities for education. The farmers in region 2 were extremely well educated. Over 90% had an education above grade 12, and the remaining 9% had an education in the grade 9-12 group. The education of farmers between the two regions was significantly different (X^2 =32.632, p value = 1.42089E-06).

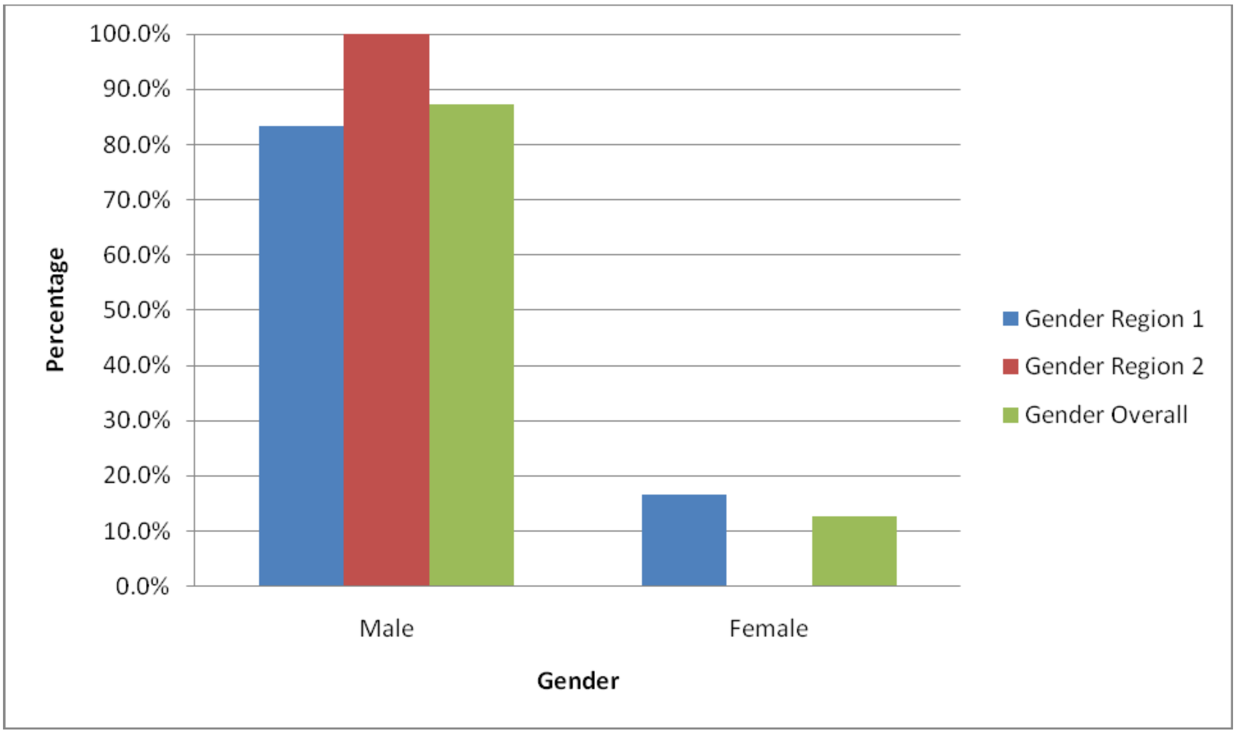

Figure 2: Distribution of farmer by gender, Andhra Pradesh and Madhya Pradesh, India, 2009.

The gender distribution is heavily weighted towards males. Overall, 87.2% of the farmers interviewed were males (Figure 2). Only Region 1 had female farmers. In this region, 83.3% of the farmers interviewed were males and 16.7% were females. The distribution of farmers by gender was not significantly different (X^2 = 2.102, p value = 0.147143) between 2 regions.

3.2 LAND OWNERSHIP

Average farm size overall was 6.4 acres (Table 3). In region 1, average farm size was 4.8 acres and in region 2 the average was 11.6 acres. The difference between regions for land ownership size was not statistically significant (T statistic = 1.996, p value = 0.06438) at the .05 level using a T-test.

Table 3: Land ownership size, Andhra Pradesh and Madhya Pradesh, India, 2009.

Region	Acres				
	Mean*	Median	Min	Max	St Dev
Region 1	4.8[a]	2.0	1.0	55.0	9.1
Region 2	11.6[a]	9.0	2.0	35.0	10.2
Overall	6.4	3.0	1.0	55.0	9.7

*Means within a column with same letters are not significantly different at 0.05 level using T-test.

3.3 FARMING PRACTICES

Establishment of Eucalyptus plantations began in 1991 due to creation of the Andhra Pradesh Forest Produce Act, which in effect ended all arrangements between the government and ITC for supply agreements. In 2004, ITC decided to promote pulp wood plantations on farm lands after realizing that supplies from government plantations would decline in the future. This produced a large increase in planting the following years. Specifically, the majority of farmers began planting in 2006 and after. Overall, 25.5%, 19.1% and 27.7% of farmers interviewed began planting in 2008, 2007 and 2006 respectively (Figure 3). The increases in planting in 2001, 10.6%, was due to a breakdown in the government plantation agreement, requiring the company to source wood elsewhere, and develop private plantations.

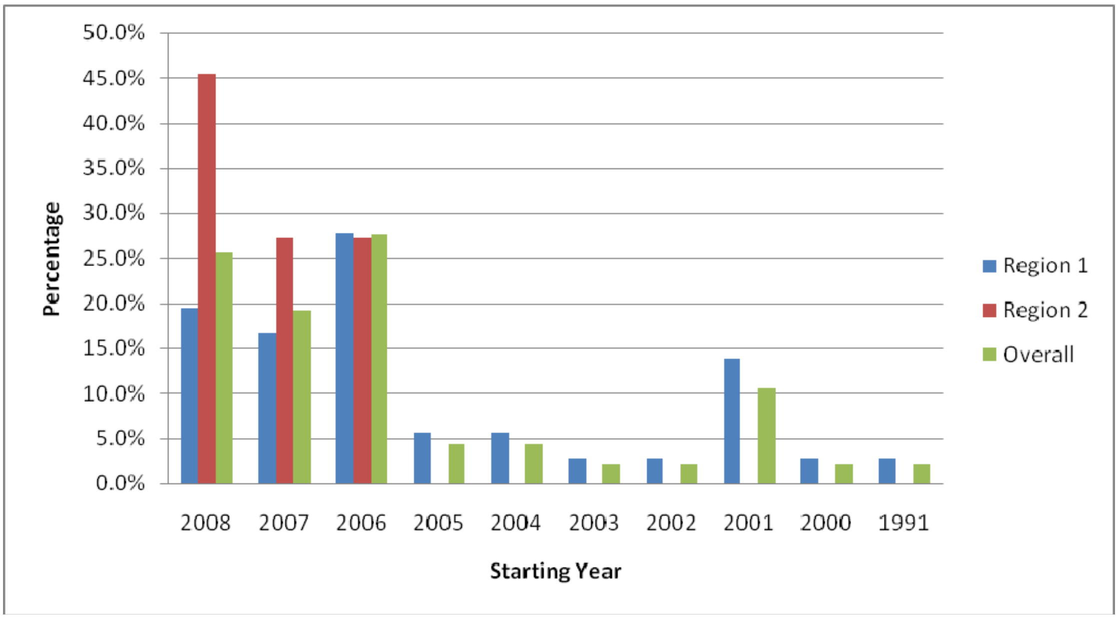

*Figure 3: Distribution of starting year of planting by farmer, Andhra Pradesh and Madhya Pradesh, India, 2009. *Not statistically significant at .05 level using Chi-Square test.*

Overall, the average trees per acre planted by farmers were 791.9. In region 1, the mean trees per acre were on average 730.6 trees. In region 2, the mean trees per acre were 992. The difference between regions for trees per acre was statistically significant (T statistic = 5.041, p value = 3.748E-5) at the .05 level using a T-test.

The average rotation age of Eucalyptus plantation was on average was 4.06 years overall. Broken down by region, the mean rotation age in region 1 was 4.14 years and 3.82 years in region 2. The difference between regions for rotation age was statistically significant (T statistic = 2.189, p value = 0.0406) at the .05 level using a T test.

Table 4: Farming practices, Andhra Pradesh and Madhya Pradesh, India, 2009.

Farming Practices	% of Farmers		
	Region	Region2	Overall
Plowing	75	91	80
Cultivation	6	4	4
Fertilization	50	0	38
Irrigation	11	0	8.5
Farm Yard Manure Application	3	0	2
Insecticide Application	3	0	2
Intercropping	78	100	83

The farming practices conducted by farmers are presented in Table 4. Overall, 80% of the farmers interviewed conducted plowing. The company recommends plowing in order to increase production from eucalyptus by aeration of the soil and water conservation. Overall, cultivation occurred on only 4% of the farm while 38% of the farmers applied fertilization. The farmers are advised to fertilize in the form of NPK twice every year. Overall, 8.5% of the farmers irrigated their farms but only farmers from region 1 applied irrigation (11%) while none of the farmers in region 2 irrigated. The application of farm yard manure occurred on only 2% of the overall farms while application of insecticide occurred on only 2% of the overall farms. The application of Phorate is recommended at the time of planting to protect saplings against root grub. In region 1, 3% of farmers applied insecticide while none of the farmers in region 2 applied insecticide. Overall, intercrops were used 83% of the time with all farmers in region 2 performing the practice. Most of the farmers (62%) only applied one intercrop. In region 1, 72% applied one intercrop while in region 2, majority (55%) had two intercrops.

Table 5: Cost of farming practices ($/acre), Andhra Pradesh and Madhya Pradesh, India, 2009.

Farming Practices	**Region 1**						**Region 2**						**Overall**					
	n	Mean	Median	Min	Max	St Dev	n	Mean	Median	Min	Max	St Dev	n	Mean	Median	Min	Max	St Dev
Plowing Cost*	27	25.8[a]	20.8	9.9	56.3	13.4	10	43.8[b]	41.7	41.7	62.5	6.6	37	30.7	25.0	9.9	62.5	14.3
Cultivation Cost	2	12.5[a]	12.5	10.4	14.6	2.9	0	0[a]	0	0.0	0.0	0	2	12.5	12.5	10.4	14.6	2.9
Fertilizer Cost	18	20.7[a]	19.8	8.3	43.8	10.2	0	0[a]	0	0.0	0.0	0	18	20.7	19.8	8.3	43.8	10.2
Irrigation Cost	4	32.8[a]	36.5	6.3	52.1	23.0	0	0[a]	0	0.0	0.0	0	4	32.8	36.5	6.3	52.1	23.0
FYM Cost	1	12.5[a]	12.5	12.5	12.5	0	0	0[a]	0	0.0	0.0	0	1	12.5	12.5	12.5	12.5	0
Insecticide Cost	1	16.7[a]	16.7	16.7	16.7	0	0	0[a]	0	0.0	0.0	0	1	16.7	16.7	16.7	16.7	0
Eucalyptus Planting Cost (per tree)		0.044[a]	0.010	0.008	0.156	0.052		0.053[a]	0.042	0.042	0.104	0.025		0.046	0.016	0.008	0.156	0.047
Intercrop Planting Cost Year 1		219.8[a]	83.3	2.5	895.8	286.0		99.4[a]	62.5	41.7	500.0	135.0		185.9	62.5	2.5	895.8	256.7
Intercrop Planting Cost Year 2		522.9[a]	522.9	4.2	1041.7	733.6		106.0[a]	91.7	62.5	208.3	53.3		198.6	91.7	4.2	1041.7	321.3
Intercrop Planting Cost Year 3		4.2[a]	4.2	4.2	4.2	0		78.5[a]	77.1	64.6	93.8	14.6		59.9	70.8	4.2	93.8	39.0
Intercrop Planting Cost Year 4		4.2[a]	4.2	4.2	4.2	0		0[a]	0	0.0	0.0	0		4.2	4.2	4.2	4.2	0

*Means with same letters in a row are not significantly different at .05 level using Ttest
Values are in Dollars, 1USD=48INR July 2009

Table 6: Revenue values for farming practices ($/acre), Andhra Pradesh and Madhya Pradesh, India, 2009.

Revenue Categories	**Region 1**					**Region 2**					**Overall**				
	Mean	Median	Min	Max	St Dev	Mean	Median	Min	Max	St Dev	Mean	Median	Min	Max	St Dev
Intercrop Revenue Year 1*	367.1[a]	197.9	27.3	1666.7	448.9	158.9[b]	125.0	41.7	508.3	130.0	308.3	177.1	27.3	1666.7	395.8
Intercrop Revenue Year 2	385.4[a]	385.4	83.3	687.5	427.2	379.8[a]	262.5	125.0	1041.7	334.6	381.0	262.5	83.3	1041.7	326.8
Intercrop Revenue Year 3	83.3[a]	83.3	83.3	83.3	0	356.8[a]	349.0	125.0	604.2	208.7	302.1	260.4	83.3	604.2	218.3
Intercrop Revenue Year 4	83.3[a]	83.3	83.3	83.3	0	260.4[a]	260.4	260.4	260.4	0.0	201.4	260.4	83.3	260.4	102.2
Euca Total Revenue*	977.0[a]	810.4	225.0	4375.0	722.6	3361.7[b]	3333.3	3333.3	3645.8	94.2	1535.1	937.5	225.0	4375.0	1200.4

*Means with the same letters in a row are not statistically different at .05 level using T-test
Values are in Dollars, 1USD=48INR July 2009

Table 7: Eucalyptus yield and price values, Andhra Pradesh and Madhya Pradesh, India, 2009.

Yield/Price	**Region 1**					**Region 2**					**Overall**				
	Mean	Median	Min	Max	St Dev	Mean	Median	Min	Max	St Dev	Mean	Median	Min	Max	St Dev
Euca Yield (Ton)*	24.3[a]	20.5	6.0	60.0	13.0	40.9[b]	40.0	40.0	50.0	3.0	28.2	25.0	6.0	60.0	13.4
Euca Price (Per Ton)*	39.3[a]	37.5	24.0	72.9	6.6	82.4[b]	83.3	72.9	83.3	3.1	49.4	40.6	24.0	83.3	19.4

*Values are statistically significant at .05 level using Ttest
Values are in Dollars, 1USD=48INR July 2009

4 COST AND REVENUES OF FARMING PRACTICES

The costs of the different farming practices involved in agroforestry establishment are presented in Table 4 while the revenues are presented in Table 5. Eucalyptus total revenue overall averaged $1535.10. In region 1, the average revenue was $977.00 and in region 2 the mean revenue was $3361.70. The difference between regions for eucalyptus total revenue was statistically significant (T statistic = 19.272, p value = 1.558E-21) at the .05 level using a T-test. Overall, the average eucalyptus yield was 28.2 tons (Table 6). In region 1, the mean yield was on average 24.3 tons while in region 2, the mean yield was 40.9 tons. The difference between regions for eucalyptus yield was statistically significant (T statistic = 7.080, p value = 8.712E-9) at the .05 level using a T-test.

5 FINANCIAL ANALYSIS

Based on the positive values of NPV, BCR, EIA, and LEV, converting traditional croplands to agroforestry are financially feasible using 12% discount rate (Table 7). In addition, IRR in both regions are greater that the discount rate used in the study, indicating the feasibility of the system.

Table 8: Summary of the results of financial analysis for converting traditional agricultural croplands into agroforestry in Andhra Pradesh and Madhya Pradesh, India, 2009.

Discount Rate	**Region 1**				**Region 2**			
	NPV	B/C Ratio	EAI	LEV	NPV	B/C Ratio	EAI	LEV
6	$711.18	2.09	$16.62	$7266.41	$3394.09	8.04	$79.35	$15556.66
12	$587.88	1.94	$31.89	$1366.75	$2903.26	7.35	$157.53	$7262.07
16	$519.81	1.86	$41.37	$2524.33	$2629.01	6.93	$209.24	$5208.63
IRR	28%				74%			

Table 9: Summary of the results of financial analysis for converting traditional agricultural croplands into agroforestry including land estimation value in Andhra Pradesh and Madhya Pradesh, India, 2009.

Discount Rate	**Region 1**				**Region 2**			
	NPV	B/C Ratio	EAI	IRR	NPV	B/C Ratio	EAI	IRR
6	$492.68	1.24	$11.52	4%	$2229.40	1.29	$52.12	8%
12	$194.66	1.10	$10.56	17%	$810.19	1.10	$43.96	16%
16	$29.38	1.01	$2.34	10%	$19.44	1.00	$1.55	22%

Sensitivity analysis using different discount rates was conducted to examine how changes in discount rate would affect the financial feasibility of the agroforestry system. Even with the changes in discount rate, the agroforestry system in both regions are still financially feasible. Even with the incorporation of land value in the analysis (i.e., opportunity cost of the land, in this case LEV), the agroforestry schemes are still financially viable in both Andhra Pradesh and Madhya Pradesh at all discount rates used (Table 8). However, as expected, there is a significant reduction in the magnitude of the different financial criteria, particularly the IRR. IRR with LEV included at 12%, is 17% for Andhra Pradesh and 16% for Madhya Pradesh. NPV at 12% is 194.66 for Andhra Pradesh and 810.19 for Madhya Pradesh.

6 DISCUSSION

This study investigated commercially promoted agroforestry schemes in two states in India. Specifically, the objective of the study is to evaluate the financial feasibility of agroforestry techniques employed by farmers in Andhra Pradesh and Madhya Pradesh, India. Education attained by farmers shows a wide disparity between the regions. In region 2, all farmers had a ninth grade education or above. It is interesting that over 50% of the farmers in region 1 had no education. This is possibly due to the fact that a high proportion of farmers interviewed in this region are tribal people, and has little access to education. Nkonya et al. (2004) in a study of landowners in Uganda, suggest that higher education levels of farmers influences household income strategy, land management practices and labor use in crop production. Higher education obtained led to higher income and reduced soil nutrient depletion. In the Sudan, it was found that adoption of new technologies increased with higher education levels of the farmers (Glover, 2005). The farmers in region 2 appeared to be better off financially, based on living arrangements and household characteristics. Although information on total income was not gathered, it was apparent that the farmers in Region 2 were better off financially, possibly relating to the education they had attained.

In region 1, the females which were interviewed were tribal people. The customs of these tribes was a matriarchal system, where the men traveled for work and the women stayed at home in charge of the household and the land. These women were involved in the eucalyptus planting because they were approached by the company and a local NGO in order to utilize their land and gain additional income. Only males were interviewed in region 2. This was due to the customs of the area, being that males were the head of household and dominant in the farming community.

Farmers have started planting in higher number within the last few years. As mentioned before, the company pushed for development of new plantations within the last ten years. The most recent surge of plantations was to meet the increased demand of the company mill. In region 2, planting has only begun since 2006. This is due to the company interest in building a new mill in the area. The company decided to begin developing plantations in the region for wood source for the new mill. Another reason for plantation development in region 2 was the competing market of the pole market in the region. Farmers from Region 1 would sell the pole-size trees in region 2 in order to increase their profit. This practice was reducing the supply of pulp wood to the mill. The company decided that it would be advantageous to develop plantations in region 2 in order to reduce the losses from region 1.

Plowing occurred on more than two thirds of the farms in this study. This practice was one of the most important, as recommended by the company. Plowing reduces the competition between rows of eucalyptus and provides protection from fires. Most of the farmers interviewed had grown crops on their lands prior to the eucalyptus plantations; therefore many were familiar with plowing techniques. The main purpose of plowing between rows is to reduce the competition from weeds or grasses which would otherwise grow in the open space. These weeds would reduce the water and nutrients that are available to the trees. In addition, the weeds and grasses produce a fire hazard to the trees. When the grasses are dry they are very flammable, as is the eucalyptus. Open fires in India are very common and several farmers and company personnel expressed concern about plantations suffering from fire damage. Reasons for not plowing included a lack of access to equipment or animals to carry out the plowing, or a lack of money to afford renting or borrowing equipment. Plowing was either conducted mechanically or by the use of draft animals. It is not known exactly what percentage of farmers in region 1 used tractors and what percentage used draft animals, but from observations, it is estimated that roughly half used each method of plowing. In region 2, all farmers who plowed, used tractors to plow their fields.

It is interesting that cultivation was so low in region 2. Cultivation should be simple to do with mechanical means, since it is another attachment to the tractor. However there was no cultivation done in this region. This lack of cultivation could be because of lack of time or money since cultivating would require more effort spent in the field and more money. It is also possible that farmers were not interested in purchasing the additional equipment needed to cultivate their land. In region 1, although few farmers cultivated, more did so than in region 2 where mechanical methods were more prevalent.

Fertilization occurred on half of the farms in region 1 and on none of the farms in region 2. The main reason for lack of fertilization was the cost associated with purchasing the fertilizer. In addition, some farmers expressed a problem of accessing fertilizer even though they could afford it. Although both of the regions are heavily agricultural regions, fertilizer was scarce or expensive. The company recommends fertilizing in order to maximize the growth of the trees.

Irrigation as well is recommended by the company in order to maximize growth. However, very few farmers irrigated their land because of the extreme cost associated with it. The majority of the farms were rain fed and received rain only during the rainy season. Many farmers said they had not received rain in a period of 7 or 8 months, from late 2008 to early 2009. The lack of rain led to some of the problems associated with the tree plantations such as breakage and wind damage.

Although these agroforestry systems are beneficial economically to the farmers who are involved, there may be better options (Saxena, 1992). One problem with the eucalyptus trees is the lack of fodder for animals. There are possible species that could provide tree cover and raw materials, fodder and food for humans, such as *Leucaena, Prosopis cineraria* or *Acacia nilotica*. In addition, farmers need to be better educated on the risks of eucalyptus, such as fire and pest and disease, and tree planting in general, before they undertake these schemes. Many of the farmers interviewed believed that the tree plantations were less risky than traditional agriculture. This may not always be the case due to pests, disease, fires and other problems along with the longer term rotation.

Another problem, addressed by only one farmer, although very important, is converting the land out of plantations. Uprooting and removing the stumps of the eucalyptus can be a very expensive and time consuming effort. This did not appear to be a factor in most of the farmers' considerations of planting. However, it is important to note that removing the tree stumps from a field is much different than removing the traditional crop residue most farmers are accustomed to and will require high levels of labor and time.

Initial investment is high for the agroforestry schemes examined. The large upfront costs associated with planting the eucalyptus may deter farmers from planting. Net returns for the first year were negative for both regions. In region 2, where an intercrop was grown for the entire rotation, positive net returns were realized after the first year. The income from intercropping in the first year does help to offset the costs, but cannot overcome the high costs for planting eucalyptus.

In the study by Jain and Singh (2000) in poplar (*Populus deltoides*), they found BC ratios of 1.01 to 1.35 and IRR values of 14% to 32% for agroforestry based systems. They also found BC ratios for a number of different crops, from 1.22 in Paddy-Gram systems to 1.17 in Groundnut-Gram systems, which are common systems in the Andhra Pradesh and Madhya Pradesh areas. The BC ratios they found range from 1.14 to 2.47 for a wide variety of crop systems. The BC ratios from the eucalyptus agroforestry systems in this study are very similar to these values. Region 1 had a BC ratio ranging from 1.86 to 2.09, with a 16% and 6% discount rate respectively. Region 2 however has much higher BC ratios ranging from 6.93 to 8.04 due to the high revenue from selling their product as poles, using a 16% and 6% discount rate respectively. IRR values in the poplar agroforestry schemes reported by Jain and Singh were 32.4% and 16.02%. IRR values for this study in region 1 was 28% and in region 2 was 74%.

This study examined only the first cutting cycle of the eucalyptus. In subsequent cycles, returns will be higher due to the sprouting of eucalyptus. Planting of eucalyptus is not needed which will reduce the costs in the first year, since only a small cost of trimming the sprouts is needed. In many cases, this trimming can actually be profitable since there is a high demand from private nurseries for shoots. The sale of these shoots can generate income and raise the profitability of the system. The company recommends a four cycle rotation, of four year cycles. This would mean that the complete genet would be 16 years.

Further research should be done on the social aspects of farmers involved in agroforestry in this study area. Research into the interaction of animals should also be further investigated. Multiple farms were located in this study where animals were involved in the farming systems; however it was difficult to place values on the impact of these animals. These aspects may have an impact on agroforestry systems.

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Private property conditions of Slovenian forests in 2010 (preliminary results)

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Abstract

The paper deals with the property structure of private small-scale forests (three quarters of all forests) in Slovenia. In the last decades, the number of holdings has increased by more than 50,000, especially in the category of up to 1 ha. In the same period, rural populations have decreased, while the areas of private forests have increased. Family farms are in possession of less than a third of all forests. The rise in the number of other private owners has been generated mostly by inheritance and denationalisation processes, which began in 1991. Denationalisation has almost been completed and has had significant effects on the property structure of Slovenian private forests. Overgrowing of agricultural land by forests has also substantially contributed to the increase in the number of forest owners and holdings. The elaboration of fourteen regional forest management plans for the 2011-2020 period is an opportunity to analyse the actual situation in the private property structure. The plans will define specific guidelines and strategic measures for the management of private forests. The analysis has been done regarding the holding size category, regional distribution, sex, age, number of co-owners and some other parameters.

In Slovenia, 313,000 holdings are privately owned, whereas 461,000 holdings are in single (42.8 % holdings and 65.9 % forests) or joint ownership. No less than 88% of private holdings are owned by people living in Slovenia, 48.7% of which are females who own 38.4% of all forests. The average male owner is 58 years old, while the average female owner's age is estimated at 62 years. The analysis and comparison of the data per forestry management regions (FMR) have shown that the average private holding has increased. In the future, the presented data calculation method will enable a permanent monitoring of the forest property structure.

Key words: small-scale forests, private forests, owner, property structure, Slovenia
FDC: 682+928(497.4)=111

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1 INTRODUCTION AND OBJECTIVES

The private forest property structure has been constantly changing owing to a number of factors: property inheritance, land trading, infrastructural encroachments upon space, overgrowing of agricultural land, and land-use changes. Data up-dating is becoming increasingly faster and at the same enables, by switching to integral data bases, faster and much more extensive analyses. Everything that a decade ago posed an unimaginable obstacle can now be analysed in a relative short time. In the database of the national Surveying and Mapping Authority, Slovenia possesses over six million plots. In the forest property analysis, a suitable substantive basis is given by the correlation of digitalized data on plots with land-use data.

In Slovenia, the small-scale private forest property has predominated already from the land reform in 1848, when exceeding more than 75% of the forests, which was the highest share in all countries under Austria of that time (ŽUMER 1976). In the early 20th century (Winkler 1994), the forests were still mostly owned by small private forest owners (52%), while a fairly high share of the forests was in the hands of large forest estates (30%). The state and administrative units owned ca. 4% of the forests, while the rest belonged to the Church (6%) and village communities (8%). After World War II, large forest estates were denationalised (partially as early as in the Kingdom of Yugoslavia), whereas rural and other private property was limited by size (farmers 45 ha, non-farmers 5 ha). The forest area ratio of 2:1 in favour of private forests stabilised in the 1960-1990 period. After denationalisation in 1991, the private forest area has increased and will reach 80% at the end of this process. This probably most important process after World War II, which has been also witnessed in other countries and has had significant effects on the manner of forest management, derives from demographic changes and structure of the forest owners population (deagrarisation). In Slovenia, the share of rural population has been gradually decreasing from 73.3% in the early 20th century by 0.5% per year till about 1950 (ca. 45%, Klemenčič 1997). There followed a great decrease, when only 9.2% in 1980 and 7.6% in 1990 of the rural population still remained in Slovenia. According to unofficial assessments (the comparable calculation methodology has changed), Slovenia's rural population dropped to approximately 5% in 2010. Contemporarily with this process, a fragmentation of the small-scale private forest property has been taking place as well.

All so far carried out analyses of the forest property structure (Winkler 1994, Medved 2000, Medved 2003) have been implemented on the basis of administrative data from forest owners indexes, which have been made in the process of revision of forestry management plans for each forestry management unit in Slovenia (N = 233, year 2010).

As the owners can have their holdings in several forestry management units and regions, their total amounts have been even doubled in the analyses carried out so far. A special problem in the analysis of private forest property structure has been, and will remain, the ownership by several natural persons within the framework of the same household and outside it. In the 2010 research, different databases were used, by which certain inadequacies in till now carried out analyses have been surpassed.

The prime objective of our research is to establish, on the basis of cadastral data in electronic form and data on forest mask, the private forest property structure with regard to status, ownership, age, sex, holding size category and regional distribution.

2 METHOD

During the research carried out in 2010, the latest forest owners database maintained by the Surveying and Mapping Authority of the Republic of Slovenia has been used. With the aid of the digitalised base of plot boundaries and forest mask, a proprietary analysis of Slovenian forests has been made, with the data processed by the Slovenia Forest Service. We have also had a conversation with the representative of the firm (Krim d.o.o.), which prepares, for the needs of the Finance Ministry, databases for tax payers, associated with the ownership of separate holding categories.

The Surveying and Mapping Authority of the Republic of Slovenia issues certificates from geodetic data collections, which are significant for the understanding of our research: 1. plot data (1a – plot plan and 1b – descriptive data on the plot), 2. property sheet, 3. ownership certificate, and 4 – data on the facility (building). Definitions of the terms and contents are outlined in detail in the Bylaws on types and contents of certificates from the geodetic data (Official Gazette of the RS, No. 113/2000) and can be delineated, in a shorter form, as follows:

<u>1a- Plot plan</u> is a certificate about the position and shape of the plot as well as a copy of land-cadastral plan or drawing from the digital base.

<u>1b- Descriptive data on the plot</u> comprise the following data: data on its owner as entered in the land cadastre (name and surname, date of birth and address of natural persons, or firm, registration No. and headquarters of corporate bodies), name and code of cadastral council, plot No., type of land-use, cadastral class (if the type of land-use is a cadastral culture), surface area, No. of land register input, No. of property sheet, and information on whether the plot is final or not.

<u>2- Property sheet</u> is a set of data on real property in a single cadastral council. It is owned by the same person or is in joint ownership of several people. The property sheet

comprises data on cadastral class and cadastral income, if the type of plot use is a cadastral culture. A component part of the property sheet is the assembler of areas and cadastral income per type of plot use.

3- Ownership certificate is a set of data on the areas and cadastral income per type of plot use, as held by every owner in the Republic of Slovenia. The ownership certificate states the numbers of all property sheets, in which real properties owned or co-owned by the same individual irrespective of the share of co-ownership, are stated.

Input data used in an analysis are data on land-use and vector base of cadastral plans.

Land-use is a graphical digital land-use base, maintained by the Ministry of Agriculture, Forestry and Food through digital orthophoto shots. Updating of the map is constant and dependent upon the changes established in the field. Land-use maps are renewed cyclically (every three years, as a rule), specifically when new orthophoto shots are made. In compliance with the regulations in force, the forest edge is adjusted with the Slovenia Forest Service's data.

Vector base of cadastral plans is run and maintained by the national Surveying and Mapping Authority. The data are geo-located and connectable with the data on the ownership of the plots, which are also run and maintained by the Surveying and Mapping Authority of the Republic of Slovenia. From the data in CPRN (citizen's personal registration number), the following can be ascertained in most of the cases:

1. Status (with regard to the first number of the 13-figure identificator):
   a. Natural persons: (identificators beginning with Nos. from 0 to 3), natural person with proper CPRN;
   b. State-owned forests: (selection of identificators beginning with No. 9 by considering the list of CPRNs maintained by the Slovenia Forest Service for state-owned plots);
   c. Missing: (identificators beginning with No. 4), plot owner unknown, reasons of different kinds;
   d. Communities: (identificators beginning with No. 8), plot owned by different communities (agrarian, village, pasture communities …);
   e. Foreign subjects: (identificators beginning with Nos. 6 and 7), plot owner not a citizen of the Republic of Slovenia;
   f. Deceased: (identificators beginning with No. 5), plot owner deceased, inheritance procedure not concluded as yet.

g. For persons with status marked a. (natural persons), the following can also be determined:

2. <u>Sex:</u> plot or part of it can be owned by a male or female,

3. <u>Age:</u> in the analysis, the owner's absolute age was determined and arranged, in terms of value, into one of the five classes (up to 30 years, 31-45 years, 46-60 years, 61-75 years, 76 plus years).

Number of owners calculation procedure:

On the basis of the land-use vector graphical base and digital cadastral plans, a graphical base of all plots that were fully or partially forested was made. The total number of plots in this base is 2,263,367. Among these entries, about 2% of the plots were registered several times owing to the different land-use or cadastral class, which was taken into consideration during our analysis. These plots were linked with the attribute base of data of all plot (real estate) owners in Slovenia. Here, the interconnecting »cadastral council/plot No.« key was used. To each plot, the information as to which forestry management region (FMR) it belongs was added. The total number of entries in this base is 4,279,528 where, however, the areas smaller than 1 m^2 were not taken into consideration.

As a total property (forest ownership certificate) of a single owner at the Slovenian level, all forest areas owned by a certain person were taken into account (link via concealed CPRN) in the area of entire Slovenia. Here, the relative share of co-ownership on a certain plot was also taken into consideration. This list of all forest owners and co-owners in Slovenia was named COOWNERS_SLO.dbf. During our next step, we also analysed the number of holdings of a single owner, by taking into consideration the borders of forestry management regions. The processing was repeated, except that this time the plot position (FMR code) and the owner (concealed CPRN) were also taken into account. This list was named COOWNERS_FMR.dbf.

On the basis of the data from the list of all owners (4,279,528 entries) we then annotated the number of the owners to each plot and, with regard to the share on the plot or the sequence of the ownership entry (in the case of equal shares) the prevailing status (male, female, missing, foreign subject, deceased or state) and CPRN. This was again a basis for the making of a list of all holdings in Slovenia (HOLDING_SLO.dbf). (In cases where a certain holding had a different number of (co)owners per separate plots, the prevalent value in view of surface area was taken into account. By considering the plot position (FMR code), a list of all holdings in Slovenia was made at the same time according to FMR (HOLDING_FMR.dbf). In this way, we calculated the number of owners and co-owners, i.e.

at the entire Slovenian level and by FMRs. In further analyses, the holdings with the surface area under 10 m^2 were not taken into consideration, as we presumed that in these cases we were dealing exclusively with technical errors.

3 RESULTS

On the basis of databases (the procedure of their preparation is described in the Methodology chapter), different numbers of entries were obtained, as shown in Table 1.

Table 1: Number of data for analysis

Data file	No. of all entries	No. of entries by considering areas exceeding 10 m^2
No. of all forest owners at the Slovenian level	476,355	466,973
No. of co-owners, increased by taking into consideration FMR borders	493,191	483,182
No. of forest holdings at the Slovenian level	325,990	318,606
No. of forest holdings, increased by taking into consideration FMR borders	334,697	327,013

Of the total 466,973 entries regarding different owners, only 5,488 (1.17%) concern public forests. By taking into consideration FMR borders, we attempted to approach the analyses from the past, when no data could have been processed at the same time. It was established that the number of co-owners thus increased by 3.37%, and the number of holdings by 2.64%. Considering that all past analyses of the property structure were based on the data gathered separately per FMRs as well as separately per FMUs, we can conclude that the past analyses regarding the number of owners and holdings are somewhat overestimated, although not by more than 5%.

The difference in the number of holdings (total 318,606 – 5,193 entries for public forests) and the number of co-owners (total 466,973 – 5,488 entries for public forests) is provided by the public forests data. From all entries for private forests we have been able to calculate, with regard to the distribution of the number of co-owners) the shares of the number of holdings and shares of forest areas (Fig. 1).

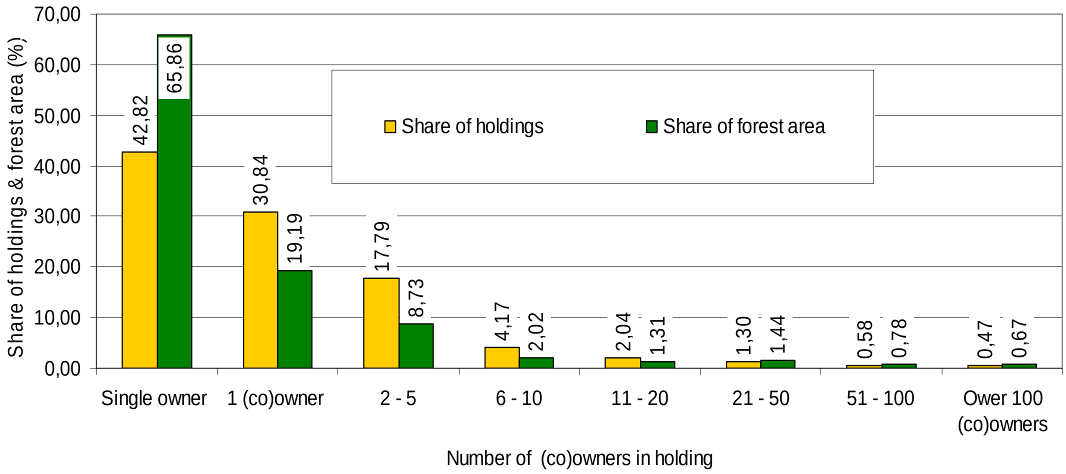

Fig. 1: Number of co-owners regarding private forest holdings in Slovenia

Less than a half of private forest holdings (42.8%) have only a single owner, managing two thirds of private forests (65.9%). Almost one third of the holdings (30.8%) have two co-owners, who manage one fifth of the forests (19.2%). A little more than one sixth of the holdings (17.8%) have three to six co-owners who, however, own only a little less than one tenth of the forests (8.7%). The remaining structure with more than six co-owners of a holding constitutes, in the total number, 8.5% of the holdings with the area of 6.2% of the forests.

Table 2: Number of analysed owners and the number of holdings

Key	No. of holdings	No. of holdings	Share of private holdings (%)	Holding: owners ratio
Owners (m+f)	388.462	276.127	88.1	1 : 1.41
Deceased	15.414	7.112	2.3	1 : 2.17
Missing	25.041	13.874	4.4	1 : 1.80
Various communities	538	399	0.1	1 : 1.35
Foreign subjects	32.030	15.901	5.1	1 : 2.01
Total private	**461.485**	**313.413**	100.0	1 : **1.47**
Public	5.488	5.193		1 : 1.06
Total all	**466.973**	**318.606**		1 : **1.47**

In further text, the development of the ownership structure in Slovenia after 1951 is presented, as well as social structure of rural and other private forests, number of co-owners, structure of the owners' sex and age (for known data only), size of average forest holding per sex and age, structure of owners and forest holdings per size categories, structure of the owners' sex per holding size categories, and structure of the owners and holdings per FMRs.

3.1 OWNERSHIP STRUCTURE OF SLOVENIAN FORESTS

Table 3 presents the trend of property changing in Slovenian forests after 1950. In this period, the total forest area has increased from 0.9 million ha to 1.2 million ha.

Table 3: Ownership structure of Slovenian forests after 1950 (in %)

Year	Private forests		Public forests	Total
	Family farms' forests	Other private forests		
1951	64	3	33	100
1970	55	9	36	100
1985	37	25	38	100
2000	35	36	29	100
2005	32	39	29	100
2010	30	47	23	100

After 1951, when Slovenia had 67% privately owned forests, their share was gradually reduced till 1990. Owing to denationalisation, however, a trend of their increase was eventually noticed. The data on the share of public forests in 2010 (23%) are merely an assessment and do not reflect the actual state of affairs, considering that the process of solved denationalisation claims for return of forest areas does not follow the entries into geodetic databases, which served as a basis for data in our analysis.

On the basis of the last analysis of the total number of private holdings per size categories and of the analysis by the Statistical Office of the Republic of Slovenia of the research into agricultural economics for the year 2007, we have assessed the socio-economic structure of private forest ownership (farmers : other owners). Figure 2 presents the number of holdings and forest areas per size categories as used in the research carried out in the past (Medved 2000).

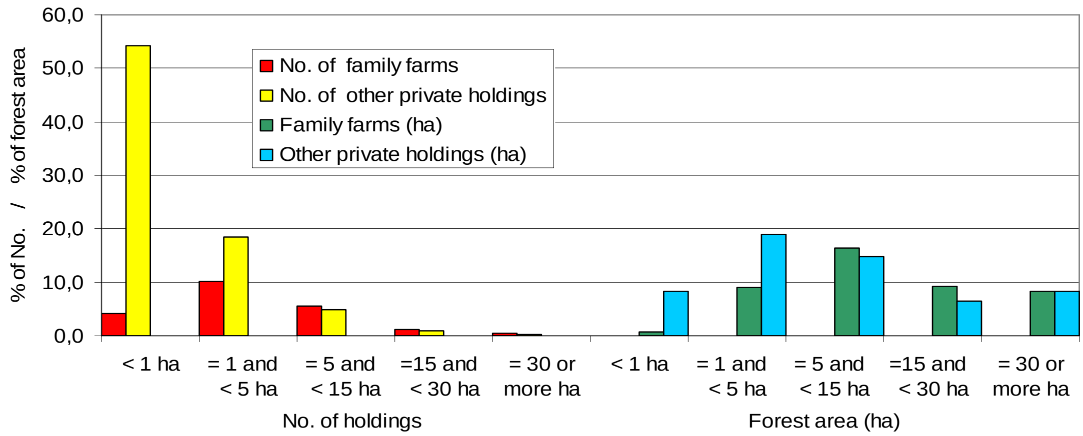

Figure 2 Structure of socio-economic and holding size categories of private forest ownership

In the property structure, family farms own a good fifth of the holdings (21.4%) that cover 43.4% of private forests. Highly prevalent in terms of the number of holdings are other forest owners (78.6%), who own 56.6% of private forests. Other owners prevail mainly in the smallest size categories of up to 5 ha. In the categories of 5 to 30 ha, family farms prevail both in terms of the number of holdings as in terms of forest areas. In the largest size category, other owners slightly predominate, what will additionally increase the forest areas after the denationalisation is completed. Then property categories for the largest holdings will have to be additionally classified.

3.2 AGE AND SEX STRUCTURE OF PRIVATE FOREST OWNERS

In the age analysis of forest owners, only the data of owners living in Slovenia (N = 388,462) have been taken into account. They are divided into five age classes (Table 4). Only a little less than 3% of them are younger than 30 years, while 19% of them are younger than 45 years. The largest group comprises 46 to 60 years old owners (33.6%). Only slightly fewer (28.8%) are from 66 to 75 years old. Almost a fifth of the owners are older than 75 years (18.3%).

Among male owners, the age structure shifts more to the younger categories in comparison with female owners. Most of the females can be found in the 46 – 60 year category. Among female owners, 51.6% of them are older than 50 years (42.8% in males), while the highest share of female owners appertains to those between 61 and 75 years of age. No less than 22.6% of female owners, however, are more than 75 years old (14.2% in males).

Table 4: Age structure of forest owners living in Slovenia

Age (years)	Male	Female	Average
	Share (%)		
Up to 30	3.2	2.6	2.9
31 to 45	18.2	14.6	16.4
46 to 60	35.9	31.2	33.6
61 to 75	28.6	29.0	28.8
76 and more	14.2	22.6	18.3
Total	100.0	100.0	100.0
Age (years)	Average ages		
Up to 30	25.2	25.0	25.1
31 to 45	39.4	39.5	39.5
46 to 60	53.5	53.5	53.5
61 to 75	67.5	67.8	67.6
76 and more	83.9	84.2	84.0
Total	58.3	61.8	60.0

The structure between the two sexes of forest owners shows that 51.3% of them are males and 48.7% females. The share of males is higher in all categories of up to 75 years. As far as the oldest owners are concerned, the difference in the share of sexes is the greatest, with females surpassing the number of males by 3.7%.

Table 5: Sex structure of forest owners living in Slovenia

Age (years)	Male	Female	Total
Up to 30	1.6	1.3	2.9
31 to 45	9.3	7.1	16.4
46 to 60	18.4	15.2	33.6
61 to 75	14.7	14.1	28.8
76 and more	7.3	11.0	18.3
Total	51.3	48.7	100.0

While both sexes are represented relatively equally in terms of the number of forest owners, males predominate by far in terms of forest areas. They own 61.6% of the forests, females only 38.4%, as well evident in Figure 3.

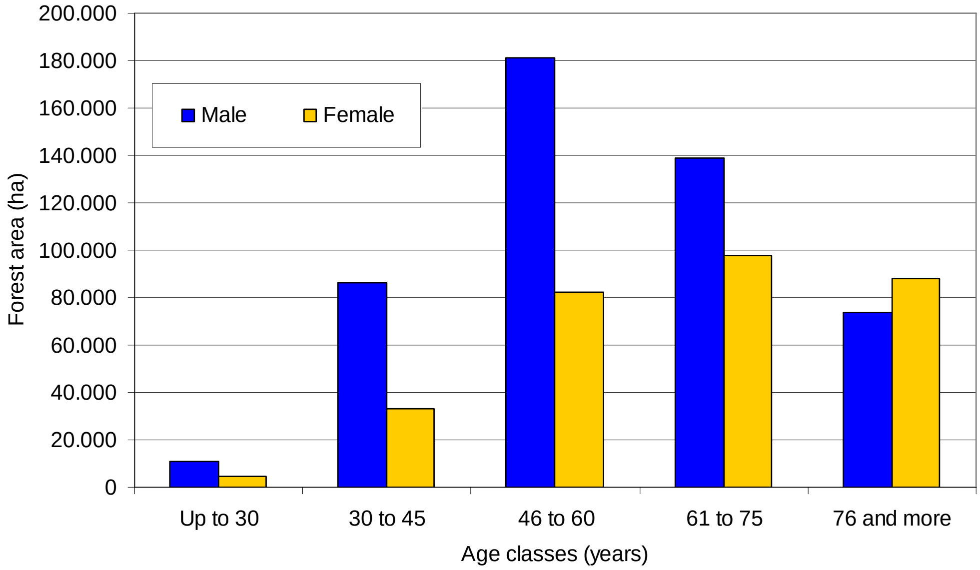

Figure 3: Forest areas with regard to the owners' sex and age

The result of a relatively proportionate number of owners between the two sexes and the great differences in the ownership of forest areas is well illustrated by the average forest area size (with co-owners included) in Figure 4.

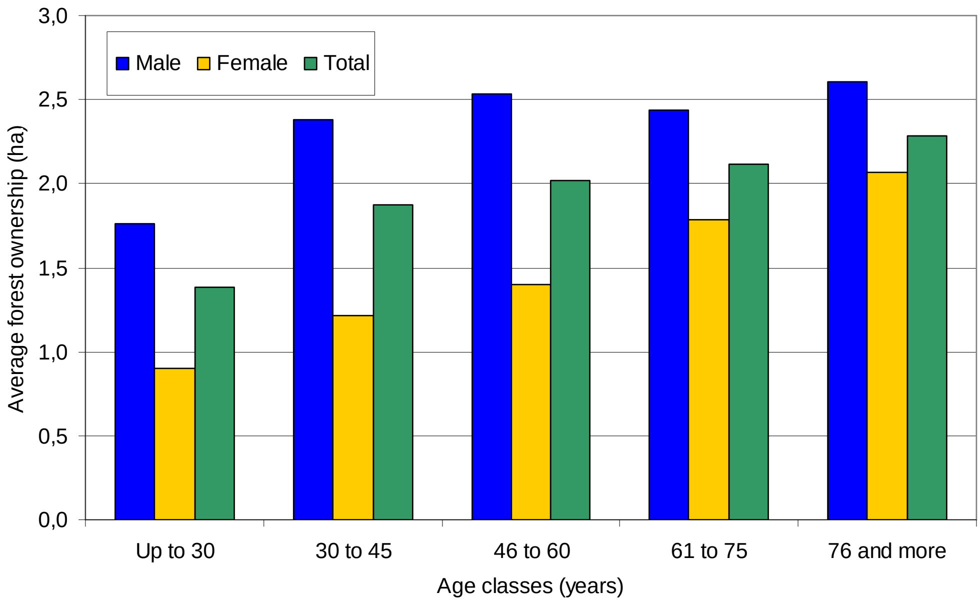

Figure 4: Average forest area owned by natural persons with regard to their age and sex

Figure 4 also shows, apart from differences in forest ownership between the two sexes, an interesting trend of forest area increase with the owners' higher age. Considering the fact that property inheritance per so-called ideal shares (co-ownership) is a very common practice in our country, it is understandable that younger owners have, on average, fewer forests in their possession. In females, this trend is particularly obvious, slightly less in men.

3.3 STRUCTURE OF PRIVATE FORESTS BY FOREST HOLDING SIZE CLASSES

Owing to the possible comparisons with the research carried out in the past, we have also made an analysis of property structure by different forest holding size classes (Medved 2000, 2003). The relative structure of this analysis is presented in Table 6, and the absolute values in Figure 5.

Table 6: Structure of owners, holdings and forest areas by size classes (in %)

Forest estate size category	Private owners	Private holdings	Forest area
< 1 ha	67.5	58.4	9.0
= 1 and < 5 ha	23.3	28.5	27.8
= 5 and < 15 ha	7.2	10.2	31.1
=15 and < 30 ha	1.5	2.1	15.6
= 30 or more ha	0.5	0.8	16.6
Total	100.0	100.0	100.0

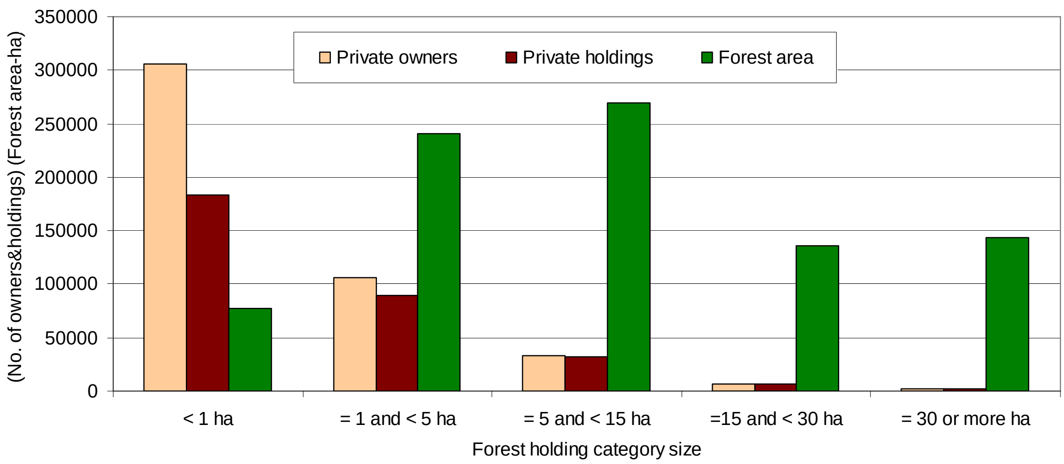

Figure 5: Number of owners and holdings, as well as forest areas per size categories

No less than two thirds (67%) of forest owners own less than 1 ha of the forests, or less than a tenth of private forests (9%). In terms of forest areas they predominate (31.1%) in the 5 to 15 ha size category and by a little less in the 1 to 5 ha category (27.8%). Only 2% of the owners own a third (32.2%) of all forests in the up to 15 ha size categories. Figure 5 also shows the absolute structure of the number of owners and holding, as well as forest areas in ha.

3.4 REGIONAL STRUCTURE OF PRIVATE FOREST OWNERSHIP

The research into the property and ownership structures per FMUs is a very clear illustration of the ratio between all co-owners who own their private forests in a certain FMU, the relation to the number of holdings that is smaller in all places (Figure 6), and the private forest area they manage in the region.

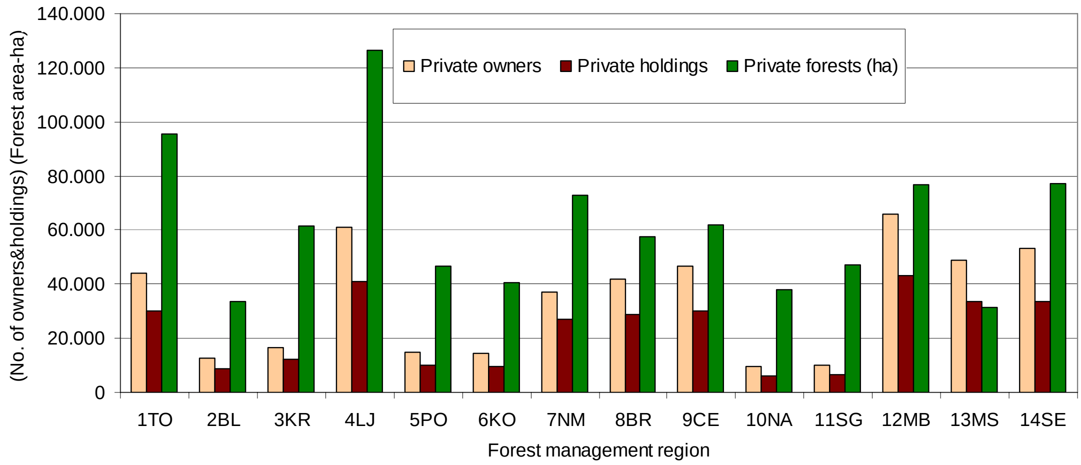

Figure 6: Regional structure of private forest ownership

Most forest owners are located in FMUs of Maribor, Ljubljana and Sežana, and least in FMUs Nazarje, Slovenj Gradec and Bled. More than 30,000 holdings can be found in FMUs of Maribor, Ljubljana, Sežana, Murska Sobota, Celje and Tolmin.

Most forests per areas are in FMUs Ljubljana, Tolmin, Sežana, Maribor and Novo mesto.

The largest average holding, i.e. between 7 and 9 ha, is located in FMUs of Kočevje, Slovenj Gradec, Nazarje, Postojna and Bled. The holding size is the smallest in Murska Sobota (1.24 ha), less than 3 ha also in FMUs of Maribor, Celje, Brežice and Sežana.

4 DISCUSSION

The analysis of the owners structure by sex has revealed that in terms of their numbers they are almost level (females 48.7% : males 51.3%). By far, however, males surpass females in terms of the total forest area (females 38.4% : males 61.6%). The owners living in Slovenia are most numerous (88.1%) when private forest holdings are at stake. The rest (11.9%) are most often foreign subjects (5.1%), missing (4.4%) or already deceased

(2.3%). The owners' age structure shows that males (58 years) are, on average, younger than females (62 years). In Slovenia, the females' life expectancy is by eight years longer than the males'. At the end of 2006, the average age of Slovenians was 42.5 years for females and 39,2 years for males.

According to our analysis, Slovenia has 313,413 private holdings, if forest areas exceeding 10 m^2 are taken into account. Similar figures were obtained in 2003 (Medved 2003), when we established, on the basis of forestry management plans, that 314,569 holdings were owned in the country. A comparable figure for 2010 amounts to 321,072 holdings, as the 2003 analysis does not include the double-counted owners who have their holdings in two FMRs. On the basis of our last findings (increased number of holdings due to FMR borders by approximately 3%), the figures from 2000 could be calculated as well. Comparable figures without FMR borders thus amount to 306,500 holdings in 2000 and 313,400 private holdings in 2010. On the basis of both studies we can thus conclude that the presented data are fairly reliable and that the method used for the analysis of property conditions is suitable. The number of holdings has increased in the last decade as well.

The same as for the number of holdings applies for the total number of co-owners, which was for the year 2000 marked, for six FMRs owing to the missing data, with factor 1.40 (Medved 2003). The analysis from 2010 shows that the estimate was relatively good, as the ratio between the number of holdings and the number of co-owners was estimated at 1 : 1.49. In 2003, this ratio was higher, i.e. 1 : 1.59. This, too, is the reason why it was estimated at that time that the number of co-owners in Slovenia was 498.825. A comparable figure from the analyses for the year 2010, which is more reliable, is about 477,000 private forest owners.

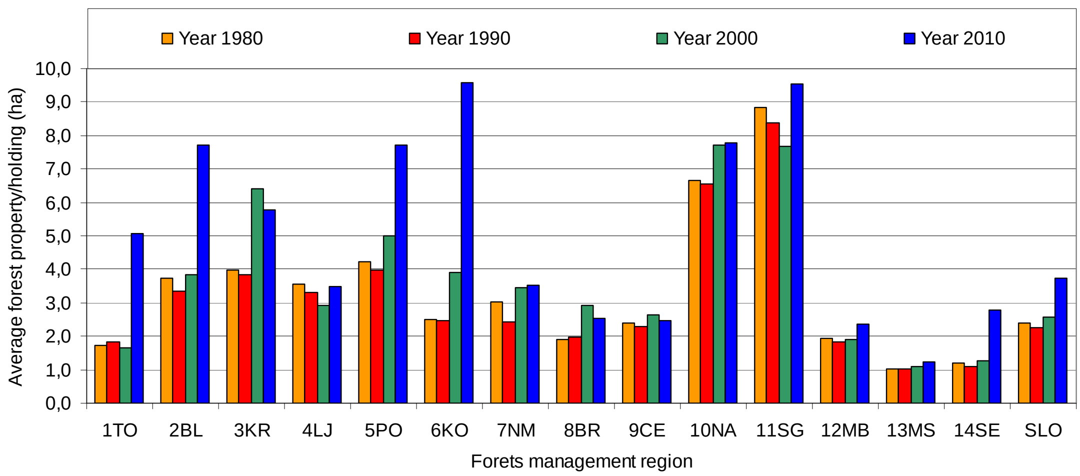

Figure 7: Comparison of average holding between FMU from 1980 to 2010

With a series of data on the size of average holding for the years 1980, 1990, 2000 and 2010, we obtained a very clear picture of the development of conditions in the former social system till 1990, of the trends in the first phase of transition (2000), and of the slow stabilisation of conditions (2010) towards the end of denationalisation. In comparison with the past periods, the size of holdings is greater owing to the returned large complexes of private forests in certain regions.

5 CONCLUSIONS

In the future, we shall also be able to use the available data in the economic and technological substantive analysis of management in spatially separated private forest complexes. Here, it will be also necessary to link the data with the place of residence, to analyse the distance from the place of residence, the openness of forests due to roads, the special technological features of the complexes, and to include the data on forest resources (wood stock, possible felling, increment).

Databases are suitable for more detailed analyses of property conditions in FMRs for the needs of 2011-2010 plans. The algorithm in the calculation of property structure is recommendable for future analyses. To assess the trends, we will no longer have to wait for ten-year FMR plans, considering that through the use of this work method from this article a permanent analysis is possible during every change in the basic owners and land-use databases.

ACKONOWLEDGEMENT

The analysis has been made within the framework of the research project entitled “New paths for development of sustainably oriented wood harvesting and use in Slovenia”, financed by the Agency for Research Activities of the Republic of Slovenia and the Ministry of Agriculture, Forestry and Food. In the data analysis, Mr Robert Ogrizek from the Slovenia Forest Service has also taken part. Mr Anton Kogovšek of Krim d.o.o. kindly helped us with his valuable pieces of advice. We are deeply indebted to them all.

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Who benefits? Small scale tree planters and companies in Vietnam and Indonesia

Moira Moeliono[1], Le Quang Trung, Nugroho Adi Utomo, Rubeta Andriani

Abstract

Is small-scale forestry, especially when linked into a partnership with a large company, really benefiting rural people? This paper seeks to evaluate the potential for small scale forestry to benefit rural people, especially in the context of household or community partnership with large companies. Based on short surveys we observed that in Vietnam and Indonesia, small-scale plantation forestry is being promoted as a means to overcome poverty among forest dependent people, while partially satisfying a growing demand for industrial raw material and utilizing millions of hectares of degraded forest land.

We find that because of differences in landholdings and security of tenure, the farmers in Vietnam have a stronger bargaining position and enter partnerships willingly if not fully informed, whereas in Indonesia, companies do not really need smallholders and therefore form partnerships more to prevent conflict with communities and as part of their corporate social responsibility programs. After exploring these differences, the paper explores more promising options for future program development and sustainable forest management.

The work is part of a CIFOR-initiated program: "Strengthening Rural Institutions to Support Livelihood Security for Smallholders Involved in Industrial Tree-planting Programs in Vietnam and Indonesia", funded by BMZ.

Key words: tree planters, companies, Vietnam, Indonesia
FDC: 232.32:682:671(597)(594)=111

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1 INTRODUCTION

Vietnam and Indonesia are geographically, politically and culturally very different countries but in both, deforestation processes have significantly reduced the original forest cover, leading both countries to implement extensive reforestation programs with different degrees of success (MARD, 2007; FWI, 2009; Handadhari, 2001 in Nawir et al 2003; de Jong et al, 2006; FWI/GFW, 2002)

Over the last two decades, both countries have embarked on reforming the forest sector and have made efforts to shift from state controlled to more small-scale plantation forestry both as a means to reduce poverty and to contribute to a growing demand for industrial raw material. In the process, millions of ha of degraded forest land will be rehabilitated and utilized. Vietnam started the forest land allocation program in 1994 (Nguyen et al, 2008) and has aggressively promoted the planting of acacia and eucalypts. By the year 2000, some 1.9 million ha of forest land had been allocated and some 807,000 ha of plantations had been established by small farmers (Nguyen et al, 2003). In Indonesia, the government initiated a new program in 2007 with projections that some 360,000 rural households would establish 5.4 million ha of industrial timber plantations by 2010 (Dephut, 2006).

To promote small-scale tree planting, the two governments offer access to state-controlled forest land, discounted credit, technical extension and subsidized inputs such as seedlings and fertilizer. Often schemes involve the establishment of partnerships between communities and companies. However, earlier experience shows that partnership schemes did not significantly alleviate poverty.

This paper compares the policies and practices pertaining to small scale plantations in Vietnam and Indonesia. We focus on those plantations established to supply raw material for the paper and pulp and chip industry. Information was gathered from secondary sources, and from focus group discussions and interviews with industry (mostly chip and pulp producers but also furniture makers), forestry officials and farmers during rapid surveys in two provinces each in Indonesia and Vietnam. In both countries, special attention is paid to the links between government programs and the activities of large companies.

The next sections provide an overview on partnerships between companies and small scale tree planters. Results of the survey are presented in the third section followed by a discussion on constraints to beneficial partnerships and recommendations for future policy improvement.

2 PARTNERSHIP ARRANGEMENTS BETWEEN COMPANIES AND SMALL SCALE TREE PLANTERS

In both Vietnam and Indonesia, company-smallholder partnerships are important in efforts to promote small scale tree planting to increase forest cover, increase supply of plantation timber and alleviate poverty. Mayers and Vermeulen (2002) define a partnership as "a range of relationships established by the two or more parties on the expectation of benefit"; they may be formal or informal arrangements and may involve third parties in a variety of roles; they are subject to conditions determined by political, economic and cultural systems. Much has been written about the positive impacts of partnership. Mayers and Vermeulen (2002; 2003) mention increased economic benefits and better returns on invested inputs; enhanced ability to access new opportunities, such as enterprise diversification; and sharing of risks. Nevertheless, other than outgrower schemes in the pulp and paper sector, company-community partnerships have not been widely adopted. Many factors hamper the establishment of partnerships, not least of which are weak tenure systems, or insufficiently large holdings, too short leases, inappropriate tree species and silvicultural systems, and pressure for short-term profit making compared to plantation rotation schedules (Morsello, 2006; Mayers and Vermeulen, 2003; Carter and Gronow, 2005).

Nevertheless, in Indonesia partnerships are often seen as essential to strengthen smallholder plantations. In fact, partnerships emerged because of frequent conflicts between local communities and large scale forestry companies, where companies were forced to accommodate the socio-cultural particularities of diverse local communities, with their legal and/or customary rights to land (Nawir et al, 2003; Maturana et al, 2006). Since the 1990s, the government experimented with many forms of partnerships. For example, through the Farm Forestry Credit scheme, community groups were eligible to receive credit through a company partner. The HTI-Trans scheme, meanwhile, involved partnerships between plantation concession holders and transmigrants, usually organized in groups. The state forestry corporation (Perum Perhutani) has long collaborated with local people providing them access to forestland for mixed uses in return for their stewardship of timber trees (Nawir et al, 2003). Most of these early partnership arrangements favored collectives and where necessary included programs to organize farmers groups and build cooperatives. However, efforts to promote collective management were not always successful: farmers do not always operate best in artificially created communities. Therefore, the latest scheme, the HTR (Hutan Tanaman Rakyat or "people's plantation forest") involves allocation of forest land for pulp and paper plantations to individual farmers.

In contrast to Indonesia, company-smallholder partnerships in Vietnam are considered more a tool to promote household economic development rather than a social goal by itself. The government does, however, encourage cooperation to establish organizations and cooperatives of different kinds (Nguyen et al, 2003). The most significant reform driving small scale forestry has been the forest land allocation program. Since 1997 some 1.9 million ha of forest land has been allocated to smallholder farmers, which empowers them to act more independently and with more profit motive due to having more secure rights than their Indonesian counterparts.

While in Indonesia, smallholders often see partnerships with companies as the main source of investment for developing their plantations, in Vietnam 74% of the tree planting enterprises were self financed, with 20% from loans and only 6 % from other sources including joint ventures or partnerships. Banks provide 32% of the loans, projects 31% and 37% come from other sources (Nguyen et al, 2003). Thus, in Vietnam, partnerships seem to be based more on a business relationship where the company provides the market and small tree planters provide the needed raw material. Such a relationship, where clear profits are obtained by both parties is a basic condition for a successful partnership. As well sustainable partnerships should fulfill the following criteria (Race et al, 2009:94):

1. all stakeholders are well informed of opportunities, risks and costs (e.g. anticipated fees and other expenses),
2. reliable markets identified,
3. growers have secure land/forest tenure (recognized use or ownership of land and forest),
4. best ‘bet’ farm and forest management is consistent with credible research and development and local field experience,
5. all partners are voluntarily entering into agreements,
6. agreements are secure (organized legal foundation),
7. neighbourhood and off-site impacts considered and management,
8. supportive government policies and programs,
9. agreed process for dispute resolution,
10. workplan reviewed regularly and changes mutually agreed.

We will use this metric to evaluate the sustainability of partnerships in Indonesia and Vietnam, in view of the observations of the status of surveyed partnerships described in the following section.

3 CONDITIONS OF COMPANY-SMALLHOLDER PLANTER RELATIONSHIPS IN VIETNAM AND INDONESIA

This section presents the results of surveys in two provinces in Vietnam (Phu Tho and Binh Dinh) and two in Indonesia (Riau and Kalimantan Selatan). In Vietnam, the selection of provinces was based on the presence of industries requiring large volumes of raw material. In Indonesia, our selection was based on the anticipated implementation of the *people's plantation scheme* (*Hutan Tanaman Rakyat or* HTR). Both Riau and South Kalimantan had proclaimed their interest and had allocated areas for such plantation. Information was gathered through focus group discussions, meetings and interviews, conducted over several weeks in 2008 and 2009. Respondents consisted of forestry officials at district and provincial levels, smallholder farmers and farmers groups and several staff from industry. In Vietnam, we were able to conduct more interviews with *individual* farmers and also made visits to several other provinces (Yen Bai in the north and Quang Tri and Thua Thien Hue provinces on the central coast) to obtain additional information. In Indonesia we engaged more with farmers *groups* through focus group discussions.

Between the two countries, there are large differences in scale, both in terms of overall forest area and how that area is allocated to the different actor groups. Indonesia claims to have 58 million hectare of production forest out of a total land area of 191 million ha (DepHut 2007), managed by companies having concessions of up to 200,000 ha. Land allocated to smallholders, however, are relatively small. In the case of transmigrants attached to industrial plantations, individuals were given full rights to only 0.25 ha and share cropping rights to 1 ha (Bubandt, 1998). Vietnam has 4.48 million ha production forest with a land area of 32.9 million hectares (MARD, 2008). Companies in Vietnam manage between 700 and at the most 1,000 ha (Trung, 2009) but smallholders can receive up to 30 hectares forest land (and more if they are willing to pay taxes) for 50 years, and therefore have a relatively stronger bargaining position.

Following is a resumé of information gathered through the interviews.

3.1 VIETNAM

Economic reforms of the mid 1980s in Vietnam led to growing demand for raw material. The national forest land reallocation combined with a series of government projects to promote tree planting produced a shift to smallholder engagement in the plantation timber production industry (Nguyen et al, 2003).

3.1.1 Buyers

The types of timber buying companies in Vietnam vary from region to region from large-scale paper producers to smallscale furniture companies. In the northern province of Phu Tho, the largest buyer is the Vietnam Paper Corporation with its factory in Bai Bang. About 50% of the Bai Bang mill's supply comes from 16 state forest companies from several provinces. The other 50% is provided by smallholder households. Some of the state forest companies also contract local households to supply material which is then sold on to the Bai Bang mill. In the neighbouring province Yen Bai, a privately-owned company supplying the Bai Bang mill has developed cooperative arrangements with some 10,000 households with a total area of 20,000 hectares spread over 5 provinces.

Many more buyers are present in the central coast area, In addition to 3 factories producing wood chips and a Japanese company (Quy Nhon Forest Plantation Ltd) there were numerous other wood processing plants including many furniture manufacturers. As a result, the market is more competitive and households are able to make better deals.

All smallholders interviewed produce either *Acacia* spp. or *Eucalyptus* spp. Only two respondents, both with larger holdings, were experimenting with other species, though the main industries are increasingly relying on fewer and fewer species.

3.1.2 Size of landholdings

The more informed and well connected and or enterprising people have managed to obtain rights to large amount of land, such as the example shown in Box 1. Often these people obtained certificates in the name of relatives, children or even bribed others to loan their name. In one case, one person had been able to hold 1000 hectares of land through such deals. Most of the informants have holdings between 3 to 20 hectares. Like all good farmers, most do not put all eggs in one basket. Since the allocated plots are seldom contiguous they manage their multiple plots under different systems. If they can afford it, one or more plots are contracted to a company, while others are planted in trees using

Box 1: Smallholder in Than Son District. Husband and wife, both teachers in the uplands, settled in the area in 1995. Total land holding is 80 ha of which 52 ha is allocated forest land. The area planted in trees(acacia) is:

- 10.7 ha planted with investment of the company,
- 22 ha planted with own investment (bank loans), seedlings bought from the company,
- 19.5 ha rented to the company at 120,000 VD/ha/yr,
- 10.5 ha occupied by others.

Income derives also from livestock, fruit trees and producing acacia seedlings for the local market .

their own money. Usually, these are then planted with locally raised seedlings (sold at 100-300VD) compared to those produced by a company (up to 700 VD per seedlings as these are often raised from imported seed).

3.1.3 Contracts and agreements

Collaboration is contract based, usually between the buyer (company) and individual households or cooperatives, witnessed by the chairman of the commune People's Committee (PC). Different kinds of contracts exist depending on the partners, land ownership and levels of investment by each party.

State Forest Companies operate based on a more or less standard contract articulating roles and responsibilities and providing details on company investments and benefit sharing. Company investments might cover different amounts and kinds of inputs, labour, and technical guidelines, and sometimes also land.

Different types of benefit sharing arrangements are as follows:

- Land owned by smallholder. Company provides loans to be repaid with interest at harvest time in volume of timber, and smallholder has to sell all produced logs to the company.
- Land owned by smallholder. Company provides input and money for wages. At the end of the rotation, smallholders might receive an additional 50% of the harvest. Smallholder has to sell all produced logs to the company.
- Land owned by smallholder. company provides inputs. At the end of the rotation, production is shared 70% for the company and 30% for the smallholder. Smallholder has to sell all produced logs to the company.
- Company rents the land (in 2007 average land rent was 68 VD per square meter) and the smallholders might get additional wages.
- Company provides land and inputs and smallholders will receive wages for planting (3-6 million VD); protection and maintenance (1st year 3 million VD and products from intercropping; 2nd year 2 million VD; 3rd year 1 million VD) plus 2% a year from the final product.

Box 2: The Vietnam Paper Corporation at Bai Bang Contract with Farmer's cooperative

1. Contract is made between company and cooperative.
2. Cooperative to establish farmer groups.
3. Company will buy from cooperative.
4. Cooperative is responsible for:
    - SMALLHOLDER producing at least 90cu.m/ha after 7 years,
    - SMALLHOLDER harvests and transports to the factory.
5. Company will pay current market price.

Alternatively, some companies merely provide loans and negotiate conditions for repayment. When loans are provided by a company, farmers are required to sell to the company. In the provinces of Quoy Nhon, Viet Tri and Viet Quong, the presence of many competing industries and easier access to credit have allowed small holders more freedom to choose their buyers and possible a better bargaining position to negotiate better prices. Smallholders in these provinces often forego signing contracts altogether in order to profit from the best prices on the market at harvest time. In contrast, in Phu Tho, one large buyer dominates the market.

Dealing with individual farmers involves high transaction costs. The amounts produced are small (on average 100 m3/ha or about 60 ton) and are individually insignificant compared to the demand (Bai Bang alone requires about 350.000 ton raw material a year). Companies need special staff to deal with farmers, to check status of land, to initiate collaboration, to organize contracting and keep the administration. Thus most companies would rather deal with middleman and or try to work through cooperatives, such as the case of the Vietnam Paper Corporation at Bai Bang, one of the most important buyers in the North (see Box 2.). Farmers could organize for better bargaining but the experience with forced communes and cooperatives has resulted in a strong sense of individualism.

Contracts with middlemen are less clear. While there is probably a more or less fixed relationship between middlemen and smallholders and between middlemen and companies, it is unclear what kind of contracts are negotiated or whether there is even such a contract.

Private owned companies have more varied agreements. Different people might have different contracts which might include:

- Kinds of investments provided by the company,
- Loans received and conditions for repayment,
- Types of work expected (protection or plantation or both).

One such company is the ‘Private Company for the Service to Plantation 327’ in Yen Bai province. The company has a contract with Vietnam Paper Corporation in Bai Bang to supply material each year. In turn the company contracts some 1000-2000 smallholders annually, Being one of the first to receive forest land allocation the company has managed to expand its land from the original 104 hectares to over 6000 hectares in 6 provinces. The director claims to cooperate with more than 10,000 smallholders in 11 districts in 5 provinces (interviews, Huong, 2006) although some of are merely labourers paid to protect the forest.

Smallholders often have multiple contracts depending on the number of plots owned. Cooperation with local smallholders is very flexible and might be different from year to year depending on circumstances. Most contracts are for the duration of one rotation usually seven years and are renewable.

3.1.4 Benefits

With high demand for raw material, tree plantations are, at the moment, making a clear profit. According to the director of the sub-department of forestry in Yen Bai province, with 1 ha of land, a smallholder can produce 100 ton of Acacia wood in 5 years. With prices ranging from 400,000 to 500,000 VD per cubic meter and productivity between 80-100 cu.m per ha, costs of investments 8 -10 million VD /ha, farmers should be able to earn about 5 million VD per ha per year. This income is usually in addition to their earnings from other farming activities and thus a significant amount.

However, in order to earn such an amount, the farmer has to be able to sell at factory gate. As said, companies do not like to buy small amounts and for the farmer the effort of harvesting and transport is often too high. Thus, farmers, especially those in remote areas prefer to connect to middlemen and or companies who then pay for harvesting and transport. The farmer receives less but still a significant income.

According to the companies, benefits for smallholders collaborating with companies include:

- better income,
- access to loans from companies,
- access to quality seedlings and technical support,
- additional incentives (e.g. study tours for successful farmers, infrastructure in areas where large number of smallholders have contracts with the company, sometimes also classrooms and electricity).

In addition smallholders derive benefits from intercropping during the first 1-2 years and are paid to protect the established forest.

Benefits to companies are:

- access to capital: companies often receives low interest loans if used for tree plantations to supply the pulp and paper industry,

- good relations with local people,
- supply of raw material.

3.1.5 Risk management

One important aspect of entering a partnership in Vietnam is risk sharing. Although apparently not considered a priority, almost all contracts discussed have a clause on risk management, usually pertaining to the shared risk of a failed harvest due to natural causes. No mention is made on risks of loss of profit due to market failures.

3.2 INDONESIA

Most raw material for the pulp and paper industry is supplied by large scale timber plantations owned by the company. Forest reforms have forced concessions including industrial timber plantations to collaborate with local communities. Mostly this consists of benefits granted to communities such as access to company land and contributions to community development. In the early 1990s, outgrower schemes in partnership with local people as well as with transmigrants were developed. Such partnerships had the dual benefit of providing extra land, labor and raw material as well as resolving conflicts with local people, usually over tenure (Nawir et al, 2003). With the renewed interest in corporate social responsibility, almost all plantation companies now include a component of collaboration with local communities both on community as well as company land.

3.2.1 Buyers

Most processing plants own their own plantations and do not need to buy from smallholders, although almost all have developed partnerships with local people. PT RAPP n Riau, is a large pulp and paper mill producing 2 million ton pulp a year, requires 9.5 million ton raw material a year. Most of this comes from its 238,000 ha concession, with additional supply obtained from partnerships with other (subsidiary) companies (FWI, 2005). As part of their corporate social responsibility program RAPP engages the 15 villages directly bordering its concessions in development of outgrower schemes. The company provides all input, sometimes even labour, and a share of profits. The area under this scheme is quite small compared to the area of concessions, less than 2000 ha and is limited to the area directly bordering the company's concession.

In South Kalimantan, we engaged with several industries which collaborated with local people. PT Hutan Rindang Banua (HRB) owns a chip mill factory in Ale-Ale village, Kota Baru, Pulau Laut, and another processing industry (PT Mangium Anugrah Lestari) Raw material is obtained from a concession of about 268,585 ha, of which around 97,000 ha has been planted with Acacia. In addition the company has 13 partnerships with local farmer groups as part of their CSR requirement.

PT Emida (see Box 3.), owns a furniture industry in East Java, and is experimenting with planting of Mahogany and *Melia azedarach* in South Kalimantan. They do not have a concession and rely on local people to plant the trees. A third company, PT Pradipta Ratanind, produces sawn timber and molding intended for the export market to Europe, Japan, Korea, and America. In 2005, the company contracted PT Inhutani 3 to fulfill its 100,000m^3 timber needs. The cooperation was later suspended due to disagreement on the pricing.

> **Box 3:** PT. Emida and local communities.
> PT Emida holds use rights of 700 ha in South Kalimantan where it grows mahagony for its furniture industry on Java. In South Kalimantan the company entered different partnerships with companies:
> (1) Company provides seedlings, operational and maintenance costs. At harvest, profit is shared 60-40 after deducting costs.
> (2) Company provides fertilizers only and has sole rights to the harvest. All benefit to individual farmers based on number of trees planted and volume produced per tree.

3.2.2 Size of landholdings

Partnerships especially outgrower schemes have not much developed in either province. These schemes are usually only successful when there is plenty of land available, farmers do not need all and alternatives are few. In Riau, for example, many local famers own between 10-20 hectares while labor is limited. In this situation, many were willing to contract out land to RAPP, especially when the company carried all costs and labour.

In South Kalimantan, transmigrants started with the officially allocated 2.5 ha of land. Since then many have expanded their holdings. They have been able to use the land more intensively and are more willing to enter partnerships with companies. Local people, on the other hand, have large claims often of more than 20 hectare which are not managed very intensively.

3.2.3 Contracting and agreements

PT Emida started its partnership with smallholders in 2007. Contracts are for 15 years, which is the full rotation for mahagony, although selective harvesting can start at 10 years. So far PT Emida has established agreements with 4 farmer groups and established some 40,000 trees. They also have one individual partnership with one employees who is planting mahogany on his land (no information on total area planted or number or trees).

Emida offers two kinds of partnerships, both on private owned land. First, the company provides all inputs and operational costs and nett profit is shared 60/40 (company-cooperative). Expenses deducted are costs for land preparation, plant management, transportation during harvesting, and overhead costs. Valuation of timber during the harvesting period is based on industrial standard (e.g. diameter >16cm, 4 m length etc). Secondly, the company provides fertilizer to trees planted and maintained by the farmer. At the end of the rotation, the company pledges to buy all trees produced at the current market price.

Box 4: PT Hutan Rindang Banua and local communities:
Collaborative management on company land: The program started in 2008 partly to fulfill government requirements, and partly to solve overlapping land tenure issues, as well as to fulfill timber supply for their mill.
Community forest management on farmers land: Group of farmers or cooperatives enter agreements with the company to plant at least one rotation of Acacia (7 years). Costs are borne by the company: land preparation, planting, harvesting and transportation. After deducting costs, profit is shared 60% for the company and 40% for the community.

To become partner, small holders have to show proof of ownership. Tenure and property rights, however, are difficult issues. Land certification is as yet rare in the outer islands and tenure systems are chaotic and confusing due to the different customary systems.

PT. HRB, on the other hand operates on state land given in concession to the company. Partnerships were established to fulfill government requirement and to partly solve overlapping land tenure issues. Two forms were initiated, one on land legally controlled by the company but disputed by local people and one on land outside the concession. Both are with formal groups with registered members and legalized through an MoU (See Box 4.).

The company currently has 13 partnerships with cooperatives or farmer groups, where all operational cost is covered by the company, and profit is shared 60/40. Valuation of harvested timber is based on industrial standard (e.g. diameter >16cm, 4 m length etc.).

Although there are many self initiated farm without external support, companies are seldom interested in partnerships with individuals. Most partnerships are between companies and communities as a whole, with farmers groups or with cooperatives. Usually companies deal only with group leaders who serve as facilitator between company and the individual members.

Agreements are sealed through a Memorandum of Understanding (MoU) rather than a contract. Although not legally binding, having a written document stating the interest of both parties is already a big step forwards in these kinds of partnerships. An MOU is also simpler and cheaper and does not require the involvement of a certified notary.

The MoU usually covers the general term and conditions applied under the partnership such as rights and obligations of parties, and the costs and profit sharing (Box 5.). The bigger and more established companies usually have more detailed clauses in comparison with the smaller companies. The formats might differ, but in all cases the conditions of the agreement are set by the companies rather than by communities. The smallholders' involvements in agreement development is very limited, at most they provide minor input prior to the signing. A contract or MoU should be able to protect the interest of small farmers. Instead it more often protects the interest of companies. Stated conditions are more often binding for the farmer than for the company. Thus although PT Emida might commit to buy all products from land under partnership agreements, the company sets the price depending on the market at the time of harvest. As farmers often do not have access to market information they have no means to verify prices offered by the company.

3.2.4 Benefits

According to PT RAPP officials, partnerships provide a dependable supply of fiber, a means to resolve conflict and empower communities. Their calculations also show that farmers can obtain some 50,000 rupiah/month/ha acacia planted. This is about five US dollars, but perceived as savings and when received as a lump sum at the end of the rotation is still a significant amount of cash. In comparison Oil palm can provide 1.5 million rupiah (160 USD) per month per ha over some 25 years. Thus, people are willing to enter partnerships with the company to plant acacia mainly due to lack of initial capital to establish oil palm, surplus of land, and the additional contributions by PT RAPP for community development such as public facilities and scholarships.

Box 5: Terms of Agreement typical of Memorandum of Understanding between company and individuals/ community:
Land is owned and free of conflict.
Tree species are determined by the company (e.g. mahogany, acacia, jabon etc) with rotations of 6 – 15 years.
Benefit sharing to be determined based on the contribution by the company.
Rights and duties of both parties.
Period of MoU dependent on length of rotation of tree species.
Signed by both parties, village staff and several other witnesses.

In South Kalimantan there is as yet no harvest from partnerships. Field observations and discussions with farmers show two main reasons for farmer's interest: the free supply of seedlings and fertilizers and a guaranteed market. Although the final price depends on the market, the fact that the company guarantees either to buy the products directly or help the farmers access other buyers is sufficient to motivate tree planting.

3.2.5 Risk Management

Unlike in Vietnam, possible risks are not part of the MoU.

4 WHO BENEFITS?

4.1 CONSTRAINTS AND CHALLENGES TO EQUITABLE PARTNERSHIPS

Partnerships are generally perceived as being desirable and providing clear benefits. Through partnerships, smallholders in both Vietnam and Indonesia obtain superior quality seedlings, technical advice, wages and a share of the harvest. In Indonesia an added benefit is contributions to community development. Partnerships also provide a better access to market.

Despite positive reports, benefits to smallholders in Vietnam are limited because they lack information on market price. Consequently, middlemen are able to capture most of the profit, mainly through their ability to assess the standing stock better than local farmers and their superior knowledge and market networks. This is consistent with earlier studies (Nawir et al, nd and Nguyen[2]). In Indonesia, meanwhile, benefits are limited because usually the company has a monopoly. With no other buyer available, smallholder farmers have no leverage in setting prices. Smallholders might be obliged to sell to the company in return for contributions such as roads, schools and health clinics. As also observed by Carter and Gronow (2005), the provision of social services by large companies, increases their power over local communities.

In comparison Vietnamese smallholders benefit more. In Vietnam prices are higher, 25-27 USD, compared to 10-15 USD per cubic meter in Indonesia. Secondly, in Vietnam, forest land allocation and the reforms of State Forest Enterprises into profit making companies have shifted some power to farmers. Smaller sized company areas, coupled with secure tenure for small holders, work towards equalizing possible partnerships. In Indonesia, companies do not need smallholder as their own plantations supply the needed raw material. As Nawir et al (2003) and Carter and Gronow (2005) also states, companies initiate partnership more to overcome conflict than in the hope of a stable sustainable flow of raw material for their industries. Companies are also not willing to work with

2 Plantation wood market chain in Binh Dinh and Phu Tho provinces: An analysis of benefit and cost distribution along the commodity line First draft by Nguyen Quang Tan. (study done for the same project)

individuals and limit partnerships to communities with land bordering their concessions to reduce transaction costs.

Yet, secure land tenure alone is shown to be insufficient to promote smallscale tree growing(Carter and Gronow, 2005). As shown in Vietnam, despite secure rights, tree planting took off only when a market became accessible. In Indonesia, smallholder tree planting is driven by the market as well but also by a consideration of opportunity costs. Thus, smallholders are willing to plant low value species such as acacia for the added benefit of social services and to save for the capital needed to plant higher value species such as oilpalm. As one RAPP official in Sumatera showed, oil palm is roughly 15 times more profitable than acacia but needs a much higher initial capital and more labour, while most of the costs for acacia planting are borne by companies.

In sum we conclude that partnerships might provide some protection (a reliable market) and facilitates tree planting (through provision of inputs), but leaves smallholders as the weaker party with no decision making power. Most of the challenges identified by earlier authors remain. Using some of the issues from the checklist by Race et al (2009) below is a review of the experience in Vietnam and Indonesia to identify some common constraints and challenges.

1. Well informed. In Vietnam all farmers interviewed have seen the contract which clearly states risks and costs, even though not all of them have a copy. However, being informed does not always mean understanding the implications of the partnerships, opportunities gained and opportunities foregone. In Indonesia, on the other hand, companies only deal with group leaders and not all farmers are well informed.
2. Partnerships are supposed to provide the reliable market where companies guarantee to buy the products at an agreed on price. However, the market for pulp wood is dependent on the global market for paper and faces the same constraints as most agricultural products. As well, not all farmers had equal access to information on markets and prices.
3. The tenure situation is better in Vietnam compared to Indonesa. While forest land allocation has its problems, it does provide clear and secure tenure. In Indonesia on the other hand, local people have no 'legal' access to forest land. The ministry of forestry claims legal control, although much of this land is claimed by customary communities or occupied by local people. Conflict over tenure is rife.
4. In the partnerships observed, the company often provides the planting stock and oversees the planting and harvesting. Silvicultural techniques applied are not

differentiated between small holdings and large plantations. So far there is little attention paid to development of silvicultural systems for small holders for optimum growth. Neither is much attention given to other options than mono-culture acacia. In Indonesia traditional local systems include mixed stands and or agroforestry which produce a high diversity of products but might be less useful for the pulp industry.

5. There is no indication that farmers are forced into the partnership (except through having no alternatives or not being aware of alternatives)
6. Agreements are as secure as the general legal system. In Vietnam farmers and companies sign a contract witnessed by the commune. Each party has access to a copy although many farmers do not bother to get their copy. Having a contract should make the agreement secure and legally binding. In Indonesia, agreements are sealed through a MoU which is not legally binding but better than nothing. There seems to be no standard contract and there also seems to be no mechanism to protect farmers from unfair contracts or from contract break by the other parties
7. No thought seem to be given to off-site impacts
8. Both Vietnam and Indonesia have issued policies and initiated programs in support of industrial tree plantation and partnerships.
9. There have been no agreed processes for dispute resolution
10. Workplan reviewed regularly and changes mutually agreed

4.2 THE ROLE OF MIDDLEMEN

The role of middlemen and or broker comprises a special challenge. Both in Indonesia and Vietnam, small scale growers are often highly dependent on the service of middlemen. For small scale growers the services of middlemen are very useful because it relieves them of the effort and expense to find a buyer and transport the products to the buyer. For companies, the services provided are even more profitable because the transaction cost of dealing with many small dispersed growers is not insignificant. Nevertheless, as shown by a study by this project[1,] middlemen obtain a larger share of the value than the growers and the longer the value chain, the smaller the proportion obtained by the farmers.

The dependency on middlemen is often also a function of lack of access to credit as banking services in remote locations are scarce. The lack of capital to establish good plantations forces farmers to go into less than profitable partnership or accept loans at unfavorable conditions. In Indonesia even where banks are available, collateral is needed which farmers do not have as ownership of land is questionable.

As is also identified by Mayers and Vermeulen (2002), the biggest challenge is the high transaction cost of companies to deal with dispersed small farmers. In Indonesia, companies limit their partnerships to individuals having land bordering their concessions but in Vietnam, a company such as Bai Bang might have to deal with hundreds of small farmers in dispersed locations. In this case, the company prefers to have a 'collector' do the collecting and only receives wood in larger quantities.

4.3 THE WAY FORWARD

Sustainable partnerships need to be based on a certain degree of shared decision making and requires empowerment of smallholders and communities in negotiation and management processes. It requires certain trade-offs where concessions are made by the company to avoid conflict and contribute to local development. But most importantly, partnerships need to be based on financial and business principles—where small scale tree planters are to be treated as small forest enterprises (Donovan et al, 2006) although within a framework of equitable social and environmental indicators where terms are negotiated rather than set unilaterally (Carter and Gronow, 2005; Mayers and Vermeulen, 2002).

Below are suggestions to move forward which are partly based on earlier studies (Mayers and Vermeulen (2002); Nawir et al (2003), Donovan et al (2006); Bukula and Memani (2006); Barr (2006) and partly extracted from conversations with respondents:

- Market access can be improved improving infrastructure but also through better information systems. Where cell phones are available, a text messaging system providing information on pricing of different products and available buyers such as in use by the Department of Agriculture in Zambia would be highly useful.
- Accelerate the forest land allocation program in Indonesia to provide secure tenure. For traditional communities there need to be acceptance of alternative forms of ownership and cooperation accommodating traditional systems of joint ownership and management systems
- More research need to be done for more appropriate silvicultural techniques combined with extension services.

- Provide Business Development Services to small scale tree planters, including the seeking of alternative business opportunities. This might include subsidized information, training and the facilitation of developing association networks as well as effective financing schemes.
- Community organizing, either to work as groups, cooperatives or even associations to strengthen bargaining power, and or to establish community institutions to oversee the working of partnerships. Farmers associations, for example, might avoid the problems of cooperatives, protect independence but provide collective power to ensure equitable bargaining (Macqueens, 2006; Bukule and Memani, 2006).
- Agreements need to be made secure through a clear, transparent and accountable legal process and include a clear statement of roles and the sharing of tasks, costs and benefits. Contracts also need to include procedures for conflict resolution and risk management
- Policy and institutional systems conducive to small holders and to partnerships. This means simple, transparent and enforceable procedures with in-build protection for the weak party. Foremost is the role of the government in granting and enforcing legal access to forest resources (Donovan et al, 2006) including clear explanations on rights and responsibilities (Nguyen et al, 2009).). Both in Vietnam and Indonesia, the government has provided legal access to forest resources at various levels but clarity on rights and responsibility is lacking. As well, there is a general sense that not enough rights are devolved to local communities.

Most importantly is the willingness of all parties to get fully engaged and to take the time to establish good partnerships. In many cases this might need external facilitation which can be the role of the government.

5 CONCLUSION

As also observed by (Mayers, 2001), partnerships are often seen as low cost means to establish tree plantations and poverty alleviation. Small scale forestry can certainly benefit farmers if a market is readily available and accessible. Similarly Company-smallholder partnerships can be beneficial to both parties under certain conditions. So far, however, neither tree planting nor tree-planting in partnership with companies have resulted in significant alleviation of rural poverty.

Nevertheless, partnerships are becoming more and more common in both Vietnam and Indonesia and accepted as being sufficiently profitable to be continued, despite the fact that still a larger share of the value is captured by brokers and middlemen.

In Vietnam

- All forestry companies we spoke to collaborate with small holders
- Tree growers collaborating with companies work on the basis of a written contract.
- Contracts are between the company and individual farmers
- Different companies have different arrangements with local people but one company tend to issue standard contracts.
- Conditions are set by the company with little room for negotiation by the farmers

In Indonesia:

- Not all companies work in partnership with local communities. Those that do perceive it as being part of their corporate social responsibility.
- Companies work with groups and prefer groups who own land bordering on the company concession.
- Partnerships are based on contracts although more often a memorandum of understanding.

In Vietnam, the limited land available for large scale tree planting necessitates partnership with farmers. In Indonesia, companies do not see partnerships as necessary as yet. The area under small holders for pulp wood is negligible compared to concession areas. Partnerships are thus perceived as part of the corporate social responsibility to support local farmers and to avoid tenure conflict.

While there are many constraints, partnership can benefit both small holders and companies if based on mutual trust and respect, managed in a transparent and accountable manner and not forced in a uniform model but allowed to be established in different forms according to need and situation. Most importantly, however, the government should establish a mechanism to protect the weaker party in a partnership from being exploited.

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The auction of high quality logs in Slovenia- our past experience

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Abstract

Forest owners association of Slovenia and the local forest owners society from Mislinjska dolina have organised four auctions of high quality logs since 2007. These auctions are organized in following Central European countries, first of all to Austria and Germany. In Slovenia, there is such selling way a kind of innovation. Before that, forest owners used to be sold also the highest quality timber together with all other, also worse quality logs. Each forest owner has now the possibility to offer his best logs to the wide range of Slovene and foreign customers, and on account of this also to achieve an essential better price.

The authors analyse the results of previous auctions, particular their relationship between prices, tree art, quality and the size of the log. They have estimated the influence of the world crysis to the results of the last two auctions, as well as the impact of the auction to the future economics of the private forests in Slovenia.

Key words: auctions of high quality logs, forest owners, private forest management
FDC: 753(497.)=111

1 INTRODUCTION

Wood marketing still represents one of the biggest problems of forest management for the Slovene forest owners. The owners are ill-informed about the situation at wood markets and have a limited knowledge of wood quality and its value, especially highly valued tree species such as, for example, a sycamore and a walnut- these are the main reasons why they make less profit than well- informed owners.

After the year 2000, Slovene owners started founding local forest owners societies. Today, there are 22 local societies which form Forest Owners Association of Slovenia with more than 2500 members.

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Different activities of these societies enable the members to be informed about forest management in other European countries.

The societies have organized several excursions to Styria in neighbouring Austria for the forest owners to attend an auction of high quality logs. The high prices of wood set by the Austrian forest owners encouraged the members of Forest Owners Society of Mislinja Valley in northern Slovenia to organize the first auction of high quality logs in Slovenia with the help of Forest Owners Association of Slovenia. The auction took place in Slovenj Gradec in 2007. Since then, auctions have been held annually, which means that the fourth auction will be organized this year. Slovenia Forest Service, its foresters, and Chamber of Agriculture and Forestry of Slovenia provided help with organizing the auction. It was based on invaluable experience and advice of Chamber of Agriculture and Forestry of Styria and its foresters who started auctions a couple of years earlier.

2 AUCTION PROCEDURE

2.1 THE PURPOSE OF AN AUCTION

The purpose of an auction is to sell top quality logs to numerous specialized buyers from Slovenia and abroad. In this way, a forest owner is able to set a much higher price than by selling the same logs to a local buyer with the rest of the wood mass.

Picture 1: The first auction in 2007

2.1 ORGANIZING AN AUCTION

The way of selling logs in an auction is similar to German sealed bid auctions, which means, that every bidder makes a bid for a certain log in a sealed envelope. The organizers begin to collect wood in December and January. Owners transport their wood to the exhibition place where the logs are numbered. The owners are given an acceptance form which includes information such as a log number, a tree species, the exact dimensions of a log, and some personal details about the owners. It also contains some conditions the owner has to accept in order to participate in auctioning.

At the exhibition place the logs are numbered again so that each log can be found in a catalogue. This is followed by a computer data processing and publishing a catalogue, which is sent to all potential buyers – either by post or in e-mail.

All buyers and sellers are required to pay a fee to enter an auction. All prospective buyers have a viewing period of two weeks which gives them a chance to assess the logs. After that they are expected to offer their bids enclosed in sealed envelopes. They are opened publicly at a stated time and place in the presence of sellers and buyers whose names are revealed only at this point. If there are two same bids for a certain log, the buyer is drawn under the supervision of the auctioneer's commission. After the computer data processing all the buyers and sellers are informed about the auction results. One of the problems of such auctions are those sellers who set the lowest price which has not been reached. In this case the log owner has the right to take the logs home. The same goes for unsold logs, which can after an agreement between the organizer and an owner be subsequently offered to the highest bidder.

The auction is followed by Open Door Day during which the public can see the exhibited logs and the auction results are presented in a press conference. In the last four years these auctions have attracted numerous visitors from Slovenia, Austria and Croatia. After the Open Door Day the transport of wood begins. In practice this means that the organizer has to collect wood for individual buyers who have to pay the wood, show a receipt or submit a bank warrant. As soon the bills are paid the money is transferred to forest owners accounts.

2.2 BUYERS AND SELLERS

Anyone can buy wood, regardless of their occupation or nationality. It is important to obtain information on the sale and submit the bid in due course. Generally these are specialized buyers looking for high quality logs of certain tree species. Most of them come from Slovenia, Austria and Germany, but there were also buyers from Croatia and Slovakia at the last auction.

Anyone who has wood can try to sell it. In Slovenia wood is sold by forest owners, especially farmers as well as some companies. Most farmers are members of Local Forest Owners Societies which organize wood transport and thus reduce transportation costs.

As an interesting fact, let me tell you about a pensioner from Maribor who has managed to set one of the highest prices for a walnut log this year. He was forced to cut down the walnut tree because of covering a roof. The felling of the tree was a very demanding task since it was surrounded by other houses, electric cables and grew near a busy road.

3 ANALYSIS AND RESULTS

3.1 ANALYSIS AIMS

After four years of auctions we have obtained a lot of information on high quality logs of different tree species, their average and highest prices, and their country of origin. We also have considerable data on buyers and sellers. We are specially interested in data on sellers – forest owners and their socioeconomic circumstances.

In our opinion, the analysis of the last four auctions proved very useful. The main aims of the analysis are:

- find out the price trends for logs of different tree species, dimensions and quality
- find out which parts of Slovenia best logs come from
- find out which groups of forest owners have been the most successful so far
- find out the influence of the world economic crisis on the auction results
- compare the average prices of Slovene and Austrian auctions
- Such analyses help us get information on everything that is necessary to make future auctions even more successful.

Table 1: Number and volume of sold logs in different years

Year	**2007**	**2008**	**2009**	**2010**
Number of exhibited logs	890	1273	824	785
Number of sold logs	771	848	594	738
Percentage of sold logs (%)	87	67	72	94
Volume of exhibited wood (m^3)	618	964	700	755
Volume of sold wood (m^3)	561	745	574	646
Percentage of sold wood (%)	91	78	82	86
Average volume of all logs (m^3)	0,69	0,76	0,85	0,96
Average volume of sold logs (m^3)	0,73	0,88	0,97	0,88

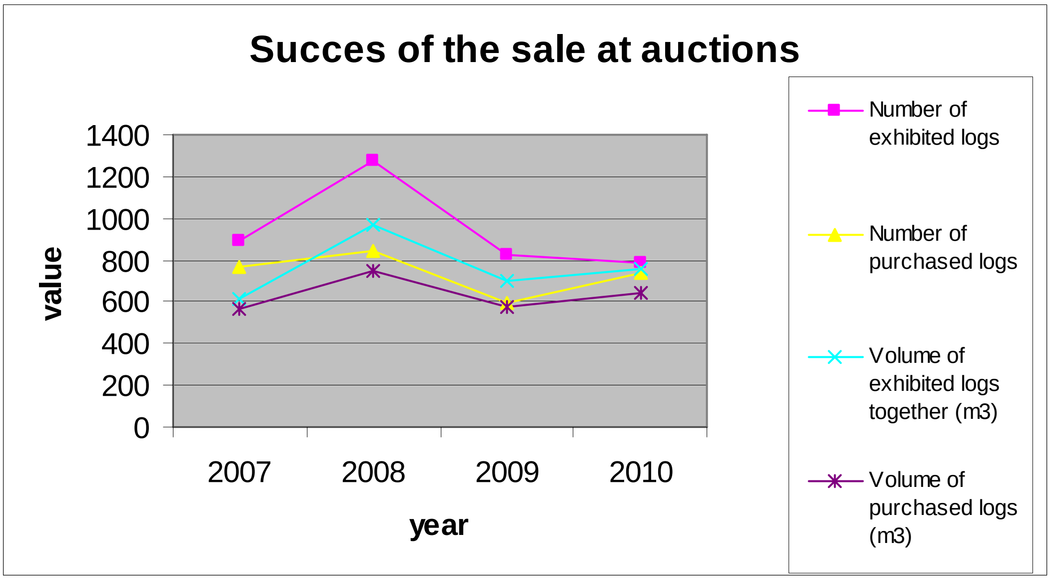
3.2 RESULTS

3.2.1 The Number and Volume of Logs

If we take into account the number of exhibited logs and the volume of sold wood, we can see that the forest owners were the most active in 2008. This fact is the result of the following factors:

- favourable economic conditions with relatively high average log prices, a stable market
- well-informed and well-organized forest owners
- successfully concluded first auction

Graph 1: Succes of the sale at auctions



Despite that more than 200 m³of unsold logs remained at the depot. The situation was similar in the previous three years. This could be the result of the fact that the definition of quality wood of owners did not correspond to the definition of quality wood of the buyers. Actually most of the unsold logs were of poor quality and therefore not suitable for long distance transportation. Many logs were too thin for such a sale. Chart 1 also shows that the average volume of sold logs in the first three years was much higher than the average volume of all logs. Due to lack of experience organizers did not reject poor quality logs. The stricter selection of logs resulted in significant improvement in the year 2010, when the percentage of sold logs reached an impressive 94%. Another reason was poor knowledge of trends in wood processing, as some good quality but commercially unattractive trees species logs (lime, beech, European ash) remained unsold.

3.2.2 Peak Prices

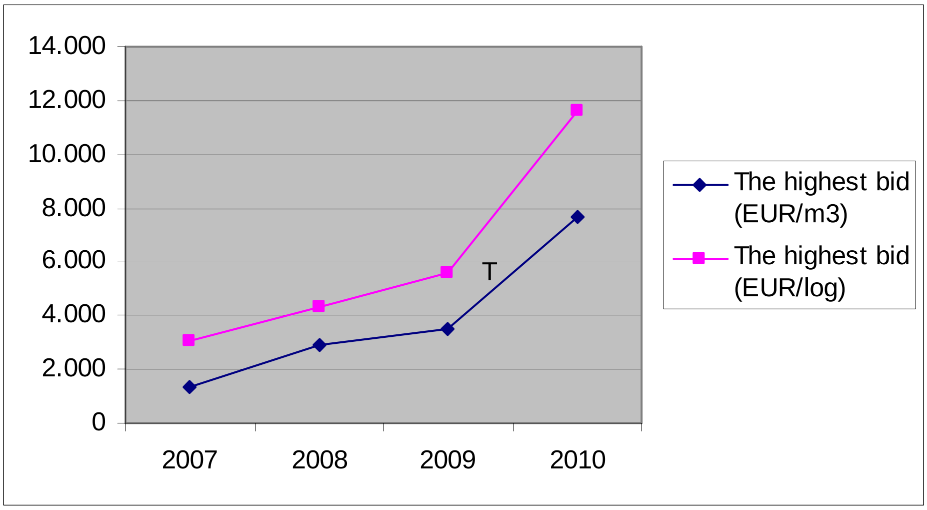
3.2.2.1 Peak Prices of Total Quantity

Table 2: Total value of sold wood and highest bids in different years

Year	**2007**	**2008**	**2009**	**2010**
Total value of sold wood (EUR)	146.731,60	235.703,79	164.074,19	206.720,00
Average selling price (EUR/m^3)	262	316	286	320
Highest bids (EUR/m3)	1.371 Cherry tree	2.913 SYCAMORE	3.530 Sycamore	7.643 Sycamore
Highest bids (EUR/log)	3.021 Sycamore	4.301 Sycamore	5.572 Sycamore	11.614 Sycamore

Table 2 shows the best year so far has been the year 2008, which is completely logical considering the offered quantity of wood. The year 2010 differs from other years regarding the average selling price – in that year the highest bids were offered for some high quality logs. The decrease of the average selling price in 2009 is the consequence of the world economic crisis. This is also the year when wood industry in Western Europe had to face serious economic hardships. In the 2009 auction, the owners set some very high prices, but there was a shortage of offers between 500 and 1,000 euros per cubic metre, which significantly reduced the average price. The increase of the average price in the year 2010 indicates economic recovery and it is also a direct result of a stricter log selection.

Graph 2: The highest bids in different years



The trend in increasing the highest bids has been present since the first auction in 2007. At the first auction the highest bid for a cubic metre of wood was approximately 1,000 euros, whereas at the second auction the best log was sold for a double price, at the last one for a tenfold price. The comparison of absolute values of prices in different years is not a suitable measure as it does not take into consideration the quality of assortments. The prices of the best assortments could have been higher. This can be deduced from the following findings:

- the buyers speculated that the wood prices in Slovenia are lower than in the rest of western European countries
- the number of buyers dealing with plywood manufacturing was not optimal at the first auction

On the other hand, the forest owners speculated as well. They were not capable of assessing the value of their wood. Forest owners in Slovenia tend to let the most beautiful trees grow and cut them down on special occasions, such as building or decorating a house, purchasing machines etc. That is why we took part in the tree selection and helped the owners with advice in 2008. The owner of one of the most expensive logs spent the profit on celebrating his wife's fiftieth birthday.

The owner of the most expensive log did not decide to sell his most beautiful log as he was not aware of its value but he set the lowest price of 1,000 euros for some other log and sold it for 4,300 euros.

3.2.2.2 The Highest Prices of Different Tree Species

As regards the production of high quality logs of deciduous trees, Slovenia is the optimal location with its varied sites and a big variety of tree species. The forestry branch takes the credit for that since it has not limited its interest only to commercially attractive wood of conifers but has been trying all these years to increase the amount of deciduous trees, especially in mainly coniferous forests. The auctions show that mainly these forests contribute to high quality of both species – conifer trees as well as deciduous trees.

They also showed that a sycamore tree is commercially the most attractive. It is followed by a chestnut and oak tree.

In the year 2007 cherry trees sold well, but in the following years even the high quality logs were not sold at highest prices. It is interesting that only a year earlier an alder tree sold well in Austria but only a year later we could not sell it Slovenia.

We have noticed another change in the taste of buyers and sellers- they are getting increasingly interested in logs of deciduous trees.

Table 3: The highest prices of different tree species

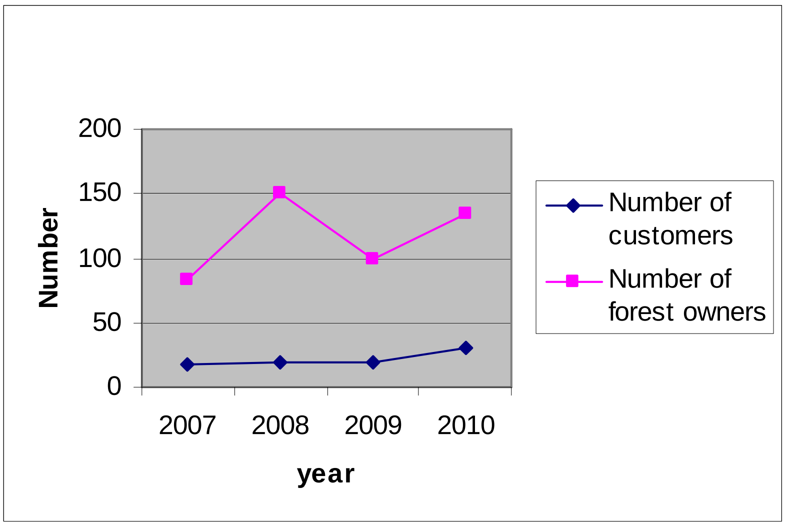
year	**2007**	**2008**	**2009**	**2010**
Sycamore (EUR/m^3)	1.327	2.913	3.530	7.643
Walnut (EUR/m^3)	900	1.335	3.028	3.383
Wild service tree *(Sorbus torminalis)* (EUR/m^3)	805	1.003	808	489
Spruce (EUR/m^3)	400	518	528	1.000
Cherry tree (EUR/m^3)	1.371	828	818	335
Pear tree (EUR/m^3)	708	325	606	452
Oak (EUR/m^3)	742	678	500	453
Chestnut (EUR/m^3)	427	346	928	618
Plum tree (EUR/m^3)				1.425

3.2.3 Buyers and Selllers

The data show that these auctions have acquired reputation among forest owners and buyers and the number of participants is increasing. According to the analysis of the forest owners dispersion we can conclude that they decide for participation on the basis of the following indicators:

- the vicinity of the auction location
- their membership in local forest owners society
- the organization of wood transportation to an auction

Graph 3: Number of bidders and buyers in different years



In the beginning we tried to engage potential buyers with the help of a list provided by our Austrian colleagues. Later we expanded the list but due to constant flow of information buyers express their interest even before the formal notification.

In the year 2009 the number of buyers decrease because of the global economic crisis. Some of them had big troubles with further sale, their storehouses were fool. Therefore they were not able to take part in the auction.

3.2.4 Individual Owners' Profit

Table 4: The highest an the average owners' profit in different years

Year	2007	2008	2009	2010
Highest profit of a seller (EUR	15.308,00	13.249,00	10.493,00	17.422,00
Average profit of a seller (EUR)	1.811,00	1.707,00	1.674,00	1.589,00

Table 4 shows that an owner participating in an auction can make a big profit. It depends on the number of sold logs. For example, one owner earned 15,308 € for 28 logs in 2007, whereas another one got 17,422 € for only four sycamore logs.

The average profit mainly depends on the number of bidders and the quality of assortmets.

3.2.5 Analysis of Logs Fetching More than 1,000 € per Log

3.2.5.1 Tree species

Table 5: Number of logs in value of 1000 eur or more within 4 years

Year	2007	2008	2009	2010	TOGETHER
Sycamore	11	28	18	20	**77**
Walnut	0	3	2	7	**12**
Cherry tree	2	0	0	0	**2**
Oak	0	4	2	1	**7**
Spruce	0	4	4	7	**15**
Chestnut	0	0	1	0	**1**
TOGETHER	**13**	**39**	**27**	**35**	**114**

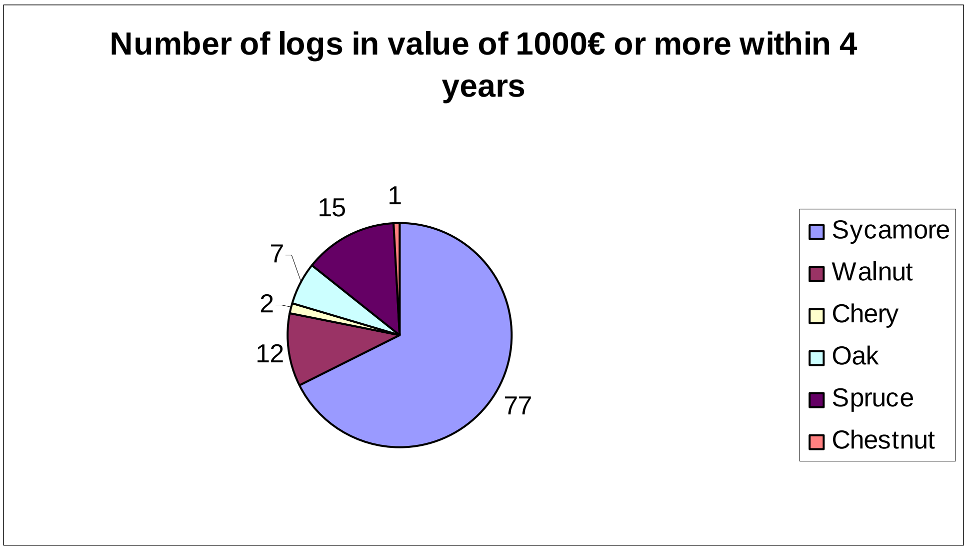
All these years, sycamore logs have topped the list, not only per cubic metre but also per log.

Walnut trees also sell very well, sometimes fetching enormous prices, but due to the smaller volume rarely exceed the price of 1,000 €. The situation is reversed with spruce and oak trees which do not fetch high prices per cubic metre but due to their great volume they can fetch over 1,000 € per a log. For instance, the volume of the best sold spruce log exceeded 6 m^3.

The cherry tree fetched the best prices in the first auction, but since then its price has been falling due to poor quality and decrease in demand.

Chestnut wood can fetch very high prices because of its rarity and versatility.

Graph 5: Number of logs in value of 1000 EUR or more within 4 years



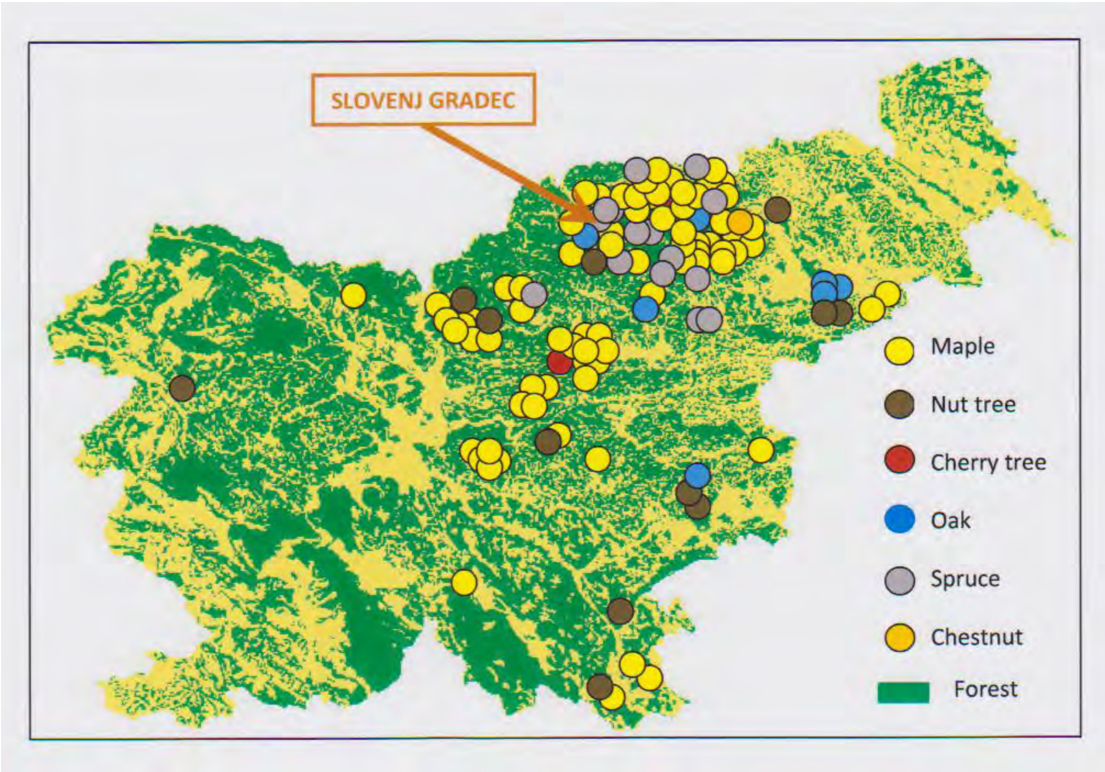
3.2.5.2 Location of Logs

The top selling logs come from the northeastern part of Slovenia, in particular the Pohorje region. Other locations of high quality logs include the Upper and Lower Savinja Valley. We think that the main reason for that is the vicinity of the auction location, since most of the owners of the best logs live no further than 70 kilometres from Slovenj Gradec.

Another important factor that influences the owner's decision to participate in the auction is the organization of common transportation provided by local forest owners societies which play an important role in informing the owners, giving them advice and encouraging them to take part in auctions. One of such societies is very active in Bela Krajina in the southeastern part of Slovenia, which is over 200 kilometres away from Slovenj Gradec. Without the society's help the owners would not be able to transport their logs to the auction.

There are very few logs from southern and western parts of Slovenia, which does not mean there are no quality assortments. The reason is that there are vast areas of state forests in the south but their management is not interested in such a wood sale.

Picture 2: Location of the top selling logs



Some owners from the Gorenjska Region in the west of Slovenia auction their logs in the neighbouring Austrian Styria.

There has been a considerable number of logs from the eastern part of Slovenia (Prekmurje), but none of them has fetched the top price.

3.2.5.3 Socio-Economic Structure of Top Selling Log Owners

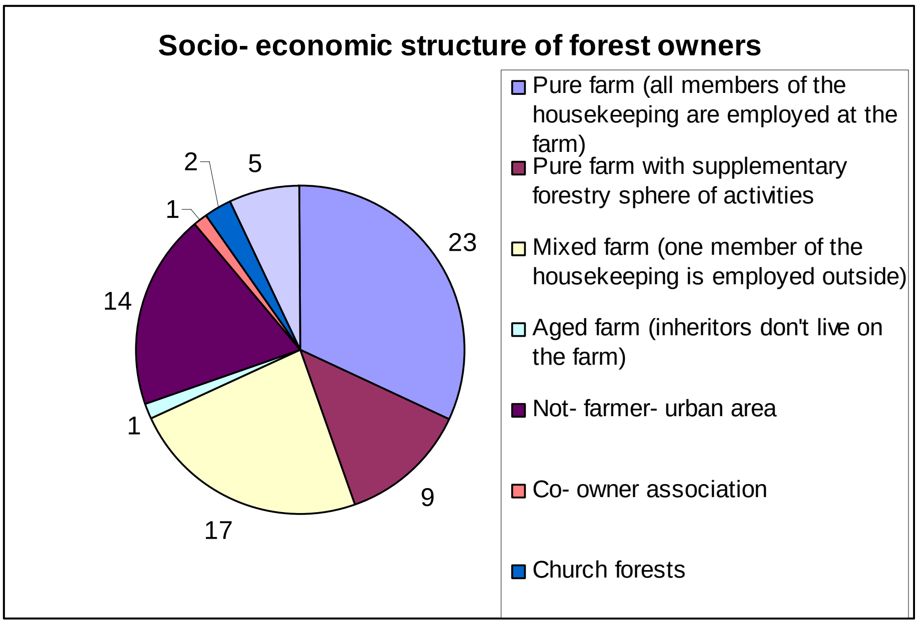
So far 72 owners got over 1,000 € for a total of 114 logs. The charts shows that the most successful owners are those who own up to 50 hectares of forest and a pure or mixed farm.

There are 31 such owners which is a proof that the owners of smaller forest estates can grow top quality trees. Selling logs in an auction represents an important source of income for these farmers. They sell a very small quantity of wood but get a substantial income for the development of their farm.

Table 6: Socio-economic structure of top selling log owners

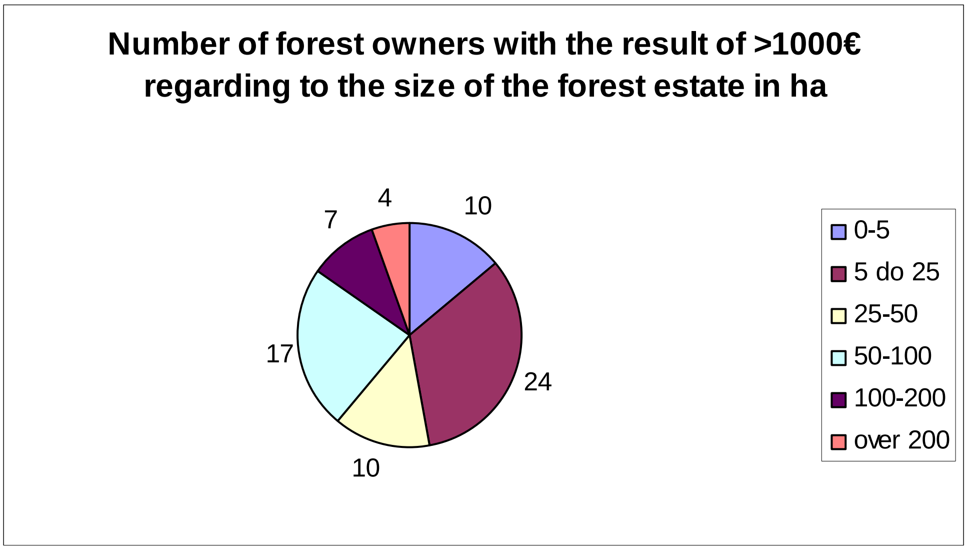
Forest area (ha)	**0-5**	**5-25**	**25-50**	**50-100**	**100-200**	**More than 200**	**TOGETHER**
Pure farm (all members of the housekeeping are employed at the farm)	1	10	5	6	1	0	**23**
Pure farm with supplementary forestry sphere of activities	0	2	2	2	3	0	**9**
Mixed farm (one member of the housekeeping is employed outside)	2	7	2	4	2	0	**17**
Aged farm (inheritors do not live on the farm)	0	0	0	1	0	0	**1**
Non farmer – urban area	4	5	1	3	0	1	**14**
Co-owner association	0	0	0	0	0	1	**1**
Church forests	0	0	0	1	0	1	**2**
Forest enterprise	3	0	0	0	1	1	**5**
TOGETHER	**10**	**24**	**10**	**17**	**7**	**4**	**72**

Graph 6: Socio- economic structure of forest owners



More than 60% of Slovene forest owners possess from 0 to 5 hectares of forest. The analysis of the participants shows that they rarely sell wood in an auction. The reason for this is probably the fact that these owners do not depend on forest income. What is more, they do not work in these forests themselves, and sometimes do not even know where their forest estates are. The majority of them are not members of local forest owners societies.

Graph 7: Number of forest owners with the result over 1000 EUR/log, regarding to the size of the forest estate



3.2.5.4 Membership of Top Selling Log Owners in the Local Forest Owners Societies

Among 72 owners, who have had the biggest profit from selling logs so far, nearly a half of them (34) are members of local societies. The proportion of non-members is higher due to bigger owners, church institutions and companies which offer a bigger quantity of high quality logs at an auction.

We estimate that 60% of all the wood mass brought to the auction is offered by the societies members.

3.2.6 A Comparison of Auction Results in Slovenia, Austria and St. Gallen (Switzerland) and principality of Liechenstein in the year 2010

Austria started to auction the most valuable wood ten years ago, first in Styria, and later in the Upper and Lower Austria.

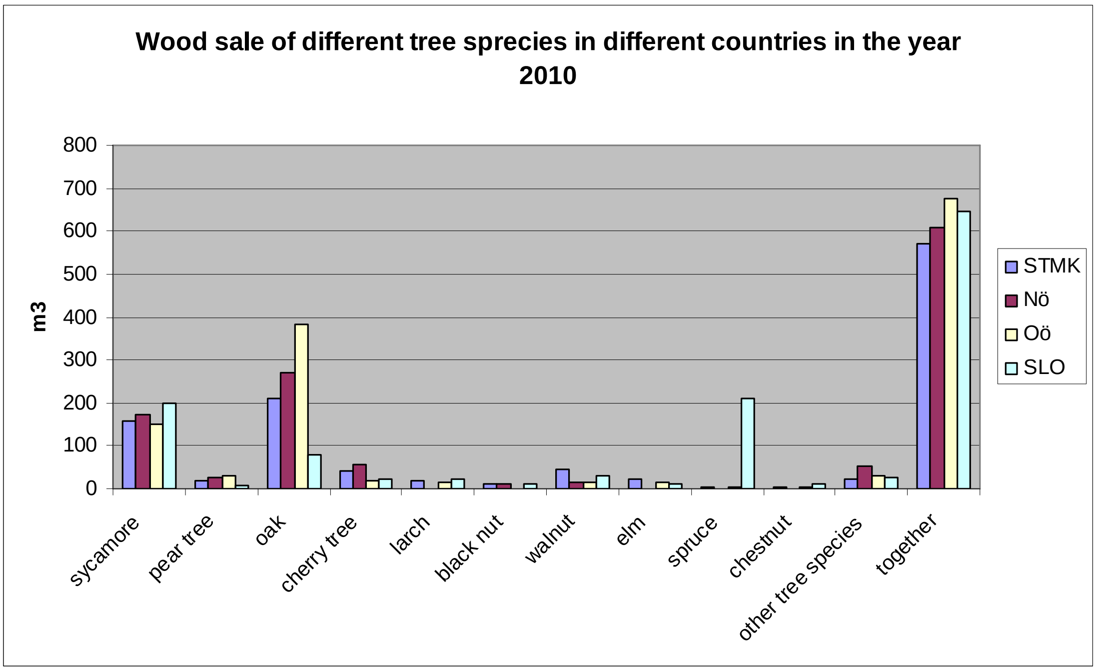
The success of an auction can be shown with the help of the average selling price. The Chart below shows that the average selling price in Slovenia is approximately 100 euros lower than in Austria. The best results are in Styria, which achieved better results with a planned selection. The prices of deciduous trees do not differ as much, which points to the conclusion that the average price in Slovenia is lower also due to a big quantity of conifers, which is four times larger than the quantity of conifers offered at all three Austrian auctions altogether.

*Table 7: The average selling price of different tree species in different countries (*Wald und Holz 5/10)*

COUNTRY	Total	Deciduous trees	Conifers
Styria	481	488	320
Lower Austria	394	394	211
Upper Austria	418	429	182
Austria	429	435	244
St.Gallen(CH) and Liechtenstein *	229	193	153
Slovenia	320	388	205

This year a total of 2,502 m³ of wood, mainly deciduous trees, have been sold in auctions. The quantity comparison of all the regions shows that the most successful country is Upper Austria, followed by Slovenia, Lower Austria and Styria. It is clear from the chart that the best selling tree species is oak, followed by a sycamore with the highest proportion in Slovenia. Slovenia is the only country that sold the biggest quantity of spruce – the quantity exceeded the total proportion of sycamore.

Graph 8: Wood sale of different tree sprecies in different countries in the year 2010



We also have the highest proportion of larch and chestnut. There are about ten other tree species that have been sold in auctions. The country with least variety is Lower Austria. But on the other hand, this country sold the biggest volume of Wild Service Tree.

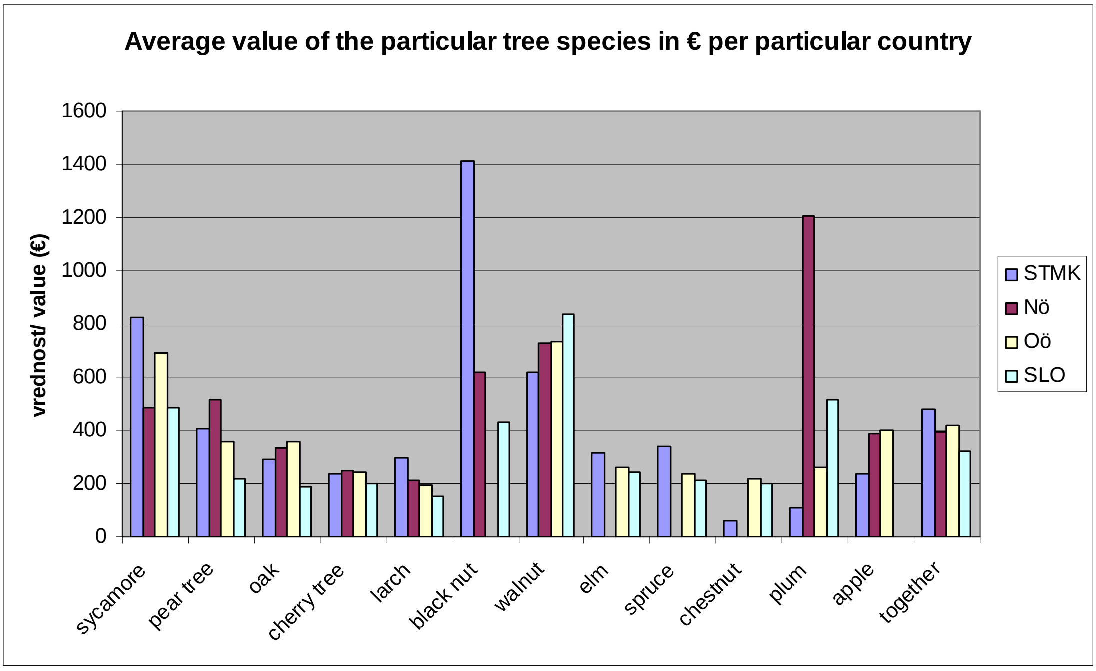
What we find interesting is the low average selling price of wood in Switzerland and (Principality of) Liechtenstein. This is probably the result of the fact that Swiss sellers offer big quantities of beech, European ash, pine and European silver fir which is rarely sold in auctions in Slovenia and Austria.

Graph 8 shows average prices of different tree species in different countries. The prices of rare tree species such as black walnut and plum vary the most.

Austria has achieved the best results in selling of sycamore logs, which is certainly the consequence of a very strict log selection.

Slovene owners have the best results in selling walnut logs, but they have worse results in selling pear and oak logs.

Graph 8: Average value of different tree species in different countries



4 CONCLUSION

Auctioning high quality wood is a major step forward in forest management in Slovenia. Until recently, it was thought that there were no high quality assortments in Slovenia. Today owners can sell their quality wood at prices several times higher than before when they sold it with the rest of the wood mass.

It is extremely important that auctions help the forest owners, auction organizers and forestry experts learn about the characteristics of high quality wood and its usage.

People are much better-informed on trends and wood industry needs than prior to 2007.

Auctions are vitally important for all forest owners, especially smaller farms, which can considerably improve their future development by selling wood.

Local forest owners societies play a significant role in carrying out auctions. They also inform their members on common transportation of wood to auctions.

Local foresters, especially of Slovenia Forest Service, play a big part in advising and log selection and thus help achieve better auction results.

When carrying out such an auction we should take into account the fact that the owners sell only the highest quality wood. The golden rule is that quality requires thickness, although thickness does not guarantee quality.

We believe that one auction per year in Slovenia is sufficient, since high quality wood is scarce. Organizing more auctions would only affect the offer and lessen the interest of buyers.

Some environmentalists are prejudiced against auctions. Their belief that they will cause forest plunder and cutting down the most beautiful trees is not justified. Undoubtedly, buyers and timber merchants will find such trees. The only difference is that the owners will get less money because the profit will go into the pockets of timber merchants.

Auctioning can encourage forest owners to perform sylvicultural tasks in the forest which are not yet profitable. Tending in young forests results in better development of the best trees.

We realize that the interest of forest owners, forestry branch and the public in auction is increasing year by year. Auctioning is also a good way of promoting forestry.

Picture 3: Top selling log owner in the year 2010 on the Open Door Day

Open Door Day attracts more and more visitors each year and represents one of the biggest annual events in the field of forestry in Slovenia.

And due all the benefits of the first four auctions we strongly believe they should continue in the future.

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Experiences in establishing private forest owners' associations and their influence on the development of forest policy and legislation of Montenegro

Mensura Nuhodžić[1], Franc Ferlin[2]

Abstract

Montenegrin private forest owners (PFOs), which forests cover one third of total forest area, started organizing in associations at municipal level in 2007. Due to a great interest of PFOs, the process of association went rather quickly based on a specific bottom-up approach. After not wholly three years, all (14) planned municipality private forest owners' associations (PFOAs) were established, which represent more than 70% of private forest areas. In 2008, the Private Forest Owners' Association of Montenegro (PFOA MNE) was established. Associating took place in parallel with the development of forest sector reform, which initially resulted in drafting of the National Forest and Forest Land Administration Policy (NFFLAP) in 2008. Participatory approach to drafting of the NFFLAP offered an opportunity to APFOs to provide their contribution. The newly established PFOA MNE then influenced considerably also the development of the Draft Forest Law (DFL), adopted by the Government beginning 2010. The DFL implemented all important statements of the NFFLAP related to private forests. In addition to a certain level of deregulation, the NFL brought about a substantially more liberal approach to private forest management. In the process of the DFL public hearings, the PFOA MNE was considered as a partner to the Ministry of Agriculture, Forestry and Water Management and the Forest Administration of Montenegro. The overall process of providing support to associating, functioning of newly-established associations, their participation in development of the NFFLAP and the DFL, including representation their interests, was provided by the Netherlands Development Organization (SNV) Montenegro.

Key words: private forest owners associations, approach to establishing of associations, influencing national forest policy and legislation, Montenegro
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1 INTRODUCTION

1.1 BACKGROUND

Private forest owners (PFO) started organizing into associations for the first time at local / municipal level in 2007 with the purpose of joint achieving of their interests. Before that, private sector was fully disorganized and not involved in decision making in forestry of Montenegro. Associating of PFOs took place in parallel with the development of the process of forestry sector reform, in compliance with widely known principles of the National Forest Programme, which initially resulted in adopting of the National Forest and Forest Administration Policy of Montenegro (NFFLAP) in 2008.

The process of technical support to associating of PFOs in Montenegro, and their participation in drafting of the NFFLAP and the Draft Forest Law (DFL), including representation of interests of PFOs, was provided for by the Netherlands Development Agency (SNV) Montenegro. Analysis of the situation and problems faced by private forestry in Montenegro (Kohler et al. 2007) was conducted beforehand for this as well as for the purpose of the reform of the entire private forestry sector. This analysis revealed key problems of private forestry, which, in addition to disorganization of PFOs, related to incomplete restitution of forests, high restrictions and administrative barriers in terms of planning and use of private forests, high financial burden (fees) borne by private forest owners, lack of any data on private forests and their ownership structure, generally too low utilisation level of private forests with the presence of unregistered / illegal logging, poor social condition of PFOs, and a lack of dialogue and confidence between PFOs and the state forest administration. These problems were the basis of the interest in and the start of the process of associating of PFOs.

This paper will present experiences gained through providing support to associating of PFOs at municipal and national levels, providing of technical assistance to functioning of newly-established associations, and results related to participation of PFOAS, i.e. their influence on the development of the new forest policy and legislation in Montenegro.

1.2 CONDITION OF PRIVATE FORESTS AND FORESTRY

Forests and other forest land of Montenegro are a very important natural resource which covers 54% of the territory of the country, close to 60% of population is linked to rural areas and thus to forests, with 0.9 ha of forests per capita at average (NFFLAP 2008). This places Montenegro among the most forested countries in Europe. However, in terms of forest growing stock (around 100 m^3 per hectare), it is well below the average of countries of South-Eastern Europe (FRA 2005). Consequently, we can say that Montenegro is rich with pure forests.

Private forests are in a poorer condition in comparison to state forests because they cover a far wider share of the Mediterranean climate area, and they are mostly degraded (coppice forests account for 36%, shrubs and maquis as much as 47%), which causes poorer production potential of such forests (growing stock accounts for around 60 m^3 per hectare, and the share of conifers accounts for 25%) (Fetić, 2010). A large share of forests is very poorly accessible by forest roads. According to results of a survey (Kaludjerovic et al. 2008), 57% of private holdings falls under the category of up to 5 ha in size, 27% under the category from 6 to 20 hectares, and 13% under the category 21 – 50 hectares in size, which places Montenegro substantially above the “average” of countries in the region (FRA 2005). According to the same survey, only two thirds of forest owners use their forests for harvesting, of which slightly more than half of timber volume (53%) for own needs (mainly fuel wood), and non-timber forest products (NTFPs) are a permanent source of income for a substantial number (28%) of rural households.

2 ESTABLISHING AND SUPPORTING PRIVATE FOREST OWNERS’ ASSOCIATIONS

2.1 NEEDS, GOALS AND CHALLENGES OF ASSOCIATING

The process of promoting organization of private forest owners started end of 2006. After a few initial meetings, PFOs showed great willingness to associate by defining their status in forestry as unsatisfactory, with a large number of own problems and needs, including, in addition to initially mentioned, the following: lack of plans for private forests; inability of PFOs to participate in preparing annual harvesting plans; unresolved problems of delineation of state and private forests; lack of modern extension service within the Forest Administration of Montenegro (FA MNE) or independently; inappropriate treatment of private forest ownership within national parks; lack of the state support to PFOAs and absence of public-private partnerships; luck of programmes for and financial support to improvement of private forests (Nuhodžić et al. 2009).

The main goal of establishing the PFOAs was to enable associations to achieve effective representation and a successful integration of interests of private forest owners in the development of the national forest policy, legislation, national strategy and programmes and forest management plans, ensuring capacity building for its members (through information, communication, representation and education) and providing them – especially in long-term – with training for providing certain professional services to its members (for example, for forest management and marketing of forest products).

One of important goals of the PFOAs was to establish appropriate cooperation, communication and partnership with the forestry administration in terms of ensuring better support to private forests, better forest management, removing administrative barriers and thus generating higher forest-based income.

2.2 APPROACH TO AND RESULTS OF PROMOTION OF ASSOCIATIONS

The approach used for promoting PFOs was “bottom-up”, i.e. it started with individual contacts and meetings with PFOs at local level, and with smaller and bigger groups later on. Their general interest in organizing was considered first. After that, important interested parties were involved gradually, primarily local units of the FA MNE.

At local level, PFOs and FA MNE were introduced to advantages of associating at the same time in order to avoid polarization of representatives of PFOs and FA MNE and to establish partnership from the very start. This was particularly important if we have in mind earlier practice, where PFOs only implemented orders of the FA MNE with no participation in decision making.

In the very beginning, the FA MNE did not demonstrate great readiness for cooperation, which made activities considerably more difficult, having in mind that the only database, which exists on PFOs is located in the FA MNE. However, after the establishment of initial associations (in 2007), cooperation improved because and it became clear that newly-established associations offered opportunities for better and easier communication and cooperation with PFOs.

Once it was concluded that interest of PFOs in associating was high in the whole territory of Montenegro, and for the purpose of intensifying process of associating of PFOs, local non-governmental organizations were engaged (through SNV), which had good contacts with local population in individual municipalities. Initial activities related to organizing were primarily aimed at information-education role in order to inform PFOs about opportunities and advantages of associating. Having in mind high interest of PFOs, three municipal PFOAs (Kolašin, Mojkovac i Bijelo Polje) were registered mid 2007, and another five (Andrijevica, Berane, Rožaje, Pljevlja and Plav) by mid 2008.

Due to a parallel process of drafting of forest policy, the process of establishing PFOAs was easier and supported by high interests having in mind that PFOs could see importance of associating and their influence in that respect.

Once associations were established in more than half of planned municipalities, two-day workshop was held (in June 2008) with representatives of all associations in order to promote establishment of the national association. At the workshop, which was attended by representatives of the Ministry of Agriculture, Forestry and Water Management (MoAFWM) and other donor organizations as well, international experiences related to associating were presented (Ferlin et al. 2008) and consideration was given to vision, mission and goals of the future national association. The conclusion of the workshop was the decision – having in mind that the process of forest sector reform was ongoing and that it was important to integrate the influence of PFOAS in creating new forestry legislation – to register the national PFOA as soon as possible based on existing municipal associations. In line with this, the Private Forest Owners' Association of Montenegro (PFOA MNE) was established less than two months later.

The establishment of the PFOA MNE was followed by continued promotion of additional associations at municipal level. Based on earlier experiences, the approach was improved so that the promotion teams were extended to involve local forestry expert, and representative of the PFOA MNE, who contributed to promotion by providing additional information on private forests and forestry, and experiences in establishing PFOAs. Based on this, another four municipal PFOAs (Nikšić, Šavnik, Žabljak i Plužine) were established by the end of 2008 (Nuhodžić at al. 2009).

During 2009, the process of providing support to the establishment of remaining PFOAs in the central region of Montenegro and southern (coast) region, as well as integration of newly-established associations into the PFOA MNE was continued. These activities resulted in another two municipal PFOAs (Podgorica and Danilovgrad) by the end of 2009. Due to a weak interest in the southern region, primarily because of low economic value of forests, it was not possible until now to establish a PFOA in the southern region.

The whole process of promoting associating was supported by media.

2.3 RESULTS OF CAPACITY BUILDING OF NEWLY ESTABLISHED ASSOCIATIONS

The associating of PFOs, which was supported by high initial enthusiasm and willingness of PFOs to make changes, resulted in the establishment of municipal associations almost in the whole territory of the state (14 in total), which represent more than 70% of areas under private forests, and it provided for *inter alia* active participation of representatives of PFOAs in drafting of NFFLAP and the DFL, a very good cooperation with the FA MNE, and establishing cooperation with neighbouring PFOAs in the region.

Technical assistance to PFOA MNE and the resulting newly established associations which was provided once they were established, contributed to initial development of functional (administrative, programme, communication) capacities and abilities to represent their interests after corresponding technical and advocacy background was prepared (by SNV).

Representatives of PFOAs participated together with forestry experts of the FA MNE in the process of training the trainers for forestry extension services (led by SNV) in 2008 and later on (Beguš 2008, 2010). In addition to training the trainers, preparations started and implementation of short training courses for PFOs, such as training in proper techniques of harvesting (felling) of trees and training for tending of forests.

2.4 CHALLENGES AND RISKS OF ASSOCIATING

After provided technical assistance, PFOAs of Montenegro (municipal and national) now have a good starting basis for further functioning, although they are still not able to function independently. There is a concern related to the work of these associations once external technical support stops. Risks for sustainability of these associations are especially the following: lack of any form of continuous financing (until adoption and implementation of the new FL); insufficiently developed capacities of associations in terms of functioning, including the lack of expert staff; lack of permanent work space / offices for the work of associations; slow implementation of the NFFLAP and possible postponing of implementation of the new FL in terms of financial support to PFO(A)s.

The above risks may cause discontent of PFOAs, mistrust of members and thus drop of the number of members. Results of restitution of forest land, unless PFOAs will have not corresponding influence on it, may have a particularly negative impact on the drop of the number of members since it is the reason why a large number of members joined associations.

3 INFLUENCE OF PRIVATE FOREST OWNERS' ASSOCIATIONS ON THE DEVELOPMENT OF NEW FOREST POLICY AND LEGISLATION

3.1 WAYS OF PFOAS INFLUENCE

PFOAs influenced the development of new forest policy and legislation by actively participating in technical working groups, expert workshops with stakeholders, and through public hearings and by giving recommendations for improving these documents. In the process of drafting of the NFFLAP, the most important was the participation of representatives of PFOAs in the work of the Group for Private Forests, which was supported by international consultant (Kohler 2007). Representatives of PFOA participated substantially in the work of technical working groups for developing DFL, Law Commission, and in public hearings, where opinion and proposals of the PFOA MNE were presented. Preparation of these opinions and proposals was supported by SNV advisors (Bakić et al. 2010).

3.2 RESULTS OF PFOAS INFLUENCE

A direct result of the influence and willingness and openness of forestry sector leadership in Montenegro is that the DFL implemented most of statements contained in the NFFLAP in relation to interests of private sector, which provided a number of opportunities for improved and sustainable private forest management.

The most important solutions of the DFL in relation to planning, private forest administration and management are the following: higher freedom of PFOs in managing their forests with expert and financial support of the state; participation of PFOs in marking of tress for felling, and the right to participate in preparing and making all decisions in forestry related to private forests (especially through PFOAs); introducing planning for private forests as well (producing development plans, forest management plans and operational plans), which is performed within public forest service activities; introducing of earlier opinions of PFOs in relation to the establishment of management units, adopting of management plans and the designation of protection forests, and participation of PFOAs in the work of local and national forest councils.

The new DFL liberalizes substantially individual administrative activities and procedures in private forests such as marking of trees in private forests by authorized persons holding a licence (not employed by the FA MNE); issuing permits for harvesting fuel wood to PFOs who are good forest managers, without the obligation for marking of trees; introduction of automated (barcode) labeling and tracking system (instead of earlier stamping) of origin of timber assortments from stump onwards, and the transfer of the responsibility for issuing certificate of origin to forest owner or user.

An important condition for the development of private forestry which is ensured by the DFL is the establishment of extension service within public forest service, which will in addition to providing expert-technical services (as before), ensure education and advisory services to PFOs as well. It is also important that the DFL allowed that these activities may be entrusted to other legal entities and licenced individuals (who meet the requirements set for this purpose), which will allow extension services to be provided through private sector as well and thus encourage competitiveness and improved quality of services provided to PFOs.

The DFL defines important financial benefits, support and reliefs for PFOs, such as: redirecting a part of the fee paid for non-timber forest products (NTFP) utilization, which comes from private forests, to associations (on the account of the PFOA MNE); introducing the compensation right for PFOs in case of designation protection forests, proportionally to reduced yield or income due to such protection; establishment of the register of private forest holdings (for holdings larger than 10 hectares) and their integration into agricultural register; establishing a system of incentive measures for PFOs and/or private forestry (for forest protection and silviculture, conversion of coppice forests, construction and maintenance of forest roads, strengthening competitiveness of private forestry, etc.). In addition to measures resulting from the National Forest Programme, the DFL directly involves forestry-related measures of the EU rural development programmes, which is provided for by the EU 2005 Regulation on Rural Development and thus offers opportunities to PFOs to participate in using funds for rural development in the same way as agricultural holdings.

The remaining, less important expectations of the PFOA MNE, which are not included in the DFL, are especially the following: explicit involvement of PFOAs in monitoring of implementation of strategic and planning documents in forestry; a possibility to approve harvesting sites independently from stamping of assortments; a possibility to perform only one type of stamping (or bar coding) of assortments; an opportunity for PFOAs to participate in decision making on the amount of compensation fee and providing system's financial support to the work of the PFOAs based on adopted work plan, which is related to activities of public forest service.

One statement of the NFFLAP, which led to polemic while finalizing DFL and is not included in it, is related to an opportunity to give certain (smaller) areas under state forests located near settlements for the so-called joint[3] use by local PFOAs or local population. This discussion revealed that there is a lack of understanding of forestry administration and profession, as well as PFOAs, what aspect is actually implied by the said statement of the NFFLAP: is this about giving the said category of state forests for governance, management or only for use? Having in mind the context of the DFL, it became clear that this can only be the right to use, and that governance will remain with the FA MNE anyway, whereby PFOAs already have a general influence on the governance as per the DFL. However, it turned out that associations would not be able to reach conditions for obtaining such right soon, i.e. that they are established for joint use of forests at the lowest local level (for example, management units). That is why the PFOA

3 "Joint use" in terms of the NFFLAP (2008) implies joint utilisation of private and related state forests by local PFOs, which are established for this purpose, or existing local communities (villages) near which these forests are located.

MNE gave up on such requirement in the process of DFL public hearings and/or postponed it to a next period when and if conditions are in place.

What remains a specific dilemma in relation to sustainability of functioning of the PFOAs is whether and when they will have capacities to accept all challenges and use all opportunities provided by the new system in forestry defined through the DFL. In those terms, a big role will belong to professional and financial support of the Government through the FA MNE.

4 FINAL CONSIDERATIONS WITH DISCUSSION

The process of associating of PFOs in MNE started in 2007, later than in any country in the region. However, for such a short period, especially with the support of one international organization (SNV), almost all planned municipal associations (14) were established, which represent more than 70% of areas under private forests in Montenegro. The coverage by these associations is now similar to Macedonia (Trendafilov et al. 2009), Albania (Lako 2009) or B&H – Republic of Srpska (Topić, personal communication 2010), and bigger than in the Federation of B&H (Topić, personal communication 2010) or Serbia (Nonić & Milijić 2009).

In Montenegro there is still no PFOAs at lower than municipality level (for example, certain rural communities), as for example the case is in Albania (Lako 2009) and Macedonia (Trendafilov et al. 2009). In the future, once the key legal and strategic documents are adopted, association goals at local level in Montenegro should be shifted from policy to economic issues, i.e. ensuring conditions for effective (joint) private forest management, taking in parallel conservation and improvement of forests and into account. Judging by a survey of such PFOs' interests in Croatia, Serbia and B&H (Avdibegović et al. 2010), we believe that lower level of associating of PFOs has a future in Montenegro as well.

Specific bottom-up approach to promotion of associating, especially technical support to functioning of PFOs in Montenegro is similar to countries in the region in which SNV is present (Albania, Macedonia, B&H). This approach is also useful for linking local capacities of people in other related sectors such as NTFP, eco tourism, rural development and environment, in Montenegro and other countries.

Through active participation in drafting of the NFFLAP and DFL, PFOAs of Montenegro contributed significantly, with the support of international institutions and experts, to integrating interests of private sector in these documents. This statement is, for example, based on the fact that out of 35 statements adopted in the NFFLAP document, as many as 20 of them are directly or indirectly related to interests of private sector, and these statements are almost entirely implemented through the DFL. Based on this, it can be concluded that interests of PFOs are incorporated in almost all aspects, which finally gives private forests a significant place in forestry sector of Montenegro. Thus, the DFL solutions were assessed, by international experts who participated in the development of forestry legislation of countries of Western Balkans (Ferlin et al. 2009), as the most inclusive in the region.

Interests of PFOs are very clearly articulated through the PFOA MNE with the said expert support, which in the opinion of some analysts of private forest sector policy is not the case in the Western Balkans countries (Glück et al. 2010). It can be stated that Montenegro is a leader in the region also in relation to this matter.

One of characteristics of actions of the PFOA MNE is that, having in mind previous situation and real opportunities for making changes with the support of international experts, proposals were made in context of sustainable development of forestry sector and then jointly discussed between key partners. Influence of the PFOA MNE was consequently achieved by partnership, and needs and interests of the PFOs were integrated almost exclusively by consensus. There is no reason for believing that this relation will continue during adoption of DFL in the Parliament. From this aspect also, Montenegro diverts considerably (positively) from countries in the region, especially from, for example, Macedonia, where some interests of the PFOs were incorporated in the new FL only at the very end, during the adopting process of the FL in the Parliament (Kampen, personal communication 2009).

In terms of current situation, there was no financial support provided to PFOAs by the state in Montenegro, similarly to other countries in the region with the exception of, for the time being, B&H – Republic of Srpska (Topić, personal communication 2009). The support to development of PFOAs in Montenegro was provided, like in Macedonia (Trendafilov et al. 2009), Albania (Lako 2009) and Serbia (Nonić & Milijić 2009) by international institution(s).

Financial support or subsidies to PFOs in Montenegro, except for a possibility to get free seedlings, was still non-existing, as the case was, for example, in Croatia (Trninić, personal communication 2009), B&H – Republic of Srpska (Topić, personal communication 2009), or as it was initially started in Serbia (Nonić & Milijić 2009) and Macedonia (Stavrevska, personal communication 2010). However, in addition to professional support, the DFL offers considerable opportunities for providing financial support to PFO(A)s.

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Environmental impacts of community forestry in the hills of Nepal

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Abstract

Community forestry in Nepal emerged from the failure of centralized forest governance with the aims to improve deteriorating environmental conditions in the hills and to provide forest products needs to local populace in 1978. This research assessed the perceptions of socio-economically heterogeneous forest user groups about the environmental impacts of community forestry practices using group interviews and case studies of eight community forests from Dhading district, Nepal. Two environmental impact related concepts - forest products supply and local environmental conditions- were assessed using six indicators among three social groups based on 3-point rating scales. The ANOVA results of summated rating scores suggest that socio-economic differences have no significant impact in user's perceptions regarding environmental impacts of community forestry. All three groups of users - elite, women, and disadvantaged – perceived increased forest products supply and improved local environment due to community forestry practices. Among eight community forests, users of Alchhidanda and Sasaha Jyamire perceived this improvement differently than the rest due to different attributes of these two forests. As perceived by users, generally, community forestry practices brought a positive change in the local environmental conditions and forest products supply situations in the hills of Nepal.

Key words: community forestry, environmental impacts, forest product supply, social group, group interview
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1 INTRODUCTION

Community forestry (CF) mode of forest governance in Nepal has been in practice since 1978 as a result of: 1) failed centralized forest governance envisioned through forest nationalization and forest acts of 1957 and 1964, respectively, that undermined the strong dependency of forest users on nearby forests for various goods and services [2] the widespread deforestation and forest degradation in the hills of Nepal leading to local and regional environmental degradation that raised national and international concerns [14]. Since its inception in 1978, community forestry policies and practices have been continuously changing in light of the changed socio-political context of Nepal [28]. During this period, CF has been the priority forestry program and popularized by the national government, donors, and local non-governmental organizations. It gained significant momentum after the implementation of new forest act in 1993 [20], which extended the scope of CF from its earlier focus on the central hills only (the middle physiographic region in Figure 1) to the national level, and defined forest user groups as the ultimate beneficiaries and managers of community forests.

The centralized forest governance practiced after the 1957 forest nationalization act and further strengthened in 1960s abruptly ended the traditional forestry practices that prevailed in the hills of Nepal for generations, where local users protected and utilized the nearby forests in a responsible way. This created distrust among local users for the government's approach to manage forest resources [30, 31]. Coupled with this distrust was a heavy dependency of increasing population on nearby forests for fodder, fuel wood, and farming land. This led to further deterioration of forest conditions in the form of accelerated forest encroachment, illegal logging, and continuing deforestation in the hills [29]. Central government's efforts to control these activities grossly failed due to limited manpower and lack of proper forest product supply provisions to local users. Consequently, the total forest area in Nepal reduced from 42.7% (38% forest and 4.7% shrubs) in 1979 to 39.6% (29% forest and 10.6% shrubs) in 1994 [11]. Along with this reduction in total forest area, the condition of remaining forests also degraded (shrub land) and increased by more than two folds during this period.

In addition, rampant deforestation and forest degradation in the hills under centralized forest governance created several environmental problems within and beyond Nepal's territorial boundary. These problems include denudation of the hill slopes, soil erosion, landslides, downstream flooding, and reduced water flow in streams and creeks [14]. Particularly, with the 1970s monsoon flooding in Bangladesh, the deforestation and soil erosion problems in the hills of Nepal caught the attention of both national and international players regarding its deteriorating hill environments. Explaining the severity of the deteriorating hill environment, Eckholm [14] stated that "as steep Mountain slopes are denuded, the heavy monsoon rains cause accelerated soil erosion, landslides, increased runoff, and sediment transfer onto the plains. If the trend continues, Nepal will lose half of its forest reserves within 30 years." Similar dire prediction from the World Bank [36] hinted that continuing deforestation will lead to a loss of all accessible forests in Nepal by the year 2000. Somewhat later, justifying the severity of deforestation and soil erosion problems in Nepal, Ives [21] noted that the environmental problem in Nepal was so severe that continuous mountain desertification would increase calamitous down stream effects and, in the worst case, Nepal will flow down to the Ganges River by the year 2000. These predictions, though far from reality, raised urgency at national and international forums regarding the future of forests and environment in Nepal. The situation urged Nepalese government and its development partners to take concrete measures to check deforestation and forest degradation in the hills and community forestry was seen as a viable option in that direction.

Community forestry has been established as a de facto modus operandi of forest governance in Nepal. As of 2009 August, a total of 1,659,775 households organized into 14,440 forest user groups manage about 22% (1,229,669 ha) of total forest area of the country [12] with the aim to fulfill forest product demands of the community vis. a vis. to improve local environment. The detailed evolutionary account of community forestry policies and practices over the last 30 years that has been marked by socio-political changes in Nepal, and its current opportunities and challenges are beyond the scope of this paper. For details, refer to Mahat et al. [22], HMG/ADB/FINNIDA [19], Hausler [18]; Malla [23], Acharya [1], Agrawal and Ostrom [6], Gautam *et al.* [16], and Ojha *et al.* [28].

In the context of Nepal, the gender and socio-economic heterogeneity of forest users have impacted community forestry practices, particularly the decision making and benefit sharing mechanisms within the forest user groups [5]. Scholarly focus has also been directed towards socio-economic and distributional impacts of community forestry policies and practices [for example -2, 35] compared to its environmental impacts. Even at the local level, studies that shed light on environmental impacts of community forestry from forest user's perspectives are rare, particularly using the criteria and indicators that are familiar to the users. Few studies have highlighted positive impacts of community forestry in terms of forest cover and conditions [3, 17]. For instance, Gautam *et al.*[17] studied the land use change impacts of community forestry between village development committees (VDCs), a political unit in Nepal, with and without community forests using Geographic Information System and found that the extent and quality of forest cover significantly increased during 14 year period (1978-1992) in VDCs that have community forests. Adhikari [3] reported that community forestry led to the increased forest products collection among users.

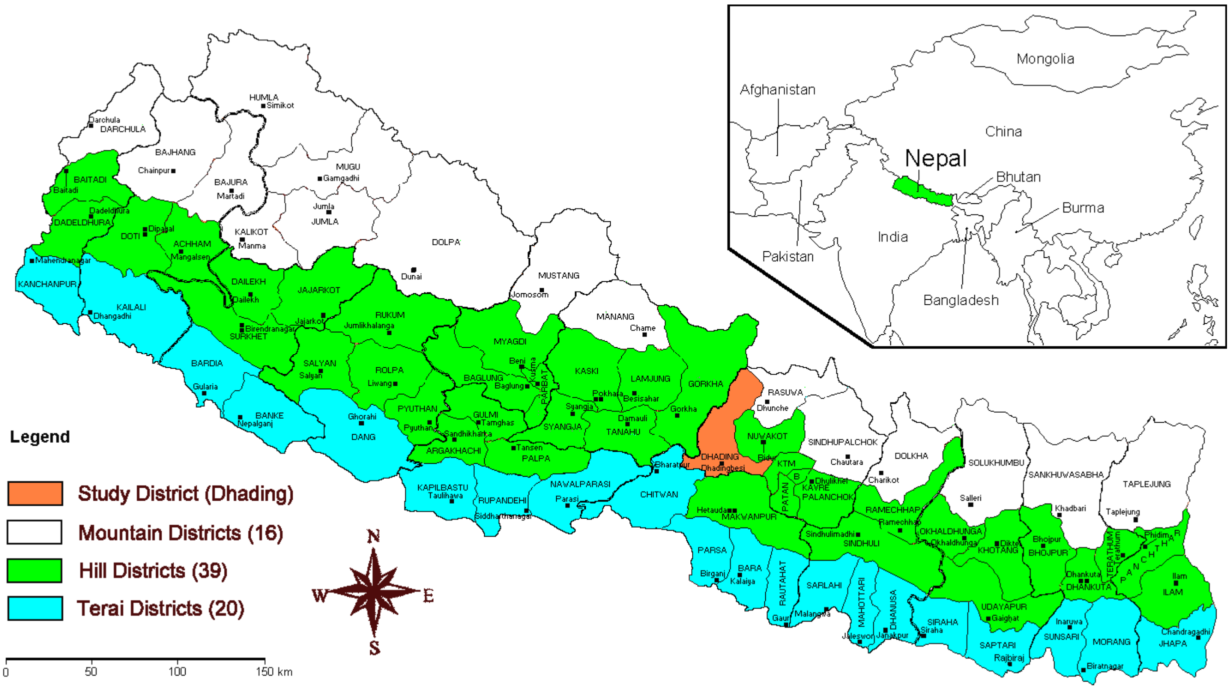
Forest users have first hand experience in observing the impacts of community forestry practices in forest products supply trend and local environmental conditions. This article attempts to document and discuss their perceptions on environmental impacts of community forestry utilizing group interviews and case studies of community forests from Dhading district of Nepal as evidenced by 1) forest products supply indicators, and 2) the local environmental indicators. Furthermore, we consider socio-economic and gender contexts to elucidate any perceived variations among different groups of forest users – elite, women, and disadvantaged – while analyzing their perceptions.

2 Study area and community forests

We focused our study in Dhading district in the central middle-hill region of Nepal, a neighboring district to capital Kathmandu in the West (Figure 1). The district is diverse in its geography and climate that characterize its landscapes and forest types. Hills (72%) and Mountains (28%) are the two landscape types in the district with agriculture (38.1 %), forest (35%), shrub (13.2%), grass (8.3%) and others (5.4%) as main land use types [26]. The altitudinal variations (300 m at Jogimara to 7,110 m at Pawil Himal) in the district forms the basis of its sub-tropical climate in the valleys to arctic climate in the Mountains [24]. Consequently, different forest types are found in the district including Hill Sal, Pinus-Schima mixed, Schima-castonopsis mixed, Oak-rhododendron mixed, Thusa-Juniper, and alpine scrubs [10]. Ethnically, Tamang, Brahmin, Chhetri, Magar, Newar, Thakuri, and Chepang are the major inhabitants in the district. Among these ethnic groups some are more forest dependent (i.e. Chepang) than others [24].

Eight community forests were purposively selected from Dhading district based on multiple attributes of forests and forest user groups. Forest related attributes include accessibility (distance from motorable road), original forest condition, and forest type, while the user group related attributes include their ethnic composition and conflicts of interest among users. Our choice of Dhading district as a study site was mainly due to its long history of practicing community forestry with areas that are completely denuded to areas that has natural forests, and it represents the deteriorating context of hill environments of late 1970s in Nepal.

Figure 1: Political map of Nepal showing mountains, hills, and terai districts and study district



All eight community forests have had at least 5 years of community forestry implementation experience. Sasaha Jyamire and Thuloban are natural forests adjoining to road with ethnically heterogeneous users. Kankalnidevi and Bagmara are also natural forests near to road but have conflicting interest among different groups of users. Alchhidanda and Machhindranath contained degraded forests with heterogeneous users and under heavy pressure for forest products from neighboring settlements. Toplang and Gurdum also contained degraded forests but have homogeneous users. These two forests are located at higher elevations than others and also farther away from near by road networks. Some salient features of these community forests are given in Table 1.

Table 1: Attributes of community forests

Attributes	Sasaha Jyamire	Kankalnidevi	Thuloban	Alchhidanda	Bagmara	Machhindranath	Toplang	Gurdum
Location®	Murali Bhanjyanj VDC-2	Gajuri VDC-1	Pida VDC-2	Nilkantha VDC-1	Kumpur VDC-6	Naubise VDC-2	Naubise VDC-7	Naubise VDC-8
Area (ha)	77.5	226	211.8	20.5	110.75	19.25	47.52	65
User households #	193	217	244	257	198	278	48	44
User population	1,144	1,208	1,441	1,394	1,328	1,872	280	255
Area/household	0.4016	1.0415	0.868	0.0798	0.5593	0.0692	0.99	1.4130
Forest condition	good	good	good	degraded	degraded	degraded	degraded	degraded
Forest type	mixed Sal, Katus	mixed Sal, Chilaune	mixed Sal, Chilaune, Sallo	Regenerated Sal	mixed Sal, Saj, Sallo	Katus-Chilaune shrubs	Khasru, Banjh, Gurans, Salla	Khasru, Banjh, Kaphal, Gurans
Elevation (masl)	630-840	685-1000	500-1200	600-700	600-800	900-1030	1200-1700	1250-1650
Year started	1996	1997	1990	1989	1997	1990	1991	1992
Distance to road	adjoining	adjoining	adjoining	adjoining	within a mile	within a mile	Farther away (5 hour walk)	Farther away (5 hour walk)
User committee composition	12 members 2 women	11members 4 women 1disadvantaged	15 members 2 women 1 disadvantaged	15 members 3 women	15 members 2 women 1 disadvantaged	11 members 3 women 1 disadvantaged	15 members 3 women	11 members 1 woman
Ethnic groups	mixed	mixed	mixed	mixed	mixed	mixed	Homogenous (Tamang)	Homogenous (Tamang)
Disadvantaged hh	15	68	30	28	27	11	0	0

® Location of community forests within a given Village Development Committee (VDC)
Source: Operational plans and constitution of community forests, 2002

3 METHODS, DATA AND ANALYSIS

Cross-sectional survey and case study methodologies were used to gauge the forest user's perceptions in environmental impacts of community forestry practices due to applicability and economy of these methods [7]. The users of each community forests were divided into three social groups – elite[1], women, and disadvantaged[2] – based on complex relationships of gender, wealth, and relative position of the group to uncover any variations in their perceptions as a result of deep rooted social divisions in the society [34]. This grouping was relevant for this study as women and disadvantaged users are hesitant to put forward their opinions if assessed together with the elite users due to socio-cultural factors [2, 23]. Using these methodologies, data were collected through group interviews and secondary sources. Secondary sources include management plan of the community forests, constitution of the forest user groups, and national community forestry databases of Nepal.

A questionnaire (survey instrument) was designed for group interview that consists of eight main concepts related to community forestry processes, impacts, and issues. Each concept was assessed using multiple indicators. This article is focused only on environmental impacts of community forestry practice, so only two relevant concepts – forest product supply and local environmental conditions – are analyzed in this paper. We used simple but user friendly indicators and response choice formats for environmental impacts. Each indicator has three response choices in the form of a rating scale along increased-decreased continuum, which are simple, easily differentiated, and familiar to the users. In the rating scale 1 represent decreased/worsen, 2 represents same as before, and 3 represents increased/ improved for a particular indicator question. Table 2 presents the environmental impact related concepts, indicators, and rating scale formats.

For group interview, seven key respondents belonging to women and disadvantaged groups were selected in consultation with a local forest ranger, who worked with the eight community forests in past 3 years and is able to provide a reasonable mix of members to capture diverse opinions within the women or disadvantaged groups from each community forests. Respondents for elite group were the members of forest user group committee only, the executive body of forest users that looks after day to day activities of community forests. If any women or disadvantaged group members were in

1 The group of people who belong to the upper profile in society as a result of one or more of the following: caste system, economic status, and exposure to information and resources.

2 The occupational group of people who are generally in the lower profile in society due to either their economic status and/or lower position in the caste system.

the committee, they were excluded while interviewing the elite group members. The composition of elite group is based on the assumption that forest user group committees are predominantly comprised of local elites.

Table 2: Environmental impacts related concepts, indicators, and response format

Concepts	Indicators/questions	Response format
Forest products supply	i. Fuel wood	1=decrease
	ii. Fodder	2=same as before
	iii. Timber	3=increase
	iv. Leaf litter	
	v. Agricultural implements (e.g., plough, yoke)	
	vi. Non timber forest products	
Local environmental condition	i. Regeneration in forests	1=decrease
	ii. Soil erosion and land slides within forests	2=same as before
	iii. Water volumes in springs and streams running through forests	3=increase
	iv. Water availability in dry period	
	v. Wildlife species and abundance	
	vi. Forest greenery	

Forest ranger facilitated all of the 22 group interviews in November and December of 2002. Toplang and Gurdum CFs have homogeneous users and no disadvantaged group interview held in these community forests. During the interview process, a cover letter in Nepali language was supplied to each social group describing the purpose and scope of the study. Environmental impact indicators based survey questions were asked to each social group and the response choices were explained. The responses to each indicator are recorded once the social group members discuss the questions and probable responses among themselves and arrive to a consensus. We emphasized group consensus for each indicator question, partly because it has to represent the view point of majority of users not participating in the interview as well and partly because community forestry itself has been practiced largely based on group consensus and efforts.

Group responses were analyzed by social groups and community forests using Statistical Package for Social Science (SPSS) [33] based on summative rating scales for each concept. The summative rating scale allows combining several indicators to measure a broader latent concept with an underlying quantitative measurement continuum. Summative scale is more reliable than single indicator because it can thoroughly describe the complex and latent concept, whereas a single indicator oversimplifies the concept [32]. In addition, a series of indicator questions measuring the same concept are more precise because respondents can accurately differentiate these indicator questions underlying a latent concept. The scale's reliability was evaluated using Cronbach alpha for each of the environmental impact concepts.

Considering summated score for each concept as an independent variable, one way analysis of variance (ANOVA) was used to compare the mean scores across the social groups and community forests. The summative score is the sum of rating scales of indicator questions for a concept and ranges between 6 and 18. Also, mean score comparisons were done to identify significant results across the social groups and community forests using Tukey's multiple comparison tests. Additional informal discussion with users and documentation analysis were carried out to infer the results. The management plan of the community forests, constitution, and meeting minutes were reviewed to get insights on past decisions and operating modality of each forest.

4 RESULTS AND DISCUSSION

4.1 RELIABILITY TEST FOR CONCEPTS

Reliability is described as the ratio of true to observed variance, higher the true variance compared to observed variance, greater the reliability of the measures used to gauge a particular concept. We tested internal-consistency reliability of each indicator representing a common concept using Cronbach alpha (Spector 1992). Cronbach alpha assess internal-consistency reliability of indicators of a concept based on summated rating scale used in survey questionnaire. The Cronbach alpha could range from 0 to 1 with higher values indicating better representation of underlying latent concept by the indicators chosen. For forest products supply and local environmental conditions the alpha values are 0.8493 and 0.7676, respectively.

4.2 MEAN SCORES OF ENVIRONMENTAL INDICATORS

Perceived mean scores for each indicator question are presented in bar charts for each of the concept (Figure 2 and 3). Mean scores for each indicator suggest that both forest product supply and local environmental impacts have been increased or improved after the implementation of community forestry as all the responses are well above 2 (i.e. same as before). Mean score for forest product supply indicators ranges between 2.86 to 3 with 3 for fuel wood and fodder supply followed by 2.95 for leaf litter, 2.91 for timber and agricultural–implements 2.91, and 2.86 for non-timber forest products (NTFP).

Similarly, the mean score for environmental impact indicators ranges between 2.59 to 3 with understory regeneration, wildlife abundance, and overall forest greenery have highest score of 3 followed by reduced erosion and landslide in forest with 2.95. Water-related indicators have relatively lower mean scores with 2.64 for water source recharge and 2.59 for increased volume of water in dry season.

Figure 2 Mean scores for forest product supply indicators (n=22)

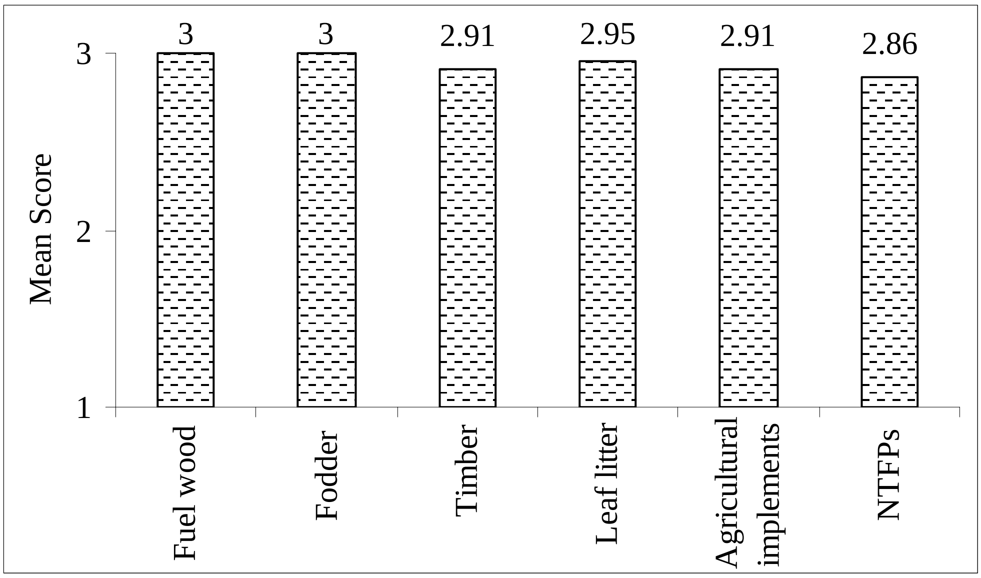
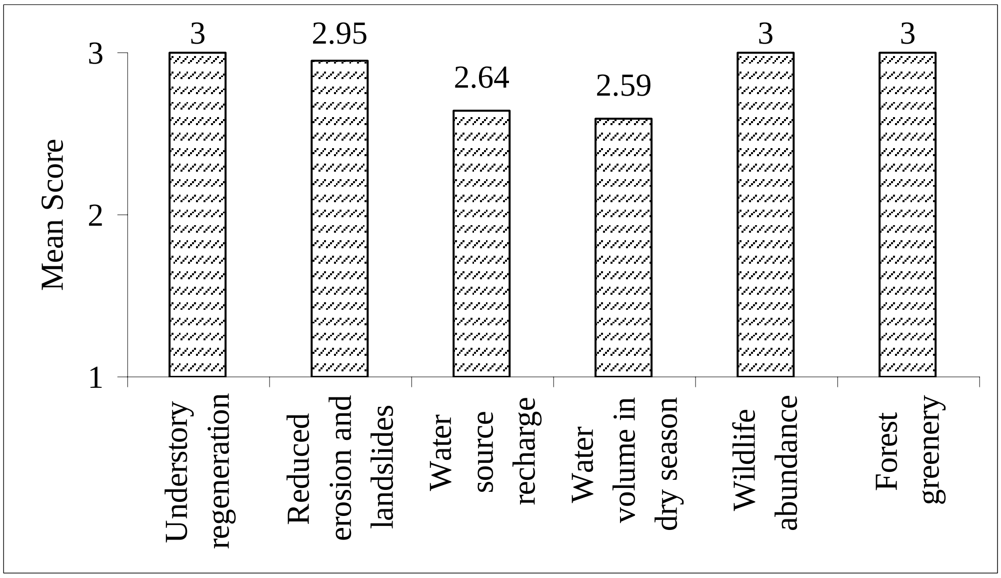


Figure 3: Mean scores for local environment indicators (n=22)



4.3 ENVIRONMENTAL IMPACTS OF COMMUNITY FORESTRY PRACTICES

Descriptive statistics of the forest user's perceptions, in the form of summated mean scores for each concept is given in Table 3. The range of mean score is 6 to 18, with 6 representing decreased or worsen and 18 representing increased or improved status of a particular concept. In fact, both environmental concepts - forest products supply and local environment - have higher summated score in the range of 15.67 to 18. The average scores for forest product supply and local environmental impacts are 17.64 and 17.18 indicating that both the forest products supply and local environmental conditions are perceived to have been improved by community forestry practices.

For forest products supply, the mean score ranges from 16.67 to 18 with smaller perceived variations among social groups than in community forests. Even though the difference is negligible, women perceived better improvement in forest product supply with mean score of 18 followed by disadvantaged group (17.50), and elites (17.38). Among community forests, the mean score is 18 for all community forests except Sasaha Jyamire (16.67) and Bagmara (16.67). The close examination of each indicator suggests that out of 22 groups interviewed, all of the groups indicated either 'improved' or 'same as before' status of forest products supply. All 22 groups indicated increased fodder and fuel wood supply while 21, 20, and 19 groups perceived increased leaf-litter, timber and agricultural implements, and NTFPs supplies, respectively, through community forestry practices. Furthermore, the ANOVA results for forest products supply suggest no variation in perceptions across the social groups (p=0.484, Table 4) and community forests (p = 0.464, Table 4).

Table 3: Mean summative scores (standard deviation) for environmental impact concepts by social groups and community forests

		Environmental impact concepts	
		Forest products supply	Local environmental condition
Social groups			
	Elites	17.38 (1.41)	17.25 (1.17)
	Women	18.00 (0.00)	17.25 (1.04)
	Disadvantaged	17.50 (1.22)	17.00 (1.10)
Community forests			
	Sasaha Jyamire	16.67 (2.31)	15.67 (0.58)^{a}
	Kankalnidevi	18.00 (0.00)	16.67 (1.15)^{ab}
	Thuloban	18.00 (0.00)	18.00 (0.00)^{b}
	Alchhidanda	18.00 (0.00)	16.00 (0.00)^{a}
	Bagmara	16.67 (1.53)	17.67 (0.58)^{b}
	Machhindranath	18.00 (0.00)	18.00 (0.00)^{b}
	Toplang	18.00 (0.00)	18.00 (0.00)^{b}
	Gurdum	18.00 (0.00)	18.00 (0.00)^{b}

Note: Same superscript (i.e. a or b) for local environmental condition across community forests indicates no significant difference in perceptions between users of these community forests at p-values 0.05 by Tukey's mean comparison test.

Our result for forest product supply is consistent with the general belief of the users and other findings [3, 34], that community forestry has improved the provisioning of the forest products to its users through the adoption of protection measures (watch man, voluntary reporting, etc.) and the end of open access situation in the forests. Furthermore, increased forest product supply implicitly refers to the improved forest conditions (i.e., increased harvestable biomass). We observed these positive impacts across all social groups and community forests we examined. Particularly, the supply of fuel wood, fodder, and leaf litters increased compared to timbers and non-timber forest products (NTFPs). Moreover, meeting minutes and forest products distribution records of community forests suggest a varying level of forest product needs expressed by different group of users. Elites expressed their need of timber products from the community forests while disadvantaged members have expressed their frequent need of fuel wood, fodder, and leaf-litter. These trends are in support of earlier studies (Malla 2001, Adhikari *et al.* 2004). One reason for this differential demand of forest products from community forests between elites and disadvantaged users is due to the availability of substitute sources for elites. Elite users also obtained these products from their private lands while the disadvantaged users solely depend on community forests for all forest products need.

Table 4: One-way ANOVA table for forest products supply impacts by social groups (a) and community forests (b)

Source of variation	Degree of Freedom	Sum of squares	Mean sum of squares	F-ratio	p-value
	(a) by social group				
Between social group	2	1.716	0.858	0.763	0.484
Within social group	19	21.375	1.125		
	(b) by community forest				
Between community forest	7	7.758	1.108	1.012	0.464
Within community forest	14	15.333	1.095		
Total	21	23.091			

For local environmental impacts of community forestry practices, the mean score varies from 15.67 to 18 with higher mean scores among social groups than among community forests (Table 5). Among social groups, the perceived mean score for women and elites is same (17.25) with a slightly lower score for disadvantaged group (17.00). Among community forests, all forests have experienced the improved status with scores ranging from 18 for Thuloban, Machhindranath, Toplang, and Gurdum to a slight lower summative score for Bagmara (17.67), Kankalnidevi (16.67), Alchhidanda (16) and Sasaha Jyamire (15.67). Examining the indicators of local environmental impacts suggests a similar trend of forest products supply (i.e., either improved or same as before) but with different frequencies. Out of the 22 groups interviewed, all of the groups indicated improved/increased status of three of the indicators, namely understory regeneration, wildlife abundance and over all forest greenery. For soil erosion/landslide incidences 21 improved responses (i.e., decreased incidences of soil erosion/landslides within community forests). For water source recharge, and water volume in water bodies during dry season, only 14 and 13 improved/increased responses, respectively.

Table 5. One-way ANOVA table for local environmental impacts by social groups (a) and community forests (b)

Source of variation	Degree of Freedom	Sum of squares	Mean sum of squares	F-ratio	p-value
	(a) by social group				
Between social group	2	0.273	0.136	0.113	0.894
Within social group	19	23	1.211		
	(b) by community forest				
Between community forest	7	19.273	2.753	9.636	0.0001
Within community forest	14	4	0.286		
Total	21	23.273			

The ANOVA results for local environmental impacts suggest that there is no difference in perceptions among the social groups (p = 0.894, Table 5). However, the environmental impacts as perceived by users across eight community forests suggest significant difference between the forests (p < 0.001, Table 5). This significance difference among community forests is further evaluated using Tukey's multiple comparison tests (see Table 3 with subscripts) to identify whether the perceived environmental impacts across community forests is similar. The results indicate that the users of Sasaha Jyamire and Alchhidanda community forests do not perceive as much an improvement in the environmental impacts than the users of all other but Kankalnidevi community forests. The users of Kankalnidevi community forest perceived the impact similar to rest of the other forests. The perceived impacts of the users of Sasaha Jyamire (mean =15.67) differ from the users of Thuloban (mean = 18, p= 0.002), Bagmara (mean =17.67, p = 0.008), Machhindranath (mean =18, p = 0.002), Toplang (mean =18, p = 0.005), and Gurdum (mean = 18, p = 0.005) community forests. Similarly, the users of Alchhidanda community forests differ from the users of Thuloban (p = 0.008), Bagmara (p = 0.03), Machhindranath (p = 0.008), Toplang (p = 0.018), and Gurdum (p = 0.018) in their perceptions of local environmental impacts of community forestry practices.

The different level of local environmental impacts perceived by users of Alchhidanda and Sasaha Jyamire are stemmed from their perception on water source recharge (improved water yield) and water volumes in water bodies during the dry season. Alchhidanda community forest emerged virtually from barren land and the users have perceived the same condition in water related issues as before the practice of community forestry. Even though Sasaha Jyamire community forest is composed of natural forests, the users are indifferent in terms of water issues before or after the implementation of community forestry. Some earlier studies have indicated positive local environmental impacts as a result of community forestry practices. Church [9] reported increased tree growth and regeneration, improved ground cover, increased soil moisture retention, reduced soil erosion, and better wildlife habitat in community forests. Similarly, other studies indicated improved environmental outcomes of community forestry practices including regeneration in degraded forests [2, 17, 25], slowing down of the deforestation rate [27], improvement in forest and natural environmental conditions [8, 13, 34, 37], increased water yield [4, 15], and increased wildlife (monkey) population [15]. In line of earlier findings by Fisher et al. (2002), in this study, we find increased numbers of leopard, common jungle fowl, partridge, deer, pheasants, and monkey in community forests as a result of improved environmental conditions reported by forest users. For example, the following qualitative observations made by forest users during interview processes and informal discussion further highlights the impacts of community forestry practices on enhanced forest product supply and improved local environmental conditions.

“The forest land was totally degraded and only shrubs were remaining, after the implementation of the program forest started to recover and we now are able to harvest small poles from the forest.” - Ram Chandra Adhikari (elite user - Alchhidanda CF)

“After the implementation of community forestry, our forest becomes dense we get more fodder for livestock from the forest but also we started to get trouble from wild animals (jackal and some times leopard).” - Krishna Bahadur Sunar (disadvantaged user - Thuloban CF)

“Our forest is started from degraded land; we never saw any wild animals roaming around the forest at that time, but now we can occasionally see pheasants and deer in the forest.” - Gyanu Tamang (woman - Toplang CF)

5 CONCLUSIONS

In the context of Nepalese hills, community forestry practices have been successful in achieving one of its initial objectives of improving the deteriorating hill environments.

Examining eight community forests from Dhading, Nepal, we found that different groups of users within community forests perceive similar impacts of community forestry practices in its role to provide forest products supply and to improve local environmental conditions. All users perceived increased supply of forest products such as fuel wood, fodder, and leaf-litter from community forests due to the shift of forest management responsibility from government to local users and the end of open access condition in those forests. Similarly, users' perceptions regarding local environmental impacts of community forestry practices also confirm the improved understory regeneration, reduced incidences of soil erosion and landslides within forests, improved water source recharge and increased water volume in water bodies in dry season (winter and spring), increased number of wildlife in the forests, and improved forest greenery (density). However, not all community forests are equal in terms of their composition and initial conditions, those started from degraded and denuded hills have not yet fully experienced all the beneficial environmental impacts of community forestry.

In contrary to 1970s and 1980s forbidding predictions of Nepalese hill environments, community forestry brought a positive change in the local environment and slowed, if not stopped, the accelerating rate of deforestation and denudation in the hills of Nepal. Forestry policy makers should internalize the environmental conservation benefits of community forestry in future policy making, especially when formulating 'reducing emission from deforestation and forest degradation' framework for Nepal.

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Small scale forestry equipment – what makes sense?

Robert T. Parker[1]

Abstract

All across the United States, non-industrial woodland owners are increasingly interested in small scale forestry equipment for harvesting products, reducing fuel loads, manufacturing wood products, and other management tasks. But it is difficult for them to find reliable, research-based information to evaluate equipment suitability for their management goals, site and forest conditions, financial ability and operational skill. This paper will describe a collaborative effort to meet this need undertaken by foresters from the Oregon and Idaho Extension Services and the National Network of Forestry Practitioners. The collaboration goal is to create a series of publications, using both traditional and web-based delivery technologies that will carefully examine: the various categories of small-scale equipment; their capabilities and limitations; key characteristics for a small-scale system; purchase, operating and maintenance costs; economic feasibility; necessary landowner qualifications; health and safety considerations; and ecological benefits. The goal for these publications is to help forestland owners make effective decisions for acquiring small-scale forestry equipment to meet their needs. Because equipment technologies change rapidly, an additional goal will be to provide a dynamic, rather than static, web-based information source that can be interactively queried and updated by forest owners equipment manufacturers, and the authors.

Key words: small scale forestry, equipment
FDC: 682+307(73)=111

1 INTRODUCTION

Many forest owners enjoy doing some of their own forest management work for the experience of working outdoors and personally handcrafting the woodlands to carefully achieve their unique goals and objectives. Activities can range from pruning, thinning, treating slash, biomass removal, commercial round wood harvesting, manufacturing wood products, and more.

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These “do it yourself” woodland owners are often interested in taking advantage of the numerous small-scale forestry technologies that meet their budgetary and operational skill capacities. However, determining what equipment choices make sense for their particular goals, site, and forest conditions can be challenging. Recognizing this need, foresters from the Oregon State University Extension Service, the Idaho Extension Service and the National Network of Forest Practitioners decided to collaborate on creating a series of publications, using both traditional and web-based delivery technologies that will carefully examine:

- Establishing an appropriate context for selecting small-scale forestry equipment (SSFE)
- The new thinking and skills SSFE may require
- Opportunities and challenges of SSFE
- Key characteristics for a small-scale system
- Health and Safety considerations
- The categories of SSFE
- Their capabilities and limitations
- Purchase, operating and maintenance costs
- Economic feasibility
- Necessary landowner qualifications
- Health and safety considerations
- Ecological benefits

The goal of our proposed publication series is to provide comprehensive, science-based information to help individual forestland owners, forest cooperatives, and contractors make decisions about acquiring the small-scale forestry equipment that will best meet their overall needs and objectives. Our outreach effort will focus on a participatory publishing model that includes audience involvement through web-based interactive tools (Web 2.0), as well as traditional publication formats (O’Reilly 2005). This initial paper discusses the importance of developing an appropriate decision-making framework, and then moves to a brief discussion of small-scale equipment options that have the widest appeal for individual forestland owners.

2 WHAT IS SMALL-SCALE FORESTRY EQUIPMENT?

The term small scale forestry equipment or technology can be applied to various devices and methods used to harvest wood products, make forest improvements, or process wood that generally are smaller, less expensive and less productive than traditional 'industrial scale' forest equipment. In additional to lower purchase and operating costs, there are a number of benefits to smaller scale technologies, including flexibility, portability between work sites, maneuverability in tight stands and potentially less impacts to trees and the site (Updegraff and Blinn 2000). Some of the more popular kinds of small-scale equipment in use today are farm tractors modified with skidding winches or processors, all-terrain vehicles (ATVs), and mini-skidders/forwarders.

Image 1: Farm tractor with winch.

Image 2: ATV with log trailer.

Many of these technologies are not necessarily new. Logging with horses and smaller crawler tractors has long been a part of forestry in the U.S., though they are not as common now as in the past. For many years, small scale technologies have been used more extensively in Europe and to a lesser extent in Canada – particularly where there are markets for small logs (e.g. pulp logs), or where forest ownership is strongly comingled with farm ownership. In the U.S.A., family forest parcel sizes on average are getting smaller and markets for small diameter timber are improving, so the interest in small scale technology is growing rapidly.

3 PART 1: GENERAL CONSIDERATIONS

3.1 ESTABLISHING CONTEXT: MAXIMIZING VALUE.

Prospective small-scale equipment purchasers need to evaluate specifics such as purchase and operating costs, performance capabilities and requisite operator skills, which in itself is a complex process due to the myriad choices available and relative scarcity of research-based data with which to base objective comparisons. Specific tasks and pieces of equipment should not be considered in isolation. Instead, they should be evaluated within a framework integrating the full range of proposed forest management activities with the tools and personnel options that will maximize ***value***, as determined by where the individual's priorities fall within the spectrum of ecological, social, and economic goals (Havel 2009, pers. com.). One forestland owner's priorities within that spectrum will likely be very different from another, potentially leading to different equipment choices for similar tasks.

3.2 SMALL SCALE MAY REQUIRE NEW WAYS OF THINKING.

Small-scale logging technologies often require some changes in the thinking of forest operators who have been immersed in larger scale technologies. "Traditional" large-scale operators may dismiss small-scale technology because they can't "get the production" as measured in volume of wood produced each day (Updegraff and Blinn 2000). Because small scale technologies are generally less expensive, SSFE contractors do not have to produce as much product volume to make their payments. If operators determine their bottom line accordingly, small scale technology can be economically competitive, particularly for people who are logging part-time, working on smaller parcels, or working on specialty products such as cedar products or firewood. Tree service contractors are more accustomed to budgeting their work this way and working with clients who privilege aesthetics over production and are willing to pay for it. They have been among the first in the Northwest U.S.A. to adopt small-scale forest technologies. Many tree service firms who are implementing contracts to reduce fire risk around wildland urban interface homes are using small scale forestry technologies to branch into logging and performing other forestry services such as pre-commercial thinning and pruning.

3.3 SMALL SCALE MAY REQUIRE NEW SKILLS

More training and skill is usually required to become efficient with small-scale forestry technologies (Russell and Mortimer 2005). SSFE tend to be small, light-weight and low horsepower machines so operators have to rely on finesse rather than brute force to move loads. Good planning, layout and intelligently capitalizing on the strengths of SSFE flexibility and maneuverability while avoiding its size and horsepower limitations is essential to achieve satisfactory results (Kockx et al. 1993).

Specialized ergonomic techniques are important with small scale technologies because some require additional manual labor and operators need to work smarter to prevent physical injury.

In addition to learning how to use small scale forestry tools effectively, forest owners who are considering doing all or some of their own logging or thinning would be well advised to receive training in chainsaw operation and felling safety. In the US, many states have organizations or agencies that offer logging safety classes, and training publications and videos are also available.

3.4 OPPORTUNITIES AND CONSTRAINTS - ARE THEY WORTH IT?

There are a number of reasons for the growing interest in small-scale equipment. The size of timber tracts is trending downwards and equipment cost-effectiveness is strongly tied to tract size – smaller tracts lend themselves to small equipment which can optimize at low levels of productivity (Cubbage 1983, Wilhoit and Rummer 1999). And, small equipment is less expensive to move in and out. Mixed-species and uneven-age management regimes are becoming more common, as is the trend towards small-diameter second growth trees. All of these factors suggest a need for smaller, less expensive and more flexible systems that can achieve the multiple forest management, environmental and economic goals that are a high priority for woodland owners.

But there are trade-offs. For example, large-scale equipment machines are often designed with numerous safety and ergonomic features not found with SSFE and as a result, operator health and safety may be compromised. While small-scale machines are capable of doing a considerable amount of work, they often require a high level of operator skill to work efficiently. Small-scale equipment is often perceived as more environmentally friendly but few studies have quantified stand and site impacts (Mauri 1995). Forestland owners should keep in mind that equipment must be adequate to perform the desired tasks and good operational planning is needed to minimize impacts. The small, relatively narrow tires on wheeled equipment can result in more rutting, particularly when the ground is soft (Burt et al. 1982). Their small size and maneuverability lend towards less tree stem damage but a more diminutive size also means lower load capacity and shorter skidding distances which can easily translate into more access roads, skid trails, more trips over skid trails, and thus more site impacts. Small-scale equipment is generally less productive and this is often considered a major obstacle to adoption, but in some situations the small size and maneuverability can outweigh other limitations.

Often, the advantages and disadvantages of small-scale equipment are weighed in contrast to large-scale machines, but the comparison isn’t always appropriate because the given tasks may not revolve around sawlog or pulp production. Many woodland owners are concerned more with visual aesthetics and making their homes and property more ‘fire safe’ by reducing the fuel loading through thinning trees and/or removing brush and slash. In these situations, costs are more a function of area than volume and sensitivity to site impacts is high.

Woodland owners may not have the same economic motivation as do contractors, who are trying to make their living in the woods. Many people simply enjoy doing their own work on their own property at their own pace and perhaps taking more time and paying more attention to fine detail to express their deep pride of ownership. Safety, task flexibility and ease of use may be much higher priorities than purely economical.

3.5 IMPORTANT CHARACTERISTICS OF A SMALL-SCALE SYSTEM.

A forestland owner's specific goals and objectives, combined with the existing forest and site conditions, determine appropriate equipment and methodologies for managing woodland properties. Within that context, there are some general criteria for defining characteristics of an effective small-scale forestry system.

Purchase price is an important consideration and although cost is usually a top priority, it's still important to buy high quality equipment that will do the desired work, do it well, and be solid and reliable. Sometimes savings through a lower purchase price is eventually lost due to high repair costs and down time, not to mention unneeded frustration, so evaluating total costs involves more than the initial purchase price (Russell and Mortimer 2005).

Costs:

- Low capital costs. Total cost is important, but the real question is what equipment will completely satisfy all the performance requirements (Vickers 1999, Wilhoit and Rummer 1999). Will it be used for multi-tasking, such as both farm and woodlands? Can one machine outfitted with various attachments do all the needed tasks or would multiple machines be more practical? Once the functions and equipment types are identified, who – and where - are the distributors? If foreign-made, how good is the service and parts availability? Are they honest and reliable? What kind of warranty do they offer?
- Low transportation costs. If it will be necessary to move the equipment from place to place, can the machine be hauled readily or will it require the acquisition of a trailer? Transportation can contribute substantially to overall ownership costs.
- Low overhead costs. Will you be able to operate the machinery or will it be necessary to hire an operator? If you have to hire someone, what level of skills do they need and how much will they have to be paid? What insurance or storage costs might be incurred?

- Low operational costs. How much gas or diesel will it burn? What about filters, belts and other frequently replaced parts?
- Maneuverability. If you're thinning and the leave trees are closely spaced, it will be valuable to have a machine that can move itself and its load quickly and efficiently while not damaging residual trees. What about topography? Steep slopes, marshy areas and fragile soils will often require different equipment than those operating on flat, even terrain.
- Minimal access requirements. Moving full-scale equipment requires roads and bridges suitable for trucks with an 80,000 lb load capacity. Many woodland owners' roads are more suited for lighter traffic: narrow widths, tighter turns, steeper grades and native material surfacing. Will you be able to haul your equipment to the job site or will you have to drive the machines to the site?
- Ability to optimize load capacity quickly.
- Able to deal with small diameter or irregular material. Traditional, full-scale equipment is designed to quickly move large volumes of wood regardless of diameter as in the case of a grapple skidder moving pre-bunched small trees. But woodland owners often need to handle wood too small or too irregularly shaped for the bigger machines. A close evaluation of the material is needed to be sure you match the right machine to the job requirements.
- Powerful enough to handle a wide range of material sizes (Wilhoit and Rummer 1999). One of the advantages of small-scale equipment is the machines often have low-horsepower engines with low fuel consumption costs. But, woodlands typically contain a wide range of tree sizes making for an ineffective operation if your equipment can only handle part of the job.
- Good parts and service availability. Scandinavia and Canada have been developing and using small-scale equipment for quite some time providing much of what's available on the market. Some companies have a strong presence in the USA with well-established dealer networks, but with other manufacturers parts might have to be shipped, involving expense and time delays. Also, if a dealer network doesn't exist, getting competent service work may be a challenge.
- Adequate safety features. What constitutes "adequate" might depend on your perception of risk, as well as the specific type, make and model of machinery in question. For example, if deemed necessary to have a roll bar – such as a farm

tractor – make sure one is installed. If it's an ATV, foot guards for the operator is a good investment.

- Reliable, well-proven technology. It's probably a good idea to utilize technology that has proved to be reliable in the operating environment you're considering. There's always some interesting new 'whiz-bang' invention hitting the market, but it might be better to let someone else do the field testing.
- Easy learning curve on how to operate. A professional operator can likely adapt readily to new equipment, but if you are not a skilled operator and/or will use the equipment intermittently, ease of operation is an attractive alternative. Additional training might be considered, but it does constitute additional time and expense.
- Interchangeability of attachments. The ability to expand a machine's usefulness by using a variety of optional accessories is a big selling point for using machines such as farm tractors. A relatively small capital cost can pay big dividends in terms of functionality. Available attachments are part of the equation, but you also have to look at how easy it is to switch from one to another. Some might take a few minutes while others may be a major project.

3.6 HEALTH AND SAFETY

Operating equipment in the woods is inherently dangerous and a thoughtful, safety-conscious attitude is key to staying safe on the job (Shaffer 1992). The equipment you choose to buy should come equipped with the safety features relevant for that type of machine, whether standard from the factory or added after purchase. Never take an unnecessary risk and never try to just 'get by'. Always expect the unexpected because in the woods, the unexpected occurs regularly. If you're not diligent and prepared, the chance of injury increases substantially.

Safety standards that are the norm for larger equipment are often lacking in most small scale forestry systems and is one of the reasons contractors desiring to use small-scale technologies may run into problems with OSHA and obtaining liability insurance (Updegraff and Blinn 2000). The necessary safety equipment is a function of the specific type of equipment in question, but in general be sure to use roll bars, screens or windshields for impact protection, counterbalance weights and liquid filled tires for stability, or whatever other kind of safety equipment is needed for safe operation.

Most industrial equipment is designed for use on level ground which makes it poorly equipped to operate safely on steep and/or rough slopes typical on forested lands. But even equipment built for forest operations must be operated within the design limits, which may require specialized training to appreciate and comply with those limits, whether the operator is a hobby tree farmer or professional contractor.

Even if you are a careful, safety-conscious operator and avail yourself of all the appropriate safety equipment, operating small-scale equipment poses an additional, and serious threat. Repetitive Stress Injuries (RSI) are common in modern industry and even though much of the large-scale equipment has been designed with features such as shock absorption, seating position, and ergonomically designed control systems to minimize the risk of RSI, it is still a problem (Bjerkelund 1994, Sennbled 1995). RSI problems are characterized by injuries to the neck, shoulder, arms, hands and cervical spine and a variety of health disorders involving the digestive tract, reproductive organs, circulatory system and nervous systems.

Studies have shown that these health problems are exacerbated by long working hours, rough terrain, driving speed and the design of the vehicle. Forestry equipment undergoes tremendous stresses and can transfer those vibration and shock stresses to the operator through the chassis to the feet, through the seat to the buttocks and back and through the controls to the hands.

Years of intensive use are not required to be at risk – even very light, short-cycle movements of hands and arms may cause RSI symptoms. RSI problems are insidious in that the damage may not be evident immediately, but only appear much later, making treatment difficult or inadequate such that the operator is left with a lifetime of discomfort and physical compromise.

RSI problems can be minimized by making sure you know how to operate the equipment properly and don't overdo it with long hours(Axelsson and Ponten 1990). Take breaks from running equipment by trading jobs or switching between running a machine and performing other chores. Avoid excessive speed and harsh maneuvering that slams the machine – and you – around needlessly (Kirk et al.1997).

4 PART 2: SMALL SCALE FORESTRY EQUIPMENT OPTIONS

4.1 CATEGORIES OF SMALL SCALE EQUIPMENT

Small scale forestry technologies are used for a range of activities, from moving logs, to creating biomass fuel, to forest fuel reduction. There is also a wide range in capability, technological sophistication, cost and required operator skills. The small-scale equipment considered here are the more commonly used options that have broad appeal and application based on their cost, practicality, flexibility and ease of use – hand-operated tools, farm tractors and ATVs. The categories are described individually, but small-scale operations can involve multiple categories of equipment in various combinations, depending on the circumstances and goals involved.

4.2 HAND-OPERATED TOOLS.

The term small-scale forestry equipment suggests small mechanized pieces of equipment, but there are a number of readily available, low-cost, simple to use hand tools that can greatly reduce a landowner's workload and increase safety. They can be used individually or in combination with other pieces of equipment.

4.3 CHAINSAW

Chainsaws are probably the most ubiquitous forestry tool in use today and perhaps because they are so popular, their familiarity sometimes leads to a lackadaisical attitude and a high number of accidents. Operators should always wear gloves, boots, hard hats, eye & ear protection, and safety chaps – yet far too few people use appropriate safety gear or seek adequate training.

4.4 PRUNERS, LOPPERS AND SHEARS

Good quality tools are not expensive and easy to obtain. Pruning trees improves aesthetics, limits fire ladder fuels and can increase wood quality. Hand pruning is hard work but offers significant benefits that address multiple management goals. Very little training is needed to use these tools, although some education is required as poor pruning techniques can damage trees. Information on correct pruning techniques is readily available through the offices of University Extension programs, state agencies and websites.

4.5 HAND TONGS OR LOG CARRIERS

The physical strain involved in moving even a small chunk of log can be difficult and awkward and can put considerable strain on the back. A tool as simple and inexpensive as small set of hand tongs that can be carried in a pocket can simplify the task with a minimum of workload and stress.

Image 3. Hand operated mini-arch.

4.6 MINI-ARC

Large, heavy and awkward loads can be readily moved by hand with an inexpensive hand-operated mini-arch. Forestland owners and tree service contractors often work on small areas or limited scope tasks that are impractical for larger, less maneuverable and more expensive mechanized pieces of equipment.

4.7 CHAINSAW POWERED CAPSTAN WINCH.

Many small-scale equipment options are advantageous in that they are inexpensive add-ons to equipment woodland owners may already possesses, greatly increasing the overall utility of the equipment. The powered capstan is a good case in point. When load weight and size, distance, terrain or operator physical ability limit use of a hand tool such as the hand-operated mini-arch, a capstan winch (often used in combination with snatch blocks) can readily move loads at low cost.

Image 4. Chainsaw powered capstan winch.

4.8 SKIDDING CONE

Dragging even a small log across the ground creates substantial pulling resistance and can cause undesirable rutting and soil disturbance. A skidding cone is a very effective and low cost alternative.

Image 5. Skidding cone.

4.9 LOG JACK AND PEAVY HOOK

A log jack and peavey hook can be quite handy for readily re-positioning a log that might be difficult or impossible to do by hand and it use also reduces the risk of over-exertion and back injury.

4.10 FARM TRACTOR-BASED SYSTEMS.

Farm tractors are the most popular small scale machines used by forest owners in the U.S. because they are often less expensive and easier to obtain parts for than machines designed exclusively for harvesting. They can be used for a variety of non-forestry tasks and for forestland owners who also own agricultural lands, this is a substantial benefit Hoffman and Blumenstock . Some tractors are designed specifically for forestry applications while standard farm tractors are not and must be modified to hold up to the high stress of woods operations and the cost of these modifications must be taken into account when considering tractors. There are numerous attachments designed specifically for farm tractors, such as winches (the most popular), grapple loaders, and log processors (Nilsson 1982, Sennblad 1995, Johansson 1997).

Farm tractors are popular for the simple reason that many woodland owners already own one and use it for other tasks. The addition of an accessory such as a skidding winch greatly expands the functionality of the machine and provides much needed versatility and cost effectiveness. Not surprisingly, skidding logs with a tractor, in combination with chainsaw felling, is probably the most common small-scale system used in the U.S.

Farm tractors can be modified to perform such tasks as:

Skidding

Forwarding

Cable winching

Loading logs

Fork lift

Processing logs

And chipping

Image 6. Tractor with processor attachment.

Tractors are a versatile tool and adaptable to many forestry jobs, but most were not designed to work in a forestry environment and may require substantial modification to be fully functional and hold up to the tremendous stresses. Uneven ground, the presence of logs, wood chunks, stumps, rocks and other obstacles can really take a toll on machinery and will likely shorten the useful life of a tractor, even when modified appropriately. Tractors built specifically for forestry work tend to be more expensive, but have the benefit of being built for the intended work and do not require substantial modifications.

If a tractor is not a purpose-built machine, these changes should be considered (Nilsson 1992), Shaffer 1992):

Add a roll bar! Most tractors are built for flat ground and are not stable on slopes, especially on side hills. Without a roll bar, if the tractor flips or rolls the end result will be a badly damaged tractor at best, and very likely a seriously injured operator as well.

Belly pans are essential to protect the underside of the machine from obstacles, which too often are conveniently hidden under brush or slash and are discovered when they penetrate an oil pan, causing expensive repairs, unwanted down time and the possible pollution of the soil and ground water.

Liquid-filled rear tires add weight, increasing stability as well as durability.

The radiator is often highly susceptible to damage from logs, sticks and branches, requiring a guard to prevent puncturing the radiator. Replacing a radiator is expensive, but a sudden loss of coolant unnoticed soon enough can mean replacing the entire engine.

Protecting your investment is a good idea and protecting the operator is an even better one. A sturdy, well-designed cab with protective screens and safety glass windows can provide a high level of comfort and keep the operator from being struck or skewered.

Tractors, like any equipment, work well only if used for the purposes and conditions they were designed for so it is important to evaluate what you want to use a tractor for and its operating environment. Tractors have limited maneuverability and are inherently unstable so should be used only on relatively flat ground (< 15-20%) and when used as a skidder, skid distances should be less than 500 feet because of economic impracticality (Updegraff and Blinn 2000).

Tractors can be equipped for skidding in several ways. The simplest system involves adding a skidding bar and plate to the tractor’s 3-point linkage. Logs are “choked” or attached by a cable or chain to the bar as shown. Using only a skidding bar is rather impractical because the tractor has to be maneuvered close to each log so in most instances, a skidding bar is used in combination with wire cranes and a cable winch system, as shown (photo). With a winch system, the cable can be pulled out to the logs and then winch them back to the tractor, allowing the tractor to remain on the desired skid trails, minimizing soil impacts. Winch systems are widely available, inexpensive and are fairly easy to attach and detach. If the terrain is difficult, the operator can drop the load and re-position the machine to a more favorable location. However, this method of skidding may not work well in thinnings with close tree spacing, and skidding often results in dirty logs that can cause problems when logs are processed into lumber, chips or other products.

Grapples are another option, especially if trees and logs have been pre-bunched, making it easy for the operator to grab and skid a load without having to climb off and on the machine. The grapple lifts the ends of the logs off the ground, reducing gouging and soil displacement and keeps the logs cleaner. Grapples are relatively inexpensive and best used on 4-wheel drive tractors with weight evenly distributed between front and rear wheels. The size of the tractor should be matched to the size of the skidding loads, and in many cases a heavy weight attachment on the front of the tractor will be needed to counterbalance the load. Grapples are better used on more gentle ground and good planning and logging design are needed for efficient, low-impact harvesting.

Equipping the tractor with a wire crane loader or a boom-arm grapple in combination with a forwarding trailer can increase efficiency as a forwarder has a very high payload capacity of 5 tons or more. Forwarding rather than skidding logs also results in lower soil impacts and cleaner logs, but can be expensive and require good harvest planning. (Photo).

With a wire-crane system, the operator attaches the cable to each log or bundle of logs then winches them to the tractor. The wire-crane system is much less expensive than others, but does require the operator working on the ground and exposing them to a higher risk of injury. It is a slower process, is less productive and requires planning and operator skill, making training a good idea.

The boom-arm grapple has the advantage of being a fast and efficient system for loading and unloading logs and eliminates the need for the operator to handle logs manually. A grapple system can off-load logs directly onto a truck and eliminating the need for a stand-alone log loader or a self-loading log truck. A big disadvantage is grapple loaders are quite expensive.

Tractors can be also be equipped with processor heads which are used to remove limbs and cut logs to desired lengths. A cable winch or a grapple loader can be used to skid logs to the processor head. These systems are fairly expensive but eliminate chainsaw work and provide increased productivity and safety. If using a grapple loader, the tractor seat should be able to rotate 180 degrees enabling the operator to face his work area and avoid twisting his body.

Single-grip harvester heads mounted on a loader boom provide the ability to fell and process a tree, but requires a large tractor, which begins to stretch the definition of small-scale forestry equipment. This system can provide a high level of productivity but are very expensive and operators must be highly trained and skilled. (photo).

Another implement that can be added to a tractor is a chipper for disposing of waste material and/or making marketable wood chips. Small-scale chipping is primarily used by tree service contractors rather than commercial chipping operations. Chippers can do a thorough job of cleaning up a site and the waste is readily loaded into a truck and transported off-site. They are fairly expensive and operators need to use caution avoid serious injury (photos).

Finally, tractors can be equipped with a fork lift for moving and stacking logs in a deck, or for handling other kinds of loads if the tractor is also used for agricultural tasks.

4.11 ATVS

All-terrain vehicles (ATVs or “four-wheelers”) enjoy wide-spread recreational and agricultural use and are also machines many forestland owners already own and can adapt to forestry work. ATVs are capable of quickly moving substantial loads over long distances with minimum site impacts. Soil impacts are minimal due to the light weight of the machine and low ground-pressure tires, particularly when used with accessories to reduce the friction of logs with the ground (e.g. skidding cones, arches, or trailers). They are limited to slopes less than 35% and are highly susceptible to roll-over on side slopes. ATVs are generally not equipped with belting or roll bars so the operator risks being thrown or crushed. If operated sensibly, safety is reasonable but even then there is the risk of repetitive stress injuries which may not become apparent immediately but only after prolonged exposure. ATVs are rugged but not purpose-built for forestry applications and may need to be modified extensively to protect both the machine and operator (Cadorette 1995).

ATVs are commonly used by farmers, ranchers and woodland owners and have become tremendously popular among recreationists. ATVs are easy to operate and readily adaptable to a wide variety of tasks. Diverse uses such as spraying weeds, hauling supplies and getting from point A to point B quickly and efficiently over rough ground make them exceptionally useful and desirable.

In spite of their small size and horsepower, ATVs are increasingly being used as log skidding machines and when used within sensible limitations can do the job well. Their individual load and volume per day production capacity is low, but that is not a high priority for most small woodland owners.

Image 7. ATV with arch.

Not all ATVs are suitable for skidding logs. The minimum requirements for a suitable machine include a 300 cc engine; integral 4-wheel drive; tracks or traction chains on the rear wheels; liquid-filled tires for extra weight; front counterweight for stability; solid front bumper; belly pan; foot guards for the operator; and a recovery winch in case the machine gets stuck.

Dragging logs directly over the ground is impractical for ATVs due to their lack of horsepower, but skidding is practical with the addition of one of several pieces of optional equipment.

Starting with the simplest and least expensive option, skidding cones slip over the front end of a log and allow it to easily slide over the ground. They are inexpensive and easy to use, but restrict the number of logs and log volume that can be skidded. (photo)

Skidding arches lift most of the weight of logs off the ground, greatly reducing pulling resistance. Several logs can be skidded at once, providing an impressive volume per turn. (photo).

Another more expensive option involves using a trailer to fully suspend the logs off the ground. There are two types of mechanisms for loading logs onto the trailer, a wire-crane loader or a hydraulic grapple loader. (photos). With the load fully carried off the ground, there is minimal soil impact and the lower pulling stress allows the ATV to transport larger loads.

One concern with ATV skidding operations is that if the arch or trailer overturns, it could overturn the ATV as well, with disastrous results for the operator. A well-designed arch carries its load with a low center of gravity, providing increased stability. The operator also has a quick release control that will immediately drop the load to the ground if safety is compromised. Forwarding trailers are less stable on slopes and side-hilling should be avoided. The bottom line is that common sense and careful evaluation of the job are requisite for conducting a safe operation.

4.12 PURPOSE-BUILT EQUIPMENT.

There are a number of pieces of equipment specifically designed and built exclusively for small-scale forestry application. Because they are purpose-designed, utility is limited to more specific functions and they lack the desirable multi-role flexibility of tractors and ATVs. The higher costs and required operator skill may also limit their use to contractors and landowners with large holdings. However, because they are specifically designed for forestry applications, their advantages may outweigh their limitations. The authors will take an in-depth look at purpose-built equipment in subsequent publications. The goal for this paper was to examine the options with the broadest range of appeal and applicability for forestland owners.

Image 8. Mini-skidder.

5 CONCLUSION

Deciding what small-scale equipment makes the most sense requires the woodland owner make a thoughtful analysis of their specific environmental, social and economic goals, the full range of proposed forest management activities, and a realistic assessment of their skill and physical ability to do the work. The costs, performance capabilities, economic feasibility and operator qualifications are important considerations but must be considered within the overall context within which the equipment will be used in order to maximize landowner value.

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Sustainable forest management plan as a planning tool for risk reduction: the case of the Brazilian semiarid

Julio Paupitz[1]

Abstract

This article discusses the importance of integrating forestry in regional planning and as part of the current environmental agendas in order to benefit rural smallholders and the poor of the vast Brazilian semi-arid region. In this region peasant forestry has quite often been postponed as a viable part of a set of options to transform social and economic conditions prevailing in this region. Aspects of land tenure and distribution together with land use are briefly analysed in order to show their relevance for the application of social forestry inclusion policies. Sustainable Forest Management (SFM) practices are still in infancy in the semi-arid region compared to the widespread application of non-sustainable production systems based on slash and burn, uncontrolled grazing and over-exploration of fuel woods. Benefits derived from Sustainable Forestry Management (SFM) practices are discussed from the perspective of natural conservation and on the basis of experimental data obtained during almost three decades. SFM systems have proved positive from economical, social and ecological perspectives and could be easily supported in the formulation of regional public policies to favour social inclusion and lessening environmental degradation. Food security, rational water use and welfare conditions that can be generated are finally pointed out as being of paramount importance to tackle sustainability at the smallholder's environs.

Key words: forest management plan, sustainability, risk reduction, Brazil
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1 INTRODUCTION

This article has the purpose of shedding some light on forestry as an opportunity for the improvement of economic and social conditions of rural smallholders and poor rural dwellers of the Brazilian semi-arid. The Brazilian semi-arid is located in the Northeast region which has experienced a development pattern marked by great social and economic inequalities, which are more visible comparatively to the more humid coastal and transition areas. The human societies of the region have contributed to the conformation of a well defined regional economy and culture within the national mosaic.

The regional development is marked by economically and socially excluding processes of human settlements since the beginning of Portuguese domination. Soon after the colonizers arrival in the 16th century large chunks of the rich coastal rain forests were destroyed. The fate of the region's rain forests continued unchanged through centuries and on its rich clay soils prospered a colonial system of large sugar cane plantation estates which privileged a slave-based economy for almost 400 years.

The Brazilian Northeast has long being characterized as a failed ground for development programs and projects. National efforts to overcome regional disparities and climatic calamities caused by cyclical droughts are known since early 18th century. Large water dams, irrigation schemes and lately, commercial agriculture projects for export have been developed, without effectively contributing to promote changes of the prevailing social and economic conditions, which are the basis of poverty and regional inequalities.

Often, politicians have claimed the importance of implementing public policies for granting land distribution, educational reforms and massive public investments in health and sanitation as instruments to revert the basis of poverty. In this context, forestry within development projects and in the design of public policies is seldom discussed by public planners of this vast Brazilian region.

In spite of huge national efforts for arresting deforestation and environmental degradation and the establishment of nature conservation units, sustainable forest production is not equated with its potential contribution to the regional economy and in particular as a source of income for thousands of farmers. Sustainable forest management as a planning tool has only timidly been incorporated by forestry institutions. The positive message resulting from many successful experiences pinpointing the region has not yet been transferred to farmers and the rural dweller, explaining forestry as a sound way to fight poverty and protect nature.

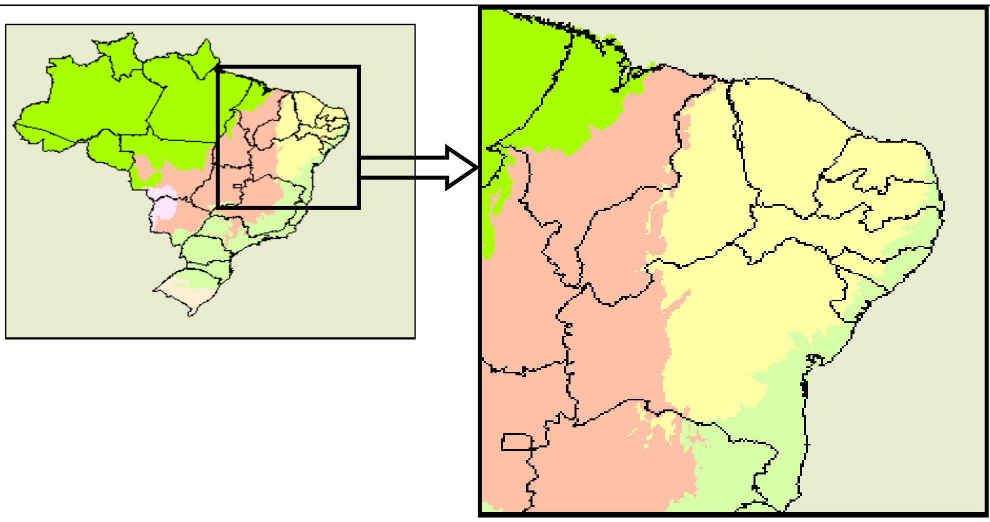
The broad perspective forest production is still missing in the environmental agendas of the Brazilian semi-arid; in spite of its pervasive nature in the economy and culture of the region. There are few signs of its participation in strategic planning proposals or in the formulation of public policies, land use planning and conservation in general. In this context, the rural household and the peasant are also forgotten as essential. The first, for its role as a production unit and the second, for his recognized management expertise in guaranteeing the livelihood of his family and enhancing sustainable use of a social and natural capital under particularly harsh ecologic and economic conditions. Forestry, agriculture, cattle ranching and cottage industries are all part of a wide set of options falling under a potentially sustainable household under the responsibility of the peasant, who can be a formidable ally in overcoming environmental problems and, a key element for a new regional development scenario.

2 HIGHLIGHTS OF THE BRAZILIAN SEMI-ARID

The Brazilian semi-arid region is inserted within the Northeastern region that has an area of 1,55 million square kilometers, 9 federal states and a population of 51,2 million of inhabitants. It is an impoverished part of the country presenting development indicators below national averages (IBGE, 2007). The semi-arid portions of the northeast have a population of 39 million inhabitants and contain the *Caatinga* Biome. The Brazilian semi-arid is considered to house the world's highest human concentration for a semi-arid region Ab'Saber (2007).

The figure below shows the insertion of Brazil's semi-arid at the Northeastern region.

Figure 1: Caatinga Biome and its insertion in Brazil's Northeast region



Source: IBGE (2005)

The *Caatinga* Biome is represented in yellow, on its eastern borders; the Biome Mata Atlantica is presented in light green. On its Western flanks runs the Biome Cerrado, characterised by the savanna type of vegetation.

The *Caatinga* biome embraces over 844 thousand Km^2, almost 10% of the Brazilian territory and larger than France and the UK together. The ecologic diversity of this biome is high and it is the least researched. It is the recognized home of more than 1900 flora and fauna species out of which 320 are considered endemic. A harsh ecology and intense human activity have not prevented the region to lodge a high level of biodiversity. Many of the region's species are only found within the biome's boundaries, however some of the floristic formations belong also to distant geographies like the Argentinean Chaco and semi arid areas of Bolivia. Comments about the natural dispersion and the phenology of *Amburana cearensis* were made by Flinta (1960) in South American semi-arid regions. The semi-arid areas of Brazil contain a diverse mosaic of ecosystems, their transition patches (ecotones) in the northeastern parts of the country.

The landscape is carved up by intermittent rivers which remain dry most of the year, the rain season is short. Terrain is usually rugged, composed by shallow and stony soils. The vegetation is xerophytic, open with deciduous trees and shrubs endowed with well adapted small and thick leaves and roots capable of standing long dry periods of 8-9 months.

Scarce and irregular rains is a current climatic phenomena throughout the region and seasonal droughts occur over large land extensions. Annual precipitation is often below 800 mm and average temperatures between 23 and 27^0C, water deficits are common. Crystalline soil structure prevents water infiltration over large areas, poor soils are common and the vegetation is composed of thorny and twisted shrubs and trees.

European settlers after 1500 occupied most of the coastal fringes which fell prey to the over logging of the once praised reserves of "pau-brasil" *(Caesalpinia echinata)*[2] used in Europe as a source of dyes for the textile industry. Over a relatively short period of time, the pau-brasil log trade disappeared due to the scarcity of the wood along the Brazilian coasts (Dean, 1997). Alongside this process the sugar cane production was also established in the region with devastating consequences on the natural rain forests of the region.

Somehow the rapid expansion of colonial settlements in the humid coastal areas saved the forests of the semi-arid from completely destroying the dryer areas of the Northeast. This is in part explained by the fact that by that time these areas could not offer more

2 Pau-brasil: Brazil redwood

profitable products than sugar, which was easily produced in the coast. By mid 17th century extensive cattle production spearheaded the economic life in the hinterlands of Brazilian northeast. Wood and non-wood forest products of the *Caatinga* helped to sustain the economy of the Sertão[3]. As such forest products were widely used to make poles and stakes for housing and corrals, tanning of raw leather for garments and other work utensils, food, medicines, dyeing materials, fodder and so on.

Broadly, land ownership and distribution are recognized as conflicting issues in Brazilian society acquiring more relevance in the dry regions of Brazilian northeast. These issues are not new and have been of great importance for prominent Brazilian scholars like Furtado (1972) and Guimarães (1989). The conclusion through their studies is that large land estates, as a land tenure category belongs to an ancient and traditional social and economic order responsible for the deep regional inequalities still found today in the region. In this context, land tenure system in the region is characterized by a combination of extreme categories; smallholdings and landlessness at one side and large land estates on the other. The roots of the phenomenon can be traced back to the time of Brazil's first Land Law, the *Lei Imperial de Terras* of 1850, issued after the national independence. The law did not promote changes in favour of the vast majority of the population. On the contrary, it precluded the emergence of a social class of farmers made up of the native Indians, immigrants and freed slaves, who were not given an other option than to sell their labour to large land owners or *"latifundários"*[4] (Mares, 2003).

3 SMALLHOLDING AGRICULTURE AND LAND USE

Agriculture and cattle husbandry are the pillars of the economy of the semi-arid and have been marked by few technological advances. Crop productivity levels remain low and lie behind other Brazilian regions. The social and organizational rural culture is still tainted by archaic production arrangements such as *"parcerias[5]"*, which until quite recently have been a widespread practice.

Subsistence agriculture is the basis of small farming, with cassava, maize and beans as main crops usually cultivated in lowland depressions called *"brejos"* characterized for their deeper soils and a higher moisture content (Cenarios Da Caatinga, 2004). Permanent rain fed agriculture is responsible for most subsistence crops, which are cultivated on alluvial soils and represent around 8% of the total arable land of the region (Campello, 2006). Fallow agriculture is an important aspect of the set of peasant strategies for

3 Sertão: Backlands, generic denomination to regions of Brazil's hinterlands
4 Latifundiário: Large land estate owner
5 Parcerias: Sharecropping system

recovering soil productivity extending in some cases beyond 5-7 years. It is a common practice and also an option for farmers to cope with unpredictable climatic conditions and lack of access to modern inputs (MMA, 2005).

Husbandry of small animals is widespread and part of the household activities and the goat herd of the Northeastern is the largest of the country (IBGE, 2006). Cattle husbandry is an essential aspect of the *Caatinga* landscape and its vegetation has for centuries sustained a large animal population due to the abundance of a wide variety of palatable plant species of the Caatinga. Traditionally smallholding production has also been responsible feeding an active network of local industrial plants responsible for the transformation of cotton fiber and seeds, sisal, waxes and oils from a variety of native species.

Commercial agriculture is part of the broad scenario and has been growing through the last decades. It is heavily dependent on irrigation systems and the intensive utilisation of technical inputs. It is present in a few areas and centred on the production of export fruits, and more recently on castor beans, jathropa, soy beans and sugar cane for bio fuel production, especially in transition areas or the so called agrarian frontier.

Extensive cattle husbandry and cotton production are historically linked with soil use in the Brazilian semi-arid. Cattle have traditionally been the main activity of large landowners and the herbaceous cotton the source of cash for the peasantry. Cattle and herbaceous cotton production and the need of subsistence croplands became the combination that fostered human settlements in the semi-arid and one of the key elements of the process of regional land ownership concentration and political power (CNRBC, 2004). Under this combination many types of land use arrangements were developed. Basically large landowners rented land areas to poor farmers and landless peasants in exchange of having their land cleared of the native vegetation for the establishment of planted pastures. In return, peasants had the right to produce subsistence crops on the referred land. Oral agreements between peasants and the large landowner or *"latifundiario"* were the only guarantee for implementation of the land use arrangements. Land use and the ownership has experienced many changes through the last decades as a result of new production systems, rural immigration and other causes that are discussed ahead.

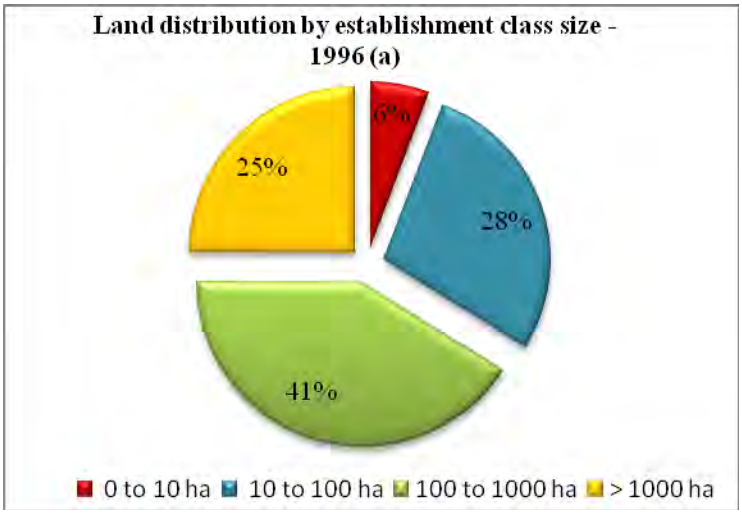
4 LAND USE AND THE RURAL ECONOMY

Updated information on land tenure and use allows understanding the evolution of land ownership and distribution of the semi-arid. The relatively recent emergence of new peasant settlements through land reform projects provides hints to the land ownership conditions in the region (INCRA, 2009). On the other hand, some factors like growing urbanization, the creation of industrial poles and the expansion of commercial agriculture influenced regional changes and have to be considered in analyzing the rural economy. An example to illustrate this situation is the evolution of herbaceous cotton, a traditional crop of the region. The culture was severely affected by a plague and areas under cultivation fell drastically from 1996 and 2006. The Brazilian census of 2006 reports a reduction of planted area in the period from 161000 ha to 42000 ha in 2006 (IBGE, 2006).

Land ownership in the Northeastern region has traditionally been under control of few rural establishments or said in another way, few land owners are responsible for most land extensions of the region. The region as a whole experienced an increase of 127 thousand farming units within a period of 10 years, the equivalent to 5% increase compared to the data shown in the Census of 1996. Agriculture land use and cattle had a slight increase in extension, expanding from 78,20 million hectares in 1996 to 78,54 million hectares in 2006. During the same period, the semi-arid showed an increase of 37 thousand new farming units or rural establishments compared to 1996 representing an increase of 5,5% in a period of 10 years, when the number of rural establishments was calculated in 1,52 million. Figure 2 shows changes in the land distribution by household classes since 1996 for the Brazilian semi-arid.

As the figure above show large properties or those with an extension above 1000 ha still hold an important share of the land in the semi-arid of Brazil. The changes between 1996 and 2006 are relatively small, for large properties in excess of 1000 ha still occupy 19% of the available land compared to the 25% the same category had by 1996. The share of land of properties in the category between 10 and 100 ha gained 7 % between 1996 and 2006. Large land estates, with extension in excess of 1000 ha sum up to 4000 units for the whole semi-arid and represent a total of 8,03 million ha. A larger number of small and middle-sized owners are observed in 2006 according to the Census data produced by IBGE. The net gain in the number of rural establishments under small and middle-sized categories, or those properties in the range of 0-100 ha is over 2 million hectares.

Figure 2: Percent land distribution by class size of rural household in 1996 (a) e 2006 (b).(Source: IBGE, 2009)



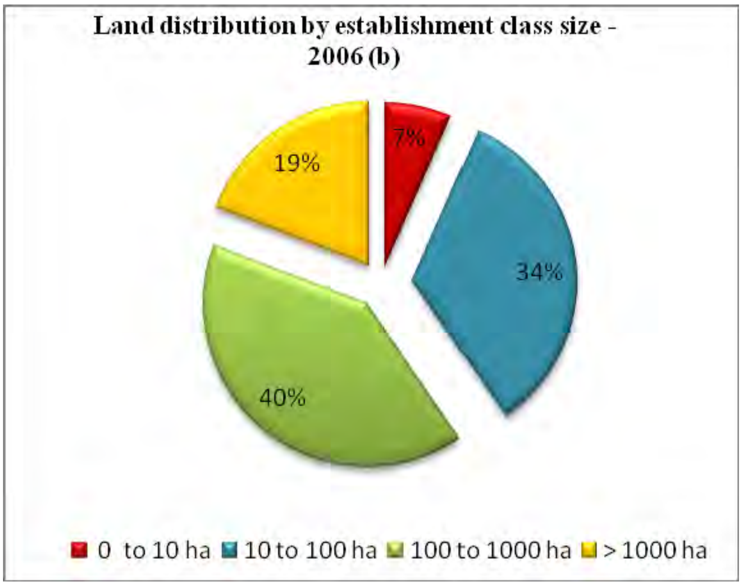


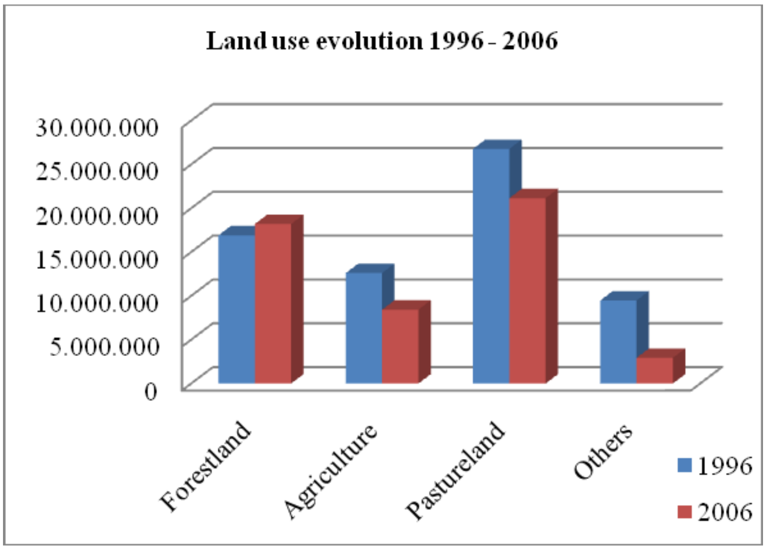
Table 3: Rural establishments' distribution by size 1996 e 2006 (Source: IBGE, 2009)

	1996				
UF	**de 0 a 10 ha**	**de 10 a 100 ha**	**de 100 a 1000 ha**	**> 1000 ha**	**Area total (ha)**
Total	**2.540.546**	**12.317.838**	**18.020.373**	**10.924.671**	**43.803.428**
UF	**2006**	**2006**	**2006**	**2006**	**2006**
Total	**de 0 a 10ha**	**de 0 a 10ha**	**de 0 a 10ha**	**de 0 a 10ha**	**de 0 a 10ha**

4.1 LAND USE CATEGORIES AND RECENT TRENDS

The evolution of broad land use categories is helpful for analyzing some of the changes affecting the agrarian economy of the region. According to IBGE, the Brazilian Census of 2006, published in 2009 important changes have occurred from 1996 to 2006 affecting the region's land use structure and production. Land categories classified as forestland increased in extension to around 1,29 million ha from 1996 to 2006 and this change represents a hike of 7,6% in favour of forests. On the other hand, the utilization of agricultural land shrunk steeply around 4,17 million ha, or 33% comparatively to 1996. On the other hand, grazing lands (natural and planted) were reduced by 30% from 1996 to 2006. The same pattern of reduction is also observed in the category "other land use", estimated by IBGE to be 5,6 million hectares between 1996 and 2006. Figure 2 shows main changes in land use classes for the semi-arid between 1996 and 2006.

Figure 3: Land use classes in Brazil's Northeast semi-arid-1996 and 2006 (Source: IBGE, 2009)



5 THE BASIS FOR SUSTAINABLE FOREST MANAGEMENT IN THE SEMI-ARID

Natural regeneration of the vegetation is one of the key issues for sustainable forest management. Evolutionary processes under the ecologic characteristics of dry areas have bestowed means to guarantee plants their continuity in next generations, in spite of prevailing conditions of water scarcity and poor soils. Chydumayo (1997), working in the forest management of the African miombo[6], under conditions very similar to the Brazilian Northeast, argues in favour of forest management of natural vegetation. The basis of the

6 Miombo: Wooded savanna, vegetation type present in Southern Parts of Africa, resembling to Caatinga and Cerrado biomes.

argument is the strength of natural regeneration of the vegetation under semi-arid conditions. In the Brazilian case, some of the characteristics of the vegetation and the availability of the forest resource corroborate the idea of sustainable utilization. The resilience of the vegetation and the diversity of the vegetation together with a high density of trees, which varies from 1000 to 5000 trees/ha, is a well known phenomena of the semi-arid. Forest regeneration in these regions follow typical semi-arid patterns with abundant sprouting from stumps, roots, seeds and branches coming just after the first rains which follow long and harsh dry periods. Otherwise, wood stocks are relatively low by the end of the felling rotation and vary according to the type of vegetation. Arboreal Caatinga forest types produce wood yielding over 300 st/ha (Fundação Araripe, 2008). Annual increments are relatively high and vary from 5 to 15 st/ha.yr.

The management of forest stands in dry areas considers the driving for competition among trees for water, differently than the conditions in more humid forests, where competition is for light. This basic difference facilitates the establishment of forest compartments through the application of coppice as a prevailing felling method. It can easily be combined with shelterwood systems and forestry regulations. As planning tools, SFM methods have slowly been accepted in this region of Brazil for reasons discussed ahead in this text.

Forests in the Brazilian semi-arid are characteristically organized in three strata; an arboreal layer between 8 and 15 m; a suppressed shrubby storey between 2 and 5 m; and an herbaceous understory below 2 m. Forest stands are made up of small diameter and twisted trees. Felling rotations are calculated between 13 and 15 years (RIEGELHAUPT, 2007). Coppice systems are generally used, and its application follows forestry regulation that requires trees belonging to the list of threatened species remains at the forest stands. Previous to the implementation of a SFM plan 20-30% of the forest area is set aside to constitute the *"Reserva Legal"*[7] and "*Areas de Preservação Permanente*"[8] according to regulations established by the forestry code.

6 FORESTS AND FORESTRY OF THE BRAZILIAN SEMI-ARID

Under the denomination of Caatinga PROBIO (2006), the remnants of the Brazilian dry forests still represent an important part of the natural vegetation of the region. The

7 Reserva Legal: Legal Forest Reserve kept at rural establishments, according to the Brazilian Forest Code, variable extension from 20%, 35% and 80% of the total size of the property, depending to which biome the forest belongs.
8 Area de Preservação Permanente: Natural preservations under the legislation, includes steep terrains, water embankments, springs, mountain tops.

remnants of the Caatinga are estimated to cover an area of 363 thousand km2 conformed by a severely disturbed vegetation.

These dry forests of Brazil help to sustain an important flow of wood and non-timber forest products in the northeastern region. Fuelwood is by far the most important forest product, for its economic and social roles.

The wood utilization for fuel is widespread, and it is estimated to make 30% other energy matrix of the northeast. Many industrial and commercial segments are dependent on the supply of fuelwood. It is estimated that the Northeastern region consumes yearly the amount of 30 million steres[9] of wood for charcoal and fuelwood (Riegelhaupt, 2004). Both energy products are intensely utilized at industrial centres mainly for a redactor of pig iron, grain drying processes, brick production, textiles, breweries, tobacco curing, gypsum, food industries and many others. Firewood and charcoal still are widely utilized at commercial establishments such as barbecue parlours, bakeries and urban households.

However current fuelwood production practices are harmful to a large extent to the Caatinga and prevent the aimed purpose of sustainable uses. Most of the production in the region when not illegal is tied to forestland conversion for agricultural purposes. The Caatinga forests are also an important support for the animal husbandry for its high percent of palatable legume species. Biodiversity and the vigour of the vegetation sprouting with the first rains after long dry seasons favour traditional animal husbandry.

The production of firewood and charcoal is essential for the livelihoods of peasants in the semi-arid, especially during the dry season and in between the harvests. Fuelwood production is practically present at every rural household of the region. The firewood trade contributes to the articulation of a high capillarity economy throughout the region, as such this type of massive production allows a low income for the producer. However, fuelwood and charcoal are practically the only possibility of work and income in vast economically depressed areas, most of them characterized by extreme poverty. Fuelwood is a cheap source of energy – it has the lowest cost per Kcal, cheaper than all oil sub products and a bio fuel of social inclusion. It is estimated that in the northeastern region the fuelwood chain of production is responsible for the generation of 700 thousand jobs during the dry season.

7 CONCLUDING REMARKS

The Caatinga biome is the most threatened of Brazilian biomes (MMA, 2008). In spite of this condition, its forests are still very important, representing large patches of the

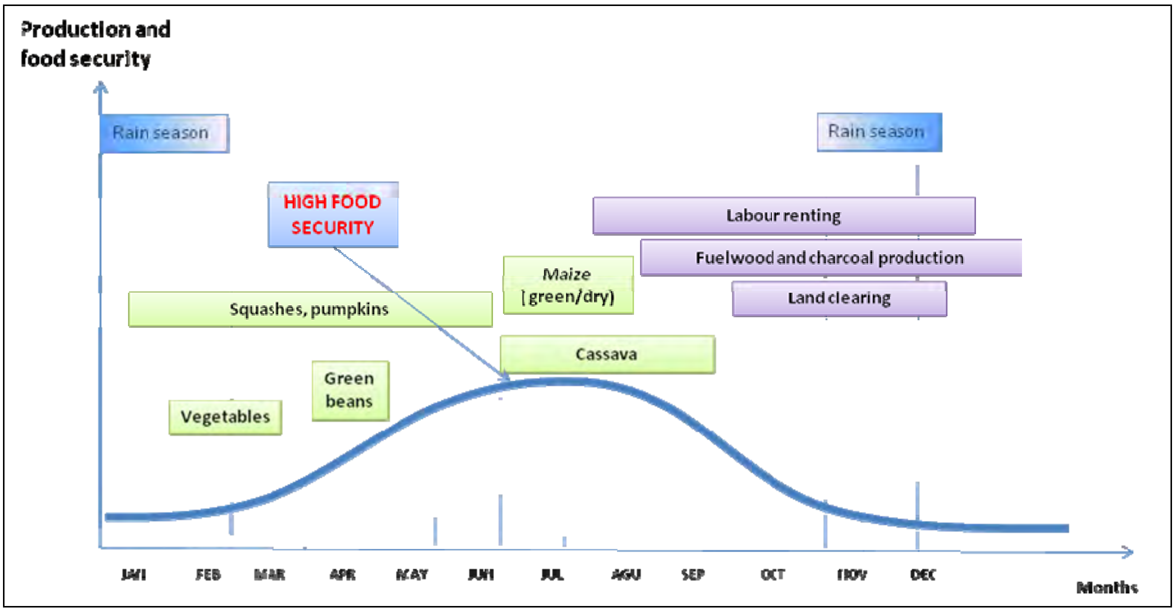
9 Stereo meter: 1 cubic solid wood meter corresponds to 3,2 st of Caatinga wood

original vegetation. Moreover, the natural forests under SFM practices have a recognised capacity for regeneration enhancing the possibilities to match current fuelwood demands, the production of environmental services, tourism and other. From a purely economic perspective, fuelwood and charcoal are the main forestry products in the region and have an important role in sustaining the generation of jobs and income generation. Other goods, like wood stakes, poles and small diameter construction materials are considered secondary products making a relatively small part of the total wood drain.

There is a combination of situations that create opportunities for the incorporation of forestry within sustainable development. Besides the natural resilience of the vegetation of the Caatinga, its vigorous regeneration and short rotations, the forests have increased their participation in the regional landscape. Important economic transformations have changed much of the traditional rural landscape. Cash crops like Cotton, has yielded room for other land use together with reductions of grazing lands. Social transformations through more intense land distribution during last years have important impacts on food security and might positively influence farmer's strategies for seasonal vulnerability. An increase of rural owners concentrated on small and middle-sized establishments (0-100 ha), could mean the incorporation of more than 2,0 million ha, with a good potential for SFM plans.

On the other hand, recently created land reform establishments have incorporated over 10 million ha of rural establishments that belonged to big land estates or "*latifúndios*" (INCRA, 2009). The forest resource under social control can be easily transformed into capital for financing agriculture and cattle acquisition. The option for changing the course of action has been demonstrated in a series of land reform establishments and a positive outcome can be appreciated (APNE, 2007). These aspects reinforce the possibilities for enhancing forestry as a sound economic and social option for thousands of small and middle-sized farmers and their families throughout the region. In this respect, empowerment of peasants to conduct their own SFM plans through adequate technical assistance, credit, market development and infrastructure would increase self reliance at the rural household. A greater involvement of peasants with SFM plans brings also the possibility of reducing peasantry's frequent vulnerability to climatic conditions, and sparing the inhabitants of the region, farmers and rural dwellers of famine threat. Figure 2, shows the importance of fuelwood production and charcoal at smallholdings throughout the region. Forest production for energy is complemented by collecting natural fibers, dyes, fruits and medicinal herbs. These activities help the farmer's family to overcome seasonal hardships that quite often are affected by extreme dry years.

Figure 4: Food security in the Brazilian semi-arid .(Source: the author)



During these years, fuelwood and charcoal become production issues of the highest importance for the livelihoods of small farmers and their families (Paupitz, 1989). The extraction of wood from small forest areas and forest thickets helps to mitigate the drastic effects of climatic extremes. The top portion of the curve hypothetically shows the period of year with highest food security level at the small household. First production begin by January-February following the rainy period, vegetables are collected together with green beans and squashes. Maize tops the harvesting and cassava is left for later collection. Once the agricultural production starts withering at the farm, the smallholder is faced with few options, such as indulging into forest production, migration or selling his labour at the nearby town. Thus, forestry is transformed into the activity that can allow a certain level of financial relief, at least during the harshest part of the year, when food staple stocks, which consist usually of beans, maize and cassava end or reach critical levels.

The opportunity for promoting smallholding forestry within the regional scope is twofold. Firstly, this can be done through the diversification of rural extension by including SFM as part of the extensionist work at existing smallholding units. Potential SFM systems can include a variety of agro forestry and silvipastoralism systems, which can optimally combine forest production with non-timber products, fibers, fruits and herbs together with arboreal vegetation for fodder. The production of aerial dry biomass of the Caatinga has been estimated in 4000 kg/ha/year and available dry fodder between 280 and 400 kg/ha/year (AMBROSIO, 2008). A set of management methods for grazing and fodder production has been developed and can be used to improve fodder production for the dry season and browsing conditions during the rainy months.

In spite of recognized benefits of SFM practices in the semi-arid region there are still few initiatives throughout the semiarid. By 2009 it has been accounted a total of 400 SFM plans in an area of 94 thousand hectares over the 9 federal states of the region. The figure is extremely low if compared with the opportunities it offers for sustainable forestry. Apparently there are some reasons preventing widespread incorporation of SFM planning as a current activity. In fact, there are some underlying issues that require better understanding, and some of them are considered in the following paragraphs. The Northeastern region has an estimated industrial fuelwood of 30 million steres (Riegelhaupt, 2007). Assuming a stock of 100 steres/ ha, the area under SFM represents only 940 thousand stere/year or less than 3,1% of an estimated demand of 30 million steres of fuelwood for the Northestern region.

A question remains to be answered in this case, where is the almost 97% of current fuelwood demand is coming from? Illegal forestry practices and institutional weaknesses are easily to blame as culprits. Firstly, the flow of illegal wood from Caatinga areas and also from more distant forest areas of the biomes bordering the Caatinga is a well documented reality and the volumes of this trade feed industries throughout the region. Part of the regional fuelwood commerce is dependent on the expansion of large commercial agricultural enterprises. Soybean plantations and cattle ranching are attractive investments for large landowners of the agrarian frontier, requiring cheap forest free land for their enterprises. Potential soybean fields and cattle ranching areas are easily transformed into cheap wood for diverse industrial purposes, which will not ask if the wood is coming from SFM plans. Consequently imbalances between supply from SFM production and cheaply offered fuelwood from deforested areas will considerably depress fuelwood market prices, which become a hurdle for the entrepreneur or farmer interested in SFM.

The establishment of SFM plans is cheap compared to forest plantations, but is still costly and it represents an economic burden for small holders and farmers in general. Fuelwood is relatively cheap and can be obtained from different sources, planted trees, pruning of cashew nut trees and other tropical fruit plantations, SFM plans and especially from areas under forest conversion, i.e. areas to be transformed into agriculture or grazing fields. Heavy bureaucracy is involved for licensing forest fellings under SFM plans and often the farmer is not encouraged to proceed as a "sustainable wood producer". Some of the institutional attitude in preventing the popularization of SFM derives in part from a prevailing society's stance about forestry and about its roles from economic, social and ecologic standpoints. Forest production quite often is understood as traditional "cut and run logging", and this fact has been exacerbated by charcoal production methods, characterized by primitive working conditions, the utilization of child labour and disregard good forestry practices.

On the other hand, a simple exercise allows understanding the potential of planned forestry for the semi-arid. According to Probio, 2007, forest remnants of the Caatinga represent 43% of the biome area estimated in 36 million ha. Taking into account the legal area discounts deemed necessary for conservation, such as the 20% for the RL areas, 5% for APP areas and 10% for Conservation Units, a total net area of SFM 6,3 million hectares could be integrated into production. Table 3 depicts this distribution.

Table 3: Potential SFM Planning Area for the Biome Caatinga (Source: Riegelhaupt, 2007)

Classification	%	Area (ha) million
Total Area – Caatinga Biome	100	844,00
Remnants	43	36,0
Legal Reserve (RL)	20	17,0
Permanent Protection Areas (APP)	5	4,2
Conservation Units	10	8,5
Potential Area for SFM	7,4	6,3

Somehow, it is natural that the civil society watches in disbelief the utilisation of forest resources throughout the region and elsewhere in Brazil. Otherwise, it is not an easy task to promote the discussion of sustainable forestry management and its inherent contribution to conservation and its potentialities in supporting the implementation of public policies oriented to fight poverty. Public ingrained perceptions about forestry and especially about SFM plans are part of the challenges Brazilian institutions need to overcome. Mass communication about the scientific basis of forest management and in general about forestry and its benefits is necessary especially to overcome many current distortions arising from misunderstandings about land conversion practices and SFM plans. Contrary to SFM plans, land conversion practices are carried out throughout the country and ligneous material is collected to clear the area for agriculture and cattle rising. Trees, shrubs and practically all vegetation including roots are extracted from 80% of the area to be converted into agricultural land. Application for licensing land conversion is an extremely easy procedure, although norms for the *Reserva Legal* and permanent preservation areas are being observed due to growing public concern and institutions that are under continuous public scrutiny.

SFM plans still remain as pioneering examples of good forestry practices, and as such, these are often publicized and recently have undergone scientific scrutiny. The monitoring of forest stands under SFM have been carried out over 20 years by a network of field stations conducted by the Brazilian network *"REDE de Manejo da Caatinga"* (*http://www.rmfc.cnip.org.br/*). Research results of stand structure, densities, volumes and biodiversity are becoming now available. Riegelhaupt et al. (2009) studied the environmental impacts on the vegetation of the Caatinga under SFM, resorting to compare forest plots with recorded interventions over a 40 year period (1965 to 2004) with undisturbed forest areas kept as natural reserves. The findings indicate that between 41% and 61% of the woody species at the forest reserves are present at the managed forest stands and that one fifth of these species (18 to 21%), belong exclusively to the undisturbed forest reserves. In short this means that these species were adversely affected by current management practices (clear felling) applied at the forest compartments. However, the study also indicates that a new and large number of species (18 to 39%) is added to the total of existing species in the areas under SFM. The authors of the study stress the importance of SFM as a contributing element to sustain and enhance floristic biodiversity within the woody strata of the forest, and it is possible to say that managed forest areas are vegetation richer than undisturbed forest areas and this is also true for areas under clear cut systems.

Summing up, the major identified problems for SFM plans in the region are:

SFM concepts are not clearly understood by civil society, a deep confusion remains about the importance of a permanent managed forest cover and land conversion for agriculture and other uses;

Bureaucracy prevents farmers and entrepreneurs to consolidate investments in SFM. Many understand the requirement of SFM as a legal demand and not as an essential planning tool to benefit society and nature as a whole. Excessive regulation, for instance implies environmental licensing while not recognizing the inherently holistic trait of SFM planning;

Regulatory secretaries (environment and forestry) have not undertaken SFM as model for forestry planning. SFM plans application remains dependent on individuals, projects, NGOs, rather than planned institutional action.

Incentives for SFM stay practically invisible, forestry financial incentives are directed to forest plantations, which are not an option in the semi-arid conditions;

Development and regulatory agencies do not recognize the importance of forest production as the main source of energy for the region. SFM does not appear as part of the institutional agendas. Forest production is plagued by informality, illegality and few channels for small and middle-sized businesses.

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Influences on associating private forest owners in Slovenia

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Abstract

Private forest management is, particularly in Slovenia, far from optimal, mostly because of diversity of ownership and property structure. In addition, Slovenian private forest owners are not adequately organized and associated when managing their forests. The willingness of private forest owners to cooperate was evaluated using the questionnaires. The sample (n=700) included equal shares of associated and non-associated owners. Forty-six percent of questionnaires were returned. The results of the survey analysis showed that 39.1% of private forest owners were members of forestry associations (associated), 19.9% owners showed willingness to cooperate i.e. to join a forestry association and 41.0% of the sampled forest owners were unwilling to cooperate. Based on the data obtained through the surveys we studied the relationship between ownership and property conditions in regard to the willingness of forest owners to cooperate. The Chi-square test showed the statistical significance of the relationship between the size of forest property and the willingness of owners to cooperate. Further, the results of multivariate logistic regression showed that it is necessary to search for private forest owners who are willing to cooperate in the group of forest owners who are younger than 50 years, who own more than 10 ha of forest land and live in common household with the co-owners.

Key words: private forests, forest owners' cooperation, ownership and property conditions, bivariate and multivariate analysis, logistic regression, Slovenia
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1 INTRODUCTION

The study of private forest management has special importance due to the prevailing share of privately-owned forests in Europe. In Slovenia, for example, 73% of forests are privately owned. Private forest management is, especially in Slovenia, far from optimal, which is a result of a diverse ownership and property structure. The diversity is displayed in a large number of owners (around 314.000) and co-owners (around 489.000), small forest property (on average < 3 ha) and fragmentation (3 plots on average) (The Slovenian Forest Service, 2005). Private forest management is further hindered by constant processes in the society which are related to an increasing number of owners due to partible inheritance and the diminishing sizes of forest property as well as a fall in the percentage of rural population, which indirectly influences the socio-economic structure of the population (Pezdevšek Malovrh, 2006). Consequently, economical dependence of people on forests is decreasing, which is reflected in insufficient exploitation of natural resources as only two thirds of the potential timber removal in Slovenian private forests is implemented and less than half of silvicultural work according to forest management plans is carried out. (The Slovenian Forest Service Report, 2007, 2008). The effects of inefficient private forest management are reflected in the decreasing economic value of forests, low utilization of site potentials, lower exploitation of financial funds for forest investments, low value and marketing of timber and unutilised forest functions. In addition, forest owners tend to be passive and unwilling to cooperate (Mori et al., 2006).

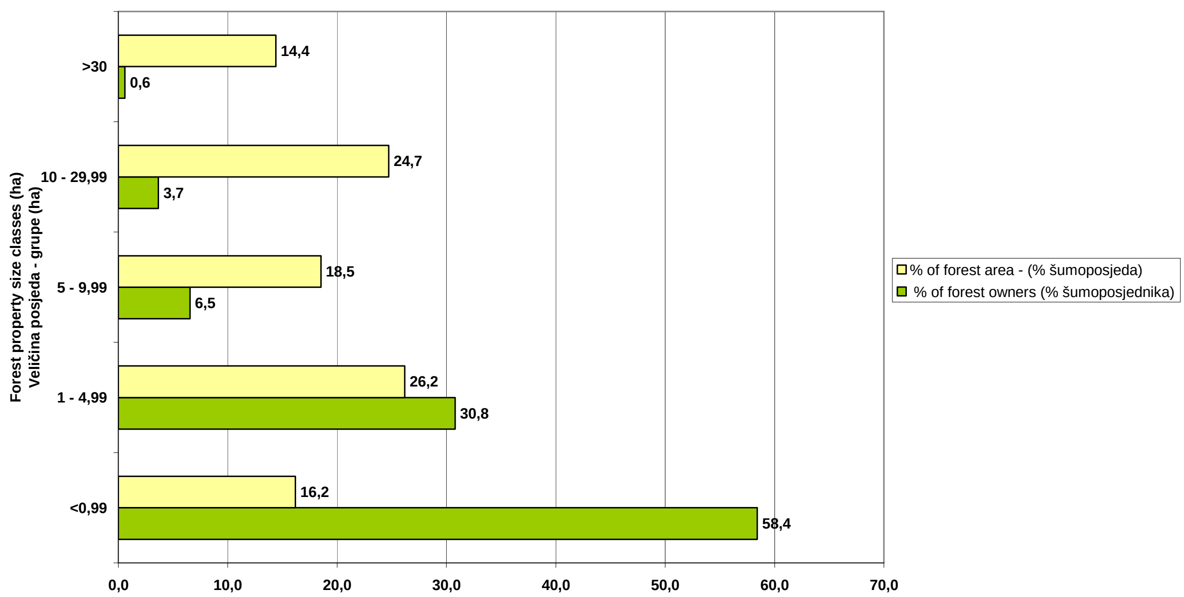
Providing the owners with a fresh incentive for forest management is therefore one of the key issues for private forest sector development. The solution lies in the activities related to encouraging cooperation among forest owners, which has become extremely important due to increased pressures of competition and a changing position in global markets, brought about by globalization and rapid economic progress and a dynamic market.

The supposition is that the willingness of private forest owners to cooperate primarily depends on the personal interests, which are linked with the owner's needs and socio-economic status on the one hand, and are limited with the state of the forest and its size on the other. In the starting phase of joining forest owners and with some examples of good practice already present, it is crucial to find out which characteristics of forest owners and which conditions influence the owners' willingness to cooperate. Considering the diversity that characterizes Slovenian privately-owned forests we decided to focus our research on analysing how the age of forest owners and the ownership and property structure affect their willingness to cooperate; these factors had proved crucial in preliminary analyses.

The aim of the paper is to find out, using of surveys analyzed by logistic regression, how certain characteristics linked with forest owners affect their willingness to cooperate and which group of private forest owners shows the highest willingness to join associations.

2 OWNERSHIP AND PROPERTY STRUCTURE IN SLOVENIAN FORESTS

The property structure of Slovenian privately-owned forests was analysed on the basis of forest management plan 2001-2010 (Graph 1). The analysis revealed that 58.4% of owners have a forest property smaller than 1 ha and that this property accounts for 16.2% of the forests in Slovenia. In terms of size such property is comparable to the property bigger than 30ha, which is nonetheless owned by merely 0.6% of all owners. Hence, the two categories of forest property, privately-owned forests smaller than 1 ha and those bigger than 30 ha, account for less than a third of all privately-owned forests in Slovenia. It can therefore be claimed that in Slovenia the most important categories in terms of size of property are those between 1 and 30 ha as they represent over a quarter of Slovenian forests size-wise as well as ownership-wise. Slightly over 6% of private owners own between 5 and 9.99 ha which covers just below one fifth of private forests in Slovenia. The last quarter of private forests is the size range from 10 to 29.99 ha, owned by 3.7% of forest owners.



Graph 1: Structure of the forest estate and forest area by size classes in Slovenia

Another important factor in property structure is the number of spatially separated plots. Namely, a certain forest property may not always be in one piece. Consequently, in forest management it is not only the size of the property that is important but also the fragmentation of property that is of major concern (Medved, 2000). Based on prior research (Winkler, Gašperšič, 1987, Medved, 1991, Medved, 2000, Pezdevšek Malovrh, 2006) it has been established that the average number of spatially separated plots is increasing and according to the latest data, owners, on average, possess property on three different locations.

The situation in ownership structure was analysed on the basis of the data provided by the land and property register of the Land Survey Institute of the Republic of Slovenia. For every forest owner we analysed the form of ownership based on their cadaster unit and plot number for all plot numbers together. Ownership was studied in three categories: firstly, one owner with no co-owners, secondly, several owners, living in the same household and thirdly, several owners living in different households (Medved, 2000). The general assumption was that owners living in common household, regardless of their number, have the same goals in forest management. The situation, however, differs where the co-owners live in different households; in these cases, the owners/co-owners does not generally share the needs and goals in forest management.

3 METHODS

3.1 SURVEYING FOREST OWNERS

A questionnaire was used to test the willingness of private forest owners to cooperate. Due to varied natural and social circumstances, the survey was carried out on the territory of the entire country - so that the sample was representative. The regional units of The Slovenian Forest Service acted as territorial units for the survey. Within regional units we focused on selected forest management units. In order to acquire an optimal distribution of sample units we selected forest management units where association forms of private forest owners exist. This system enabled us to carry out a parallel survey of forest owners who are members of local associations on the one hand, and those who are not, on the other.

Sourcing from the data base – the *index* of forest owners – the forest owners were divided into five groups (*stratums*), based on the criterion of property size. In the process of choosing the sample, a separate sampling was carried out independently for each stratum (Vehovar, 2001). Within each stratum, the owners were equally divided into two groups, i.e. into owners who are members of different forms of cooperation and those who are not. Inside the two groups, the owners were selected systematically. The survey was aimed at acquiring the following information about the forest owners: gender, age, level of education, place of residence, (the size and type of settlement), fragmentation of plots, economic status, property size, their membership in forestry associations (associated, willing to cooperate and unwilling to cooperate).

3.2 STATISTICAL METHODS

All collected data in our research were first analysed through the use of frequency distribution and crosstabulation. For the purpose of logistic regression, the analysed characteristics were then classified into two types of variable: the dependant variable and the independent variables. The dependant variable (response variable) Y represents the object of our research - "willingness to cooperate" and had three values: associated, willing to cooperate and unwilling to cooperate; Y is thus a nominal variable. The independent variables (explanatory variables) X_1, X_2..., explain the degree of willingness to cooperate. The independent variables comprise: owner's age, size and fragmentation of the forest property, form of ownership and number of co-owners. These variables can either be continuous, discrete or attributive. The χ^2 test was used in order to find out whether there is a relationship between pairs of variables. Statistically significant relationship between two variables was defined where p value was less than 0.05. Willingness of private forest owners for cooperation regarding the age of forest owners and the ownership and property structure was performed by the nominal logistic regression method (Backhaus, 2004, Grimm et.al, 2002, Košmelj, 2001a, Košmelj, 2001b, Hosmer, Lemeshow, 2000, Albright et.al., 2000, Norman, 2000), by means of the *Backward stepwise* algorithm (Field, 2009) of the *SPSS for Windows 16.0* software package.

The nominal logistic regression is a generalised version of logistic regression. Logistic regression belongs to the generalised linear models, which are used for the prediction of binary dependant variables ("yes"/"no"). In our case, however, the dependant variable has three values - associated, willing to cooperate and unwilling to cooperate. This kind of statistical model is referred to as nominal logistic regression model (Košmelj, Vadnal, 2003). The last category of the independent variable was chosen to represent the reference category.

4 RESULTS AND DISCUSSION

4.1 BASIC INFORMATION ABOUT SAMPLE - PRIVATE FOREST OWNER

The sample represents 322 forest owners, 75.8% of whom are male and 24.2% are female. The average age of the respondents is 54 years and the average level of education is completed primary education (31.7%) or vocational school (32.6%). The majority of respondents (68.9%) live in rural area, a hamlet or a small village of up to 500 inhabitants with neither shop nor post office, who generally belong to a village local community (82,9%). More than half of the respondents (58.9%) consider their economic status to be average.

4.2 GENERAL DATA RELATING TO PROPERTY CONDITIONS

The mean area of forest holding of the respondents is 16.7 ha. The size of the smallest forest property is 0.1 ha, while the biggest forest property extends up to 150 ha. The respondents were classified depending on the size of their forest property into categories referred to as stratums. The stratums and the shares of the respondents per stratum are given in Table 1.

Table 1: Size of forest property (stratum)

	Stratum (ha)				
	Up to 0.99	1 to 4.99	5 to 9.99	10 to 29.99	Over 30
n	19	90	64	91	58
%	5.9	28.0	19.9	28.3	18.0

Table 1 show that approximately the same number of forest owners from all stratums participated in the survey. The exception is the first stratum (up to 0.99 ha) with the share of only 5.9 %. Such small number of the respondents from the first stratum is due to several causes: some owners refused to take part in the survey or were not even aware that they own a forest, the address of some owners could not be found or it was impossible for us to contact them or they are deceased. The refusal of the owners of forest properties smaller than 1 ha to participate in the survey shows their inactiveness, lack of interest or negative attitude towards foresters and even the forest itself.

The respondents, generally know how many separate plots of forest they possess. Only 2.5 % of the respondents could not answer this question and were therefore excluded from the analyses relating to the fragmentation of forest property. Forest holdings of most respondents are divided into several separate lots, 4.3 on the average. Such fragmentation is highly inconvenient for management. In fact, only 28.7% of the respondents own undivided forest property, i.e. a forest property on only one location, whereas forest property of the other respondents is fragmented into two separate parcels (16.6 % of the respondents), three separate lots (12.1 %), four separate parcels (9.9 %) or more. The average number of separate parcels of forest property per stratum is given in Table 2. We can see that forest property becomes more fragmented, the bigger it gets.

Table 2: Average fragmentation of forest property

	Stratum (ha)				
	Up to 0.99	1 to 4.99	5 to 9.99	10 to 29.99	Over 30
Average number of separate plots	1.3	3.0	4.8	5.3	5.4

In fact, most undivided forest properties are found in the first stratum (72.2%). The situation in this stratum is, as can well be expected, a prevailing number of undivided forest properties, generally too small to be fragmented. Only 16.7 % of the respondents from the first stratum own a forest property on two locations and only 11.1% own a forest holding on three locations. The forest properties in the stratum of 1 – 4.99 ha already tend to be more fragmented; on the average, they are divided into three separate lots. Almost one third (30.3%) of the respondents from the second stratum own an undivided forest property, 24.7 % own a forest property on two locations, while, surprisingly, as much as 12.4 % of the respondents own a forest property on more than six locations. Most fragmented forest properties fall under the middle category of 5 – 9.99 ha; in this stratum, only 8.9 % of forest properties are undivided. In the stratum 10 – 29.99 ha, on the one hand, the share of undivided forest properties increases (27.8%), whereas, on the other, half of the respondents (50 %) own a forest property on more than five locations. As for the forest properties of over 30 ha, 31.5% are undivided, whereas 27.8% are fragmented into more than six separate plots.

4.3 GENERAL DATA RELATING TO OWNERSHIP STRUCTURE

The analysis of the ownership situation was performed on the sample of 308 respondents out of 322. This was due to the non-identical records on some plot numbers in different databases (Register on forest owners and the Land Survey Institute of the Republic of Slovenia).

More than half of the respondents (59.4 %) are the sole holders of their forest property (Table 3). As for the rest, they have co-owners; 18.8 % of these respondents share common household with their co-owners. The management of a private forest property is simpler where there is a sole holder or all joint owners share common household (which is the case in 78.2 % of the respondents). The rest of the respondents (21.8%), do not share common household with the other co-owners. The management of such properties is more demanding as it involves constant coordination of interests of the joint owners.

Table 3: Structure of the respondents by ownership

Form of ownership	n	%
Sole holder	183	59.4
Joint owners – share common household	58	18.8
Joint owners – do not share common household	67	21.8

On the average, the respondents who entered a co-owner relationship have 8 co-owners. More than half of these respondents (54.4 %) share their forest property with one co-owner, 10.4 % with two co-owners, and one particular forest property is shared by as many as 98 joint owners. Based on the frequency distribution of the number of co-owners, to simplify the data processing, the respondents were classified into three categories based on the number of co-owners; the categories and the share of respondents per category are given in Table 4.

Table 4: Structure of the respondents by number of co-owners

Number of co-owners	n	%
1 co-owner	58	54,4
2 to 5 co-owners	29	23,2
More than 5 co-owners	28	22,4

Table 4 shows that 54.4 % of the respondents who are in a co-owner relationship share their forest property with one co-owner, 23.2 % with 2 to 5 joint owners and 22.4 % with more than 5 joint owners.

Among the respondents who live in common household with their co-owners, 84.5 % have only one co-owner and 15.5 % between 2 to 5 co-owners. As for the respondents who do not share common household with their co-owners, the situation is different. In this case, the number of co-owners is higher, namely, there is a prevailing number of respondents who share their forest property with more than 5 co-owners (41.8%), followed by the respondents with 2 to 5 co-owners, whereas the share of the respondents with one co-owner is 28.4%.

The χ^2 test showed that the independent variables form of ownership and number of co-owners are statistically significantly correlated (χ^2 =44,993***, p=0,000). Due to a strong correlation of these two variables (r_s=0,973***) and a high Variance Inflation Factor (VIF>5), in order to avoid the multicollinearity in the nominal logistic regression model, the variable number of co-owners was later on eliminated from the nominal logistic regression model.

4.4 RESULTS OF BIVARIATE ANALYSIS

The joint distribution of the dependent variable degree of willingness to cooperate and each individual independent variable (size and fragmentation of forest property and form of ownership) was displayed through the use of crosstabulation. Then, the χ^2 test was performed in order to test the statistical significance of relationship between each individual independent variable and the dependent variable willingness to cooperate.

4.4.1 Influence of forest property size on the willingness to cooperate

Increasing the forest property size, (from the smallest to the biggest), the number of the owners who do not cooperate nor are willing to do so in the future decreases (Table 5). Owners of forest properties bigger than 30 ha are the most keen to cooperate with other forest owners (60.3 % already cooperate). The willingness to cooperate is primarily expressed by the owners from stratum 10 to 29.99 ha (26.4 %) and stratum 5 to 9.99 ha (21.9 %). The least interest to cooperate is shown by the owners of the properties smaller than 0.99 ha; only 10.5 % of them cooperate with other forest owners and only 5.3 % expressed the willingness to do so.

*Table 5: Willingness to cooperate in relation to property size (χ^2 =58,734***)*

Size of property (ha)	Willingness to cooperate		
	Cooperates	Willing	Unwilling
Up to 0.99	10.5%	5.3%	84,2%
1 to 4.99	21.1%	15.6%	63,3%
5 to 9.99	37.5%	21.9%	40,6%
10 to 29.99	50.5%	26.4%	23,1%
Over 30	60.3%	19.0%	20,7%
Total	39.1%	19.9%	41.0%

The stratums were then regrouped in two categories by forest property size, namely forest property of the area of up to 10 ha and those bigger than 10 ha, for the purpose of multivariate nominal logistic regression.

4.4.2 Influence of fragmentation on willingness to cooperate

The independent variable fragmentation of the forest holding was initially discrete with a large number of values (1, 2, 3, ...); for the purpose of crosstabulation, however, it has been transformed into a categorial variable and was assigned six categories. The crosstabulation showed that the owners of more fragmented forest properties tend to show greater interest for co-operation (they more often cooperate and they are also more willing to cooperate) than the owners of less fragmented forest properties. In fact, the smallest interest for co-operation was shown by the owners of undivided forest properties (36.7 % of them cooperate, whereas 16.7 % are willing to do so) and among the owners of forest properties on two locations 44.5 % cooperate and only 9.6 % are willing to cooperate, (Table 6).

Table 6: Fragmentation of forest property and willingness to cooperate (χ^2 =14,439)

Number of separate plots	Willingness to cooperate		
	Cooperates	Willing	Unwilling
1	36.7%	16.7%	46.7%
2	44.2%	9.6%	46.2%
3	34.2%	18.4%	47.4%
4	54.8%	16.1%	29.0%
5	41.7%	20.8%	37.5%
6 or more	35.4%	30.4%	34.2%

However, the χ^2 test showed that there is no statistically significant relationship between the fragmentation of forest property and the willingness to cooperate (χ^2 =14,439, p=0,154). The nominal logistic regression confirmed the results of the χ^2 test, showing a statistically insignificant relationship between fragmentation and the willingness of the owner to cooperate. Thus, the variable fragmentation was not considered in the multivariate nominal logistic regression model.

4.4.3 Influence of form of ownership on willingness to cooperate

Table 7: Willingness to cooperate per form of ownership (χ^2 =7,634)

Form of ownership	Willingness to cooperate		
	Cooperates	Willing	Unwilling
Sole holder	37,2%	20,8%	42,1%
Joint owners – share common household –	53,4%	17,2%	29,3%
Joint owners – do not share common household	31,3%	19,4%	49,3%

The biggest interest for co-operation was shown by the respondents who are joint owners of forest property and share common household with their co-owners. 53.4% of them already cooperate (Table 7). Further, the biggest willingness for co-operation was expressed by the sole holders (20.8%). The respondents who are joint owners and do not share common household with their co-owners are the least keen on co-operation; only 31.3 % cooperate and no more than 19.4 % are willing to do so.

The χ^2 test showed that the willingness to cooperate is not statistically significantly related to the form of ownership (χ^2 =7.634, p=0.106). Nevertheless, the bivariate nominal logistic regression was further investigated. The bivariate nominal logistic regression showed that dependence/influence of the form of ownership on the willingness to cooperate is statistically significant (p=0,010) only when comparing the respondents who are willing to cooperate with those unwilling under the consideration of the following two forms of ownership: the respondent is a joint owner and shares common household with his co-owners, and the respondent is a joint owner and does not share common household with all co-owners. The variable form of ownership was considered in the multivariate regression model later on.

4.5 MULTIVARIATE LOGISTIC REGRESSION

In order to find out the differences between the owners who cooperate with other forest owners, those who are willing to cooperate and those unwilling, a multivariate model of logistic regression was performed. The following independent variables were considered in this model: the size of forest property (up to 10 ha and over 10 ha), the form of ownership (sole holder, co-owners who share common household, co-owners who do not all share common household) as well as the owner's age (under 50 and over 50). The results of the multivariate nominal logistic regression are given in Table 8. Let us first compare the associated owners with those who are unwilling to cooperate. The most influential factor here is the size of property (p=0.000), followed by age (p=0.002) and type of ownership where several owners live in common household with the co-owners (p=0.007). Owners with a smaller property (up to 10ha) are thus less likely to show willingness to cooperate (95 % CI is in such case 0.097–0.320), the odds being 0.176 lower compared to owners with bigger property; owners aged under 50 showed 2.452 times higher tendency to be willing to cooperate (95% CI is in such case 1.381 – 4.351) than those aged over 50; and owners who share common household with the co-owners are 3.446 times more likely to be willing to cooperate (95 % CI is in such case 1.407–8.441) compared to owners who do not share the household with the co-owners. The

Table 8: Results of multivariate nominal logistic regression

	B	Std. Error	Wald	df	Sig.	Exp(B)	95% CI Lower	95% CI Upper
Willingness of the owner to cooperate:Cooperates/Unwilling								
Size of forest property								
Up to 10 ha	-1,738	,305	32,484	1	**,000**	,176	,097	,320
Over 10 ha						1,000		
Form of ownership								
Sole holder	,454	,362	1,571	1	,210	1,575	,774	3,205
Joint owners – share common household	1,237	,457	7,329	1	**,007**	3,446	1,407	8,441
Joint owners – do not share common household						1,000		
Age								
Under 50 years	,897	,293	9,384	1	**,002**	2,452	1,381	4,351
Over 50 years						1,000		
Willingness of the owner to cooperate:Willing/Unwilling								
Size of forest property								
Up to 10 ha	-,307	,326	,886	1	,347	,736	,388	1,394
Over 10 ha						1,000		
Form of ownership								
Sole holder	-,059	,427	,019	1	,890	,942	,408	2,177
Joint owners – share common household	,538	,525	1,048	1	,306	1,712	,612	4,793
Joint owners – do not share common household						1,000		
Age								
Under 50 years	-,035	,324	,012	1	,914	,966	,512	1,822
Over 50 years						1,000		
Willingness of the owner to cooperate:Cooperates/Willing								
Size of forest property								
Up to 10 ha	-1,431	,353	16,388	1	**,000**	,239	,120	,478
Over 10 ha						1,000		
Form of ownership								
Sole holder	,514	,425	1,457	1	,227	1,671	,726	3,848
Joint owners – share common household	,700	,559	1,566	1	,211	2,013	,673	6,022
Joint owners – do not share common household						1,000		
Age								
Under 50 years	,932	,341	7,476	1	**,006**	2,539	1,302	4,950
Over 50 years						1,000		

comparison of the willing and unwilling to cooperate revealed a significant statistical influence of the size of property (p=0.000) and age (0.006). Owners with smaller property (up to 10ha) display 0.239 times lower tendency to cooperate (95 % CI is in such case 0.120–0.478) compared to owners with a bigger property; furthermore, owners aged under 50 are 2.539 times more likely to be willing to cooperate than older owners (95 % CI is in such case 1.302-4.950).

5 CONCLUSIONS

The survey of 322 forest owners who were proportionally selected for the sample (i.e. half of them associated and half non-associated) revealed that 39.1% of the owners were associated, 19.9% were willing to join a forestry association and 41.0% were unwilling to do so. The statistical model of bivariate analysis, the χ^2 test was used to establish a potential correlation between ownership and property conditions and the willingness of owners to cooperate. The analysis showed a connection between the size of forest property and the owners' willingness to cooperate in forestry associations. A multivariate model of nominal logistic regression was used to compare the three categories: the associated owners, owners who are unwilling to cooperate and those who are willing to join a forestry association. The model included all statistically characteristic variables from the bivariate logistic regression models as well as the age of the owners. The results show that the non-associated and the unwilling to cooperate differ most significantly in the size of forest property (p=0.000), age (p=0.002) and the ownership type where several owners share common household (p=0.007). The discrepancy between the willing to cooperate and the unwilling is most strongly pronounced in the size of forest property (p=0.000) and age (p=0.006) while no such differences can be observed between the associated owners and those willing to cooperate.

It can be concluded that private forest owners who are the most willing to cooperate in forestry associations are younger than 50 years, own more than 10 ha of forest land and live in common household with the co-owners.

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Local community perception as driving force in rural development strategies

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Abstract

Rural development requires a multidisciplinary approach and appropriate scientific acquirements and tools capable to analyse the complexity of sustainability: availability of natural resources, environmental vulnerability, social needs and conflicts. Particularly, local communities participation is recognised to be an important tool in identifying development strategies according to a bottom-up approach. Within the framework of a project aimed to identify innovative development models, a research was carried out in a mountain district of Italy. The studied area involves four municipalities located between two regions (Lazio and Abruzzo) characterised by high wilderness values and biodiversity richness but by low local empowerment and weak development policies. The municipalities are analysed considering the historical changes of statistical data related to population (inhabitants, migrations, labour force) and land use systems (agricultural lands, forest and total territorial areas). At the same time a questionnaire was submitted to a random sample of local population (about 100 hundred interviewed persons in each municipality). The questionnaire was structured in different sections aimed to assess social and cultural interest of local population; their perception of natural resources and environmental constraints affecting the territories, their interest and needs in development models considering agroforestry products. The data are analysed in order to identify main factors, such as labour, education and age, affecting: i) people participation at local community life; ii) people identification with the territory in which they live; iii) local communities awareness about environmental problems and agroforestry potentialities in promoting local development. The study results allow to assess human pressure on environment and ecological resources and they help to formulate innovative development strategies taking into account the point of views and needs of people living in the territories.

Key words: participation, human pressure, agroforestry products
FDC: 907:0=111

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1 INTRODUCTION

Nowadays in European Western countries, agriculture importance is declined, in term of economic impact at local level. Also in traditional rural areas local communities are constituted by a growing diversity of social groups (for example, it is frequent to find people living in rural spaces who are employed in urban centres and every day move from the living places to the job places also covering relatively long distance) who are not directly dependant on agricultural resources. Thus, in rural communities there is an increasing of social heterogeneity and rural development is not synonymous with agricultural development (Storey, 1999). Agriculture sector is an element of more complex systems in which the human community, with its diversity in term of needs, objectives and perspectives, play a central role. In fact, the inhabitants of the locality directly perceive any positive or negative changes that occur in the territory. Therefore, sustainable development pass through sustainable community development defined as the local place able to meet the economic needs of their residents, enhance and protect environment, and promote local society development (Bridger and Luloff, 1999). The definition of strategies finalised to promote community development must take into account that local communities are usually organised in social groups (for example, gender, age, associations and organisations) and people belonging to the same group usually develop a similar perception or behaviour regarding a particular aspect.

Consequently, the key words of rural development are *integration* (all sectors of rural economy and not just agriculture need to be looked at and integration implies the involvement of all interested parties), *participation* (local people should be involved in the process of formulating development strategies) and *empowerment* (people should have a real and effective power in strategy formulation).

The growing awareness of the importance of participation determined a radical rethink of development strategies since the beginning of '80s when it became clear that failure of development process was often due to the absence of people's participation (Anderson, 1986).

Since the Rio de Janeiro conference (1992) social dimension acquired increasing interest in planning rural development and became key element in the assessment of ecosystem complexity (Betta *et al.,* 2009). Nowadays, it is recognised the importance to adopt a bottom up approach in order to promote the rational use and management of natural resources. This approach should particularly stress the role of local community participation through which all stakeholders and actors living and utilising the resources of the territory have the possibility to manifest ideas, objectives, needs and constraints.

Thus, it becomes necessary to develop methods and tools able to assess how different stakeholders perceive the complex ecosystems (Gasparino *et al*., 2006). This is particularly relevant in small communities located in marginal areas where the different stakeholders not only need to be informed, but to be directly involved in the different phases of the decision process in order to limit social conflicts and promote development models shared by all actors living in the territory.

Therefore it is relevant to know the individuals' opinion about a particular question relate to their territory (problems and potential solutions) as well as their potential behaviour regarding some future hypothetic scenarios because individuals play a crucial role in making sustainable development effective: day-by-day choices have a straight influence on the future evolution of our societies (Catenazzo *et al*., 2008).

According to these general issues, a survey was carried out in a sample area of Central Italy. The area involves four local communities (Municipalities of Arsoli and Subiaco in Lazio Region; Municipalities of Tagliacozzo and Carsoli in Abruzzo Region) where it is recognised the need to identify rural development strategies able to harmonise economic growth, improve social welfare and preserve physical and biological environments.

A questionnaire was arranged and submitted to a sample of population living in the four communities with the following aims:

- stimulation of local communities to assess problems and potentialities of the territories where they live;
- development of tools and methods able to investigate complex ecosystems;
- identification of criteria according to which sustainable development strategies should be planned.

2 MATERIAL AND METHODS

Available statistic data of the four Municipalities have been collected and a description of the studied areas in term of land use system dynamics and changes, demographic statistics, employment figures have been carried out (ISTAT, 2009). Statistic and geographic data of the four Municipalities were stored in a geographic information system and analysed using spatial analysis techniques according to the conceptual framework purposed and developed by the project ANCONAPACO (http://anconapaco.regione.marche.it/ricerca.htm).

The historical evolution and change of agricultural lands in comparison with total territorial area was utilised as indicator of the maintenance and preservation of agricultural activity in the areas (*rural presidium*). The population density and the balance between immigration and emigration were utilised as indicator of the human pressure on the territories (*human presidium*). Throughout the linkage and combination between these two indexes, a third synthetic indicator was identified (*territorial presidium*).

A questionnaire was submitted to a random sample of local population living in the four Municipalities. A total amount of 402 persons were interviewed.

The questionnaire was structured in different sections containing the following thematic issues:

- general data of the interviewed person such as age, gender, profession, distance of the job place from living Municipality, etc. with the aim to find factors affecting perception and behaviour of the respondents;
- assessment of people participation within community life in term of quality and level of information regarding social, cultural or political aspects, degree of identification with the territory and potential interest in moving to other places;
- awareness of natural resources and perception of environmental problems and potentialities of the territory focusing on local agroforestry products as tool for development;
- participation and interest in cultural and social events that are organised within the territory or in boundary territories and perception of challenges that are occurring in the territory or that are expected to be occurred.

The questionnaire contained both qualitative opinions (open sentences of the interviewed persons) and quantitative questions (the interviewed persons could answer “yes” or “no”, in addition to the option “I don’t know”).

The data were analysed in terms of frequency of answers to each questions considering both qualitative and quantitative data. Statistical analysis has been carried out in relation to quantitative data for assessing the existence of difference in relation to living communities (Municipalities), and age of the respondents. The analysis was performed throughout the Principal Components Analysis test and the χ^2 test. Principal Component Analysis (PCA) is one of the most important methods of ordination analysis. This method provides a new set of orthogonal coordinates axes so that the projection of points into them has maximum variance. In this study *n* quantitative variables measured in *p* samples were organized in *n x p* matrix. Taking into consideration the putative bias of variables due to an arbitrary choice of units of measurement, the *n* variables were standardized according to the STAND procedure. The correspondent Stand-matrix was used to calculate the variance-covariance (VARCOV) matrix applying the SIMINT procedure. Subsequently three eigenvectors (PC1, PC2, PC3) were extracted from VARCOV matrix and the standardized data were projected into these eigenvectors following the EIGEN and PROJ procedure respectively. All computation was performed using NTSYS pc version 2.1 software package.

On the basis of the data collected through the questionnaire, a synthetic framework was implemented. We assumed that sustainable development must be addressed in several directions, covering both environmental and socio-cultural aspects. Considering the questionnaire, we focused on some key questions through which weak and strength points can be identified in each municipality.

Practically, we identified the following key indicators:

- quality of information and communication as indicator of the capacity to promote local community participation in the decision process;
- degree of linkage of the inhabitants with the environment in which they live as indicator of the capacity of the territory to attract people creating favourable conditions for their life;
- cultural opportunities at local level as indicator of the capacity of the territory to stimulate the exchange of experiences and knowledge among people living within the territories;
- knowledge and interest on local agroforestry products as indicator of rational utilisation of natural resources.

On the basis of this assumption, we formulate hypothesis about the main constraints that affect each territory and we identify possible strategic issues that should be implemented for improving sustainable local community.

3 RESULTS

3.1 DESCRIPTION OF THE STUDIED AREA

The study area is located in Central Italy and involves four Municipalities across Lazio and Abruzzo Regions: Arsoli and Subiaco are in Lazio Region; Carsoli and Tagliacozzo are in Abruzzo region (figure 1). The municipalities are relatively near Rome (the average distance by train or car is about one hour travel), and the city attracts people from all the studied municipalities because offers job, recreational opportunities, amenities or facilities.

The area presents morphology and landscape typical of inner areas of Central Italy located close to Apennine Mountain and the altitude of the territories belonging to the four Municipalities is between 326 m a.s.l. and 1737 m a.s.l. The investigated Municipalities are included within the Comunità Montana Valle dell'Aniene (Arsoli and Subiaco) and the Comunità Montana Marsica 1 (Comunità Montana is a public authority comprises several municipalities located in similar mountain and hilly territories).

According to the indicators related to the *rural presidium* (figure 2), 37.5% of the territories are classified as areas with abandonment problems (the *rural presidium* have reduced during the period 1990-2000). In these areas the reduction of agricultural practices determined a reduction of territory maintenance. The agriculture is still dominant in limited area (10.4% of the territory) while in 14.6 of the territory *rural presidium* trend is intermediate. The abandonment resulted to be strong in territories belonging to Comunità Montana Valle dell'Aniene, although Arsoli doesn't show a great abandonment of agricultural practices.

At the same time, the human presence is reducing and 64.6% of the areas belonging to the two Comunità Montane show a tendency to be abandoned (figure 3). Only 4.2% of the territory is classified as urban, while the 20,8% of the territory is classified as rural areas with low human density. The *human presidium* is lower in Arsoli and Subiaco than in Carsoli and Tagliacozzo.

Considering the combined indicator *territory presidium*, 54.2% of the territory is classified as area with evident abandonment phenomena and 10.4% of the territory is classified as weak rural areas (figure 4). The abandonment is particular manifested in Carsoli and Subiaco; while Tagliacozzo is classified as weak rural area (reduction of agricultural presence but stable maintenance of human presence); Arsoli is defined as rural area with weak growth (the agricultural activity is stable but the trend to the abandonment is manifest). In table 1 key statistic data of the four Municipalities are reported.

3.2 SAMPLE DESCRIPTION

A total amount of 402 persons have been interviewed during the period September-December, 2009. The sample was randomly chosen within each Municipality, targeting persons with age between 18 and 65 years. The average age of the respondents is about 39 years, ranging between 36 years (Arsoli) and 41 years (Tagliacozzo and Subiaco); 45%

of the sample is between 18 and 35 years old (young) and 55% is between 36 and 65 years old (adult). Males and females represent 55% and 45% of the sample, respectively.

Most of the interviewed persons (60%) have the secondary school degree, while 12% are still students at secondary school or at university (figure 5) with highest value in Tagliacozzo. Most of the interviewed persons are employed as public dependents (teachers, public officers, medical officers) or as entrepreneurs (with their commercial activity or as dependants). Unemployed are 5% of the interviewed persons. Workers are 12% with highest value in Arsoli (22% of the sample) and Carsoli (18% of the sample).

About 17% of the sample moves every day outside the town of residence for job (figure 6): the average distance between the job place (Rome is the more frequent) and the living place ranges between 45 km (Arsoli) and 63 km (Subiaco) and usually respondents move at least 5 days/week and stay far from their own town about 9-10 hours/day.

3.3 PEOPLE PARTICIPATION AND COMMUNICATION TOOLS IN THE LOCAL COMMUNITY

According to the respondents, posters or leaflets, local journals and friendly persons are the main communication tools through which the inhabitants get acquainted with social, cultural and political aspects and events that are occurring in the living community. Internet is also quite commonly used in all Municipalities. About 70% of all respondents retain to be enough informed and 63% of them consider good the level of information in the four Municipalities. Only in Tagliacozzo more than half of sample considers the level of information poor and not properly developed locally (table 2). This criticism is probably due to the great awareness that characterises Tagliacozzo community in comparison with the other investigated communities (as explained below).

According to the age of the respondents, there are not evident differences regarding the quality and level of information in all Municipalities, except in Subiaco where younger respondents retain communication and information manifestly weakest than older respondents (table 3).

Considering the all sample, 61% of the interviewed persons feel a strong identification with the territory in which they live (people appreciate to live in its own territory mainly because of the quality of physical environment such as the climate and the landscape diversity, and the local culture and tradition). The appreciation of the living place is stronger in adults (older than 35 years) than in young people (age between 18 and 35 years) and these differences are more evident in Subiaco and Carsoli. At the same time almost half of the sampled persons would like to move to other cities, with highest percentage recorded in Tagliacozzo (62%) and lowest in Subiaco (32%). The main reasons to change living place are: the aspiration to improve job position, the desire to implement social and cultural activities and the expected increase availability of opportunities for youngest that occur in biggest cities. On the contrary, persons who wouldn't like to change place showed to appreciate the living territory mainly for the quality of the life (the investigated communities are small, with great wildness, without pollution or other typical problems that affect any big city) and the strong relation with local traditions and cultures.

The potential interest to move to other living places is stronger in young than in adults (globally, 71% of the youngest would like to move to another place, while only 29% of the oldest would like to do it), underlining the need to implement at local level opportunities mainly addressed to young generations such as the creation of job opportunities and the organisation of specific events for youngest. In Tagliacozzo, more than 90% of the youngest would like to change living place, underlining again the greater expectation and need of the local community living in Tagliacozzo in comparison with the other investigated areas in term of professional and socio-cultural opportunities.

3.4 AWARENESS ASSESSMENT OF ENVIRONMENT AND NATURAL RESOURCES

The investigated territories are characterised by a rich wildness due to the presence of Apennine Mountains. Large forests and natural environments dominate the landscape pattern. At the same time agricultural activity may be practiced in the most favourable places for producing typical agroforestry goods such as olive oil, cheese, wine, legumes, mushrooms, honey, etc. The respondents of all investigated communities showed a great awareness of the environmental value of the place where they live and manifest to appreciate it. Forests, mountains, natural parks, natural cave, and water resources such as lakes and rivers are the most appreciate natural resources of the investigated territories. At the same time, 48% of the respondents affirm that this natural richness is treated by several environmental constraints (table 4). In Arsoli, for example, a quarry represents one of the main environmental problems; in Subiaco people complain the abundant waste presence along the river. Urban wastes are one of the main problem that affect all the communities and usually people strongly require that public authorities urgently solve the problem promoting differentiate collection of the waste.

In rural lands, often located in marginal areas, local agroforestry products, such as organic products, can be considered as expression of specific or unique environmental conditions that allow to obtain goods of high value. Typical products are considered a powerful tool through which to contribute to the promotion of rural development (mainly because they stimulate rural tourism). In the studied areas, about 84% of the all respondents affirm to know the term “organic product”, although the definitions they provide are very dissimilar. Most of the respondents define biological product with an adjective (good, necessary, sure, special, etc.); others interviewed people give a more “technical” definition such as “products without chemical treatments” or they associate these products to the high costs and, thus, they retain organic products expensive and not convenient. The higher costs of organic products in comparison with traditional agricultural products probably affect the effective consume of them. In fact, only less than half of the interviewed sample affirms to consume regularly these products (lowest percentage in Tagliacozzo) and to be interested to increase the expense to buy them (highest percentage in Tagliacozzo).

According to the respondent age, it seems that typical products (in term both of consume and purchase interest) fascinate less young than adults (table 5). Anyway, most of the respondents consider local agroforestry products a potential tool for promoting rural development, although this possibility is perceived in different way among the four communities: highest percentage of respondents in Tagliacozzo (98%) and lowest in Carsoli (76%). Moreover, a great difference emerged among the respondents regarding the possibility to purchase such products within the communities and, thus, the market visibility of them (highest possibility in Tagliacozzo e lowest possibility in Carsoli). These differences may witness a different level of natural resources valorisation strategies among the four Municipalities analysed in the survey.

3.5 ASSESSMENT OF CULTURAL INTEREST AND PERCEPTION OF FUTURE CHANGES

In all communities people participation at cultural events, usually organised by local authorities or private organisations and associations, is very large: about 86% of the all respondents affirm to regularly participate at these events, with highest percentage in Tagliacozzo and lowest in Subiaco (table 6). Thus, both young and adult people appreciate to spend time outside just to have some food or drinks, listen to popular music and meet friends. According to the respondents, in the four areas the most common and frequented events are popular parties (called “sagre”) usually organised in same squares of the town or in some parks. These events are well known and spread in the whole Italy; and are usually dedicated to some typical and local agricultural products: for example in Arsoli is common the “Sagra della Fagiolina Arsolana”, a typical and local variety of bean (Lauteri *et al.,* 2007). According to the respondents, in Tagliacozzo other cultural events are organised and appreciated by the local community. Among them the “Festival of Cinema” or the “Festival di Mezza Estate” that are events known also outside the area and the region. Moreover, in Tagliacozzo other particular events are related to organic food. In these occasions population can acquire knowledge, get information and test organic products. Thus, the survey highlighted a different level of cultural consume in the four municipalities, with greater cultural differentiation and offers in Tagliacozzo in comparison with other investigated areas.

At the same time, most of the interviewed persons also know events that are organised in other areas, usually close or not so far from the communities in which they live (Tagliacozzo showed the highest percentage of respondents who know these events) and most of them usually participate at such events with greatest interest in younger than in older respondents (table 7). Thus, young people are more available to move outside the communities where they live looking for interesting events, probably because they are less busy within the household and they have more free time. The difference between young (more interested) and adult (less interested) is evident; but, interesting, the young participation at events organised outside the communities is stronger in Arsoli and Carsoli, probably because within these communities the cultural events are quite rare or, at least, not so much frequent and limited in term of quality and offer. This is probably due to the limited dimension, in term of community inhabitants, in comparison with Tagliacozzo e Subiaco where the bigger dimension of the towns obviously stimulates a greater cultural offer.

In all communities, most of the respondents perceive that cultural activity has an economic incidence over the own economic resource (although 88% of the interviewed affirm to dedicate limited economic resources to cultural activity) and would be available to increase the expenses for cultural activities if interesting events would be organised. In this sense, according to the age of the respondents, young showed a greater interest than adults, especially in Carsoli and Tagliacozzo, confirming the need to invest resources at local community level mainly addressed to favourite young generations.

Finally, the questionnaire contained a last question related to the perceived or whished challenges that are occurring or are expected to occur within the communities. According to the respondents, a limited percentage of people (the average value for all communities is 31%) perceive the need of challenges. Only in Tagliacozzo the feeling appears strong and according to the respondents the expected challenges should be mainly addressed to promote a better use of natural resources, to increase job opportunities and to organise meeting points and events for youngest.

4 DISCUSSION AND CONCLUSIONS

The main findings of the study can be summarised in a logical framework in which key indexes of sustainable development are assessed in each Municipality of the studied area (table 8).

The issues related to the quality of communication and information appears weaker in Tagliacozzo Municipality than in the other investigated territories. As it was mentioned above, the respondents of Tagliacozzo showed a highest level of education and cultural interests; thus, probably, Tagliacozzo inhabitants perceive a strong need to be involved in the decision process related to the main questions affecting the territory. The highest percentage of respondents that wish or perceive challenges or deep changes at local level is probably due to criticism of the population regarding policy makers and it can be taken as measure of a certain level of unsatisfied of the population. On the contrary, in the other municipalities, a limited percentage of the sampled persons perceive the need of profound changes that should occur at local level; in this sense, they appear less detractor of the local administrations.

This appears confirmed by the analysis of the question related to the connection of the respondents with the territory in which they live: Tagliacozzo recorded the lowest percentage of people who are not interested to move to other living places (although the *human presidium* classifies the area as intermediate with stable population living there) and who retain that there are not environmental problems in the territory. Thus, Tagliacozzo respondents confirm the criticism related to their territory. On the contrary Subiaco respondents showed to appreciate their territory, although several environmental problems (in particular the degradation of water resources like the waste presence on the river). Moreover, the strong identification with the territory appears in contrast with the index *territorial presidium* that classifies Subiaco as area with severe problems of abandonment. Carsoli and Arsoli manifested an intermediate level of connection with the territories, although the abandonment trend threatens the territory, especially in Carsoli.

Considering the age of the respondents, in all communities the youngest showed a lower level of integration and linkage with the territory in comparison with the oldest. According to this aspect, in all areas it appears urgent to promote policies aimed to encourage young generation to remain in the territories. In this sense the most important issues to be implemented are the possibility to have concrete job opportunities, the safeguard of the environment and the preservation of historical and cultural heritage.

The strong interest of the respondents of all investigated areas in cultural activities, highlights the need to implement cultural events suitable to create a favourable environment for sharing cultural experiences. The appreciation of Tagliacozzo respondents of particular events like “Festival del Cinema” and “Festival di Mezza Estate”, confirm the need to increase the cultural offer also in other areas where few and limited events are usually organised. These events should be mainly addressed to young people who manifested a greatest need to satisfy their cultural interests.

Finally, regarding the issue related to the use and management of natural resources, Tagliacozzo appears to be more organised mainly thanks to the facility to buy typical agroforestry products and the highest interest to invest economic resources to buy organic products. In other realities, in particular in Carsoli, respondents often lament the difficult to find in the market such products although most of the respondents consider the valorisation of typical agroforestry products an important tool for promoting rural development in marginal and inner areas. Therefore, it would be envisaged to better organise the whole chain of organic and typical products in the investigated areas promoting the cultivation within the farming systems and facilitating the market visibility of typical local products.

ACKNOWLEDGEMENTS

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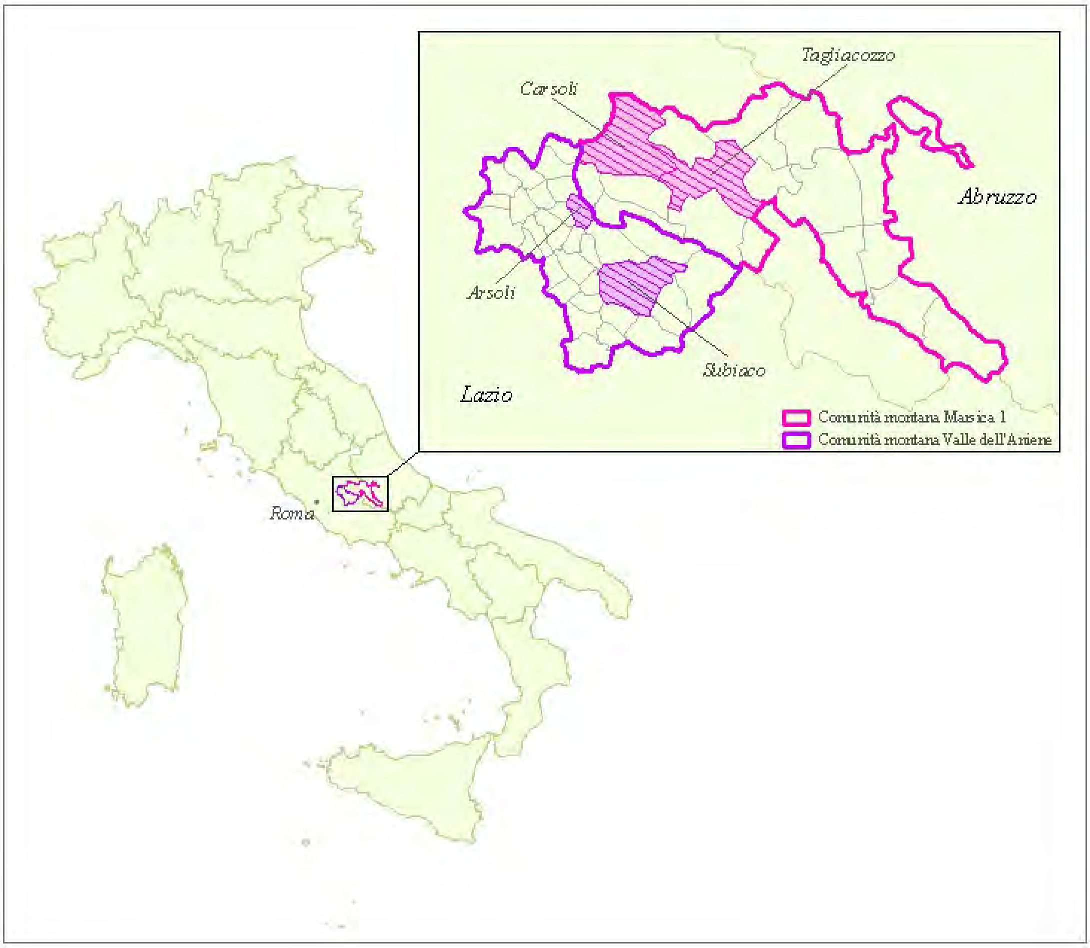
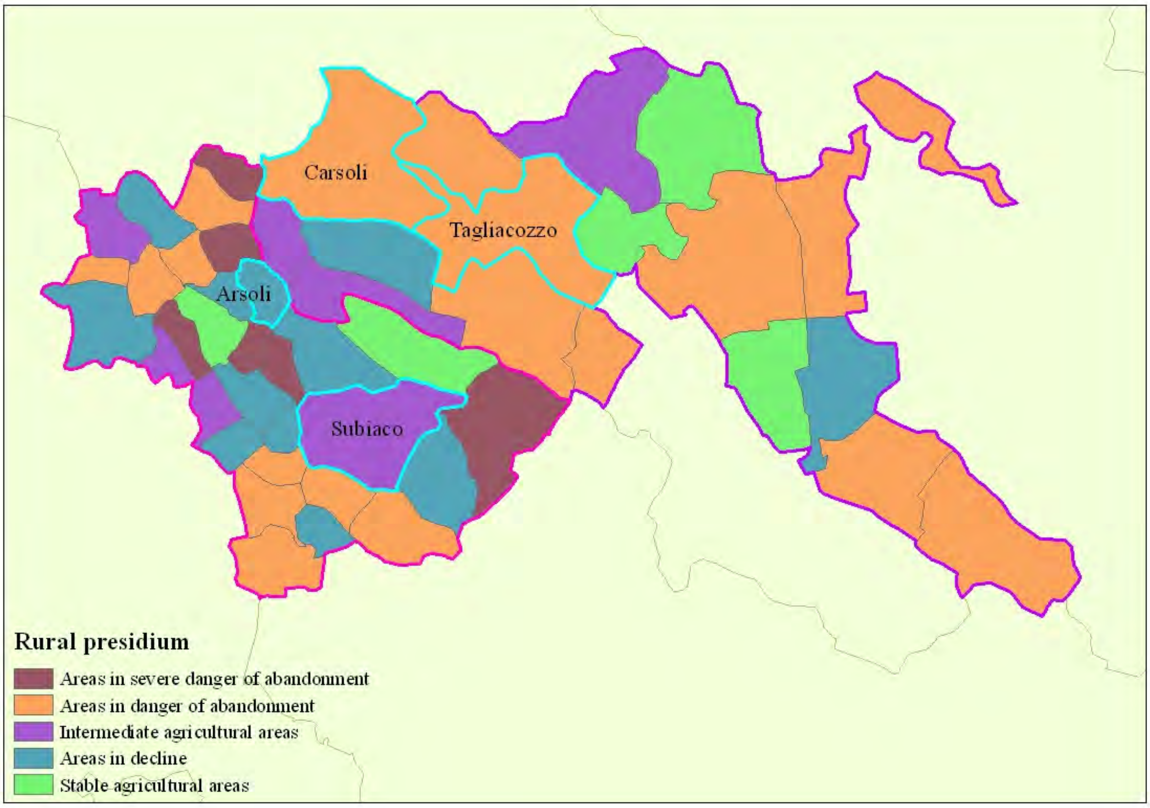


Figure 1: location of the investigated areas. The study was conducted in four Municipalities located across two Regions of Central Italy: Arsoli and Subiaco in Lazio Region (belonging to the Comunità Montana Valle dell'Aniene); Carsoli and Tagliacozzo in Abruzzo Region (belonging to the Comunità Montana Marsica 1).

Table 1: Statistic data utilised to estimate rural presidium, human presidium and territorial presidium in the four investigated Municipalities.

	Arsoli	*Subiaco*	*Carsoli*	*Tagliacozzo*
Territorial area (ha)	1213	6344	9527	8940
Incidence of utilised agricultural area (UAA) in the total area in 2000 (%)	27	31	14	32
UAA evolution over the period 1990-2000 (%)	0,30	-22,20	-48,63	-40,81
Inhabitants	1537	9030	5086	6532
Population density (inhabitants/km^2)	126,71	142,32	53,39	73,06
Net migration (annual average per 1000 inhabitants from 1991 to 2001)	-10,23	-7,81	2,56	1,94

Figure 2: Classification of the investigated areas according to the index rural presidium. The index is calculated in each municipality through the evolution of the incidence of utilised agricultural area over the total territorial area over the period 1990-2000.



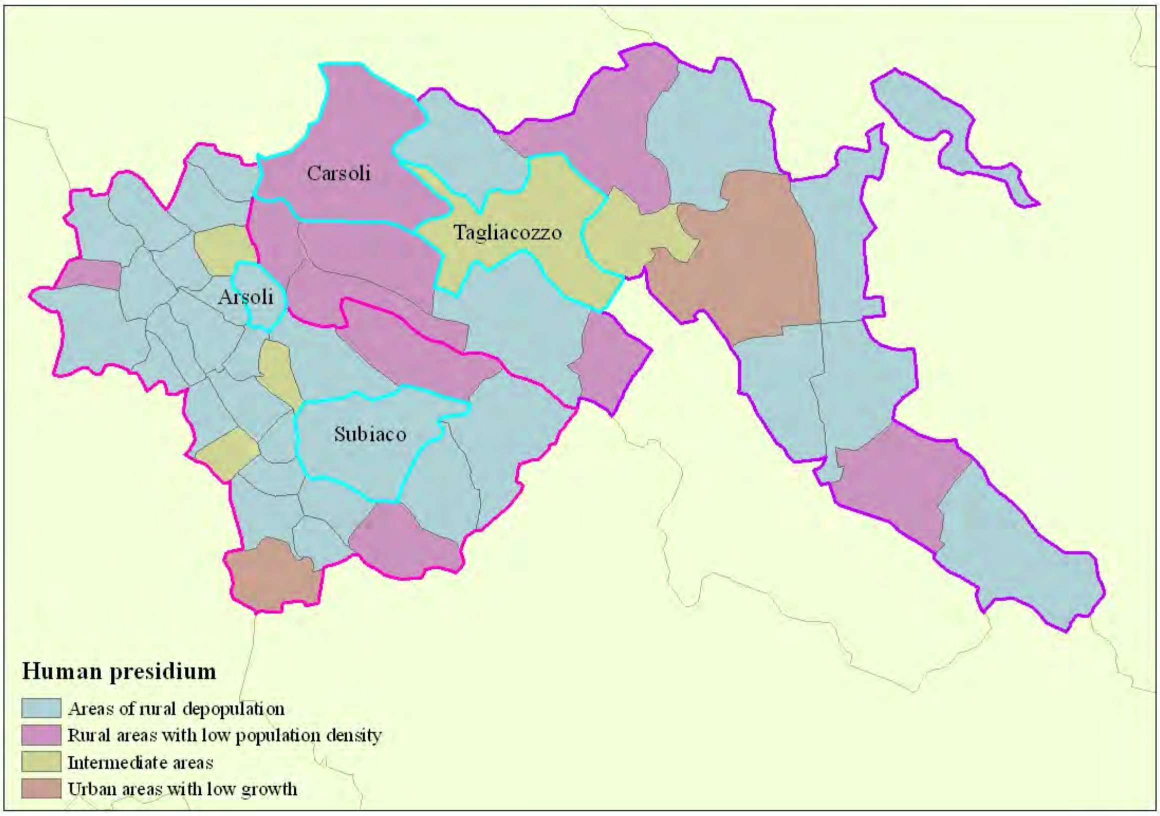


Figure 3: Classification of the investigated areas according to the index human presidium. The index is derived from the comparison of the population density and the balance between immigration and emigration in each territory.

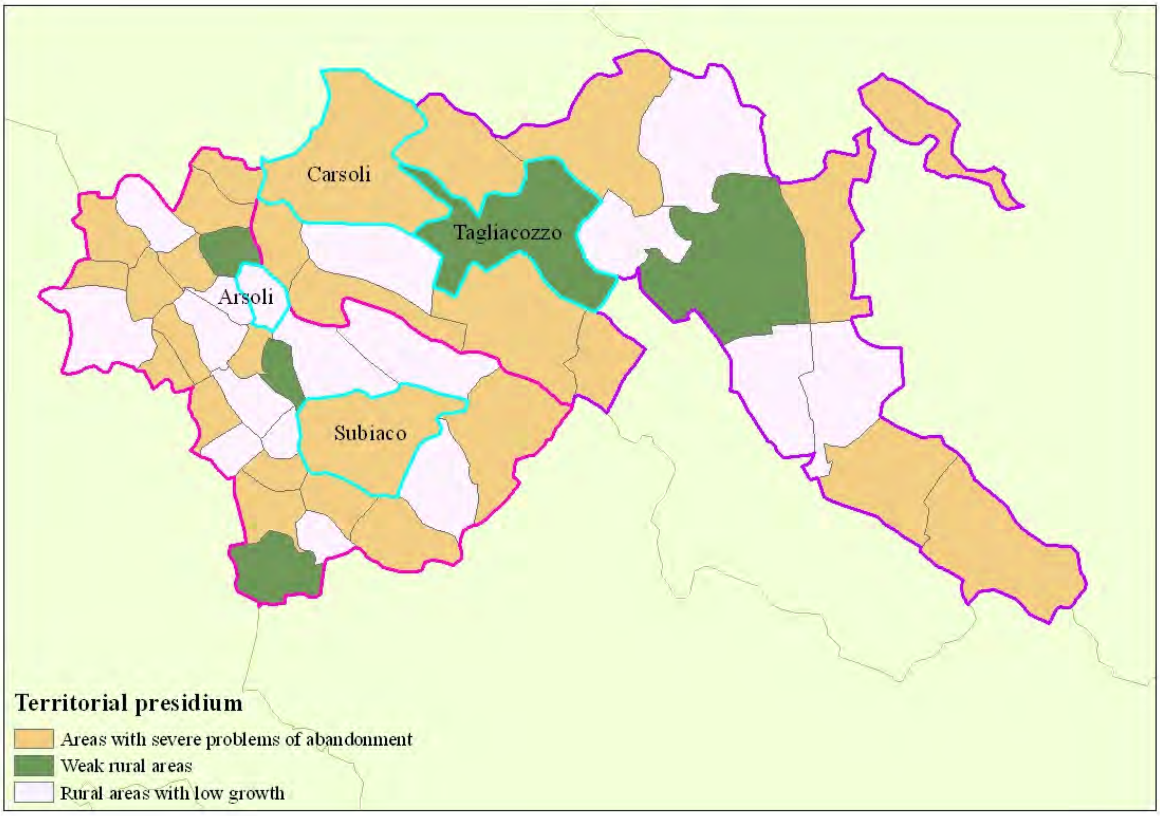


Figure 4: Classification of the investigated areas according to the index territorial presidium. The index is the result of the combination between the rural presidium and the human presidium.

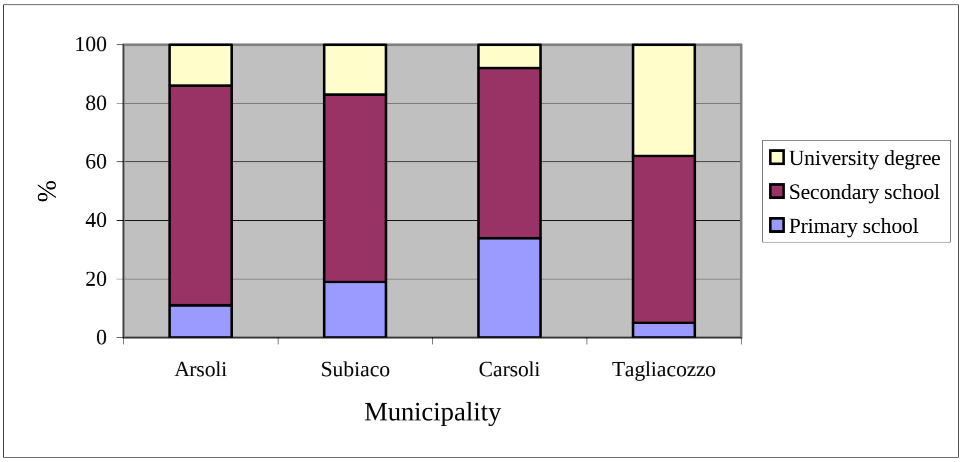


Figure 5: Education level of the questionnaire respondents in the four Municipalities. The questionnaire was addressed to people with age between 18 and 65 years.

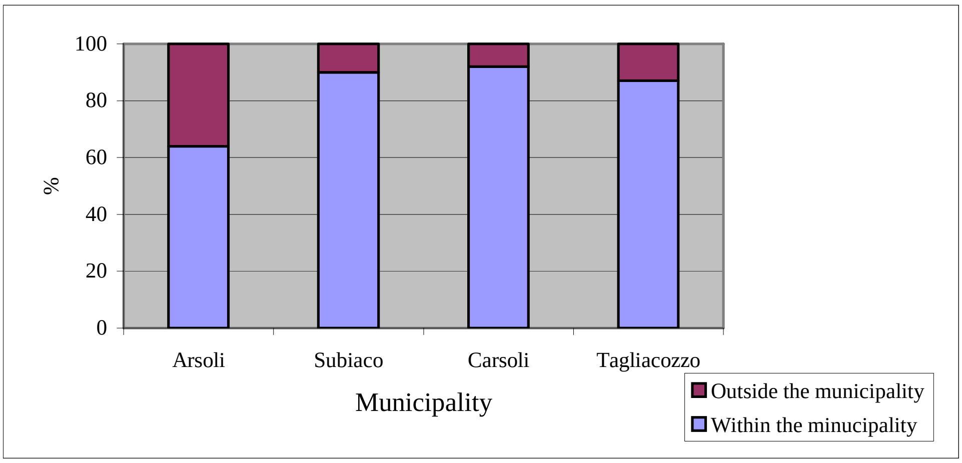


Figure 6: Location of job place of the questionnaire respondents in each Municipality. The nearness of Rome offers job and recreational opportunities for the inhabitants of the four Municipalities.

Table 2: Llevel of participation and quality of communication in the four Municipalities (percentage of respondents).

Parameter	*Arsoli*	*Subiaco*	*Carsoli*	*Tagliacozzo*	*All*
Enough informed	80	78	75	49**	70
Good level of communication	70	72	69	43**	63
Strong identification with the territory	60	67	53	64	61
Interested to move to other places	52	32**	47	62**	48

** Statistical difference (P<0.01)

Table 3: Llevel of participation and quality of communication according to the class age of the respondents in the four Municipalities (percentage of respondents). Young and adult categories includes respondents with age between 18 and 35 years and between 36 and 65 years, respectively.

Parameter	*Arsoli*		*Subiaco*		*Carsoli*		*Tagliacozzo*		*All*	
	young	adult	young	adult	young	adult	young	adult	young	adult
Enough informed	81	78	61**	88	71	78	45	52	66	74
Good level of communication	76	63	72	72	67	71	53	37	67	60
Strong identification with the territory	56	65	33**	86	37**	69	50	73	45	74
Interested to move to other places	67**	35	67**	13	63**	31	93**	42	71	29

** Statistical difference (P<0.01)

Table 4: Awareness of natural resources and environmental value in the four Municipalities (percentage of respondents).

Parameter	*Arsoli*	*Subiaco*	*Carsoli*	*Tagliacozzo*	*All*
Knowledge of local typical products	88	88	86	74	84
Consume local typical products	60	43	42	33**	45
Available to increase the expenses for typical products	37	47	48	61**	48
Usually go outside for lunch/dinner	92	86	92	77**	87
Existence of environmental problems in the territory	38	47	47	61**	48
Typical products as development tool	85	87	76**	98**	87
Possibility to buy typical products	53**	80**	28**	98**	65

** Statistical difference (P<0.01)

Table 5: Awareness of natural resources and environmental value according to the class age of the respondents in the four Municipalities (percentage of respondents). Young and adult categories includes respondents with age between 18 and 35 years and between 36 and 65 years, respectively.

Parameter	*Arsoli*		*Subiaco*		*Carsoli*		*Tagliacozzo*		*All*	
	young	adult	young	adult	young	adult	young	adult	young	adult
Knowledge of local typical products	85	91	75**	95	86	86	55**	87	77	90
Consume local typical products	57	63	39	45	33	51	18**	43	38	50
Available to increase the expenses for typical products	35	39	42	50	43	53	40**	75	40	55
Usually go outside for lunch/dinner	98	85	94	81	100**	84	98**	63	98	78
Existence of environmental problems in the territory	43	33	58	41	47	47	45*	72	48	49
Typical products as development tool	81	89	83	89	76	76	98	98	84	88
Possibility to buy typical products	56	50	78	81	24	33	98	98	60	68

*Statistical difference (P<0.05)
**Statistical difference (P<0.01);

Table 6: Assessment of cultural interest and perception of future changes (percentage of respondents).

Parameter	*Arsoli*	*Subiaco*	*Carsoli*	*Tagliacozzo*	*All*
Participate at cultural events in the community	86	71*	89	99**	86
Knowledge of cultural events in neighbouring communities	57	63	60	90**	67
Participate at cultural events in neighbouring communities	77	67	82	81	77
Economic incidence of cultural activities	73	74	84	72	76
Interested to increase expenses for cultural activities	70	85	75	70	75
Perceive the need of challenges in the community	28	16	27	54**	31

*Statistical difference (P<0.05)
**Statistical difference (P<0.01);

Table 7: Assessment of cultural interest and perception of future changes according to class age of the respondents in the four Municipalities (percentage of respondents). Young and adult categories includes respondents with age between 18 and 35 years and between 36 and 65 years, respectively.

Parameter	*Arsoli*		*Subiaco*		*Carsoli*		*Tagliacozzo*		*All*	
	young	adult	young	adult	young	adult	young	adult	young	adult
Participate at cultural events in the community	91	80	78	67	84	94	100	98	88	85
Knowledge of cultural events in neighbouring communities	72**	39	67	61	73	47	98	85	77	60
Participate at cultural events in neighbouring communities	90**	50	88*	54	95**	63	90	75	91	63
Economic incidence of cultural activities	81	63	89	66	100**	69	93**	58	91	64
Interested to increase expenses for cultural activities	69	72	83	86	82	69	85*	60	79	72
Perceive the need of challenges in the community	30	26	22	13	27	27	43	62	30	32

*Statistical difference (P<0.05)
**Statistical difference (P<0.01);

Table 8: Synthetic framework elaborated for the identification of weakness and strenghtful traits in the four investigated Municipalities.

Index	*Arsoli*	*Subiaco*	*Carsoli*	*Tagliacozzo*
Information and communication	***	**	**	*
Identification with the territory	**	***	**	*
Cultural opportunity	**	**	**	***
Valorisation of natural resources	**	**	*	***

- weak; ** medium; *** strong

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Forest operation plan for Agrarian community – case of Agrarian community Ravnik - Orlovše

Tine Premrl[1], Janez Krč[2]

Abstract

The Agrarian communities are one of the oldest forms of common property in Slovenia. Motivation for such type of owners association came from farmers' needs for grazing, hay and firewood harvesting. That common land was usually low-productive, degraded, and located close to the settlements where farmers lived.

After socio-economic changes, and nationalization of agrarian communities land in the fifties and sixties it came to afforestation and revegetation process.

The Agrarian community Ravnik -Orlovše represents one of the 350 such communities in Slovenia. It was re-established according to The Denationalization Law in 1995. It is composed from 88 member's ideal share (pars pro diviso) and manages on 657 hectares of land. Community members, shareholders are mostly small scale forest owners coming from nearby towns. The Community assembly is the main board where important decisions are made at annual assemblies, while the elected management board is responsible for organizing forest operation activities.

The main income for the community comes from forests utilization. Forest management plan for 2006-2015 in community forests prescribes a 33.350 m3 allowable cut. Consequences of afforestation and revegetation process are that there are lots of young and heterogeneous forest stands with tending activities needs.

In the research we prepared a plan for forest operation works, which includes on information of forest and forest income, together with valuation of the community earnings.

Working methods were based on participation with different stakeholders in the decision making process. During the plan preparation we collected and interpreted information (national forest inventory, survey among owners), prepared proposals and adjusted all collected information on feedback loops base. The result of the research is an adapted

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Forest operation plan that includes shareholders expectations on one hand and forest site potentials and silviculture measures on the other hand.

Key words: agrarian community, forest operation plan, private forest owner
FDC: 62+682=111

1 INTRODUCTION

On 25th of January 1994, the Law on the re-establishment of agrarian communities and the return of their property and rights was adopted. On that legal basis more than 350 common agrarian or pastureland communities were re-established. In 1996, former members or their heirs got back the property which included land and buildings. The Agrarian Community Ravnik – Orlovše (AC) became the first re-established agrarian community in Slovenia, members of which got their land back in denationalization process.

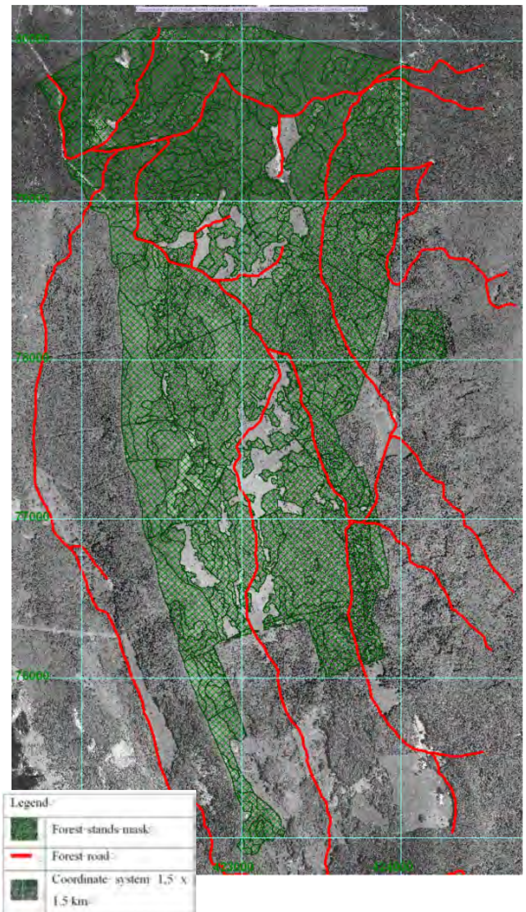

Figure 1: Map of the Agrarian Community Ravnik – Orlovše estate with Forest truck roads and Forest stands mask

AC is now an organization of members-owners of common ideal shares. The re-established agrarian community is composed of 88 member's ideal share. Each member owns a portion of 1/88, which represents an original share or a part of the original share, which was divided among inheritors during the inheritance process. Members now own different parts of shares, some own the original 1/88 share, which represents 1 of the 88 original founders and members, whil others own smaller parts of the originale 1/88share, which was divided among them.For example: 1/176, 1/264, 1/352… of the original share. Members of the AC expect to obtain certain benefits from their share (dividend, fire wood, technical wood or hay). Because of this a size of their share is important as it gives members the right to defend their equity rights and interests in voting decisions, profit sharing and other abovementioned benefits. If it is dividend one of the motivation to be or to become member of AC professional management forest as the most important source of income is existential. In our research which will be presented further on, we focused on forest operation works with the aim to optimize this income source in a sustainable way, which will give members a permanent and regular forest rent. In the research we didn't use only technical optimization tools but we put a lot of effort in participation with different decision making actors (members of AC, foresters).

2 METHODS AND RESULTS

As already mentioned above the aim of this research was to analyze forest resources and prepare Forest Operation Plan (FOP) which includes members' expectations and will optimize forest rent in a sustainable and permanent way. Before we started our research we had made some assumptions regarding forest funds and members.

Supposition were that optimize organized forest operation works can provide stable yield, uniformly distributed between income and investments and can reach forests and members needs or expectations.

Forest operation plan as a written document can be a useful instrument in forest management.

We also assumed that AC forest needs intensive silviculture measures because of the forest history (afforestation and revegetation process) and a lack of management in the last decades.

For spatial information we sup posited that forest information system with stand map is a useful and valuable tool also for forest operation works which will be used for provision of for forest operation work optimization.

In the forest plan, we want to include participants and information which will make the plan operative and useful. So we prepared a communication strategy plan (Figure2), a plan with feedback loops as a tool through which new findings and new participants' remarks can help build the final product, which is a valuable, useful and realistic Forest operation plan for AC forests.

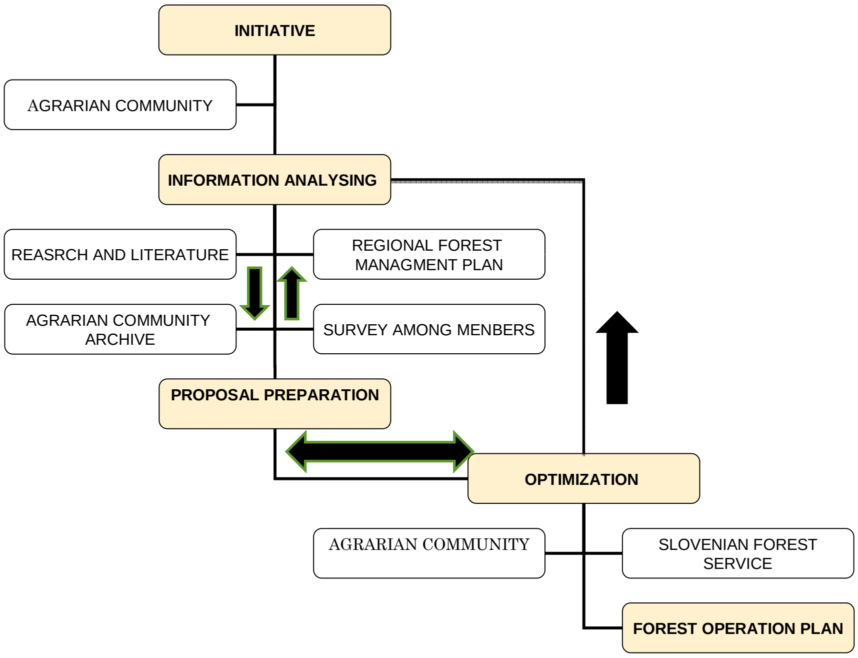

Figure 2: Research communication and work plan in the process of Forestry operation plan preparation

First step after AC initiative to have such FOP as a tool to guideline their forestry activities was to gather information. Sources of information were actual Podkraj - Nanos Forest Unit Management Plan, AC archives, and survey among AC members.

Second step of FPO was analyzing results of survey which we made among members, analyzing of forests information data, forest rent calculating with items including in forest rent calculation procedure.

Third step was preparing and presenting possible solutions, management proposals based on first and second step analyses and optimization them with AC and Slovenian Public Forest Service (SPFS) local forester.

For every step we have used different methods from space analyzing tool to surveys and participation methods. A lot of input was done on AC member’s survey and spatial analyzing.

SURVEY AMONG MEMBERS AND AGRARIAN COMMUNITY ARCHIVES ANALYSIS

With the analysis of the membership rule book and law rights we found out that members as owners are important actors in the decision making process, so we realize getting to know them and their opinion through a survey would be very useful for further steps in the FOP preparation as we wanted the FPO to be useful and its guidelines considerate.

The assumption was that members of agrarian communities are too poorly equipped to carry out the forest operation works FOW, especially harvesting and skidding, even though they are motivated to work in forests. Another assumption was that members are not economically dependent on revenue from forest and that they work in forest, together with their family members, mainly to prepare firewood.

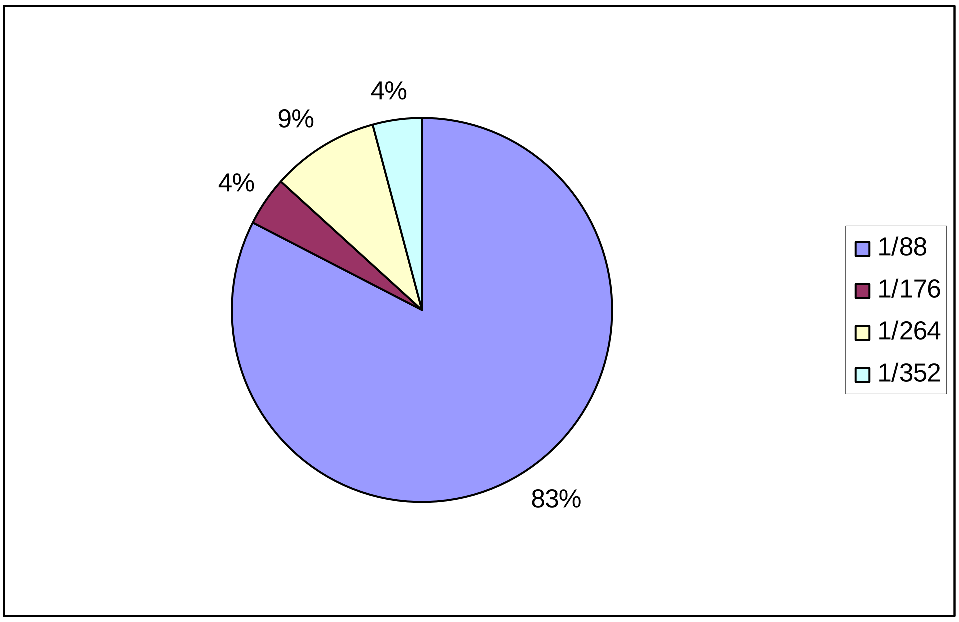

Figure 3*: Different share distribution among members*

The results of the archives analysis show that the AC has 97 members. A majority of them, 83 %, own an original 1/88 share while the rest of the members divided their share among their heirs in inheritance process.

In the past, all the first 88 members came from Vipava or nearby villages. Today 74 % of shareholders still come from Vipava and its surroundings, while the rest of them live in other towns and have almost no contacts with their families' home town.

Members have realized that further dividing of shares, especially when new members have left the local town, presents a management problem for the AC and a future threat as some of the decisions which have to be common are now more difficult to make.

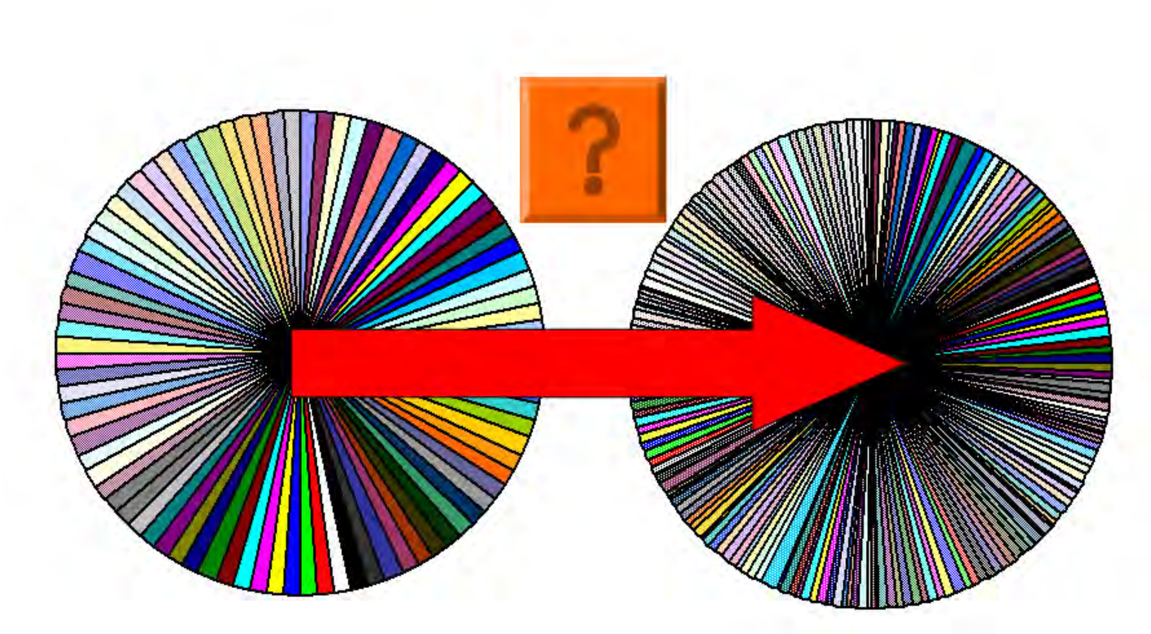

Figure 4: *Estimation presenting a doubled number of members as a consequence of division of shares*

In figure 4 we present potential worries, taking into account that each color in the two circles presents an individual member with their own preferences and expectations and this makes it even more difficult to pool common interests.

A majority of members, who participate in annual assemblies and who, we assumed, represent the active part of AC members in the decision making process, were included in the survey. Members included in the survey represent almost a half of all the members.

Socio-economic profile of the AC members shows that more than a half of those surveyed were older than 60 years, low educated and already retired. The survey also showed that the majority of members have non-agricultural property and that they are not economically dependent on income from agriculture. The majority of members are interested in working actively in AC forests for firewood harvesting and silviculture works. 62% of the surveyed members of the AC are satisfied with the business results. 7% of the surveyed members are thinking of selling their shares in the coming years.

The last part of the survey focuses on members' knowledge and skills for forest works as well as motivation for working and managing forests. Most of the surveyed members have also their own forests but they do not depend on them economically. Those who work in their forest annually harvest around 15m3 of timber for domestic use on average.

The surveyed members have one or two chain saws on average (one is 7 years old, the other 17), 43% of members are equipped with tractors, which are 23 years old on average. One third of the members also have a skidder winch.

Based on the skills and equipment of the AC members, survey results show that it will be difficult to find reliable persons among average members for realization of all the necessary forest works. There are three exceptions though, namely three members who work as forest contractors and are therefore able to take over large forests operations. For the AC it would be optimal to include those members (contractors) in extensive and intensive forest operation works (harvesting, skidding) while the rest of the members who are also interested in working in AC forests could conduct the firewood harvesting for their own needs and silviculture works, especially thinning from which they can get firewood.

REGIONAL FOREST MANAGEMENT PLAN

The Forest management unit plan (MUP) was done for the management unit Podkraj - Nanos 2006-2016. Plan for the period 2006-215 provided for 33,350 m3 allowable cut. In the research the MUP has been used as a data source for forest growing stock, annual allowable cut, forest roads system (openness). With spatial analyzing tools (GIS) we intersected AC land register data with forest information system data. For the stands which are divided by land register borders into several property outside the AC we took into account only the part belonging to the AC property. The final database includes 282 stands for which basic information for decisions in optimization process were calculated.

We have made calculations for every stand on AC estate (Table 1). These calculations provide important information for optimization process. The aim of the preliminary, calculative optimization follows the goals of the next step optimization with AC and Slovenian Public Forest Service (SPFS) representatives. As for calculative and also for the final optimization we want to balanced spatially and periodical outcome. Regarding the financial output (forest rent) we schedule forest balanced operation process which will include maintaining of young stands on one hand and final cutting on the other one. From the past harvesting information we supposed that from final harvesting stands we get 80 % of log wood and 20 % of low quality wood. From stands in younger phases we anticipated low quality wood. Timber prices were collected out of several price lists from the local forest companies.

CALCULATION ITEMS	SUM (EUR)	CONIFERS (EUR)	DECIDUOUS (EUR)
1 Selling price	766.334,92	758.502,40	313.390,31
2 Cutting and skidding costs			
2a. Cutting	133.590,17	123.720,13	62.224,39
2b.Skidding	159.204,33	155.407,69	53.481,28
2c. Manipulation on truck road	31.309,56		
3 Construction and maintenance of skidding roads	18.194,82		
5 TOTAL COSTS (2 +3 +4)	342.298,89	312.966,12	129.101,86
6 FOREST TAX (1-5)	424.231,33	438.335,29	180.290,32
7 production cost of standing timber			
8 Silviculture costs	14.358,37		
9 Forest management costs	1.005,05		
10 FOREST RENT (6-7-8-9)	408.867,91		

***Table 1**: Forest rent calculation results for all Agrarian Community forests*

Through calculation scheme we calculated the forest tax and the forest rent (Table 1) for each of 282 stands. Forest rent from each stand was input for optimization between profitable and unprofitable forest stands. Calculation on the forest stands level was very diverse in financial output and in special distribution and this presented a problem for participants in adjustment process on relation PROPOSAL PREPARATION – OPTIMIZATION (Figure 2). Although information like: forest tax and forest stands information (tree species, expected wood quality,...) was recognized as very valuable information in case of market demand oscillation (price) for some wood assortments or in case of forest salvage cutting (spruce bark beetle attack). One of the research goals was FOP assessment as the useful tool for users (local public forester, AC management board, contractors). The aggregation of forest management planning from the stand level to higher forest section level was also conducted.

We made an optimization between forest sections. Forest section provides the basic variable considering calculated forest rent (Table 1). Although sections represents basic field spatial units which are normally larger (average size is 30 hectares) than forest stands (from 0,25 hectares onwards).

Lower or negative forest rent was calculated in sections where harvesting costs or silviculture costs presented higher share in comparison to standing timber value (Figure 5).

Figure 5: *Variation of forest rent and difference between standing wood price on the section level*

Results of this analysis were used in optimization process of forest sections and adjustment in participation process. Conclusions of first level optimization process in which proposals were made were among participants generally well accepted and only minor adjustments were made.

Annual timetable of forest operation works on the section level was optimized and in this process resulted in Forest operation plan for Agrarian Community Ravnik – Orlovše. FOP was also presented to the members of AC on annual assembly.

3 DISCUSSION

For Ravnik Orlovše agrarian community forests are the main source of income. The Forest Management Plan for the period 2006-215 anticipates 33,350 m3 of cutting volume. This amount of wood together with silvicultural works was optimized in the process of FOP preparation based on set of goals. FOP optimized by sustainable forest rent represents members of AC the base for their future management decisions.

Members of AC have a decision making influence through voting on annual assemblies for general decisions while their elected management board runs the business of agrarian community and takes care for FOW. Analysis of survey among members shows that the majority of members are not able to fulfill all anticipated FOW from FOP. Therefore AC will have to hire contractors to fulfill anticipated FOW.

According to FOP AC can expect sum of 408.876 EUR forest rent in ten years time. More options were discussed with AC members considering this amount. Forest rent can be divided among members as shareholders profit or it can be used for investments connected with wood processing industry and other kinds of wood use (biomass heating system, sawmill etc.).

Before going into larger investments they want reorganize AC. Idea was to establish the shareholder company which will be the land owner and members would be stakeholders. With this reorganization they would like to overcome the present situation where individual member as a private land owner has the “veto” right. Current situation is blocking the spirit of enterprise behavior and causes unbridgeable problems in decision making process when consensus of all members is necessary to carry out some important activities related on co-ownership (buying or selling forest parcels, long term renting etc.).

Fortunately forest operation works can be carried out with the normal majority members’ consensus. This will enable realization of forest operation works in Agrarian Community Ravnik – Orlovše Forest Operation Plan.

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Classifying forest owner motivations, management constraints, and information sources – a factor analysis approach

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Abstract

Family forest owners and the lands they manage are vitally important for a host of economic and environmental benefits. Thus, it is important to understand the motivations and constraints that these landowners face. This study, conducted in the state of Virginia in the U.S., was designed to determine the motivations for owning forest land, constraints to managing the land, and primary sources of information to assist in management. Results are based on data from a mailed survey to 3,435 forest owners, with a usable response rate of 32%. The top two motivations for owning forest land were "enjoyment of scenic beauty" and "protection of biodiversity". Through factor analysis, we developed four categories of landowners based on motivations: those with amenity motivations, those with economic motivations, those with recreation motivations, and those who primarily own land as part of the farm. The top two constraints to active forest management were "lack of time" and "lack of labor". Through factor analysis we developed four categories of forest owners based on their primary constraints: those with human-related constraints, those with scale-related constraints, those with financial constraints, and those with time and labor constraints. The primary sources of management information were the Virginia Department of Forestry and private consultants. Through factor analysis we developed two categories of forest owners based on their information channels: those who receive their information through direct interaction with natural resource professionals and those who take a self-learning approach.

Key words: forest owners, management, information sources
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1 INTRODUCTION

Family forest ownership is vitally important in the U.S. Nationally, there are about 10.4 million family forest owners, who collectively own nearly 104 million ha of forest land (Butler 2008). In addition to timber, these lands provide a wide array of ecosystem services such as clean water, clean air, soil protection, and fish and wildlife habitat. In Virginia, a southeastern state, there are about 402,000 family forest owners who collectively own over 3.9 million ha of forests.

In 1996 the Virginia Forest Landowner Education Program (VFLEP) was created through a partnership with the Sustainable Forestry Initiative, the Virginia Forestry Association, the Virginia Department of Forestry, and Virginia Tech's College of Natural Resources and Cooperative Extension Service (Johnson et al. 2004). Over the years VFLEP has provided a wide array of education services to Virginia's family forest owners. The current study was established in order to further understand the motivations, constraints to management, and primary information sources for Virginia's family forest owners.

2 METHODS

2.1 SURVEY RESEARCH

The study population for this research included family forest owners who were listed in the VFLEP database. This large database had been compiled over many years and included forest owners selected at random from county tax rolls as well as all forest owners who attended some type of educational programs offered through the Virginia Cooperative Extension Service. All forest owners in the database who owned at least 0.8 ha of forest land in Virginia were included, resulting in a survey population of 5,793 forest owners. A proportionate stratified random sampling design was used to select 3,435 forest owners (60% of the survey population). For validity purposes, the survey questionnaire was pilot tested; it was mailed to 120 family forestowners, using an advance letter that alerted them to the survey, followed by the survey package (cover letter, questionnaire, self-addressed stamped return envelope) a week later. For practical reasons, the pilot test was conducted with forest owners living in Montgomery County, Virginia. After all responses from the pilot test were analyzed, a focus group consisting of local family forest owners was held to discuss the questions and answers. Focus group participants made comments, and provided suggestions about unclear questions and survey format (length, format, wording of questions, font size).

The revised questionnaire was administered using a slightly modified version of the tailored design method (Dillman, 2000) by using two waves of mailings of the survey packet (advance letter, cover letter, questionnaire, self-addressed stamped return envelope), and a wave of reminder cards to initial non-responders after a month. The first mailing was in late April 2007. A month after the first reminder card was sent, a second mailing was made of the survey packet together with a further reminder, for non-respondents. Recipients were requested to return the questionnaire even if they did not fill it out, and to provide a reason why it was not filled out. The useable response rate was 32 percent.

2.2 DATA ANALYSIS

Although the survey was very broad-based in nature, our interest in this paper is on the classification of forest owner motivations for owning the forest, constraints to active management, and primary sources of information that they use to inform their management. Thus, variables related to these categories were reduced through factor analysis, using the principal components analysis (PCA) as described below. Two procedures were first used to determine the appropriateness of factor analysis for these data. First, a correlation matrix was created and a visual inspection ensured that there were enough significant correlations among the variables. Both the number of correlations equal or greater than 0.3, and the significance of the correlations were considered (Hair et al., 1998). Also, the Bartlett test of sphericity was run to test for the presence of non-zero correlations among at least two of the sets of raw variables.

The second procedure was the measure of sampling adequacy (MSA), used to quantify the degree of inter-correlations among the raw variables. A higher MSA means that there is a high degree of correlation between the variables (i.e., factor analysis is appropriate). MSA values can range from 0 to 1 with 1 indicating a perfect prediction of each variable by others without error; 0.80 indicating meritorious prediction; 0.70 indicating moderate prediction; 0.60 indicating mediocre prediction; and 0.50 or less meaning low prediction (Hair et al., 1998). We chose the cutoff point of 0.80 for our analysis.

After verifying the appropriateness of the use of factor analysis, the next step was to compute communalities. Communalities are the estimated amount of variance shared among all variables in the analysis and on which derivation of the factors from the factor analysis is based. Variables having communalities less than 0.3 were excluded from further analysis, the rest were retained. Our data involved multiple groups using the same scale with different variances (as opposed to variables with different scales); for that reason, the appropriate extraction technique used was the covariance matrix. The number of factors extracted was determined using the latent root criterion (any individual factor should account for the variance of at least a single variable if it is to be retained for interpretation). Given that our goal was to summarize the information contained in the original set of variables to the least possible number of independent, uncorrelated factors, orthogonal rotation of the factors would simplify the factor structure using the orthogonal method. The rotation method used was Varimax, because it provides as many orthogonal factors as possible by simplifying the columns in the factor matrix (i.e., makes as many values as possible in each column close to zero).

When the factors were rotated, we analyzed the factor loading for each variable (the correlation between that variable and the factor; a high factor loading indicates a high variance of that variable accounted by the factor). As a criterion of significance suggested by Hair et al. (1998), variables having a factor loading greater than 0.5 are practically significant. In case one or more variables loaded on more than one factor in the rotated component matrix, we used the component score coefficient matrix (showing the amount of variance accounted for by the factor solution for each variable) and eliminated the variables with communalities less than 0.3 (at least 1/3 of the variance of each variable must be taken into account). Also, variables that did not load on any factor and/or their communalities were too low (<0.3) were ignored in the interpretation. The Anderson-Rubin method was used to compute the factor scores because it ensures the orthogonality of the derived factors; the scores are uncorrelated compared to other methods such as regression or the Bartlett method. Cronbach's alpha was calculated for the original set of variables before they were reduced through factor analysis to assess the reliability of the measures. A reliable measure of the scale has a Cronbach's alpha value of 0.70 or greater, as suggested by Hair et al. (1998). We also validated the factor analysis by using an estimated split sample (i.e., we split our sample in two samples of the same size). We validated the factor models by comparing the factor matrices from the two subsets and by comparing them to the developed model (that used the total sample size).

After validation of the factor analysis, each extracted factor was used as a stand alone variable using the Anderson-Rubin method for computing the factor scores (to ensure the orthogonality of the scores).

3 RESULTS AND DISCUSSION

3.1 MOTIVATIONS

Table 1 presents the importance of a variety of motivations for owning land, based on 1,084 responses. The most highly rated motivation was “scenic beauty”, with 88% of respondents rating it as an important motivation to own land. The second most highly rated motivation was “biodiversity protection”, with 86% of respondents rating it as important. Only one economic-related motivation, “real estate”, was highly rated. The lowest rated motivation was “owning land for a secondary residence”, with only 16% of respondents rating it as important. Owning the land as a source of supplementary income was also not a highly regarded motivation, with only 23% respondents rating it as important.

Seventy-two percent of our respondents stated that passing the land to their heirs was important, however, Butler *et al*. (2007) came up even with a larger number. They found that 76% of the family forest owners, controlling 78% of the non-industrial forest land, intend to pass their land to their heirs. This indicates a higher emphasis on amenity values and less on timber production and other economic values. However, it is also interesting to see here that 27% of our respondents owned their land primarily for timber production, which is different from Birch (1996), who found that only 3% of family forest owners hold their land primarily for timber production. Moser *et al*. (2005) found that only 1% of family forest owners own their land primarily for timber production. They cited the primary reason for owning forest land was that the forest was just a “part of the farm” (40%). Interestingly, that is almost identical to our results (42%). The same study also found that “enjoying the woods” was the second-highest ranked reason for owning land, followed by recreation, land investment, and biodiversity. Our study found the same reasons were highly ranked as well, but the order was not the same because we had scenic beauty (the equivalent of enjoying woods), biodiversity and land investment highly ranked. On the other end of the spectrum, our most unimportant motivation was “to own land as a source of supplemental income” (20%), followed by the production of non-timber forest products with 17%, and retirement fund (15%).

Birch (1996) also found that 40% of family forest owners own their land just because it is part of their residence, compared to 50% for our study population. Butler *et al*. (2007) found similar results as ours because in their study, though owners primarily own their land for noncommercial reasons, 41% of them (who owned 70% of the total family forest land) had harvested trees for commercial purposes at some point during their land tenure.

Table 1: Frequency of importance of motivations for owning forest land (n=1,084).

Motivations	Very unimportant (%)	Somewhat unimportant (%)	Somewhat important (%)	Very important (%)
To enjoy beauty or scenery	1	3	21	67
To protect nature and its diverse animal and plant species (biodiversity)	1	4	28	58
For privacy	3	6	24	50
To pass land on to children or other heirs	5	9	26	46
For land investment (real estate)	9	16	31	33
Part of home	4	4	14	50
To have a healthy lifestyle	6	12	29	34
For hunting or fishing	11	13	25	34
For recreation other than hunting or fishing	9	13	31	25
Part of farm	3	5	13	42
For production of sawlogs, pulpwood or other timber products	12	13	28	27
For production of energy (firewood, biofuel)	12	19	29	18
As a retirement fund	15	16	25	17
For cultivation/collection of non-timber forest products	17	20	19	8
To supplement yearly income	20	19	15	8
Part of vacation home	5	5	7	9

All of these results indicate that family owners do not have one single motivation, but several at the same time; and that though more and more owners attribute a greater importance to amenity values of the forest, economic motivations remain present and important.

3.2 Development of Motivation Classes

The MSA was the first test used to assess the adequacy of the factor analysis. As shown in Table 2, the Bartlett's test of sphericity was very significant (0.000); and the Kaiser-Meyer-Olkin MSA was 0.851, greater than our chosen reference point of 0.80. Also, the Chronbach's alpha for our motivation scale was 0.82; which is greater than 0.7, indicating acceptable reliability of the measures (Hair et al. 1998). Following these tests, we extracted factors using the principal components analysis (PCA) technique.

Table 2: Measure of sampling adequacy for motivation variables.

Kaiser Meyer-Olkin Measure of Sampling Adequacy		0.851
Bartlett's Test of Sphericity	Approx. Chi-Square	4610.58
	df	120
	Sig.	0.000

Four factors, with an eigenvalue equal or greater than one, were extracted from the analysis, with the first factor having the greatest explanation power, with an eigenvalue of 4.5. All four factors combined explained a total of 53.24% of the total variance (Table 3).

Table 3: Results of the extraction of component factors for motivation variables.

Factor	Eigenvalue	% of Variance	Cumulative % of variance
1	4.566	28.536	28.536
2	1.537	9.609	38.143
3	1.400	8.749	46.894
4	1.016	6.349	53.243

Since the first factors in the unrotated component analysis factor matrix explained too much of the variance of the whole set of variables, we rotated the factors (Table 4) to redistribute the variance to the other factors for both simpler interpretation and more meaningful factor pattern (Hair et al. 1998). Variables such as "secondary residence" and "pass land to heirs" were poorly explained by all four factors together, with respective communalities of 0.215 and 0.212. These two last variables were not taken into account in the remainder of the analysis for they did not have a communality of 0.3 or greater (Hair et al., 1998). The four-factor solution, in its factor matrix, contained information representing 53.24% of the total variance.

Since VARIMAX is an orthogonal rotation, it minimizes the number of variables that load highly on more than one factor, which simplifies the interpretation. The following variables loaded 0.5 or higher on each factor (at least half of the variable was accounted for by the factor) and in a decreasing order of loading (Table 5).

Table 4: Rotated component analysis factor matrix for motivation variables.

	VARIMAX – rotated loadings				
Variables	Factor 1	Factor 2	Factor 3	Factor 4	Communality
Scenery	0.717	0.118	-0.015	0.187	0.564
Biodiversity	0.659	0.138	0.013	0.169	0.482
Land investment (real estate)	0.131	0.630	-0.116	-0.041	0.430
Part of home	0.602	0.049	0.310	-0.629	0.857
Secondary residence	0.170	-0.020	0.056	0.424	0.212
Part of farm	-0.009	0.031	0.954	0.055	0.915
Privacy	0.782	0.046	0.129	0.063	0.635
Pass land to heirs	0.180	0.235	0.178	0.310	0.215
Non-timber forest products	0.281	0.368	0.358	0.160	0.368
Energy	0.348	0.326	0.350	0.075	0.355
Timber production	0.020	0.747	0.146	0.189	0.616
Hunting/fishing	0.281	0.255	0.104	0.563	0.472
Recreation	0.611	0.183	-0.039	0.415	0.580
Retirement fund	0.184	0.772	-0.001	0.072	0.635
Supplemental income	0.099	0.684	0.293	0.084	0.570
Lifestyle	0.728	0.215	0.141	0.129	0.613
Total					
Sum of squares (eigenvalue)	3.228	2.5	1.463	1.328	8.519
Percentage of variance	20.176	15.623	9.142	8.302	53.243

Table 5: Distribution of motivation variables across the four factors.

Factor 1	Factor 2	Factor 3	Factor 4
Privacy	Retirement fund	Part of farm	Part of home
Lifestyle	Timber production		Hunting/fishing
Scenery	Supplemental income		
Biodiversity	Land investment		
Recreation			
Part of home			

Despite the VARIMAX rotation, motivation for owning forest land as part of the home still loaded higher than 0.5 in both factor 1 and factor 4, but from the component score coefficient matrix (Table 6), the variable had a greater absolute communality on factor 4 (73% of its variance was accounted for, by factor 4 compared to 33% by factor 1), thus, it was more appropriate to have it as part of factor 4 rather than factor 1.

We termed factor 1 *amenity motivations* for owning land because all of the variables that loaded significantly on it suggested amenity-related values. All variables that loaded significantly on factor 2 suggested economic values, thus, we termed it *economic motivations*. The sole variable that loaded significantly on factor 3 was “part of farm” so we named factor 3 *farming-related motivations*. Hunting/ fishing was loaded significantly and positively on factor 4 while "part of home" was loaded significantly but with a negative sign. We determined that factor 4 had to do with something people would do away from their home, so we labeled it *recreation motivations.*

Table 6: Component score coefficient matrix for motivation variables.

	Factors			
Variables	Factor 1	Factor 2	Factor 3	Factor 4
Scenery	0.067	-0.045	-0.055	0.058
Biodiversity	0.153	-0.033	-0.044	0.050
Land investment (real estate)	-0.021	0.301	-0.129	-0.138
Part of home	0.332	0.039	0.120	-0.730
Secondary residence	0.042	-0.105	0.031	0.275
Part of farm	-0.169	-0.157	0.858	0.127
Privacy	0.304	-0.119	-0.008	0.015
Pass land to heirs	0.008	0.025	0.068	0.185
Non-timber forest products	0.015	0.083	0.124	0.050
Energy	0.051	0.076	0.127	-0.002
Timber production	-0.128	0.383	0.006	0.007
Hunting/fishing	0.045	-0.018	0.029	0.389
Recreation	0.218	-0.064	-0.091	0.271
Retirement fund	-0.041	0.406	-0.107	-0.104
Supplemental income	-0.079	0.275	0.073	-0.049
Lifestyle	0.253	-0.026	-0.012	0.038

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

Since our significance criteria for selecting factor loadings was 0.5, we excluded two additional variables, production of non-timber forest products and production of energy, because neither of them loaded significantly on any of the four factors. In the end, four motivation variables were eliminated from the rest of the analysis: secondary residence, passing land to heirs, non-timber forest product production, and energy production.

3.3 CONSTRAINTS TO ACTIVE FOREST MANAGEMENT

There are many potential constraints that affect a landowner's management decisions. Table 7 shows a number of them. Lack of resources (time, labor, and finances) to allocate to forest management were the most limiting. Environmental concerns were not as limiting as resources, but were more limiting compared to constraints exogenous to the owner, such as timber theft. Lack of markets did not represent a major limitation to practicing sustainable forest management.

Table 7: Frequency of importance of constraints to forest management (n=971).

Constraints	Not limiting (%)	Somewhat limiting (%)	Very Limiting (%)
Not enough time to allocate to forest management tasks	28	32	19
Not enough labor to allocate to forest management tasks	29	29	17
High property taxes	39	25	14
Not enough financial means to afford management costs	35	29	13
Trespassing, poaching and dumping	39	23	11
Concerns about environmental damages caused by harvesting equipment	42	20	11
Insufficient profit from management or harvest	34	25	9
Area too small to make management worthwhile	43	20	8
Development of nearby lands	45	17	7
Managing land is not cost effective	42	22	7
Difficult to find loggers	44	16	7
Fear of lawsuits	51	15	5
Soil too wet and/or infertile	47	20	5
Difficult to find professional forestry advice	53	12	5
Dealing with endangered species	50	9	4
Regulations that restrict harvests	49	16	4
No local markets for forest products	44	16	4
Timber theft	49	8	4
Damage or noise from motorized vehicles	51	9	3
Neighbors complaining about forest management	54	6	2

Previous studies, such as Arano *et al*. (2004), identified three main reasons constraining family forest owners from managing their land: (1) the belief that forests do not need any management, mother nature will take care of itself; (2) owners just lack information on the options that might help them do what they want to, and (3) the high cost of managing the land. Gan and Kolison (1999), as well as Measells *et al*. (2005) also found similar constraints by emphasizing that the factors preventing owners from optimizing their land potential were related to their lack of capital, lack of knowledge, and lack of participation in educational opportunities.

Of the three barriers identified by Arano *et al*., (2004), two of them are often addressed by Extension programs. The lack of awareness can be addressed with educational programs, which would provide owners with options they can choose from. Then, depending on the chosen options, additional income could be generated, which would offset the costs of management. Only the first barrier is very difficult to address because it is related to the subjective norms of the person.

Another constraint to active forest management is that foresters normally only focus on the model owners and tailor their approach to their needs. Butler *et al*. (2007) gave an analogy of the forestry community approach as “preaching to the proverbial choir”. Related to that point is the lack of technical expertise of owners, which limits their responsiveness to favorable investment opportunities (Proyer 1987). There are also constant threats to the ownership of the land as the Roper Public Affairs and Media study (2007) found; they can be grouped in four different categories: (1) financially-related threats, including the offers to buy (targeting aging and/or financially struggling owners), financial pressures (the cost of maintaining the land and paying taxes can be very heavy); (2) intergenerational land transfer, indeed, elder owners wish to transfer the land but the next generation may not want to take it because of the tax bills and maintenance cost; (3) development, as it represents a big threat to private ownership by taking over forests for housing developments and shopping malls; and (4) loss of owner control, as government rules dictate to owners what they can and cannot do, making some wonder if it is worth keeping the land.

3.4 DEVELOPMENT OF CONSTRAINT CLASSES

Despite the many incentives offered to family forest owners to actively manage their forest through financial, technical or educational assistance, a number of factors may decrease the willingness of landowners to manage their forest land actively. In this analysis, we grouped the 20 original constraints to forest management variables into four categories through PCA. The Bartlett’s test of sphericity was highly significant (Table 8), and the Keiser-Meyer-Olkin MSA value was much higher than the requirement of 0.8 needed for the data to be adequately analyzed with factor analysis. Also, the Chronbach alpha of our constraints scale was 0.89, which is greater than the threshold stated by Hair et al. (1998) for ensuring the reliability of the measures.

Table 8: Measure of sampling adequacy for constraint variables.

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		0.918
Bartlett’s Test of Sphericity	Approx. Chi-Square	6383.79
	df	190
	Sig.	0.00

Four factors were then extracted from the set of variables. The four-factor solution explained 52% of the total variance (Table 9).

Table 9: Results of the extraction of component factors for constraint variables.

Factor	Eigenvalue	% of Variance	Cumulative % of variance
1	6.736	33.678	33.678
2	1.535	7.674	41.352
3	1.129	5.643	46.995
4	0.996	4.981	51.976

Table 10: Rotated component analysis factor matrix for constraint variables.

	VARIMAX-rotated loadings				
Variable	Factor 1	Factor 2	Factor 3	Factor 4	Communality
Dealing with endangered species	0.499	0.136	0.302	0.041	0.360
Fear of lawsuits	0.507	0.148	0.416	0.020	0.453
Regulations that restrict harvest	0.450	0.291	0.446	-0.032	0.487
Insufficient profit from management or harvest	0.104	0.546	0.611	0.075	0.687
No local market for forest products	0.222	0.510	0.450	-0.026	0.513
High property taxes	0.334	-0.071	0.730	0.146	0.671
Lack of financial means to afford management costs	0.179	0.096	0.573	0.438	0.562
Development of nearby lands	0.640	0.235	0.199	0.157	0.529
Trespassing, poaching, and dumping	0.809	-0.010	0.126	0.129	0.687
Timber theft	0.508	0.172	0.242	0.129	0.363
Lack of time to allocate to forest management tasks	0.193	0.160	0.049	0.849	0.786
Lack of labor to allocate to forest management tasks	0.130	0.294	0.166	0.815	0.795
Area too small to manage	0.071	0.551	-0.132	0.257	0.392
Soil too wet or infertile	0.388	0.433	0.092	0.242	0.406
Damage or noise from motorized vehicles	0.498	0.397	0.044	0.118	0.422
Concerns about environmental damages by harvesting	0.522	0.463	0.016	0.089	0.495
Neighbors complain about forest management	0.462	0.445	0.094	0.107	0.431
Difficult to finding professional forestry advice	0.311	0.494	0.201	0.127	0.398
Managing land is not cost effective	-0.016	0.537	0.269	0.352	0.485
Difficult to find logger or other service provider	0.276	0.600	0.171	0.093	0.474
Total					
Sum squares (eigenvalue)	3.351	2.849	2.223	1.973	10.396
Percentage of variance	16.754	14.246	11.113	9.863	51.976

All variables in the set had higher communalities than the 0.3 in the unrotated component analysis factor matrix; thus, they all were included in the rest of the analysis. However, several variables, such as “insufficient time” and “insufficient labor” loaded significantly on more than one factor; suggesting a need to rotate the factors using VARIMAX. Table 10 shows the rotated component analysis factor matrix.

Varimax rotation simplifed the variables that previously loaded on more than one factor. Five variables (endangered species, damage/noise from motorized vehicle, neighbors’ complaints, harvesting regulations, and poor soil) did not have significant loading on any of the four factors, thus they were eliminated in the subsequent analysis. Five variables loaded significantly on the first factor, four on the second, three on the third and two on the last factor. In decreasing order of loading, variables were classified as shown in Table 11.

Table 11: Distribution of constraint variables across the four factors extracted.

Factor 1	Factor 2	Factor 3	Factor 4
Trespassing/poaching dumping	Difficult to find logger	Property taxes	Insufficient time
Development of nearby land	Small land area	Insufficient profit	Insufficient labor
Harvesting damages	Not cost- effective	Cannot afford management	
Tree Theft	No market for products		
Fear of lawsuit			

Given that all variables in factor 1 suggested constraints caused by other humans, we labeled it *human-related constraints*. Variables that loaded significantly on factor 2 suggested a lack of cost-effectiveness because of the small scale of the property. Factor 2 was then labeled *scale-related constraints*. Variables that loaded on factor 3 were all financially related, it was labeled *financial constraints*. Time and labor issues were the only variables that loaded on factor 4, therefore, it was labeled *time/labor constraints*.

3.5 SOURCES OF INFORMATION

For landowners managing their forest land, one may assume that the owners had used some sources of information. Out of 1,068 respondents, 67% used some source of information for purposes related to the management of their forest land at least once in the last 11 years (Table 12).

The Virginia Department of Forestry (VDOF) was the most used source of information, with 54% of respondents. Private consultants (foresters or biologists) are next, with 25%

of respondents; followed by extension foresters or other university employees, used by the same number of people as magazines, newspapers, and newsletters (21%). Only 13% of owners used neighbors, friends, family, or other forest owners as a source of information. The Roper Public and Media Study (2007) found that owners use mostly their friends, family, or neighbors to get information about land management in general; also, they do not really prefer getting information from government offices/programs because of the regulatory notion that they attach to them. West *et al*. (1988) also found that peer influence was a significant source of advice for management activities among family forest owners. Our results contrast with the Roper report and West *et al*.'s (1988) findings. A logical explanation is that owners first turn to their family, friends, and neighbors to get the information they need. If these people cannot satisfy their need, they can recommend other trustworthy sources of information that they might have used in the past. When needed information is too technical, or important things are at stake, or legal issues are involved, owners may ultimately get the needed information only from professionals, including as state agencies. Also, only 11% of respondents were using the internet to get information about forest management; this result is similar to that of Butler *et al*. (2007), with the implication that the internet was still not accepted as a trustworthy medium to provide useful information.

Table 12: Frequency of use of various information sources for forest land management (n=1,068).

Information provider	(No.)	(%)
Virginia Department of Forestry	577	54
Private consultant, such as a forester or a biologist	267	25
Extension forester or other university employee	224	21
Magazine, newspaper, newsletter	224	21
Other forest landowner	139	13
Neighbors, friends, family	139	13
Conservation/environmental organizations	128	12
Internet/web	117	11
A forester from a company that produces forest products	96	9
Logging contractor	96	9
Arborist	43	4
Lawn and garden company	32	3
Television/radio	32	3
Local government	21	2

Apart from the source of information used, there is also a wide variety of supporting material available for landowners to acquire information related to their need to manage their land. Table 13 shows the importance of information sources for managing forest land.

The two most highly preferred types of support were "publications, books, and pamphlets", with 86% who rated them very useful; and "direct interaction with natural resources professionals", with 83% of respondents finding it useful. Overall, hands-on sources of information tended to be preferred to other self-learning types of information like the internet or videotapes and DVDs. This fact was confirmed by West *et al*. (1988), who stated that "personal contact is more effective in transmitting specific non-industrial private forest owner management advice, and in gaining adoption of that advice, especially for timber management and timber harvesting."

Table 13: Frequency of importance for various types of information channels used for forest land management (n=765).

Types of material	Don't know (%)	Not useful (%)	Some-what not useful (%)	Some-what useful (%)	Very useful (%)
Talking with a forester or other natural resource professional	11	3	3	25	58
Publications, books or pamphlets	9	2	3	38	48
Newsletters, magazines, or newpapers	10	2	7	40	40
Workshops/shortcourses with support materials	18	5	8	30	39
Visiting other forest lands or field trips	21	6	10	33	31
Talking with other forest land owners	20	6	10	41	24
Internet/web	25	9	13	30	22
Conferences or video conferences	28	10	18	27	16
Videotapes or DVDs for home viewing	30	11	15	27	17
Television or radio programs	28	9	19	35	10
Talking with a logging contractor	27	14	18	30	11
Membership in a land owner organization	36	12	18	23	11

The usefulness of a membership in a landowner organization was uncertain as 36% of respondents did not know whether or not it was an important source of information. Likewise, 30% of respondents did not know if videotapes or DVDs were useful or not. For our sample, written materials (books, magazines and newspapers) tended to be easily identifiable by landowners and are among the most highly ranked as providing useful information about forest land management; this is consistent with Kuhns *et al*. (1998), who found that owners with higher educational levels used written materials more than those with lower educational levels.

The importance of written materials in helping owners to manage their land was similar in our study and that of Butler *et al*. (2007), who found that the most preferred information channel for family forest owners in general is through publications. However, other authors, including West *et al*. (1988) found that written materials “heighten general awareness of non-industrial private forest owners about management issues, but are not effective channels for transmitting specific management advice, and are only minimally effective in convincing owners to change management practices”. In other words, written materials rank high in promoting a general awareness but not in actual use for specific management issues.

The proportions of owners using the different types of information providers are similar for both resident and absentee owners (Table 14); state agencies were most used as information providers in both groups.

Table 14: Use of information providers for resident and absentee owners (n=913).

Source	Resident owners (n=837) %	Absentee owners (n=76) %
Virginia Department of Forestry	54	51
Land and garden company	3	1
Arborist	3	5
Extension forester or other university employee	20	24
Private consultant, such as a forester or a biologist	26	20
A forester from a company that produces forest products	10	8
Local government	3	1
Logging contractor	11	5
Other forest landowners	13	11
Neighbors, friends, family	13	11
Television/radio	3	4
Magazine, newspaper, newsletters	21	18
Conservation/environmental organizations	12	8
Internet/web	12	5

3.6 DEVELOPMENT OF SOURCE OF INFORMATION CLASSES

Table 15 provides the results of the MSA for the set of variables about sources of information. The Bartlett test of sphericity was significant at 0.000, and the Kaiser-Meyer-

Olkin MSA value of 0.901 reinforced the appropriateness of the use of factor analysis. Also, the Chronbach alpha for our source of information scale was 0.9, which is greater than the threshold stated by Hair et al. (1998) for ensuring reliability of the measures.

Table 15. Measure of sampling adequacy for source of information variables.

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		1.901
Bartlett's Test of Sphericity	Approx. Chi-Square	3860.75
	df	66
	Sig.	0.000

Two factors were extracted from the factor analysis using PCA (Table 16). The two-factor solution explained 53.69% of the total variance.

Table 16: Results of the extraction of component factor for source of information variables.

Factor	Eigenvalue	% of Variance	Cumulative % of variance
1	5.503	45.860	45.860
2	0.940	7.830	53.690

Table 17. Rotated component analysis factor matrix for source of information variables.

	VARIMAX-rotated loadings		
Variables	Factor 1	Factor 2	Communality
Publications, books or pamphlets	0.422	0.371	0.316
Newsletters, magazines, or newspaper	0.409	0.409	0.334
Internet/web	0.270	0.690	0.549
Conferences or video conferences	0.619	0.443	0.579
Videotapes or DVDs for home viewing	0.207	0.817	0.711
Television or radio programs	0.249	0.791	0.688
Visiting other forest lands or field trips	0.798	0.235	0.692
Workshops/shortcourses with support materials	0.834	0.200	0.735
Talking with a forester or other natural resource professional	0.643	0.221	0.462
Talking with other forest land owners	0.496	0.509	0.505
Talking with a logging contractor	0.308	0.572	0.422
Membership in a land owner organization	0.562	0.365	0.450
Total			
Sum of squares (eigenvalue)	3.309	3.134	6.443
Percentage of variance	27.577	26.114	53.691

Two variables had the lowest communalities in the unrotated component factor matrix: “newsletters/magazines/newspapers” and “publications, books or pamphlets” with 33% and 31% of their variance, respectively, accounted for by the two-factor solution. This suggests those two variables had little in common with the others but their communalities were still higher than the threshold of 0.3. Thus, all variables in the set were retained for further analysis. The VARIMAX rotation allowed a more equitable distribution of the variance between the two factors (Table 17). The two-factor solution model explained 53.69% of the variance of the set of variables. In other words, the factor matrix of the two-factor solution contained information representing 53.69% of the total variance of the set of sources of information variables included in the analysis.

Five variables loaded significantly on the first factor while another five also loaded on the second factor. Two variables, “publications, books or pamphlets” and “newsletters/magazines/newspapers” did not load significantly on either of the two factors; thus, they were not taken into account in further analysis. The summary of the variables loading significantly on either of the two factors is shown in Table 18, in decreasing order of loading.

Table 18. Distribution of source of information variables across the two factors extracted.

Factor 1	Factor 2
Workshops/shortcourses	Videotapes/DVDs
Field trips	Radio/TV
Interaction with natural resource professionals	Internet/Web
Conferences	Interaction with logging contractor
Membership in a landowner organization	Interaction with other forest landowners

Since no variable loaded significantly on both factors at once, we did not need to use the component score coefficient matrix. The variables that loaded on factor 1, except for “membership in a landowner organization”, suggested direct interaction with professional people in the field. We then labeled factor 1 *direct professional information*. Variables that loaded on factor 2 suggested a more distant approach, though some of the sources of information themselves still come from professionals; they also suggested that the individual learns by him/herself. We labeled factor 2 *self-learning*.

3.7 VALIDATION OF THE FACTOR ANALYSIS

We used the split sample method to validate the results of the factor analysis. The original sample was randomly divided into two equal samples, and then we re-estimated the factor models for comparability, both between the two smaller samples, and between the smaller samples and the original sample. The validation results for the motivation variables are shown in Table 19.

Table 19: Validation of the factor-solution for the motivation set of variables.

	Sample 1				Sample 2			
	VARIMAX-rotated loadings				VARIMAX-rotated loadings			
Variables	Factor 1	Factor 2	Factor 3	Factor 4	Factor 1	Factor 2	Factor 3	Factor 4
Scenery	0.684	0.091	-0.026	0.138	0.753	0.146	0.031	0.173
Biodiversity	0.614	0.154	0.006	0.166	0.715	0.127	0.039	0.113
Land investment (real estate)	0.041	0.633	-0.129	-0.003	0.212	0.625	-0.097	-0.099
Part of home	0.521	0.025	0.329	-0.706	0.605	0.052	0.238	-0.643
Secondary residence	0.218	0.019	0.061	0.424	0.172	-0.035	0.074	0.405
Part of farm	0.009	0.084	0.962	0.063	-0.025	0.000	0.935	-0.043
Privacy	0.810	-0.038	0.091	0.019	0.752	0.138	0.187	0.005
Pass land to heirs	0.153	0.251	0.111	0.186	0.233	0.201	0.278	0.390
Non-timber forest products	0.240	0.381	0.312	0.120	0.330	0.350	0.424	0.143
Energy production	0.404	0.375	0.236	-0.124	0.298	0.264	0.451	0.184
Timber production	0.080	0.746	0.106	0.113	-0.016	0.743	0.206	0.209
Hunting/fishing	0.347	0.199	0.222	0.504	0.268	0.388	0.018	0.492
Recreation	0.659	0.170	0.013	0.359	0.607	0.228	-0.065	0.381
Retirement fund	0.111	0.779	-0.010	0.058	0.259	0.765	0.020	0.037
Supplemental income	0.119	0.694	0.292	0.019	0.081	0.673	0.299	0.095
Lifestyle	0.739	0.261	0.147	-0.005	0.728	0.153	0.153	0.187

Table 20 provides the comparisons of the different variables that loaded significantly across all factors for the three samples used for the validation of the factor-solution.

For the three first factors, all variables that loaded on each factor were the same for the three models; the only difference was the order of importance of their loadings, they were swapped. For factor 4, the model from the total sample and from sample 1 had the same variables loading on them, and in the same order of importance of their loadings;

but it was not the case for sample 2 because "hunting/fishing" did not load significantly on any factor, with a loading of 0.492 (very close to 0.5). From these comparisons, we can say that our factor solution was relatively stable.

Table 20: Comparison of motivation variables loading on each factor between the three samples.

	Sample 1	Sample 2	Total sample (model)
Factor 1	Privacy Lifestyle Scenery Recreation Biodiversity	Scenery Privacy Lifestyle Biodiversity Recreation	Privacy Lifestyle Scenery Biodiversity Recreation
Factor 2	Retirement fund Timber production Supplemental income Land investment	Retirement fund Timber production Supplemental income Land investment	Retirement fund Timber production Supplemental income Land investment
Factor 3	Part of farm	Part of farm	Part of farm
Factor 4	Part of home Hunting/fishing	Part of home Hunting/fishing	Part of home Hunting/fishing

The validation results for the constraint set of variables are shown in Table 21, using the two samples we selected randomly.

Table 21: Validation of the factor–solution model for the constraint set of variables.

	Sample 1				Sample 2			
	VARIMAX-rotated loadings				VARIMAX-rotated loadings			
Variables	Factor 1	Factor 2	Factor 3	Factor 4	Factor 1	Factor 2	Factor 3	Factor 4
Dealing with endangered species	0.120	0.418	0.076	0.082	0.444	0.451	-0.01	0.092
Fear of lawsuits	0.654	0.151	0.057	0.154	0.536	0.484	0.063	0.034
Regulations that restrict harvests	0.308	0.433	-0.009	0.116	0.369	0.492	0.094	0.058
Insufficient profit from management or harvest	-0.034	0.252	0.639	0.407	0.007	0.342	0.696	0.252
No local market for the forest products	0.312	0.608	-0.074	0.231	0.132	0.614	0.307	0.132
High property taxes	-0.003	-0.042	0.551	0.612	0.291	0.071	0.560	0.185
Cannot afford management costs	0.192	0.159	0.698	0.379	0.159	0.203	0.549	0.271
Development of nearby lands	0.526	0.360	0.274	0.130	0.637	0.262	0.236	0.051

	Sample 1				Sample 2			
	VARIMAX-rotated loadings				VARIMAX-rotated loadings			
Trespassing, poaching and dumping	0.691	0.191	0.140	0.055	0.827	0.001	0.115	0.073
Tree theft	0.467	0.355	0.126	0.117	0.466	0.253	0.106	0.143
Not enough time for forest management tasks	0.111	0.173	0.109	0.837	0.211	0.071	0.038	0.883
Not enough labor for management tasks	0.212	0.161	0.212	0.820	0.106	0.161	0.213	0.848
Area too small	0.426	0.426	-0.025	-0.093	0.066	0.519	0.230	0.302
Soil (too wet and/or infertile)	0.498	0.277	0.280	-0.004	0.401	0.357	0.202	0.341
Damage or noise from motorized vehicles	0.480	0.330	0.205	-0.049	0.426	0.221	0.308	0.145
Environmental damages by harvesting equipment	0.501	0.434	0.245	-0.110	0.641	0.031	0.433	0.030
Neighbors complain about forest management	0.311	0.393	0.198	-0.016	0.414	0.264	0.343	0.147
Difficult to find professional forestry advice	0.405	0.149	0.169	0.168	0.282	0.127	0.433	0.093
Managing my land is not cost effective	-0.060	0.581	0.342	0.408	-0.066	0.508	0.288	0.372
Difficult to find logger or other service provider	0.283	0.621	0.149	0.036	0.105	0.729	0.188	0.145

Table 22 provides a list of the variables that loaded on each of the four factors for constraints to active forest management and across the three samples for validation of the model.

For factor 1, four variables loaded significantly across all three samples; "trespassing/poaching/dumping" had the highest load factor across all three samples. However, the model derived from the total sample size had an additional variable (tree theft). By looking closer, we realized that this variable had very similar loadings (0.467, 0.466 and 0.508 respectively for sample 1, sample 2 and the total sample). Though "tree theft" loaded significantly on factor 1 for the total sample, its loadings remained relatively constant across the three models; which suggests stability of the results.

For factor 2, models from sample 2 and from the total sample had the same list of four variables loading significantly on the factor though they were not in the same order of importance. Also, three of those same variables loaded significantly on factor 2 in sample 1; however, "small land area" was not significant in sample 1, it had a loading of 0.426. Factors 3 and 4 had the same variables loading significantly on them, across all three samples.

Table 22: Comparison of constraint variables loading on each factor between the three samples.

	Sample 1	Sample 2	Total sample (model)
Factor 1	Trespassing, poaching, dumping Fear of lawsuits Development of nearby lands Damage by harvesting equipment	Trespassing, poaching, dumpingDamage by harvesting equipmentDevelopment of nearby lands Fear of lawsuits	Trespassing, poaching, dumping Development of nearby lands Damage by harvesting equipment Tree theft
Factor 2	Difficult to find loggers No markets Management not cost-effective	Difficult to find loggers No markets Small land Management not cost-effective	Difficult to find loggers Small land area Management not cost-effective No markets
Factor 3	Cannot afford management Insufficient profitHigh property taxes	Insufficient profitHigh property taxes Cannot afford management	High property taxes Insufficient profit Cannot afford management
Factor 4	Insufficient time Insufficient labor	Insufficient time Insufficient labor	Insufficient time Insufficient labor

Despite the swapping and the small differences in the variables loading for some of the factors in our models, we can say that all three models are stable at least within the sample of our study population; thus, the results are robust enough to be used for further analysis.

The validation results for the source of information variables are shown in Table 23; though their order of loading are swapped, four variables loaded significantly on factor 1 across all three samples, "interaction with professionals" also loaded significantly on factor 1 for both sample 1 and the total sample but not for sample 2 where it failed to qualify, with a loading of 0.486 (which is very close to the 0.5 threshold).

Table 23: Validation of the factor-solution model for the source of information variables.

	Sample 1		Sample 2	
	VARIMAX-rotated loading		VARIMAX-rotated loading	
Variables	Factor 1	Factor 2	Factor 1	Factor 2
Publications, books or pamphlets	0.175	0.435	0.161	0.477
Newsletters, magazines, or newspaper	0.176	0.451	0.183	0.486
Internet/web	0.294	0.706	0.306	0.611
Conferences or videoconferences	0.554	0.512	0.678	0.402
Video tapes or DVDs for home viewing	0.274	0.779	0.190	0.783
Television or radio programs	0.329	0.719	0.249	0.762
Visiting other forest lands or field trips	0.818	0.156	0.613	0.471
Workshops/shortcourses with support materials	0.759	0.284	0.852	0.207
Talking with a forester or other natural resources professionals	0.576	0.280	0.486	0.391
Talking with other forest land owners	0.299	0.653	0.268	0.742
Talking with logging contractor	0.260	0.535	0.199	0.710
Membership in a land owner organization	0.659	0.168	0.533	0.467

Table 24 shows that five variables loaded significantly on factor 2 for all three samples; two of them (Videotapes/DVDs) loaded very highly across the three models and the rest of the five swapped from one model to another. The comparisons of the models from the three samples suggested that our results are stable, at least within our sample; and can be used for subsequent analyses.

Table 24: Comparison of source of information variables loading on each factor between the three samples.

	Sample 1	Sample 2	Total sample (model)
Factor 1	Field trips Workshops/shortcourses Membership in a landowner organization Interaction with professionals	Workshops/shortcourses Conferences Field Trips Membership in a landowner organization	Workshop/shortcourses Field trips Interaction with Professionals Conferences Membership in a landowner organization
Factor 2	Vidoetapes/DVDs TV/radio programs Internet/web Interaction with other forest owners Interaction with logging contractor	Videotapes DVDs TV/radio programs Interaction with other forest owners Interaction with logging contractor Internet/web	Videotapes/DVDs TV/radio programs Internet/web Interaction with logging contractor Interaction with other forest owners

4 CONCLUSIONS

Within the last decade, a number of studies have focused on various segmentations of the family forest owner population. One rationale behind these segmentation studies is to focus specific outreach efforts toward identified groups of forest owners as opposed to older approaches that considered all forest owners as a uniform group.

Table 25: Categories of family forest owners according to their objectives, (Butler et al. 2007).

		Amenity-Focused	Multiple-Benefit	Passive
	Definition	Non-income generating benefits >income generating benefits importance	Income generating benefits = non-income generating benefits	All benefits considered unimportant
Landowner characteristics	Absenteeism	High	Low	High
Timber harvesting	Harvested timber (%)	22	31	10
	% reporting income from timber important	25	85	14
	Active management of land	Hesitant	Motivated	Neutral
Sources of forestry information	Contact with foresters	Less likely	More likely	Less likely
	Most preferred sources of information	Printed or on-line materials (brochures and fact sheets)	Personal on-site assistance from a forester	Internet

For instance, according to several benefit-based segmentation techniques (Table 20), forest owners can be classified as amenity-focused, multiple-benefit, or passive (Salmon *et al*. 2006; DeCoster 1998; Kline *et al*. 2000). Each segment is unique in terms of its needs and preferences about the mode of delivery of information. Multiple-benefit people prefer receiving personal on-site assistance from foresters, while amenity-focused owners prefer printed materials, and passive owners prefer online materials. Within each segment, there is also a difference between absentee owners and on-site owners: absentee owners prefer printed materials (newsletters, magazines, etc.) because they do not have much of a local social network, including contact with foresters. In contrast, people who are living on their forest land tend to prefer one-on-one interaction with professionals to printed or online materials (Downing and Finley 2005). Higher level interactions between multiple-benefit landowners and local foresters is a result of the social and community networks that these landowners participate in, and not because these landowners had actively sought out the information.

Over two-thirds of landowners from the amenity-focused and passive segments live at least one county removed from their forest land, thus, they are isolated from the communities that surround their forest land (Table 25). Therefore, a suggestion and objective for outreach is to raise the forest owner awareness about compatibility of forest management and their goals.

For multiple-benefit owners, participation in social networks in the region in which their land is situated means that it is quite likely that personal assistance could have far-reaching effects when the information they get is shared with neighbors and peers (West *et al*. 1988; Rogers 2003). Passive landowners are either disinterested in forestland ownership, or researchers failed to identify the aspects of ownership they value.

These three groups are analogous to other classifications including those of Butler *et al*. (2007) because all of them can be put on the profit-amenity continuum.

The categories of forest owners created in this current work are similar to those of prior studies. Forest owners are very diverse, and approaches to reaching them with educational, consulting, technical assistance, and financial assistance programs should be targeted to the interests of the specific category.

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Forest landowner willingness to pay for nontimber forest products education in West Virginia

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Abstract

Non-Timber Forest Products (NTFPs) are often the foundation of private family enterprises and are usually produced for enjoyment or to generate supplemental income. Harvesting of NTFPs in West Virginia's and other states' rural communities is often done in "informal markets"--markets where transactions are made on a cash basis and few, if any, records are kept. Though NTFPs have played a significant role to the income of many West Virginia residents (whether a grower, picker, harvester, distributor, or buyer) there is not much scientific, or otherwise systematically recorded data about these products' benefits, tradeoffs, risks, and constraints stemming from their harvest or their markets. A mail-based survey showed a low degree of activity of landowners actively harvesting or producing NTFPs in two regions of West Virginia. However, a high degree of general interest was expressed in returned questionnaires. Willingness to pay for educational events related to NTFPs was related to prior consideration of NTFP enterprises, interest level in two categories of NTFPs, higher average income, and higher educational attainment.

Key words: nontimber forest products, education, West Virginia
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1 INTRODUCTION

Non-timber forest products (NTFPs) have always been important to income earning potential and subsistence of people around the world. Most countries and states, however, do not have inventory and marketing data for many of these products (Von Hagen et al. 1996). Despite increasing use and recognition of NTFPs as important products derived from forests, they continue to be thought of as "rural" resources collected from

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rural areas and important to rural people (Guijt et al. 1995). Jones and Lynch (2002) suggest that NTFP harvesting in the United States is often rooted in traditions that have persisted through declining resource bases, loss of rural knowledge, and the domination of timber production.

Nontimber forest products are often categorized into four types: edible forest products (berries, mushrooms, nuts, etc.), specialty wood products (canes, hand carvings, etc.), products used in the floral and decorative trade (Christmas trees, various mosses, vines, etc.), and medicinal and dietary supplements (American ginseng, goldenseal (*Hydrastis canadensis*), etc.); (Chamberlain et al 1998).

Though NTFPs have played a significant role to the income of many West Virginia residents (whether a grower, picker, harvester, distributor, or buyer) there is not much scientific, or otherwise systematically recorded data about these products' benefits, trade-offs, risks, and constraints stemming from their harvest or their markets (Von Hagen et al 1996, McLain and Jones 2002). Harvesting of NTFPs in West Virginia's and other states' rural communities is often done in "informal markets" --markets where transactions are made on a cash basis and few, if any, records are kept (Chamberlain et al. 1998).

Bailey (1999) found that the harvesting of these products is often motivated by financial gain, which can be intensified by numerous factors, including: the harvester's financial need, time available for harvest, and the prices offered for their respective product. The ecological status of species harvested as NTFPs is often not known. Likewise, information on harvesters is usually unavailable (Jones and Lynch 2002). American ginseng (*Panax quinquefolius*) is one exception; the West Virginia Division of Forestry is required by law to certify and weigh this product before the root leaves the boundaries of the state (WVDOF 2007).

Research and educational outreach efforts have been carried on in the past with the motivation that the production of these products and the subsequent revenue generated might encourage landowners to become aware of untapped revenue potential of their properties. In the eastern United States, it is common knowledge that the restricting resource for landowners to participate in production and sales of alternative forestry enterprises is the time landowners have to devote to these activities.

In order to substantiate the importance of NTFPs to West Virginia landowners, we conducted a survey to identify the activity level and educational needs of landowners with respect to these products. Specifically, our objective was to examine landowners' willingness to pay (WTP) for NTFP educational workshops and how WTP is associated with respective demographic and landownership attributes.

2 METHODOLOGY

2.1 STUDY AREA

For the purpose of assessing differences in landowners' interest in NTFPs and their level of engagement (LOE) with these products, four counties in West Virginia were selected for this survey. Two adjacent counties were selectively chosen from a "rural" region of the state (Ritchie and Wirt Counties) and two from an "urban" region consisting of Berkeley and Jefferson Counties in the eastern panhandle (Rosenberger et al 2002, USDA National Agricultural Library 2005). We made this distinction because while West Virginia is one of the most rural states in the eastern US, there are regional differences in land use in various parts of the state. These two regions differ in the urbanization process currently taking place. Proximity to urban areas and the flat agricultural land of the eastern panhandle of West Virginia have led to increasing population and urbanization (Hailu 2002) contrasted with the traditional timber-based rural setting of Ritchie and Wirt counties of the western Ohio River valley.

Land in the eastern panhandle of West Virginia is undergoing significant changes in use and ownership resulting from a combination of largely widespread and uncontrolled forces (Rosenberger et al. 2002). Productive agricultural land is converted to residential, commercial or industrial uses because of their high returns and/or demand for these uses of land. For example, a substantial amount of land in and around counties located near large metropolitan centers, particularly in the eastern panhandle region, is being used for second or retirement homes, campground and weekend recreational use, or has been purchased for profitable investments by residents of the District of Columbia, Baltimore, and other nearby cities. Most of these developments seek flat, well-drained land for their activities.

2.2 MAIL SURVEY

The study population consisted of taxpayers owning more than ten acres who were filtered from a database purchased from the West Virginia Tax Office in spring 2005. This minimum sampling acreage was used because landowners with less than 10 acres have limited management options (Gracey and Pelkki, 1996) and fall below the area required for current federal cost share programs. For each region (rural and urbanized), 1000 names and addresses were randomly selected from the resulting tax list.

The mailing itself consisted of four stages; a pre-notification postcard, the survey, a reminder postcard, and a second survey. Pre-notification of the survey to the randomly selected landowners was done by a label-addressed postcard to alert them of the upcoming survey, as well as to establish its legitimacy and confirm mailing addresses (Fox et al. 1988). A four-page survey (including cover page) was used to collect data for the study. Questions pertained to land ownership, ownership and activities related to NTFPs and forest-based enterprises, and general demographic information.

The survey mailing was carried out with the following schedule:

19 January 2007—Pre-notification mailed

30 January 2007—Initial questionnaire mailed. Accompanying the survey was a return preaddressed stamped envelope with a first class postage stamp.

20 February 2007—reminder postcards were mailed to all participants that had not yet replied to the initial survey.

5 March 2007—an identical survey was sent to the participants who had not yet responded.

By March 31, 2007, 351 we received pre-notification postcards were returned because of bad addresses, resident deceased or unable to forward. The remaining 1649 had valid addresses and 735 (37%) of these surveys were returned. Although 735 responded, 203 were excluded from the analysis, because they either returned the survey back blank (156) as instructed if they were not interested in participating, or sold their land that was listed in the 2004 tax record and currently owned less than 10 acres (47), thus reducing our relevant responses to 532 (26%). The respondents included absentee West Virginia landowners residing in 20 different states and the District of Columbia.

2.3 FACTORS RELATED TO WILLINGNESS-TO-PAY

We used linear regression methods to assess relationships between willingness to pay for NTFP workshops and “engagement” levels, regions (urban vs. rural), land ownership attributes, and demographic variables. Level of engagement (LOE) with NTFPs was derived from a table in the questionnaire that allowed the respondents to check their frequency of harvesting or other activities for each of 14 different NTFPs (see table 1). Options in this table were: frequently, occasionally, rarely, never but interested, and never and not interested. These five levels were condensed into three categories for use in regression methods by combining those that had actually harvested (frequently, occasionally, and rarely) into one category representing a high level of engagement and leaving the other two categories as medium and low engagement levels. We further condensed the 14 NTFPs into 4 categories and screened the highest level of engagement in each category for each respondent. These categories were: 1) edibles, 2) specialty wood products, 3) floral/decorative, and 4) medicinal herbs.

A logistic regression using a stepwise selection procedure was used to identify factors related to the WTP variable. WTP was taken from a question asking respondents to fill in a dollar amount that they would be willing to pay for a two hour evening workshop. They also filled in the number of miles they would be willing to travel to the workshop (WTT). The explanatory (independent) variables included five demographic questions, six property characteristic questions and the four engagement variables (table 1). Occupations were classified into white collar, blue collar (trade, craft, or labor job families or occupations), and retired categories (OPM 2008). Yearly income was categorized into two classes, income below and above $45,000 as median household income is $33,466 (ERS 2008) which falls in our $30,000 to $45,000 category in the questionnaire. There were 163 respondents in the lower income bracket and 223 in the upper bracket.

Table 1: Variables used for assessing factors related to educational interest.

————————————Variable type————————————			
Dependents	----------------------Explanatory----------------------		
Educational interest	*Property*	*Demographics*	*Engagement*
Willingness to pay (WTP)	Total acres	Age	Medicinals
Willingness to travel (WTT)	Acres forested	Gender	Specialty wood products
	Acres other	Occupation	Edibles
	Years owned	Income	Floral/decorative
	Live on *x* acres	Education	Own NTFP enterprise
	Last timber harvested		Thought about NTFP enterprise

3 RESULTS

3.1 DEMOGRAPHICS AND PROPERTY ATTRIBUTES

Landowners varied by region for several demographic attributes. In general, landowners in the eastern, more urbanized region were more likely to have white collar jobs (67%), earn more than $45,000 per year and either have college (57%) or advanced degrees (67%; table 2).

Table 2: Demographic attributes of respondent by region.

Attribute	-------Region------- Eastern	Western	p[a]
Age (yrs)	62.2	61.0	0.241
Male respondents (%)	49	51	0.351
Occupation (%)			
Blue collar	47	53	0.261
White collar	67	33	<0.001
Retired	47	53	0.398
Income > $45,000 (%)	60	40	<0.001
Education (%)			
High school	18	82	<0.001
College	57	43	<0.001
Advanced degree	67	33	<0.001

[a] *Probability values for Chi-square tests of association.*

While respondents from both regions have owned their property for about the same amount of time (23-25 years), the average property size for the Eastern/urban region was significantly smaller than that of the respondents from the Western/rural region and had a lower proportion of their properties in forest (Table 3). Nearly nine out of ten respondents from western counties had harvested timber while only 63% of respondents from the eastern counties reported having harvested timber.

Table 3: Property characteristics by region.

Property Characteristics	---------------Region--------------- Eastern/Urban	Western/Rural	*p*
Property owned (Yrs)	24.6	22.8	0.293
Total acres owned	69.3	116.6	<0.001
Acres forested	24.8	80.0	<0.001
Percent forested	38.6	66.7	<0.001
Acres other (Pasture/Fields)	41.0	35.5	0.308
Live on acreage (ac)	38.6	57.1	0.008
Last timber harvest (Yrs)	21.2	16.5	0.043
Have harvested timber (%)	63	89	<0.001

3.2 NTFP ENTERPRISES OWNERSHIP

From the 532 valid responses, only 16 respondents (3.0%) indicated that they have owned or operated an NTFP enterprise, while 65 respondents (12.2%) have thought about developing NTFP enterprises. The interests were broad and categorized by NTFP type (Table 4). Enterprises owned by respondents were shiitake mushrooms and honey for the floral and decorative category, firewood sales in the specialty wood products category, and Christmas tree farms in the floral and decorative category. Five times as many respondents listed considering NTFP enterprises than actually owned enterprises. We categorized their responses of paw paws, ramps (wild leek), maple syrup, fruit trees, and shiitake mushrooms into the edible products category, tree nurseries into the specialty wood products category, Christmas tree and grapevines into the floral and decorative category, and ginseng, black cohosh, and medicinal herbs into the medicinal and dietary supplements category.

Table 4: Number of respondents that owned or have thought about developing NTFP enterprises by NTFP category.

NTFP Category	Owned	Thought about	*Total*[a]
Number of respondents:	*7*	*35*	*42*
Edible products	2	15	*17*
Specialty wood products	2	2	*4*
Floral and decorative	4	13	*17*
Medicinal and dietary supplements	0	10	*10*
Total	8	40	

[a] Note: 16 respondents have owned an enterprise and 65 claimed to have thought about developing an NTFP enterprise for a total of 81 respondents. This table lists only those that specified the type of enterprise. Three respondents filled in both “owned” and “thought about” NTFP enterprises.

3.3 INTEREST IN NTFP TOPICS

Respondents interest in NTFPs were varied, but for the most part were generally high. Among the four main NTFP categories, 69% of the respondents reported at least some interest in edible forest products, 56% for medicinal herbs, 45% for floral and decorative products, and 36% for specialty wood products. However, there were significant differences be in NTFP topics by region. In general, landowners in the more rural western region had greater interest in specialty wood products (57% claimed interest; chi-sq=4.35; p=0.037), floral and decorative products (53%; chi-sq=5.44; p=0.019), and medicinal and supplemental health products (57%; chi-sq=10.12; p=0.001).

3.4 WILLINGNESS TO PAY FOR EDUCATIONAL PROGRAMS

Five variables were associated with a landowner's willingness to pay for educational programs in NTFPs. Landowners interested in medicinal and supplemental products were more likely to list a positive dollar value they would be willing to pay for an educational workshop than those not interested in this same topic (OR=10.1; Table 5). Likewise, those interested in floral and decorative products were also more willing to pay for educational programs. Financial and educational status showed a positive relationship to WTP with those earning more than $45,000 and those with an advanced college degree more likely to say they would pay for education than respondents in the lower income and educational categories.

Table 5: Variables related to willingness to pay for NTFP educational events.

		95% Confident Interval			
Variable	Odds Ratio	Lower bound	Upper bound	Chi-Sq	p
Have considered NTFP enterprise	6.72	1.999	22.592	9.4846	0.002
Interest in floral and decorative	4.207	1.997	8.861	14.2892	<0.001
Interest in medicinal products	10.167	4.21	24.556	26.573	<0.001
Earn more than $45,000 per year	2.796	1.36	5.749	7.8218	0.005
Have advanced degree	3.351	1.274	8.817	6.0052	0.014

4 DISCUSSION

The response to this survey by landowners revealed a high degree of interest in all four categories of NTFPs. Educational outreach that incorporates these levels of interest by topic category might be more successful in successfully reaching interested landowners. Landowners in the western region were statistically more likely to harvest (and be interested in) medicinal herbs and edible NTFPs as well as willing to pay and travel to a workshop than those in the eastern region. Still, landowners in the eastern region who show an interest in NTFPs are willing to pay and travel to two-hour workshops and should not be overlooked as potential outreach clients.

The results of this survey are comparable to other surveys. Chamberlain and Predny (2004) found that a high concentration of medicinal plant-based enterprises exist in the southern Appalachian forest (rural communities). A conclusion of this survey would show that the rural areas where more likely to harvest, and have an interest in, the medicinal plant category of NTFPs (Table 3). Jones et al (2005) survey of harvesting of NTFPs on all

U.S. national forests (which also comprises of many rural communities in West Virginia) reports that national park rangers surveyed indicate that all NTFP categories are being harvested, ranging from specialty wood products to floral greens to medicinal plants. A survey done in southern India revealed that the rural communities had a high dependence on NTFPs (Silori et al 2005). A survey by the Alaska Boreal Forest Council reports that the Tanana Valley, which is largely rural, has a large dependence on edible forest products, as well as medicinal plants (Bates 2000).

While our study shows that a majority of respondents have harvested or have interest in all four categories of NTFPs in both regions, it does not necessarily suggest that educational programs need to cover all the topics to be successful. Edible forest products, dominated by fruits, nuts, and berries, garnered the most interest of all products, while specialty wood products received the least amount of interest, particularly in the eastern region. Outreach programs looking to attain greater numbers of interested landowners might find more success in by focusing on the more popular topics.

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Biofuel and agricultural economy of developing countries: present and future strategy for small-scale farming

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Abstract

This paper discusses the impact of sourcing alternative fuel energy like 'Biofuel' in the agro based economy of developing countries like Bangladesh, China, India and the Philippines. The growing concern of finding alternative fuel energy instead of fossil-oil to meet its uprising price trend, developing economies are also at a strategic debate on how to deal with the new fuel production. The tradeoff between food grain and biofuel crop is seen as an issue to the economists of the developing countries. Particularly, when a country is burdened with a high population pressure and poverty stricken, what strategy may balance an efficient tradeoff between the demand for food crop and bio-fuel crop in the small-scale farming context? The study finds that, the developing economies may suffer adversely if the measures against food crisis are not taken carefully in the process of massive biofuel plantation activities. Biofuel production is associated with many controversies of which food crisis, price hike, biodiversity and socioeconomic impact on small-scale farms are major. The study recommends that any change in the ratio of food grain and biofuel crop towards more biofuel crop production will adversely affect rural small-scale farm economy of developing countries. Increased reliance on imported food crops due to unplanned biofuel production may hasten the sustainable development one way or another of such developing economies. Thus, the developing economies should adopt the strategies that balance the rural farm economy according to individual scenario.

Key words: Jatropha, Bangladesh, Pakistan, the Philippines, Pongamia, Rural Economy, biofuel policy
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1 INTRODUCTION

Mankind recognized coal as an energy source in the Bronze Age. Perhaps that was the beginning of a new journey of civilization to to-day. Historical evidence indicates that King Solomon was probably known to the coal deposits of Syria whereas the Greeks did a few centuries before the birth of Christ. North American Indians used coal to bake the pottery they made from clay long before the land was discovered by Christopher Columbus, the discoverer of the New World. The earlier version of James Watt's steam engine which was invented in 1705 by Thomas Newcomen required ample amount of coal to create heat for moving the piston through vapor pressure. Since then coal has been used for quite a long time as the only energy source. Coal stayed as the main energy source for America as well as for the rest of the world until the demand rose for petroleum. Particularly, automobile industry boosted the demand for petroleum. This fact results in a greater shift to petroleum based products along with household consumption. Coal used to be only resort to operate steam engine until modern petroleum was available as an energy source. Literarily coal is the first well known mineral used in the ancient time to meet the need of energy. The use of mineral as the main source of energy that led to the super industrialization caused tremendous damage to the global environment secretly.

In December 1879, the introduction of electric lighting systems by Edison, the inventor of the modern electric industry, gave a new thought to the world's energy sector. Edison's invention of electric lighting systems began the electric age of human civilization by putting aside the use of gas light. The modern electric utility industry began in the 1880s. At that time, in order to produce electricity, gas or coal was used. The commercialization of electric power started its journey being unable to anticipate of what would happen with the electric revolution after about two centuries. In the late 1880s, power demand for electric motors increased dramatically to its height for transportation and industry needs. By inventing electricity Edison brightened the world and ignited the dream of many new inventions which were not possible without such a start. Since then, the unavoidable energy, electricity, that invaded our daily life and kept all machines running either way being produced from water, gas or nuclear power.

With the passage of time, fossil-oil has been recognized more useful and efficient for modern civilization. On the other hand, various ways have been invented to produce electricity namely water, farness oil and nuclear fusion. One way or another, producing electricity claims again mineral energy. World-wide energy consumption increased 17-fold in the last century (Demirbas, 2007a and 2007b), while emissions from fossil-fuel combustion became the primary causes of atmospheric pollution leading to the greenhouse effect, acid rain, ozone depletion and climate change (Marchetti, Miguel and

Errazu, 2007). A few decades ago, we had realized a fact that shook our consciousness and pride of having a very modern science. We know now extracting minerals out of the heart of this planet for energy is nothing but a process of shorting the life of the entire living kingdom. The extraction of minerals and unplanned use of non-renewable energy warns us a dark time in the future. By using non-renewable energy we have damaged the environment so adversely that we are afraid whether the planet would remain suitable for us for another century.

A growing concern of environmental friendly energy thus has been a center point of the research scholars from various disciplines. In searching for the answer what could be the best option to fuel this modern world, researchers find hope with the biofuel energy. Biofuels have become more attractive recently because of their environmental benefits and the features of renewable resources such as oil seed, horticultural or agronomical crop (Ma and Hanna, 1999). As a result of realizing the fact, the European Union is on the third rank of biofuel production worldwide, behind Brazil and the United States. Sugar beet, wheat and rapeseed are the major crops converted to commercial biofuels in Europe today. On the other hand, the developing countries such as Bangladesh, China, India and the Philippines, also attempt to replace fossil-fuel as much as possible. Within the European Union the ambition is that 5.75% of the energy used in transportation shall be biofuels by 2010 (Balat, 2007). Whatsoever the motivation or planning to save the world by saving the environment with renewable energy like biofule, the debate is ongoing. Particularly an issue with regards to developing economy is crucial – how is the farm economy tackling the introduction of new environmental friendly energy, biofuel. This issue is the center point of this paper from the socio-economic view point on developing countries. We have tried to analyze the issues relevant to biofuel by analyzing some developing countries namely Bangladesh, China, India and the Philippines. The growing concern of finding alternative fuel energy instead of fossil-oil to meet its uprising price trend in developing economy is also at a strategically debate on how these countries are going to grapple up with the situation. The tradeoff between food grain and biofuel crop is another concern to the economists of the developing countries. Particularly, when a country is burdened with a high population pressure and poverty stricken what strategy may balance an efficient tradeoff between the demand for food crop and growing demand for biofuel crop in the context of small-scale farming.

In the following section we attempt to discuss the evolution of biofuels before debating on the advantage and disadvantage of biofuel production. Biofuel production in the developing countries follows. Trade off between biofuel and food crop cultivation sheds some light on the strategic aspects for small-scale farming. Conclusions are drawn by discussing the issues to be considered in policy formulation for the developing countries.

2 USE OF BIOFULES

Defining biofuel is as easy as complex. Generally biofuels refer to liquid and gaseous fuels as a source of energy. Biofuels are predominantly produced from renewable biomass. Biofuels are a wide range of fuels which are in some way derived from biomass. Modern conversion technologies can process primary renewable biomass to usable high quality liquid fuel. Biofuels are currently produced in different forms such as solid biomass, liquid fuels and biogases. The use biofuel varies along with the form. The following uses are commonly seen in today's world:

- Replacement of fossil-oil as liquid fuel: Ethanol can be used as a fuel for vehicles in its pure form. Bioethanol is an alcohol made by fermenting the sugar components of plant materials and is made mostly from sugar and starch crops.
- Generating Electricity: Electricity also can be produced using Bioethanol which simply the replacement of petroleum product. Bioethanol can also be used in the heating systems of massive building structure without any harmful impact to the environment as well as at micro level.
- Adding Lubricity to Diesel Fuel: Bioethanol is also usually used as a gasoline additive to increase octane and improve vehicle emissions.
- Biogas: Biogas usually produced from the decomposition procedure of biomass. Biogas is a sustainable and cheaper source of energy that can be used for daily household needs. It has been already used in many developing countries as an energy source for cooking.

3 VARIOUS TYPES OF BIO-FUELS

In the earlier section we have discussed about the use of biofuels. Different biofuel is used for different purposes. Except for biogas the usual raw materials are plant biomass. Since the inception of biofuel, a remarkable development has been carried out in biofuel industry. With the passage of time, use of biofuel has been experimented heading towards more feasible and sustainable stage. Based on the development process till date, biofuel can be classified in broader groups. This classification is also made based on the source and consumable fuel processing technique. They are discussed as follows:

FIRST GENERATION OF BIO-FUEL

First generation bio-fuels are the more common fuels that are produced from food crops and animal fats. Some examples include biodiesel, vegetable oil, bioalcohol, methanol, solid biofuels and biogas.

a. Biodisel: Biodisel is a liquid fuel usually used for automobile energy. Biodiesel is actually a replacement of fossil-oil but without any pollutant effect. Biodisel usually is produced from soybean, palm, sunflower, safflower, cottonseed, rapeseed and peanut oils though there are plenty of options. Based on quality and quality the above crops are being used currently in the biofuel producing plants. The other feedstocks for biodiesel include animal fats, vegetable oils, Jatropha (Figure 1b), Mahua, mustard, flax, sunflower, palm oil, hemp, field pennycress and Pongamia (Figrue 1a, 1c and 1d)). Most of the feedstocks are part of food crops.

b. Vegetable oil: Vegetables oils are the similar first generation biofuel and occupy a prominent position in the development of alternative fuels. The sources of vegetable oils are almost similar to the biodiesel with the exceptions of Jatropha, mahua, Pongamia etc. Vegetable oils are not as good as biodiesel for vehicle engines and associate with problems like high viscosity, irregular occurrence of fuel atomization and depositing in engine.


Figure 1a: Pongamia seed


Figure 1b: Jatropha seed


Figure 1c: Rubber seed


Figure 1d: Castor seed

b. Bioalcohols: Alcohol compounds such as ethanol which is produced by the action of microorganisms and enzymes are known as bioalcohol. Propanol and butanol are another type of bioalcohols but not as popular as ethanol. Biobutanol which is also called biogasoline is commonly recognized as a replacement of gasoline (petroleum product). The feedstocks for Bioalcohols are wheat, corn, sugar beets, sugar cane, molasses, potato and fruit waste.

Figure 1e: Jatropha

Figrue1f: Pongamia

Source: Wiki media, 2010

d. Methanol: Methanol is another type of biofuel produced from a wide range of feedstock through a thermochemical conversion. Though the major feedstock of methanol is wood and agricultural reduces but currently also being produced from natural gas. Methanol can be a closer replacement of hydrogen based fuel.

e. Biogas: Biogas refers to a gas which is a popular source of energy for medium scale use. Many developing countries have already adopted this biofuel in their daily uses. All biogases are an output of an anaerobic digestion process on mainly agricultural biomass as well as animal waste. Biogas is a mixture of methane and CO_2.

d. Solid biofuels: The most known solid biofuels are wood, sawdust, domestic refuse, charcoal and dried manure. Firewood is one of most used solid biofuel in the developing counties for household consumption. Firewood produces heat directly if burnt in furnace or handmade stove. Beside a very little direct use other known solid biofuels are processed into a concentrated fuel product before final use. The current types of processes are pellet, cube and puck. Solid biofuels are associated with considerable amount of pollutants. A problem with the combustion of raw biomass is that it emits considerable amounts of pollutants. It is assumed that though solid biofuels are associated with pollutants but at a lesser degree than the fossil-fuel. A derivative of solid biofuel is biochar.

SECOND GENERATION BIOFUELS

Second generation bio-fuels are made from waste biomass, making them a more sustainable solution as compared to their first generation counterparts. They include various alcohols such as ethanol derived from wood. These include waste biomass, the stalks of wheat, corn, wood, and special-energy-or-biomass crops (e.g. Miscanthus). Second generation biofuels use biomass to liquid technology, including cellulosic biofuels.

Many second generation biofuels are under development such as biohydrogen, biomethanol, DMF, Bio-DME, Fischer-Tropsch diesel, biohydrogen diesel, mixed alcohols and wood diesel.

Cellulosic ethanol production uses non-food crops or inedible waste products and does not divert food away from the animal or human food chain. It is a non-food crop based biofuel product that uses fast growing grasses rather than starchy foods. The most notable benefit for consumers, for instance, is the fact that cellulosic ethanol can potentially be produced in much greater supply on a regular basis than any first generation biofuel. In addition, fast growing grasses can absorb much more carbon dioxide each day than the other food crop during growth cycle. The only drawback behind cellulosic ethanol use is that current production technologies that are comparatively expensive making it less competitive.

THIRD GENERATION BIOFUELS

The third generation bio-fuels are generally made from algae which are low-input and can be farmed on a massive scale. Algae-fuel is a way to recycle carbon dioxide by photosynthesis and to extract carbohydrates for making fuel. This generation of biofuels is also called oilgae. Based on laboratory experiments, it is claimed that algae can produces up to 30 times more energy per acre than land crops such as soybeans. Thus, it can be seen that third generation biofuel is comparatively cheaper than other generations of biofuel. Unfortunately no lab experiment has been commercially trialed to justify this calim. Helioculture is a newly developed technology which is claimed to be able to produce 20,000 gallons of fuel per acre per year by using algae. Figrure 1g is an example of Algal biofuel production.

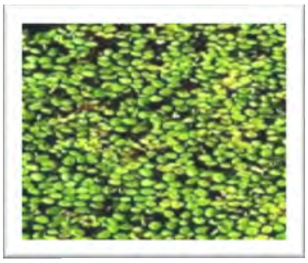

Figure 1g: Algal biofuel

4 BIOFUEL PRODUCTION IN CHINA, INDIA AND BANGLADESH

In this section we have discussed the production of biofuel in Bangladesh, China, India and the Philippines. Out of these four countries China has been in front line in producing biofuel. China has taken massive production activities for the last couple of years. The Philippines is another dominant biofuel producer in the Asian region. Bangladesh and India have recently put substantial effort for enhancing the production keeping in mind the disadvantaged of biofuel production in their over populated lands. Table 1 reveals a picture of biofuel production of the selective feedstocks in the world.

Table 1: Five common biofuel feedstocks, displaying energy harvested (gigajoules per hectare)(Source: Fresco, 2006, http://bcjournal.org/2008/biofuels-and-the-developing-world/)

Item	Yield Gj/ha	Billion hectares (required land)	Percentage
Sugercane	104.4	0.86	34
Corn	54.0	1.66	66
Jatropha	32.4	2.78	112
Rapeseed	16.2	4.54	182
Soyabean	9.0	10.00	400

4.1 BIOFUEL PRODUCTION IN BANGLADESH

Bangladeshi is a highly populated country (current man land ratio is approximately 1:14 decimals). She has 0.32 million hectare of unused land. Research findings reveal that planting biofuel crops namely karanja (Pongamia), Jatropha and Mahua or any other suitable crops on such unused land can reduce diesel fuel import by 28%. There are some native plants which grow well in the fallow lands. Some of the well-known non-edible oil seed producing plants are Jatropha (*Jatropha curcas*), Karanj (*Pongamia pinnata*), Castor (*Ricinus communis*), Rubber (*Hevea barasiliensis*) seeds. Bangladesh has not involved in biofuel production substantially as there is debate on the appropriate policy and technology. Policies have been formulated to support and motivate small-scale farmers to utilize their unused farm land and marginal land as well.

4.2 BIOFUEL PRODUCTION IN CHINA

China is one of the most progressed nations in Asia to set the goal of attaining 1% of its renewable energy by producing biofuel by 2020. Available statistics reveal that as of 2005, 20 million of rural household have been able to use methane as biofuel. As of 2010, electricity generation by bioenergy is expected to reach 5 GW. The annual use of methane gas is expected to be 19 cubic kilometers by the end of 2010. China is the world's third-largest producer of ethanol, after Brazil and the United States. Besides, china produces 8 billion cubic meters of methane gas every year from the biofuel facilities. The Yunnan Provincial Forestry Department also plans to plant 1.27 million hectares of biofuels plantations with the aim of being the largest biofuel producing zone by 2015 (Li, 2007). Forty counties in the Yunnan province have begun to develop biofuels plantations. Besides, the United Nations Development Program and China's Ministry of Science and Technology are co-funding a 4-year project to encourage local farmers to grow Jatropha curcas as raw materials for biodiesel. A survey conducted by the Chinese Academy of Forestry in 2004 identified 151 families of oil-bearing woody plants, with 697 genera and 1,553 species for biodiesel production (Li, 2007). One of the most promising options for large-scale biofuel use is the Chinese pistachio (pistacia Chinensis Bungo), the only species of the cashew family found in China[4].

4.3 BIOFUEL PRODUCTION IN INDIA

India is not as advanced as china for producing biofuel. One of the most crucial factors behind less progression is socio-economic scenario as well as the patronized public policy. India has been going through political debates on her biofuel production strategy and finally negotiated a national biofuels policy recently. The newly founded policy needs to be tested over time along the way to be more specific. The new policy sets a general target of 20% ethanol and 20% biodiesel blending by 2017. The fear of inflation in food price is an obstacle in understanding the status of biofuel production potentialities in India. Due to the existing fear and other political economic reasoning it is difficult to anticipate whether the existing ethanol targets for this year will be met–currently 5%, with a 10% target scheduled to take effect in October, 2010.

4.4 BIOFUEL PRODUCTION IN THE PHILIPPINES

The Philippines is one of the most potential biofuel producing country in the region. Currently the Philippines's biofuel production is confined to only biodiesel. Primary feedstock for biodiesel production in the Philippines is coconut oil. The latest statistics reveal that the Philippines have seven biodiesel production plants as of August 2007 with a capacity of 257 million litters a year. The Philippines started producing ethanol in 2008.

The Philippines are the largest producers of coconut oil in the world - approximately 1,400 million liters per year that helps to operate the biofuel production from copra efficiently. According to Department of Energy data, there are ten companies currently producing coconut methyl ester (CME), with a total annual capacity of 323.6 million liters. Another biofuel crop, sugarcane, is considered a substantial source for ethanol production. The government sees it as the most reliable feedstock due to its well-established farming technologies and the highest yield per hectare compared to other feedstock (corn, cassava, and sweet sorghum). At present, the sugar industry can only supply 79% of the needs of the 5% ethanol blend, which is between 200 and 400 million liters per year.

The other potential biodiesel feedstocks in the Philippines are Jatropha and palm oil. The government has announced the plan for massive propagation and cultivation of Jatropha to cover around 2 million hectares (ha). Mostly these lands are low yielding public and

4 Worldwatch Institute (2010). Statistical information are obtained from the reprinted articles (refer to the reference).

private properties for food crop. This effort will produce about 5,600 million liters of biofuel in the next 10 to 12 years (Fresco, 2007).

5 CONTROVERSIES ON BIO-FUEL PRODUCTION

There are many controversies and political speculation surrounding biofuel production and its associated impacts. First-generation biofuels are more on this debate due to the agricultural, economic, and social implications caused by the potential expansion of biofuel production facilities. The following findings reveal the controversies:

5.1 CONTROVERSY ON BIOFUEL IN BANGLADESH

- Food crisis is a common event in Bangladesh Economy. In the last military-controlled interim government has exported several thousand tons of maize from Bangladesh for biofuel production abroad despite the raging food crisis in the country with the aim of earning foreign currency (Dawla, 2010).
- The cause of food crisis was referred to the climate change and biofuels on the International Day for the Eradication of Poverty. Although the US government has consistently denied this fact by saying that it only contributes to about 3% price rise. The price rise scenario is completely different to Bangladesh context.
- Though technically biofuel is environment-friendly but it has indirect impact on deforestation and biodiversity. The rate of encroachment can be fueled by the poor people to generate more income using encroached forest land for biofuel production instead of reforestation.
- It seems that biofuel production is eco-friendly and potential to reduce carbon emission but a massive plantation may have opposite impact on micro climate due to poor environmental management in Bangladesh.
- If biofuel plants are not cultivated or planted with environment-friendly technology, there is a chance of increase in use of chemical fertilizer for boosting the production which may not bring any positive impact on environment as a whole. Moreover, mono-cropping intensity may increase and deplete the fertility more. Bangladesh has a poor control over agricultural production. A general interest in mono-cropping may adversely affect the country’s agricultural economy.
- The rising pressure on cultivable land to meet the increasing demand for biofuel production may boost the rural poverty in some cases. Particularly, the women-headed households which struggle hard to collect woods and twigs from the

forests for selling them to secure their livelihoods. Thus, unplanned biofuel production is potential to cause more suffering for the marginalized rural farmers.

- Increasing demand for biofuels leads to a rise in food import costs. Moreover MNCs that control the energy markets can also promote biofuel plantation to produce biofuel. Due to such intervention the food prices are likely to increase in Bangladesh.
- Bangladesh meets 35% of her primary biofuel requirements from the existing biomass stocks. Due to the increasing demand for biofuel, the biomass resources can be more expensive.

5.2 CONTROVERSY ON BIOFUEL IN CHINA

In China the first thing is to provide food for her 1.3 billion people. Thus it is very crucial to remember how the biofuel production will affect the overall agricultural crop production. Besides, while rivalry between food and fuel producers for grain is not limited to China, the problem is particularly acute in this country because of the low per capita availability of arable land to feed her vast population.

- The demand for biofuel will lead to increase in the demand for biofuel feedstock such as maize, sugarcane, and cassava. Such increase in biofuel feedstock will be likely increase significantly.
- Researchers predict that increased maize prices as an effect of biofuel expansion will indirectly increase livestock production costs due to the significant dependency on maize for animal feed. This fact may decline the overall livestock production causing a low income from farming activities. The socio-economics of the associated families will be adversely affected in china.
- Increase in the price of agricultural products may provide incentives for farmers to stay away from producing less profitable grains that can cause a shift in the crop production structure leading to a decrease in agricultural diversity. This process can divert food crops away from human food chain which can be a catastrophe for agricultural sector.
- The agreement between Chinese forestry authority and giant energy companies to establish large scale biofuel plantations in the southwest reflects rising interest to renewable energy sources. Without any proper measurement and scientific analysis this massive plantation activities can cause great loss to the region's forests and biodiversity.

- Southwestern China is the habitat of the largest intact natural forests which maintains the microclimate of the region. These areas have already shrunk rapidly due to rampant logging in recent years. The emerging biofuel craze may likely pull the last string of ecological collapse in the region.
- A proper business standard is a vital requirement for the sustainability of the industry. Without any business standards producers need to cope with the unfair competition. As the raw materials for biofuel varies, a business standard will ensure fair competition in such a largest market like China.

5.3 CONTROVERSY ON BIOFUEL IN INDIA

- The food versus fuel controversy has been especially fierce in India, where many families are unable to afford food at the current inflated prices.
- A potential competition within the biofuel producing industry is likely to occur if a proper land use policy is not followed before production operation. Indian Railway has a vast land that can be used for biofuel plantation being classified as industrial land. In comparison to that many private or medium scale producers will not be able to compete in the biodiesel market. The unequal competition may adversely affect the overall production of biofuel.
- Absence of uniform land leasing arrangement or property rights may obstacle biofuel plantation all over India. The lands that are used for biofuel plantation usually leased from different agencies namely brewing and tobacco, state government under unilateral allocation. In addition to that many Indian states are controlled by local parties that are effectively independent in many respects can be retained from biofuel production. A tension may arise pertaining to a decision of biofuel plantation by the central government conflicting state or private interests.
- Many of the biodiesel plantations are owned by foreign investors in India. Most of their business models are associated with high prices paid by international importers. It is hard to presume that these companies would agree a lesser price ceiling set by government.
- A technical problem is likely to be encountered by the Indian automobile industries. There are many automobiles with older technologies and unsuitable for biofuel. If the ethanol is in effect as the biofuel for the sake of environment how the owners of such automobiles will be meeting the situation. It is an issue relevant to middle income group of people and simply cannot be avoided.

5.4 CONTROVERSY ON BIOFUEL IN THE PHILIPPINES

- Coconut farmers are usually small scale producer of coconut oil who produces copra as the primary produce. The farm size is about five hectares on an average. Coconut oil is extracted from copra by the local millers and then processed to produce Coconut Fatty Acid Methyl Ester (CME). It is generally assumed by the experts that creation of another market for coconut oil will destabilize the price of CME leading an impact on copra price as well.
- Food security is also a concern in the Philippines like other developing countries. Currently sugarcane is used as feedstock to produce biofuel at a large scale. The potential implication of using sugarcane as the input materials of biofuel may adversely affect the general price level of other agricultural commodities.
- Without a proper action plan, large scale biofuel production is likely to affect livestock industry and as well as fish industries indirectly.

6 ISSUES TO BE TAKEN INTO ACCOUNT

A list of controversies claims a rectification in the strategic decision of biofuel production in a developing country. It is more authentic and justified to find out a suitable solution rather than debating and making delay in production of biofuel. In order to construct a positive strategy toward overcoming the debate on biofuel the following issues can be taken in to consideration by the policy makers:

- A price hike is expected due to unplanned biofuel production. Moreover food security is also a concern for the balance between biofuel and food crop.
- Looming damage to biodiversity because of land conversion from forest to biofuel plantation and massive monoculture plantations as well.
- Biofuel certification and regulations on commercial production.
- Selection of appropriate marginal lands for biofuel production. A set of new policies need to reiterates the guidelines for specific land use such as marginal lands and degraded forestlands.
- Community aspects of biofuel production under small-scale farming systems
- The socio-economic impact of introducing biodiesel engines in a developing country overlooking the consequences.
- Increasing demand for biofuels leads to a rise in food import costs and influence of MNCs over biofuel production

7 SCENARIO PLANNING STRATEGY FOR BALANCING THE TRADEOFF

Scenario planning is necessary to combat the anticipated negative consequences of biofuel production in unready economic settings. Various suitable models can be adopted for sustainable production of biofuel crops in developing counties. Some of the social forestry and small-scale farm forestry models that ensure better livelihood for the people involved in biofuel production can be adopted. For instance, a roadside plantation model under social forestry management can be a great option to meet the necessity of biofuel production without affecting the food crop production. The best way to deal with this issue is to employ strategic scenario planning. The following section provides some clues for potential strategic planning to reach a better position than a prolonged debate.

A policy is to be adopted for biofuel production so that the chance of affecting the demand for food crop can be minimized (Beament, 2009).

- Business guidelines need to be adjusted as biofuel production can be influenced by the international traders.
- Forestland should be protected with appropriate policy so that people, no matter poor or well-off, can deplete the forest land for biofuel production.
- Second generation biofuel needs to be promoted more than the first generation as the feedstocks of second generation are mainly non-food crops. Second generation biofuel has a vast opportunity to combat the controversies on biofuel production for the developing countries.

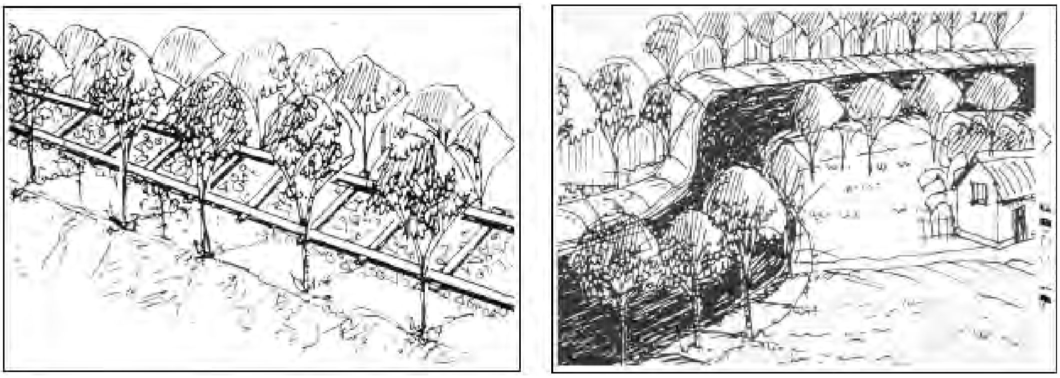

Figure 2a & 2b: Plantation on marginal land and plantation on roadside (Source: Adapted from Mango et al. (1992) in Safa, 2006).

- More intensive research is required for the third generation bio-fuel to find suitability case by case within the developing countries.

- Unused land should be given priority for biofuel plantation rather than agronomical or horticultural cropland.
- Social forestry models such as roadside plantation embank plantation, railroad plantation etc. needs to be adopted and strongly patronized by the public and private agencies for biofuel plantation so that additional pressure on the existing food crop land is not expected (Figure 2a & 2b; 2c & 2d).

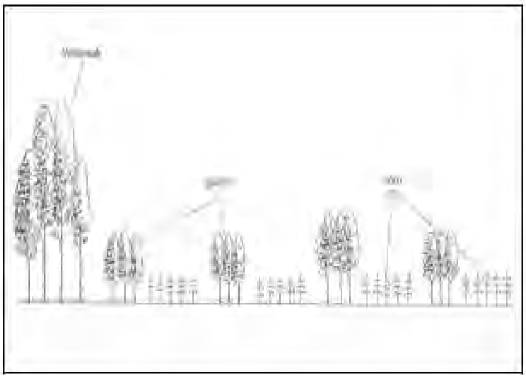


Figure 2c & 2d: Homestead agroforesry and Plantation on canal banks (Source: Adapted from Mango et al. (1992) in Safa, 2006).

8 CONCLUDING COMMENTS

Biofuel is an alternative best source to produce fuel to replace fossil-fuel. The issue has been analyzed by several researchers at different corners of the world. It is proven that biofuel is the best resort for environmental sustainability to reduce emission and other environmental pollution. Producing biofuel and associated activities are more easily manageable for developed countries than the developing ones. Planning and implementation may be easily adoptable in developed countries with less effort. But the scenario is completely opposite in the developing countries. Policy formulation and implementation is always a complicated process in the developing countries due to poor governance.

A corn or a sugarcane producing country - USA and Brazil - have comparative advantage on biofuel production. On the contrary, the developing nations like Bangladesh, India, China and the Philippines are associated with several problems such as over population, land erosion, food insufficiency and natural calamities. A minimum level of inflation can create a fearing havoc in these countries' economy. Besides, how a significant role in biofuel production can benefit them sustainably is far more important than joining the rate race of biofuel production for foreign currency. A very careful case by case scenario planning can be helpful to join the movement of biofuel paradox. Biofuel production is an issue that is not to be solved by the tools of political economy in a twinkle of eyes. A global suitable policy for countries involved in biofuel production needs to be articulated so that the benefit of trading may not harm poorer nations. It is important to remember the beginning of fossil-fuel use which was revolutionary but ended up with tremendous hue and cry on environmental issues. In promoting biofuel as if it does not turn up another catastrophe for the poorer nations but one way or another profitable for developed nations. Small-scale farm management can be a suitable option to utilize unused land owned by small farmers of the developing countries so that an expected balance can be made for sustainable biofuel energy sector.

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Challenges for diversification of activities in private forest sector in Slovakia

Zuzana Sarvašová[1], Miroslav Kovalčík[2]

Abstract

Non-state forest sector in Slovakia manages 45% of forests. The traditional source of income in forestry, and especially for small-scale forestry (SSF), is wood. The diversification of production activities towards to new products and services helps to maintain sustainable forest management. The diversification of economy in SSF enterprises is an important way how to survive in economic crisis. According to quantitative analysis of data from Economic Accounts for Forestry average level of diversification in some European countries is about 25%. On average it is 20% in Slovakia, but in SSF only 6-7%.

A main challenge for diversification of activities in private forest sector flows from national forest policy, represented by National Forest Programme and Rural Development Policy. An example of new entrepreneurial activities in private forest enterprise based on SAPARD measures is analysed. Non-state forest enterprise in Veľký Klíž (forest land owned by around 600 owners) provides recreational services that are at the same time an additional source of income. This source represents on average about 10% of the enterprise income.

Key words: private forests, economy, diversification, recreational services, policy influence
FDC: 682(437.6)=111

1 INTRODUCTION

During last sixty years, the countries of Central and Eastern Europe have experienced two profound changes in the dominant political ideology; a transition to socialist centrally planned economy during the early 1950´s followed by a transition back to the market economy in the years following 1989 (Dale – Baldwin, 1999). These changes had great impact on socio-economic and legal framework and brought changes in forestry sector as well (restitution of forest land). In Central and Eastern Europe countries (CEE) the

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proportion of forest land in private ownership varies from 5% in Romania to 80% in Slovenia. Average private forest ownership is about 30% (FAO, 1997). That means that non-state sector plays an important role in many countries. The process of land restitution in forest sector in these countries has been still going on. Main problems in non-state forest sector are insufficient skills and knowledge on forest management, lack of information on forests, bureaucracy, a need of assistance to non-state forest sector in protecting their forests from fires, diseases and timber steals, and sometimes also low interest of the forest owners (Pivoriūnas – Lazdinis, 2004; Vančura – Trejbalová, 2004).

Forest research in Slovakia deals with sustainability and development of forests, utilization of its benefits in favour of the forest owners and society. Slovakia with its 41% forest coverage belongs to the most forested countries in Europe.

After the year 1989 there occurred a shift in the perception of forest functions from the strictly productive character to the acknowledgement of its other functions (recreational and environmental). Significant changes in forest management and organizational structure took place as well. Forestry after 1989 can be characterized by decrease in the number of employees, long-lasting wage disparity in comparison with other economic sectors, reduction of state funding of the performances in public interest, increase of wood deliveries, progressive stabilization of wood export, preparation for EU accession and the link-up to the Common Agricultural Policy.

From the macroeconomic point of view the share of forestry on the main economic indexes is rather differentiated. The share of forestry on the gross domestic product (GDP) is decreasing. It is because of the faster growth of the economy as a whole. In the GDP of forestry (0.52% in 2008) the utilization of ecological and social functions of the forests are not included. Although these forest functions begin to play a more significant role in benefits for the public, are still registered in other branches, which use these functions. The share of the forestry, wood-processing industry including the value of environmental and social functions is assed to approximately 3.3% of the GDP.

Investments into forestry were undersized which resulted in out of date machinery, almost stagnate forest road building and neglecting their reparation and maintenance. The volume of investments has nowadays an increasing tendency.

The economic performance and GDP of forest sector were from mid-2008 onwards significantly impacted by global financial crisis. The reduced demand for timber and timber-based products contributed to the imbalance between demands and supply and resulted in a fall of average prices per m^3 of timber by 12%. The sectoral GDP given in current prices rose by 1.18%; however, sectoral contribution to national GDP was at 0.42% on 0.04%was fall down and the trend is expected to continue in 2009.

The majority of sectoral investments (42.39 million Euros in 2008) went into construction (59.0%) and machinery / technology upgrade (33.5%). The remaining 7.5% were other investments. In the state sector, the investments annually rose by 11.8% whilst remaining largely unchanged in the non-state sector (1% up).

Funding of forest activities was undertaken in the years 2000 – 2006 through SAPARD-program (Special Assistance Program for Agriculture and Rural Development), Sectoral operational programs (Council Regulation 1257/99) and Rural Development Plans. For the actual planning period it is the European Agricultural Fund for Rural Development – EAFRD.

The aim of this paper is to analyse the situation in Slovakian forestry concerning to diversification activities especially in non-state forest sector. And on the example of successful implementation of project supported by SAPARD measure “Diversification activities in rural areas” to describe the possibilities occurring for small-scale forestry enterprises in the frame of rural development policy.

2 FORESTRY IN SLOVAKIA

Total forest area in Slovakia is 2,007 thousand hectares of which forest cropland is 1,933 thousand hectares. The state subjects manage 55% from the total area of forests, but hold property rights only to 40% of the area (Moravčík et al., 2009).

Table 1: Forest structure (forest crop land) by ownership and use 2008 (Source: Green Report 2009)

Category	Ownership category						
	State	**Municipal**	**Private**	**Community**	**Church**	**Agro co-operatives**	**Unknown**
	Forest crop land, ha / %						
Ownership	777 107	187 818	252 192	495 051	57 818	4 438	159 167
	40.2	9.7	13.0	25.6	3.0	0.2	8.2
Use	1 067 124	170 264	139 080	519 361	32 530	5 232	-
	55.1	8.8	7.2	26.9	1.7	0.3	-

The category of non-state forests in Slovakia includes private, community, church, agricultural co-op and municipal forests (Table 1). The process of forest restitutions has not been completed yet; therefore forests of unknown owners are temporary managed by state enterprises. Most common legal and organizational forms of non-state forest subjects are: land associations with /without corporate entity status; Ltd. companies; shared companies; physical persons with/without business licence and administrative units (commercial, semi-budgetary) attached to municipalities.

Non-state forest enterprises are considerable diverse as regards the size of forest property, organisational structure and also expertise of forest land owners. Main problems of non-state sector in Slovakia are therefore effective forest property management, insufficient application of new ecological technologies, and insufficient compensation for restricted rights of forest owners, discrimination of forest owners caused by nature preservation restrictions, and unknown owners and the division of the common real estates.

Table 2: Key data on forestry sector in Slovakia 2008 (Source: Green Report 2009)

Indicator	**Ownership category**					**Total non-state sector**	**Total state sector**
	Private	**Community**	**Church**	**Agro co-operatives**	**Municipal**		
Growing stock, 1,000 m^3	35,044	118,141	8,065	1,104	42,698	**205,052**	**247,038**
Area of mature stands, ha	29,831	92,059	6,036	1,259	33,360	**162,545**	**190,963**
Growing stock of mature stands, 1,000 m^3	11,990	35,470	2,340	409	14,174	**64,383**	**75,454**
Total increment, 1,000 m^3	919	3,052	244	32	1,078	**5,325**	**6,462**
Total increment, $m^3.ha^{-1}$	6.52	6.05	6.04	6.07	6.27	**6.24**	**6.16**

There are no significant differences in basic data between state and non-state forestry sector (growing stock, area of mature stands, total increment) (Table 2). The average size of individual private holding is 2.8 ha. The very important force in forestry is creating sphere of forest service's suppliers who are doing outsourcing for state and non-state sector as well. According to national statistics in 2008 there was registered more than 15,400 such subjects active in NACE 02 Forestry.

3 MATERIALS AND METHODS

The overall approach to analysing the diversification activities is based on a cross-country comparison. In total, 15 European countries were included to analyses: besides Slovakia it was Slovenia, Bulgaria, Hungary, Czech Republic, Romania, Lithuania, Austria, Germany, Italy, Portugal, Greece, United Kingdom, and out of EU Switzerland and Norway.

The following methods of received data processing were applied:

- Qualitative analysis of key data about forestry sector in Slovakia from Green Report and Economic Accounts for Forestry
- Quantitative analysis of data from Economic Accounts for Forestry (EAF) for 2005, 2006 and 2007, according to EAF classification
- As non-wood products there were analysed and summed items: 54,000 – other products, 15,000 – forestry services, 17,000 – non-forestry secondary activities (inseparable), 25,000 – other subsidies on production, 30,000 – interest receivable
- The item 18,000 – output of the forestry "industry" represent total production of forestry
- There was calculated a ratio between the value of non-wood products and services and the value of total production of forestry with aim to analyse the level of diversification in the country
- For statistical processing of the data there were applied non-parametric statistical tests: Mann-Whitney U test and Kolgomorov Smirnov test (significance level $\alpha=0.05$ for the number of degrees of freedom $f = k (n - 1)$).

Economic accounts for forestry describe measure and analyse the generation of income and its distribution through the production account, the account of income generation, the entrepreneurial income account and the capital account. Economic accounts for forestry are an integrated part of the national economic accounts and their construction based on rules, principles and concepts of the ESA 95 methodology (European Commission, 2000).

A case study analysis was the main method for describing diversification activities in private sector in Slovakia. An example of entrepreneurial activities was analysed from small forest holding point of view. The proportion of recreational services in total income of forestry holding was analysed in the official statistics and documents. In addition to that, face-to-face interviews with key actors were used as a research method. The case study data were collected by using a semi-structured thematic interview guideline. It allowed flexible conversations to take place still ensuring that all the main issues were discussed (see e.g. PATTON 2002). The themes were chosen to cover the critical aspects relating implementation of new recreational service.

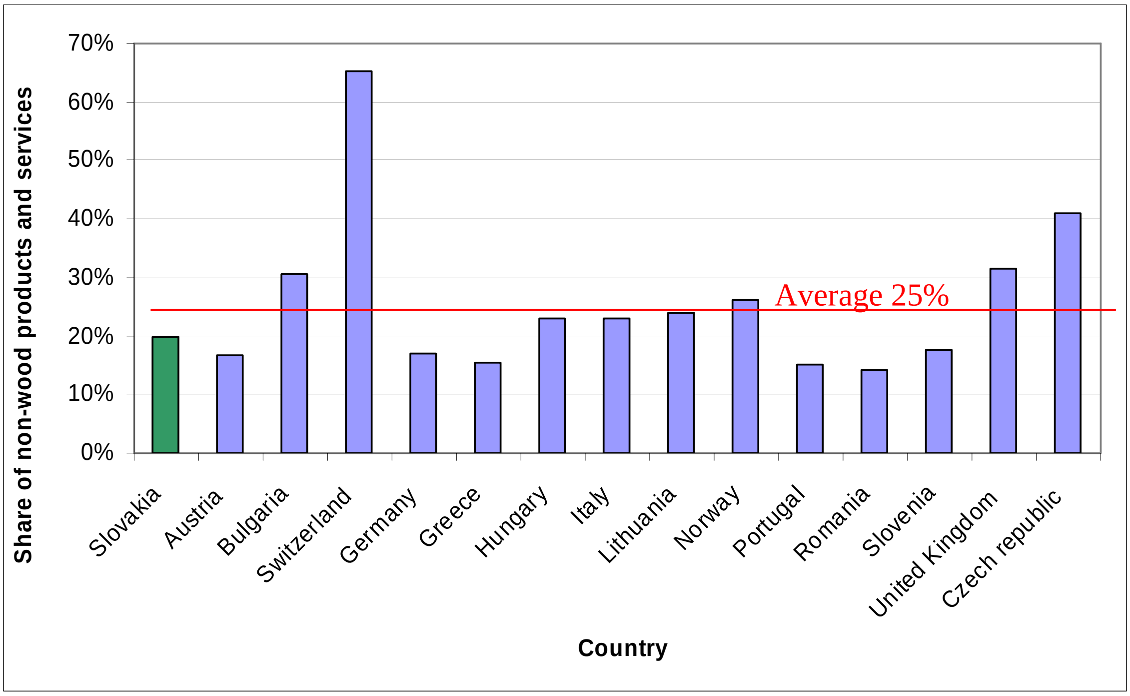
Main themes of the interview guideline were:

1) History and status of enterprise
2) Most important challenges for diversification
3) Most important actors and stakeholders
4) Critical aspects
5) Supporting factors
6) Results and benefits
7) Role of public policies

4 RESULTS

4.1 DIVERSIFICATION OF ACTIVITIES IN THE FORESTRY SECTOR

Diversification of activities in the forestry in selected countries was compared through the share of non-wood forest products and services on total production of the forestry in the country. Non-wood forest products consist of goods of biological origin other than wood, derived from forests, other wooded land, and trees outside forests such as natural gum, cork, and other forestry products. They include also agricultural products growing in forests such as mushrooms, truffles, other forest growing products (berries, nuts, etc.) and live animals grown in forest. Services include for instance, hunting as a sport or recreation, operation of reserves, national parks and other recreational services in forests. Comparable data were available for 15 European countries (Picture 1). The highest share of income from non-wood products and services was in Switzerland (65.27%). On the other hand the lowest level was in Romania (14.3%), Portugal (15.2%) and Greece (15.5%). Average level of diversification in the selected European countries is about 25%.



Picture 1: Activities diversification in forestry in some European countries

Although there are some differences in descriptive characteristics (mean, median, standard deviation, range and skewness) between old EU members[3] (include Switzerland and Norway) on the one hand and new EU members[4], they are no statistical significant and are due to chance (table 3).

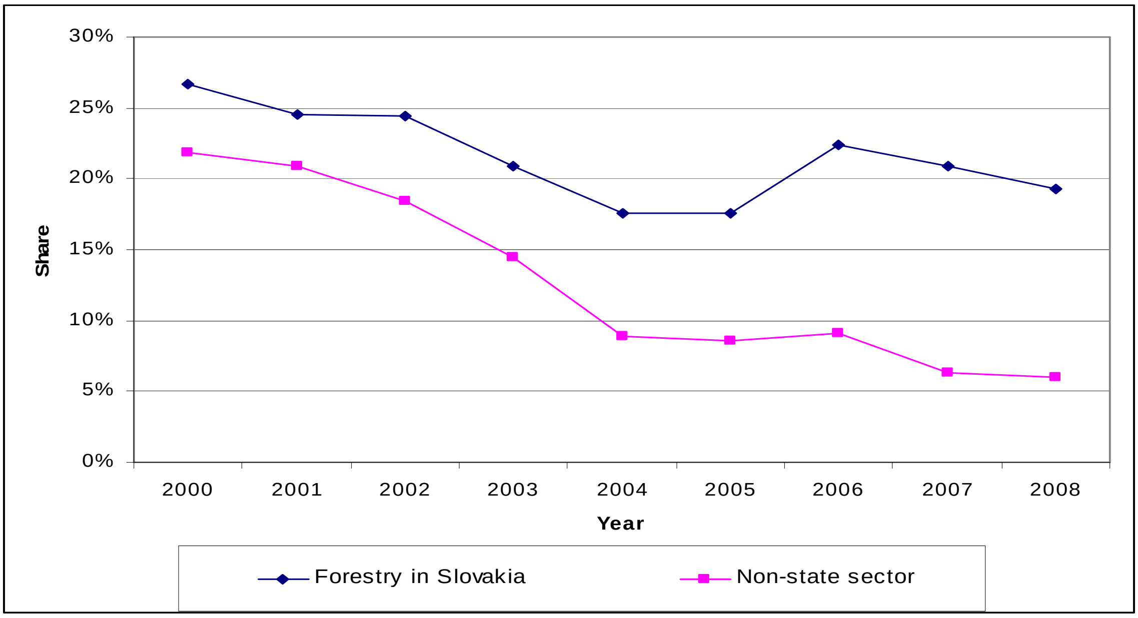
Table 3 Testing of differences between old and new countries

Diversification of activities	n	Mean	Median	Min	Max	Skewness	Standard deviation
Old EU countries	8	26.27%	20.01%	15.22%	65.27%	2.21	16.80
New EU countries	7	24.27%	23.15%	14.32%	40.85%	1.09	8.93
H_o: ($x_a = x_b$) > p, H_A: ($x_a \neq x_b$) ≤ p, (Mann-Whitney U test), U = 25.0, p = 0,73							
H_o: ($x_a = x_b$) > p, H_A: ($x_a \neq x_b$) ≤ p, (Kolmogorov-Smirnov test), D^- = -0,143, D^+ = 0,357, p > 0,1							

Forestry in Slovakia receives majority of its incomes from the sale of wood and timber. The share of income from timber sales in Slovakia is around 80%. In non-state forest sector it is in average higher, 93-94%. That means only 6-7% are incomes from other goods and services (Kovalčík et al., 2009). The trend is during last few years decreasing and unfriendly (Picture 2). Therefore it is important to increase the share of non-timber

3 Old EU members: Austria, Switzerland, Germany, Greece, Italy, Norway, Portugal, United Kingdom
4 New EU members: Slovakia, Bulgaria, Hungary, Lithuania, Romania, Slovenia, Czech republic

revenue. There is big challenge for diversification of activities especially in private sector, where the decrease was more than 15% between the years 2000 and 2008. Partly it is caused by land restitution process (small-scale forest owners are oriented mostly on wood production and forest management is their subsidiary activity), and partly by everlasting problems with market integration of until now non-marketed forest goods and services. As was mentioned above there is some possibilities defined in NFP but the implementation of such activities is still on the beginning.



Picture 2: Development of income share from other forest goods and services

One of the most prospective and the most developed activity is nature-based tourism and related recreational activities.

In general, tourism is one of the most rapidly growing industry sectors at the moment. In that context, especially forest related recreation is the activity promising the growth of turnover especially for small forest companies.

4.2 RECREATIONAL SERVICES IN VEĽKÝ KLÍŽ FORESTS

Case study represents a new innovative form to utilize forest areas in a form of private forest enterprise.

Sub-mountainous municipality Veľký Klíž, situated on the territory of the mountain Tríbeč (Western Slovakia), has 920 inhabitants living on cadastral territory of 4,241 hectares.

Forest enterprise of the municipality Veľký Klíž (community ownership category in the table 1 and 2) associates about 600 owners of agricultural and forest land with total area

786 hectares. Annual cut is about 800 m^3 of that about one half is fuel wood. Existing 248 ha of pasturelands is put on lease to Hunters' Association "Vrch Hora". Under good economic conditions felling of pine trees reaches almost 420 m^3 annually with following assortments – 30% saw log, 60% pulpwood and 10% poles and fuel wood. Forest managers are capable to produce 20% of saw log, 60% of pulpwood and 20% of fuel wood according to the timber prices and the needs of the association members. Turkey oak with its 50% proportion in tree species composition is not used for production of saw log as there is almost no demand after this assortment and wood is of low quality (many knots, curvature and cracks due to frost). Wood of Turkey oak forms a main component of fuel wood for the association members. The enterprise supplies 4-6 customers with log and pulpwood under good economic conditions. That means the annual income from wood is around 18,000 €.

The most important challenges for forest managers in preparing innovative project were as follows:

- Diversification of own production activities,
- Ensuring additional income for the members,
- Enhancement of the development of the municipality and the region with the use of natural and cultural potential of the municipality.

There was prepared and developed project supported by SAPARD (Special EU pre-accession assistance for agriculture and rural development) and in framework of this project there was reconstructed old-time forester's house and build up own facilities to provide background for other various recreational services (e.g. 9 round trails, forest guides, sport and playgrounds for children). In the beginning it was necessary to persuade the shareholders (members of association) about the need of investment. It required, in addition to others, suspension of paying membership shares for the period of two years of the project implementation.

Local associations (like hunting club), ALEA (Environmental Agency focusing on marketing of forest recreational services, local joiners, municipality and neighbour forest enterprise were the most important actors besides the forest owners.

The critical aspects were decision of the owners about suspension of paying membership shares, and during the implementation phase the cash flow. This was solved by loan from neighbour forest enterprise.

Supporting factors flow from the enthusiasm of forest managers and their personal interests. We need to highlight the important role of informal cooperation and cooperation networks in this process. Not least role had also possibility to use financing from SAPARD and other grant agencies (ORANGE).

The results and benefits of the project can be divided into economic benefits and others as:

- Receipts of about 2,000 € per year for recreational services related to the forester's house, (only accommodation represents 9.5% of total income),
- Receipts of the municipality related with providing next services with regard to the needs of tourists (e.g. information),
- Creating new jobs for local joiners.
- Other benefits are:
- Recreation and education facilities for the inhabitants of the municipality (mainly pre-school children and elementary schools pupils),
- Creating an area for regular meetings of municipality organizations,
- Participation in public beneficial activities (e.g. waste collection),
- Improving the environment for local inhabitants.

Nowadays, the share of income from non-wood products and services is around 3,300€ (15.5%), what is above the average in SSF enterprises in Slovakia.

5 DISCUSSION

Diversified economy, which is based on a wide range of profitable sectors or products, plays a key role in sustainable economy. There is a link between economic diversity and sustainability. Economic diversification can reduce national economic volatility and increase its real activity performance (Shediac et al., 2010).

A challenge for diversification of activities brings new possibilities of income for rural areas. Farming and forestry businesses represent primary sector in rural areas. They give essential raw materials and provide a place of beauty, rest and recreation. The challenge for diversification is about meeting the possibilities and unlocking the potential.

Forestry along with traditional income source from wood must develop new products and services. On the other hand, it has a great deal to offer. Diversification of forestry and non-forestry activities as well as activities carried out in the framework of related sectors must be aimed at the increase of employment and incomes.

Priority areas defined in National Forest Programme for Slovakia are tourism (forest tourism, education, tourist guide, hunting), energy (use of alternative energy sources – bio energy, water) and the environment (environmental services in protection and enhancement of biodiversity). Diversification of production activities means their extension beyond the forestry in the areas of non-traditional wooden products, growing of ornamental trees and bushes, Christmas trees, medicinal plants, etc. (National Forest Programme of the Slovak republic, 2007).

Income diversification helps to maintain sustainable forest management and, as it is presented by Illukpitiya – Yanagida (2008), reducing forest dependence contributes to the conservation of biodiversity and thus to conservation of forest resources.

Level of activities diversification in the compared countries was about 25% of the total income of forestry. Data from Global Forest Resources Assessment (2005), which based on total value of non-wood forest products removals in 2005, presents this level of activities diversification in the same countries about 16%, but they include just the non-wood forest products (any services).

There have been carried out many studies on diversification of activities in forestry. For example Karppinen (1998) found out in his study that owners, who stressed that both, monetary and amenity benefits of their forest properties, were the most active in their silvicultural and cutting behaviour. Non-timber objectives seemed not to exclude wood production: a group called recreationists harvested slightly less than other owners. Recreationists were willing to invest in forestry but were selective with respect to management practices

Illukpitiya – Yanagida (2008) found that in rural households in forest margins of Sri Lanka there is a positive relation between the index of income diversification and total income that indicates an increase in income due to increased diversification of income sources.

In general, we can state that non-state sector has been still under formation and it has been also improving own situation (for example establishment of associations as the powerful actors in the local policy). Main advantage of non-state sector is its independence in economic activities. It is easier to be engaged in other businesses than only in key business. There are also problems, of course, as short history of forest land management or lower skills and knowledge.

There are many factors that determine, which forestry activities forest owners carry out in their forest properties and which influence whether forest owners engage in entrepreneurial activity. Primary objective of forest owners is production or consumption of wood and non-wood goods and services. The forest owners whose objectives is timber production and who are business-oriented are more likely to manage and harvest their stands (Ní Dhubháin et al. 2007).

In European Union (EU), at national and regional levels, there is a great amount of different policy documents at different levels highlighting the need to improve the competitiveness of rural regions in Europe. On European level one of the most important policy document securing implementation of practical measures for forestry sector is Rural Development Policy (RDP). EU stresses an important role of RDP for enhancing economic value especially for non-state forestry sector, together with maintaining the sustainable management and multifunctional role of forests (Council Regulation 1698/2005).

During current programming period 2007-2013 EU rural development policy recommends to support diversification of activities through innovations in forestry. The most attractive opportunities for innovation are offered especially within the Measure 227 - Non-productive investments. Construction of new tourist infrastructure elements could be very important for rural development. Increasing of tourism attractiveness brings new opportunities for small-scale foresters. This measure is unfortunately not implemented in Slovakian RDP.

6 CONCLUSIONS

Main conclusions based on our analysis show findings as follows:

- Average level of diversification in the selected European countries is about 25% (based on results of Economic Accounts for Forestry - EAF).
- The level of activities diversification in Slovakia is comparable with other European countries (20%), but in non-state forest sector it is lower, and income from other goods and services is about 6-7% on average.
- There are good examples for diversification of activities and for innovation in non-state forest sector.
- Construction of new infrastructure for tourism may be very important for rural development. Increasing of tourism attractiveness brings new opportunities for small –land forest owners.
- Main fostering factor for introducing new services was the support from EU funds.
- The diversification of economy in SSF holdings is an important way how to survive in difficult time especially during this time of economic crisis.

It seems that despite the important role that economic factors play in the development of diversification process, appealing to this kind of factors alone is not enough. Some social and political issues are very important as well.

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Conservation of private lands: listening to the landowners

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Abstract

An ever-increasing population has required continual expansion of urban areas and higher rates of development on previously undeveloped lands. As such, private landowners confront the dilemma of selling their property for development purposes or striving to protect the resources on their land. Some landowners have little option but to sell the property in lieu of rising costs. The last few decades, though, have seen local, state and federal organizations partner with individual landowners in an effort to protect private land. Conservation easements work as a contractual agreement between an individual landowner and a third-party representative, or holder, where both seek to preserve natural systems like forest stands, riparian and watershed zones, and open space lands from development demands. This research seeks to identify the factors landowners incorporate when deciding the future of their land. This study took place in the Inland Northwest region of eastern Washington and northern Idaho, USA. In-depth, semi-structured interviews were conducted with twenty-eight landowner and six key informant interviews to identify factors associated with conservation easements. Two distinct categories of conservation easement landowners were identified: donated conservation easement owners and purchased conservation easement owners. Private landowners without conservation easements constituted another category; these landowners had sought information on easements but had not followed through. For donated conservation easement owners, conservation of the environment was the principal factor for donating conservation easements. With purchased conservation easement landowners, their easements had been purchased through a federal agency program. Their lands were used for agricultural purposes prior to selling the development rights and were at various stages of habitat restoration. Finally, non-conservation easement owners considered easements but in the end placed no type of restrictive

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covenants or conservation easements on their properties. This group was interested in protecting their properties from development. However, economics influenced all of these landowners to ultimately decide against placing a conservation easement on their property.

Key words: conservation, private land, landowners
FDC: 682:907(72)=111

1 INTRODUCTION

As human populations encroach on previously undeveloped land, private landowners in the United States find themselves at a crossroads – allow for parcel division and subsequent growth or protect their land by restricting commercial activities and development. For those landowners wishing to preserve their lands, conservation easements allow for protection while maintaining private property status. Conservation easements allow owners to sell or donate development rights to a non-profit organization or government agency for the management, care and general responsibility of the designated property (Squires 2000).

In 1981, the National Conference of Commissioners on Uniform State Laws drafted the Uniform Conservation Easement Act, which outlined general standards and guidelines for the 50 states to establish their own conservation easement policies. The inclusion of federal income tax benefits to easement policy, through the Tax Reform Act of 1976, provided monetary incentives to landowners looking to preserve their land. However, such financial opportunities have left room for unscrupulous practices by some landowners, professionals, and others involved in land protection (Miller 2005). Looking to curb tax violations by private landowners and require more accountability in the establishment and maintenance of easements, proposed policy changes by the federal and state government may change the effectiveness of conservation easements as a land conservation tool (Miller 2005).

The land trust community and those professionals involved in conservation easements have made an effort to increase professional standards, yet little is known about how landowners perceive proposed changes in federal conservation easement policy. This paper, using a regional, qualitative case study, looks at the motivations behind private land donation and landowners' perceptions of program-wide changes. It provides a background on easement history and policy in the United States and seeks to identify factors that influence private landowners to conserve their property. Finally, we discuss how landowners may react to proposed changes and the implications for the future of conservation easements.

CONSERVATION EASEMENTS

As a form of land preservation, conservation easements serve to protect private lands from development threats or commercial activity on the property (Wright 1994). The easement allows a private landowner to voluntarily limit or restrict any or all of the development rights of the land while simultaneously preserving its natural, agricultural or cultural qualities (Huntsinger and Hopkinson 1996; Sokolow and Lemp 2002). The easement serves as a contractual agreement between the private landowner and the "holder" of the easement rights (Lind 1991), with the easement terms recorded as part of the property title. Most conservation easements are either donated by the landowner or purchased by the holding non-profit organization or government agency.

Conservation easements were first used to protect scenic areas. During the 1880s, the municipality of Boston sought to preserve its parkways through conservation easements (Wright 1993). By the 1930s, the U. S. Forest Service had created a series of easements for the Blue Ridge parkways (Haapoja 1994). However, conservation easements were used only sporadically through much of the 20th century. In the year 2000, fewer than three million acres of land had been protected by easements. By 2005, that acreage more than doubled to over six million acres with 1,667 land trusts holding the majority of the easement rights (Land Trust Alliance 2005).

In 1976, Congress modified the U.S. Code on charitable donations to include "perpetual donations of easement" as a federal income tax deduction; (Diamond & Noonan 1996). With the passage of the 1976 Tax Reform Act and its subsequent revision in 1977, landowners donating perpetual conservation easements fitting Internal Revenue Service (IRS) conservation definitions became eligible for tax relief. Further tax law changes allowed donors to receive credit toward estate and state property taxes (Parker 2004). These additional conservation easement provisions established a method of protecting the land that could not be circumvented by time or people (Thompson 1989). In contrast, purchased conservation easements do not allow for federal income tax deductions. (For more information on conservation easements, see Lind 1991)

The perpetual length of conservation easements is not a foolproof method of land protection. Abuses do occur and recent years have seen an increase in the number of publicized abuses by easement donors, easement holders, and subsequent owners. National coverage of non-profit business practices, especially those of a worldwide conservation organization, brought intense scrutiny to the previously little-known world of conservation easement donation (Stephens & Ottaway 2003). As a result, conservation easements and their potential for violations have been investigated by the federal government. Violations investigated include: inflated property appraisals, unprofessional standards of practice and questionable conservation values on more than 400 easements (Miller 2005).

Since then, the land trust community has taken steps to respond to the problems. Initial reforms, succeeding negotiations, and continual lobbying have laid the groundwork for tighter professional standards both in and around the land trust community as well as temporary changes to landowner tax benefits.

These conservation easement donation and policy changes have occurred only recently. It is unknown how the suggested changes will affect the land trust community, landowners, or the use of conservation easements as a whole. Other aspects of conservation easements could continue to make future modifications problematic, either for easement holders or landowners, if not adequately addressed. These include: the long term monitoring and enforcement of easements and subsequent ownership (Mahoney 2004; Thompson 2004); easement holder responsibilities and liabilities (Wright 1993); and lack of public accountability (Raymond & Fairfax 2002; Merenlender et al. 2004).

For landowners considering conservation easements but needing economic compensation, potential changes in the regulations may reduce participation or compliance (De Alessi 2000; Merenlender et al. 2004). There is little literature documenting landowners' perceptions of conservation easements, their motivations for placing restrictive covenants on private property, and their subsequent reactions toward possible federal policy changes on a voluntary decision by private landowners.

The continued public interest in conserving land and the circumstances outlined above make the process of such conservation arguably more problematic than it has been in the past. This research uses a case study approach to begin to identify the major issues private landowners must consider when contemplating the possibility of entering into an easement.

2 METHODS

The inductive nature of the study led to the use of theoretical, rather than statistically-based sampling in the selection of study participants. Theoretical sampling is an approach in which subjects are not selected randomly, but rather on the basis of their knowledge or experience in a particular domain. Thus interviewing was only discontinued when the fieldworker, in consultation with local advisors, reached the judgment that all relevant categories of subjects were represented in the data (Charmaz 2000). This process allows the researcher to uncover views and perceptions (in this case toward conservation easements) through a series of probing interview questions. This method utilizes each new bit of information emerging in the data collection process as observations to be juxtaposed against information already in hand rather than testing a predetermined hypothesis. Observed patterns are tested through additional observations until the patterns stabilized and no new information is gleaned from subsequent interviews (Glaser and Strauss 1999; Strauss and Corbin 1990). By using this approach, it was possible to uncover and then explore different dimensions embedded in the decision process about whether to enter into an easement agreement rather than assume they were understood in advance. In this case, this included reasons for conserving land, awareness levels of potential policy changes, and the perceived effectiveness of such programs for conservation purposes.

This method also typically allows for the inclusion of key informants in the study. These are individuals who although they are not part of the study population per se are selected because they may by virtue of their relationship with the subject matter have particular insights that the population members may not. Although the results of the subject and key informant interviews collected in this manner are not suitable for statistical analysis, theoretical sampling is designed to capture the range and variability of stakeholders and their viewpoints in the specified population rather than focusing on occurrence frequency estimates in the general population. We suggest this method is particularly appropriate here given the highly specialized nature of our target population.

We began with the possibility in mind that landowner viewpoints and preferences may vary based on ownership tenure, use of the land, type of institution holding the conservation easement, and the economic stability of the landowner. Categories of landowners and informants emerged as data collection continued. Conservation easement landowners were not presumed to be homogenous, either in terms of the type of easement, the entity that held the easement, or their reasons for establishing the protected status on their property and the economic benefits of such an action

This study took place in the Inland Northwest region of eastern Washington and northern Idaho. Interviews with 28 landowners and six key informants were conducted between October 2005 and December 2006. Detailed notes were taken by the field worker during interviews and then summarized.

In-depth, semi-structured interviews were conducted with key informants including land trust staff, board members, legal experts and extension agents working with private landowners. Initial landowner contacts were selected from publicly available participant lists for both donated and purchased conservation easement landowners. From these initial contacts, subsequent participants' names were gained by referral. Interviewing was discontinued only when the "*saturation point*" was reached, meaning that novel information was no longer being uncovered in new interviews and informants indicated that all relevant categories of potential respondents had been sampled (see below) (Charmaz 2000). Interview topics covered land management practices; easement donation or establishment; economic influences; and perceived changes to easement policy.

3 RESULTS

In the initial interviews, it became clear that two distinct categories of conservation easement landowners could be identified. These categories relate to how the conservation easement was placed on the property and the type of organization holding the easement. The categories are: landowners who donated conservation easements to non-profit land trusts and those that sold a conservation easement to a public agency. Private landowners who sought out information on conservation easements but never established an easement provide another important dimension of the issue. Descriptions of these categories are described and analyzed below, as well as their reasons for placing easements on their properties, economic influences, and perceived effects of conservation easement policy change.

LANDOWNERS WHO DONATED A CONSERVATION EASEMENT

These landowners created conservation easements on their property by donating development rights to a local land trust. Most of them were familiar with land conservation techniques because of related employment or through volunteerism with local organizations. Property size ranged from two acres to 250 acres; easements were established three to ten years ago.

Conservation of the environment was the principal reason for donating easements. Increased development pressures, love of family-owned and working lands, and a responsibility for land stewardship were often mentioned as well. Development-oriented policies at the local level tended to stimulate the final decision to protect the land.

Interestingly, none of the landowners expressed immediate interest in the tax benefits of land donation:

The driving interest [was] to be able to preserve our home and preserve this setting, this landscape…for the natural habitats and vegetation for the birds and small wildlife. I didn't do it because I was going to get a tax benefit; I didn't even know about that.

About half of these landowners filed for the federal tax benefits; however, all said that the process of appraising and surveying the property negated any financial benefit as they lacked sufficient ordinary income to significantly benefit from the resulting tax deductions:

The easement reduced the value of the land almost by half. It cost over $3000 to get that evaluation and we spent the time and effort it took to go up there and put in the time. The savings we got never really paid our expenses. You have to be making a substantial amount of money before a tax deduction will help you.

In contrast, all landowners interviewed thought that the tax benefits were necessary to entice future landowners to donate conservation easements; by reducing those tax benefits, they asked, "Why would that be attractive? I don't understand that thinking at all."

Regarding policy changes at the national level, landowners thought that agency or governmental involvement in the easement donation process would cause more problems and increase the potential for violations. Unscrupulous easement activities should be handled on an individual basis by the holding entity; broad policy changes affecting all current and potential easement landowners rather than specifically addressing those suspect cases were considered impractical.

Interviewees thought that public accountability should be considered principally by land trust staff and not by a public committee. Conservation easements exist on privately owned and donated land and are established for public benefit of the protected habitats and spaces, not public use.

An easement isn't necessarily public, and I think to put it under public scrutiny or public access and lose control of my land, no way would I do that. I think that is way more open to abuse, far more than the way it is now.

None of the landowners interviewed had any interest in being told *how* to protect and conserve their land.

The seven people on the [county] board shouldn't be making decisions about this land. Those seven people have never hiked on this land. Those seven people have never watched the wildlife walk over this land. Those seven people didn't grow up on this land. Those seven people don't have any right to tell me how to protect my own land.

Landowners expressed a strong interest in the stability and longevity of easement holders, because organizations needed to be viable, strong, and true to their mission to maintain perpetual care of the easement property:

I want to know that the land trust that holds my easement is going to be around in 50 years, or a hundred years. I want them to be strong enough to continue to protect my forest even when I'm no longer here to do it.

LANDOWNERS WHO SOLD CONSERVATION EASEMENTS

Conservation easements held by the landowners in this category were purchased through the Natural Resource Conservation Service's Wetland Reserve Program. Prior to selling the development rights these landowners had used their land primarily for agricultural purposes. Agricultural land within the easements' boundaries was being converted to wetlands. One condition of the conservation easement program included wetland habitat restoration fully funded by the holding agency. Most of the landowners were introduced to the program by regional biologists from local, state or federal agencies. Easements were sold on properties ranging from 35 acres to 2000 acres; the easements were created between one and twenty years ago.

These landowners expressed no single driving motivation; instead, they all mentioned a joint interest in wildlife habitat and keeping the land undeveloped and they congratulated themselves for their foresight in receiving financial assistance to do so.

We were really doing this for wildlife habitat, but you know, why not seek financial compensation if it's within the rules?

None of the landowners were responsible for restoration costs incurred, and they all received monetary compensation for the easement-restricted land. One participant said that the organization was interested in keeping wildlife on the property, but they needed money. Selling the easement was the only way they could do both:

We needed to do some economic activity on the land to bring in revenue, something that would allow us to keep at least part of the land for wildlife. We looked into leasing [it] for agriculture. We looked at putting vineyards on the property. We looked into opening up the property for the public. In the end, it worked out best financially to sell an easement because we could keep the entire place for wildlife and still get a good return on the easement.

Many of the landowners who sold easements expressed displeasure with the bureaucratic tangles involving a federal agency:

[Easement conditions] turned out to be far more stringent than initially anticipated. I was disappointed. There was a lot of money spent on my farm and you would be hard pressed to find the results today.

There were complaints about time delays, lack of flexibility, dissatisfaction with the restoration process, and a desire to have a non-perpetual agreement. Yet when asked, none of these landowners had ever considered an easement with a local land trust; they had more confidence in the staying power, maintenance responsibilities and finances of a government agency. The advantages of working with such a "stable entity" outweighed the disadvantages of the bureaucracy.

Regarding conservation easement policy reform, these landowners were less familiar with the issues. Although the format of purchased conservation easements differed from donated easements, some participants expressed the perception that abuses still occurred in the federal program. They, too, had no desire to see universal changes to the program, but wanted the abusive practices stopped at the individual level. Most were very satisfied with the process of selling an easement.

Although these conservation easements were bought by, and the land restored and maintained through a federal agency, none of the participants were interested in the general public being actively involved in the process. Public access was prohibited under the easement terms set forth through the federal program.

The general public, those serving on any advisory committee, don't necessarily have the background to understand the technical terms involved with habitat restoration or property management. I'd feel more comfortable with biologists, lawyers or other professionals being advisors, not just anyone. The average person would think that the federal government put money on this property so the public could walk around it. It's still private land, my land, and I don't want anyone on it, chasing off wildlife or doing damage.

LANDOWNERS WITHOUT EASEMENTS

The final group of landowners had at one point considered or even negotiated terms for conservation easements for their land's protection. All had had specific contact with holding organizations or conservation easement landowners to learn about easements as a land conservation tool. Ultimately, economics influenced all of these landowners to decide against placing conservation easements on their property. Their concern for future economic flexibility outweighed their concern for future land preservation.

We wanted to protect our forest because all around us, you see 5-acre lots with large homes being built…If we put a conservation easement on our land, and reduced our property value, what were we going to live on?

Similarly, participants thought that it was enough for them to be stewards of their land, and there was little appeal for dictating future owners' actions and responsibilities to the land.

REASONS TO CONSERVE LAND

Generally, landowners who chose to protect their property with a conservation easement did so to preserve the biological, historical, or aesthetic values of the land. The principal difference between the two categories was how the conservation easement was placed on the property. Donated conservation easement landowners initiated contact with a local non-profit organization to donate all or part of the development rights on their property. Purchased conservation easement landowners were contacted by program officials about the possibility of restoring habitat through a funded program.

When deciding to protect their land, donated easement landowners tended to weigh conservation and aesthetic values as the more important factors. They valued the intrinsic, holistic benefits of preserving intact habitats; the conservation ethic of land stewardship; and doing their part to ensure open space for future generations. Their motivations tended to focus on the direct impacts of preserving their land.

With regards to the financial advantages of donating easements, landowners tended to de-emphasize the tax benefits. Most thought that while tax deductions were enticing, the gains from filing for the deductions depended strongly on the owner's annual income. Generally, the tax benefits, if taken at all, were secondary to the conservation of the land. Landowners who sold a conservation easement had a markedly different view, primarily because the easement was contingent upon them receiving monetary compensation for restricting rights. While they all contrast, purchased easement landowners valued the claim that wildlife habitat or land protection was most important; none would have participated without earning just compensation for their actions. This attitude was not evident with donated easement landowners.

One final difference between landowners who donated and those who sold conservation easement was the size of the acreage preserved. The donated easement landowners we interviewed protected properties ranging from 2 acres to 250, preserving a total of 1,110 acres, with a median property size of 100 acres. However, we were unable to identify landowners with significant additional land holdings not already included in the conservation easement. In contrast, the purchased easement landowners interviewed all retained sizeable amounts of land unencumbered by easements or other restrictive covenants. While their median easement size was 400 acres and they collectively protected 2,530 acres, these landowners sold conservation easements on roughly 40% of their holdings.

VIEWS CONCERNING POSSIBLE CONSERVATION EASEMENT POLICY CHANGE

As with the reasons to preserve land through conservation easements, both donated and purchased conservation easement landowners thought that changes to easement policy would not be particularly effective. Most participants believed that changes needed to occur at the local level, looking at individual problems rather than generalized ones. All tended to believe that while abuses have occurred, they will continue to occur and there is little benefit to drastic alteration of conservation easement programs that have been successful on a national scale. To counteract violations, it was important to strengthen local easement holders, raise industry standards to better suit changing needs, and focus on the landowners.

Suggested changes in easement policy that would open up easements to public scrutiny were generally seen as unattractive. Both types of landowners with easements emphasized that the easement decision was theirs to make as a private property owner; there was no reason to believe the general public could make better decisions. One participant succinctly stated that “The public isn’t half as smart about managing the property or forest as we are.” The emphasis on private property rights included concerns about creating a public registry of easement properties, public access, and citizen involvement in easement design. Concern was noted because “people may have different ideas on it, [people] that are interested in developing property.”

4 DISCUSSION

One of the more important details about conservation easements was that landowners voluntarily decided to put private property into protected status agreements. This decision not only entailed a lengthy and detailed process, but was irrevocable. A landowner’s choice to put 20 or 200 acres of their property into a perpetual non-development designation led to one question - why? Were the landowners seeking to ease their tax burden by placing acreage into some protected status? Or did the landowner feel some responsibility to their land and want to see it preserved long into the future? The answer appeared to lie somewhere in the middle.

For some landowners, there were practical, economic benefits to limiting the natural resource use or development of a property. There was the possibility of continuing their livelihoods through working farms or forests or gaining financial compensation for limiting activities on the land. However, there was also a sense of stewardship regarding the land or an appreciation for natural aesthetics, intact ecosystems and the visual beauty provided by wildlife species. Determining which factor was stronger in enticing any given landowner to place conservation easements on the property was difficult. Most landowners emphasized reasons relating to a land ethic or conservation values.

Landowners wanted their lands to remain natural for future generations, protect the working landscape, and remove the threat of development by future owners. While there remained "suspicion…toward efforts of private owners…to influence the future use and disposition of their holdings" (Mahoney 2004: 574), it was widely accepted that the preservation value of the land bestowed benefits on society as a whole. They felt a vested interest in not only protecting family legacies or preserving the hard work accomplished over the years, but also in knowing that the natural systems will remain into the future. Similarly, many landowners believed they had a better understanding of what their land needed – knowledge they had gained over years of work and observation. There was little insight another person could provide that would supersede their personal experiences on that land.

Although altruistic conservation values influenced many landowners, it was clear that economic gain also played strongly into their decisions. Some never considered conservation easements without compensation. This supported the idea that landowners were interested in protecting their property, but with "the condition that they [were] compensated, in full or in part, for foregoing lucrative [development] activities" (Mahoney 2004: 575). Generally speaking, landowners sought to conserve their land, but they also expected to receive "something in return, a little something" as acknowledgement for their good deed. Landowners not utilizing conservation easements described this as a principal factor in their decision-making process.

At the national level, the federal government's response to conservation easement tax violations initially sought to restrict easements to those specifically preserving the conservation values of the land. It also presented strict guidelines for public accountability that ran the risk of alienating conservation easement donation as a viable option for land protection. Through lengthy, internal measures, land trusts across the county, through the Land Trust Alliance, are working to address changes. These may include: land trust accreditation, conservation easement registries, and public accountability boards to ensure that easements meet "public interest" standards (Pidot 2005).

Landowners' responses to the easement violations were tempered– in fact, many landowners thought that minimal changes were needed at the national level. Instead, they felt that changes should be addressed locally or individually. Broad proposals that attempted to meet federal guidelines were not widely accepted by individual landowners, primarily because many changes were perceived as infringing on property rights. Most landowners guarded these rights closely, emphasizing that personal factors led to personal decisions to protect their property and the public had no valid position for involvement. They had no inclination to accommodate the general public's perception of protected property out of fear of mismanagement, abuse, and lack of education.

5 IMPLICATIONS

There are several lessons from this research for the land trust community. The most obvious is that conservation easements have become less of the purely aesthetic, conservation-based ideal than they were one-hundred years ago. They have shifted to represent the dual-purpose method of land protection that balances preservation values with economic opportunities. Landowners looked to conserve their land because they wanted to see it protected, but only some did so without expectations of compensation.

The recent extension of tax benefits appears to recognize this need. The Food, Conservation and Energy Act of 2008 extended the tax provisions through 2009, but did make them permanent. (The previous tax benefit provision expired at the end of 2007.) The brief extension of tax benefits may provide a further incentive for many landowners to commit to or investigate conservation easements. Future proposals that extend or make permanent these tax deductions could affect the quantity and quality of easements created. However, the extension of tax benefits for a relatively brief period of time is also a potential source of concern. As more landowners become interested in conservation easements and tax deadlines approach, land trust staff may find themselves increasingly pressured to cut corners in the lengthy easement process to meet the deadline. This could leave room for error or worse, blatant violations that lead full-circle to increased public scrutiny. These violations, in turn, could also bring further scrutiny from the Internal Revenue Service, especially with landowners looking for that increased tax compensation. Intense governmental scrutiny of private land donations may stop many landowners from placing easements on their property. From this study, it is apparent that some type of financial compensation is necessary to entice future donations of conservation easements. How much of a private benefit, though, depends on the regulation and uniformity of easement monitoring.

The landowners we interviewed placed a high importance on their private property rights. They willingly donated partial interest in their lands to a holding organization, yet they strongly emphasized that the property, protected for the public benefit though it may be, was still private and therefore, not subject to public scrutiny. Increased scrutiny from the IRS, local officials, or even neighbors could have an effect on private landowners' use of conservation easements as a land conservation tool. Additionally, they thought that most violations should be handled by the holder organizations or local authorities, rather than imposing national standards across the board. To increase local responsibility and authority, conservation easement language should be more uniform. By maintaining standard language, holding organizations can better enforce and defend easements in the face of violations. Uniform language also helps to set a precedent in legal situations and better account for public benefit of the donation.

Although the landowners in this study generally had a low regard for public accountability on a large scale, the national perception of conservation easements depends on more transparent operations. In the wake of congressional scrutiny and successive IRS audits of easement properties, the public benefit aspect of easements needs an improved method for certifying easements. One option would be to include county or state oversight in the negotiation phase between landowners and holders. This public entity, as part of the process, would certify that any specific easement met the public benefit criteria necessary for the tax benefits. Landowners who opt to certify would be eligible for the benefit; those that opt against public involvement could still grant an easement, but would be ineligible for the tax benefits. This necessary step, in turn, would also serve as verification that property appraisals are accurate and less prone to inflated values.

It is likely that some changes, especially those that weigh public benefit over private, will discourage some landowners from granting conservation easements. Continued research, at the national, regional and local levels is needed to track how these policies influence conservation easement donation. The recent surge in private land protection is promising. The events of the last several years could continue to play a major role in land conservation policy, provided that policymakers look to both the landowners making these decisions and the public that benefit from them.

This study represents only a portion of the entire population that has donated or sold conservation easements. Responses may vary across regions or ecological boundaries. The most important issue to consider anywhere in the United State is what the landowners themselves will allow for “new and improved” conservation easement policy. Failure to account for their personal boundaries and their participation could prove detrimental to the land trust and conservation easement movement. The land trust community and government entities that employ conservation easements to protect land need to be prepared to change enough to satisfy professional standards but not so much that they scare away the very clients they seek to attract – the private landowners.

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The sustainability imperative

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Abstract

Not since the Industrial Revolution in the 18th and 19th centuries has such a profound transformation with worldwide impact emerged onto the world stage. Like its industrial counterpart, the Sustainability Revolution is creating a pervasive and permanent shift in consciousness and worldview affecting all facets of society.

This paper provides a historical framework for understanding the revolutionary scope, outlines its major characteristics, and the key movements within the revolution. It also discusses the Sustainability Imperative for extensionists.

We're in the midst of a Sustainability Revolution. Not since the Industrial Revolution in the 18th and 19th centuries has such a profound transformation with worldwide impact emerged onto the world stage. Like its industrial counterpart, the Sustainability Revolution is creating a pervasive and permanent shift in consciousness and worldview affecting all facets of society.

The Sustainability Revolution, dating back to the 1972 UN Conference on the Human Environment, gained prominence in the 1987 Brundtland Report. This report created a structure to protect the Earth's ecosystems while taking into consideration economic and social justice concerns. Two key science-based analyses reinforce the Brundtland findings and are currently fueling the Imperative. The first is the Millennium Ecosystem Assessment from 2005 which states that two-thirds of ecosystems and their services are degraded or being used unsustainably. The second is the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC 2007) which states unequivocally the Earth is warming, and humans play a significant role in climate change.

This revolution has five key characteristics. First, it's large and diverse, international in scope, in all sectors of society, including government, industry, the private sector, education, churches, and the arts. Paul Hawken estimates 30,000 sustainability groups in the US, and 10's of thousands worldwide. Social researcher Paul Ray estimates 50 million sustainability advocates in the US, and 80-90 million in the European Union.

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There's remarkable similarities in overall intentions and objectives. Sustainability is often confused with only ecological concerns, but sustainability values represent a much broader context of issues that literally have spread underground in all sectors of society throughout the world.

It covers a wide range of issues: conservation, globalization, socially responsible investing, corporate reform, ecoliteracy, climate change, human rights, population growth, health, biodiversity, labor rights, social and environmental justice, CSA's, local currency, conflict resolution, women's rights, public policy, trade and organic farming – and on and on.

In this revolution, groups take both oppositional and alternative stances. This means some groups oppose globalization, biotechnology and habitat destruction. Other groups such as Extension, offer alternatives to the status quo – voluntary simplicity, supporting local economies, and community-building are examples.

And most important for extensionists, its leadership is decentralized. Who's in charge? Leadership is made up of hundreds of thousands of citizens and community leaders from around the world.

Its decentralized character is one prime reason that extension professionals have been slow to recognize it. What can extensionists do to engage in this revolutionary, science-based, systems thinking, full world vision paradigm shift? The Sustainability Imperative contains six essential steps: First, focus on one problem and one solution. Ecologically speaking, there is definite agreement among scientists that of all the challenges facing our global civilization, stabilizing population and temperature are pivotal to making progress on all other fronts.

Second, we must use our existing already-in-place distribution system. Third, Extension educational programs must holistically address the total energy, water and carbon footprints of the lifestyle choices of our stakeholders.

Fourth, we must be a model for others to emulate. Extensionists have to walk our talk. We must shrink our own ecological footprint, and visually demonstrate the knowledge and practices we are teaching. Fifth, we must help communities rethink municipal systems that constrain our options for living sustainably. Public transportation, conservation subdivisions, growth management, and revitalization of urban areas all support more sustainable lifestyles for people. We must help citizens and community leaders understand and evaluate their potential for change.

And finally, we must return to the essential land-grant institutional values – quality education at a fair price, taking university education beyond the brick walls; inculcating

thriftiness and frugality values, encouraging good stewardship of the land, and living a conservation ethic.

Our clientele – both traditional and new to us – are hungry for a revolutionary, science-based, systems thinking, paradigm shift. It is imperative we help them make that a reality.

Key words: sustainability, historical view
FDC: 611:902=111

Whether Wisconsin or Warsaw, it's all about relationships: the role of family forest owner social networks in forestry education

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Abstract

Europe and the United States are experiencing similar trends in family forest ownership – more smallholdings, increased fragmentation, more absentee urban owners, and aging owners. These trends increase the challenge of providing information and educational programming to family forest owners. Cooperation among family forest owners can be an effective means for addressing this challenge. But many owners, even where organized forestry cooperatives are well established, do not join cooperatives. In the United States, there has been considerable recent interest in meeting private forest owner outreach and education needs through existing social networks. Yet, little is known about private forest landowner social networks.

This research examines the basis and structure social networks used in forestry related information seeking by selected family forest owners in Wisconsin, USA. Data were derived from semi-structured interviews with thirty-one Wisconsin family forest owners. Qualitative analysis and social network analysis were used to identify the social basis for, and structure of, forest owners' information networks. We discuss key results and their implications for the role of social networks in providing information and education, as well as in market access, and addressing landscape scale management.

Key words: private forest owner, social network, landowner association, forestry education
FDC: 682:944=111

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A qualitative decision-support system for evaluating forest models

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Abstract

Forestry decision making is a complex process and an important issue in forestry. Foresters have to decide upon different questions and choose among a set of available options. This means that they have to take into account a variety of economical, environmental and social criteria, at the same time. Decision Support System (DSS) is computer-based tools which can assist foresters to simulate, evaluate, and/or optimize management alternatives. In this study, we describe a methodology for qualitative decision making. Based on this methodology, we build a Decision Support System for multi-criterion evaluation of computer models for estimating the vegetation height and canopy cover from remotely sensed data. We use DEXi, a computer program for development of qualitative multi-attribute decision models and evaluation of options. Our decision support system evaluates forest models and assists in the decision making process. Forest models are produced by computer programs and are widely used in forest modeling. We consider forest models for the vegetation height and canopy cover from remote sensing data. Each model represents a combination of the different satellite (SPOT, IRS and Landsat) data, sampling strategy, model quality and usability. Having in mind the factors (indicators) that influence the decision making process, we make an effort to organize them in a hierarchical tree structure. At the top of the hierarchy is the root attribute Selection of the optimal forest model. The structure of the system is stable while the influence of particular factors may vary. Because the system can be used for different purposes and for achievement of diverse goals, we decided to demonstrate its use in several cases. We demonstrate three possible scenarios of use of the system by changing the weights in the evaluation process.

Key words: decision-support system, forest models. evaluation
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1 INTRODUCTION

Forestry decision making is a complex process and an important issue in forestry. Foresters have to decide upon different questions and choose among a set of available options. This means that they have to consider a broad range of ecosystem attributes at various spatial and temporal scales and take into account a variety of environmental, economical, regulatory and social criteria, at the same time. For example, decision making in forest management planning with multiple criteria and functions, and often with multiple stakeholders with conflicting interests call for more flexible and versatile decision support than can be gained using ‘‘traditional’’ simulation and optimization tools alone (Editorial, 2005).

Decision Support System (DSS) is computer-based tool which can assist foresters to simulate, evaluate, and/or optimize alternatives in order to solve specific problems (http://ncseonline.org/NCSSF/).

Numerous decision support methods have been developed widely used in today’s forestry. Each method has its own special characteristics, and different techniques are suitable for application in different types of decision situations (Editorial, 2005). For example, some methods have been especially developed to manage risks and uncertainty (e.g. Pukkala et al, 1996), non-linearity of evaluations or predict and evaluate different factors like parameter impact, cost and efficiency (e.g., Huth et al, 2005). Others are intended to applications in conflict management tasks or for making use of incomplete or low-quality information or in complex forest management planning (e.g., Kangas and Kangas, 2005).

In this study, we describe a methodology for qualitative decision making. Based on this methodology, we build a decision support system (DSS) for multi-criterion evaluation of computer models for estimating the vegetation height (H) and canopy cover (CC) from remotely sensed (RS) data. The DSS should evaluate computer models and assist in the decision making process.

The purpose of the DSS is to answer the following questions:

- Which computer models are best with respect to various priorities and different usage scenarios?
- Is there an optimum model that performs well under a wide range of different priorities? Which models represent a good compromise?

The paper is structured as follows. The next section describes the data (computer models that we want to evaluate) and emphasize the need for this DSS. Section 3 presents the methodology for qualitative decision making and the structure of the DSS with a brief description of its components, while Section 4 shows an empirical application of the use of the system. Finally, selected usage scenarios are presented and some conclusions are drawn.

2 METHODS AND MATERIAL

2.1 DATA

Forest models represent computer models of the vegetation height (H) and canopy cover (CC) obtained from remote sensing data by using machine learning techniques, over a study area in Slovenia. They were generated in our pervious study (Stojanova, 2009) by applying a set of available machine learning techniques on a combination of LiDAR (Light Detection And Ranging) and different satellite (SPOT, IRS and Landsat) and aerophoto data. In this way, 46 different models were generated. The models differ regarding the following features: combination of LiDAR and other RS data, level of image segmentation levels and sampling strategies.

We use the following notation for the models: RSsource_ApproachX, where *RSsource* is the name of the satellite or aerial photographs, *Approach* denotes the sampling technique used or if the entire test area is used and *X* denotes the number of the dataset when sampling technique is used. An example of this notation for the models is *SPOT_plot4*, which means that this is computer model that was created from an integration of LiDAR and SPOT data using plot sampling techniques having plots with size of 400 m and distance between the plots of 2000 m.

2.2 DECISION PROBLEM

The decision problem concerned in this study is to objectively evaluate the performance of forest models and select the best model with respect to various priorities and different usage scenarios

The evaluation process is complex and requires several factors to be evaluated for each forest model at the same time. The factors that need to be concern have diverse nature and are measures on different scales; hence we cannot combine them in a simple manner. Therefore, we use a DSS that connects all influence factors in a hierarchical structure. The methodology and the structure of the DSS are described in the next section.

3 METHODOLOGY AND DECISION SUPPORT SYSTEM

Methodologically, we have taken the approach of model-based decision support (Bohanec, 2003). The model-building process is supported by the software tool DEXi (http://www-ai.ijs.si/MarkoBohanec/DEXi/), which is particularly suitable for a hierarchical decomposition of evaluation problems that require judgment and qualitative reasoning. DEXi facilitates the development of attribute trees, definition of decision rules, evaluation and analysis of options, and graphical output.

A DEXi model is characterized by the following:

- Each model consists of a number of hierarchically structured variables called attributes. Input attributes are terminal nodes of the hierarchy. All the attributes in the model are qualitative.
- Attributes are aggregated through several levels of aggregate attributes into the overall assessment, which is represented by the root attribute of the hierarchy. The aggregation of values in the model is defined by decision rules.

The model is gradually hand-crafted through four steps: (1) identifying attributes, (2) structuring attributes, (3) defining attribute scales, and (4) defining decision rules (Bohanec, 2003). If necessary, these steps can be iterated.

3.1 IDENTIFYING ATTRIBUTES

Clarifying the role of the input factors was the first step towards the definition of the new DSS. We have identified 12 important characteristics that are included in the decision making process (Price of LiDAR, Satellite and aero photo data; Comprehensive Resolution; ML techniques applied; Visual quality of the produced maps and Time consuming).

Having in mind the multi-attribute nature of our evaluation problem, the next step was building a multi-attribute system organized hierarchically into a tree of attributes.

3.2 STRUCTURING ATTRIBUTES

Having in mind the factors that influence the decision making process we make an effort to organize them in a hierarchical tree structure.

Attribute	Scale
Select optimal model	Unsatisfactory; Satisfactory; Good; *Very Good*
├**Price of data**	low; *high*
│ ├Price of Lidar	low; middle; *high*
│ └Price of Satellite and aerophoto data	low; *high*
├**Model quality**	low; *high*
│ ├Comprehensive Resolution	low; *high*
│ └**Machine Learning**	low; *high*
│ ├RMSE_H	low; middle; *high*
│ ├RMSE_CC	low; middle; *high*
│ ├Corelation of H	low; *high*
│ └Corelation of CC	low; *high*
└**Usability**	no; *yes*
├Visual quality of the produced maps for H	low; *high*
├Visual quality of the produced maps for CC	low; *high*
└**Time consuming**	low; *high*
├Time of pre-processing	low; *high*
├Time for building the model	low; *high*
└Time for visualization of the model	low; *high*

Fig.1: The structure and scales of the evaluation model

At the top of the hierarchy is the root attribute Selection of the optimal model. It is decomposed into three descendants: Price of data, Model quality and Usability. Price of data indicates the cost of the model and aggregates Price of LiDAR and Price of Satellite and aero photo data. Model quality reflects the quality of model demonstrated through the use of two indicators Comprehensive Resolution (resolution of the derived maps) and Machine Leaning (ML techniques applied), while Usability basically incorporates non objective indicators as Visual quality of the produced maps for H and CC along with Time consuming and reflects the user point of view. At the bottom level we have 12 independent input attributes. The tree structure is presented in Fig.1.

3.3 DEFINING ATTRIBUTE SCALES

We used several qualitative attributes with increasing scales for the representation of input values. The scales are shown in Fig. 1. The lowest value is considered “bad” and it is labeled as “Low” or “No” in the system. The values of the scales increase and the most preferred values are labeled as “Very high” or “Yes”. The lowest value, out of five possible, for the target (root) attribute *Select optimal model* is labeled as “Unsatisfactory” and the most preferred as “Excellent”.

The input values of the basic attributes of the evaluated models were obtained indirectly by applying discretization over the continuous space across which all basic attributes were initially defined.

3.4 DEFINING DECISION RULES

The decision rules are defined by specifying the relative importance (weight) of the contributing attributes. Each attribute has a local weight i.e. the attribute weight in relation to the aggregate attribute above it and a global weight i.e. the global weight of the attribute in the model. With normalization of both mentioned weights, the local norm and global norm weights are achieved. The attribute weights of the DEXi model are represented in Fig. 2.

Attribute	Local	Global	Loc.norm.	Glob.norm.
Select optimal model				
Price of data	25	25	25	25
Price of Lidar	60	15	69	17
Price of Satellite and aerophoto data	40	10	31	8
Model quality	25	25	25	25
Comprehensive Resolution	50	13	50	13
Machine Learning	50	13	50	13
RMSE_H	43	5	45	6
RMSE_CC	43	5	45	6
Corelation of H	7	1	5	1
Corelation of CC	7	1	5	1
Usability	50	50	50	50
Visual quality of the produced maps for H	60	30	60	30
Visual quality of the produced maps for CC	20	10	20	10
Time consuming	20	10	20	10
Time of pre-processing	100	10	100	10
Time for building the model	0	0	0	0
Time for visualization of the model	0	0	0	0

Fig.2: The local and global attribute weights of the model

4 RESULTS AND DISCUSSION

In order to illustrate the possible practical use of the developed model-based decision support system, we present three different scenarios of use of the decision support system. The scenarios are obtained by setting the importance of each attribute in the model. The output from the evaluation process, for each scenario, is resented in Fig3.

In the first scenario, the goal is to evaluate forest models according to their price and select the model with the best price. The attributes that reflect the price of the data in the model have higher influence related to others. This is achieved by setting a higher weight for these attributes. The global normalized weight of the aggregate attribute *Price of data* is 50%.

The second scenario evaluates the forest models according to the quality of the model putting a higher weight on the attributes that reflect the model quality. The global weight of the attributes in the model that reflect the model quality is 50%.

Finally, the third scenario evaluates the models with respect to their practical use and sets a global normalization weight of 50% of the aggregate attribute *Usability*.

By the first scenario, the biggest number of forest models is evaluated as *Unsatisfactory*. This means that more than the half of the built models can not be accepted because they are too expensive i.e. they have high price of data. In addition, this scenario evaluates 3 models as *Excellent* (SPOT_plot4, SPOT_strip1 and SPOT_strip2), 12 models as *Very Good* and 4 models as *Satisfactory.* The output of the DEXi evaluation process by the price scenario is presented in Fig 3a.

The second scenario evaluates the forest models with respect to the models quality. The results show that the biggest number of models have acceptable accuracy of the estimates, thus they are evaluates as *Satisfactory*. There are 3 models evaluated as *Excellent* (SPOT_plot4, SPOT_strip1 and SPOT_strip2) and *Unsatisfactory* and only 2 models evaluated as *Very Good*. The models selected as *Excellent* are the same as the ones selected as optimal from the previous scenario. The DEXi output chart from the performed evaluations by this scenario is presented in Fig 3b.

The third scenario evaluates the forest models with respect to the usabilty of the model. It results in a broader set of models (a total of 9 models) evaluated as *Excellent*, including the models evaluated as optimal from the previous two scenarios. As presented in Fig 3c, there are 7 models evaluated as *Very Good* and *Good* and only 4 models evaluated as *Satisfactory*. The biggest number of models as evaluated as *Unsatisfactory*.

We can conclude that the models: SPOT_plot4, SPOT_strip1 and SPOT_strip2 are optimal for the 3 different scenarios we used in this study. These models have been created from an integration of LiDAR and SPOT data, by using plot samples with size of 400 m and distance in between of 2000 m and strip samples with size of 200 and 400 m and distance between the plots of 1000 m (consider the notation for the models given in Section 2.1).

The results from the analysis demonstrate that the applied methodological approach and built DEXi models can answer the decision problem defined at the beginning of this paper. In addition, they provide a more general investigation approach of the process of estimation of forest properties which is of the most important challenges in forest decision making and management.

5 CONCLUSIONS

In this study, we developed a model-based decision support methodology for qualitative decision making in forestry. Based on this methodology, we built a Decision Support System i.e. a system for evaluation of computer models for estimating the vegetation height and canopy cover from remotely sensed data. Each model represents a combination of the different satellite (SPOT, IRS and Landsat) data, sampling strategy, model quality and usability. Having in mind the factors (indicators) that influence the decision making process, we make an effort to organize them in a hierarchical tree structure.

We use DEXi, a computer program for development of qualitative multi-attribute decision models and evaluation of options. Typically, DEXi models are developed in collaboration between decision analysts and experts in the given field where experts suggest attributes and decision rules, while decision analysts conduct the process and define components of the model.

The system supports the decision maker in the making of the right objective decision and selecting of the optimal model. The models output can be easily changed an adopted by specific end-user needs but the structure of the decision models can stay the same. The 4 steps of building the model-based decision system are essential for the decision making process.

The structure of the system is stable while the influence of particular factors may vary. This assures that the same parameters are taken into account in the decision process but with certain adaptations. Because the system can be used for different purposes and for achievement of diverse goals, we decided to demonstrate its use in several cases.

We demonstrate three possible scenarios of use of the system by changing the weights in the evaluation process. The models SPOT_plot4, SPOT_strip1 and SPOT_strip2 were evaluated as optimal for the 3 different scenarios used in this study. These models have been created from an integration of LiDAR and SPOT data, by using plot samples with size of 400 m and distance in between of 2000 m and strip samples with size of 200 and 400 m and distance between the plots of 1000 m (consider the notation for the models given in Section 2.1).

Multiple criteria decision support methods cannot replace or do away with the traditional forest planning tools. Instead, they complement each other. Numeric simulation and optimization especially contribute to the examination of future production possibilities and to the generation of alternative forest plans, although they may fail to satisfactorily cover whole complex decision problems of multiple-purpose forestry (Editorial, 2005). Simulation and optimization results can then be used together with other information sources, such as geographic information system (GIS) analyses, expert judgments, subjective preferences and descriptive data, in a multiple criteria decision support framework.

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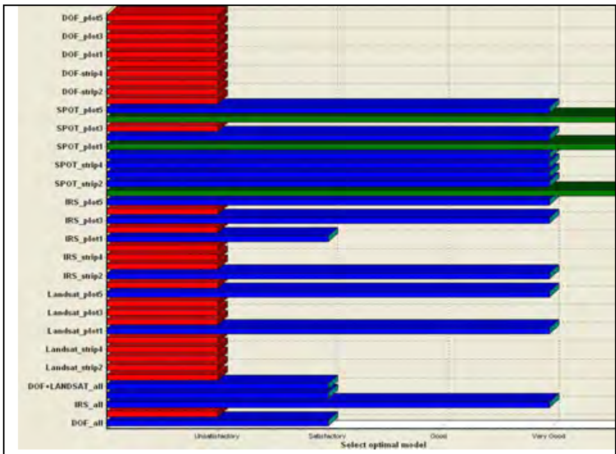
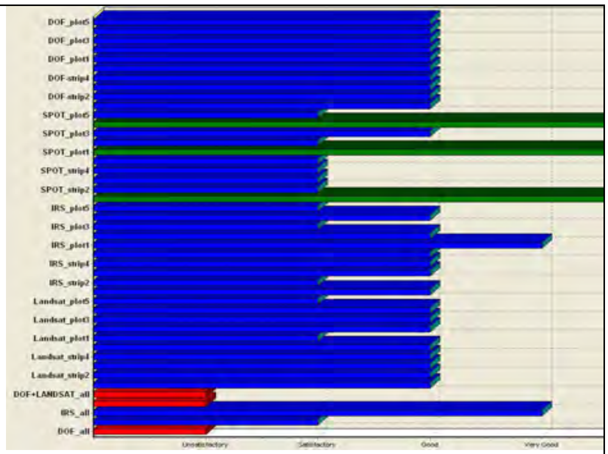
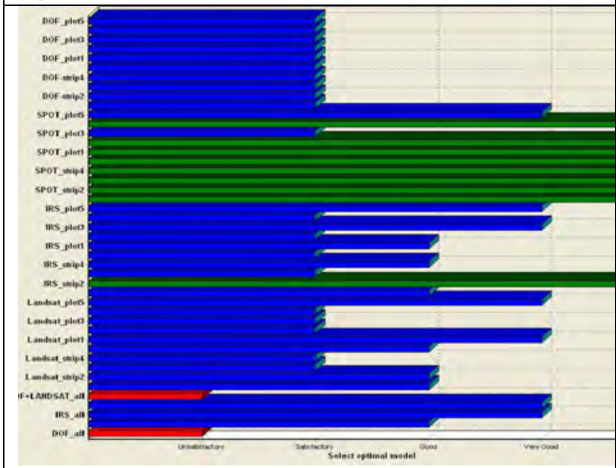
	
a.) Price scenario	b.) Model quality scenario
	
c.) Usability scenario	

Fig.3: DEXi output charts from performed evaluations with different scenarios

a.) Price scenario b.) Model quality scenario c.) Usability scenario.

Role of Slovak small -scale forestry in wood business and carbon storage

Roman Svitok[1], Jozef Tutka[2]

Abstract

Wood markets in Slovakia from the viewpoint of Small-scale Forestry are evaluated as well as analysis of wood removals since 1995. Sawn wood, wood based panels, wood pulp, paper and paperboard analysis since 1993, from the viewpoint of production, consumption, imports and exports. Three periods of wood markets are identified: transition 1990 -1999, growth 2000 – 2007 and crisis since 2008.

A forecast and vision of wood removals is made for the year 2020.

Wood removals and wood consumption are transformed into changes in carbon storage in forests as well for four basic wood products – houses, furniture, paper and other wood products on the base of their components like sawn wood, plywood, particleboard, fiberboard, paper.

Carbon storage in forests and wood products is evaluated since 1980. Overview of the changes in home carbon storage in wood and wood products on the base of wood and wood products production, imports and exports.

Key words: small -scale forestry, wood business, carbon storage, Slovakia
FDC: 161.14+682(437.6)=111

1 INTRODUCTION

Wood production and wood processing experienced significant changes since the beginning of 90's. Wood producing and wood processing industry during economy transformation went two different ways. Wood processing industry was privatized and - forestry was reprivatized, in other word return of forest ownership to the original owners according to ownership before 1948. Overall 46% of forest area remains in the state ownership. Wood processing industry has been fully privatized. State forestry sector had to find a new production structure. Private sector of wood processing industry and

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forestry found new structure, started to build its new capacity and to seek new customer's relations. Customer's relation stabilization lasted until 2000, and since then we can see a significant growth of the wood industry, its wood consumption from domestic sources as well as higher production and consumption of wood industry products in the domestic market.

This positive development was interrupted by the international economic crisis at the end of 2008, with continual impact until now days.

Wood consumption in houses, furniture and paper is favorably reflected in the carbon storage that does not pollute the air.

2 MATERIAL AND METHODOLOGY

Statistical data on wood production, wood imports and wood exports from green reports of Slovakia, data FAO UNECE, EUROSTAT, Statistical Office as well as data from record of Ministry of agriculture and ministry of economy were used. Data are collected for the period of 1993-2008.

Carbon volume assessment is based on the expected consumption of materials such as sawn wood, veneers, plywood, particleboards, fiberboards and others in separate categories of consumption in Slovakia in 1980-2008.

Consumption was estimated from data of EUROSTAT and FAO/UNECE as a sum of production and variance of imports and exports. Volume (m^3) calculation in to weight units (metric tones) we made by use of conversion factors of EUROSTAT and UNECE. Humidity was determined as an average value for individual components. Storage period (products durability) is an expert's estimation of professionals from various areas of wood industry. This way the data for the period of Slovak Republic existence, e.g. 1993-2008 were estimated. For the period of 1980-1992, only cumulative data for Czechoslovakia were available. Particular products production was estimated by modeling of wood removals and production of separate branches wood industry.

3 WOOD PRODUCTION

Until 1999 roundwood production was at the level of 5.3-5.6 million m^3 per year. Since 2000, roundwood production reaches the level of 6-7 million m^3 per year. Increased production in 2005 and 2006 was caused by the windstorm in High and Low Tatra in November 2004. Coniferous and non-coniferous wood proportion remains balanced except years 2005 and 2006 due to windbreak calamity in coniferous forests.

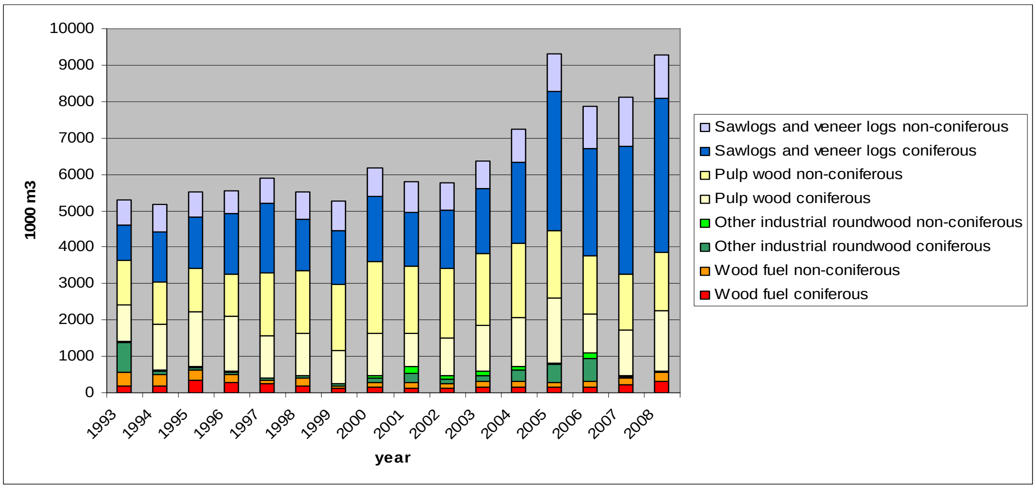
Saw logs production has a constantly growing trend in coniferous and non-coniferous. Non- coniferous saw logs share increases significantly in four years 2005-2008 and is the best since 1990.

Since 1995 pulp wood production steadily ranges from 2 700-3 200 thousands m^3 except wood from calamity in 2005-2006.

Fuel wood production share remains at relatively very low level. It is a result of the ability of the domestic wood processing industry to use wood for products as well as wood export market where industrial wood is more expensive than fuel wood. Consumption of the fuel wood gradually dropped from the beginning of 90's until the end of 20th century, as a result of higher use of gas as relatively more comfortable energy source for households. Resulting from cancelled subsidies for heat energy and gas, people started to use more wood as a source of energy. Since the prices of the fuel wood had also increased, people started to use more wood residues for heating.

However at the time of the crisis the situation is shifting more in favor of higher consumption of wood for energy in the industry and in households.

Slovak veneer logs production continuously drops down due to the destruction of wood working capacity for veneer production. Veneer logs production, as the most valuable wood assortment, is undersized considering wood quality in Slovak forests.

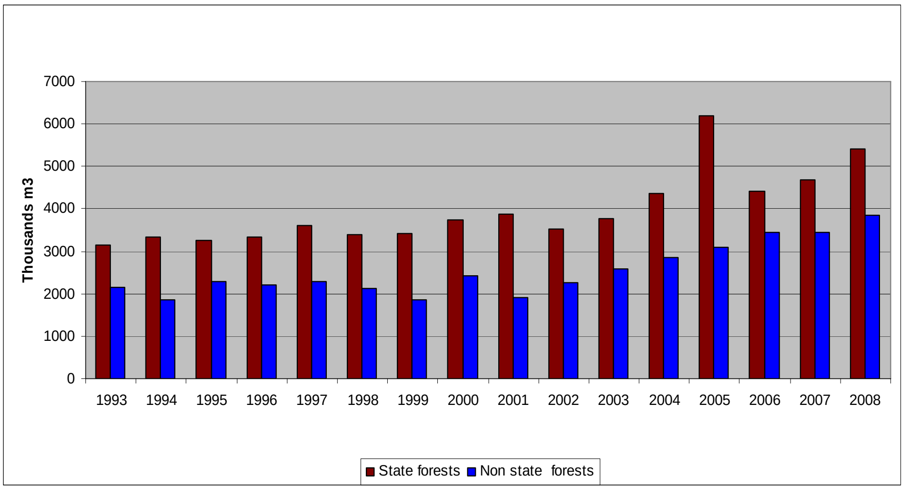


Picture 1: Wood removals in Slovakia (Source: Data of Ministry of Economy, EUROSTAT, Statistical Office of SR, Ministry of Agriculture, National Forest Centre Zvolen)

Other industrial roundwood production, after decrease at the end of the century, again reaches levels from beginning of 90's in the years 2003-2006. In the recent time other industrial roundwood production is decreasing.

4 SHARE OF PRIVATE FOREST OWNERS IN WOOD PRODUCTION.

Forest ownership of non-state forests owners represents 54% of the forest area. The transfer of forest ownership rights has not yet finished, mainly due to problems with ownership documentation caused by the decease of the original owners during the period of 40 years of the previous regime. Part of private forest owners rented their forest out to State Forests. Therefore State Forests manage approximately 56% of the total Slovak forests.



Picture 2: Wood removals by state and private forest owners (Source: Data Statistical Office of SR, Ministry of Agriculture, National Forest Centre Zvolen)

State Forests share 57-65% of total Slovak wood removals. Higher wood removals from State Forests during 2005-2006 was caused by the large windfall that occurred in the forest area owned by state forests enterprises.

5 ANALYSIS OF STATE FORESTS WOOD REMOVALS DURING CRISIS 2008-2009

In 2008 coniferous wood removals reached the level of 740 000 m^3, which was equally spread among all quarters. Average wood price continuously fell down from 52.28 €.m^{-3} in the first quarter of 2008, to 39.07 €.m^{-3} in the fourth quarter of 2008. Pulpwood supplies increased, while and the supply of saw and veneer logs decreased.

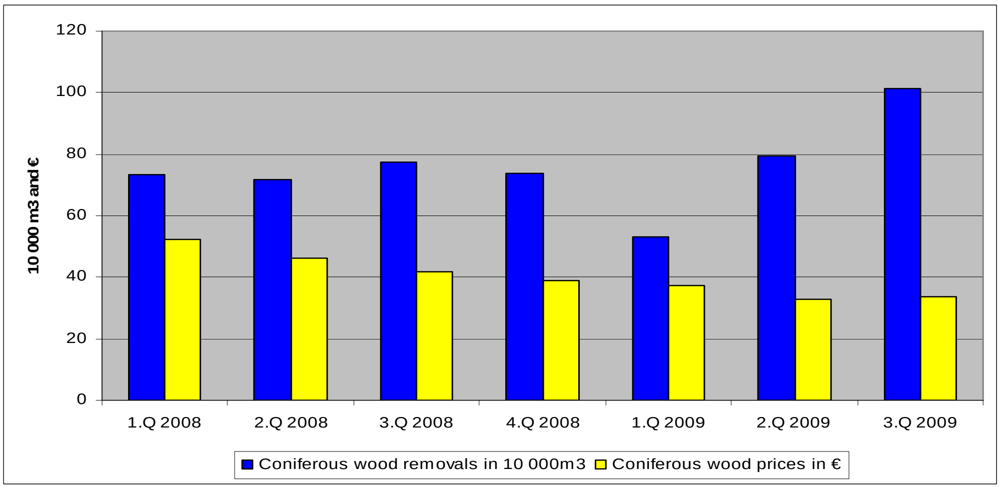
For saw logs, share of the highest quality assortments of saw logs – grade IIIA continuously dropped.

Massive shock in removals of coniferous roundwood started in the first quarter of 2009.

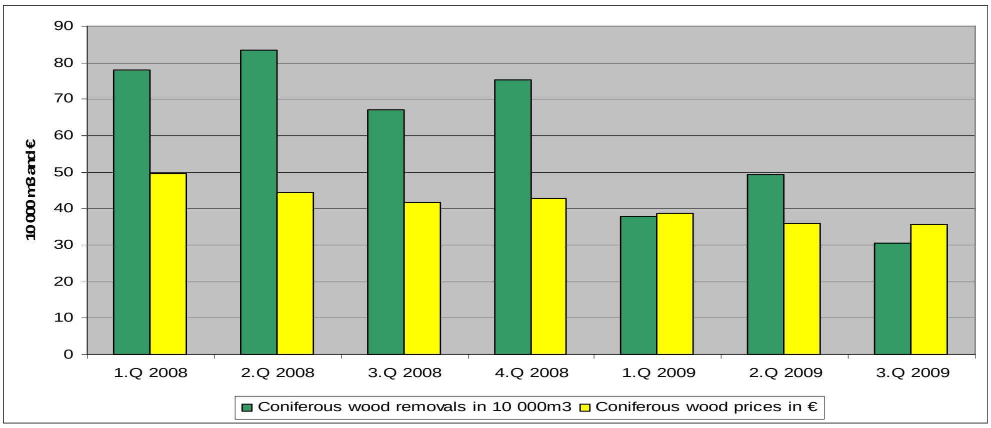
However, in the next two quarters coniferous wood removals started to increase above the average of 2008, while highest coniferous wood removals was in the third quarter of

2009 – over 1 million m^3. Wood prices per $1m^3$ constantly dropped to 33.85 €.m^{-3} with very similar trend of wood assortments structure removals as in 2008, e.g. decrease of veneer and saw logs and increase of pulpwood and stems.

Non-coniferous wood removals experienced similar situation as coniferous wood removals. Prices fell down from 49.62 €.m^{-3}, in the first quarter of 2008, to 35.83 €.m^{-3}, in the third quarter of 2009. Prices in the second and third quarter are very similar and decrease is only 6 cents in non-coniferous wood and 3 cents for coniferous wood. Non-coniferous pulpwood removals were very similar to the coniferous increase, but at non-coniferous was fairly unbalanced and too unstable. Removals of non-coniferous fuel wood and wood for energy were twice higher than in former years. Most important factor was the decrease of non-coniferous wood removals in 2009 to about a half of 2008 removals.



Picture 3: Coniferous wood removals in 10 000 m^3 and prices in € Lesy SR 2008-9 (Source: Quarterly reports on Wood supply in forestry. Les D (MP SR))

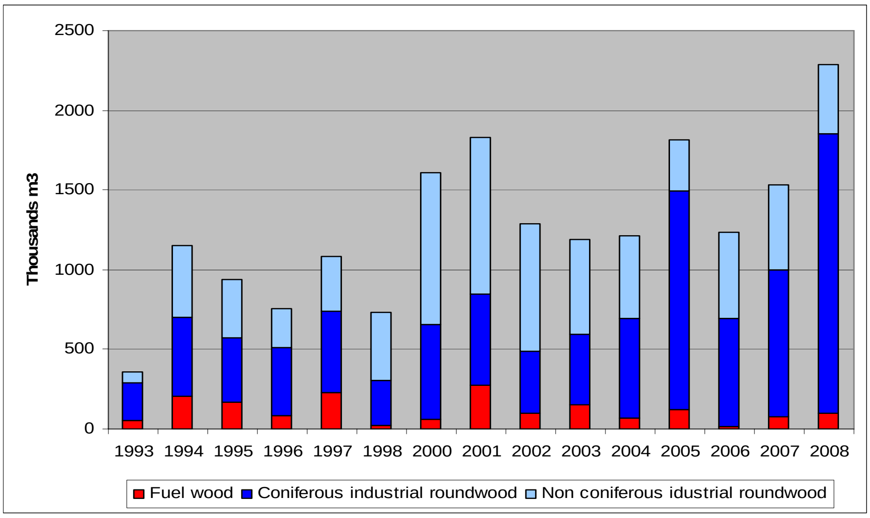


Picture 4: Non coniferous wood removals in 10 000 m^3 and prices in € Lesy SR 2008-9 (Source: Quarterly reports on Wood supply in forestry. Les D (MP SR))

6 WOOD IMPORT

Slovak roundwood and fuel wood import is very small, due to very high domestic production. During the woodworking recession time at the beginning of 90's, wood imports were minimal, and since 2000 the level reaches 140 thousands m^3.

Since 2002 in, resulting from the revival of the wood working industry, wood imports increased to the level of 350 thousands m^3 per year, except year 2005 due to influence of higher domestic removals caused by the large wind break. Mainly non-coniferous saw logs and pulpwood are imported.

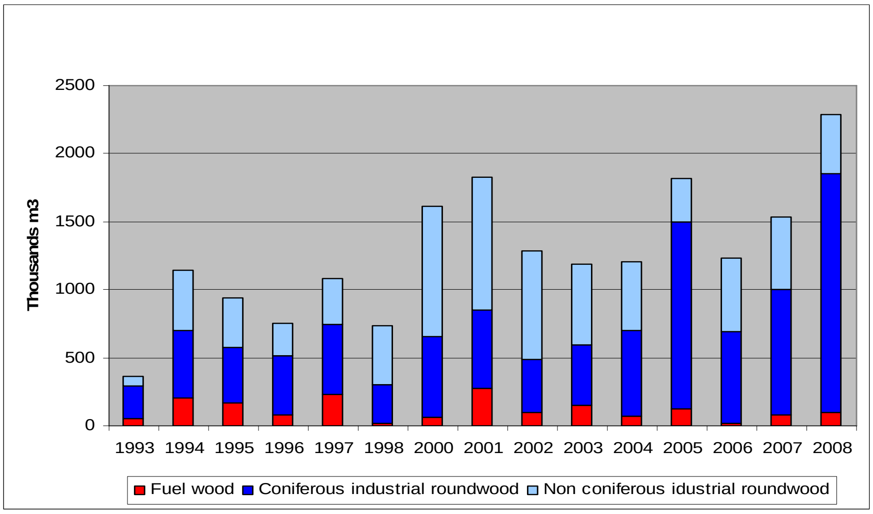


Picture 5: Wood imports (Source: Data Statistical Office of SR, Ministry of Agriculture, National Forest Centre Zvolen)

Wood residues, wood chips and particles, wood charcoal imports start after 1999 at very low level.

7 WOOD EXPORT

Round wood export, as sale of wood with the lowest added value, gradually increased since 1993 from 363 thousands m^3 to reach its maximums of 1 828 thousands m^3 in 2001 and 2 289 thousands m^3 in 2008. Since 1998, export of wood residues and wood chips is higher at level of 150 thousands m^3, with annually growing trend.



Picture 6: Wood exports (Source: Data Statistical Office of SR, Ministry of Agriculture, National Forest Centre Zvolen)

8 WOOD SUPPLY FORECAST TILL THE YEAR OF 2020

Wood supply was derived based on the outlook of its harvesting, decreased by the loss of manipulation, harvest residues and waste, which represents 3,5-5,5% from raw timber.

With regards to the development of wood supply, decreased supply of wood for domestic and foreign market is estimated for this and next year, even though the wood supply increased at the beginning of the economic crisis in 2008. World financial and economic crisis started to impact only in the third quarter of 2008 and therefore annual results for 2008 were still good. In 2009 however, the full impact of decreased wood supply, as well as a big price drop took place, although in last two quarters of 2009 we can see the increase of supply of coniferous wood timber as a partial effect of demand and supply.

In 2009 a significant shift in quality assortments classification occurred. Share of the most valuable assortments was decreasing – saw logs qualities class I and II. In the saw logs the quality class also shifted towards the worse grades. Production of saw logs of quality grade IIIA and partly IIIB decreased. Majority of the supply has shifted towards the quality grade of IIIC.

Due to its relatively good viability, the pulp and paper industry did not experience a significant drop in the pulpwood supply in 2009. Fuel wood supply experienced an increase, caused by the fact that the prices of pulpwood got near the prices of fuel wood, and as a reaction of the population to a lower disposable income in the time of the crisis people tried to eliminate the impact by lowering their expenses on heating

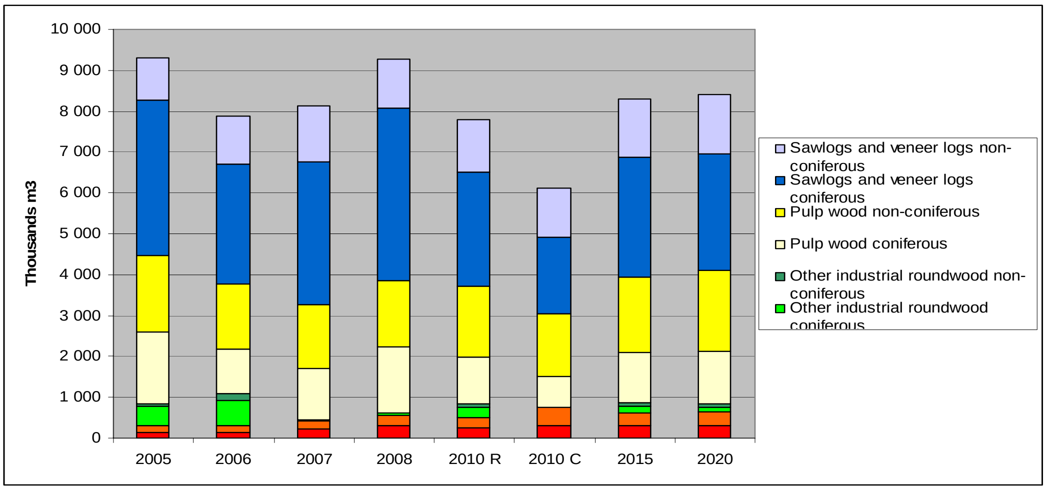
In 2010 a stabilization of wood supply is expected, due to the approximate one-year delay in the development tendencies of wood supply and it's processing, comparing to the USA and EU15. Turning point is expected in the middle of 2010, with increasing wood supply afterwards. With regards to the development of harvesting technologies by the 2020, a gradual decrease of share of harvesting residues and waste that remained unused is expected. Residues should become part of the production of chips as part of the fuel wood.

From the long term perspective, an increase of roundwood supply is expected, due to the development of harvesting potential and should reach almost 8 400 thousand m^3 in 2020. The difference is in the increase of soft and hard wood supply. While the supply of coniferous timber remain at level of around 4 400 thousand m^3 during the whole period, the increase of total timber supply will be caused by the increase of supply of non coniferous roundwood from approximately 3 300 thousand to 3 700 thousand m^3.

At the same time a change of structure of these wood assortments is expected, with gradual increase of the share of veneer assortments as well as the transfer of wood processing technologies in order to use thinner wood assortments for sawn wood. This is explained by the higher valuation of wood in final products, such as high quality furniture and by the increasing construction of houses and apartments in Slovakia after the year 2010, and by the higher frequency of furniture renewal.

Although its percentage share of the total supply will remain at the same levels during the whole period, pulp wood supply will be increasing in the absolute terms due to the overall supply increase. Increase will be caused by the hard pulpwood, to almost 2 000 thousand m^3 in the year 2020. It is also expected, that the utilization of this assortment in the wood processing industry will change. Utilization of pulp in pulp-paper industry is expected at the level of 2 200 – 2 400 thousand m^3 during the whole time period. The increase will be in the processing of this assortment for particleboards, which are an important element in the production of furniture and construction of wooden houses and wood-based constructions.

Production of the fuel wood from the raw timber is expected to gradually increase, while the fuel wood supply will increase only due to the total harvesting increase and its share on the total supply will slightly decrease. Fuel wood increase will be caused by the increase of the forest chips production from the residues of harvesting. Another significant part of the fuel wood supply will be the wood under 7cm diameter, which is processed for fuel wood chips.



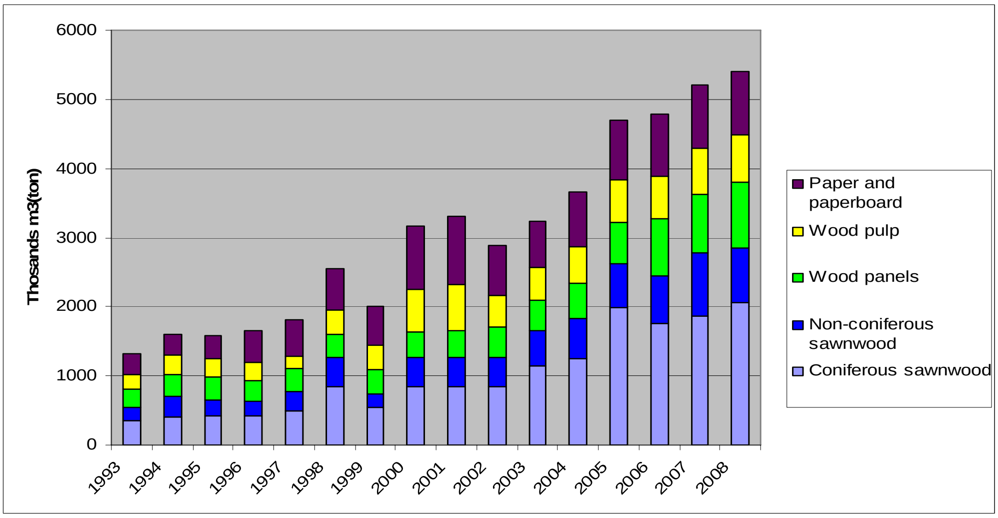
Picture.7: Perspective of wood removals till year 2020

9 WOOD PROCESSING INDUSTRY PRODUCTION

The production output of the wood processing industry, as a dominant customer of timber in Slovakia, is steadily increasing, with the exception of the fluctuations in the restructuring time in 90's. Stabilizing element in Slovakia is the pulp and paper industry, with the exception of slight decrease of production in 2002-2003, when the restructuring also impacted this industry. In the recent period the pulp and paper industry is reaching its former levels.

Sawn wood production (hard wood and soft wood) is steadily increasing. Its maximums were reached in the recent years and indicate a viability of this segment and the ability to positively react to the increased wood production caused by the large windfall.

Wood panels production has an increasing tendency that also can be viewed positively. Wood panels however do not have the proper structure in all commodities. Only a small irrelevant amount of the most expensive assortment (veneer) is produced, and similar situation is in the production of plywood. As for the particleboards, Slovakia practically does not produce OSB boards. Production of MDF boards, required by the market is only at its starting phase. Since the year 2000 its production volume is around 25 thousand m3, all segmented.

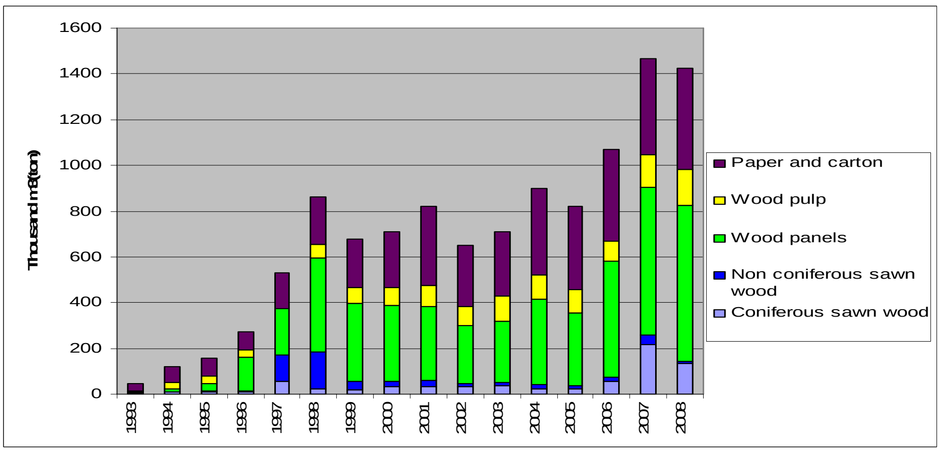


Picture 8: Wood processing industry output (Source: Statistical Bureau, UEROSTAT, National Forestry Institute NLC Zvolen)

Import of products of wood processing industry is adequate with regards to the production.

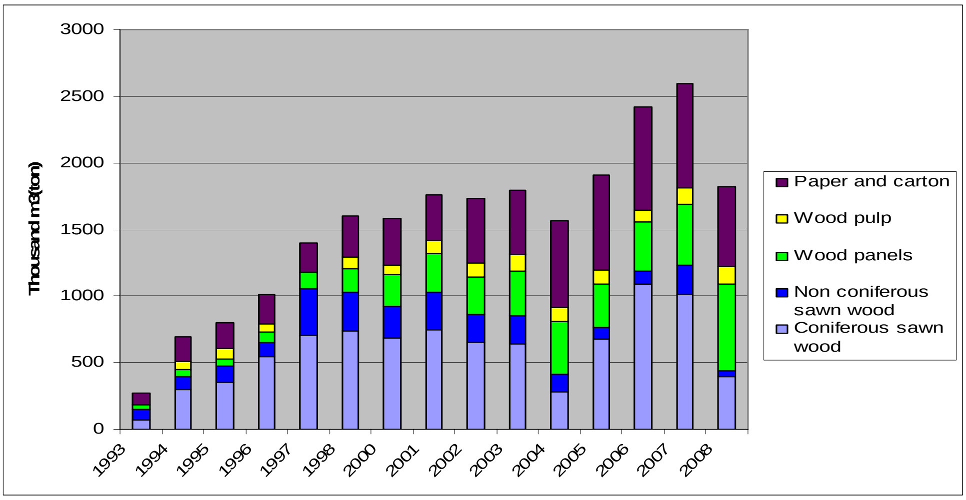
Import of sawed timber reaches more-less steady levels of around 50 thousand m^3 since the year 1999.

Import of wooden panels has a slight increasing tendency. Commodities that are not produced by the domestic market, or are produced in small scale (MDF, OSB, hard particle boards) are imported. In the area of paper and cardboard, mostly commodities that are not produced by the domestic industry (newspaper), or are used for further processing.



Picture 9: *Import of products of wood processing industry (Source: Statistical Bureau, UEROSTAT, National Forestry Institute NLC Zvolen)*

Export of products of wood processing industry has an increasing tendency. Export of sawn wood, as a product of wood processing industry with lowest added value reached its peak in 2001 and started to decrease afterwards. Increased export in years 2005-2007 is a result of a windfall in High Tatras. Export of panels more-less reflects the production of this commodity and has an increasing tendency. Export of pulp and paper industry increases for the products with highest added value, while the export of pulp remains at the stable level.



Picture 10: Export of products of wood processing industry (Source: Statistical Bureau, UEROSTAT, National Forestry Institute NLC Zvolen)

10 WOOD CONSUMPTION

The wood produced by the forestry is consumed directly by the population only to a limited extend – fuel wood, pole timber and small pole stage. The population consumes wood mainly indirectly by the products of wood processing industry (sawn wood, furniture, paper, cardboard), partly by the energy production industry (heat, electricity). Following factors impact the consumption of wood assortments:

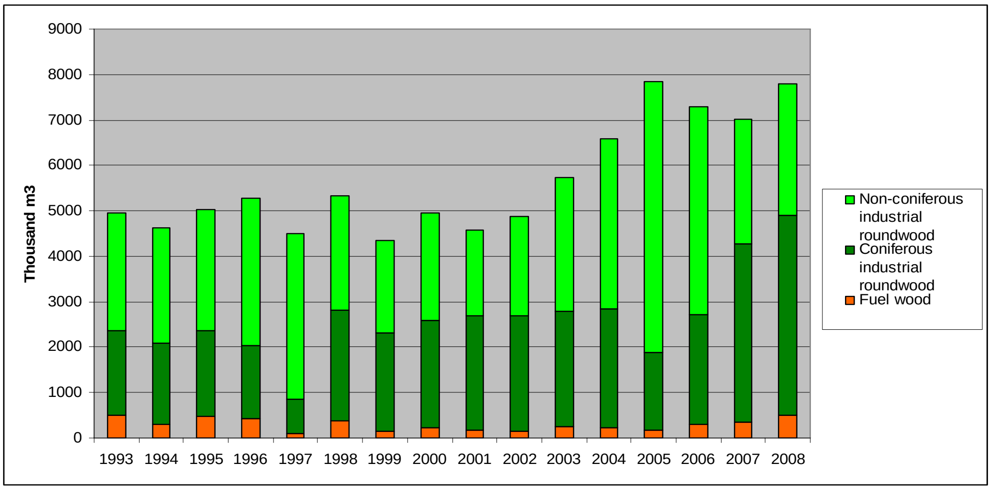
- Income of households;
- Size of households;
- Number and size of houses and apartments and the intensity of their renovation;
- Prices of energy sources;
- Movements on international wood markets;
- Speed of furniture innovation;
- Media used for recording, providing and storing of information

- Environmental requirements of the population

Wood consumption is best described by the potential of wood processing industry. Until year 2000 the restructuring of wood processing industry caused the unstableness of the consumption. At the beginning of year 2000 a restructuring of the pulp – paper industry occurred. Last 4 – 5 years we can see the stabilization of wood consumption in wood processing industry, however at new level, higher by 1 mil. m^3 comparing to the previous period.

Until year 2002 we can observe very unstable situation or even slight decrease of wood consumption. At the same time we can see a gradual increase of export of raw timber as a commodity with the lowest added value. This was caused by the restructuring of large wood processing plants and introduction of small and medium size businesses in wood processing industry. Stabilizing element was the pulp – paper industry, which was however also restructured at the end of 90's to increase the processing of pulp hardwood, which did not have any domestic demand. Simultaneously a negatively impacted also unemployment rate increase, reduction of the consumption basket of the population and decrease of construction of houses and apartment blocks.

Fuel wood consumption remains a separate issue. Consumption of this wood was gradually decreasing from the 90's until the end of the 20th century, due to the higher use of natural gas as relatively more comfortable energy source for households. Resulting from cancelled subsidies for heat energy and gas, people started to use more wood as a source of energy. Since the prices of the fuel wood had also increased, people started to use waste wood for heating.

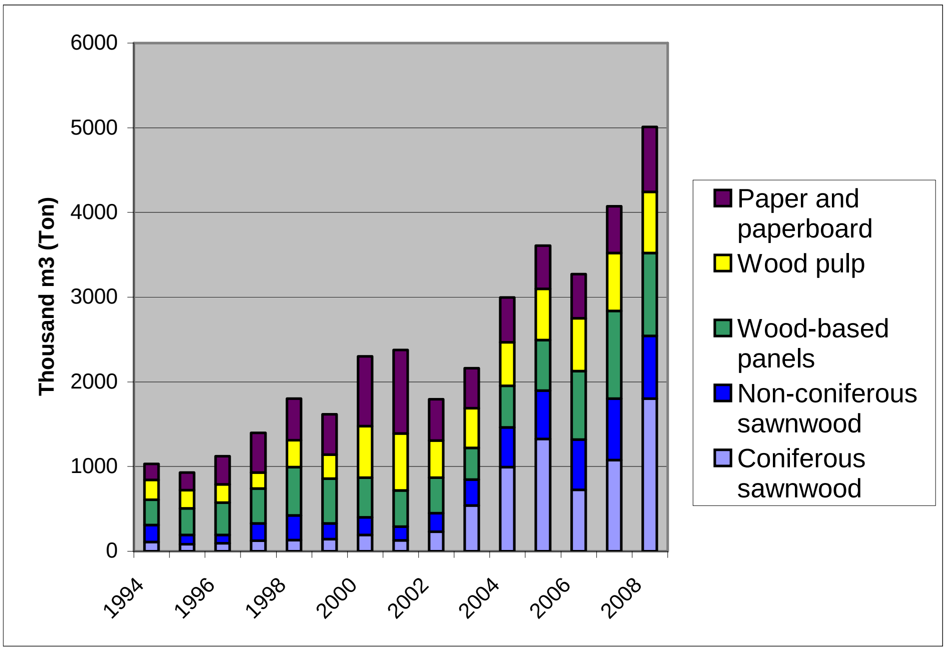


Picture 11: Wood consumption (Source: Quarterly reports on Wood supply in forestry.Les D (MP SR), Data from Ministry of Economy, Statistical Bureau, UEROSTAT, NLC (National Forestry Institute) Zvolen)

Table 1: Production and consumption of wood per capita (Source: Quarterly reports on Wood supply in forestry.Les D (MP SR, Data from Ministry of Economy, statistical Bureau, UEROSTAT, NLC (National Forestry Institute) Zvolen)

Wood assortment	**1990**	**2000**	**2005**	**2007**
	m^3 per capita			
Roundwood - production	0,865	1,082	1,729	1,506
Roundwood - consumption	0,837	0,805	1,403	1,298
Industrial roundwood – production	0,800	0,943	1,289	1,428
Industrial roundwood – consumption	0,771	0,751	1,370	1,232
Pulpwood - production	0,343	0,488	0,671	0,521
Pulpwood - consumption	0,310	0,360	0,546	0,432
Fuel wood-production	0,066	0,051	0,055	0,077
Fuel wood -consumption	0,066	0,040	0,033	0,065

With regards to the increase of the employment and income of the population, processing of produced raw material in the domestic environment and thereby increase of the added value of wood products is recommended. Materialization of the above objectives is confirmed by the data mentioned in the below table, from which a gradual increase of production and consumption of basic wood assortments in m^3 per capita can be seen.



Picture 12: Wood industry products consumption (Source: Data from Ministry of Economy, Statistical Bureau, UEROSTAT, National Forest Institute Zvolen)

The consumption of products of wood processing industry reflects the structural changes in wood processing industry, which can be seen e.g. in the restructuring of the pulp and paper industry in the beginning of the century, as well as the economic growth of the society after 1997, leading towards overall increase of consumption of the population.

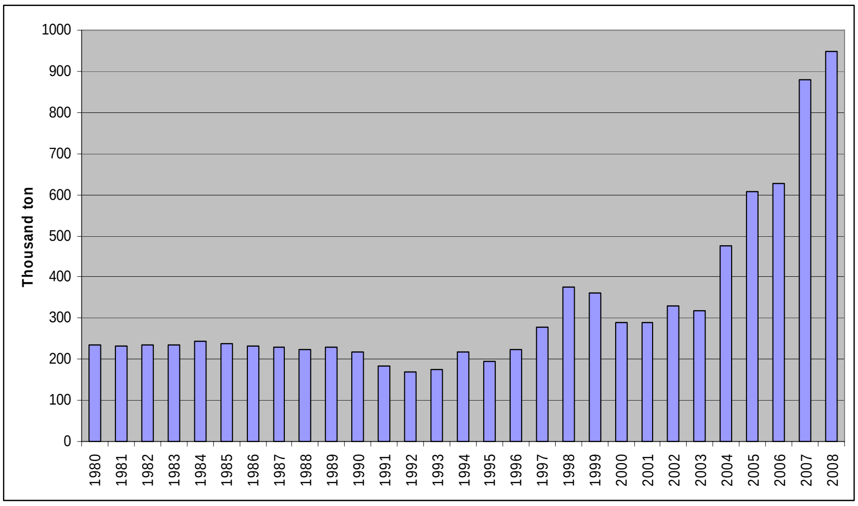
11 ASSESSMENT OF VOLUME OF CARBON, STORED LONG TERM IN WOOD PRODUCTS

Carbon from wood is stored in three basic categories of wood products:

- Furniture
- Wood Constructions (houses)
- Products from paper

Table 2: Carbon storage in furniture wood, wood construction and paper in thousand tons of dry matter and CO_2 per year.

year	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**
Dry matter	464	443	364	265	251	298	274	315	375	517
CO_2	849,833	811,718	667,264	485,573	460,859	545,958	503,195	576,839	686,888	947,846
year	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**
Dry matter	476	412	432	459	457	695	882	848	1188	1362
CO_2	872,944	755,461	791,408	842,026	837,655	1274,193	1617,455	1555,459	2178,363	2497,762



Picture13: Storage of dry matter in furniture

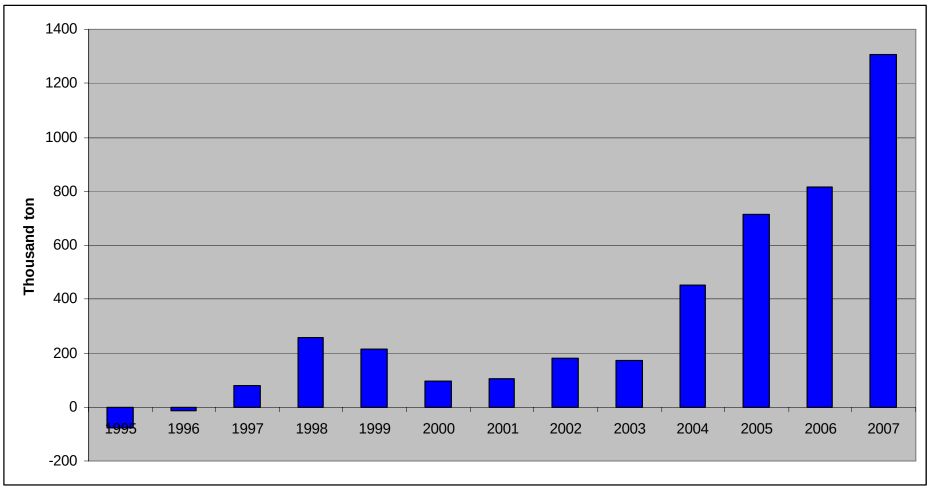
Table 3: Storage of Carbon in dry matter of furniture wood in thousand ton of oven dry wood and CO_2 per year

year	**1982**	**1983**	**1984**	**1985**	**1986**	**1987**	**1988**	**1989**	**1990**
Dry matter	235	236	244	236	231	231	223	229	219
CO_2	430,076	433,141	448,006	433,524	423,870	422,874	409,465	422,874	409,465
year	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**
Dry matter	184	168	174	219	194	224	278	376	360
CO_2	337,031	308,022	318,486	401,087	355,510	410,233	509,077	688,652	660,867
year	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**
Dry matter	290	288	329	317	475	609	628	880	949
CO_2	531,357	528,891	602,389	581,223	870,597	1116,141	1151,201	1612,943	1739,353

Table 4: CO_2 marginal storage (+ variance) of comparable sets of time periods in thousand tons of dry matter of furniture and CO_2

Year	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**
Dry matter, thous. Ton/year	-41	-8	43	139	116	53	57
CO2 thous. Ton/year	-75,179	-14,097	79,001	255,510	212,861	97,833	105,021
Year	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**
Dry matter, thous. Ton/year	98	94	246	390	444	712	775
CO2 thous. Ton/year	179,515	171,758	450,328	714,721	814,170	1304,921	1420,867

Carbon storage in dry matter of furniture wood in Slovakia is around 600K tons of CO_2 per year. Income The decrease of population income impacted the furniture less significantly than wood constructions. The decrease from the start of 90's is slower than for wood constructions. After the start of the millennium the domestic furniture sale is increasing and the carbon storage as well.



Picture14: Net Carbon Storage in furniture

Net CO_2 storage in dry matter of furniture as a volume of dry matter stored in new furniture reduced by dry matter of destroyed furniture in comparable set of previous time period – 15 years ago, is In Slovakia for the period of 1995-2008 around 400K tons of CO_2 per year. In the beginning of 90's carbon storage in the furniture decreased. Therefore during the whole period between 1995-2008 the new carbon storage in dry matter of furniture is only 5 700 thousand tons, although in new furniture the increase is around 600 -700 thousand ton of CO_2 per year.

11 TRADE BALANCE OF CARBON FROM EXPORT AND IMPORT OF WOOD AND WOODEN PRODUCTS

Similarly to the carbon storage in dry matter from consumption, EUROSTAT data was used also for the estimate of dry matter volume for each product of import and export for years 2003-2008. The total trade balance of stored CO_2 came out positive for Slovakia, i.e. more dry matter in wood products is exported then imported. The variance is 944 – 1293 thousand tons of dry matter. Most favorable trade balance of carbon retention is for round timber – 532 - 942 thousand tons of wood dry matter, while the lease favorable balance is for fibre boards, sulphite unbleached wood pulp and uncoated mechanical paper, each approximately 30-75 thousand ton of dry matter wood.

Table 5: Total trade balance of wood and wood products from import and export

Variance export - import in thousand ton of dry matter					
2003	**2004**	**2005**	**2006**	**2007**	**2008**
1092	944	1276	1230	1293	1195
Variance export - import in thousand ton CO_2					
2003	**2004**	**2005**	**2006**	**2007**	**2008**
2002	1731	2340	2256	2371	2191
Variance export - import in thousand € for CO_2					
2003	**2004**	**2005**	**2006**	**2007**	**2008**
40044	34616	46791	45118	47428	43829

12 DISCUSSION AND CONCLUSION:

Wood assortments production, its transport and processing in Slovakia are interconnected segments of Forestry and Wood Processing Industries. In years 2005 – 2008 consumption, production as well as foreign trade (export and import) reached their highest levels. Wood processing industry output was four times higher in 2008, when compared with year 1993, while the forestry industry had increased its roundwood production only by one third. Despite significantly positive results, domestic consumption of round timber needs to be increased to reach the levels of its potential production, while the wood processing industry production should focus more on finalization of products and reduce export of timber.

Until the middle of the year 2008, timber production and wood processing benefitted from positive aspects of integration of Slovakia into the EU and world economic growth.

Although essential for small economies like Slovakia, the integration of Slovakia into the world economy also brings some risks. It may be temporary, but the world economic crisis, launched in the USA, is directly impacting Slovak forestry and wood processing chain, mainly by lower wood consumption in North America and increased export of wood processing products into Europe, with decreasing dollar exchange rate. Similar applies for ever increasing consumption of round timber in China and increasing output of its wood processing industry, which after the recession of consumption in USA will probably start to seek new markets in Europe. Due to the fact, that crises from USA usually delay before they enter the EU and last longer afterwards, next two years Slovakia should expect decreased production of wood processing industry as well as decreased demand for wood assortments and wood processing products, compared to year 2008.

Separate issue will remain the impact of increase of energy prices in two aspects. First, the pressure on costs of wood harvesting in forestry as well as costs of wood processing, and second increased demand for wood as an energy source. However, at the time of crisis, due to the lower demand for oil its price is falling, which could be a signal for increased use of fuel wood, as a renewable ecologic raw material.

Another advantage of using wood based products is, besides the sustainable use of natural source with very good impact on human life, also the retention of carbon in these products, decreasing the air pollution from gas causing the climate change.

Despite all possible risks the wood processing industry should be viewed as a perspective production that is based on utilization of domestic renewable and ecologic source.

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The true colours of carbon

Sebastian Thomas[1], Paul Dargusch[2], A. Griffiths[3]

Abstract

This paper presents a framework which describes the nature of carbon offset projects and their probable sustainable development outcomes in a simple and transparent manner. The framework offers buyers of offsets the opportunity to direct investment towards projects with broader sustainability benefits. Small-scale forestry activities are considered highly desirable in this framework, and "Blue Carbon" afforestation projects (in coastal and aquatic environments) are highlighted as a potentially beneficial yet currently unregarded offset choice. The power of this framework lies in its simplicity and utility for offset buyers and their stakeholders, and resultant potential to effectively direct market demand toward projects that provide greater climate change mitigation and sustainability benefits

Key words: aforestation, carbon, small scale forestry
FDC: 682:914=111

THE TROUBLE WITH OFFSETS

International market mechanisms designed to mitigate climate change and achieve global greenhouse gas (GHG) emissions reductions rely heavily on "offsets" generated by carbon management projects in developing countries. These projects are intended to contribute to sustainable development as well as reducing emissions; arguably they do neither. This article proposes a practical framework to facilitate enhanced sustainability outcomes in GHG offset projects. The power of this framework lies in its simplicity and utility for offset buyers and their stakeholders, and resultant potential to effectively direct market demand toward projects that provide greater climate change mitigation and sustainability benefits.

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The Clean Development Mechanism (CDM) is one of the flexibility mechanisms established by the Kyoto Protocol to the United Nations Framework Convention on Climate Change (UNFCCC). The CDM is intended to achieve reductions in emissions of greenhouse gases

(GHGs) and promote sustainable development (*1*). CDM projects are designed within operational parameters stipulated in registered CDM methodologies, and offsets are generated through projects registered with the CDM Executive Board. The international carbon market is growing rapidly, with over US$6.5 billion in project-based transactions in the primary CDM market in 2008 (*2*), and CDM offsets serve as one of the primary means for firms in industrialised nations to achieve net reportable emissions reductions (*3*). The CDM has been widely criticized, however, for its lack of positive ecological outcomes and the disproportionate representation of certain project sectors and countries, and has thus far failed in its mandate to achieve sustainable development (*4-6*). As a consequence, there is widespread uncertainty about the integrity of offsets and this has impeded progress in implementing effective climate change mitigation and adaptation policies.

THE COLORS OF CARBON FRAMEWORK

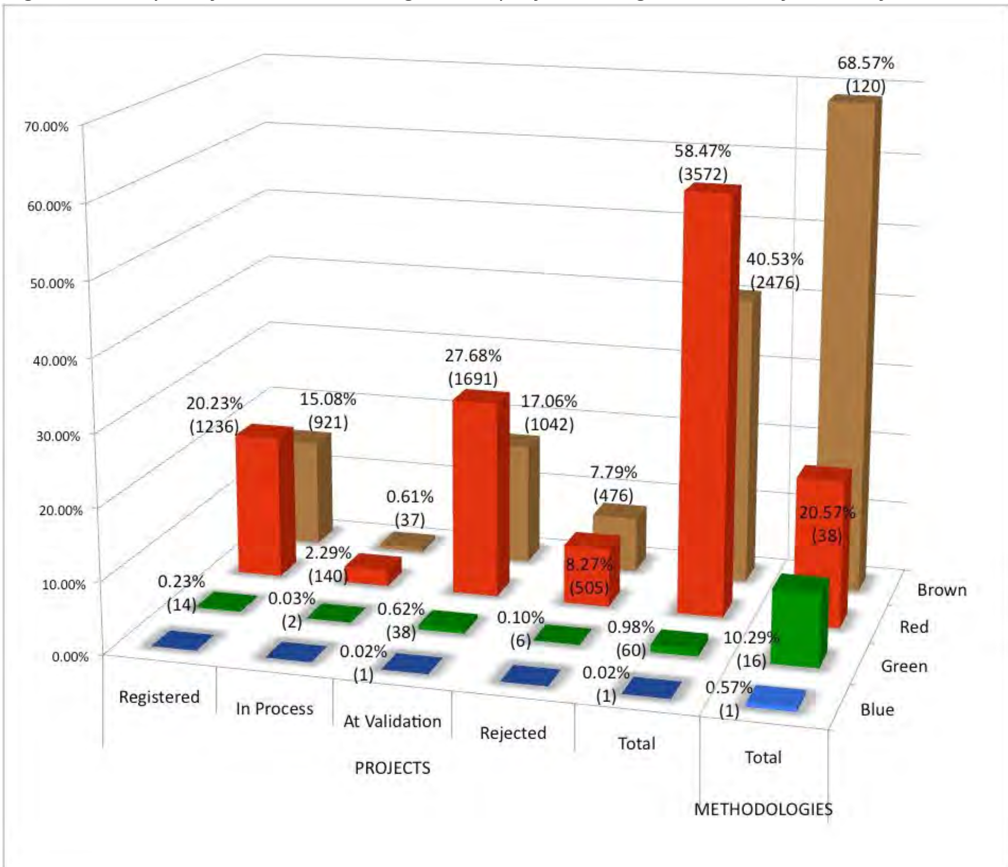
While the methodologies available for CDM projects are numerous and diverse, they can be characterized as achieving emissions reductions in one of four fundamental ways: through avoidance, reduction, destruction or sequestration of emissions. The framework presented here assigns a color code to each methodology. The color labels are a means of describing the nature of carbon management projects. The analysis presented here involved the application of the framework across all 175 registered CDM methodologies[4] and all 6109 CDM projects[5] in the CDM "pipeline". Data was sourced from the United Nations Environment Program (UNEP) Risoe Centre CDM Pipeline Database (*7*).

In simple terms Brown projects represent improvements in existing methods rather than innovation, Red projects involve new and alternative technologies or processes, and Green projects directly sequester carbon in vegetation and soils. Blue carbon projects are essentially a sub-category of Green, also involving sequestration, but in aquatic environments. In this framework the majority of CDM methodologies are Brown and most projects are Red, as shown in Figure 1. While a tenth of methodologies are Green, there are only 60 Green projects, less than 1% of the total. There are 10 methodologies which

4 21 of which are no longer active
5 2171 of which were registered as of 1 May 2010, with 2772 at the validation stage, 179 in process and 987 rejected or withdrawn. The total number includes projects that are currently registered using methodologies that have been superseded *(7)*.

account for 77% of all projects in this analysis. Two of these (ACM2 and AMS-I.D), both involving electricity generation from renewable sources, account for nearly half of all CDM projects (23.8% and 23.4% respectively). Many of these are hydroelectricity projects located in China, and their overall sustainability benefits are uncertain (*8*). A single Blue carbon methodology exists (AR-AMS3). There is one project (currently at the validation stage) which employs this methodology involving mangrove afforestation in tidal wetlands around several small islands in Indonesia (*9*). There are as yet no methodologies featuring seagrasses or other aquatic vegetation.

Figure 1: Analysis of CDM methodologies and projects using the Colors of Carbon framework[6]



It is estimated that by 2020 projects employing Brown methodologies will have generated 4.92 billion certified emissions reductions (CERs) measured in metric tons of carbon dioxide equivalent (tCO2e), more than 60% of the total (UNEP). Red projects will have

6 Registered" projects include those that have already been issued with certified emissions reductions and those that have not; "In Process" includes projects that are requesting registration, that are under review, or those that have had reviews or corrections requested by the CDM Executive Board; "At Validation" includes projects being assessed by Designated Operational Entities; "Rejected" includes projects rejected by the CDM Executive Board, withdrawn by project developers, and projects that have been rejected or terminated in the validation process by Designated Operational Entities. Some of the 6109 projects employ multiple methodologies. In these cases the Color is assigned based on the principal methodology of the CDM project.

achieved reductions of nearly 3.14 billion CERs, almost 40%. In contrast, Green and Blue projects will have accounted for less than 76 million CERs, less than 1% of total emission reductions by 2020. There is a clear imbalance between the expected reductions from different project types, with Green and Blue projects significantly under-represented.

The framework provides numerous advantages to offset buyers. Primarily, it informs buyers and their stakeholders about the nature of their offset acquisitions. This embraces the fact that not all offsets "are created equal": their true sustainability credentials can only be judged if the nature of the source is understood. Project developers or intermediaries in the offset supply chain (such as brokers and banks) could add value to their services by providing more information about the nature of offsets for sale. If the framework were to be widely disseminated and legitimized – perhaps through endorsement by governments and adoption by industry leaders – buyers (predominantly corporations) could more transparently demonstrate their sustainability credentials by declaring the colors of their current and planned offset acquisitions in their public reporting initiatives. The framework is also transparent, cost-effective and accessible, avoiding the administrative and transaction-related flaws of existing certification-based schemes such as the CDM Gold Standard, which has been largely ignored in the CDM market. Of the more than 2100 projects currently registered only 17 have the Gold Standard label, with 11 at validation and a further 119 listed for assessment (*10*).

Brown methodologies are those that improve the operations of existing systems. In this category we include methodologies that destroy captured emissions of industrial gases through decomposition and burial. The Brown category covers methodologies involving energy efficiency, landfill gas capture, recovery of fugitive emissions, some fuel switching, cement production and CO_2 capture. Red projects are those methodologies that involve alternative development pathways. These include renewable energy provision from sources such as wind, solar and geothermal power, as well as some fuel switching and improved energy distribution systems. Red methodologies create new emissions pathways for future development. Green methodologies involve direct sequestration of carbon in terrestrial soils and vegetation through agriculture and forestry-based projects. Green methodologies are currently employed under the CDM although the number of Green projects is minimal.

Blue carbon methodologies involve sequestration in coastal and marine environments through ecological restoration and afforestation. The absence of Blue carbon strategies from the climate policy discourse is an important deficiency, as the ocean is a dominant component of the global carbon cycle and more than half of all carbon accumulated in vegetation through photosynthesis is in marine organisms (*11, 12*). Vegetated coastal ecosystems including mangrove forests, salt marshes and seagrass meadows are immensely important ecological resources and largely unregarded. These areas provide vital ecosystems services including the provision of habitat, production of food, regulation of local climate and disease vectors, nutrient cycling and pollination and are highly effective carbon sinks (*13-16*). Blue carbon projects not only generate these ancillary benefits but will develop the adaptive capacity of coastal communities that are likely to be disproportionately affected by the biophysical impacts of climate change (*17, 18*). One of the goals of this paper is to encourage and facilitate the adoption of Blue carbon methodologies within the international climate change mitigation and adaptation frameworks.

Efforts to create functional definitions of sustainable development are fraught with difficulty. One of the fundamental challenges is the difficulty of determining and measuring specific impacts and results. While economic outcomes are perhaps the simplest to quantify, social and environmental impacts are often less clear and measurable. A further challenge is quantifying ancillary benefits, such as improving food resource security by restoring and safeguarding habitat and breeding areas, reducing the biophysical impacts of erosion, salination and inundation, and developing adaptive capacity by promoting long-term integrated environmental management. The complexity of the issue and the urgent need for sustainable development strategies has resulted in an array of approaches and interpretations (*19-21*). Indeed, the diversity of sustainability indicators, criteria and reporting schemes has been described as a “Zoo” (*20*).

The value of the framework presented here is its simplicity. On one hand, it is possible to make general assumptions about the likely sustainability outcomes of different methodology types, as shown in Table 1. The table presents assumptions about the probable consequences of different methodologies based on the interpretation of the “reasonable person”, a premise related to the precautionary principle and broadly applicable (*22, 23*). On the other hand, the framework demonstrates that projects which are likely to have the broadest range of long-term sustainability impacts (contributing to improved resource security, adaptive capacity and greenhouse mitigation) are those which feature least in the CDM.

Table 1: Summary of probable sustainability outcomes of different methodology types

The project:	**Brown**	**Red**	**Green**	**Blue**
Has net positive climate benefits	✓	✓	✓	✓
Has sustained long-term impacts beyond the project lifetime		✓	✓	✓
Improves local technical capacity	✓	✓	✓	✓
Reduces pollution other than GHG emissions	✓			
Generates new income beyond the project boundary	✓			✓
Develops local infrastructure beyond the project boundary		✓		
Increases resource security		✓	✓	✓
Provides ecosystem services			✓	✓
Has net positive biodiversity impacts			✓	✓
Actively sequesters atmospheric carbon dioxide			✓	✓
Enhances local adaptive capacity to manage climate change impacts			✓	✓

While constraints affecting Green carbon projects have been previously identified (*24-27*), the framework offers the opportunity to direct regulation and investment towards correcting these imbalances in a transparent and cost-effective manner.

FACING FUTURE TIDES

Climate change is occurring as a result of human activities (*28*). The increasing quantity of carbon present in the active planetary carbon cycle is causing extensive and progressively more severe biophysical impacts (*29, 30*). The lack of effective policy responses to date and the continued increase in GHG emissions imply that impacts will continue to grow in frequency and intensity (*31*). A realistic response to current projections must acknowledge that mitigation alone is no longer sufficient – adaptation is a necessity, particularly in developing countries and coastal zones (*32, 33*). The most appropriate policy structures are those that incorporate emissions abatement and adaptive measures in coherent strategies to achieve a range of local sustainability outcomes. Project activities that generate carbon credits through active sequestration of atmospheric CO_2

while enhancing adaptive capacity should be considered more valuable than those that earn “hot air” credits for avoidance of future emissions (*34-36*).

There are many reasons for the dearth of Green and Blue projects in existing international climate policy structures, including practical and informational constraints, issues of leakage, cost-effectiveness and permanence, and even charisma (*26, 37-39*). It seems clear however that Green and Blue projects are those that most effectively address the widest range of sustainable development priorities and contribute most to developing the adaptive capacity of communities most directly threatened by the impacts of climate change. It is also the case that the barriers to the implementation of these project types are being steadily overcome (*40*).

The widespread adoption of this framework may also reshape the role of intermediaries (such as banks) in the CDM market. Intermediaries have featured prominently in the growth of the market to date, and while this has provided necessary liquidity, offsets have been commoditised to the detriment of mitigation and sustainability outcomes. The bundling of offsets of all types for the purposes of price risk mitigation has benefits for business cost management but does little to promote the fundamental objectives of the CDM. The framework does not exclude the use of these types of financial instruments – offsets of particular colors could still be bundled – but it does entail their reform. The diminution of the role of intermediaries may also lead to greater proportions of offset profits being shared by buyers and project originators, including host country parties.

The Colors of Carbon framework can be easily communicated and understood by the public. It offers a true market mechanism for the promotion of better sustainability outcomes – a system with minimal transaction costs, fundamentally driven by buyer demand, yet sufficiently robust and rigorous to be meaningful. Widespread adoption of the framework should drive demand for Green and Blue CDM projects and therefore invigorate investment and development in those sectors. These methodologies are likely to achieve real and significant emissions reductions, protect and enhance ecological systems and biodiversity, promote social sustainability by improving resource security and livelihoods, offer protection from geophysical climate change impacts, and contribute to the overall resilience and adaptive capacity of threatened human communities and biological systems.

There is a great deal of discussion about how to respond effectively to climate change. There are diverse proposals for defining and evaluating sustainable development. There is a huge and growing international market mechanism which was intended to address the issues of mitigation and adaptation, and which has been widely criticised as failing to do so. The framework presented here is a practical tool that has the potential to drive investment towards the most beneficial projects, thereby contributing to genuine reform of an admirably ambitious but poorly functioning system.

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Socioeconomic and environmental basis for development of small scale forestry in a highly degraded watershed of the Venezuelan Andes

Armando Torres-Lezama[1], Emilio Vilanova, Hirma Ramírez-Angulo, Giancarlo Alciaturi

Abstract

In the last 20 years, *Mocotíes* watershed in the Venezuelan Andes has suffered an intense process of land use change from natural forests to "sun grown coffee" (*Coffea arabica*) monocultures in sites with high slope increasing risk conditions and vulnerability for people living in lower parts of the watershed. Here, using a local-scale approach, 37 productive units (10% of total) in the *San Isidro* microwatershed (51.85 km^2) were assessed to evaluate socioeconomic conditions and local perception of ecosystem services and how these are affected by human activities. Almost 65% of the people work in small farms with less than 5 ha. Familiar property remains as the most important form of management. An important lack of financial support was detected in order to improve coffee productivity and to include better practices for conservation. Severe soil loss was detected for 45% of the area regarding high slopes cultivation and chemical fertilizers use. Agroforestry and tree planting are well perceived as people tends to recognize soil protection and climate change mitigation as two of the most important ecosystem services. Using the small-scale forestry approach, it is believed that current land management could be highly improved to: 1) progressively include tree cover into coffee monocultures; 2) restore degraded areas where forest cover is lost and 3) reduce deforestation. Recommended policies and actions include institutional strengthening, decentralization and the development of community-based forest enterprises. General principles presented in this work could provide a preliminary basis for land restoration to the rest of *Mocotíes* watershed.

Key words: deforestation, erosion, livelihood, land restoration, Venezuela
FDC: 682+228.9+913(87)=111

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1 INTRODUCTION

Worldwide, a low proportion of forests, close to 36% are considered primary forests (FAO 2010). High rates of deforestation and degradation are still occurring specially in the tropics and as a consequence degraded forestlands and secondary forests cover significant areas in many tropical countries (Shono *et al*. 2007). This has also been very common in watersheds of the Andean region in Latin America where poor management and negative environmental impacts have been documented (see FAO 2004). Still, since secondary forests and other degraded forest lands are usually part of subsistence agriculture systems for many rural populations (OIMT 2002) there is a growing interest to develop restoration strategies in order to recover biodiversity, ecological functioning and a consistent (long term) supply of ecosystem services.

Land restoration covers a wide range of techniques and principles very close related to landscape complexity (Lamb *et al*. 2005). Implementation of successful restoration projects often requires a carefully treatment of several elements regarding multiple stakeholders with multiple interests (local, regional and national) and the presence of complex ecological systems across a large landscape, with a variety of land-uses (Gilmour 2005). Usually the first step to restoration is to determine the type and severity of degradation of each site to define specific objectives of restoration, which will in turn determine the course of action (Montagnini *et al.* 2008). Nevertheless, when it comes to forest landscapes a common strategy that has been used for many years involves tree planting and the use of aforestation and reforestation techniques. However, it has been argued that either because of biodiversity issues (e.g. the widespread use of monoculture based on exotic species) or social concern (lack of participation) tree planting, especially in the tropics, has not been sufficient to recover ecosystem services and to improve local livelihoods hampering original restoration objectives (cf. Lamb *et al*. 2005).

Small-scale forestry (SSF) constitutes an opportunity in many countries to provide goods and services that cannot be produced through industrial and large-scale operations and to promote poverty alleviation and development. SSF usually involves a more substantial analysis of social issues that are often misplaced or forgotten by industrial forestry projects. In addition, it seems as a much more sustainable enterprise on social and ecological grounds (Harrison *et al.* 2002). Hence, SSF offers an interesting option to deal with restoration in order to manage degraded forest lands in a more sustainable manner. Currently, there are not many SSF experiences properly documented in Venezuela. An important case is reported in Torres-Lezama *et al*. (2008) for a mountainous area in the Andean region western part of the country.

In the Venezuelan Andes an important proportion of mountainous watersheds have been severely affected by human activities regarding expansion of agricultural frontier and semi-urban settlements (Mejía *et al*. 2008). Particularly, in the *Mocoties* watershed the risk of natural hazards like landslides and flooding, due to the unfavorable geologic, geomorphic and climatic conditions, is increased due to lack of proper land use planning, under design of bridges and lack of environment management (Hernández and Valbuena 2004)

Mocotíes watershed has suffered in the last 20 years an intense process of land use change from natural forests to "sun grown coffee" (*Coffea arabica*) monocultures in sites with high slope increasing high risk conditions and vulnerability for people living in lower parts of the watershed. In February 2005, after unusual rainfalls, this area was affected by floods and mass movements causing severe losses (87 dead; economic loss: 80 million USD) (Ayala et *al.* 2007). Therefore, an interest on restoration strategies along with planning for a proper land use management has occurred in the last years. Here, based on a local assessment (micro-watershed scale) of social and environmental conditions and perceptions of ecosystems services and environmental degradation a preliminary basis and potential strategies for land restoration is proposed using the small-scale forestry approach.

2 MATERIALS AND METHODS

2.1 THE STUDY SITE

The *Mocotíes* river watershed (502.36 km^2) is part of the *Chama* watershed system and the *Maracaibo* Lake influence zone and it is located in *Mérida* state within the Venezuelan Andes). *San Isidro*, along with *El Guayabal* and *Ovalles* micro-watersheds shapes *La Mejía* subwatershed (8° 24' 04" – 8° 15' 50" N, 71° 40' 50" – 71° 34' 07" W in the *Antonio Pinto Salinas* municipality within *Mocotíes* watershed (Figure 1). With a total area of 51.85 km^2, *San Isidro* microwatershed is located between UTM coordinates 914.706 - 926.294 N and 209.765 – 217.118 E. Precambrian (granites, gneisses and schist rocks) and Paleozoic (phyllites and schist rocks) geological units occur in this microwatershed. Soils are mostly Entisols (Troporthent typical loam - fine) in the Precambrian units (*Sierra Nevada* formation) whereas in the *Mucuchachi* formation (Paleozoic) predominate Troporthent typical skeletal clay. Altitude varies between 700 and 3000 meters above sea level. Slopes are mostly steep (30 – 55%) to very steep (>55%).

Climate classification according to Koeppen and Trewartha (Rondón 1991) is Gwbi. Mean annual rainfall varies between 1100 and 1350 mm. Mean annual temperature varies between 8 and 24 °C. Two main types of Holdridge' life zones comprise vegetation in this area: Dry Sub-Mountainous Forests and Humid Mountainous Forests (`cloud forests`) located mostly above 2,200 m of altitude (Alciaturi 2008).

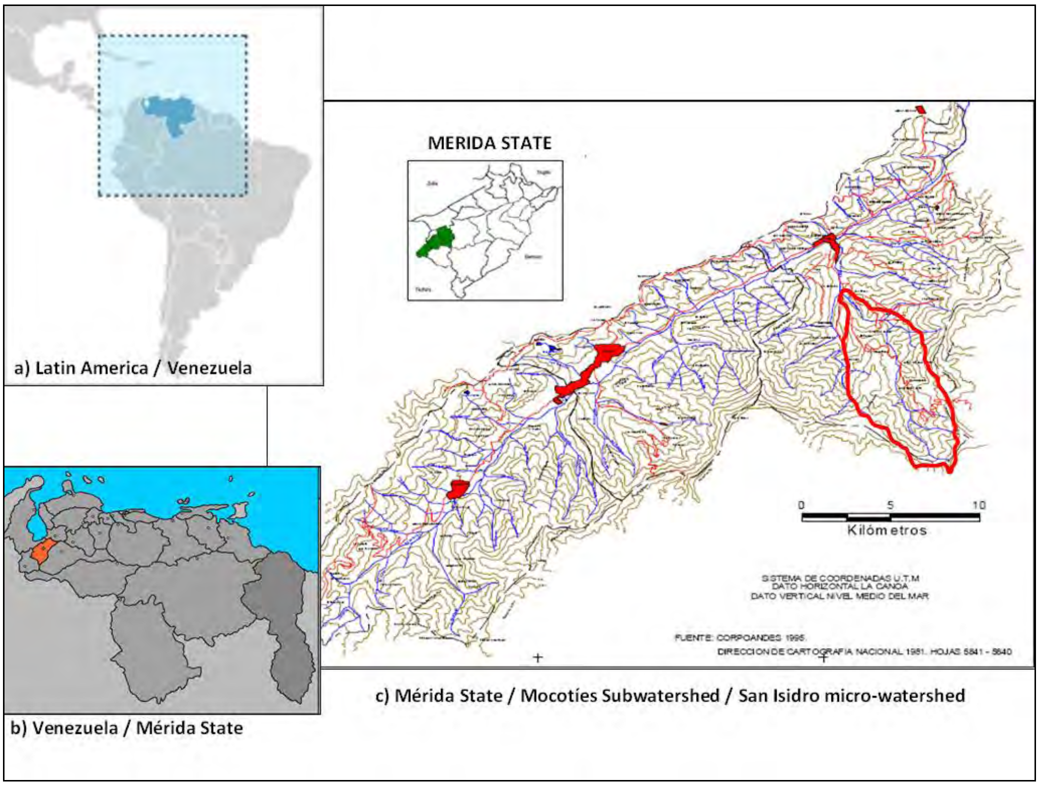

Figure 1: Location of study site in Mérida state, Venezuela. Note: the Venezuelan map includes Guyanan territory (dark shaded area) claimed by Venezuela under the Geneva Agreement of February 7, 1966.

Land use in the area is a complex mixture of different types of cover where close to 47% are cloud forests located within the *Juan Pablo Peñaloza* National Park. An association of coffee (mainly *catuai* variety) and banana plantations represents 32%, and 13.5% is mostly horticulture mainly for carrot production (Figure 2). Nonetheless, coffee production appears as the most important economic activity in the area (Alciaturi 2008). In fact, coffee ranks among the five most valuable agricultural exports from developing nations employing 25 million people worldwide and is cultivated in many of the world's most biodiverse regions (Ricketts et al. 2004). Management of coffee in the San Isidro micro-watershed is basically made under "sun- grown" coffee monocultures where forest cover is eliminated over high slopes areas with severe consequences in terms of biodiversity and soil conservation (Figure 3).

The total population for *La Mejías* subwatershed reached 5.526 by the year 2.000 (González and Romero 2003) . Overall, population density would be 37 inhabitants per km^2; however, most of the population (84.2%) is concentrated in the urban sector of

Puerto Rico with a surface of only 3 km^2. The remaining 15.8% is located in the rural sectors of *San Isidro*, *Guayabal* and *Ovalles* microwatersheds. In other words, although this subwatershed has a predominantly urban population, the economic base is purely rural. Furthermore, it is worth mentioning that population of *Antonio Pinto Salinas* municipality was decreasing in the 1960s. This is associated with the dynamics of coffee cultivation. In the 1980s started a slow demographical recovery; nevertheless, only in 1990 population reached a value similar to 1950 (20-625 vs. 20.445). By 2001 population was 23.273.

2.2 RESEARCH METHOD

A mix of qualitative and quantitative methods has been used to collect biophysical and socio-economic primary and secondary data for examining conditions and sources leading to an overall characterization of the study site and the *Antonio Pinto Salinas* municipality. This analysis included both the *San Isidro* microwatershed and *La Mejías* subwatershed. General elements as population distribution, employment and poverty were obtained. Ecological factors that could directly affect land stability and productivity were also examined. Elements such as land-use capacity, use of soil conservation techniques and range of forest cover within each farm were observed.

Socio-economic and environmental assessment included structured surveys. Several important indicators were grouped in three basic areas: 1) demographic and educational profile of people; 2) general economic outline of employment and incomes; 3) land-use appreciation and environmental perception of ecosystem services. Survey application had a sampling intensity of 10% of farms following the Cea D'Ancona (2004) methodology. Informal surveys were also conducted with representatives of governmental institutions and community leaders in both *San Isidro* microwatershed and *Antonio Pinto Salinas* municipality. Informal dialogue and discussions were also very useful during this stage. Survey data were processed by means of a spreadsheet application.

An additional effort was necessary to get an accurate geographic map data base of *San Isidro* micro-watershed. Cartographical revision included the inventory of relevant material. *La Mejías* subwatershed maps (1:25.000) prepared by González and Romero (2003) were very useful. A Geographical Information System (GIS) was used to develop the base map and slope sectors of *San Isidro* microwatershed from a cartographical – digital database. Baseline cartography included a detailed location of coffee production areas. The polygonal of the *Juan Pablo Peñaloza* National Park in the Batallón and La Negra *páramos* (moors) was realized through UTM coordinates and landforms specified in the decree creating this protected area

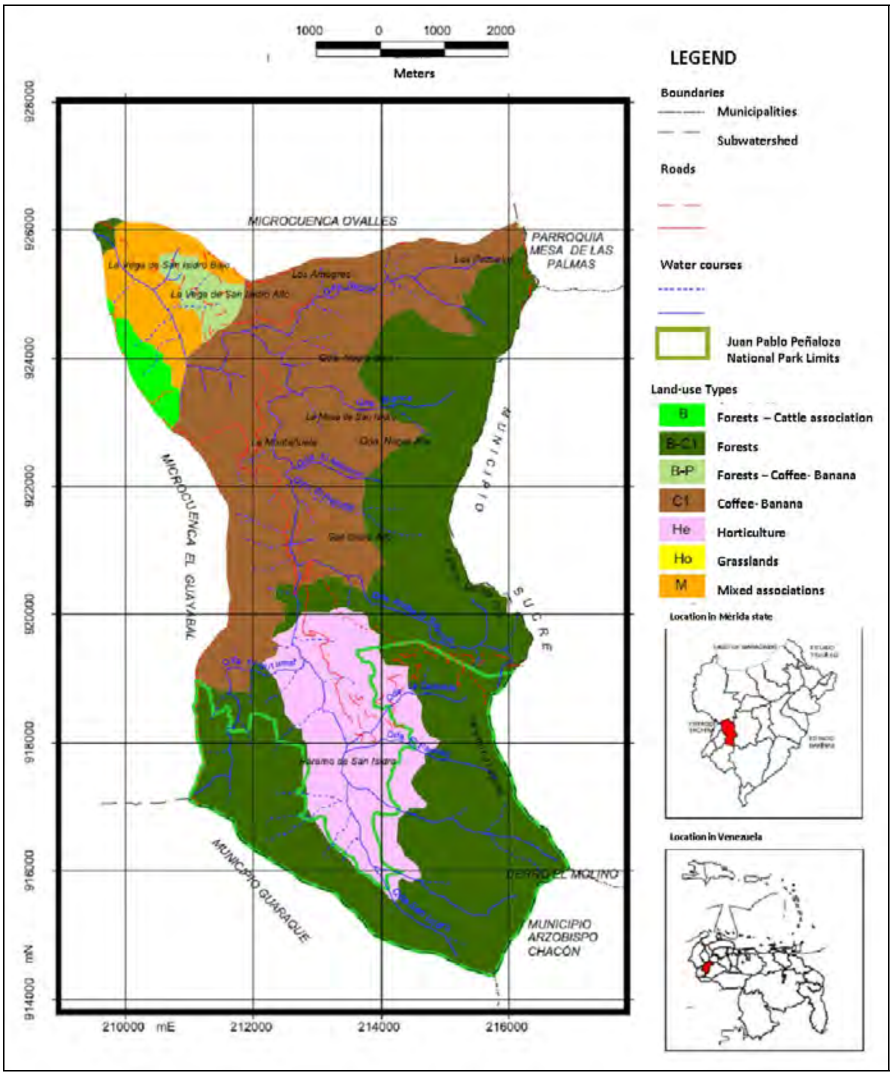

***Figure 2:** Land-use map in San Isidro micro-watershed in Venezuelan Andes, Mérida state.*
Source: Alciaturi (2008).

***Figure 3:** Main features of coffee production in San Isidro micro-watershed, Mocotíes Valley, Mérida state.*
Photos: Emilio Vilanova.

3 RESULTS AND DISCUSSION

3.1 SOCIOECONOMIC AND ECOLOGICAL ASSESSMENTS

Overall, almost 65% of the people work in small production areas with less than 5 ha (Table 1) and familiar property remains as the most important form of management. This is a common feature in majority of coffee productive area over the *Mocotíes* Valley (Alciaturi 2008). Close to 70% of production is dedicated to commercial use in *Mérida* state and the rest of the Andean region through local associations. Remaining coffee production is basically used for self-consumption.

Table 1: *Distribution of coffee production areas and surface in the San Isidro micro-watershed*

Total surface (ha)	Number of production units (farms)	%
Up to 2	10	27,03
2,1 – 5	14	37,84
5,1 – 10	5	13,51
10,1 - 20	2	5,405
Without data[1]	6	16,22
Total	37	100

[1] *People surveyed were reluctant offering this information.*

Since 1950 a consistent process of shift in land property has occurred in the *Mocotíes* Valley from big-size producers to family and small forms of management (Rivero 2001). However, a decrease in coffee production in the Venezuelan Andes has been documented since 2002 where other two states (Portuguesa and Lara) are currently the top producers at national scale (Rojas-López 2007). The Agriculture Ministry, a governmental institution, reports a consistent decrease in cultivated area for coffee production in the *Pinto Salinas* municipality since 1995 (Figure 4)

Technological improvements, including the use of high yield productive varieties of *Coffea Arabica*, are often economically unreachable for small farmers causing an eventual abandonment of land and modification of traditional forms of employment (Cartay 1999; Rojas-López 2007). Results of *San Isidro* survey revealed that less than 36% of people are effectively working on coffee production, here including all cases where coffee cultivation is part of several associations as it was shown in land use map in Figure 2.

An additional outcome of the survey indicate that this process of reduction in cultivated area for coffee plantations resulted in that majority of farms (58%) once dedicated to commercial purposes are actually, catalogued as subsistence and self-consumption farms. Economic investments are usually poor and mostly used for fertilizers and infrastructure. Only 20% of producers indicated the use of credits or any other form of economic incentives to improve agricultural activities.

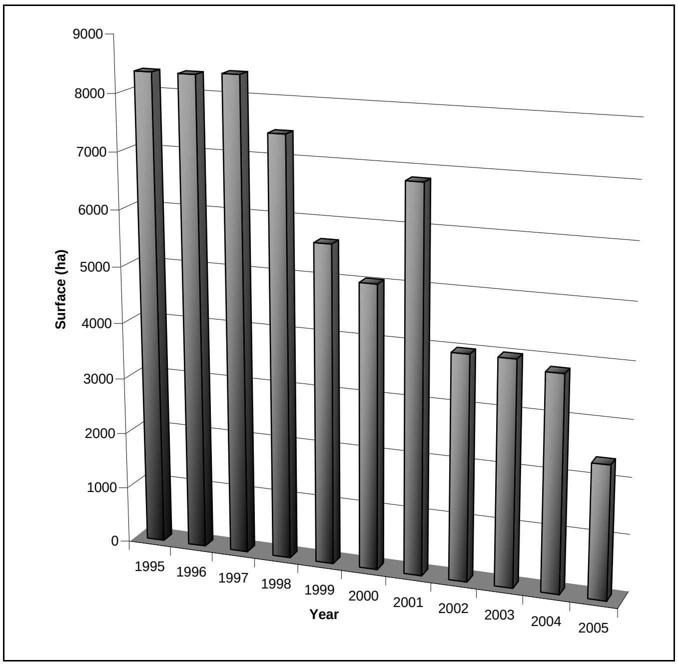

Figure 4: Land cultivated area for coffee production in the Antonio Pinto Salinas municipality. Source: MAT (2007)

Severe soil loss was detected for 45% of the area regarding high slopes cultivation and chemical fertilizers use. Higher values were detected in farms where coffee is associated with other crops (mostly banana) and producers tends to manage their land in a more intensively manner in terms of soil preparation, use of chemicals and reduction of tree cover favoring “sun grown” coffee plantations.

Although there has been an intense debate about whether coffee production should be made using “shadow trees” in the context of crop productivity (see DaMata and Rodríguez 2007 for more details) it is unquestionable, specially for high altitude agriculture like the case for Venezuelan Andes, that soil conservation usually would be favored by using different forms or combination of trees species (FAO 2000). In addition, with an accurate selection of species, an increase in forest cover would have connective benefits for other ecosystem services such as pollination for coffee production (Rickets *et al*. 2004). In general, these systems would involve less intensive interventions – for example, less drainage, less intensive tillage, less reliance on large machinery, and less use of artificial fertilizers, pesticides and fungicides providing more room for nature alongside crops and in many cases they create habitats in which wildlife can thrive (Amend *et al*. 2008).

In *San Isidro* micro-watershed, almost 38% of surveyed farms included in a diverse range of land area, small remnants of cloud forests. A small proportion of owners (27%) indicated a sporadic use for small scale logging for wood products. An important fact that should be addressed here is that the lack of statistics and monitoring on these constrains a more detailed analysis on how wood extraction is a major cause of deforestation in this area. Nonetheless, informal surveys with government institutions revealed an apparent reduction on illegal logging in the last 10 years (Alciaturi 2008).

About 40% of people recognized the existence of severe environmental problems mostly regarding poor water quality caused by an intensive use of chemicals. Although it seems that there is an apparently good social perception on how ecosystem services are functioning, however, in all cases people acknowledge that recent flooding events and reduced coffee productivity could be influenced by reduction of forest cover and deforestation. Nevertheless, a more accurate analysis of potential links between loss of forest cover and other ecosystem services such as pollination and regulation of erosion is still needed.

Results of survey revealed a very vague and diffuse local perception on how environmental issues should be addressed in order to improve ecosystem services conservation and livelihood. For instance, only 24% of people acknowledge the relevance of *Juan Pablo Peñaloza* National Park within the *San Isidro* watershed revealing a very weak link between protected areas and local communities. Bevilacqua *et al* (2006) in a national-scale analysis about Venezuelan protected areas system found similar patterns in a high proportion of areas located near populated sites.

In terms of restoration and conservation, close to 37% of people expressed some ideas about potential practices related to a more sustainable management of coffee production and watershed management. Reforestation was the most common recommendation proposed among people’s response. Including tree cover among coffee cultivated areas in a variety of options was considered as a sound alternative to reduce natural degradation. However, there are several limitations of this practice in terms of potential constraints for coffee productivity regarding species competition, increase in pest susceptibility and limitations for mechanized operations, among others that should be considered (DaMata and Rodríguez 2007). In *San Isidro* micro-watershed, farmers located in higher parts of the area were reluctant about a wide-spread use of trees in coffee plantations. High cloud density, limited solar radiation and lower temperatures are, already, limiting factors for coffee productivity. In consequence, the SSF approach that is discussed next needs to pay attention on this important fact.

3.2 THE SMALL-SCALE FORESTRY (SSF) APPROACH

Based on results obtained through a local scale analysis performed in the *San Isidro* micro-watershed, the proposed use of general principles of SSF, here meaning all activities related to forest ownership, plantation management, legislation, institutional participation and potential creation of local forest-based enterprises, is intended to: 1) progressively include tree cover into coffee monocultures; 2) restore degraded areas where forest cover is lost and 3) reduce deforestation in the Mocotíes watershed. In the context of restoration of degraded lands in the Mocotíes watershed, the SSF approach bring together ecological elements to improve and sustain vital ecosystem services such as prevention of erosion in a highly vulnerable area and the social concern of needs and livelihood of local communities.

3.2.1 Using trees for coffee plantations in the Mocotíes watershed

The complex synergies between the ecological and physiological elements participating in a potential process of incorporating tree species within coffee plantations in the *Mocotíes* watershed requires a profound analysis escaping the aim of this paper. However, general working rules should be mentioned in order to enhance potential of small-scale forestry (SSF) in the *Mocotíes* area. In consequence, an initial intended strategy involves general principles of SSF to first highlight the relevance of soil conservation to reduce risk and vulnerability for local communities. A collateral action supporting this idea requires attention on how other plant species beyond trees could be used in a multiple-use planning for land. In addition, this also requires a zoning to detect the potential use of trees in all watershed. For instance, high altitude farms (> 2000 meters) can incorporate the use of tree species under live fences systems and other plant species (grass and small shrubs) to favor soil protection.

Social assessment in this study revealed a progressive decrease in local dependence of coffee production as the most important economic activity in recent years. As farming practices change, the cultural landscapes that have developed from them are also eroded or abandoned. An important goal of the SSF approach using trees in coffee plantations is not only related on the increase of “shading” but to enhance local agrobiodiversity and other relevant ecosystem services. In most ‘developing’ countries, traditionally home to much of the world’s agrobiodiversity, monoculture models of agricultural ‘development’ have for decades pushed out diverse traditional systems and encouraged or coerced farmers to switch to a smaller number of varieties (Amend *et al*. 2008). In terms of improving ecosystem services, some reasons for incorporating tree species into coffee monocultures include timber, fuel wood and fruit production and direct ecological benefits such as increased biodiversity and carbon sequestration (Dossa *et al*. 2008). Middle (between 2000 and 1000 meters) and lower parts (< 1000 m) of watersheds are perhaps the most suitable areas since, for the case of *San Isidro* micro-watershed social acceptance is higher in this areas.

The establishment of plantations affects not only the landscape and environment but also local communities (Cossalter and Pye-Smith 2003). Consequently, priority should be given to an analysis of current laws and regulations that determine land-use patterns on public and private land, in order to reach regional and local agreements that supports social acceptance of SSF projects, providing a more open process of information exchange between all stakeholders. Poorly planned and managed plantations can have negative environmental impacts. Alteration of biodiversity and a threat to water resources (e.g. impacts on water quality and quantity) and soil fertility are the most commonly mentioned effects (Cossalter and Pye-Smith 2003; Schirmer 2007)). Negative environmental effects can be reduced considerably if the selected species match the social factors (as considered in this study), and management is appropriate, including adequate selection of seed sources, nursery and plant production control, and planning of silvicultural treatments.

3.2.2 SSF for restoration of degraded land

In the context of this paper, restoration for *Mocotíes* subwatershed represents a process that aims to regain ecological integrity and enhance human well-being in deforested or degraded forest areas (Maginnis and Jackson 2005). Undoubtedly, such complex goal needs complex approaches to fully understand links between all stakeholders, ecosystems dynamics and what perhaps is most important, the relationship between people and the ecosystem services sustaining vital functions and activities. Multi-stakeholder processes have basically offered a new work mechanism introducing a broader understanding and encouraging respect among all stakeholders (Yuliani *et al.* 2006). Taking a landscape-level perspective into account in site-level management could help for not only having healthier landscapes, but also improve stand-level management.

Incorporating trees through plantation in the *Mocotíes* watershed, as is mentioned previously, has definitely a place in a restoration process. However, since restoration means a multi-objective process, realistic and pragmatic visions are needed to understand what forest plantations are capable of delivering and recognize that other functions and spaces within the landscape needs to be created so that other complementary restoration strategies can be deployed (Maginnis and Jackson 2005). In consequence, SSF approach fits into a more integral and developed strategy where alternatives such as promotion and enhancing of natural forest recovery, assisted natural regeneration and enrichment planting should be evaluated (Lamb *et al*. 2005; Shono *et al*. 2007). Nevertheless, evaluation of potential restoration strategies in the *Mocotíes* watershed would need to pay attention on the state and conditions of those areas with potential for restoration. A general view of most common tropical coffee production systems is presented in Figure 5 showing different levels of restoration conditions.

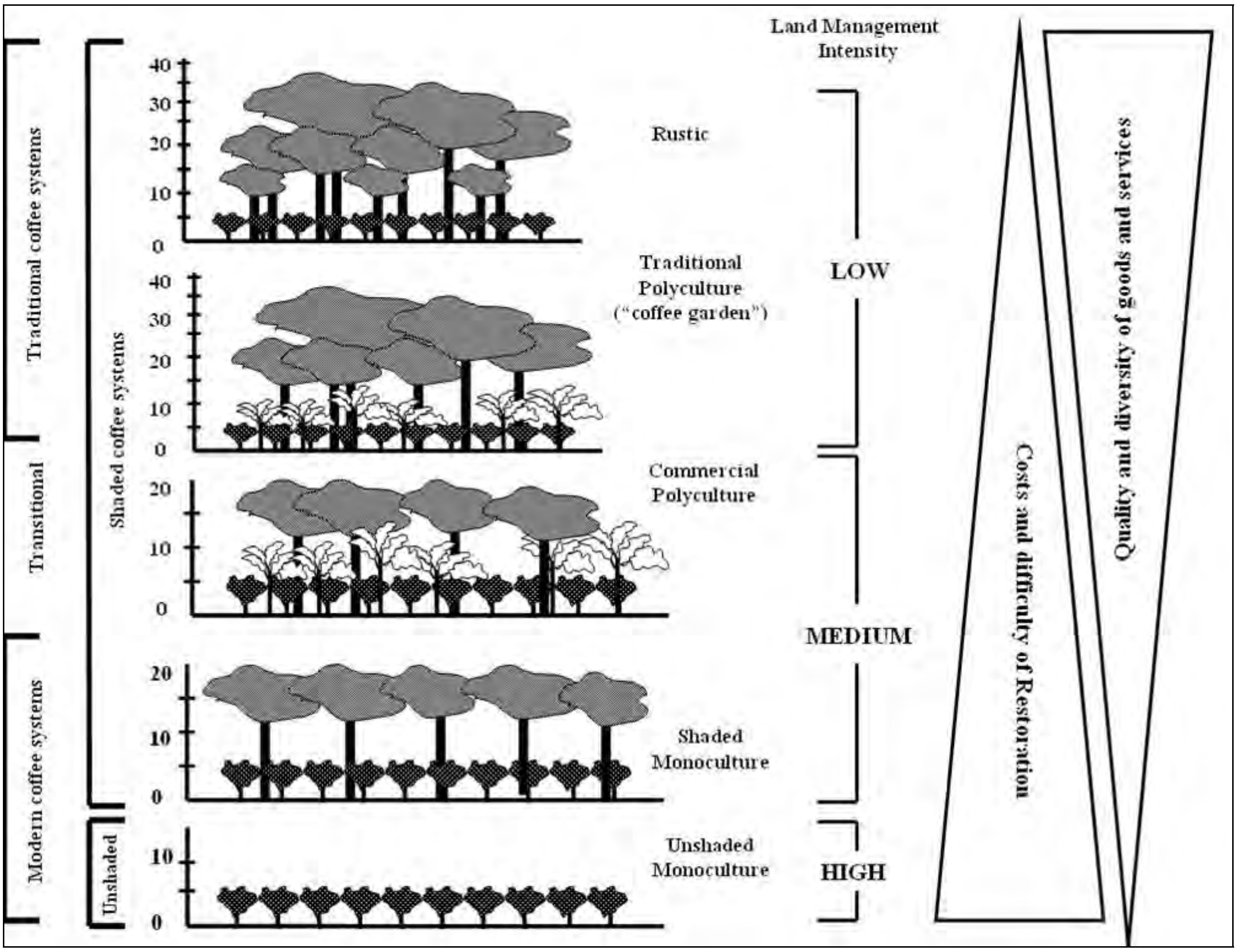

Figure 5: Five common coffee production systems in the tropics and conditions of management and restoration potential. Source: Adapted from Moguel and Toledo (1999) and Aronson et al. (2007).

3.2.3 Reducing deforestation through Small Scale Forestry

Lack of updated statistics about state and conditions of forest cover in Venezuela is a very common fact documented in several technical reports (e.g. GFW 2002; Torres-Lezama *et* *al*. 2008). In consequence, a strong limitation prevails to improve analysis and research capacity about forest-related problems. Based on FAO statistics (FAO 2000), *Mérida* state lost between 1975 and 1988 close to 122,000 ha (-1.65% annual) reaching 498,700 ha by the end of 1988. Almost a decade later, forest cover reached 388,680 ha (34.4% of Mérida state total surface). In spite of not having precise statistics for the particular case of *Mocotíes* watershed, several studies reports higher deforestation rates occurring in mountainous watersheds (cf. Hernández and Pozzobon 2002; Pozzobon *et al*. 2004).

Approximately 46% of *San Isidro* micro-watershed is covered by forests mostly within a National Park starting above 2200 meters of altitude. However, as is shown in Figure 2, several areas of different types of forests-crops associations still covers important parts of *San Isidro* area without any formal or legal protection. The use of wood and other forest-related goods, as social assessment revealed, isn't of high appreciation by local communities. Nonetheless, progressive elimination of forest cover took place since initial establishment of shaded coffee plantations and transition to sun-grown coffee variety affecting forests and biodiversity. Although there is an intense debate about the potential of forestry plantations for reducing pressure over natural forests (see Cossalter and Pye-Smith 2003 for more details), it is believed that small scale forestry alternatives proposed here offers opportunity for forest remnants conservation by reducing human pressure for agriculture expansion. Agroforestry technologies such as improved fallow, live fences and fodder banks, as well as options for direct reforestation or aforestation could provide a multiple-based strategy for land management. Forests remnants would offer ecosystem services such as carbon sequestration, biodiversity conservation and water regulation highly acknowledged by local communities. Additionally, strengthening link between local people and the *Juan Pablo Peñaloza* National Park through ecotourism activities could open new forms of management in the *Mocotíes* watershed area.

4 GUIDING SMALL-SCALE FORESTRY PRACTICES AND POLICY RECOMMENDATIONS

A well-balanced participation between the public and private sectors and a well-designed policy of incentives is needed to promote the implementation of a SSF management, not only in *Mocotíes* area but throughout rural areas of Venezuela. An opportunity for SSF remains because the current forest law established a novel policy for incentives for new socio-productive mechanisms favoring small-scale operations. This policy also includes the encouragement for social participation and empowerment through economic incentives including tax concessions and financial support.

Employment opportunities related to coffee production combined with other forest products and services could assist in poverty reduction and in sustaining livelihoods for most of the population. FAO guidelines for Market Analysis and Development (MA & D) – described by Lecup and Nicholson (2006) and ITTO (2007) – provide a promising approach to deal with the social complexity related to the creation of community forest-based enterprises (CFEs). In order to facilitate CFEs, several conditions are required: a) a multiple-product strategy incorporating better practices for coffee production, agroforestry management and non-timber forest products; b) restructuring of land tenure; c) promotion of new political institutions and d) a shift in economic decision-making from the household to the collective level, aimed at greater participation in the market economy.

Special attention is required to informal arrangements such as customary property rights or and other pre-existing rules for community forest management that have not been codified in law. In the process of enterprise development, a systematic monitoring process is needed over those related issues that are critical for linking CFE with potential buyers of coffee, wood and other forest products and services. These include quality improvement, certification and development of an effective administration and market procedures (Donovan *et al*. 2008). Currently, some promising experiences on sustainable coffee production are undertaken in several parts of Venezuelan Andes that could be used to model *Mocotíes* experience.

5 CONCLUSIONS

In the last 30 years, land use in *Mocotíes* watershed experienced an intensive transformation involving the use of landscapes mainly for coffee production and other agricultural associations severely affecting ecosystems stability. In addition, traditional coffee systems have also been modified by more intensively land management systems amplifying the intensity of environmental impact. Critical regulation services such as erosion control and climate regulation appears as the most affected and the most acknowledged by local communities. As a consequence, a highly degraded environment resulted and an increase in risks and vulnerability affected the whole watershed system.

Combined ecological, economic and social forces in *Mocotíes* watershed and in the Andean region of Venezuela shaped a complex situation where small-scale forestry can have a high potential. Results of social assessment helped to outline three complementary potential strategies based on general principles of small-scale forestry: a) increasing tree cover in coffee plantations; b) SSF as part of a restoration program and c) SSF to reduce deforestation). Without any doubt, SSF faces serious challenges for successfully implementation in the Mocotíes watershed. Lack of incentives and very weak institutional framework threats potential benefits of SSF strategies presented here. The integrated planning and policy approaches discussed in this paper can contribute to social and economic development by offering decision-makers a range of options for sustainable development. Social networking and community associations closely linked to research institutions open a promising way to improve local livelihood and ecosystem conservation.

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Changes in private forest policy in Croatia

Suzana Trninić[1], Maja Pleše[2]

Abstract

Nearly all private forest properties in Croatia are small scaled holdings (average size is less than 1 ha) which is the result of historical circumstances.

Typical forest owners are generally older population of rural areas or descendants who live in cities. Interest for managing of the properties is secondary to the poor, which is understandable given the small income. Managing small scale forest plots is difficult and hardly sustainable.

Changes in forest policy in 2005 regarding private forest estates: the availability of the percentage from the found named “Green tax” and support through the establishment of Forest Extension Service for private forests.

Money from the fund is used for work in biological renewal, infrastructure and research projects for private forests. FES through its extension work coordinates funds in accordance with the requirements of the profession and forest owners’ request. From the same source is financed collecting and maintaining a database of private forest, which is necessary for further development.

Would advisory work be so successful if there are no funds for implementation, or whether the funds would be used for real purposes and in the same amount if there is no advisory work?

Key words: private forest properties in Croatia, historical circumstances small scale forest plots, “Green tax”, Forest Extension Service, extension work
FDC: 682:902:903(497.5)=111

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Possible economic consequence of climate change in forestry

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Abstract

The paper deals with framework economic evaluation of possible impacts of global climate change in the Slovak republic forestry. Some current approaches to quantification of impacts are characterized. There are distinguished the primary and secondary impacts of CO_2 and greenhouse gases equivalents on forest ecosystems and economic. In the first case it is the question of direct influencing the biochemical reactions of natural growing process through CO_2 increase. Within the second group the mediated impacts of global climate change on forest ecosystems, as well as inputs and outputs of forestry production are concerned. In this case CO_2 and greenhouse gases equivalents are considered one of initial factor of global climate change. The paper presents the some natural and value indices for measuring the impact of global climate change. In addition the paper deals with the results of negative externalities quantification based on the principle of exchange tree species composition, increased costs for selected processes of forest production and reduced realization of timber depending on incidental felling.

Key words: economic evaluation, climate change, greenhouse gases, forestry, quantification, forest production, externalities
FDC: 111.82:682=111

1 INTRODUCTION

Growing number of world population and extensive human activities reflect lawfully in direct or indirect changes on the surface of the Earth (Nátr 2000). This author states that indirect effects of human interventions in the Earth's system are the most important. Uptake of substances from their natural localities is not so disturbing like releasing only of some components of substances taken up. Carbon dioxide (CO_2) is one of sequestrated component.

According to Wittwer (1995) with doubling the atmospheric concentration of CO_2 (from 0.0314 to 0.0628%) near the Earth's surface and with expected increase of the

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temperature also the rate of photosynthesis, growth of plants' roots and production of biomass will increase on average by 33% as well as accumulation of dry matter, total yield of the production of plants and collection index. On the other side the rate of photorespiration, rate of breathing, conductivity of stomata, concentration of nitrogen in tissues and others will decrease.

Nátr (2000) states that with regard to markedly higher complexity of our planet than is the complexity of plants as well as with regard to recent limited level of knowing the effect of increased concentration of CO_2 on the climate and plants, many even serious theses lead to frequently contradictory statements.

According to findings of Priwitzer et al. (1977) the increased concentration of CO_2 in the atmosphere has only short-term stimulating effect on the photosynthesis rate and subsequently on the increase of the biomass of tree species, especially in juvenile stage. Recent observations indicate that long-term effect of CO_2 increased concentration and the impact of other stress factors (extreme temperatures, photo oxidants and acid-forming oxides) can lead to acclimation depression of photosynthetic activity of the assimilatory organs and production increment.

We can suppose that global climatic changes contribute also to the black box of the universe behaviour and the substance of its phenomena. Finding these connections requires own space and time. Thus clarifying the substance of climatic changes and their impact on human activities, including the contribution of the black box of the universe to these changes has been implemented only in time and space available for the man.

2 PROBLEMS

Up to now only few works dealt with the problems of economic impacts of climatic changes on the forests of Slovakia. One of recent works is case study by Holécy, Miňďáš and Škvarenina. (2000). The work is based on simulating scenarios of the development of standing volume. The simulation was made on the basis of the change of the composition of tree species – spruce, beech, oak when moving from "i" age class to the age class "i+1" (according to the method of passing probability) for the period of 80 years. In total there were defined 5 scenarios: basic one and minimal and maximal version of the percent of passing (changes of tree species composition) without and with adaptation measures. Deteriorated % of passing between age classes in minimal version was for spruce 2% and for oak and beech 1%, and in maximal version for spruce 5%, beech 2% and oak 1.5%. Risk of management, or damage of management according to the scenarios 2-5 were quantified as differences in comparison with basic scenario 1 on the level of official prices of forest stands still in accordance with the Decree 465/1991 of the Coll. Derived risk of possible impacts of climatic change on the value of forest property ranged in the extent 2.23- 4.20 billion Euro (67.32 – 126.7 billion SKK). Expected implementation of adaptation measures lowered this risk by 0.66- 1.12 billion Euros (20.7-33.7 billion SKK).

As to foreign authors Šišák, L. and Pulkrab, K. (2004) dealt with these issues. They came out from the scenario of forests development to time horizon in the year 2050. They supposed in this scenario a certain change in tree species composition and their yield classes in altitudinal vegetation zones and of constant prices on inputs and outputs of forest production. They evaluated economic impacts on the level of total mean value increment and gross annual profit. They supposed in the calculation of impacts in time horizon by the year 2050 the composition of forest tree species corresponding to the shift of one altitudinal vegetation zone higher. Due to this change in tree species composition there will be in the 3rd altitudinal vegetation zone loss of total mean value increment at the amount 2.0 thousand CZK per ha, in the 4th altitudinal vegetation zone the loss of 1.2 thousand CZK per ha and in the 5th altitudinal vegetation zone 2.4 thousand CZK per ha. According to their calculations also the loss of gross annual profit has similar course.

The work on quantification of damages caused by air pollutants to forest ecosystems (Tutka, Zachar, Nociarová 1990) can be considered a preliminary model of solving economic site of the abovementioned problem. The quantification of the effect of air pollutants on forest ecosystems in changing ecological conditions was examined by means of correlation and regression analysis. Costs of measuring unit of selected performances in silviculture and logging and economic results were dependent variables, and the effect of air pollutants given in the percent of salvage felling, percent of incidental felling and the index of forest health condition were independent variables. The consequence of ecological conditions loading reflects in the change of economic indicators. In correlation and regression analysis time factor in form of the duration of air pollutants effect was not considered. It is supposed that the percent of incidental felling and the index of forest health condition will be possible to apply as universal measure of negative influencing the growth process of forest ecosystems and the performances of forest production.

Kaňok (1987) also studied and evaluated the effect of air pollutants on 40 production-economic indicators in Northern Moravian forests. He found that profit drop was 10% in forests slightly affected by air pollutants and almost 40% in forests heavily affected by air pollutants. In forests heavily affected by air pollutants annual wood realization decreased by 1% and total costs of forest production increased by 2.9% per m^3 of felling.

3 METHODS AND PRELIMINARY KNOWLEDGE FROM SOLUTION

A basis of economic quantification of the impacts of climatic changes on forests and forestry on certain time level is relevant alternative (scenario) of the composition of forest tree species on forest lands in existing altitudinal zones. They are based on existing scenarios of the climate (Lapin, Melo et al. (2000), Miňďáš et al. 2003)). Reconstructions of vegetation distribution in boreal and sub-boreal zone (Miňďáš et al. 2003) represent certain limit models of tree species composition for corresponding climate. In case the parameters of possible climate changes of next decades and centuries do not exceed the range of the climate of boreal and sub-boreal regions it will be possible in this interval to look for the answer regarding the composition and distribution of tree species with appropriate taking anthropogenic factor into account.

Based on the results of the analysis of the classes of conditions suitability for individual tree species, determined on the basis of the frequency of current occurrence and growth responses of respective tree species in altitudinal vegetation zones, there were proposed also scenarios of tree species distribution by the year 2045 and 2075. There were used also the results of growth simulation by means of growth simulator SIBILA as well as the results of the analysis of the impacts of climate change on production, ecological stability, vitality of tree species and structure of stands (Čaboun et al. 2008).

3.1 PROPOSAL OF SCENARIOS OF TREE SPECIES COMPOSITION IN 2100

The proposal of an alternative relevant scenario of tree species composition was based on the synthesis of knowledge on possible model of tree species composition by Miňďáš et al. (2003) and on time series by the year 2100, which also some scenarios of climate development work with (CCCM200, GISS98). Basic scenario of tree species composition in the year 2100 (Tab. 2) was derived by extrapolation of tree species composition from the period 1950-2004 (Tab. 1). Objective extrapolation would require time series since from the year 1800. Due to lack of relevant data it was impossible to apply it. Scenario of minimal and maximal alternative of tree species composition was derived from initial level of area tree species composition in 2004 and then in 2010, 2020, …2100. For decreasing (increasing) tree species proportion in individual decades due to climatic changes there were used data from the work by Holécy et al. (2000). The data were applied for the change of area proportion and not for standing volume. The change of the fertility of forest lands was not taken into account. Lowered proportion concerned mainly tree species that have limited area with vertical shift of their distribution area (Tab. 2 and Fig. 1).

For the purpose of economic quantification of the basic scenario of tree species composition and the scenarios illustrating the impacts of climatic changes there was applied a parameter of total mean increment of net yield of coppice-with-standards at average rotation age of given group of tree species (Tutka et al. 2000).

In the scenario of maximal and minimal change of tree species composition being based on optimal average values of annual air temperature (T) and water balance (Q) of given tree species also the model of reconstructed distribution of vegetation in sub-boreal region was taken into account (Miňďáš et al. 2003), Tab. 2. In the scenario of maximal change of tree species composition there is considered the highest retreat for spruce, less for fir and larch, followed by dwarf pine and hornbeam. A certain area is created for spruce due to shift of timber line and for dwarf pine covering the areas of alpine grasslands and exposed plateaus with limit disposition of soil substrate. It is supposed that this will not compensate reduction of the area and for spruce even the loss of the volume and value production.

Table 1 Actual and prospective tree species composition

Tree species	**Year**			**Prospective composition**	**Average yield class in m**
	1950*	**1980***	**2004***		
Spruce	26.6	26.4	26.4	18.2	29.2
Fir	7.5	5.8	4.07	6.7	28.2
Pine	6.1	7.5	7.26	4.2	25.3
Dwarf pine			1.05		19.9
Larch	1.1	1.6	2.34	2.3	26.1
Other coniferous	0.4	0.2	0.02		15.1
Coniferous together	**41.7**	**42.5**	**41.13**	**37.0**	
Oak + Turkey oak	14.7	14.4	13.39	17.7	23.5
Beech	29.5	29.5	30.88	35.9	25.6
Hornbeam	5.9	5.7	5.72	0.9	22.9
Other broadleaved.	8.3	8.0	7.85	8.5	22.5
Broadleaved together	**58.3**	**57.5**	**58.87**	**63.0**	

*Source: PIL, Report on the Forestry in SR 1993-2009

Areas where spruce will retreat will be covered by beech and similar tree species (ash, maple, elm, etc.) as a consequence of more suitable ecological disposition. On places formerly covered by beech the communities of the character of current oak woods and pine woods as well as similar communities will be distributed. It is supposed that areas, which current communities of oak woods retreat from, will be covered by the oak woods, pine woods and other communities of Balkan type with lower demands after the value of average annual water balance. It is also supposed that the area of forests will not drop, on the contrary, it will grow by reforested area that is not suitable for agriculture and by the areas at timber line, which have not been covered up to now by forest tree species or have not been included into forest lands.

Table2 Scenarios of forest tree species proportions in 2100

Tree species	**Year 2 1 0 0**			**Average yield class**	**Note**
	Basic (Extrap.20th cent.)	Maximal scenario	Minimal scenario	Absolute In m	% of changes for decade
Spruce	26.2	15.7	21.6	29.2	-5mx, -2mn
Fir	3.2	2.6	3.7	28.2	-2mx, -1mn
Pine	8.2	11.1	8.0	25.3	+3mx, +1mn
Larch	3.3	3.7	2.5	26.1	+1mx, +0,5mn
Dwarf pine	1.1	1.0	1.05	19.9	-0,5mx, 0mn
Other conif.	0.1	0.02	0.1	25.1	+1mx, +0,5mn
Conif. Together	42.1	34.1	37.0		-
Beech	32.1	37.5	34.6	25.6	+2mx, +1mn
Oak + Turkey oak	12.6	15.5	14.8	23.5	+1,5mx, +1mn
Hornbeam	5.6	4.2	5.4	22.9	-1mx, -0,5mn
Other broadleaved	7.6	8.7	8.2	22.5	+1mx, +0,5mn
Broadleaved together	57.9	65.9	63.0	-	-
Coniferous + broadleaved together	100.0	100.0	100.0	-	-

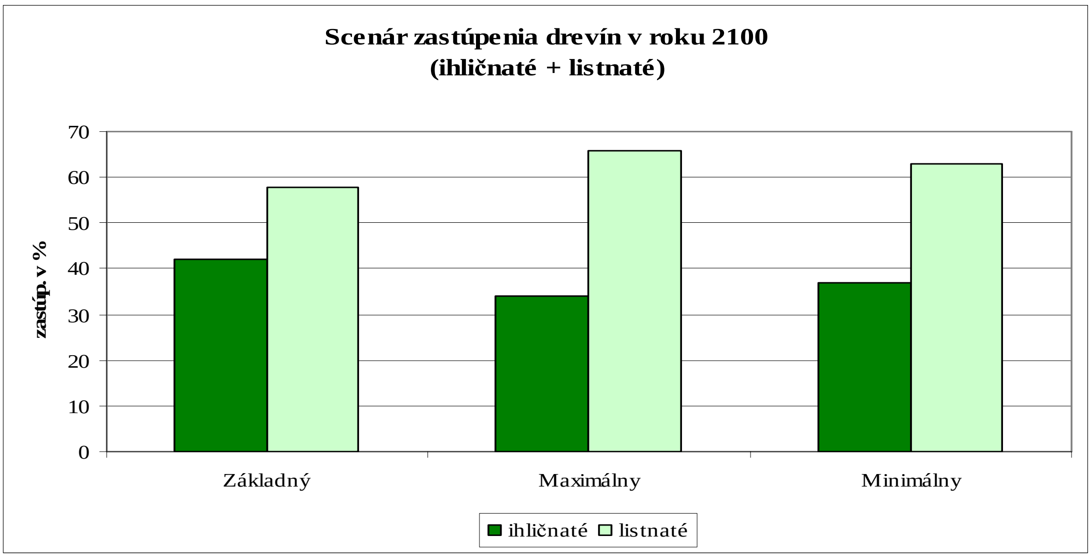

Figure 1: Scenario of the proportions of coniferous and broadleaved tree species in 2100

3.2 SCENARIO OF TREE SPECIES PROPORTIONS IN TIME HORIZON 2045 AND 2075

Table 3 Scenarios of forest tree species proportions in 2045 and 2075 for fir-beech (5th altitudinal vegetation zone)

Tree species	Year	Necessary measures		Suitable measures		Not necessary measures		Sum
		Ha	%	Ha	%	Ha	%	Ha
Beech	2045	3,24	0,0	12,96	0,01	99743,4	99,99	99759,6
	2075	3,24	0,0	16,2	0,02	99740,16	99,98	99759,6
Oak	2045	0,0	0,0	0,0	0,0	2517,48	100	2517,48
	2075	0,0	0,0	0,0	0,0	2517,48	100	2517,48
Spruce	2045	18435,6	9,52	25430,76	13,14	149713,9	77,34	193580,3
	2075	18017,6	9,31	24886,44	12,86	150676,2	78,1	193580,3
Fir	2045	29,16	0,08	1662,12	4,46	355752,2	95,46	37266,48
	2075	3696,84	9.92	7983,36	21,42	25586.28	68,63	37266,48
Larch	2045	3116,88	18,3	1172,88	6,78	13002,12	75,19	17291,88
	2075	3029,4	17,52	1130,76	6,54	13131,72	75,94	17291,88
Pine	2045	0,0	0,0	0,0	0,0	11482,56	0,0	11482,56
	2075	0,0	0,0	0,0	0,0	11482,56	0,0	11482,56

Source: NFC-FRI, final reports of research task "Impact of global climate change on the forests of Slovakia" 2007

By applying the results of the suitability of site conditions of some tree species for possible models of climate changes in time horizon 2045 and 2075 there were elaborated scenarios of tree species proportions for all altitudinal vegetation zones (Čaboun et al. 2008), tab. 3. In these scenarios there were considered also alternatives of necessary, suitable and not necessary implementation of forestry measures. This fact will reflect also in the economics of management and economic result. As an example of these scenarios for the year 2045 and 2075 there is given the 5th altitudinal vegetation zone (Čaboun et al. 2008).

4 QUANTIFICATION OF ECONOMIC IMPACTS OF CLIMATE CHANGE

4.1 QUANTIFICATION OF ECONOMIC IMPACTS ON THE BASIS OF NET YIELD

In derivation of economic impacts of climatic changes we can use extensive, intensive and relative economic indicators. Holécy et al. (2000) quantified climatic changes by means of extensive indicator of net current value of standing volume or net current value of forest stands. The author Šišák and Pulkrab (2004) expressed the impacts of climatic changes in nominal values of net yield or gross profit per ha of forest. In our case the quantification of economic impacts for the scenarios of possible tree species composition from Table 2 was done on the basis of total mean increment of net yield of coppice-with-standards at average felling age (TMIA) for given group of tree species (Tutka et al., 2003).

In fact it is average annual parameter at rotation age of limit net yield of main (regeneration) felling and aggregated felling yield of intermediate (tending) felling in Euro.ha^{-1} at felling age. The results of quantification of basic scenario of the change of tree species composition and scenarios expressing the impacts of climatic changes are given in Tab. 4, Fig. 2. It follows from the data the highest drop of annual yield in rotation in maximal scenario (mx) and minimal scenario (mn) of the impact of climatic changes in comparison with basic scenario (bs) was recorded for spruce –14.27 mil Euros (mx) and –6.24 mil. Euro (mn) (by –40% and by –17%). Slightly lower drop was recorded for fir (-39% and –13%). For coniferous tree species total drop of annual yield reached the value -14.84 million. Euro (mx) and -7.83 mil. Euro (mn) (by –31% and – 16%).

In the group of broadleaved tree species there was recorded according to the scenario mx and mn an increase of annual yields at felling age in comparison with bs for beech by +17% (mx), +6% (mn) and for oak by 23% (mx) and 17% (mn). An increase was recorded also for other forest tree species by 15% (mx) and 8% (mn). Drop of net yield was recorded only for hornbeam, namely by –28% (mx) and –6% (mn).

With expected shift of optimal vegetation conditions of tree species toward the north and to higher altitudes broadleaved tree species will obtain more area. Thus in sense of alternative scenarios of tree species composition their share in the production of net annual yield will increase as well. Proportionally to their proportion also total annual yield will increase but it will not compensate the loss due to expected drop of the proportion of coniferous tree species.

In the presented scenarios of tree species composition in 2100 (mx and mn) there will be a decrease of net annual yield of coppice-with-standards by –7% and –3%. Due to lack of knowledge in this field there were not taken into account during the calculation of economic impacts of climatic changes possible positive effect of adaptation measures, mainly in silviculture and felling, as well as the changes in the structure of utility of quality classes of timber (assortments).

Reality of the variant of economic quantification was preliminary verified by comparing of basic scenario of the development of tree species composition in 2100 with current state. The parameter of annual net yield at felling age 94.80 million Euro must be modified by discount rate (2.5%) to the real age of trees (60 years) felled in tending felling and regeneration felling. Then the area of forests, where regeneration felling is not carried out, must correct it and tending felling is carried out only to certain limits (25% of protected territories of the 5th degree, protective forests and protected territories of the 3rd – 4th degree). Then the value of net yield will be 34.35 million Euro, (94.80x0.45289x0.80), what is quite real parameter in comparison with economic result (gross profit) of the forestry of SR in the year 2004: 28.28 million Euro or in the year 2008: 32.00 million Euro. In those years also the volume of incidental felling was quite high and incidental felling affected the costs of forest production.

Table 4 Value of TMIA of net yield of coppice-with-standards in rotation period in 2100

Groups of tree species	**TMIA of net yield of coppice-with - standards in million Eur**			**Difference (drop) of TMIAof net yield of coppice-with-standards**		**Percent of change in comparing with basic scenario (%)**
	Basic scenario (Bs)	Maximal scenario (Mx)	Minimal scenario (Mn)	Maximal - basic scenario (Mx)	Minimal-basic scenario (Mn)	
Spruce	35,65	21,38	29,41	-14,27	-6,24	-40mx, -17mn
Fir	5,91	3,58	5,11	-2,32	-0,80	-39mx, -13mn
Pine	3,98	5,41	3,88	1,43	-0,10	+36mx, -0mn
Larch	2,89	3,25	2,19	0,37	-0,70	+13mx, -24mn
Dwarf pine	0,03	0,03	0,03	0,00	0,00	-0mx, -0mn
Other coniferous	0,03	0,00	0,03	-0,03	0,00	-0mx, +0mn
Conif. together	48,50	33,66	40,66	-14,84	-7,83	-31mx, - 16mn
Beech	25,73	30,04	27,32	4,32	1,59	+17mx, +6mn
Oak+ Turkey oak	16,66	20,51	19,58	3,85	2,92	+23mx, +17mn
Hornbeam	0,60	0,43	0,56	-0,17	-0,03	-28mx, -6mn
Other broadleaved	3,32	3,82	3,58	0,50	0,27	+15mx, +8mn
Broadleaved together	46,31	54,80	51,05	8,50	4,75	+18mx, 10mn
Coniferous + Broadleaved	94,80	88,46	91,71	-6,34	-3,09	-7mx, -3mn

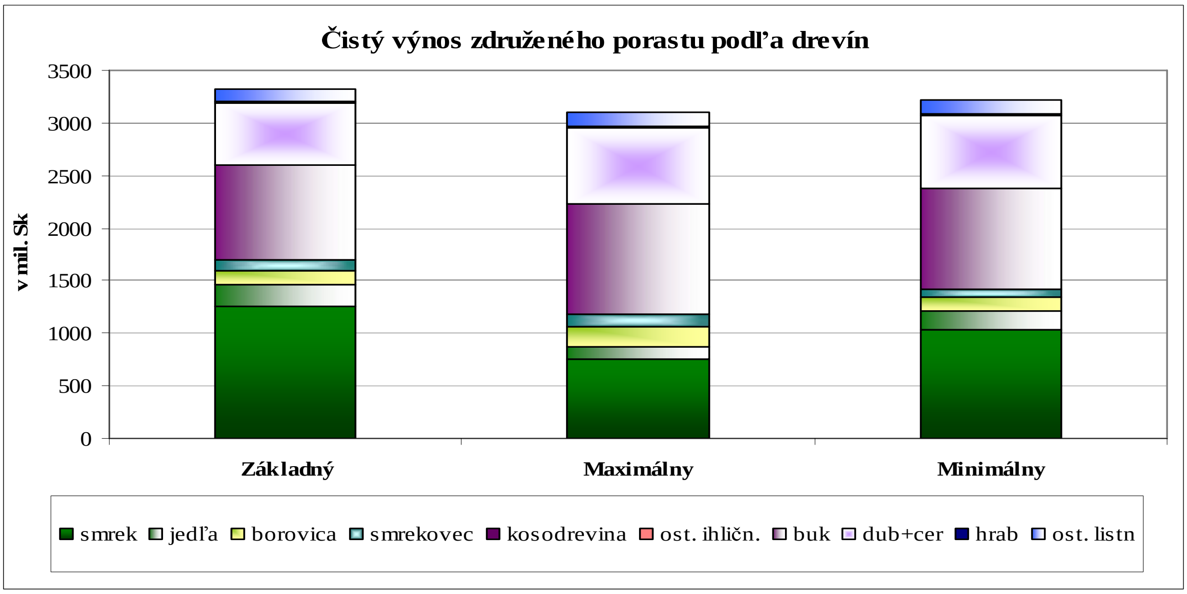

Figure 2: Net yield of coppice-with-standards according to tree species

4.2 QUANTIFICATION OF CLIMATE CHANGE IMPACT IN THE YEAR 2045 AND 2075

Table 5: Value of economic impacts of climate change in 2007, 2045 and 2075 in the 5th altitudinal vegetation zone (fir-beech)

Tree species	Year	Area together	Necessary measures		Suitable measures		Without measures		Yield together	Annual yield
			Area	Yield	Area	Yield	Area	Yield		
		Ha	Ha	Mil. Eur	Ha	Mil. Eur	Ha	Mil. Eur	Mil. Eur	Mil. Eur
Beech	2007	99759.6	0	0,000	9.72	0,047	99749.88	596,02	596,06	5,96
	2045	99759.6	3.24	0,008	12.96	0,063	99743.4	595,98	596,05	5,96
	2075	99759.6	3.24	0,008	16.2	0,079	99740.16	595,96	596,05	5,96
Oak	2007	2517.48	965.52	2,626	1490.4	8,107	61.56	0,41	11,14	0,11
	2045	2517.48	0	0,000	0	0,000	2517.48	16,70	16,70	0,17
	2075	2517.48	0	0,000	0	0,000	2517.48	16,70	16,70	0,17
Spruce	2007	193580	4344.84	14,409	15973.2	105,949	173262.3	1 401,51	1 521,87	15,22
	2045	193580	18435.6	61,141	25430.8	168,681	149713.9	1 211,03	1 440,85	14,41
	2075	193580	18017.6	59,755	24886.4	165,070	150676.2	1 218,81	1 443,64	14,44
Fir	2007	37266.5	592.92	1,894	4642.92	29,667	32030.64	249,60	281,16	2,81
	2045	37266.5	29.16	0,093	1662.12	10,621	35575.22	277,22	287,93	2,88
	2075	37266.5	3696.84	11,811	7983.36	51,012	25586.28	199,38	262,20	2,62
Larch	2007	17291.9	1108.08	1,082	648	1,265	15535.8	37,00	39,34	0,39
	2045	17291.9	3116.88	3,043	1172.88	2,290	13002.12	30,96	36,30	0,36
	2075	17291.9	3029.4	2,958	1130.76	2,208	13131.72	31,27	36,44	0,36
Pine	2007	11482.6	6.48	0,005	204.12	0,306	11271.96	20,60	20,91	0,21
	2045	11482.6	0	0,000	0	0,000	11482.56	20,98	20,98	0,21
	2075	11482.6	0	0,000	0	0,000	11482.56	20,98	20,98	0,21
Total	2007	361898	7017.84	20,016	22968.4	145,342	331912.14	2 305,13	2 471,38	24,70
	2045	361898	21584.9	64,285	28278.7	181,655	632211.66	2 152,87	2 398,81	23,99
	2075	361898	24747.1	74,532	34016.8	218,370	303134.4	2 083,10	2 376,01	23,76

Quantification of economic impacts of climate change according to the scenarios of tree species proportions in the year 2007, 2045 and 2075 was not implemented by the method Cost-benefit analysis as it was considered formerly in the methodology. With regard to high degree of uncertainty following from the absence of knowledge in partial tasks, which should be inputs for elaboration of initial "model forest stand" of the forests in Slovakia, quantification was carried out on the basis of net yield of coppice-with-standards (Tutka et al. 2003). Economic impact of climate change on the level of change in tree species composition and urgency of measures to be done in altitudinal vegetation zones in the year 2007, 2045 and 2075 was determined for all altitudinal vegetation zones but it is presented only for the 5th altitudinal vegetation zone (fir-beech) in table 5. From the data in before last column and in last column of the table it is obvious that changes in the yields between time levels occurred only with oak, spruce, fir and larch. The highest movement was between the year 2007 and 2045. Yield increase was recorded for oak and fir, while yield drop for spruce and larch. Between the years 2045 and 2075 there was registered only smaller change for fir, namely drop in yield.

4.3 QUANTIFICATION OF ECONOMIC IMPACTS ON THE BASIS OF THE VOLUME OF INCIDENTAL FELLING

Emissions of harmful admixtures into the atmosphere hinder solar radiation penetration, damage protective layer of the atmosphere or accumulate transformed and own radiation of the Earth. In this way they influence the ecosystems on the Earth directly by affecting growth processes and indirectly by own contribution to climate change. At the end of the 80s there was paid a great attention to SO_2 pollutants directly damaging the tissues and influencing the growth processes of forest tree species.

The dependence of total costs of some performances in silviculture and felling as well as economic result on the volume of incidental felling, being given by regression functions of the second degree, modified to actual cost level, is presented in Table 6-8. Correlation indicator, characterizing the level of explained relations of analysed variables, is except for timber transportation little or moderately significant with regard to the fact that whole basic set of organizational units of middle link of management was analysed. Other natural-production factors affected the total costs as well. To increase the significance of these effects it will be necessary to make stricter the selection of reporting units for the observation of given parameters.

With regression dependencies of the performances in silviculture (Tab.6) total costs of cleaning and silviculture are growing with the % of incidental felling. For the performance -artificial forest regeneration total costs grow to 50% of the volume of incidental felling and then they fall down by 100%. The level of the costs is higher than in case without incidental felling. For other performances in silviculture given in Tab.6 the total costs fall with increasing % of incidental felling.

Table 6: Dependence of the costs of respective performances in silviculture on the volume of incidental felling

Performance of forest production	$y = a+bx+cx^2$	y – costs of performances of forest production C – total costs	X_2 = % of incidental felling (X_2 – proportion of incidental felling total felling x 100)
	Kind of costs	**Equation**	**Correlation index**
Artificial forest regeneration	C	$y = 41\,412.8 + 227.97x – 2.219x^2$	0.1948
Care about young stands	C	$y = 5113.3 – 19.47x + 0.138x^2$	0.1305
Protection of young forest stands	C	$y = 4878.6 – 18.58x + 0.132x^2$	0.2099
Cleaning	C	$y = 6424.8 + 7.59x – 0.023x^2$	0.0814
Forest protection	C	$y = 67.1 + 0.048x – 0.0013x^2$	0.0815
Silviculture together	**C**	$\mathbf{y = 89\,891.8 - 132.35x + 5.42x^2}$	0.2099

Total costs per technical unit of the performances in felling and timber transportation (Tab. 7) decrease with the increase of the percent of incidental felling. For the performance - timber skidding they grow up to 50% of the volume of incidental felling and then with 100% of incidental felling fall down to the value being lower by 15% than in the case without incidental felling. Unit costs of timber handling show a decrease down to 50% of incidental felling and after that they grow above the value of absolute member of regression equation.

Table 7: Dependence of the costs of performances in felling on the volume of incidental felling

Performance of forest production	$y = a+bx+cx^2$	y – costs of the performances of forest production C – total costs	X_2 = % of incidental felling (X_2 – proportion of incidental felling to total felling x 100)
	Kind of costs	**Equation**	**Correlation index**
Timber felling	C	$y = 166.9 - 0.266x – 0.0027x^2$	0.3730
Timber skidding	C	$y = 255.9 + 1.96x – 0.0235x^2$	0.3976
Timber handling	C	$y = 128.5 – 1.603x + 0.019x^2$	0.2989
Timber transport	C	$y = 194.9 – 1.207x + 0.0046x^2$	0.7416

Parameter of economic result of main activities of forest production is very closely connected with the course of individual performances in silviculture and felling (Tab. 6 and Tab. 7). Economic result per ha of forest shows growing trend with % of incidental felling (Tab.8). In case of economic result per m^3 of felling its value grows up to 50% of incidental felling and then drops with 100% of incidental felling below the level of economic result without this felling effect.

Table 8: Dependence of economic results of main activities of forest production on the volume of incidental felling

Indicator	X_2 = % of incidental felling (X_2 – proportion of incidental felling to total felling x 100)	
	Correlation index	**Equation**
Economic results per ha of forest	0.44467	$y = 161.03 + 6.81x - 0.00598x^2$
Economic result per m^3 of felling	0.14631	$y = 98.8 + 0.998x - 0.0135x^2$

5 CONCLUSION

Nature character lies in the balance and in the cycles that maintain the life (Brown 2001). All waste of any human being in the nature provides nutrition for another living creature and thus it is recycled. At present production processes constructed and directed by a man respect this fact only to a small extent. Pressure on the use of ecosystems during last half of a century exceeded the limits of sustainable yield. Other reasons were that market prices for goods do not include costs from the sphere of the environment and social sphere.

By Dahl in Brown (2001) socialism has collapsed, as it did not allow the prices would reflect economic reality. Capitalism is being endangered by a collapse, as it does not allow prices to reflect ecological reality.

Solution could be applying ecological economics that would offer the world where the man and nature will be in harmony. Including the costs of the environment into the prices on products and services would reflect ecological reality and eliminate gradually negative contribution of a man to natural processes of global changes.

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Sense or sensibility - male and female private forest owners in Swedish forestry press

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Abstract

Traditionally, forest ownership and forestry in Sweden has been the men's domain. Today, however, 38 % of the private forest owners in Sweden are women. To examine to what extent women's ownership proportion is reflected in the forestry press and whether gender affects how the forest owners are depicted, articles on private forest owners from seven years of the forestry magazine "We Forest Owners" were studied. A quantitative examination of the numbers, range and placing of the articles in the magazine was performed, showing that the women do not get attention reflecting their proportion of ownership. Connotations in the headlines were assessed qualitatively by linking dominant words to stereotyped traits of instrumentality and expressiveness, revealing a gender bias in the depiction of the forest owners. Finally an analysis of the articles' photographs was conducted, evaluating the portrayal of the forest owner. The findings corresponded to the result of the headline analysis, showing gender biased visualization of female forest owners.

Key words: gender, forestry, private forest owner, press
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1 INTRODUCTION

Forest ownership and forestry has traditionally been the men's domain. The traditional gender order has long affected the Swedish family forestry, and still does (Lidestav 2008). In spite the fact that the proportion of female forest owners has increased markedly in recent decades, the idea of the forest being a masculine arena has not been broken. Forestry remains largely as the men's field of action despite the fact that today's forest management to a high extent can be managed from the desktop at the same time as the practical forest work has become easier (Törnqvist 1995). Even when the owner of a

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forest farm is a woman, the one primarily responsible for the forest management is usually a man, possibly the co-owning spouse, a son in law or a forest officer. Women have often been depicted, or described themselves, as being in need of a male mentor to enter the field (Lidestav and Sjölander 2007). Many women seem to be trapped in a subordinate position compared to men when it comes to the management of the family forest farm. While male forest owners rely mostly on their own abilities and skills for the practice of the forest farm, women put at greater faith in the forest inspector (Torstensson 2009).

There have been many efforts to highlight the presence of female forest owners and their potentials. Women have evidently entered the forest owning community permanently and a concrete example of their intentions to develop as forest owners are the variety of support organizations for female forest owners that have been set up by women, such as "The black woodpecker" (Spillkråkan) with some 300 members (Flyckt 2008). Also within forestry research, where research projects with an applied gender perspective have not been frequent much more than a decade (cf. Lidestav 2000), many projects focusing on women and forestry are today introduced, producing knowledge that can be of strong support for the development of legitimacy of women in the male dominated field of forestry.

A relevant issue, connected to the perception of women's capability of managing forests and forest farm based businesses, is how women are portrayed in forestry media. The traditional gender order has long affected the Swedish family forestry, and still does (Lidestav 2008). The question would be if media, addressing family forest owners, has broken free of this tradition, or if it is conserving the gender order, potentially making the readers consider women as lacking the potential to succeed in the role as a forest farm owner (cf. Lidestav and Sjölander 2007).

The aim of this paper is to examine if the attention that female private forest owners receive in forestry press reflects their owner representation, and if the sex of the forest owner portrayed in media matter in the description and visualization of him or her.

2 WOMEN IN SWEDISH FORESTRY

The tradition of men as the statutory and natural heir to the parents' forest holdings was long persistently strong in Sweden. In a study of farmers in the 2000th century, Flygare (2001) found that the families actively selected one of the sons to become the heir of the farm. It was a thoroughpaced approach, where the succeeding son already in early years was encouraged to actively participate in agriculture. The whole family, the father as well as the mother and sisters, was involved in encouraging the son's interest. As a consequence the son's interest and all the work he already had put into the farm became the main arguments for him being the farm's new owner after the parents (Flygare 2001). The role of women in agriculture at the farm was as replacement - the standard applied was that women could only take on male tasks as long as no man was available. The woman's ordinary work was domestic and livestock, while the male work was the land-based production (Flygare 2001). This may well be translated into the conditions for family forestry, as agriculture land and forest land historically have been linked together. The differences between men and women's roles in forestry is however even greater in comparison to farming, where women rarely participated in the forest work at all, except for the collecting and chopping of firewood, a task that did not have high status among men (Johansson 2000).

In a historical perspective, it is a relatively short period of time that women in marriage have had equal rights to ownership and management. The provisional regulations stating that some women's real properties were to be managed by the male spouse weren’t abolished until 1950. This means that many forest owners of today have grown up in families where a woman's right to the management of her forest was not taken for granted (Lidestav, Engman et al. 2000). It is reasonable to assume that this way of looking at things still affects women in their willingness and ability to manage a forest farm (S:son-Wigren 2004). Possibly it could, at least partly, also give reason for some of the differences between male and female forest owners that have not yet been fully explained; it is for example confirmed that female forest owners' properties on average are smaller than male owners’ and that the forestry activity is lower on forest properties owned by women (Lidestav 1998). The number of women who themselves are involved in forestry activities is also underrepresented in comparison to men in relation to ownership proportions (cf. Lindroos 2005). The difference is least for forest management activities such as planting and clearing, while the largest difference found is for cutting and roundsmen of wood.

Gender-neutral laws and changed policies have, however, contributed to a development that have resulted in a nearly doubling of female forest ownership over the last thirty years, from about 20 percent in 1976 to almost 40 percent in 2006 (Lidestav 2008). In the time span of the published magazines studied in this paper, 2002-2009, the proportion of ownership has been somewhat stabilized at approximately 38 % (Skogsstyrelsen 2003; Skogsstyrelsen 2009). This increase in the number of female owners has, for example, proved through the expansion of women's networks for forest owners which started to spread mainly in the 90s (ATL 2009) in a time period characterized by an emerging women's movement in rural and sparsely-populated areas (Rönnblom 2008). Just like gender division of labor creates bases for solidarity among women (Connell 1987), many women have chosen not to wait for a self-generated change, but have taken matter into their own hands.

Increased female participation in forestry and forest management can challenge male dominance. In an analysis of the construction of masculinity over a 20-year period in the Norwegian Forest Owners' Federation’s member magazine, Brandth & Haugen concludes that a change of the masculinity became visible during the 1980s, partly as a reaction to the women's entry into forestry, manifested for example by the founding of the organization “Girls in Forestry” (Brandth and Haugen 2000).

The benefit of more women entering and succeeding in forestry have not yet been fully explored, although there are many opinions of the potential advantages, such as the intention among many women to connect forestry development with community development (cf. Arora-Jonsson 2008). Lidestav and Sjölander (2007) have identified three main types of arguments used for increasing the number of female forestry workers; to compensate for a predicted lack of labor in the industry as well as maintaining a workforce in the countryside, to function as modernizers in a conservative culture in need of change and, finally, to achieve legitimacy for the forestry field which suffers from gender inequality.

There is no doubt that it can be hard for a woman to achieve credibility within the traditionally masculine field of forestry. The typical masculine traits for male foresters are prevailing; strength, energy and toughness are words for this masculine stereotype (cf. Brandth and Haugen 2000). Since these stereotyped traits are assigned to the man who for so long has been the image of a successful forester, the challenge for women could be perceived as to contest these traits as necessary for doing well as a forest owner (cf. Connell 1987).

The idea and use of stereotypes is connected to gender roles. Psychologists often see role theory as a form of social determinism, stressing the way individuals are trapped in stereotypes. In that way, stereotyped interpersonal expectations are social facts, made effective through the rewarding of conformity, and likewise the punishing for departures from these expectations (Connell 1987). Gender roles could be described as the existence of different expectations on men and women. There is no doubt that the idea of men and women having very different ways of thinking, feeling and acting has left its mark not only on history but also in the modern society of today (Spence and Buckner 2000). Early theorists have been using the terms instrumentality and expressiveness, two personality dimensions that they have applied when suggesting that men and women have inherited characters. Thus, men were assumed to have greater instrumentality and women to have greater expressiveness. Some theorists have proposed these traits to be inborn, other have suggested that men’s greater instrumentality and women’s greater expressiveness to be the result of society’s gender-role distinctions (Spence and Buckner 2000).

Although the idea of instrumentality, corresponding to masculinity, or expressiveness, corresponding to femininity as inborn traits have been heavily opposed (cf. Spence and Buckner 2000), the social and cultural impact on the gender roles in old centuries’ family forest farming could, on the other hand, be satisfactorily applied. The tradition of a son to be raised as the obvious heir to the family estate, a practice supported by the entire family and facilitated trough knowledge transfer from the father in particular (Lidestav and Ekström 2000, quoted from Lidestav 1998) can be considered as a process of socialization, supposedly starting very soon after birth. A similar construction of femininity and masculinity proceeds within family forest ownership where a genderization likely to affect the forest management behavior is preserved by, for example, a lower participation among women at forestry education and training courses (Lidestav and Ekström 2000). Regarding genderization as a process of socialization, the construction and use of language becomes of interest. Language constitutes society and reality, thus making the language not a tool for depicting reality, but is in itself the source to reality (van Zoonen 1994). The language used in media therefore plays a significant role in how we perceive reality. The language or photographic images as well, used in forestry press is therefore not only relevant for assessing the prevailing discourse and existing notions of gender issues. It has some inherent power to dictate to the reader what reality is valid, for example to what extent women are suitable to perform various tasks connected to forestry farming (cf. Lidestav and Sjölander 2007).

3 MATERIAL AND METHOD

For the study of female forest owners’ representation and depiction in media, the forestry magazine We Forest Owners (*Vi Skogsägare*) was chosen. The magazine is primarily distributed as a member benefit to a large proportion of private forest owners in Sweden – those who are connected to one of the four major private forest owner associations. The magazine is distributed six times per year with a circulation of 96 700 copies (Tidningsstatistik AB 2008). In addition to the magazine's large circulation, it is particularly suitable in the study since it, logically enough, often includes reports on private forest owners and their activities. All 42 issues of the magazine from a period of seven years, from No. 3 in 2002 to No. 2 in 2009, were studied.

The focus of the study is on private forest owners and their forest farm based activities, either traditional forestry or alternative business, alternatively a combination of those activities. To be included in the study, the articles were to report on Swedes with private forest farms. It had to have a quite distinct focus on the person in question as a forest farm owner along with his or her forest management or businesses strongly connected to the estate being a forest farm. Self-descriptive articles were excluded. Reports on forest owners as being elected representatives, successful wood processing professional and so forth were also excluded, unless the forest ownership or the farm based businesses was far more than a minor side issue.

A quantitative analysis was performed in order to measure to what extent male respectively female forest owners were represented in the magazine. Initially, the main actor of each article was defined. When more than one person was described and interviewed in the report, making the main actor less obvious, most often occurring when the reporter made an article on a family, the main actor was defined from the amount of text given to the different actors in the article. The number of articles for men respectively women was identified as well as the page distribution and the placing in the magazine.

In the next step, the headlines were subjected to a qualitative analysis. The underlying assumption was that the headline represents a condensed version of the contents in the article, an assumption that showed consistency when reading the full articles. The headlines were chosen for analysis, since they possibly plays the largest role when it comes to sending a message to the reader about the article’s content; irrespective of whether the article is fully read or not, depending on the readers interest in the subject, it is most likely that at least the headline will be read. Since the number of relevant articles identified is restricted to 36, a content analysis was abandoned in favor of semiotics, focusing on the choice and combination of words in order to analyze the construction of particular meanings (cf. van Zoonen 1994) . The level of analysis here was the possible connotation in the headlines, potentially revealing a more or less conscious message of how the main actor in the article should be interpreted by the reader. The headlines were evaluated with the objective to identify conceivable meanings produced bearing reference to the representation of gender. As a tool for this aim, the two personality dimension instrumentality and expressiveness were used to function as collective points for recognized stereotypes of male and female traits in order to facilitate an evaluation of whether different meanings were produced depending on the sex of the main actor in the article (cf. Spence and Buckner 2000). The included headlines were then analyzed with respect to the mediated essence. In order to refine the assessment by reducing ambiguousness, the dominant (cf. Ongstad 1999) word, or group of words, was appraised and focused on. All in all, eight representative traits could be drawn up, which subsequently were linked to instrumentality or expressiveness, four traits for each dimension.

The headlines, occasionally enclosing more than one mediated trait, were categorized as either an expression of instrumentality, expressiveness or as neutral; the latter category implying either that the meaning produced seemed unbiased in relation to the two dimensions, or including ambiguousness in the interpretation of the signification of the enclosed traits.

Table 1: *The identified traits unfolding the essence of the message, linked to instrumentality or expressiveness.*

Instrumentality	Expressiveness
sense (reason, logic)	sensibility (emotionality, feelings)
rationality (efficiency, productivity)	aesthetics (beauty, art)
business acumen (management, profitability)	romanticism (love, family, sentimentality)
strength (power, speediness, adaptability)	softness (sensitiveness, weakness)

Finally, a quantitative picture analysis was carried out with the purpose of studying how the main actor is visualized with respect to the stereotyped image of the competent forester being in possession of masculinity, manifested by hard work and the use of powerful tools or heavy machinery (cf. Brandth and Haugen 2000). For this analysis, the largest photo showing no other person than the main actor was chosen in order to establish how the main actor is brought out when only he or she was displayed. When no picture showing solely the main actor was available, the largest photograph of all was chosen for analysis, provided that the main actor also was in the picture.

Two principal variables in the pictures were chosen; “work” and “machinery or tools”. First, the occurrence of work being performed or simulated for the photographer was identified, as well as the distinguishing between physically heavy work and lighter work. Heavy work is here defined as the specific task being executed either demands quite some muscle strength or is presumed to result in an increased pulse or induced perspiration. Secondly, the presence of machinery or tools that were handled by the main actor, or put on deliberate display, was identified, including the distinguishing between lighter tools and heavier tools or machinery. Lighter tools are here defined as not demanding any substantial strength or effort in order to use, such as a small knife.

4 RESULTS AND DISCUSSION

4.1 THE ARTICLES

In the 42 issues of We Forest Owners, 36 articles met the stated criteria, reporting on private forest owners and their forest farms based business activities. In 27 (75 %) of these articles, the main actor was a man and in 9 of them (25 %) the main actor was a woman.

In all, the articles were of 87.3 pages (each article measured with the accuracy of one tenth of a page), divided on 68.1 pages for articles with male main actors and 19.2 pages with articles with a female main actor. The average range for an article with a male main actor was thus 2.5 pages, 18 % more than the 2.1 pages of average for articles in which the main actor is a woman. Conclusively, of the total space dedicated to articles about private forest owners and their farm based activities, 78 % was given to articles where a man was the main actor and 22 % was given to articles in which the main actor was a woman.

There was a large variation in between the issues regarding where in the magazine the relevant articles were placed, ranging from page 12 to 62 (page 12 to 62 for the men and page 12 to 54 for the women). However, the average starting page for articles with male main actors was 28 and for articles with female main actor, the average starting page was 34.

There is an obvious underrepresentation of female forest farm owners. Considering the fact that 38 % of the private forest owners are women, this is not made visible in the magazine. As shown, it is not only a matter of men being overrepresented as forest farm owners in numbers; more space is dedicated to them as well as a more prominent placing in the magazine, i.e. closer to the beginning. The result of these three variables combined implicates that women are dedicated a subordinate significance as private forest owners.

An objection to this interpretation could be that no regard has then been shown to the attention given to women in articles with male main actors, for example the role of the wife, meaning that women might be given more space than apparent when focusing solely on the main actor of the article. An examination of the articles where a man is the main actor shows that in 48 % of them, the wife's role was paid attention to or at least mentioned. However, the corresponding proportion for articles with female actors was

Table 2: *Articles in We Forest Owners, reporting on private forest owners; the sex of the main actor, page volume and placing of the article*

Issue	**Sex, main actor**		**Number of pages**		**Starting page**	
	Male	*Female*	*Male*	*Female*	*Male*	*Female*
No 3, 2002		1		1,0		14
No 6, 2002	1		2,5		30	
No 4, 2003	1		1,0		33	
No 4, 2003	1		1,7		28	
No 5, 2003	1		3,0		36	
No 6, 2003		1		2,3		18
No 4, 2004	1		1,8		15	
No 5, 2004	1		2,7		28	
No 1, 2005	1		3,5		33	
No 2, 2005		1		2,8		28
No 2, 2005	1		2,0		15	
No 5, 2005	1		1,5		17	
No 5, 2005	1		3,0		15	
No 6, 2005	1		1,8		24	
No 6, 2005	1		2,0		23	
No 2, 2006		1		3,0		44
No 3, 2006	1		2,5		12	
No 3, 2006		1		2,0		48
No 3, 2006		1		1,3		54
No 5, 2006		1		2,5		12
No 1, 2007	1		3,0		22	
No 2, 2007		1		1,8		50
No 2, 2007	1		3,0		12	
No 3, 2007	1		3,5		60	
No 3, 2007	1		3,0		26	
No 4, 2007	1		1,5		28	
No 5, 2007	1		3,5		16	
No 6, 2007	1		3,0		44	
No 1, 2008	1		1,6		22	
No 2, 2008	1		3,0		28	
No 3, 2008	1		2,5		62	
No 3, 2008	1		4,0		42	
No 4, 2008		1		2,5		34
No 4, 2008	1		1,5		40	
No 5, 2008	1		4,0		32	
No 6, 2008	1		2,0		16	
Sums	**27**	**9**	**68,1**	**19,2**		
Mean values			**2,52**	**2,13**	**28,11**	**33,56**
Proportional	**75,0 %**	**25,0 %**	**78,0 %**	**22,0 %**		

44 %, showing that men also get attention in these articles as well. Still, even though there is chance that the result would have been somewhat different if measuring all words and pictures and connecting them to the sex, the fact remains that someone was made main actor, with the highest share of attention. And that someone was, relatively after adjusting for the lower owner representation, seldom a woman.

4.2 THE HEADLINES

Table 3 shows the headlines, the assessments of the dominant words creating meaning and the applicable dimension. Some of the meanings were lost in translation in between Swedish and English. The expression "Jack-of-all-arts", for example, conveys a straight message of strength, focusing on capability. The term used in the headline in Swedish is "tusenkonstnär", which conveys both a palpable meaning of aesthetics as well of a meaning of capability.

In the headlines, the choice of words and wording, or choice of quotation, produced in most cases a fairly clear undertone, particularly visible through the dominant words. The production of a meaning suggesting that a story of a sensible, strong, productive or in business successful person can be anticipated by the reader was by far the foremost common when the main actor in the article was a man. Nearly four out of five (78 %) men were casted with these traits of instrumentality. The corresponding share for female main actors was a third (33 %). For female main actors, the most common implication was that of expressive traits; four of the women (44 %) had this meaning produced by the dominant word or words in the headline which can be compared to only 15 % of the men. However, the difference between the number of headlines producing a tenor of expressive qualities to the woman and the number of headlines implicating traits of instrumentality was negligible; three women had this meaning produced in the headline (33%). Very few of all articles headlines did not produce any clear connotation regarding gender when interpreting the dominant words. An absence of specific traits or a presence of contradictory traits was found in only 11 % of the articles analyzed, distributed to 7 % for men and 22 % for women (two articles each).

The result shows that the men, with the headline as a carrier, generally have been assigned traditional masculine traits. They therefore fit well into the traditional, stereotyped view of men as the suitable sex for the heavy and technology-intensive work of forestry. Very few men were assigned expressive, neutral or ambiguous traits. Among the articles with female main actors, the result is altogether quite neutral. If only the women's articles would have been studied, it would have been tempting to draw the conclusion that there is no gender bias. However, it is in comparison to the men's articles that the bias is visible. Women don't seem to have gained the benefit of being depicted as able to master the sometimes quite sturdy and physically trying work that can be found at a forest farm.

One could argue that the persons responsible for the headlining don't intend to depreciate the women's capacity for forestry or other traditionally male-dominated work but instead merely try to bring forth the skills and advantages that the women in question have, such as being good at sewing, baking or growing flowers, all skills being accounted for in the articles. That would seem to be a reasonable argument, at least when evaluating the articles individually. However, what speaks against it is the way the reporters', or perhaps rather the editors, make a system of their choice of headlines. For example, the masculinity traits of the

***Table 3**: The headlines of the articles deconstructed into dominants and assessed with traits. Columns with female main actors' articles are shaded*

			Instrumentality		**Expressiveness**		**Neutral**	
Headline (dominant words are underlined)	**Trait(s)**	**Dimension**	*Man*	*Woman*	*Man*	*Woman*	*Man*	*Woman*
Grandpa **awakened the love** for the forest	sensibility, romanticism, softness	Expressiveness				1		
He **sees the opportunities** in the forest	business acumen, strength	Instrumentality	1					
The horses pull logs and tourists	aesthetics, rationality	Neutral					1	
Build a sauna or **throw spears** at Sjögetorp	strength	Instrumentality	1					
"I **have** the whole forest **in my head**"	sense	Instrumentality	1					
Norrlandish foresters must be **Jack-of -all-arts**	aesthetics, strength	Neutral						1
Quality trees **in less than a minute**	strength	Instrumentality	1					
A bit of **flexibility** is never wrong	rationality, strength	Instrumentality	1					
Trout reward for successful forestry	romanticism, business acumen	Neutral					1	
Elisabeth took over the **family farm**	romanticism	Expressiveness				1		
Firewood sale **successful investment**	business acumen	Instrumentality	1					
"It's important to **go your own way**"	strength	Instrumentality	1					
Inventiveness gets the farm to flourish	sense	Instrumentality	1					
First breakeven - then the **profit comes**	business acumen, strength	Instrumentality	1					
Idea of a both new and old processing **lands softly** on the market	softness	Expressiveness			1			
Flourishing forest interest	aesthetics, softness	Expressiveness				1		
Shoulders the processing **all the way** from forest to house	strength	Instrumentality	1					
Sewing machine and chainsaw **excellent supplements**	rationality, strength	Instrumentality		1				
Nourishing forest product	rationality, business acumen	Instrumentality		1				
New opportunities in the binoculars	strength	Instrumentality		1				
At the same forest farm for **fifteen generations**	strength	Instrumentality	1					
The forest work is the best **relaxation**	softness	Expressiveness				1		
The dogs **a driving force** for the family's forest farm	strength	Instrumentality	1					
Inventor from Bureå **manages giant dimensions**	strength	Instrumentality	1					
Here **opportunities** for even greater growth **are showed**	business acumen	Instrumentality	1					
They are **living the life** on the forest farm	romanticism	Expressiveness			1			
The forest and the tourism **benefits** from cooperation	strength	Instrumentality	1					
Detailed planning is the key to the future	sense, business acumen	Instrumentality	1					
First with saw line at farm level	strength	Instrumentality	1					
Mattias' rolling business **gives strength** to the forest farm	strength	Instrumentality	1					
Cultivating joy with a great variety of trees	sensibility	Expressiveness			1			
Historic treasure was in hiding at the old farm	romanticism	Expressiveness			1			
Belief in the future at the edge of the tundra	sensibility, strength	Neutral						1
Good spin at the farm	strength	Instrumentality	1					
The forest an exciting **challenge**	strength	Instrumentality	1					
He cut branches that **turn into money**	business acumen	Instrumentality	1					
		Number of articles	21	3	4	4	2	2
		Prop. of all articles	**78 %**	**33 %**	**15 %**	**44 %**	**7 %**	**22 %**

dominant words can be challenged when looking at the full sentences of the headlines in the three articles that were assigned to the instrumental dimension. In the first headline a sewing machine is mentioned. In the second headline the word “nourishing” is used which is the translation of the Swedish word “matnyttig” which literally means “good for food”. In other words, the connection to housework, traditionally the work for women at farms (cf. Britt, Niskanen et al. 2001), is thereby obvious in these headlines. The third article’s headline speaks of “opportunities”, which was judged to be an instrumental traits as linked to strength (as in being able to spot opportunities), however not the most obvious connection to instrumentality and masculinity. The conclusion therefore is that there appear to be a convention that a female forest owner is not to be described as strong, powerful, business oriented and so forth, at least not without enclosed descriptions of more expressive, feminine traits, no matter how similar to men’s their activities are.

4.3 THE PICTURES

55.6 % of the male main actors and 44.4 % of the women in the main pictures had their picture taken while actually working, or having assumed a posture as if they were working. Of the men working, 40 % of them (22.5 % of all men) had their picture taken while performing physically heavy task, as in carrying something heavy like a large wooden baulk or drilling a hole with a large hand drill and so forth. None of the main pictures of a female main actor included the displaying of heavy work being performed.

In the main pictures, a fourth of the male main actors (25.9 %) were portrayed using, or posing next to, heavy machinery such as forest machines or small scale saw mills. None of the female main actors had any heavy machinery in their main picture. Including all kind of machinery or tools no matter size, only one woman (11 %) was portrayed handling a tool, which can be compared to 51.9 % of the men. The tools that the men were using were of both heavier and lighter types, ranging from brush cutters to, as in one case, a remote control. The woman in question was using a knife with which she was opening a cardboard box.

The conclusion of the analysis of the pictures is somewhat similar to the conclusion made from the headline analysis. The absolute absence of main pictures showing women at heavy work, or being in the same picture as heavy machinery or heavier tools, supports the image of forestry not being a natural domain for women. There are pictures showing forest work being performed in three of the articles with female main actors, in which the women use chain saws. However, in none of these article that kind of picture was chosen to be the largest. Instead, pictures of the woman talking in a cell phone, showing her dressmaker's workshop or kneading dough were given the largest space. In line with the reasoning regarding the headlines analysis, one could argue that these women are portrayed as having many pursuits. Yet again, it is the systematic nature of the selection that is interesting. There was not a single main picture that seriously could challenge the stereotyped image of women being weak. Instead the consistent choice was to not portray women as primarily skilled in, or physically fit for, traditional forestry.

Adding up the three analyses, it is an important question to raise whether the women's under representation in the magazine as well as the lack of emphasis of their qualities as foresters could be explained by the fact that the historically high proportion of ownership of today has appeared in a relatively short period of time. Thus, the argument would be that women have not yet entered the field of active forestry or forest farm related activities in a proportion that corresponds to their owner representation. As a consequence there would be a proportional lower number of articles since there would be less to report on, i.e. fewer female active forest farm owners. That would be a credible explanation. However, that would not explain why those women reported on, evidently being active forest farm owners, in average are dedicated shorter articles or a have been granted a less prominent placement in the magazine in comparison with men. Furthermore, that would neither explain the in comparison with men relatively few advantageous instrumental traits connotated in the headlines introducing a report on a woman, nor give reason to the lack of emphasis on women's qualities as foresters in their main pictures.

5 CONCLUSION

Two main conclusions can be drawn from the analyses in this paper. First, women have not yet received attention in forestry press that corresponds to their ownership representation in private forests. In relation to their ownership proportion, they are granted fewer and shorter articles with less prominent placing in comparison to men. Secondly, when the private forest owner is a woman, she tends to be described and visualized as subordinated men regarding the ability to perform traditional forestry. Instead, their legitimacy as forest farm owners is obtained mainly through alternative activities, often associated with traditional women's work. The existence of a palpable gender inequality among male and female forest owners is apparent and elucidated by the press' portrayal of the man as the perfect cut for the field of forestry.

APPENDICES

List of the articles with the headlines in the original language (Swedish)

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Appendix List of the articles with the headlines in the original language (Swedish)

Issue	Sex	Headlines in English	Headline in Swedish (original language)
No 3, 2002	Woman	Grandpa awakened the love for the forest	Morfar väckte kärleken till skogen
No 6, 2002	Man	He sees the opportunities in the forest	Han ser möjligheterna i skogen
No 4, 2003	Man	The horses pull logs and tourists	Hästarna drar timmer och turister
No 4, 2003	Man	Build a sauna or throw spears at Sjögetorp	Bygg bastu eller kasta spjut på Sjögetorp
No 5, 2003	Man	"I have the whole forest in my head"	"Jag har hela skogen i huvudet"
No 6, 2003	Woman	Norrlandish foresters must be a Jack-of -all-arts	Norrländsk skogsbrukare måste vara tusenkonstnär
No 4, 2004	Man	Quality trees in less than a minute	Kvalitetsträd på mindre än en minut
No 5, 2004	Man	A bit of flexibility is never wrong	En gnutta flexibilitet är aldrig fel
No 1, 2005	Man	Trout reward for successful forestry	Öringen belöningen för lyckat skogsbruk
No 2, 2005	Woman	Elisabeth took over the family farm	Elisabeth tog över släktgården
No 2, 2005	Man	Firewood sale successful investment	Vedförsäljning lyckad satsning
No 5, 2005	Man	"It’s important to go your own way"	"Det gäller att gå sina egna vägar"
No 5, 2005	Man	Inventiveness gets the farm to flourish	Idérikedom får gården att blomma
No 6, 2005	Man	First breakeven - then the profit comes	Först plus minus noll - sen kommer vinsten
No 6, 2005	Man	Idé om nygammal förädling landar mjukt på marknaden	Idé om nygammal förädling landar mjukt på marknaden
No 2, 2006	Woman	Flourishing forest interest	Blomstrande skogsintresse
No 3, 2006	Man	Shoulders the processing all the way from forest to house	Axlar förädlingen hela vägen från skog till hus
No 3, 2006	Woman	Sewing machine and chainsaw excellent supplements	Symaskin och motorsåg utmärkta komplement
No 3, 2006	Woman	Nourishing forest product	Matnyttig skogsprodukt
No 5, 2006	Woman	New opportunities in the binoculars	Nya möjligheter i kikaren
No 1, 2007	Man	At the same forest farm for fifteen generations	På samma skogsgård i femton generationer
No 2, 2007	Woman	The forest work is the best relaxation	Arbetet i skogen är den bästa avkopplingen
No 2, 2007	Man	The dogs a driving force for the family’s forest farm	Hundarna en draghjälp åt familjens skogsgård
No 3, 2007	Man	Inventor from Bureå manages giant dimensions	Uppfinnare från Bureå klarar jättedimensioner
No 3, 2007	Man	Here opportunities for even greater growth are showed	Här visas möjligheter för ännu bättre tillväxt
No 4, 2007	Man	They are living the life on the forest farm	De lever livet på skogsgården
No 5, 2007	Man	The forest and the tourism benefits from cooperation	Skogen och turismen vinner på samarbete

No 6, 2007	Man	Detailed planning is the key to the future	Detaljerad planering är nyckeln till framtiden
No 1, 2008	Man	First with saw line at farm level	Först med såglinje på gårdsnivå
No 2, 2008	Man	Mattias' rolling business gives strength to the forest farm	Mattias rullande företag ger drag åt skogsgården
No 3, 2008	Man	Cultivating joy with a great variety of trees	Odlarglädje med massor av trädslag
No 3, 2008	Man	Historic treasure was in hiding at the old farm	Historisk skatt gömde sig i den gamla gården
No 4, 2008	Woman	Belief in the future at the edge of the tundra	Framtidstro vid kanten av tundran
No 4, 2008	Man	Good spin at the farm	Bra snurr på gården
No 5, 2008	Man	The forest an exciting challenge	Skogen en spännande utmaning
No 6, 2008	Man	He cut branches that turn into money	Han klipper grenar som blir till klöver

Legitimacy of forest policy in Finland –forest owners' and other citizens' perspectives

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Abstract

Forest policy should enhance the sustainable production of the material and immaterial benefits of forests to serve the needs of all citizens, including forest owners. The information on legitimacy perceptions of citizens is essential for policymakers to avoid friction and conflicts concerning environment. The differences in the perceptions on forest policy between Finnish forest owners and other citizens were studied by a nationwide mail survey. The questionnaire measured the overall *legitimacy* of the forest policy, *the acceptance of laws*, *the justice of the procedures, the acceptance of power relations*, *the acceptance of forestry operations.* The overall legitimacy was evaluated positively and the forest owners considered forest policy in general more acceptable than other citizens. The most critical acpects in evaluating legitimacy were the justice of the procedures and the use of clearcuttings. The acceptance of power relations of different stakeholder groups was important for non-owners but not for forest owners. Forest policy competence was negatively associated in legitimacy formation in both groups; the more people knew about forest policy, the more critical they were. The essential challenges for designing more legitimate forest policy are to have a wider perspective on benefits of forest and to allow more flexible forest management practices, for instance uneven-aged forest management.

Key words: forest policy, Finland
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1 INTRODUCTION

Legitimacy of forest and nature conservation policy has emerged as crucial question in conflicting claims for intensive forestry and biodiversity conservation. Climate change has raised the issue of increasing use of wood-based bioenergy - but also demands to

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conserve biodiversity for better adaptation in changing climate. For the smooth functioning of society is essential that policy is perceived legitimate. The concept of legitimacy refers to citizens' consent to the governance and institutions of policies.

Legitimacy is defined by social psychologists as "the belief that authorities, institutions, and social arrangements are appropriate, proper and just." Legitimacy is a property that leads people to defer voluntarily to decisions, rules and social arrangements. (Tyler 2006) It is also seen close to satisfaction to the system, and reliance to the system. The information on legitimacy perceptions of forest owners and the public at large – and potential differences in their views - helps policymakers to avoid friction and conflicts concerning environment. Understanding the changing values in society is focal for retaining the legitimacy of the forest policy and when it comes to the crunch, the problems of the policy can be detected. When the citizens accept the exercise of power, carrying out decisions is easier, the degree and quality of private and public actors' cooperation improve and fewer attacks towards the system occur.

Forest policy has effects on divergent citizen groups. Forest policy regulates the management of all forests despite the ownership. Non-industrial private forest owners possess some 60 % of forest land in Finland and every fifth Finn is a forest owner (Karppinen et al. 2002) Furthermore, Everyman's right provides free access to forests for all citizens regardless of ownership for recreational activities (e.g. picking berries and camping). Forest policy should enhance the sustainable production of the material and immaterial benefits of forests to serve the needs of all citizens: forest owners and non-owners. Decision makers in forest policy operating in the conflicting field should have knowledge on citizens' opinions. For this purpose, survey studies provide a reasonable way to get grounded and generalized information.

Despite the importance of private forests, few studies have directly compared the differences in the forest attitudes between ordinary citizens and non-industrial private forest owners. In Finland, Karppinen and Hänninen (2000) examined the attitudes of the Finnish public and forest owners towards the forest conservation and the economic utilization of forests. They identified four attitude groups: 1) citizens who supported either increased forest utilization or 2) increased forest conservation, and rejected the alternative, 3) multifunctionalists who supported both increased conservation and economic utilization of forests, and. 4) indifferent citizens who opposed both. Such indifferent citizens obviously accept the present situation or are disinterested in the issue. Forest owners' attitudes towards forestry differed from those of the other Finns. About half of the forest owners belonged to the supporters of economic utilization of forests while only every third of the non-owners shared this attitude. One fifth of the forest owners supported conservation at the expense of wood production, whereas conservation supporters amounted to one fourth of the non-owners. (Karppinen and Hänninen, 2000)

American studies have not reported significant differences between the attitudes of forest owners and other citizens (Bliss et al. 1994, 1997, Bourke and Luloff 1994). Yet, Bliss et al. (1997) detected differences in attitudes between timber sellers and non-sellers. According to Karppinen and Hänninen (2000), the majority of the Finnish forest owners resemble American timber sellers. Finnish owners are more oriented to timber production than their American counterparts.

This paper provides an approach for measuring the legitimacy of forest policy among general public. This framework is suitable for measuring the legitimacy of other political fields as well. Moreover, the features of legitimacy of Finnish forest policy are relevant also outside the country, since Finland is often considered a good example of how to manage with forest issues and forest policy.

The contribution of this study is to provide understanding how the forest owner's attitudes to forest policy differ from those of non-owners. Further, this study reveals gaps in the legitimacy of Finnish forest policy and points out the generally agreed aspects of the forest policy.

2 FOREST SECTOR AND FOREST POLICY IN FINLAND

Finnish forest and nature conservation policy operates in the conflicting field with strong claims for intensive forestry and biodiversity conservation. Forests cover more than 70 per cent of the land area of Finland. Measured by the proportional share of forest land, Finland is the most forested country in Europe. (Finnish Statistical… 2009)

The objective of forest policy is to ensure the welfare based on the use of forests and the diversity of the forest nature. Sustainable forestry has several dimensions: economic, ecological, social and cultural sustainability. Their reconciliation is a great challenge to which forest policy needs to respond (Ministry of agriculture and forestry, 2010a). It has not been easy to combine the aims of forest and nature conservation policies. In Southern Finland, the intensive forestry has reduced the amount of old-growth forests and endangered such ecosystems (Working group… 2000). The share of over 140-year-old forests is only 1.6% of the total forest area in southern Finland (Finnish Statistical… 2009).

The export-oriented forest industries and the forest sector as a whole had an important role in building up national welfare after the Second World War, although forest sector had gained a remarkable power position in the Finnish society already earlier during the

20th century. Importance of the forest sector has decreased, but it still strongly contributes to Finnish national economy and employment. Since the 1990s forest debate has focused on biodiversity conservation which often conflicts with intensive forest use. Forest industries have also been criticized for investing abroad and decreasing the domestic employment in the sector. Nature conservation has been the essential driving force in questioning the power position of the forest sector in Finland. (Donner-Amnell and Rytteri, 2010)

Forest Act and Nature Conservation Act control forest use. The purpose of Forest Act is to promote economically, ecologically and socially sustainable management and utilisation of forests. Forests should produce wood in a sustainable way while their biological diversity should be maintained. For example according to Forest Act, a seedling stand with economic growth potential must be established in the cutting area within a reasonable period of time after regeneration fellings. The aim of Nature Conservation Act is to: 1) maintain biological diversity; 2) conserve nature’s beauty and scenic values; 3) promote the sustainable use of natural resources and the natural environment; 4) promote awareness and general interest in nature; and 5) promote scientific research. For example it is prohibited to manage the special habitat types in a way to jeopardize the preservation of the special characteristic of the area. On the other hand, based on the Act on the Financing of Sustainable Forestry, the state allocates financial subsidies to forest owners, for example, for the tending of young stands, for forest road construction and maintenance of biodiversity.

The Finland’s National Forest Programme (NFP) is the strategic base of the Finnish forest policy. The NFP aims to ensure forest-based employment and livelihoods, biodiversity and vitality of forests, and opportunities for recreation for all citizens. The programme was prepared as an open process between all stakeholders in forest issues. However, Finnish Association for Nature conservation stated dissenting opinion. They criticized the balance between forest utilization and conservation: NFP promotes growing use of wood, but allocates too little resources for biodiversity conservation. (Finland’s National Forest Programme 2015)

Finland has taken an active role in the preparation and implementation of international forest policy. This is seen also as an active participation in the initiatives concerning EU’s forest sector, which is stated as a high priority by the Ministry of Agriculture and Forestry (Ministry of agriculture and forestry 2010b).

3 LEGITIMACY OF POLICY AND ITS COMPONENTS

Policy is traditionally divided into four components: structure, processes, actors and outputs (Inglehart 1977). Structure can be described by institutions, such as laws, administrative organizations and rules. These are typically quite constant over time and they don't have a powerful role in the evaluation of legitimacy. Processes are ongoing political instruments and ways how policy is managed. This part of the political system is usually considered to be at the core of legitimacy (Leventhal 1980). Actors refer to people who actually concern politics. Outputs describe the actual state of the world which the political system has created. They refer to distributive justice: How fair is the outcome?

These four components describe basic features of policy. Since the focus of this study is peoples' experience of legitimacy, they were analyzed from a social psychological point of view. Laws were operationalized by asking the acceptance of certain forest related laws. Processes were examined using Leventhal's six procedural justice rules: suppression of bias, accuracy of information, representativeness of participants in the decision, consistency across individuals, mechanisms to change incorrect decisions, and ethical principles (Leventhal et al. 1980). Actors in forest and nature conservation policy are often not familiar to common people. However, most people have an opinion on the stakeholder groups which rub elbows with decision-makers and the groups who are objects of forest policy. So, the role of the actors was studied via acceptance of power relations between stakeholder groups. Outputs were covered by measuring acceptance of forestry operations. Yet, these did not cover the whole range of forestry operations in Finnish forests.

Personal traits affect on how people evaluate policy (e.g. Weatherford 1992). For instance, if people don't trust one another, it is probable that they don't have trust in policy which is based on cooperation. Several background variables were considered in the study, such as forest policy competence, the size of the forest estate if any, and the trust in people's own life and fellow men.

4 DATA AND METHODS

Finnish citizens' attitudes on forest policy were studied by a nationwide mail survey. The survey questionnaire was designed basing on theories of legitimacy (Tyler 2006), previous studies on legitimacy (Sunshine and Tyler 2003, Weatherford 1992), qualitative studies of legitimacy of Finnish forest policy (Rantala and Primmer 2003) and two focus group interviews. Pilot study was conducted in 2006.

The target population was Finnish-speaking Finns over 18 years of age, excluding people living in Aland island. Population Register Centre took a random sample of 3000 citizens. They were sent a mail questionnaire at the beginning of May 2008. After a week, a reminder postcard was sent to the whole sample. At the end of May, the questionnaire was sent again to those who had not responded. After two follow-up mailings, 1260 citizens had returned the questionnaire. The response rate was 42 % (Valkeapää et al. 2009).

As in previous forest owner studies (e.g. Karppinen et al. 2002,), those citizens who owned less than 5 hectares of forest land were not defined as forest owners. Smaller holdings don't significantly contribute to household income formation and their role in roundwood production is minor. If more than half of the responses were missing in the questionnaire, the observation was left out of the analysis. Finally, the data consisted of 824 non-owners (including 98 respondents who owned less than 5 hectares) and 304 forest owners who owned more than 5 hectares of forest land.

Non-response was studied in June 2008. Random sample (n=100) was taken from people who did not return the questionnaire. 28 of them were reached by telephone interview. The main reasons for not responding were busyness and disinterest in the subject. The distributions of answers in control questions did not differ significantly between the non-response and actual sample.

Attitude statements were provided with three types of response alternatives using 5-point Likert-scales: agree–disagree, accept – not accept and far too much – far too little. Sum variables were counted to condense information from original statements to get an overall evaluation on *the legitimacy* of the forest policy, *the acceptance of laws*, *the justice of the procedures, the acceptance of power relations*, *the acceptance of forestry operations, forest policy competence* and *trust* in ones' life and fellow men. The overall attitudes were formulated by counting the means of the responses in the statement set. So, the range of the scale remained the same as in the original statements, from 1(negative) to 5 (positive), where 3 is neutral. *The acceptance of the power relations* was counted to a sum variable after recoding original statements (scale 1-5: far too little, slightly too little, adequate, slightly too much, far too much) so that the middle option (adequate) was coded to 5, slightly too much and slightly too little to 3 and far too much and far too little to 1. So the overall attitude varied from 1 (not adequate) to 5 (adequate) and there was no neutral alternative. The wordings of the statements are shown in results section. For forest policy competence and trust see appendix 1.

The significance of the differences between forest owners' and other citizens' answers to the original attitude statements were analyzed by the χ^2 independency test and Mann-Whitney's non-parametric test for two independent samples. The differences in means in the overall statements (interpreted as the centre of gravity) were analyzed by T-test for two independent samples. Sum variables were approximately normally distributed.

Differences in the formation of legitimacy were analyzed by linear regression models explaining *the legitimacy* of the forest policy by *the acceptance of laws*, the *justice of procedures*, *the acceptance of power relations* and *the acceptance of forestry operations*. Also the effects of *forest policy competence*, *personal traits and demographic variables* were taken into account.

5 RESULTS

Forest owners' and the other citizens' attitudes were examined based on the means of the general attitudes and the original statements. The sum variables of the overall attitudes are bolded in tables. Since 3 is the neutral answer, the mean above 3 is considered to be a positive attitude to and mean below 3 negative. After the descriptive analysis, the regression model is estimated to explain the overall legitimacy by these overall statements and background variables.

5.1 OVERALL LEGITIMACY

The overall legitimacy was evaluated positively and also all the attitude statements were positive, on average, in both groups. Forest owners considered forest policy in general more legitimate than other citizens. They agreed more than other people with all other statements except "The forest laws and regulations have to be followed even if they do not make much sense to me". (Table 1).

Table 1: Overall legitimacy and original statements. Means for forest owners and other citizens and p-values for equality of means. (scale: 5-fully agree, 3-neutral, 1-not at all agree).

	Forest owners	Other citizens	Sig.
Legitimacy	**3.4**	**3.3**	**0.038**
I am satisfied with the way the forest issues are managed in Finland.	3.2	3.1	0.049
The forest laws and regulations have to be followed even if they do not make much sense to me.	3.2	3.4	0.009
Forest conservation is managed well in Finland.	3.6	3.3	0.000
Forests are used well in Finland.	3.5	3.3	0.003

5.2 ACCEPTANCE OF LAWS

The acceptance of laws was overall positive. Forest owners considered the forest related laws less acceptable than other citizens in all measured aspects. Forest owners' evaluations were negative while other citizens' positive on the statements: "The Nature Conservation Act restricts the fellings of the forest populated by the flying squirrel" and "The Forest Act restricts the forest owner's decision-making ". A remarkable difference was also detected in the statement "The Forest Act restricts fellings because of the biodiversity", although both groups had positive stand in the issue (Table 2).

Table 2: Overall acceptance of laws and original statements. Means for forest owners and other citizens and p-values for equality of means. (scale: 5-fully accept, 3-neutral, 1-not at all accept).

	Forest owners	Other citizens	Sig.
Acceptance of laws	**3.5**	**3.8**	**0.000**
The Forest Act enacts the earliest time for cuttings.	3.7	3.8	0.103
The Forest Act obliges to generate a new seedling stand after the fellings of the forest.	4.3	4.5	0.003
The Nature Conservation Act restricts the fellings of the forest populated by the flying squirrel.	2.8	3.3	0.000
The everyman's right allows picking of berries in all forests.	4.6	4.8	0.000
The Forest Act orders as a rule that the forest must be managed as even-aged.	2.6	2.9	0.000
The Forest Act restricts fellings because of the biodiversity.	3.4	4.0	0.000
The Forest Act restricts the forest owner's decision-making	2.7	3.2	0.000

5.3 JUSTICE OF PROCEDURES

The procedures were evaluated negatively in general. Forest owners were not quite as negative as other citizens. The statement "All parties can contribute equally in decision making" deviated most strongly from neutral (3). (Table 3).

Table 3: Overall justice of procedures and original statements. Means for forest owners and other citizens and p-values for for equality of means. (scale: 5-fully agree, 3-neutral, 1-not at all agree).

	Forest owners	Other citizens	Sig.
Justice of procedures	**2.6**	**2.5**	**0.032**
Everyone concerned has the opportunity to participate in decision-making.	2.7	2.5	0.060
All parties are treated equally in decision making.	2.5	2.3	0.005
Decisions are based on up-to-date knowledge.	3.1	2.9	0.035
Decisions follow ethical principles.	2.8	2.6	0.000
Incorrect decisions can be dissolved.	2.6	2.5	0.693
All parties can contribute equally in decision making.	2.2	2.2	0.938

5.4 ACCEPTANCE OF POWER RELATIONS

Forest owners were somewhat more willing to accept current power relations than other citizens, measured by the overall acceptance. (Table 4). Forest industry was considered, on average, to have too much power, while ordinary citizens, forest owners, recreationists, nature tourism entrepreneurs, and researchers were regarded to have too little power. Forest owners considered that environmental authorities and associations have too much power in policy. Forest owners considered themselves have too little power and other citizens considered citizens and recreationists have too little power.

Table 4: Overall acceptance of power relations and original statements. Means for forest owners and other citizens and p-values for equality of means. (general statement's scale: 5-far too much,3 – adequate, 1-far too little; the overall statement's scale 1-not adequate to 5 -adequate).

	Forest owners	Other citizens	Sig.
Acceptance of power relations	**3.4**	**3.3**	**0.022**
Trade organizations	3.2	3.0	0.007
Members of Parliament	3.3	3.3	0.349
Nature tourism entrepreneurs	2.9	2.7	0.000
Forest owners	2.1	2.7	0.000
Forest industry	3.6	3.8	0.000
Forest authorities	3.5	3.4	0.014
Citizens	2.3	1.9	0.000
Researchers	2.8	2.4	0.000
Recreationists	2.8	2.2	0.000
Environmental associations	3.6	2.9	0.000
Environmental authorities	3.5	3.0	0.000

5.5 ACCEPTANCE OF FORESTRY OPERATIONS

Table 5: Overall acceptance of forestry operations and original statements. Means for forest owners and other citizens and p-values for equality of means. (scale: 5-fully accept, 3-neutral, 1-not at all accept).

	Forest owners	Other citizens	Sig.
Acceptance of forestry operations	**3.3**	**3.1**	**0.000**
Forest road construction	4.0	3.6	0.000
Fertilization	3.4	3.2	0.011
Ditching	3.4	3.0	0.000
Clearcuttings	2.6	1.9	0.000
Restoration	3.4	3.9	0.000

Forest owners were more approving concerning the current forestry operations than other citizens. The only exception was forest restoration to a more natural state, which was more acceptable for non-owners. All other operations were, on average, evaluated positively by both groups, except clearcuttings. (Table 5) 76 % of the citizens and 56 % of forest owners did not approve this cutting method.

5.6 FACTORS AFFECTING LEGITIMACY

The general linear models using OLS regression were estimated to explain legitimacy by overall measures of the components of legitimacy and background variables, separately for forest owners and non-owners (Tables 6 and 7). Multicollinearity was not at a disturbing level in the models; VIF factors were less than 2 for all explanatory variables. The model for non-owners had more explanatory power than that of forest owners'. The adjusted coefficients of determination for the reduced models were 0.379 and 0.359, respectively.

Table 6. Regression models explaining legitimacy for citizens not owning forest (> 5 ha).

Non-owners	Basic model			Reduced model		
Variable	B	t	Sig.	B	t	Sig.
Intercept	,975	3,571	,000	,911	4,430	,000
Acceptance of laws	,016	,406	,685			
Justice of procedures	,313	8,036	,000	,321	8,290	,000
Acceptance of power relations	,128	3,993	,000	,130	4,101	,000
Acceptance of forestry operations	,365	8,478	,000	,371	8,661	,000
Forest policy competence	-,106	-3,511	,000	-,105	-3,510	,000
Trust	,119	2,663	,008	,126	2,840	,005
Region (Northern Finland reference category)						
Southern Finland	-,077	-,592	,554			
Western Finland	-,048	-,366	,714			
Eastern Finland	-,098	-,679	,497			
Oulu region	,116	,764	,445			
Household's monthly incomes € (>5000 reference category)						
< 1000	-,220	-2,223	,027	-,214	-2,173	,030
1000-3000	-,173	-2,535	,011	-,173	-2,548	,011
3000-5000	-,146	-2,049	,041	-,141	-1,993	,047
R-square	0.387			0.386		
Adj. R-square	0.375			0.379		
n	667			672		

The procedural justice, the acceptance of forestry operations, forest policy competence and trust were significant explanatory variables for both groups, while the acceptance of laws was not in connection with legitimacy in either group. For non-owners, also the acceptance of power relations explained legitimacy. Other explaining variables had significant positive effect on legitimacy but the forest policy competence had a significant negative effect. For forest owners, the place of residence (region) was a significant explanatory factor. Forest owners living in northern Finland were more critical than owners living in western or eastern Finland. Household incomes explained legitimacy of forest policy in non-owners' model: wealthier citizens were more approving than poorer citizens. For forest owners, the size of the forest estate had a significant positive effect: the larger the forest the more legitimate the forest policy was considered.

Table 7. Regression models explaining legitimacy for forest owners.

Forest owners	Basic model			Reduced model		
Parameter	B	t	Sig.	B	t	Sig.
Intercept	,514	1,201	,231	,846	2,335	,020
Acceptance of laws	,059	,864	,388			
Justice of procedures	,321	5,422	,000	,334	6,261	,000
Acceptance of power relations	,005	,090	,928			
Acceptance of forestry operations	,329	4,908	,000	,332	5,168	,000
Forest policy. competence	-,129	-2,096	,037	-,129	-2,182	,030
Trust	,189	2,563	,011	,181	2,603	,010
Region (Northern Finland reference category)						
Southern Finland	,183	,920	,359	,152	,780	,436
Western Finland	,504	2,536	,012	,430	2,233	,026
Eastern Finland	,569	2,810	,005	,554	2,780	,006
Oulu region	,272	1,274	,204	,268	1,287	,200
Household's monthly incomes € (>5000 reference category)						
< 1000	,324	1,521	,130			
1000-3000	,085	,784	,434			
3000-5000	,102	,915	,361			
Size of forest estate	,004	2,171	,031	,004	2,273	,024
R-square	0.395			0.382		
Adj. R-square	0.357			0.359		
n	238			247		

6 DISCUSSION

The overall legitimacy and its components were evaluated positively, the only exception being the justice of the procedures. In five out of six Leventhal's (1980) criteria for procedural justice, i.e. representativeness, consistency, bias suppression, correctability and ethicality, forest policy was evaluated negatively. Consideration of different parties' viewpoints and their treatment and correcting bad decisions got most critics. Interestingly, the use of new information was the most positively evaluated element of procedural justice. Concerning all the other statements, only clearcuttings and acceptance of even-aged forest management were evaluated negatively in both groups.

Analysis of the attitudes of forest owners and non-owners revealed interesting features of legitimacy of forest policy. Forest owners considered forest policy in general more acceptable than other citizens. Forest owners conceive that the forest policy functions better in respect with overall legitimacy, procedural justice, acceptance of power relations and acceptance of forestry operations. The only exception was acceptance of laws. This is understandable, since the laws restrict forest owner's decision making in their forests. Everyman's right has strong support in both groups.

Forest owners tend to accept the current power relations more often than other citizens. Expectedly, forest owners felt themselves to have too little power and other citizens considered citizens and recreationists to have too little power. Concerning other stakeholders' power status, the largest differences in evaluations were detected in environmental authorities and environmental organizations. Forest owners thought that these have too much power, while non-owners felt that environmental stakeholders have adequately power. However, both groups considered the forestry administration and even more so the forest industry to have too much power.

Concerning forestry practices, forest owners accepted treatments aimed at intensifying wood production, such as clearcuttings, forest road construction and ditching of peatlands more often than other citizens. Forest restoration to a more natural state was more acceptable for non-owners than for forest owners. This is in accordance with Karppinen and Hänninen's (2000) notion, that non-owners are more pro-environmentally oriented.

The legitimacy was composed differently in forest owners' and other citizens' assessments. The procedural justice and the acceptance of forestry operations were key aspects in legitimacy evaluation. The acceptance of laws was not explaining legitimacy. As opposed to forest owners, for non-owners also the acceptance of power relations explained legitimacy. Moreover, the owners of the larger forest estates were more approving concerning forest policy. This may suggest that forest owners, and especially large forest owners are well represented in forest policy formulation, while other citizens may experience power deficit in decision making concerning their environment. Nevertheless, forest owners felt that they have too little power in decision making. Interestingly, forest policy competence was negatively associated in legitimacy formation in both groups; the more people knew about forest policy, the more critical they were.

The legitimacy in general was evaluated positively, even if some focal aspects of the forest policy were criticised severely. This notion resembles the system justification theory (Jost & Banaji 1994), which claims that "people are motivated to preserve the belief that existing social arrangement are fair, legitimate, justifiable and necessary" (Jost et al. 2003). According to the theory, the conception of well-working forest policy is a belief, which makes the policy as a whole to look acceptable, although there would be complaints in details. Further, the more positive evaluation of legitimacy of forest policy was, the less was the awareness of forest issues. According to system justification theory, the belief in legitimate policy shelter people of seeing the defects of policy if the possibilities to affect are limited (Jost et al. 2003, 2004).

Forest owners appear to consider forest policy legitimate in general, and accept current forestry practices. From the point of view of forest extension organizations this is good news. However, forest owners were critical concerning clearcuttings and even-aged forest management. Also Karppinen (2005) noted that forest owners had favourable attitude towards natural reforestation, although this was not reflected into forestry practice.

The prevailing tendency to increase participatory approach in policy-making seems to be in line with the aspirations of all citizens including forest owners. Besides the involvement of stakeholder groups, also direct participation via web pages, discussion fora, are more often available in policy formulation processes. However, it can be questioned, how informed citizens are of these possibilities.

The essential challenges for designing more legitimate forest policy are to have a wider perspective on benefits of forest and to allow more flexible forest management practices, for instance uneven-aged forest management. In addition, all stakeholders should have equal treatment in policy making process.

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APPENDIX 1

Statements for forest policy competence

it is easy for me to take a view of forest issues

I am interested in decision making in forest issues

I would like to influence on decision making in forest issues

I know a good deal about forest conservation

I know a good deal about forestry

Statements for Trust in ones' life and fellow men.

Most of the people are reliable

People tend to think mostly only themselves

People tend to take advantage of others

Life has become unpredictable

My business turn out well by planning

I am happy with my life

APPENDIX 2

Correlations of legitimacy with general statements for other citizens and forest owners.

(correlation is significant in 0.05 level, **correlation is significant in 0.01 level (2-tail)).*

Non-owners

	1	2	3	4	5	6
1 Legitimacy						
2 The acceptance of the laws	,045					
3 Procedural Justice	,482**	,104**				
4. The acceptance of power relations	,384**	-,040	,394**			
5. The acceptance of forestry practices	,416**	,053	,300**	,245**		
6 Forest policy competence	-,156**	,015	-,096**	-,113**	,027	
7 Trust	,298**	,132**	,299**	,236**	,239**	-,022

Forest owners

	1	2	3	4	5	6	7
1 Legitimacy							
2 The acceptance of the laws	,084						
3 Procedural Justice	,462**	,182**					
4. The acceptance of power relations	,213**	,223**	,346**				
5. The acceptance of forestry practices	,362**	-,011	,219**	,207**			
6 Forest policy competence	-,032	-,062	,024	-,028	,070		
7 Trust	,227**	,160**	,148*	,138*	,210**	,020	
8 Size of forest estate	,163**	,019	,025	-,113	,179**	,243**	-,031

Changes of carbon stocks in beech stand in SE Slovenia: effect of forest management practice

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Abstract

The impact of different forest management practices on the carbon stocks of a beech forests in the Dinaric Alp was studied. Dynamics of aboveground and belowground carbon stocks for the managed beech forest was quantified for the years 1997 till 2006. Plant physiological measurements and measurements of carbon stocks and fluxes were combined with a process based GOTILWA+. For the same beech stand we simulated three different forest management practices (self thinning, moderate thinning of 10% of basal area, intense thinning of 50% of basal area) and the GOTILWA+ model reproduced well the response of carbon pools and allocation processes, differing after man-made disturbances. For the self-thinning forest stand the simulated gross primary production (GPP) averaged 21445 kg C ha^{-1} year^{-1}, net primary production (NPP) 11954 kg C ha^{-1} year^{-1} and net ecosystem exchange (NEE) -7896 kg C ha^{-1} year^{-1} in the simulation period 1997-2006. Simulation of a moderate thinning of 10% of basal area resulted in minor decrease of annual GPP, NPP and NEE and moderate increase of heterotrophic respiration. Simulated intense thinning of 50% BA caused drastic decrease of annual GPP (14053 kg C ha^{-1} year^{-1}), NPP (8289 kg C ha^{-1} year^{-1}) and NEE (-2110 kg C ha^{-1} year^{-1}) and heterotrophic respiration strongly increased (6179 kg C ha^{-1} year^{-1}). The results of the simulation show that even the most severe thinning of 50% BA removal didn't result in shifting the beech stand under study from a sink to a source of carbon. The GOTILWA+ model proved to be applicable to the investigated forest ecosystems and offers many possibilities for further application, including the impacts of the rising atmospheric CO_2 concentrations and climate change or applying different forest management practices, important for small-scale ownership.

Key words: carbon dynamics, thinning, beech forest, GOTILWA+ model, small-scale ownership
FDC: 161.14:111.83(497.4)=111

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1 INTRODUCTION

Terrestrial ecosystems are an important component in the global carbon cycle, especially forests, because of the large pools and long-term storage of carbon in the vegetation and forest soils that can be manipulated by management (Kramer, Leinonen et al. 2002). The net carbon exchange of terrestrial ecosystems is the result of a delicate balance between uptake (photosynthesis) and losses (respiration), and shows strong diurnal, seasonal, and interannual variability (Valentini 2003). Private forest owners share the same climate change uncertainties including increased natural hazards risk, irrespective of the size of their forested estate and intensity of their means of production. At the same time the awareness of responsibilities and limitation regarding ecological services in the local communities and society is increasing. Carbon and water flux data issued from a regional and global flux network do matter also on smaller scales as net carbon exchange from different types of vegetation canopies. However, a central question is raised concerning the partitioning of the carbon stored by forest between harvestable and nonharvestable biomass compartments and soil organic matter. Unfortunately, short-term changes in the amount of carbon stored in those compartments cannot be easily measured (Kramer, Leinonen et al. 2002). These short-term changes need to be known to assess the potential of forests to store carbon on a short-term and on long-term basis, since wood products, leaves and branches, roots and soil organic matter (Cudlin, Kieliszewska-Rokicka et al. 2007) have different turnaround times. Combining both measured data on stand level and process-based models (Davi, Dufrene et al. 2005), predictions in terms of gross primary production (GPP), net primary production (NPP), respiration and net ecosystem exchange (NEE) could help to reduce the uncertainty about partitioning of carbon flux between storage pools (Kramer, Leinonen et al. 2002). Also the impacts of different forest management techniques and climate change on the net ecosystem balance can be assessed (Davi, Dufrêne et al. 2006).

The objectives of this study were to quantify carbon stocks for a managed beech forest stand in the Dinaric Alps, using the GOTILWA+ model (Gracia, Sabaté et al. 2003). Three different forest management techniques were applied in order to simulate aboveground and belowground carbon stocks, netto and gross primary production in selected beech stand. Further possible application of the model is discussed concerning the effect of different forest management techniques and anticipated climate change on small-scale ownership in beech forests in the Dinaric Alps.

2 MATERIAL AND METHODS

2.1 SITE AND STAND DESCRIPTION

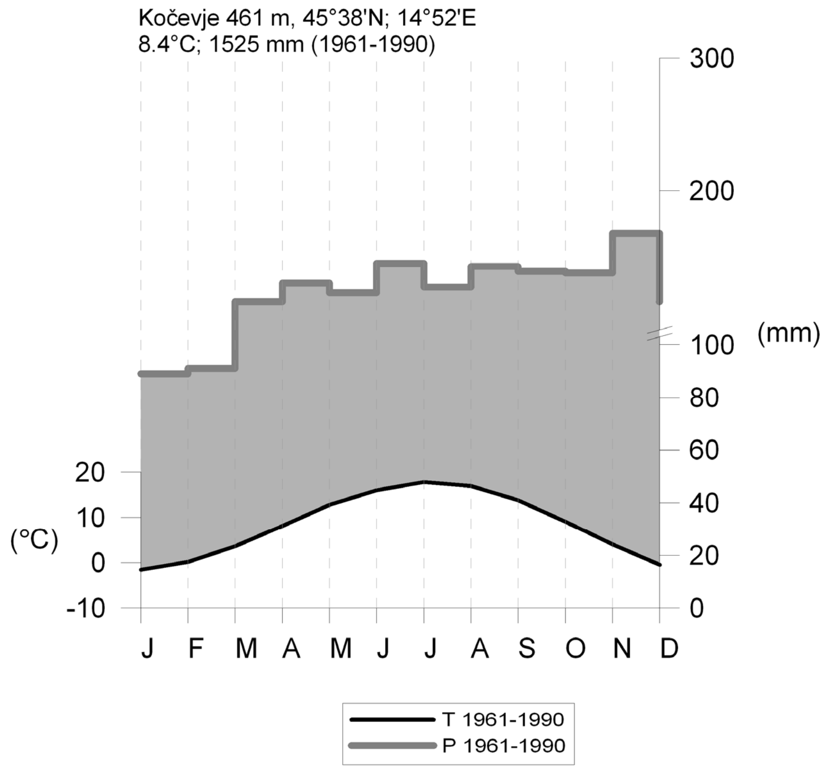

Figure 1: Monthly values of precipitation (P), mean monthly air temperature (T) at Kočevje meteorological station for the period 1961-1990 (ARSO archive)

The investigated beech forest Snežna jama is located in the northern part of the Dinaric Alps in SE Slovenia (45º20'N, 14º30'E, 880 m a.s.l). The bedrock is Cretaceous limestone and the soil is generally shallow (leptosolic). The climate of the region is montane Dinaric with an annual precipitation up to 1600 mm (Vilhar, Starr et al. 2005). Using this value and an environmental lapse rate of 6 ºC per km elevation (Barry 2001), the long-term mean annual temperature at the study area would correspond to 5.9 °C . The particular stand in which the study was carried out was classified as an *Omphalodo-Fagetum* association (Puncer 1980), and dominated by silver fir (*Abies alba* Mill.) and European beech (*Fagus sylvatica* L.). Norway spruce (*Picea abies* (L.) Karst.), maple (*Acer pseudoplatanus* L.), elm (*Ulmus glabra* Huds.) and lime (*Tillia cordata* Mill.) make up less than 1 % of total growing stock. Stand stem volume of the research s 30 x 30 m is 1028 m^3 ha^{-1} and the basal area is 66 m^2 ha^{-1}. The site is south facing, having a slope of ca. 10 %, and the prevailing soil units are Eutric Cambisols and Rendzic Leptosols {Vilhar, 2009

#1021; Kutnar, 2006 #1110}. The soil layer, however, is not continuous, and about 30 % of the area is bare limestone rock. Up to 40 cm of organic matter can be found accumulated in holes and cracks.

2.2 APPLICATION OF THE GOTILWA+ MODEL

GOTILWA+ (Growth of Trees Is Limited by WAter), is a mechanistic deterministic forest growth model (Gracia, Sabaté et al. 2003). It comprises of a two layer canopy photosynthetic model, coupled with a carbon allocation and growth model and a soil respiration and hydrology model. It describes monospecific stands, which can be even or uneven aged. From the interactions between daily precipitation, air temperature, vapor pressure, global radiation, wind speed, and atmospheric carbon dioxide concentration the forest growth processes can be simulated and explored how these processes are influenced by climate, tree stand structure, management techniques, soil properties and climate change. GOTILWA+ has been used to explore the responses of different forest types to water availability, especially in the Mediterranean and other arid or sub arid zones, the effects of global change on the forest dynamics, production and carbon fluxes, as well as the effects of different forest management techniques on the carbon stocks and fluxes (Sabaté, Gracia et al. 2002). Nevertheless, the model is general enough to be applied to other forest types.

The model was run for the years 1997 till 2006 simulating tree different forest management techniques:

First simulation represented self-thinning process, which was realistic for the forest stand under study in the simulation period from 1997-2006. For this simulation also the independent plant physiological measurements and measurements of carbon stocks and fluxes were used for critical testing of the model.

Second simulation introduced moderate thinning of 10% of basal area (BA) in different DBH classes in 2001, as it would be traditionally used for thinning of a beech stand in the optimal phase.

Third simulation introduced intense thinning of 50% of basal area (BA) in different DBH classes in 2001, as it would not be traditionally applied for these forest ecosystems.

Input parameters were derived from the measured data on stand biomass, leaf photosynthesis, litter decomposition, soil respiration, soil analysis including soil hydrological measurements and recorded meteorological parameters {Vilhar, 2010 In press #1168}. The simulation results were evaluated in previous studies {Vilhar, 2010 In press #1168}{Vilhar, 2008 In press #980} using the goodness-of-fit with observed values of soil moisture content, soil temperature, soil respiration and tree ring width.

3 RESULTS

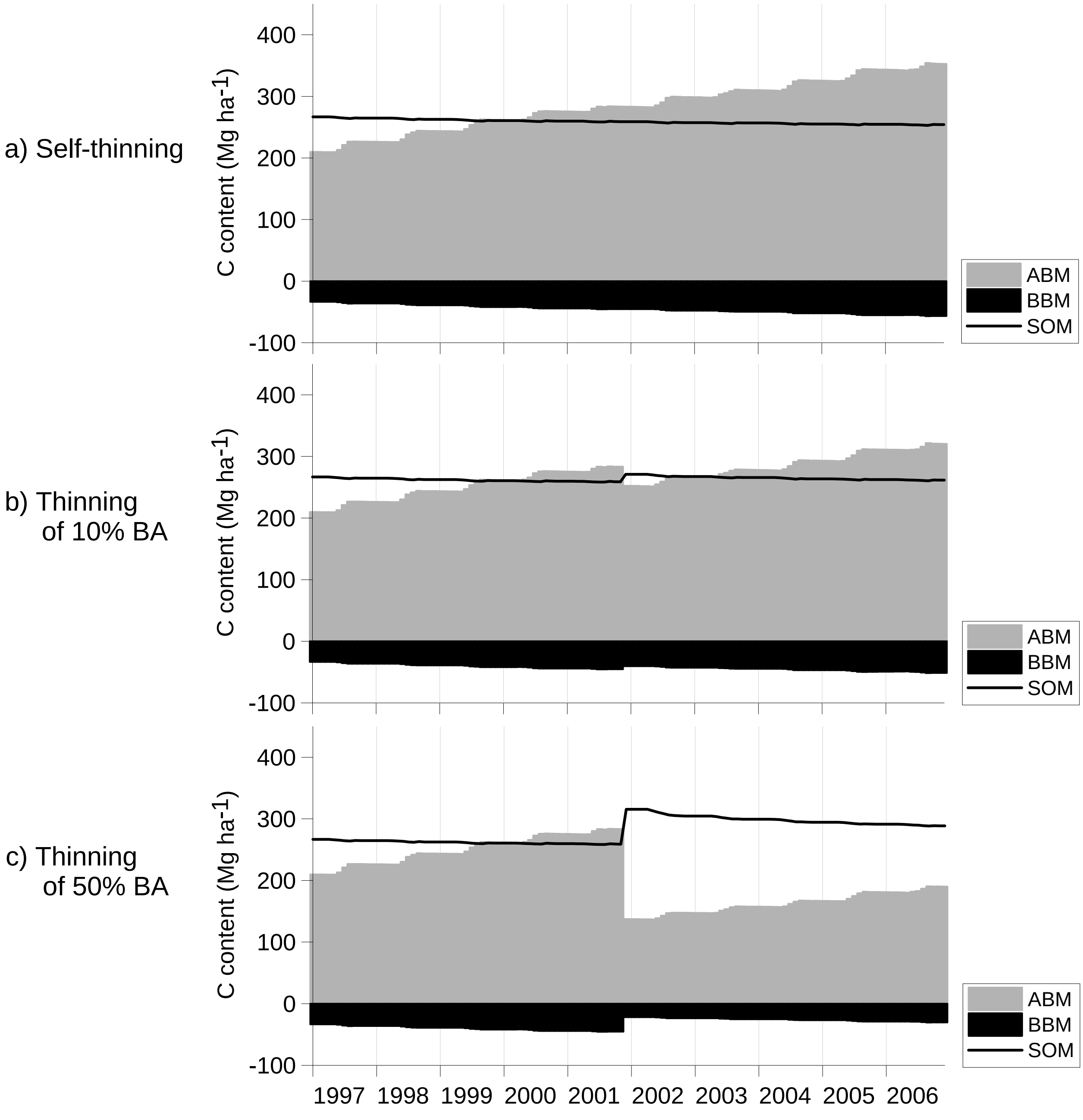

Figure 2: Carbon content (Mg ha^{-1}) in aboveground biomass (ABM), belowground biomass (BBM) and soil organic matter (SOM), simulated with the GOTILWA+ model for the years 1997 till 2006 under three different forest management techniques: a) self-thinning, b) moderate thinning of 10% of basal area (BA) in 2001, c) intense thinning of 50% of basal area (BA) in 2001

The results of the first simulation of realistic self-thinning show increased aboveground biomass (ABM) during the simulation period from 210 Mg C ha^{-1} in 1997 up to 353 Mg C

ha^{-1} in 2006 (Figure 2). The belowground biomass (BBM) presented ca. 16 % of the ABM during the whole simulation period and ranged from 36 Mg C ha^{-1} in 1997 up to 57 Mg C ha^{-1} in 2006. Soil organic matter (SOM) was slightly decreasing during the simulation period and ranged from 265 Mg C ha^{-1} in 1997 to 254 Mg C ha^{-1} in 2006.

Removal of 10% of basal area in 2001 resulted in 8% decrease of ABM and BBM and 4 % increase of SOM in the first year after the thinning. Removal of 50% of stand basal area in 2001 decreased ABM and BBM for 50%, and increased SOM for 21%, respectively. The differences in the thinning intensity influences biomass production significantly. In 2006, 5 years after simulated thinning the ABM increased to 321 C ha^{-1} after 10% of BA removal and 190 C ha^{-1} after 50% of BA removal. BBM increased to 52 C ha^{-1} after 10% of BA removal and 31 C ha^{-1} after 50% of BA removal and SOM decreased to 261 C ha^{-1} after 10% of BA removal and 289 C ha^{-1} after 50% of BA removal. ABM and BBM in 2006 simulated after 10% of BA removal corresponded to 91% of the self-thinning ABM and BBM and after 50% of BA removal to 54% of the self-thinning ABM and BBM. SOM in 2006 corresponded to 103% of self-thinning SOM after 10% BA removal and 114% after 50% of BA removal.

For the self-thinning forest stand the simulated annual photosynthesis or gross primary production (GPP) ranged from 14943 kg C ha^{-1} $year^{-1}$ in 2001 up to 27352 kg C ha^{-1} $year^{-1}$ in 2005 and averaged 21445 kg C ha^{-1} $year^{-1}$ in the simulation period 1997-2006. Simulated GGP is similar to the one, obtained by Davi et al. {Davi, 2008 In press #981} for the same forest stand by the CASTANEA model (15840 - 21700 kg C ha^{-1} $year^{-1}$) and higher than in beech stand in Hesse (12260 kg C ha^{-1} $year^{-1)}$, Soroe (12123 kg C ha^{-1} $year^{-1}$) or Vielsalm (13280 kg C ha^{-1} $year^{-1}$), estimated by the EUROFLUX methodology (Granier, Aubinet et al. 2003). Monthly pattern of GPP followed the high peak in summer months, decrease in autumn, reaching zero in winter and increase in spring months (Falge, Tenhunen et al. 2003). The net primary production (NPP) followed the same monthly dynamics as GPP, reaching negative values during the winter months due to the autotrophic respiration. Annual NPP ranged from 7319 kg C ha^{-1} $year^{-1}$ in 2001 up to 15348 kg C ha^{-1} $year^{-1}$ in 2005 and averaged 11954 kg C ha^{-1} $year^{-1}$ in the simulation period 1997-2006. The simulated NPP for selected beech stand was higher than those in Hesse (4407 kg C ha^{-1} $year^{-1}$) and Collelongo (8120 kg C ha^{-1} $year^{-1}$) (Granier, Aubinet et al. 2003). Net ecosystem exchange (NEE) defined as the difference between the GPP and the total respiration (autotrophic and heterotrophic) was negative during the vegetation period and reached positive values during the winter months. Annual NEE ranged from -3840 kg C ha^{-1} $year^{-1}$ in the 2001 up to -11531 kg C ha^{-1} $year^{-1}$ in 2005 and averaged -7896 kg C ha^{-1} $year^{-1}$ in the simulation period 1997-2006. The simulated NEE is higher than the

NEE, obtained in the study of Davi et al. (In press) (-2110 kg C ha^{-1} year^{-1}) and higher than those from Hesse (-2133 kg C ha^{-1} year$^{-1)}$, Soroe (-733 kg C ha^{-1} year^{-1}) or Vielsalm (-4497 kg C ha^{-1} year^{-1}).

Simulation of a moderate thinning of 10% of basal area (BA) resulted in minor decrease of annual GPP (20878 kg C ha^{-1} year^{-1}), NPP (11746 kg C ha^{-1} year^{-1}) and NEE (-7514 kg C ha^{-1} year^{-1}) for the beech stand under study whereas heterotrophic respiration slightly increased (4232 kg C ha^{-1} year^{-1}). Simulated intense thinning of 50% BA caused drastic decrease of annual GPP (14053 kg C ha^{-1} year^{-1}), NPP (8289 kg C ha^{-1} year^{-1}) and NEE (-2110 kg C ha^{-1} year^{-1}) and heterotrophic respiration strongly increased (6179 kg C ha^{-1} year^{-1}).

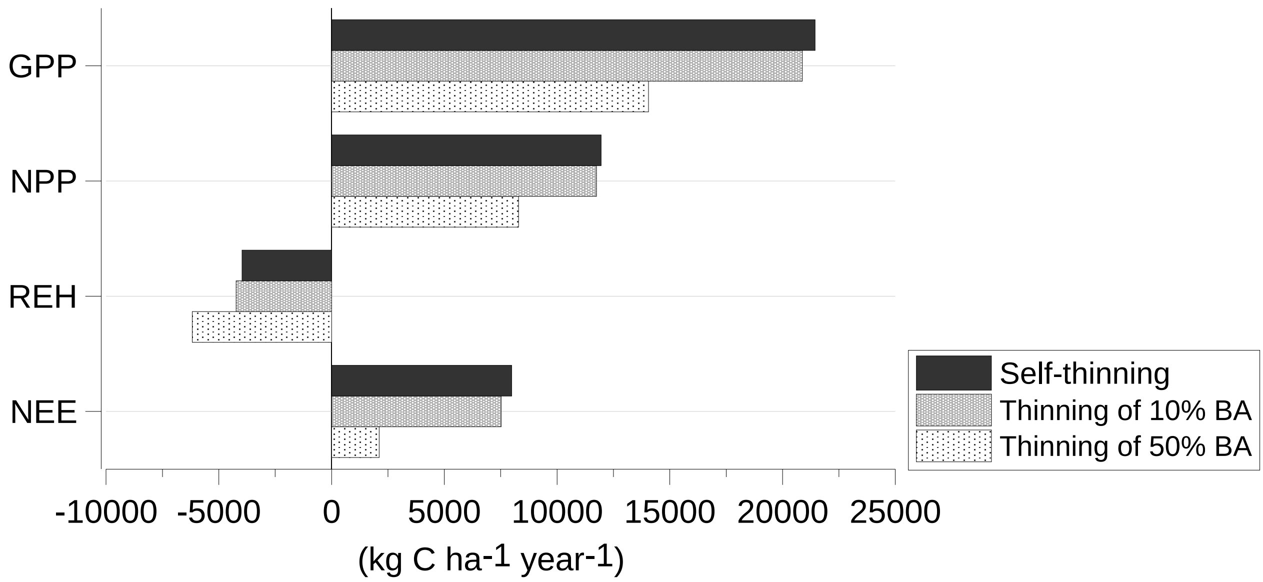

Figure 3: Average gross primary production (GPP), net primary production (NPP), heterotrophic respiration (REH) and net ecosystem exchange (NEE) (kg C ha^{-1} year^{-1}) for the years 1997 till 2006, simulated with the GOTILWA+ model applying three different forest management techniques: a) self-thinning, b) moderate thinning of 10% of basal area (BA) in different DBH classes in 2001, c) intense thinning of 50% of basal area (BA) in 2001.

4 DISCUSSION

The GOTILWA+ model proved to be very efficient tool in assessing the pools and storage of carbon in the forest vegetation and soils and also to simulate the changes in the amount of carbon stored in those compartments when applying different forest management techniques, information important for small-scale ownership. Average yearly NEE values show that the selected managed beech forest in the Dinaric Alps was a sink of carbon in the simulation period from 1997 till 2006, even when intense thinning of 50% basal area was applied.

Simulated aboveground biomass for the self-thinning forest stand was higher than 129 Mg C ha^{-1} reported for the managed beech forests in Spain (Merino, Real et al. 2007), 120-161 Mg C ha^{-1} in Germany (Joosten, Schumacher et al. 2004) and even higher than those reported for unmanaged beech stands 205 Mg C ha^{-1} in Spain (Merino, Real et al. 2007). Standing biomass for beech is favored by the increased temperature as well as rainfall (Sabaté, Gracia et al. 2002). The simulated belowground biomass accounted to 16 % of the aboveground biomass and was higher than reported 25 Mg C ha^{-1} by Merino (2007) for managed beech forest and 50 Mg C ha^{-1} for unmanaged beech forest on Cambisols. This corresponds to 20 % of the aboveground biomass in unmanaged forest and 17 % of the aboveground biomass in the managed forest. Our results are consistent with the idea that the C stocked in tree biomass increases with the stand age and number of larger trees (Merino, Real et al. 2007) which are larger in studied forest ecosystems than those reported by other authors. The annual photosynthesis (GPP) in this beech stand was similar to the one, obtained by Davi et al. (In press) for the same forest stand by the CASTANEA model and higher than in beech stands from the EUROFLUX network (Granier, Aubinet et al. 2003). Also the net primary production (NPP) for selected beech stand was higher than those in the EUROFLUX network (Granier, Aubinet et al. 2003). The net ecosystem exchange (NEE) differs significantly between the beech stands from our study and EUROFLUX network and it is higher than the NEE, obtained in the study of Davi et al. (In press). In broad-leaved stands, variation of NEE within the year is strongly dependent on tree phenology. After bud break, as is true for stand transpiration, the rapid increase in carbon uptake by forest is roughly parallel to the increase in leaf area index (Granier, Aubinet et al. 2003). During the leafed periods, short-term (day-to-day) fluctuations in NEE can be observed, corresponding to conditions of low photosynthesis and/or high ecosystem respiration (low incident radiation, rainfall events, and high air temperature). During the period when trees are without leaves, NEE variation is smaller; its time course depends mainly on temperature.

Possible future model application would include the impacts of the rising atmospheric CO_2 concentrations and climate change on the net ecosystem balance and to determine the possibility of shifting this forest ecosystem from sink of carbon to a carbon source, when applying forest management practices of higher intensity than presented in this study.

5 CONCLUSIONS

The influence of climate and management practices can in some cases shift a terrestrial ecosystem from a sink to a source of carbon. The quantification of all carbon stocks in a forest stand with measurements is often not possible therefore we combined detailed measurements and process based model GOTILWA+ which can be run also for a small forest estate. In our study we tested the model for a beech stand and run it for the period 1997-2006. It reproduced well different independent plant physiological measurements and measurements of carbon stocks and fluxes, used for critical testing of the model. For the same beech stand we simulated three different forest management practices and the GOTILWA+ model reproduced well the response of carbon pools and allocation processes, differing after man-made disturbances. Simulated carbon stocks in the studied beech forest applying no management practices but self-thinning are slightly higher than those reported from beech stands in Spain and Germany. The annual photosynthesis (GPP) in this study was higher than reported in other studies, and also the net ecosystem exchange (NEE) was higher than reported. The results of the simulation show that even the most severe thinning of 50% BA removal didn’t result in shifting the beech stand under study from a sink to a source of carbon. The GOTILWA+ model proved to be applicable to the investigated forest ecosystems and offers many possibilities for further application.

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Extension service in Latvia – how to meet the needs and wishes of private forest owners

Lelde Vilkriste[1]

Abstract

Close to fifty percent of Latvia is forested, and today forest sector is one of dominated sectors in national economy. After regaining independence in 1990 forests were given back to previous owners or their inheritors. Today close to 41 % of total forest area are managed by 145 505 private forest owners (PFO).

Previous studies and statistical data of the State Forest Service (SFS) gave evidence that private forests not always are managed in sustainable way. One of main tasks of Forest Policy (FP) in Latvia is to change forest owners' behavior to meet requirements of sustainable forest management.

The paper discusses different stages in the development of extension system in Latvia in last ten years. Research is based on analyses of the SFS activities in extension field and statistical data on private forest sector. Three opinion polls in 2001, 2003 and 2008 were designed to obtain information about current level of knowledge on forest management and wishes in future. Choice of different informative and educational sources today and in future, preferred way of obtaining information and knowledge and evaluation of extension system of the SFS was studied.

For the first time extension system under the SFS was established in 2000. Opinion poll of PFO in 2001 formed base for further extension activities. Training of forest extension agents, developing of informative and educative materials and education methods were only the start for it. Next opinion poll of PFO gave appraisal and pointed next steps in extension work, but opinion poll of 2008 pointed that state policy and decisions didn't always correspond to whishes of PFO.

Key words: private forest owners, forest policy, extension, opinion polls
FDC: 682:903=111

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1 INTRODUCTION

Latvia declared its independence from USSR on August 21, 1991. Soon after forest properties were given back to previous owners or their inheritors. Traditions of forest management were lost in half of century break of private ownership. System of regaining forest estates was relatively complicated as well as system of obtaining and privatization of forest land. Today forest coverage in Latvia exceeds 50 %, and close to 41 % of the total forest area are managed by 145 505 private forest owners (PFO). In 2007 the average forest holding area per owner doesn't exceed 7,1 ha.

Information of the State Land Service (SLS) data base indicates that there are no vital changes in the number of PFO and forest properties, but tendency on the fragmentation of properties was realized. In last five years annually close to 10 % of PFO change something in their forest property structure or left their owner status, but newcomers don't change characteristic of ownership structure significantly. Last research on private sector from 2007 gives characteristic of PFO:

- gender aspects: male PFO – 54 %, female PFO– 46 %;
- average age of PFO – 54 years (female – 56 years, male – 52 years);
- 73 % of PFO live in the region where forest property is situated;
- the proportion of urban forest owners increased 15 %.

Forest sector is one of dominated sectors in state economy, and PFO are important players in timber market. Sustainable management of private forests is not only conception of FP, but also foundation-stone of long term supply of quality timber resources.

FP was approved by the Cabinet of Ministers in 1998. The main aim of forest policy is to ensure sustainable management of forests and forest lands. One of objectives of FP is to ensure the knowledge and skills needed to improve the forest policy, legislation and practice and to ensure sustainable forest management by promoting the development of forest education, forest research and exchange of information within the forest sector. FP goals in forestry education are related to the state support to private forestry with extension and consultations in connection with the ensuring of the long-term functions of forestry. Implementation of FP is the task of the SFS.

2 MATERIALS AND METHODS

Data collection from data bases of the SFS and SLS was done for study needs. First of all description of the development of extension system in Latvia under the SFS is given. Figures characterized extension work were taken from annual public reports of the SFS and the CSC.

The second part includes results from various opinion polls of PFO done or organized by author. The method of interviews was worked out in frames of doctors' dissertation and was starting point for observing forest owners behavior and its influencing factors in Latvia (Vilkriste, 2002). The surveys had to be carried out with a help of personal interviews and questionnaire at owners' residence place. According methodology respondents were randomly selected from data bas of PFO. Results of these polls describe average private forest owner in Latvia. Urban forest owners living in the big cities or district centres were not included in the opinion polls.

In addition to opinion polls in 2001 and 2003 interviews with active PFO were organized. Special method was designed by author. In settled time period visitors of local forestries were interviewed by staff of the SFS. Table 1 represents number of respondents in each activity.

Table 1: *Opinion polls of private forest owners in Latvia*

year	**2001**	**2003**	**2007**	**2008**
PFO (average)	264	420	162	364
Active PFO	2000	1260	-	-

3 EXTENSION SYSTEM IN LATVIA

Forest extension in Latvia was mainly provided by the SFS. Majority of extension functions were transferred to the new the Consultancy Service Centre (the Forest Consultancy Centre from 2010) in 2006. Several NGO and forest companies as well as educational institutions also take part in extension activities of PFO. These activities are not systematic and large scale therefore review of organizations outside the SFS isn't included in the paper.

3.1 LATVIA STATE FOREST SERVICE

The State Forest Service Law effective from January 2000 obligated the function to provide information and consultancy to PFO on the forestry issues. In the first step

Department of Support and Development was formed. Particular post of consultant – engineer (extension agent) was enforced in each of 32 head forestries. The essence of tasks of extension agent was to organize extension and information of private forest owners in the territory of head forestry.

Training of the first extension agents of the the SFS started 2 years earlier than system of extension was implemented. Latvian – Swedish project "Training of forestry extension agents" started in 1998 and in 1,5 year period educated 40 specialists from the SFS. Teaching course included totally 1 month classes and lectures, several practical works and homework, and 10 day study trip to Sweden and Finland. Extension agents work out also proposals for prospective extension system in the SFS.

Employees of the SFS have to inform the forest owners regarding the demands of legislative and regulatory acts and provide consultancy services in forest management and utilization. In 2000, the number of head forestries was reduced from 32 to 26, also number of forestries decrease from 259 to 197. The second optimization took place in 2006. It led down to 23 head forestries with 118 forestries and 8 service points. New structural unit the Consultancy Service Centre (CSC) was established to provide services and extension to PFO.

In 2008, each head forestry area has established a separate forestry, which operates on a one-stop-shop principle and serve forest owners whose property is located in the forest district area. Customer Service Division which serves all owners without reference to their living place was established in the Head Office of the SFS in Riga. Due to oncoming territorial reform in Latvia new optimization of the SFS was done. Today the SFS consists of 10 head forestries and 77 local forestry offices.

In association with developing extension system education and training of the SFS staff was also started. There were about 733 seminars in regional forestries in 2000. Later seminars were organized for bigger groups of specialists and number of seminars decreased to 88 in 2003. Today the SFS has launched a scheme for raising the vocational competence of its forest officers. In 2007 and 2008 district foresters, deputy district foresters and forest rangers took part in one week training course. Just two lessons were allocated for improving skills of communication and adult pedagogic.

3.2 CONSULTANCY SERVICE CENTRE

The Consultancy Service Centre (CSC) as structural subdivision of the SFS was established in July 2006 to advise the forest owners not only on routine forestry matters, but also help them get financial support from the national and EU funds for promoting forestry and offer high quality services in forest management and utilization. Major concerns of the CSC are informing, consulting, training and giving services to the forest sector stakeholders. The CSC offers also different paid services in forest management, except forest harvesting and timber selling activities. Price List for the paid services is regulated by the Regulations of the Cabinet. The CSC is responsible also for informative function and issues quarterly the paper "Cone" and once in month the electronic version of the paper. Advice and consultations are available at the offices of the CSC territorial units, including also on-site visits. The CSC employees offer lectures and organize informative seminars and workshops.

In March, 2010 reorganization of extension system of the SFS was done again. New structure the Forest Consultancy Service Centre continues functions of the previous CSC as affiliate of the Latvian Rural Advisory and Training Centre.

3.3 EXTENSION SYSTEM IN NUMBERS

Beginning of the development of the extension system was passionate and work was done with great enthusiasm and creativity. There were around 400 forestry's workers and 831 forest rangers involved in extension activities in 2000. Number of published informative and educative articles on the forest related issues in the regional and local mass media had increased from 430 publications in 2000 to more than 600 in 2003. Top level was reached in 2004 when more than a thousand different articles were published. Later number of articles got reduced, and the CSC reported 109 articles in 2008. Notable amount of various leaflets, infopages, factsheets and brochures were published or printed in the first years of operating. More than 70 different informative materials for PFO were produced in 2002. Regional foresters were active also in cooperation with TV and radio. In 2001 and 2002 more than 100 broadcasts with participation of specialists of the SFS were fixed.

Progression of the extension system was characterized also by diverse activities. Year 2000 was notable for more than 1500 meetings in rural municipalities where specialists of the SFS gave information about actualities in forest management. In the same time special information panels or bags were organized in each forestry and municipality office. For the first time special educational broadcasts were designed for private forest owners in 2001. This year was also starting point for opinion poll of private forests owners never visited offices of the SFS. First educational forest trails were designed in 2002 and year after there were 46 trails with total length up to 200 km. Forest newspaper "Cone" was issued quarterly from 2004. This year was also the starting point to put into practice idea on establishment of demonstration area. First private owners with excellent management practices were chosen for it.

To promote the best forest management practices special competition was firstly arranged in 2001. In 2002 and 2003 there were more than 500 forest owners who reported correspondence to the criteria settled out by jury. Starting with 2004 interest of owners to participate in this activity had decreased.

Most important part of the tasks of the SFS specialists was providing of information and consultations. For example, in 2000 approximately half of total working hours of forest officers and rangers was spent on providing consultations on owners' properties. Quantity of consultations provided by the SFS specialists until 2006 is shown in Figure 1. Number of consultations in first four years had increased nearly for 10 %.

Top of activity level in providing advice was reached in 2005. Real number of given consultations went beyond before planned amount for 20 % and totally reached 94700 cases. It was possible to maintain that in average each second private forest owner got advice from the specialist of the SFS in forest management. Decrease in the volume of consultancy service started in 2006. The proportion of consultations given in office and on-site is inconsistent by years.

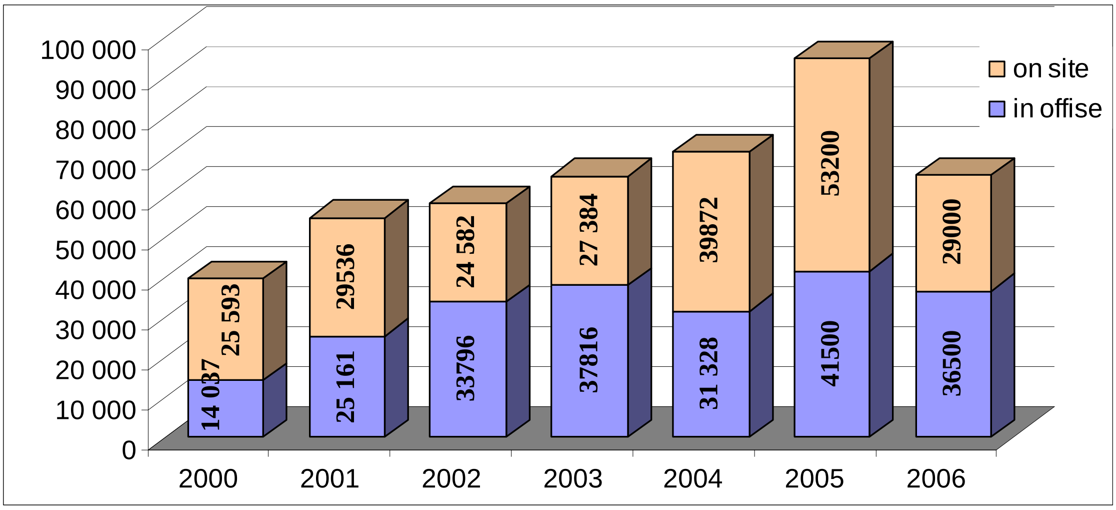

Figure 1: Number of consultations given by the SFS (2000 – 2006)

Watershed in extension system was in 2006 caused by allocation of extension functions to two organizations: the SFS and the CSC. Total number of consultations decrease by 30 %. Table 2 demonstrates number of consultations after changes in extension system.

Table 2: Consultations provided by SFS and CSC (2007-2009)

year	**2007**	**2008**	**2009**
in office (SFS)		1742	1887
on site (SFS)	2706	465	138
In office (CSC)	1071	1752	no data
total	3777	3 959	2025

The CSC offer also paid services. In the second year of operation the CSC came up with 245 pay consultations, in 2008 this number reached 494 cases. Different services in the forest management were provided to 2000 PFO in 2007, a year later this number reduced to 1506 ones. In the first year demand for preparing cutting sites and documentation was dominating, later services and consultations regarding EU funds overrun.

Seminars of PFO were very popular in the first years of extension work. Annual public report of the SFS in 2000 reported 545 seminars with 7607 participants. Already after 2 years the number of seminars increased for 30 %, but the number of participants for 37 %. It was small growth in the quantity of seminars in further two years, but the quantity of participants was decreasing. In average there were only 10 forest owners per seminar in 2004.

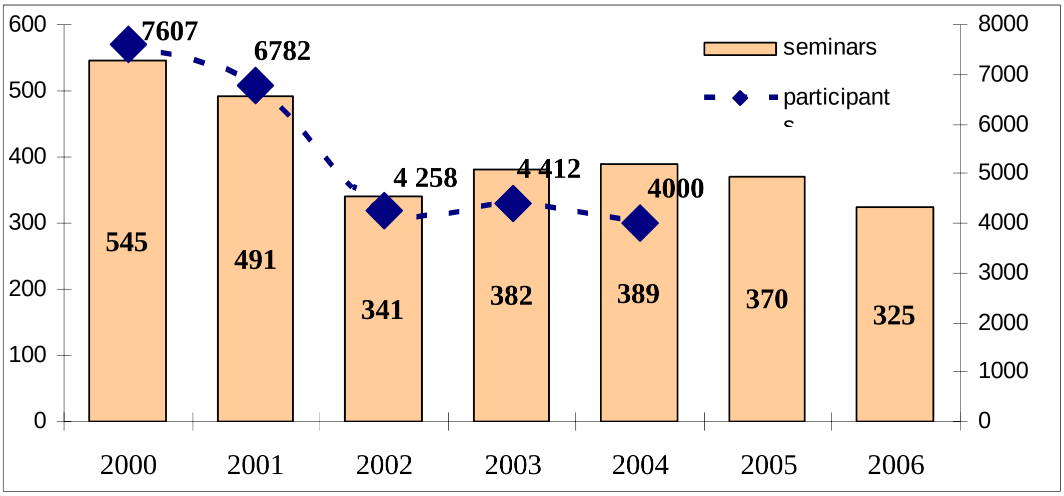

Figure 2: Seminars organized by the State forest Service (2000 – 2006)

Later the number of seminars organized by forest specialists decreased considerably. In 2007 the SFS reported about 47 seminars and the CSC about 43 seminars. Activity level of both organizations increased in 2008, when accordingly 120 and 123 seminars were organized. Number of participants of the CSC seminars had exceeded 4 000. Most of these seminars were organized with regard to EU funds and in the classrooms.

4 RESULTS OF OPINION POLLS

4.1 FOREST OWNERS NEED KNOWLEDGE AND INFORMATION

Information on knowledge and awareness of PFO were tested in several ways. Firstly, PFO were asked directly about their knowledge and practical skills in the forest management. Secondly, a couple of questions related to actual issues or problems on private forest management were included to test actual knowledge of PFO. Thirdly, discussions with PFO and their future plans also were insinuation to information that would be required in the nearest time.

Table 3 shows that proportion of PFO without knowledge and practical skills in forestry had increased more than 2,5 times in seven years period. In the same period proportion of PFO with forest related education had raised for 4 %.

PFO in opinion polls gave also evaluation of their knowledge in the 5 point system. In 2003 the average rating of self-appraisal was 3,1 points, in 2008 it reached 3,7 points. It was noticed that PFO with forest education estimated their knowledge to 3,5 points, but owners with knowledge obtained in practice with 4,5 points.

Table 3: Forest related education and knowledge of PFO

year	**2001**	**2003**	**2008**
Forest related education	8	6	12
Practice, experience	68	55	21
No knowledge and practice	24	39	66

It was indicated that 75 % of PFO managed forest property on their own or together with family members in 2001. Opinion poll in 2008 stated the fact that less than 20 % of respondents didn’t realise any forest activity in previous year. Dominating activity was firewood collection; forest harvesting was fixed only in 40 % of answers. About 86 % of respondents declared that decisions in the forest management were made by themselves, 10 % of respondents did it together with family members. Only 4 % of respondents were outside decision making process. In most cases all activities were organised and done by owners, only 15 % of respondents reported the use of services of forest companies.

In 2003 less than 8 % of respondents didn't plan forest activities in the nearest future. In five year period amount of planned activities had reduced for 20 % and proportion of PFO who had planned income from forest decreased to 21 %. In 2008 number of respondents who didn't plan any activity in nearest years reached 55 %.

In 2003 close to 85 % of respondents had opinion that they knew what nature protection in the forest means. Particular aspects were given by 65 %, but after the qualitative analyses it was noticed that only each third PFO know about nature protection. Other question was about legislative requirements in nature protection. In this case 58 % gave positive answer, but totally only 19 % of respondents know about them. In 2008 situation was very similar. It was also noticed that above 46 % of respondents spoke about selective cutting in their property, but in fact only 11 % of PFO had some hunch what it means.

Firstly knowledge on forest related taxes was tested in 2003. Most part of PFO (80 %) mentioned property tax, but only 15 % pointed out something about income tax. Qualitative analyses of answers demonstrated there was also wish for higher tax rates than current ones were. In average desired tax rate for the income tax was 11 % (in group of active PFO – 9 %) in the place of the existing 25 %. Each fourth owner had heard about reduction in taxes for young stands and regeneration. Knowledge on tax issues until 2008 hasn't improved.

Respondents were asked about their recommendations to the Forest Law and other normative acts. The generality of respondents (74 %) didn't have any opinion, 6 % considered them to be good, 9 % of respondents would like to have less restrictions and more freedom in decision making process, but each tenth made proposals for changes in legislation. In most cases wish to reduce bureaucracy and recall different limitations in the forest management was expressed.

4.2 DEMAND FOR KNOWLEDGE AND INFORMATION

Percentage of PFO who wanted to increase knowledge or have additional information on forest management has decreased from 51 % in 2001 to 44 % in 2008. Results of opinion polls in 2001 and 2003 demonstrated that interest to improve awareness had 60 % of PFO with knowledge and less than 40 % of PFO without knowledge and practice in forest management.

Reasons why PFO were unwilling to perfect their knowledge differ from year to year. In 2001 main reasons were too small forest holdings (49 %), there was no need for information (25 %) and no interest (16 %). Two years later each third of respondents mentioned age (in average – 69 years), each forth the fact that there was no need for additional information. Existence of knowledge and no reason to have more had been both pointed in 14 % of answers. In 2008 each of three main reasons were prescribed by 10 % of respondents: it was fair knowledge, there was no need and forest property had little value. It is necessary to remark that number of the same answer “there is need of new knowledge, because it is possible to get (to ask) all information from local forest ranger” has tendency to increase from 2004.

Studies in Latvia approved the fact that level of knowledge has significant correlation with size of property, age of PFO and previous competence. Male forest owners are more interested in obtaining information than female forest owners. Younger forest owners and owners living outside their forest property more frequently pointed out lack of time as obstructive in perfection of knowledge.

More than third of PFO were interested in obtaining knowledge on forest regeneration, forest legislation, precommercial thinning and afforestation of abounded agriculture lands in 2001. After two years PFO pointed out more than 30 actual questions. About 20 % of them were related to forest regeneration, 13 % were about forestry in general and 10 % set down forest thinning issues. While opinion poll of active forest owners pointed out more than 100 different questions, 43 % of them were related to forest regeneration and 32 % to thinning activities. Last opinion poll in 2008 showed tendency that owners were more interested in forest management issues generally, not in some specific activity or topic.

4.3 SOURCES OF INFORMATION AND KNOWLEDGE

In 2001 majority of PFO got information on forest related issues from mass media. Forest specialists were mentioned in nearly half of all answers of respondents. Role of specialists of the SFS in obtaining information_increased in 2003. Each fifth of respondents had got information from relatives, friends or neighbours. In group of active PFO forest specialists were mentioned in 80 % of answers, but mass media as source for information in 70 % of cases. Tendencies for choice of actual information sources in 2001 and 2003 were similar. Research results indicate that usually PFO give preference to the same sources of information also in future.

In 2008 PFO gave preference to live information channels. Specialists of the SFS were mentioned by 66 % of respondents and friends and neighbours by 14 %. Percentage of mass media in seven year period had decreased from 72 to 19 %. Firstly internet was mentioned in opinion poll in 2003 by 5 % of respondents, in 2008 this number reached 7 %. Several respondents spoke the word to receive information via e-mail in future.

PFO were asked about preferable way for perfection or obtaining knowledge. Significant difference was found between average and active PFO and also time period between 2001 and 2003 (Figure 3). Jump was fixed in wish to visit specialists, also possible demand for onsite consultations increase for both groups of PFO. Active PFO constantly gave preference to direct contacts with specialists in forest than literary studies. Role of printed literature as education source also had increased from 2001 to 2003.

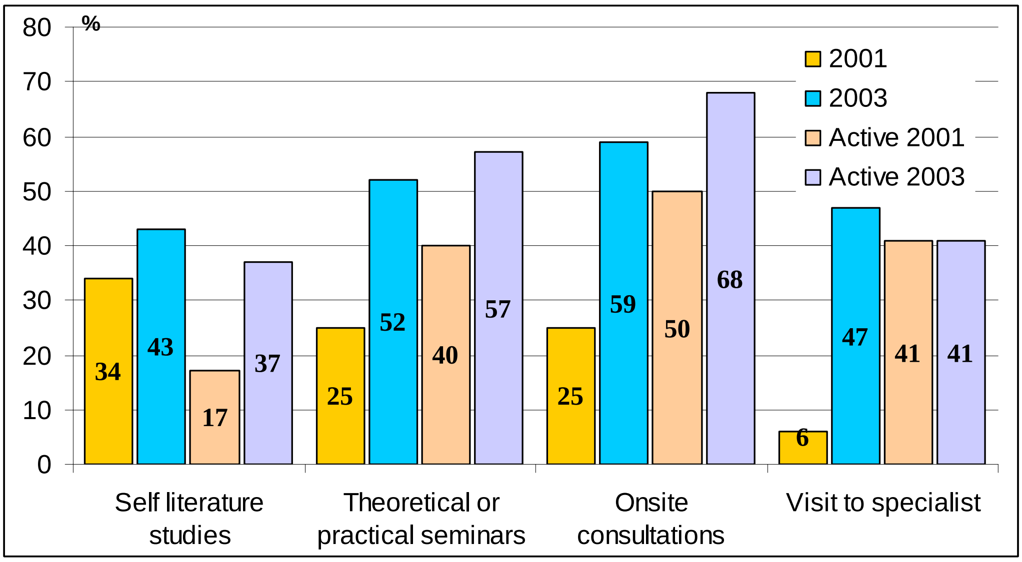

Figure 3. Sources for obtaining knowledge in 2001 and 2003

In 2008 probable demand for seminars decrease to 23 %, but role of the SFS as educators kept the leader positions. Deep studies of target groups for each channel of informative and educative sources were done.

4.4 USE AND EVALUATION OF THE STATE FOREST SERVICE

In 2001 up to 60 % of respondents reported use of the SFS services. Target of visit in 53 % cases was only related to forest harvesting. Each third of visitors of the SFS mentioned issues related to sanitary conditions and the same amount was interested on advice in forest management in general.

Originally also 60 % of PFO gave positive answer to question about calling specialists of the SFS in 2003. The qualitative analyses of data showed that totally close to 74 % of respondents had met specialists of the SFS. In 60 % of cases the reason for visit was need for cutting license, but 51 % of visitors had need for advice. It was surprising that 9 % of visitors of the SFS mentioned also services of marking out and making a sketch of the cutting area and pre-harvest inventory of the cutting area which were not included in tasks of the SFS.

In 2003 demand for consultations had increased, each third of respondents mentioned that he/she would like to have advice in future. Desire to get also practical help and services from specialists of the SFS was expressed in 4 % of answers.

In 2008 66 % of respondents reported about visit to specialists of the SFS, but the qualitative analyses of data and information indicated that it should be more, close to 90 %. Advice as task of visit was mentioned by 20 % of respondents.

Close to 95 % of respondents were satisfied with received services in the SFS in 2001. In 2003 this number decreased to 91 %. Mentioned reasons for dissatisfaction were not related to functions of the SFS. For example, often changes in requirements of legislation, no information on prices and timber market.

PFO evaluated in five point system different aspects of the SFS extension system: occurrence and attitude of specialists, availability and quality of information. In 2001 only occurrence of employees of the SFS was evaluated with 4,5 points, other positions got 4,7 points. Two years later there were no changes in evaluation, but reasons for lower points were studied. PFO were not satisfied that specialists were too far from their residence place and offices of the SFS were closed when they finished their work.

4.5 KNOWLEDGE ON EXTENSION ORGANIZATIONS

In 2001 PFO knowledge and comprehension of tasks of the SFS was tested. Several statements were proposed to respondents. Majority (80 %) of respondents knew about main functions of the SFS- controlling observance of the provisions of statutory acts. Great part (68 %) of PFO knew also about possibility to get advice without charge. It was established that comparatively large part of PFO had wrong understanding about functions of the SFS. For example, consultations on forest harvesting was mentioned in 60 % of answers, preparation of forest management plans and elaboration of normative acts were pointed out by 45 % of respondents each, but forest management in 25 % of all answers.

In 2003 only 10 % of PFO had knowledge about main tasks of Forest Department of Latvia Agriculture Ministry. Separately were analyzed comprehension about mission of Head Office of the SFS and local forestry office. About 38 % of PFO had some vision about Head Office and 71 % of PFO had an idea on tasks of local forestry. In most cases PFO mentioned the issue of cutting licenses and other documentation, controlling observance of the law and extension activities.

In 2008 PFO were asked to make comments on changes in extension system in structure of the SFS. Relatively small proportion of respondents could do it. About 40 % declared that nothing was changed for them. Close to 9 % of PFO mentioned positive changes. Reasons for it were different: better attitude, progress in use of IT tools, services are available also outside location place of forest property, much stricter requirements, better communication, and improvements in general. 8 % of PFO had negative attitude to changes in the SFS. Most owners were not satisfied with fact that they had to travel longer distance to the office of the SFS. There were also comments that forest rangers after optimization of the SFS were so loaded with tasks that it would be problem to meet them in future and they couldn't do their duties in the best way. Several comments gave a message that close to 5 % of respondents still think about specialists of the SFS as forest managers and business people. PFO were asked also to give their opinion on potential improvements of extension system. There were more than 50 proposals from 6 % of respondents, but anything was practically used or related to real improvements, except the idea to implement use of the Internet in providing documents.

5 DISCUSSIONS AND CONCLUSIONS

First forest extension agents of the SFS acquired brilliant knowledge from Swedish experts and also got training in Latvia. Hard work was done to establish extension system in 2000. After first year opinion polls of average and active PFO were organised and results of them formed base for improvement and the development of further activities. For example, comments on occurrence of employees led to implementation of doorplates with working hours. It was recognised that PFO didn't have or had missing understanding about tasks of the SFS, and special campaign of articles was organised in mass media. Local municipalities were mentioned as place where PFO would like to get information about forestry, and cooperation and information exchange with municipalities were realised.

Forest experts came to the conclusion that topics mentioned by PFO as interesting in future meant only information about current knowledge of PFO. Forest experts had to see reality of forest management of private forest sector and put stress on the right topics to improve sustainable management. Only self evaluation of knowledge of PFO couldn't be a base for solutions in the development of extension system. Generally PFO with knowledge need more thorough knowledge, but the ones without any knowledge firstly needed their interest in forest management to be arisen.

After two years new opinion poll was organised to check results of extension and got better understanding about needs and wishes of PFO. Vital job was done inside the SFS to analyse and explain results to employees. Sometimes results of opinion polls were contradictory or inexplicable. For example, majority of PFO mentioned that TV and radio were important source of information, but in reality special broadcasts for PFO were rarity.

Seminars were nominated as one of preferable tools in obtaining knowledge, but information of the SFS indicated that less than a percent from the total number of PFO had visited seminars. Proposal of PFO to organise seminars in evenings and on weekends was not supported. Number of seminars decreased due to low attendance level and high seminar costs. Also number of articles in mass media had decreased with time, because there were not so many actualities as in the beginning of forming extension system. It is possible to conclude that in 2004 extension system of the SFS was in turning point. Different tools of extension were designed, implemented and tested and relevant knowledge on PFO behaviour, needs and wishes was obtained. It was more time for individual work with PFO, and increase in number of consultations in 2005 also gave evidence on it.

Communication issues were very important topic in training of staff of the SFS. Interviews of PFO approved the fact that PFO didn't use professional forester language. For example, PFO never did forest management, but they did planting, cutting or other definite activity. In general if PFO use term "cleaning" it could be anything starting from collecting branches and firewood up to tending or precommercial thinning, sometimes also getting ecological trees, dead and dry wood out was included. Terminology of PFO pretty often described also negative attitude to extension. Some examples of interviews were good example: I don't need knowledge, I would like to have information how to measure basal area*;* I don't need any advise (information), tell me only how many trees I had to plant; I don't have a plan to make any use of the SFS in future, I always ask to my neighbour or sometimes the certain name of person was mentioned (in most cases it was a local forest ranger).

Although development of the extension system was speedy, step-by-step principle was taken into account. In 5 years it was an excellent system where principles of adult learning and pedagogic were taken into consideration. Opinion polls of PFO and feedback of PFO from other activities were used to make improvements. Unfortunately it was not possible to calculate the return of money invested in extension work or measure effectiveness of extension activities. Statistical data of the SFS indicated that there was improvement of forest management in private forest sector, but it was not possible to separate contribution of extension activities from other FP tools used. On the one hand extension was admitted as a very important tool which demonstrated results, but on the other hand budget and human resources for extension activities were reduced.

In 2004 PFO offered opinion that they would like to have also practical help from foresters, not only advisory service. In 2006 new organization the CSC was established under the SFS. Also optimization of number of forestries and staff was ongoing within the SFS structure. These changes offered several improvements for PFO required by them before. For example, services in forest management and developing plans were offered in the CSC, services of the SFS was available also outside forestries where forest property is located and in the Head Office of the SFS.

Unfortunately changes in the structure of the SFS and optimization caused also negative changes. After reduction of forestries a lot of PFO had to travel longer distances, change in routine caused negative attitude to extension system in general. Mainly PFO who were older, had smaller forest properties and lived far from forest centre were influenced more negatively by other ones. It was hard to reach this group of PFO also before, but after changes proportion of this group would increase. Like in other countries small size forest owners remain outside extension activities, this group wasn't interesting for any organization and also didn't look for activities by themselves. On the other hand this group is characterized by great number of PFO and implementation of FP was a vital issue also in smaller properties.

It was not easy for specialists of the SFS to get in trust of PFO. Owners are very loyal to their previous choice and don't want to change their "source" of information. With optimization of the structure of the SFS not only offices, but also specialists and their tasks and duties were changed. PFO in a lot of situations were confused about it and sometimes also services fee.

Reorganization in extension system in 2006 was hard not only for PFO, but also for forest specialists. Process took a lot of time and energy as well as finances. Specialists of the SFS and the CSC had to do more than double work. Firstly, to continue working with their own tasks, secondly, promote new organization of extension services and thirdly, break previous system in mind of PFO and explain the new one. That led to reduction of number of consultations, seminars and other extension activities in two year period.

It is possible to maintain that both structures started development of extension system from the beginning, but in the same time it was necessary to create new extension system and partly destroy old one. In 2008 activities of the SFS and the CSC had increased due to growing demand of PFO related to EU grants. New extension system gained speed, but March 2010 brought again new information on changes in extension system. The CSC was separated from the SFS and became as affiliate of the Latvian Rural Advisory and Training Centre.

Detailed studies of effectiveness of each period of the development of extension system aren’t possible, because information on finances isn’t available. Also there is not possible to measure the return of extension activities in short time period. Experiences of other countries make us think that extension system in Latvia at the moment is back to its starting point. It will be necessary to create a new team of extension specialists and regain belief of PFO. This time it will be possible to do with help of more modern tools as before, for example IT and the Internet.

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Study of a model to present a learning phenomenon in log loading work

Hirokazu Yamaguchi[1], Masaru Oka, Jun Kashima

Abstract

In this report, we have attempted to make a model that can be used for a estimation of improving operator's productivity by analyzing how an operator can gain proficiency in the operation of forest machines. We followed the subsequent machine work of the operators, who were experienced and inexperienced operators in forest machine operation. The work time consequently showed a tendency to decrease as the work experience of operator increased. This phenomenon can be expressed by the log-linear learning model, with over 0.95 determination coefficient in the regression analysis. We then used the learning model to estimate the time requirements for long-term improvement through observation of the operator's initial improvement. Accuracy in comparing of the predictive values and actual values of the work time suggested that an operator's improvement in forest machine operation can be forecast by observing the operator's early progress.

Key words: learning model, log loading work, Grapple loader
FDC: 305=111

1 INTRODUCTION

In Japan, many forestry contractors have been experiencing financial difficulties due to the long-term stagnation of domestic timber prices. This has caused an overall decline in the forestry industry and has resulted in the expansion of less-maintained forest and the devastation of forest sites. To revitalize Japanese forestry and to achieve stable domestic timber supplies, the Japanese government has proposed a forestry revitalization plan. This plan attempts to introduce more effective forestry machinery. Forest machines, while highly effective, are very difficult to control, so the productivity of a forest machine is greatly influenced by the skill of its operator. It is necessary, therefore, to promote skilled operators who can master the operation of forest machines while introducing more productive machines. There is, however, at present, not enough information in Japan on the amount of time required for an operator to be trained in the use of forest

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machines, and little research has been done in this field. As a result, there have been problems: without knowing how effectively their operator can use new forest machines at forest sites, contractors have been unable to draw up business plans or assign operators effectively. In this report, we have attempted to make a model that each contractor can use to estimate productivity by analyzing how an operator can gain proficiency in the operation of forest machines.

Figure 1: Log handling work with Grapple Loader

2 MATERIAL AND METHODS

It is thought that the way in which an operator improves differs depending on the nature of the work or the complexity of the machine. Moreover, the operator's experience, his learning abilities, and his dexterity are assumed to have an influence on the speed at which he will gain proficiency. In this study, we focused on the use of the grapple loader in log handling operations, which is a fundamental part of forestry machine work. We followed the subsequent machine work of the operators, who came from a broad range of experience in forest machine operation, including inexperienced operators. We then applied a learning model to each operator.

2.1 PARTICIPANTS

Six operators cooperated in this investigation. The participants were divided into two categories according to their experience. The first consisted of four operators who were inexperienced in forest machine operation. The second consisted of two experienced who had had 12 to 27 hours experience of machine work with a grapple loader or an excavator. Table 1 shows the details of each operator’s experience. Prior to the study, each operator was allowed 30 minutes of practice time to learn how to control the machine.

Table 1: Details of each operator's experience

Participants	Category	Experience (hour)	Contents of experienced machine work
A	Inexperienced	1.0	Practice or check
B	Inexperienced	0.5	Practice or check
C	Inexperienced	0.5	Practice or check
D	Inexperienced	1.0	Practice or check
E	Experienced	27.0	Work with grapple-loader or excavator
F	Experienced	10.0	Work with grapple-loader or excavator

2.2 INVESTIGATION

The investigation period was about 6 months, from the middle of June to the beginning of December 2009. Each participant was studied at least five times. On each occasion, we measured the time it took to load 2.35m^3 of logs (75 logs with an average diameter of 0.138 m and a length of 2 m) onto a forwarder and then unload the same load. The participants were required to use the grapple loader installed on the vehicle, and they had the chance to control the machines like they would in ordinary operations. Outside these studied days, we calculated the hours of experience for each participant, using daily reports on the content of their work, their working time and the machinery they used for the work. We examined the time required for the log loading work and analyzed their improvement in relation to their accumulating experience.

2.3 LEARNING MODEL

A log-linear model was used to represent the learning process. In manufacturing, this model has long been used to calculate production costs, making estimates for and improving the efficiency of the production line. For example, this model proves that the price of a product can be reduced as manufacturers produce a commodity more efficiently the second time than the first time. In this study, improvement in the operation of forestry machinery is expressed as the change in productivity (time for requested work) in relation to the increase in the experience of the operator. When assuming that the operator's improvement can be expressed by the log-linear model, this model is as follows:

(1) $$y = ax^b$$

where the operator's experience, in hours, is X and the time taken for the requested work is Y, *a* and *b* are the coefficients.

2.4 TIME REQUIREMENTS

The main purpose of introducing the learning model was to predict an operator's long-term improvement after his initial improvement. We then used the learning model to estimate the time requirements for long-term improvement through observation of the operator's initial improvement. When applied to the log-linear model, improvement is shown by the line on the logarithmic graph as follows:

(2) $$\log_{10} y = \log_{10} a + b \log_{10} x$$

(3) $$y_1 = a_1 + bx_1$$

where let $\log_{10} y = y_1$, $\log_{10} a = a_1$, $\log_{10} x = x_1$

This implies that the model's coefficient can be calculated if at least two points are plotted on the graph. Observing the operator's work twice, we calculated the coefficient, and compared the model's predictive values with the actual data from the study. The predictive values of two observations were also compared with that of three observations.

3 RESULTS

3.1 THE LEARNING PROCESS AND THE LEARNING MODEL

Figure 2 shows the relationship between the time required for the log handling work and the operator's experience over the time period of the study. For inexperienced operators A-D, their work time decreased as their operation experience increased. This is shown by the curve that decreases rapidly until about 10 hours experience time, and decreases gently afterward that. However, a clear improvement could not be confirmed for operators E and F, who had at least 12 hours of machine operation experience before the start of the study. The learning model was applied to operators A-D, whose improvement was confirmed. The linear approximation coefficients *a* and *b* were calculated using the method of least squares on the logarithmic graph(Figure 3). As a result, coefficients *a* and *b* were calculated for each operator as shown in Table 2. Determination coefficient was over 0.95, which is evidence of a close relationship between the operator's work time and their experience. In this way, their improvement was represented by the log-linear learning model.

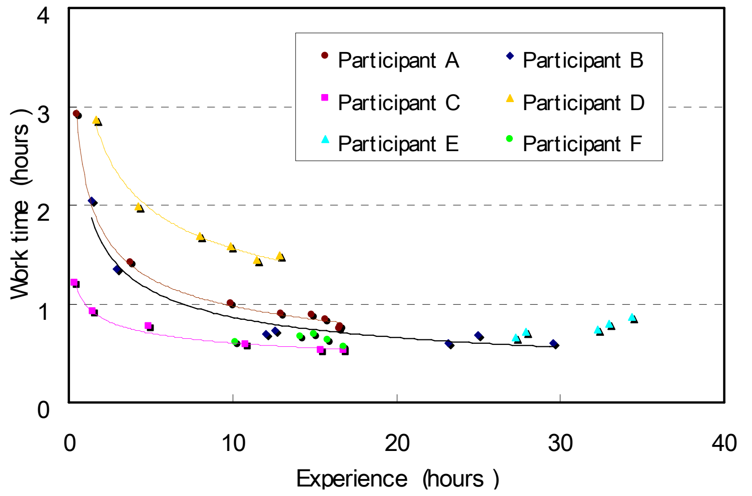

Figure 2: The relationship between the time required for the log handling work and the operator's experience

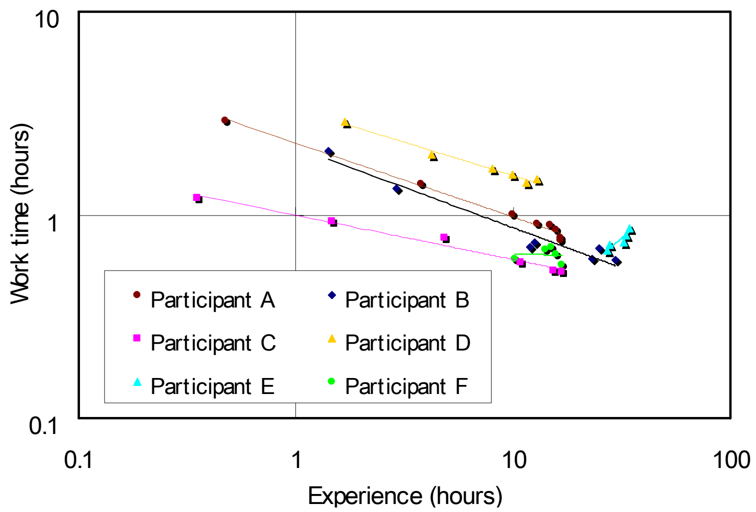

Figure 3: The relationship between the time required for the log handling work and the operator's experience (on logarithm graph)

Table 2. Coefficients of Learning Model

Participants	Coefficient (a)	Coefficient (b)	Coefficient of determination (R^2)
A	2.259	-0.364	0.992
B	2.146	-0.395	0.977
C	0.995	-0.218	0.989
D	3.320	-0.328	0.992
E	0.038	0.874	0.815
F	0.654	-0.011	0.001

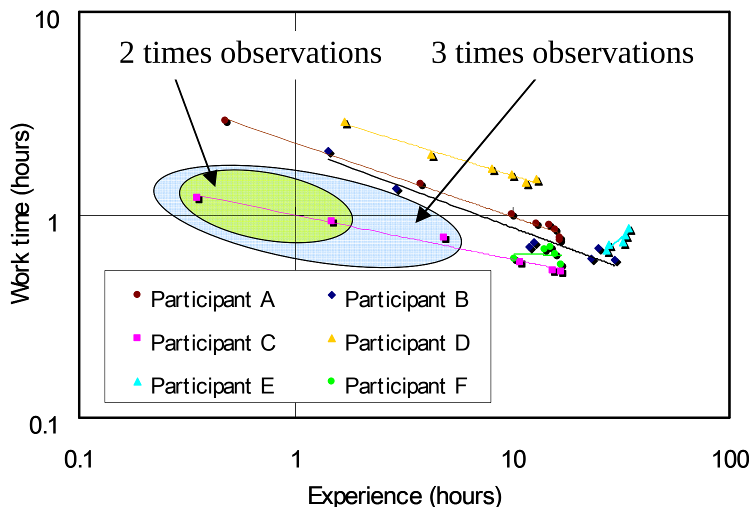

Figure 4: Observations used for the calculation of the learning model coefficients

3.2 ACCURACY OF ESTIMATES USING THE MODEL

Coefficients used for estimation were given by 2 or 3 observation plots on the logarithm graph (Figure 4). A comparison of the predictive values and actual values of the work time in each study of operators A-D is shown in Table 3. The margin of error in the model outside the observation periods was about 6 minutes, and the mean was 1-4 minutes for each operator. The margin of error was about 10% for the overall operation time.

Analyzing these results in terms of different observation frequencies, the average margin of error in the model was 4.9% in the case of two observations and 6.4% in the case of three observations, showing that the accuracy of two observations is higher than three observations.

Table 3. A comparison of the predictive values and actual values of the work time

Partici-pants		1st	2nd	3rd	4th	5th	6th	Average absolute error	Error rate (%)
A	Actual time	**2:55:17**	**1:25:32**	**1:00:41**	**0:54:18**	**0:53:47**	**0:50:34**		
	Error (2 observations)	0:01	0:01	0:23	1:25	1:42	0:34	1:01	1.9
	Error (3 observations)	0:09	0:13	0:07	1:09	0:55	1:15	1:06	2.1
B	Actual time	**2:02:59**	**1:21:02**	**0:41:47**	**0:43:39**	**0:36:15**	**0:38:16**		
	Error (2observations)	0:01	0:01	5:35	0:07	1:59	5:46	3:22	8.4
	Error (3 observations)	1:46	1:48	0:29	4:43	3:37	3:19	3:53	9.9
C	Actual time	**1:12:38**	**0:55:28**	**0:46:33**	**0:35:02**	**0:31:57**	**0:33:02**		
	Error (2 observations)	0:00	0:00	2:16	3:02	2:42	1:49	2:27	6.7
	Error (3 observations)	0:35	1:01	0:27	4:21	4:17	1:43	3:27	10.3
D	Actual time	**2:52:08**	**1:59:09**	**1:41:25**	**1:35:11**	**1:27:28**	**1:31:22**		
	Error (2 observations)	0:01	0:00	1:05	3:18	3:34	1:43	2:25	2.6
	Error (3 observations)	0:12	0:34	0:20	2:31	5:45	0:47	3:01	3.3

4 DISCUSSION

The work time for the log loading operation using a grapple loader showed a tendency to decrease as the work experience of an inexperienced operator increased. This can be expressed by the log-linear learning model. However, improvement could not be confirmed for the experienced operators who had at least 10 hours of forest machine work experience. The reason for this is that the shortened work time of experienced operators who skilled in machine operations was not large enough to be apparent among other uncertain factors which influenced the work time. To solve this problem, it is necessary to reduce uncertain factors to negligible levels by increasing the number of observations or developing a easily repeatable means of investigation. The predictive accuracy of the learning model, as adapted for forest machinery work, suggests that an operator's improvement can be forecast by observing the operator's early progress. However, there is room for discussion about convergence at the end stage of the learning process, including possible corrections to the model.

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"Iriai" traditional management of village common forest resources in Japan: transformation and sustainability

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Abstract

Iriai in Japan was a sustainable management system of common forests in villages producing basic domestic needs, and functioned as a tie of the local community before the Second World War. Under the "common property regimes" only the group members have access to resources based on the recognized regulations on resource utilization. Although the central government tried to abolish the Iriai forest management system since the Meiji era a significant percentage is still held in common at local level. The study attempts: to reveal the changes in iriai forest management system; to recognize the challenges and to analyze the opportunities for sustainable management. The paper is based on the information collected reviewing the literature selected through the search methodology. The paper revel the changes in "iriai" forest management system through the changes in: forest management setting; rules and regulations; community access for forest resources: type of forest uses: and the reaping and distribution of benefits by the village community. Challenges for sustainable forest management are recognized as: the disappearance of the role of irai forest resources in the village; and conflicting issues in diverse management objectives among stakeholders. Respects for traditional management strategies and customary practices; continued interest of community in traditional food, local commodities and natural environment; and their respect to local governance and strong group dynamics are found to be the important opportunities prevailing for future sustainability of iriai forest management. Integrating traditional and modern techniques and cross-institutional collaborations would ensure the sustainability of Iriai forests management system.

Key words: Iriai Forest Management, Challenges, Opportunities, Sustainability
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1 BACKGROUND

Ideogram of tree and forest carried on ancient memories of natural surroundings in Japan. Chinese characters "words from the Han Dynasty" and "Buddhism" came to Japan via Korea in the sixth century (Cultural News, 2007). Local forms of community organizations and intensive sustainable management systems under traditional forestry practices done by local people in the country are some what similar to what have been documented in many Asia countries. According to McKean (2003), the history disclose the fact that Japanese forest management from the viewpoint of "common pool resources" is a long-term success resilient institutions, cooperation over time and resulted with environmental conservation. Before the Second World War, common forests in villages played an important role in producing basic domestic needs, and functioned as a tie of the local community (Yao, 1988).

People called "Iriai" for the parts of the environment for which lay beyond their own thresholds and outside of their own possessions, but recognized claims of usage, not to produce commodities but to provide for the subsistence of their households. Illich (1982) recognizes that "Iriai" in Japanese is quite close to the meaning of "commons". The common designate certain aspects of the environment for which customary law exacted specific forms of community respect. Iriai is a customary institution by which the resource is jointly managed and controlled not by individuals, or by an organization with a corporate status, but by a group of households residing in the local community (Goto, 2007). The law of the Iriai regulates the right of way, and the rights to fish hunt, graze, and to collect wood or medicinal plants. Hence, many research consider the phenomena of Iriai for the study of legal rights and legal consciousness, see it as a struggles as a political battle unique to Japan but not as an internationally widespread one (Illich, 1982). Successful common property institutions possess: self conscious and self-governing co-owners; mechanism for resolving internal conflict; rules for monitoring of behavior and enforcement of sanctions; arrangements to prevent abuse by guards; easily enforceable rules and ecologically conservative; commons investment and benefits proportion to the effort in terms of time and money (McKean, 2003). Inoue (1998) argues that under the "common property regimes" only the group members have access to resources "local commons" based on the recognized regulations on resource utilization. The terminology of commons is properly classified in regards to open access resources as "global commons", and common property resources as "local commons"

The central government of Japan has tried to abolish the Iriai forest management system since the Meiji era. The government investment in forest plantations was made in the first half of the 20the Century on the assumption of a continuing strong demand for timber (Yao, 1988). With the globalization and opening up of international markets, timber products could be imported far cheaper creating poor return form government investments and forcing the local extraction to be subsidized. On the other hand, import demand for wood product of the country has been leading to the severe depletion of natural forests in developing countries which is quite difficult to be regulated (Curtis, 2007). Forest is the single most important component of social common capital which is fast emerging as one of the pivotal economic concepts of the twenty-first century (Uzawa, 2004). Presently new appreciation for indigenous wisdom emerges and the limitations of conventional forestry models are acknowledged (Dugan, et al. (1989). Community property rights and community management, and common property rights in resources seem to be the key to restoring sustainable use of environmental resources (McKean, 2003). Iriai system of forest management experiencing in Japan which is an institutional settings of commons in the western sense has become a vital research interest at this age of global and local environmental crises (Murota, 2003).

Japan has almost 70% forest covering 25.21 m hectares of which 10.33 m hectares is plantation and a significant percentage is still held in common at local level under Iriai system (Curtis, 2007). The area of forests governed through common property institutions in the world has increased substantially in the past two decades mainly because of new legislation and policy initiatives. The increasing forest area under community-oriented tenure regimes can be seen as an admission of the fact that local communities can govern their natural resources effectively than by the national or provincial level decision makers (Agrawal, 2007). Mitsumata (2007) has suggested that there is an urgent necessity to reconsider the Iriai system, and emphasized the need to understand the challenges and possibilities for the promotion of Iriai forest management system.

The objectives of this study were to ascertain the changes of strategies taken on Iriai forest management systems before and after the Second World War; to examine the current threats which hinder the programs attempting to revitalize the Iriai forest management systems; and to recognize the presently prevailing opportunities which provide incentives in order to revitalize the aged old Iriai forest management system to a sustainable system.

A search methodology was developed and undertaken to identify relevant literature written on changed strategies, current threats prevailing opportunities of the Iriai forest management systems as well as the common forest management systems. The paper based on the information collected reviewing the literature selected through the search methodology. Institutional transformation; rules and policy impositions; change of Iriai rights; shifting products interests; and earning income and sharing benefits are discussed as the changed strategies. Major current threats are explained in terms of land abandonment; lost of recognition; deterioration of environment; conflict with local authorities; and difficulties in timber management. Local conduciveness; community-centered forestry rules; livelihood contributions; protection of village environment; local initiatives; effective administration; and building partnerships are discussed as the main opportunities.

2 CHANGES IN "IRIAI" FOREST MANAGEMENT SYSTEM

Changes in forest management setting: The property of commons was evolved during the medieval period (1185-1600) and prevailed under pressure because of their importance during the Tokugawa period (1600-1867) until it was subjected to be changed during the Meiji period (1867-1912) (McKean, 1991). The common forest "Zaisankuyurin" has roots in the Iriai in the Edo era (1603 ~ 1867) (Mitsumata, 2000). The social institutions developed to manage tree plantation created cooperation among the ruling elite and village communities on timber production by 1670s. Different tenure arrangements: yamawari (dividing use rights of village forest land among families), nenkiyama (long term leases of forest land to villagers by the government), and buwakibayashi (villagers producing timber on government land and sharing the harvest with the government) eventually promoted to different forms of community base forest management (Marten, 2008). The extending village cooperation to manage forests with mutually reinforcing silvicultural improvements, social institutions for forest land use, and timber marketing institutions eventually led to the reforestation reaching completion in the 1920s (Marten, 2008).

"Iriaiken tenure" the community access forest resources became "joint-owned property" controlled after the Meiji government in 1950's taken over the control of forest from local overloads (Curtis, 2007). After the World War II, most of the forest lands governed by the customary institution of Iriai were changed arguing that the common ownership was an obscure, ambiguous, and outdated arrangement (Goto, 2007). However, the leadership of management committees of Iriai forests in Gunma Prefecture organized collective work in forests to facilitate the regeneration of extracted grasses. Voluntary tree planting on Iriai forest by communities was ceased by 1980 with the decline of timber price. Eventually some of the Iriai forest parcels were allotted to individuals by forest management committees and began to manage as private individual properties (Kijima et al., 2000). According to Goto (2007) in Ishimushiro village, formally 90 households belong to the

Ishimushiro Common Forest Association jointly used about 1,000 hectare of iriai "satoyama" forest lands. They take part in a traditional form of mutual assistance among households based on the principle of equal exchange of labor call "Yui" particularly in re-thatching their roofs. Although about 50 households moved to the village they were not belong to the association and did not join *yui* activities.

Under the nationwide Iriai Forestland Modernization Project, Common Forest Associations had to be reorganized as Forest Producers' Association or a joint stock company in order to compatible with modern proprietary relationships. The Forestland Modernization Project was meant to change primitive form of democracy that required unanimous consent changed to a modernization upholds that governed by few persons with money and majority support as they wish (Goto, 2007). The Authorized Neighborhood Association (ANAs) established in 1990s which has the corporate status is possess of common property of village communities. There were 22,050 ANAs constituting 7.4% of all Neighborhood Association in the country by 2002. Presently, the prefecture government sponsored Forest Producers' Cooperatives (FPC), local government authorized organization with corporate status ANA and traditional common pool resource Iriai systems are directly involve with the management of Iriai forests. The Modernization Policy in 1996 emphasizes the joint forest operations for efficient forest production (Yamashita et al., 2008).

Changes in rules and regulations: The Iriai forest rules and regulations lasted for two and a half centuries until Tokugawa-era. The strict management rules including dates and time, and places and amounts of specific resources allowed to be extracted from Iriai forests were implemented to prevent overexploitations. Even use of tools in Iriai forests was strictly regulated (Kijima et al., 2000). The households were fully aware of the usable extent of the Iriai forestlands for sustaining their livelihoods. They had to establish very strict rules on the use of Iriai forestlands even setting the length of the sickles used to mow the grass. The important decisions concerning the management of Iriai forests require the unanimous consent of all its members. The households not individuals constitute the Iriai group required the unanimous consent to take decision to use the Iriai forests for some specific purpose (Goto, 2007). The forest rules and regulations began to change in Tokugawa-era in various legal forms as forests owned by villages, shrines, schools, property wards, representative individuals, or specific groups of individuals (McKean, 2003). However, the community members in many areas informally formulated strict management rules and enforced effectively by rotational patrolling and severe punishment schemes (Kijima et al., 2000).

After the Meiji Restoration of 1868, a policy to demarcate forestlands classified into privately-owned forests and others as nationally-owned forests (Goto, 2007). The legal changes since 1873 have transformed the property rights (McKean, 2003). The Meiji government in 1950's had taken over the control of forest resources and converted many community own forests to joint-owned private property (Curtis, 2007). The government passed legislation to put in place a legal system for Iriai during the Meiji era in order to decide a process for disposing of the rights and obligations attending Iriai when such land was transferred to private ownership or state control (Hirofumi, 2004). On the other hand, Meiji civil code enclosed legal protection of Iriai forest and provided a few legal mechanisms to preserve commons as *sony-ûrin* or *zaisanku* by villagers (McKean, 2003). The leadership of management committees of Iriai forests in Gunma Prefecture strictly imposed the rules on extraction of resources and use of tools (Kijima et al., 2000). The real thrust of the legislation was to gradually replace Iriai with either private property or state management. Eventually, the Iriai system that had supported farming villages for centuries was virtually destroyed in most of the areas.

With modernization and development initiated in the latter half of the nineteenth century, the customary institution of Iriai transformed into a modern legal system. The Iriai Forestland Modernization Law was established in 1966 with view of creating modernize agricultural and mountain villages (Goto, 2007). "Local Autonomy Law' revised in 1991 again changed the rights and ownership of the Iriai forest. A new law enacted the Modernization Policy in 1996 attempts to modernize Iriai rights in order to adopt joint forest operations (Yamashita et al., 2008). Today only few examples of such common property Iriai system are remaining in the country (Uzawa, 2004). Since 1996 until 2004 a total of 6,567 Iriai forests covering 568,263 hectares have been regularized under the law established rights regarding the use of Iriai forests (Okuda, 2007)

Changes in community access for forest resources: The concepts of 'souyuu' (co-ownership)' and 'Iriai' (commonage)' managed the biological resources of *satoyama* more generally co-owned and co-managed before the Meiji period (Kambu and Nishi, 2008). Although the customary rights varied according to the locality, the right of Iriai is collectively held by its members residing in the community and they lose the right once moves out the community. The Meiji Restoration after 1868 classified the forests as readily identifiable ownership rights and others as nationally-owned forests. The Iriai rights were dissolved and transformed into different forms of property rights as a result of several measures adopted by the government (Goto, 2007).

Thereafter, the government and business leaders made every possible effort to dissolve Iriai customary rights legalized in Meiji era blaming that it is hampering the development efforts of the villages. Despite the government efforts there were several villages continued their traditional form of Iriai rights. The households moved to Ishimushiro village since the end of World War II, neither belong to the Common Forest Association (CFA) nor enjoy the Iriai rights in the communal use of the Iriai forestlands. They have to depend on other sources of cash income and have no right even to harvest thatch grass in the Iriai fields to thatch their roofs (Goto, 2007).

The rights and ownership of the Iriai forest were changed with the establishment of "Authorized Neighborhood Association (ANAs) a formal local institution with corporate status, by the village community under the "Local Autonomy Law' revised in 1991 (Yamashita et al., 2008). Under the modern system any holder of a certificate of land title is able to own lands in the community even without living in the community (Goto, 2007). The Modernization Policy in 1996 facilitated by a new law enacted to modernize Iriai rights changed the forest ownership in order to adopt joint forest operations for efficient forest production (Yamashita et al., 2008). However, some of the Iriai forests in Ishimushiro village have become officially designated protected forests restricting the uses (Goto, 2007).

Changes in type of forest uses: The local village communities had depended on a variety of essential non-timber forest products for many centuries. The most important products were: water supply for rice fields and household use; fuelwood and charcoal for domestic cooking and heating; and leaf litter for fertilizer and grass for livestock (Marten, 2008). Grasses extracted from Iriai forests were used as green manure on paddy fields and raw materials for making compost and also as feed for horses. Firewood was commonly used as the main domestic energy source (Kijima et al., 2000). The villagers of Ishimushiro collected about 4 bundles of raw wood per day from hillside forests immediately adjacent to the hamlet (satoyama) made them into charcoal in forestlands deep in the mountains (okuyama) (Goto, 2007). During the winter months when farm jobs were limited the communities in Gunma prefecture produced charcoal for urban markets using matured tress from broadleaf varieties which has vigorous coppicing ability (Kijima et al., 2000).

By 1500s, the demand for large quantities of subsistence forest products was increased with the rapidly increase of population while demand for timber was increased with military conflict. After intensive deforestation during 1600s, scarcity of timber and other forest products, soil erosion, floods, landslides, and barren lands (genya) were more common creating ecological disaster (Marten, 2008). The demand for non-timber forest products was declined drastically while demand and price for timber was increased due to severe shortage of timber after the World War II. As a result couple with the government subsidized tree planting campaign community planted cedar and larch trees in their Iriai forests in Gunma prefecture (Kijima et al., 2000).

Under the market economy after the World War II, the demand for main products of Iriai forests such as grasses and fuel wood drastically declined with the availability of substitutes and change of consumer preferences. With the modernization began in 1950s, the households began to use kerosene and electricity, replace their thatched roofs with galvanized iron sheets, and adopt tractors. Eventually, rendering firewood, brushwood, fodder, and thatch grass increasingly unnecessary and primary use of the Iriai forestlands have been limited to mushroom collection (Goto, 2007). On the other hand the demand for and price of timber was relatively increased until the end of 1960s (Kijima et al., 2000). However, the timber trees are rarely harvested since 1980s with the declining of timber prices (Kijima et al., 2000)

Changes in reaping and distribution of benefits by the community: Iriai was not perceived as scarce in a strictly economic sense but considered as an aspect of the limited environment, necessary for the community's survival and necessary for different groups in different ways (Illich, 1982). In some regions communities have managed Iriai forests well in preserving ecosystem and earned better livelihoods due to the gains made from forest products (Mitsumata, 2000). The households of Ishimushiro village in the old days lived reasonably well on faming and forestry enjoying their Iriai rights despite the few ways of earning cash income. They gathered firewood and brushwood for use as fuel and harvested fodder in the Iriai forestlands. The households raised enough money from the forests to jointly buy and raise milking cows. They earned extra income by making charcoal in the Iriai forests during the period of cold weather. After generations the branching off from the head families restricted the arable land use for growing crops only for household consumption. Very small tract of Iriai forestlands were indispensable for gathering firewood, brushwood, and other necessities for living (Goto, 2007).

According to Kijima et al., (2000) by 1960, the income earned from firewood and charcoal from Iriai forests far below compared to the high payoffs from the investment in conversion them to timber forests in Gunma prefecture. The Iriai members sold the expensive matsutake mushrooms to brokers and raised money for the Forest Association’s fund. The fund was used to pay the real-estate tax on the Iriai forests and to make donations to village welfare events (Goto, 2007). The profit from school forest in property ward forests at Ohara in Shiga prefecture and Shiraito in Shizuoka prefecture has been used for the enhancement of the quality of education (Mitsumata, 2007).

The demand for and price of timber was relatively increased until the end of 1960s creating conversion of Iriai to timber forest with high payoffs. During the 1960s, lumber for pulp and logs for shiitake mushroom could be sold well and the Common Forest Associations (CFAs) paid dividends to each member household in Gunma prefecture. However, selling of lumber and logs were no longer commercially practicable. With the declining of timber prices, timber trees were rarely harvested in the 1980s and 1990s because the cost of harvesting exceeded the expected revenue (Kijima et al., 2000). Mushroom hunting has become the only economically viable activity in many Iriai forests these days (Goto, 2007).

Presently, sharing benefit under Iriai system varies from place to place without paying corporate taxes. The Forest Producers' Cooperatives (FPCs) share benefits equitably according to the investment made and the individual contributions in management by the members. The benefits of the Authorized Neighborhood Associations (ANAs) are not legally allowed to share but use for collective consumption. Both Forest Producers' Cooperatives (FPCs) and Authorized Neighborhood Associations (ANAs) have the corporate status and liable to pay the corporate tax (Yamashita, et al., 2008).

3 CHALLENGES FOR SUSTAINABLE MANAGEMENT OF IRIAI FOREST

Disappearance of the role of irai forest resources: The mountain villages are presently facing a problem of declining population and aging. In most communities in the northern mountainous areas of Gunma prefecture regardless of the forest management system, the number of households is decreasing (Kijima et al., 2000). Nakaya hamlet in Nagano prefecture has a problem of ageing population and lack of local leadership (Yamashita, et al., 2008). The role Iriai forests have been changed drastically and the households find it difficult to earn enough income even to pay the real-estate tax on the Iriai forestlands (Goto, 2007). The communities of mountain villages in Iwate prefecture migrated cities searching high and steady income after declining the demand for charcoal and forest products (Okuda, 2007). Abandonment has created the problem of using and managing the village forests (Kambu and Nishi, 2008). Although the forestry account book indicates the history of tree planting from 1955 to 1980, harvesting has almost never been carried out in the northern mountainous areas of Gunma prefecture (Kijima et al., 2000). Presently, some of the Iriai forest has become officially designated protected forests restricting the uses but exempt from the real-estate tax (Goto, 2007).

In many cases it is difficult to show a concrete figure of the land area to define the Iriai forest in terms of utilization and management. Some forests are communally owned but not utilized or managed by communities while some privately-owned forests are used by community being recognized as Iriai forests (Mitsumata and Murota, 2007). Torigoe (2007) explains that the forest land and wilderness are often owned in "common" which is different from the "collective ownership' of the village community under the current civil code. Under the collective ownership, who share the ownership have the discretion to dispose of their equity or to demand its breakup is merely another version of individual ownership. The principle of recognizing "rights based on the original nature of property" to the right to the environment has always been protected in Japan. However, the rights have been violated by the present legal system especially those living in the urban areas.

The modern civil law system has been developed based on rules historically accumulated in Europe, and avoiding the local rules likely to form logic of livelihood based on "compromise" (Torigoe, 2007). He further, argues that this is an outrageous act that forgets the nature of the "law of the time" involving in environment preservation. Even under the Modernized Iriai Rights program established in 1966 the "Iriai Right-holder Groups could not be lawfully registered group name without corporate status creating practical problems between rules of Forest Product Cooperatives and local scenarios (Yamashita et. al., 2008). Many studies examine the existing common property management but do not plan to study any social engineering development (McKean, 2003). The problems of managing forest as social common capital cannot be solved by adopting a system of private ownership or management by the government or some other public agency. The best approach is a system of shared property (Hirofumi, 2004).

Development has led to the decline in village forests the traditional rural landscape symbolizes the environmental, economic, cultural, and social linkages between ecosystem services and human well-being. According to Kambu and Nishi (2008) transformation of Iriai forest ownership and management from commons to private by the modernization process has complicated the present problems. Declined in village forests have resulted with the extinction of several plants and animal species and the erosion of culture. Some of the Iriai forest lands are used for different other activities. The Iriai forests including seashore are used as dumping grounds for garbage and some places are used to establish nuclear and oil power plants (Mitsumata, 2007). Kambu and Nishi (2008) suggest the reconsideration and reinforcement of Iriai concept for the restoration and conservation of village forests.

Conflicting Management Objectives among Stakeholders: The local authorities impose their administrative authority according to the modern law system formulated rules. The village communities make effort to ameliorate the impacts of government rules by stressing the importance of their collective resolutions (Torigoe, 2007). After the transformation of Iriai forests into national forests under cooperatives in Tohoku region, the communities were denied access to the forests. They have to purchase fuelwood and other products from the cooperatives (Okuda, 2007). Disputes between local communities and municipalities in Aminoko, Amamioshima and Kagoshima have been reported concerning the establishment of waste disposal plants in Iriai forests (Mitsumata, 2007). The local administration of Kunigami in 1999 had drawn up a plan to locate a general waste landfill site in Yanbaru forest, without considering the Iriai rights of the community. They forcibly started construction in 2001 even without waiting the district court's ruling and cut down 80% of the trees on the site (Mitsumata and Murota, 2007). The local communities in Kaminoseki and Yamaguchi have disputes with the Electic Company against the plan to construct a nuclear plant (Mitsumata, 2007).

Although the communities jointly own and use non-timber forest products efficiently and effectively, the Iriai system does not provide proper incentives for the management of timber forests, whose high value is responsive to good management (Otsuka and Place, 2001). Kijima et al. (2000) have revealed that individualized management is more efficient than collective management as far as the timber is concerned. Timber trees have been more actively planted and carefully managed under individualized than under collective management in the northern mountainous areas of Gunma prefecture.

4 OPPORTUNITIES FOR FUTURE SUSTAINABILITY

Respects for traditional management strategies and customary practices: Local conditions that provide incentive for the sustainable common forest resource management are: a relatively homogeneous population; strong and accepted community institutions for decision making; management systems based on group control rather than on hierarchical control; and reasonable equity among group members (FAO, 1999). A few including Ishimushiro hamlet still retains many of the intrinsic features of Iriai practice in an intact form (Goto, 2007). Village communities continue to value the village forest as their common property resource even though the Iriai forest system is declined and increase the tendency of abandonment (Yamashita et. al, 2008). Mitsumata (2007), on the basis of several case studies has the opinion that some Iriai forests have been well managed by the cooperation of local communities. Despite the policies which intended to extinguish, the Iriai forests have continued to exit accordance with the changes of the society.

The success of the governance of forest commons is depend on the group characteristics such as interdependence, dependence on forests as well as other mediating factors (Agrawal, 2007). The Iriai forest still functions, in part, as a tie and unity of the village communities. Communities in Hisayama-cho, Fukuoka Prefecture are concerned with the common forest as its benefits are spent for the community and the forest keep a strong sense of belonging to the community. Unity of the village community also influences the continuance of the common forests and the use of its benefits creating strong interaction between the common forest and the village community (Shunsuke, 1988). The profit earned from Iriai forest mountains in many regions are used for supporting community organizations and holding annual mountain festivals. The community organizations arrange community fire services, youth clubs, women associations and old people association for the local community (Mitsumata, 2007).

The common forest management is favored by the presence of: government willingness to assist local groups to formulate and enforce rules; policy and implementation structure that provides attention to a people-centered forestry paradigm (FAO, 1999). Torigoe (2007) has explained that awareness of the need of modern as well as community rules is of vital importance for the particular areas to find a solution unique to each of them. Mitsumata and Murota (2007) explains the Iriai rules, the internal law of the common valid within a community as a “living law” in contrast with the current national law, as well as similar to the “Internal Village Regulations in Haneji Magiri”, the common forest bond and agreement on Iriai forest. Some of the community members in the northern mountainous areas of Gunma prefecture who collectively managed forest resources do not interest in dividing community forest land use rights because collective management work well in the area. It has been revealed that 74% of the community forests in the northern mountainous areas of Gunma prefecture are still collectively managed under the leadership of core members of the community (Kijima et al., 2000).

Some regulations which are incorporated into customary law such as use of tools, season and species in Iriai forests have been imposed with the intension of sustainable resource management (Inoue, 1998). The forests located near farms and mountain villages call “satoyama” were wisely managed by communities as “Iriai forests” setting various kind of limits on their exploitation (Okuda, 2007). The Iriai rights still exist as an effective means of protecting people’s lives. The local communities can protect their Iriai forest in mountains from garbage dumping by exercising their Iriai rights (Mitsumata, 2007). Naha District Court acknowledged the Iriai rights of communities for Yanbaru forest in Kunigami-son and issued a provisional disposition order to prohibit the construction of the waste landfill site by local authorities (Mitsumata and Murota, 2007). The profits earned from Iriai natural resources called common profit restricted and contributed to local public benefits investing for elementary school and maintaining roads in the community (Mitsumata, 2007).

Continued interest in traditional food, local commodities and natural environment: Evidence reinforces the perception of that common pool resources make important livelihood contributions to needy families, particularly in reducing household vulnerability (Fuys, 2006). Livelihood itself cannot be sustained if the rights based on original nature of property are violated. The subsistence rights, the people have the rights to intervene with the land to live using the rights based on the original nature of property has always been protected in Japan (Torigoe, 2007). The community members jointly own and use forest are efficient and effective in managing non-timber forest products (Otsuka and Place, 2001).

Iriai as an approach of shared property those who dwell near the forest, live with it, and actually make use of it in their lives, come together to decide how to maintain it, how to use it, and how to provide the labor" (Uzawa, 2004). Iriai forest played a great role in the past on self-sufficiency in daily life of local households supplying grasses, foliage, wood, and many kinds of mushrooms, and still functioning in mountainous villages in Uyashinai, Kawabemachi and Akita (Mitsumata, 2007). In many mountain forests local village communities under the common ownership are free to harvest and use non forest products such as grapes, conkers, Chinese yam, fiddlehead fern and bamboo for household consumption. Even trees in mountain forests can be used freely to build a house in Kagoshima prefecture. Only some kind of trees are restricted for use in Mie prefecture, the quantity of trees to cut down is restricted in Oita prefecture, and the time when trees can be felled is restricted in Ehime prefecture (Torigoe, 2007). Yamashita et al. (2008) have observed that village communities in Sakae of Nagano prefecture still collect mushrooms, edible wild plants, and firewood from their Iriai forests. In Gifu Prefecture, local households gain substantial income from holdings of only 0.8 hectare (Dugan, 1989). The Forest Association rebuilt houses of Iriai members using timber harvested from Iriai forests if their house was burnt down in Gunma prefecture (Goto, 2007).

Local commons are responsible for the ecological functions to achieve sustainable utilization of common property resources while maintaining social order by means of resource management institution (Inoue, 1998). The traditionally established "rights based on the original nature of property" is the "right to the environment" which refer the rights of communities to involve in environment preservation (Torigoe, 2007). The village forest area covers about 40% of the entire land area of the country and more than half of the area home endangered species (Kambu and Nishi, 2008). The Iriai an exceptional system in the history of social institution in which local residents jointly control regional natural resources is being frequently discussed concerning the environmental conservation (Mitsumata, 2000). Even though it was unwritten, the customary law humanized the environment, regulates the right of way, the right to fish and to hunt, to graze, and to collect wood or medicinal plants in the Iriai forests (Illich, 1982).

According to study conducted in the northern mountainous areas of Gunma prefecture by Kijima et al. (2000), collective management system have advantages over individualized management in the protection of forest resources. Holding the mountain annual festivals make respect and pay gratitude of the local community to the natural environment and keep alive their concern for Iriai forest regardless of the forest making a profit to the community. The School Forest in property ward forests at Ohara in Shiga prefecture even now has the conservation consciousness which has been deeply rooted in the school and school education (Mitsumata, 2007). Presently, the people of Kunigami-cho, Okinawa are using Iriai rights known as “Somayamato rights” campaign against waste disposal into their village (Mitsumata and Murota (2007)

It is reported that some communities in mountain villages are living integrating traditional techniques and new technology to utilize local resources like water, wood, minerals on a sustainable basis. The people in mountain village in Tono in Iwate prefecture borrow national forest and use them collectively creating the community an opportunity to recover the rights to use the forests. The “Cooperative for Normal Community Forests in Hayachine” formed by the local villages with the permission of “Iwate South Forest Management Office” maintain the forests using the funds collected from outsiders who are coming to collect edible wild plants. They improve the facilities for visitors, collect garbage, organize markets and patrol the forest area (Okuda, 2007). In addition to deploying a protest movement against the construction of the waste landfill site by local authority, the communities in Kunigami-ward implemented a “Zero Waste” project in order to review their waste disposal habits (Mitsumata and Murota, 2007). Intensive timber-stand management systems are a long-term, intergenerational investment by the communities in Imazu, Gifu Prefecture. Local households gain substantial income from holdings of only 0.8 hectare. They have practiced a labor-intensive, highly selective logging for more than 250 years (Dugan, 1989).

Respect to local governance and strong group dynamics: There are many cases of common property management of forest longstanding at the local level and still a viable approach. These management systems have strong relations between village groups and local institutions, between individuals and the laws that govern the forest and between governments and villagers. Common property regime make management decisions jointly is a desirable option when collective enforcement of fairly restrictive use rules as it take less time, lower transaction costs than endless one-on-one deals(FAO, 2007). Assessing and addressing ownership and land rights is a key issue for either promoting or regulating the use in the restoration and conservation of village forests (Kambu and Nishi, 2008). Yamashita, et al., (2008) also have learned that the modern principals for natural property rights are becoming less relevant for the Iriai forests and insist the importance of retaining tradition systems without too many transaction costs or complex regulations. Common property institutions make incentives of users to increase their own welfare as well as to conserve plant diversity, prevent soil erosion and sustain long-term forest conditions (FAO, 2007). Hisayama City Planning Area established in 1970 controls the number of new comers which is supposed to weaken the tie and unity of village community in Hisayama (Shunsuke, 1988). With the rapid urbanization most of Iriai forest has become valueless because the communities don't rely on the common forest for getting fuel and fertilizer. Japanese forest common property regimes have mechanisms by which the entire common property user group may sell its assets, the shared rights to stock or capital assets of the user group or corporation (McKean, 1992). However some Iriai forests remain valuable as a result of the reorganization of the ownership and use (Yao, 1988).

Partnership among local communities, government, private sector and other interest groups to work together would leads to a sustainable forest management and an equitable sharing of benefits (FAO, 1998). The government has increased the number of cooperative efforts between downstream and upstream local village communities to assist sustainable forest management in headwater areas. Further, the government plan to address the "forests for the people," in recognition of the role forests play in preserving an environment for daily life and contributing to culture (Kato, 2003). The Kanazawa University held a Roundtable Seminar on 8 October 2005 and discussed the strategies towards conservation and sustainable use of village forests, with particular emphasis on the linkages between ecosystem services and human well-being (Kambu and Nishi, 2008).

The Hayachine Cooperative in Iwate prefecture is working with village communities to grow shiiake mushroom and process the mushroom. Further, the cooperative has a contact with government to produce wood for cultivating mushrooms. The village communities in Sakae in Nagano prefecture are still continuing their forestry activities which were initiated in collaboration with national government and local government after timber production by some large private companies (Yamashita, et al., 2008). The National Forest Wood Production Cooperatives in Iwate prefecture is still very active and play a very important role in charcoal industry. Further, they are harvesting hardwood forests and producing pulp materials with the participation of village communities and selling the pulps to pulp companies. (Okuda, 2007)

The Forest Owners' Cooperatives comprising forest land owners are also functioning at village level and undertake different forestry operations including cutting trees, thinning and planting in Sakae and Iiyama in Nagano prefecture (Yamashita, et al., 2008). The area of Sayama Hills (Totoro forests) village at one time was almost abandoned, and became a wasteland. The Totoro no-furusato Foundation has improved the lands to a designated natural park of Tokyo Met. and Saitama Prefecture through its strategy of a Biodiversity Conservation of Village (Nippon Keidanren Nature Conservation Fund, 2003). Honda Motor Co., Ltd., have initiated community forestry activities playing a leading role as a responsible member of society in promoting environmental conservation. Upon entering the Honda Company all new associates receive environmental education on their environmental responsibility and provides opportunities to participate as volunteers in community forestry service activities (Keidanren Nature Conservation Fund, 2007).

5 CONCLUSIONS

Iriai forest management system has some similarities to common property resources management as local commons but require the unanimous consent of all its members for important decisions. The customary institution of Iriai forest management system has been continuously changed into modern legal systems with informally formulated management rules and collectively held customary rights. Land abandonment and lost recognition have affected the social linkages between ecosystem services and human well-being developed through Iriai forest management. Imposing administrative authority according to the law without considering the Iriai rights ignore the collective resolutions. Some Iriai forests are still exiting and managed with customary rules as a social institution making livelihood contributions through non-timber forest products while maintaining ecological functions. Some Iriai forests are managed integrating traditional techniques and new technology as well as in collaboration with the government, and private sector on a sustainable basis as a viable approach.

Cross-institutional collaborations among local communities, governmental organizations and private sector, together with management responsibilities of local communities would ensure the revitalization of Iriai forests in the country. One of the concepts to support such trial is "Collaborative Forest Governance" (CFG), which is defined as collaboration among various stakeholders who have a range of interests in local forest use and management. The CFG should be associated with both of "open-minded localism", in which the local people have an intention to open their resources and environment to outsiders, and "principle of involvement" which recognizes the rights of stakeholders to speak and make decisions in a capacity that corresponds to their degree of involvement in and commitment to forest use and management. These principles might be applicable to other cases in the world. Development of the design principles to institutionalize the CFG is required.

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