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IUFRO Unit 4.05.00 – Managerial economics and accounting

SUSTAINABLE FOREST MANAGEMENT FOR THE FUTURE

– the role of managerial economics and accounting

Knjiga sažetaka
Book of Abstracts

May 10 – 12, 2018, Zagreb, Croatia

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4.05.01 - Managerial, social and environmental accounting
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Predgovor/Preface

Forestry in Croatia was established in the second half of the 18th century. It all began with the first forest inventory and mapping (1764), the foundation of forest offices (1765 in mountain region, 1773 in lowland region) and the first legally binding Regulation (1769) which introduced sustainable forest management in Croatia. Forestry was born in the most forested part of Croatia, where it began its two-and-a-half-century long development.

Natural resources represent common good and wealth. Their use, economic function and evaluation have to be planned directly since they represent the basis of future industrial and economic development. Forests are considered renewable natural resources, and the main characteristic of renewable natural resources is that their reserves are not permanent, but they can increase or decrease in future. However, a renewable natural resource cannot renew itself above the level determined by existing ecosystem's capacity. Forestry economics encompasses all know-how related to forestry, and with the activities of market elements, it observes how a man and the society act in certain circumstances and conditions. The specific features of forest management are particularly manifested in the long-term biomass production cycle, the forests' multiple functions and benefits, the fact that many of its values cannot be evaluated directly on the market, long period from the start of works, natural renewal, afforestation, nurture, cleaning, thinning, etc. to economic effects, which exceeds human lifetime. The forest sector has an important influence on the rural development, contributing to poverty decrease, achieving sustainable development and providing different ecological services. The priority of the world as a whole and each country should be to develop appropriate sustainable development strategies which would include special measures for the forests' preservation, sustainability and vitality.

The Faculty of Forestry, which marks 120 years of productive continuous work in science and higher education in the field of forestry and 70 years of the stated activities in the field of wood technology, has developed into a leading institution of higher education, a regional leader and a full member of science and higher education in Europe.

The IUFRO 4.05. Unit concentrates on the economic and accounting aspects of management of different types of forest enterprises, specifically small-scale enterprises. The group deals with the economic analyses of forest enterprises, principles and techniques of accounting relevant to forest enterprises, fundaments of decision-making, and the economic and accounting tools for planning, supervising, measuring, controlling, and evaluating the status and performance of forest enterprises.

The conference is aimed at forest researchers and practitioners from IUFRO 4.05 members, i.e., members engaged in managerial, social and environmental forest economics and accounting, forest ecosystem services as well as scientists, experts, researchers and practitioner working in the area of forestry and land-use, forest and natural resource policy and decision support makers, land-use planners, stakeholders, researchers and specialists of related fields.

Editor-in-chief
Stjepan Posavec

European Forest Accounts: Establishing the economic aggregates of the forestry and logging industry

A comparative analysis of Austrian, German and Finnish approaches

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Keywords: *forestry statistics, National Accounting, Environmental Accounting, Economic Accounts for Forestry, EUROSTAT, forest accountancy data network*

Introduction

The European Forest Accounts (EFA) represent the current scheme of sector statistics throughout the European Union. They were designed by the working group on Forestry Statistics and Accounts of EUROSTAT, the statistical office of the European Union. European concepts for sector-specific accounting on the national level date back to 1969, when the Economic Accounts for Forestry (EAF) were introduced in terms of a satellite account to the National Accounts. Their main purpose was to analyse the production process and primary income generated by it. From the beginning, this kind of sector statistics lacked a specific legal background but were based on a gentlemen's agreement instead. Consequently, the data collected by EUROSTAT has been characterized by gaps in terms of countries, periods and / or contents ever since. The EAF underwent several revisions, the latest set of coherent data covering the periods from 1996 to 2004. Between 2005 and 2013, forestry statistics were based on the 'Integrated Environmental and Economic Accounting for Forests' (IEEAF), which originally encompassed 19 tables on physical assets, economic as well as environmental aspects related to forests and thus addressed a range of forest ecosystem services. Ultimately, the IEEAF was replaced by the EFA in 2016, which once again focusses on timber production. The most relevant items are nowadays highlighted in terms of core tables and priority data within tables.

Unlike the former EAF, the EFA fit the requirements of National Accounting directly as well as comprehensively. Hence, the results are not only suitable for sector-specific analyses but serve also as a well-founded documentation of the sector within the national economies. However, the differentiation between forestry and logging significantly adds to the challenges for a sound determination of the income generated by the sector.

Material and Method

In this paper we investigate major hurdles associated with establishing core-table B1 of the EFA which specifically deals with the economic aggregates of the forestry and logging industry. We confront the EFA-specific general documentation (EUROSTAT, 2016; Pizzoli, 2016) with the respective documentation of data sources, approaches and results from Germany (Dieter, 2017; Englert 2014; Englert and Seintsch, 2014; Rosenkranz et al., 2017; Englert and Rosenkranz, 2017) and Austria (Sekot, 1998, 2004, 2007a,b, 2008, 2011; STATISTIK AUSTRIA, 2017). Alternative data sources, possibilities for overcoming data deficits as well as valuation issues are addressed. Pros and cons of specific alternatives as well as respective implications are discussed.

Results

EFA-table B1 follows the industry approach which is based on the concept of local kind-of-activity units. Consequently, the sector is defined by activities irrespective of the institutional units involved. This triggers problems of delimitation, with the potential of double counting on the one hand and omissions on the other whenever institutional units are pursuing activities which belong to different industries and so-called unseparable secondary inputs and outputs occur. This is of special importance in case the results from satellite accounts of different industries are fed into the National Accounts. In Austria, for instance, almost half, and also parts of the forest sector in Germany, are associated with small-scale farm forestry and might be considered as secondary activity along with the Economic Accounts for Agriculture.

The interface between the EFA and the National Accounts is also of interest in terms of data sources. In National Accounting, a number of items such as the input

of financial services, several taxes on production and the compensation of employees are specified somehow for the forest sector as in the case of both Austria and Germany. Some of these may alternatively be assessed based on the empirical information collected by forest accountancy data networks and hence aggregated for represented categories of institutional units. Respective differences can be quite significant and the choice of the ultimate data source and approach requires trade-off-considerations in terms of reliability and consistency.

Whereas some data are quite readily and specifically available, such as the total volume harvested, severe data deficits pertaining to other items are quite likely to occur and have to be addressed. Alternatives range from (annotated) omissions to guesstimates based on expert opinion. Respective Austrian examples include the turnover ratio as well as the structure of intermediate consumption and gross fixed capital formation of tree nurseries or forest-related consulting. In Germany, respective examples are the blanket valuation of the unexploited increment across all tree species and age classes as well as the production results and costs of forestry service providers.

The obligatory differentiation between forestry and logging implies the need to estimate and evaluate the increment as output of the timber growing industry as well as the timber harvested as intermediate consumption of the logging industry. There are various possibilities how to establish these data with quite far reaching implications for the results. In the Finnish case, a large share of stumpage sales and separate logging contractors in the roundwood markets form the basis for the differentiation of prices, which are applied also to delivery sales volumes. Stumpage prices are also employed in the valuation of the net increment.

The total labour input in annual working units is a non-monetary element of EFA table B which necessitates quite far-reaching assumptions as well.

Discussion

The consistency of approaches and hence also the comparability of results hinges on unanimously agreed and generally applied operational definitions and methods. Establishing the economic aggregates of the forestry and logging industry as part of the EFA being a voluntary exercise, neither the availability nor the quality of the data can be safeguarded at predefined levels. Individual examples indicate the potentially wide range of results as dependent from data sources and approaches. A systematic documentation, analysis and discussion of alternatives is advocated in order to improve the homogeneity of statistical data and to facilitate efforts for improving the quality of results and a more comprehensive documentation in terms of countries and periods.

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European Forest Accounts: Establishing the core tables on wooded land and timber

A comparative analysis of German, Austrian and Finnish approaches

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Keywords: *forestry statistics, National Accounting, Environmental Accounting, European Forest Accounts, Economic Accounts for Forestry, EUROSTAT, forest accountancy data network*

Introduction

The European Forest Accounts (EFA) are part of the National Environmental and Economic Accounting, which illustrate the interaction between economic and household activities and the environment (Bormann et al., 2006). As an essential satellite calculation, they amend the economic data of the National Accounts of the EU Member States with ecological data. The results of the EFA are reported to EUROSTAT by the member states on an annual but voluntary basis.

Until the reporting year 2013, the "Integrated Environmental and Economic Accounting for Forest" (IEEAF) formed the framework of the forestry and environment reporting module. In the years 2013 to 2016 the table framework of the IEEAF was revised by the "Task Force to review IEEAF". The task force aimed to simplify the processing of the tables and adapt to new data requirements (e.g. data on renewable energies). The new EFA-tables were introduced in 2016, replacing the IEEAF from the reporting year 2014.

The current standard framework of the EFA-tables, as established by the EUROSTAT Working Group on Forestry Statistics, consists of ten tables, five of which are defined as core tables. Core tables A 1a/b, and A 2a/b contain data on assets. These are the forest area and timber stock and their respective value. The four tables on assets are complemented by four economic tables containing the extended forest accounts (core table B1), the output of the forestry and logging industry as well as tables on monetary supply and use of timber (B 2, B 3a and B 3b). EFA-tables C 1a and C 1b describe the material flow of timber. EUROSTAT (2016) provides suggestions and definitions for the calculation of the EFA-tables. However, there is as yet no official guideline that strictly defines the account positions and their calculation methods. The manual on the IEEAF even explicitly points to alternative approaches for valuation. Consequently, results in the EU Member States may greatly differ, based on data availability, forest accounting practices and calculation methods.

The change from IEEAF to the EFA-tables entailed the need to partly revise, update and enhance the methods of calculating the forest accounts in the Member States. In Germany, we aimed for consistency between forest reporting systems (e.g. the Joint Forest Reporting Questionnaire and the test accountancy network) as well as for the creation of an efficient calculation system based on the most current data available. Unlike Germany, Austria is not reporting regularly on tables A1 and A2 yet. Respective experiences stem from a pilot study on the IEEAF as well as a more recent feasibility study for 2014.

In this presentation we aim to introduce and discuss the methods of compiling the German, Austrian and Finnish core-tables on assets (EFA tables A 1a, A 1b, A 2a and A 2b), of the challenges we met and how we tackled them. This applies mostly to the evaluation of changes of forest area and timber stock, as well as their respective value.

Material and Method

We compare official frameworks (e.g. EUROPEAN COMMISSION, 1999; EUROSTAT, 2016) with the respective documentation of data sources, approaches and results from Germany (Dieter, 2017; Englert and Seintsch, 2014; Rosenkranz et al., 2017), Austria (Schermaier, 2016; Sekot, 1998, 2004, 2007a, b, 2008, 2011; STATISTIK AUSTRIA, 2017) and Finland (e.g. Uotila, 2017). Furthermore, the use of alternative data sources and approaches as well as their impact on results are discussed.

Results

Core table A 1a covers the physical balance of forest area. It contains the area of wooded land at the begin-

ning and end of the reporting year as well as area changes due to e.g. afforestation, deforestation or statistical reclassifications. While decennial or quintennial data on forest area are available, e.g. in National Forest Inventories (NFI) or the Global Forest Resource Assessment (FRA), there are no statistics on forest area changes during the reporting years. Thus, forest area changes have to be estimated by means of extra- or interpolation (Austria, Finland) and special annual surveys (Germany), both subject to uncertainties.

Core table A 1b focuses on the value of forest area (here: forest floor without timber stock). EUROSTAT (2016) suggests the valuation of forest area based on market transactions. However, there are no official national statistics, in Austria, Germany or Finland, compiling transactions of forest ground. In Austria, average prices for forest area available for wood supply were calculated based on literature research and expert interviews. In Germany, the land expectation formula, developed by Faustmann, was used to calculate an average value/hectare of forest area available for wood supply. The calculation is based mainly on the current stumpage value and distribution of tree species groups. However, the dependency of the value of forest area on the current stumpage value can lead to heavy price fluctuations between reporting years. In Finland, forest ground valuation has traditionally been based also on the land expectation formula, but inconsistently with changing discounting rates according to ground fertility and regional location, in order to avoid too high or negative land values. Another approach has been to employ consistent discounting rates, but zero values of land when the expectation value would become negative. Neither of these Finnish approaches, employed for forestland pricing and forest planning purposes, are theoretically correct, nor used for statistical purposes.

The physical balance (volume) of the timber stock is compiled in core table A 2a. For each reporting year the timber stock, net increment, removals and irretrievable losses have to be calculated. As opposed to the definition of timber volume given in EUROSTAT (2016), including all trees regardless of diameter, the volume of standing timber in the German NFI incorporates all aboveground timber from 7 cm diameter at breast height. As annual data are not available in Austria, Germany or Finland, FRA- and NFI-data is used to calculate the net increment for forest available for wood supply in Austria and Finland, whereas Germany mainly uses the results of the Forest Development and Timber Volume Modelling (WEHAM 2012). Both, modelling and differing definitions may lead to deviations in the calculation of timber volume compared to other EU Member States.

The value of the timber stock is calculated in core table A 2b. EUROSTAT (2016) suggests the use of a stumpage value as a basis for the calculation. As in Austria and Germany, timber is rarely sold at stumpage value the common approach is to calculate an average timber price less harvesting costs over all wood types, which is then transferred to the standing timber. In Finland, stumpage sales are very common in private forests, and these prices are employed widely for valuation purposes.

Discussion

In regard to the completion and consistency of the EFA-core tables A 1a/b and A 2a/b two main challenges arise. First, the definitions suggested by EUROSTAT (2016), such as those concerning timber volume, might differ by EU Member States. Consequently, data taken from National Forest Inventories or other data sources might not be consistent. Any recalculations will be based on assumptions. Second, some crucial data are not available on an annual basis. In this case Member States will have to fall back on extra- or interpolation or modelling data, which in turn are subject to assumptions. Depending on data source and method, the results of the EFA-calculation may vary greatly between the EU Member States and data comparability is impaired.

In order to ensure comparability, a compilation of definitions, data sources and methods across all EU Member States is strongly suggested.

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Silvi benchmark

Benchmarking forest production data based on "typical enterprises"

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Keywords: *benchmarking, accounting data, forestry, agriculture*

Introduction

The timber growing industry is facing the challenges of globalization, such as rising demands for timber and price competitions of timber production. Also, due to globalization, population growth and the consequential greater demand for food supply and other commodities, forestry has to compete with agricultural land use in terms of production and profitability. The cost-effectiveness of forestry around the world is influenced, amongst others, by the respective regulatory policy frameworks, the choice of forest management type as well as the choice of harvesting and timber-transport system which lead to diverse use of labour, costs and revenues for forest production.

In a globalized world, in-depth knowledge of the different country-specific framework conditions, the resulting operations and management strategies of forestry and logging and finally the economics of these different systems is of great importance. In order to obtain comparable data across countries, a harmonized approach for all participating countries and a global uniform data base is essential. So far, there is generally a lack of internationally comparable forest production data. Many countries feature little or no data on forest-based production systems. Whereas for agriculture a global network (*'agri benchmark')* already exists, there is, as yet, no respective forum to develop and discuss concepts and methods for an international forest production database.

Objectives

Against this backdrop, we aim to establish a lasting international network for benchmarking forest production data using the "typical forest enterprise" approach. We will develop concepts for creating the network, for defining "typical forest enterprises" and for harmonizing the forest production data. Furthermore, we will propose a framework for safeguarding sustainable financing of the network. By connecting with *agri benchmark*, we aim to provide comparative studies of forest and agricultural production data. Thus, the aim is to provide strategic insights to stakeholders from forestry, logging and timber industry, policy and development agencies.

Method and expected impact

Starting from a nucleus of core partners we would like to expand to other countries relevant in the forest business sector with the objective to become a permanent global network in the future.

At the outset, a concept for creating the international network will be developed and the database will be established in core countries. As it is usually not feasible to generate such information based on large sample sizes because gathering such in-depth data is rather costly, *agri benchmark Cash Crop* therefore developed the concept of "typical farms" which has been applied in about 50 countries for more than a decade already. Based on standard operating procedure scientists around the world – including countries without any meaningful official statistics – are able to collect and share information on crop production systems and their economics. It is planned that *silvi benchmark* establishes its network based on a similar approach.

In regard to data input, economic data for understanding forest production conditions is collected in the beginning. Further, possibilities for adding data on forest ecosystem services and sustainability indicators will be examined. As for *agri benchmark*, the motto for *silvi benchmark* will be "put your country in and get the world back". That means, when participating in the network by funding the supply of country specific typical enterprise data, institutions will gain access to the data of all other participating countries. By further connecting to *agri benchmark*, not only are comparisons of forest production systems possible, but comparing forest production systems to other land use systems on national as well as international levels will be feasible. Possible users of *silvi benchmark* data are the forest and

logging industry, scientific and governmental institutions in the partner countries, international organisations such as FAO and OECD, EU-Commission bodies such as Eurostat, as well as the World Bank who could use the results from *silvi benchmark* as a source of information and as basis for joint projects.

The presentation will introduce our idea of establishing *silvi benchmark* to potential partners from other countries and provide a systematic overview of the concept of *agri benchmark*. Based on this, options to apply *silvi benchmark* in global forest production are explored.

Service-dominant logic: a useful mindset for forestry sector

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Keywords: *service science, service system, value co-creation, management, forestry*

Introduction

Today's economic activities are grounded on foundations that were laid down more than two centuries ago. The purpose of economic exchange is to make and distribute tangible goods that embody the value or utility and where the market price reflects a good's value (Vargo et al., 2008). This type of value is denoted as (monetary or nominal) exchange value and is essentially created on a market by a certain company, with little or no consumer involvement (Lusch and Vargo, 2006). Each consumer then judges the utility of a particular object (i.e. good) for him or her and thus expresses the good's (real) use value. If the consumer voluntarily decides to acquire the good under consideration they will settle for a (nominal) exchange value, despite the object itself has at least the same or greater use value for them.

The forestry sector is an example of a rigid institutionalised structure where changes occur slowly (Weiland, 2010). Moreover, evidence exists that institutional and market changes shape the forestry service market, demanding reconstruction of existing business models to meet customer needs (Mattila et al., 2013). A potential reconstruction mechanism for such cases offers the novel alternative mindset called *service-dominant logic* (S-D logic). The logic was introduced by American researchers in their 2004's seminal paper, based on the previous work done in the 1990s (Vargo and Lusch, 2017, 2004). The logic stimulates one to re-evaluate the process of value creation from a fresh perspective, offering the possibility to re-consider their actions or decisions.

The purpose of this paper is twofold: first, to introduce the S-D logic meta-theoretical framework and second, to present a potential application in the field of forestry on a case study. The data used for this study were extracted from the dataset used within the FACESMAP COST action FP1201 and available from the authors upon request.

S-D logic essentials

The S-D logic originates from marketing research and challenges the prevailing goods-dominant logic (G-D logic) where the primary unit of exchange are goods (end products or services [plural]). On the contrary, S-D logic states that people exchange to acquire the benefits of specialized competences, i.e. knowledge and skills (Vargo and Lusch, 2004). The focus is given to service (singular) that is defined as the "*application of specialized competences (knowledge and skills), through deeds, processes, and performances for the benefit of another entity or the entity itself*" (Lusch and Vargo, 2006, p. 283). Goods and services (in the traditional sense) are *operand resources*, i.e. resources that an act or operation is performed on, and knowledge and skills are examples of *operant resources*, i.e. resources that act upon other resources (Vargo et al., 2008). According to S-D logic, value is co-created by a set of actors, yet it is always determined by the beneficiary. Such value is always contextual and determined by the beneficiary as a unique experience. In other words, value-in-context reflects the combination of two foundational premises (FPs), namely FP9, all social and economic actors are resource integrators, and FP10, value is always uniquely and phenomenologically determined by the beneficiary. The latest update of the S-D logic (Vargo and Lusch, 2016) consists of 11 foundational premises and five axioms that are presented in Table 1.

Table 1: The eleven foundational premises (FP) and five axioms (A) of the S-D logic (Vargo and Lusch, 2016)

Abbreviation	Definition
FP1/A1	*Service is the fundamental basis of exchange.*
FP2	Indirect exchange masks the fundamental basis of exchange.
FP3	Goods are a distribution mechanism for service provision.
FP4	Operant resources are the fundamental source of strategic benefit.
FP5	All economies are service economies.
FP6/A2	*Value is co-created by multiple actors, always including the beneficiary.*
FP7	Actors cannot deliver value but can participate in the creation and offering of value propositions.
FP8	A service-centred view is inherently beneficiary oriented and relational.
FP9/A3	*All social and economic actors are resource integrators.*
FP10/A4	*Value is always uniquely and phenomenologically determined by the beneficiary.*
FP11/A5	*Value co-creation is coordinated through actor-generated institutions and institutional arrangements.*

The focus in S-D logic is set in the processes that cannot occur independently from various active actors that co-create *value-in-context*. This value co-creation process implies mechanisms for facilitating resource integration and service exchange, namely institutions and institutional arrangements that are nested in and interlock with service (eco)systems (Vargo and Lusch, 2017). Service (eco)system function is to "*make use of its own resources and the resources of others to improve its circumstances and that of others*" (Vargo et al., 2008, p. 149). The S-D logic process-orientation is depicted in Figure 1.

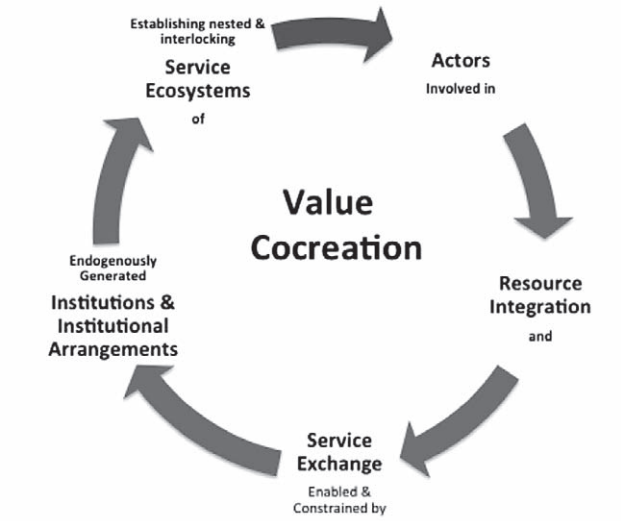

Figure 1: The narrative and process of S-D logic (source: Vargo and Lusch, 2016)

The S-D logic has a tendency towards becoming a (general) theory (Vargo and Lusch, 2017). However, in this paper we considered it as a conceptual framework and make an attempt to apply it to the field of forestry sector. Specifically, we opted to analyse the case of high quality wood auctions through the lenses of S-D logic.

Application to forestry sector

We performed a case study where we qualitatively analysed the high-quality wood auctions event that occur annually in north-eastern Slovenia. The auctions began in 2007 following the examples of Austria and Germany (Kobal et al., 2013). The aim of the auctions is to engage the local suppliers and specialized buyers in an exchange situation where buyers bid for high-quality roundwood. Wood suppliers have the unique opportunity to sell their roundwood for higher price than otherwise and buyers have the opportunity to buy roundwood that will be capitalised on high-quality products, like e.g. luxury furniture, furniture, wooden instruments and artistic products.

From the S-D logic perspective, the ultimate objects being exchanged are services, where the principal operant resources are the knowledge and skills possessed by the involved actors (FP1). Wood buyers utilize their salesmanship skills and woodworking knowledge, and forest owners along with district foresters share their knowledge on quality wood silviculture (FP6, FP9). The organizers (i.e. *Forest Owner Association Mislinjske doline*, *Slovenian Federation of Forest Owner Association*, *Slovenia Forest Service*) actualise their organisational skills and communicational knowledge in an effort to bring together wood sellers and buyers (FP7, FP10). The possession of these operant resources by actors represents their strategic benefit since they can engage these resources in value creation processes elsewhere (FP8, FP5). For instance, a luthier has information and salesmanship skills for selection and acquisition of high-quality roundwood, which he will turn into an instrument in a process where other resources will be integrated with, like knowledge of violin making and related skills. This violin represents a proposed value (FP7) for a violinist, which afterwards employs their resources in a service exchange in another service ecosystem.

On the other hand, the forest owner has an incentive for taking adequate silvicultural measures, if he or she actualizes luthier's demand for high-quality roundwood. High-quality roundwood is considered an operand resource, a distribution mechanism for value creation and it "embodies" the traditional ecological knowledge and tacit forest management skills possessed by the forest owner and district forester, respectively (FP3). We can think of roundwood as an "input" in the value creation process, which produces value only when integrated with other operant resources. The institution (i.e. "the rules of the game"), which is defined and accepted by all actors, enable them to effectively co-create value (FP11). A concert violinist is expected to play on a quality instrument (besides quality performance of a musical piece) that produces a sound that satisfies the audience, potentially creating value for them.

Discussion and conclusion

This alternative mindset can be found useful when analysing the elements and outcomes that auction ought to have. In the presented case, one might consider that a high-quality roundwood is a result of applying (various) operant resources, such as traditional ecological knowledge and silvicultural skills. Since time is a non-discretionary resource, the entire benefit one might get from the high-quality wood can be attributed to adequate (silvicultural) decisions made and measures applied in the past. Those decisions and measures are frequently a result of acquired competences (e.g. knowledge and skills) of an actor, and from the perspective of S-D logic their source of strategic benefits (FP4).

The outcomes of S-D logic deliberation have rather strong potential for managerial application, particularly when deciding on middle- or long-term investments or designing public policies. Demand-oriented policy instruments, like e.g. general regulations and taxes, can be replaced with "softer" supply-oriented instruments, like e.g. information provision for specific groups of owners (cf. Niskanen et al., 2007). Likewise, the outcomes might affect the decisions made by individual actors to act or not to act in a certain context regarding ecosystem services (see e.g. Matthies et al., 2016) or expand the existing services for particular groups (see e.g. Mattila et al., 2013). In-depth investigation with S-D logic lenses and comparison with the analyses made with G-D logic lenses will enable one to identify the ultimate causes of successful value creation and persistence of certain business models or activities.

Thinking and deliberation about familiar issues in an alternative way presents a transdisciplinary approach for discovering further details of the studied case. S-D logic conceptual framework offers a novel mindset to analyse such cases. And when used in this way, it shows promising for designing and evaluation measures and actions in all phases of managerial, namely goal and pathway identification, pathway selection and change process monitoring and control. Furthermore, and despite its juvenility, the S-D logic possesses a large potential to become a midrange or even a general theory of value creation and exchange.

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Forest Accountancy Data Networks

The current state of a socio-economic research approach

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Keywords: *Forest accountancy data networks, FAN, DACH-region, forestry economics, socio-economic monitoring*

Introduction

Forests and other wooded land cover approximately 43% of the EU-28 land area (EUROSTAT, 2018). The share of forest land in the European countries, as well as the share of publicly owned forests, is heterogeneous. On average 60.3% of the forest land in the EU-28 is owned privately with holding sizes from less than 1 ha up to several thousand hectares. The importance of income from forestry for the individual owner ranges from none to high, often correlated with the size of the property. However, the ownership and management of forests may be motivated by non-monetary goals as well.

Whereas in many European countries the profitability of public forest enterprises is readily documented, knowledge about the socio-economic situation of private forest enterprises is often scarce or practically missing. The approaches used for monitoring in Europe are very heterogeneous (Hyttinen et al., 1997). Two decades ago the European Union launched the Concerted Action project MOSEFA "Monitoring the Socio-economic Situation of European Farm Forestry" (Niskanen and Hyttinen, 1999) which led to 'Guidelines for Establishing Farm Forestry Networks' (Niskanen and Sekot, 2001). These guidelines comprise the experiences of experts in operating Forest Accountancy Data Networks (FAN). An FAN *"is a form of infrastructure for empirical economic research. The main components are a sample of enterprises regularly providing accounting data on the one hand and a central database on the other. Such an infrastructure is particularly suitable for monitoring economic indicators and can be used to generate aggregate industry statistics"* (Sekot, 2017 p. 436). FANs share a long tradition in central Europe with its roots in the late 1950s.

The aim of this presentation is to give an overview of the developments in European FANs during the last two decades since the MOSEFA project ended. The main questions focus on what is the current state of FANs in the participating countries, which major developments of the FANs occurred and what are limiting factors for implementing an FAN.

Material and Method

The research is based on a systematical literature research according to the PRISMA guidelines (Moher et al., 2009), narrative literature research and short expert interviews with FAN researchers.

Results

17 research facilities from 14 European countries participated in the MOSEFA project. Methodological issues of cost accountancy in farm forest enterprises were documented for 13 of these countries (see Hyttinen and Kallio, 1998). Tab. 1 shows the current status of FANs in 13 European countries.

Table 1: Development and current state of FANs in 13 European countries.

Country	before 1998	1998 – 2017	2018
Austria	Yes	Yes	Yes
Belgium	No	No	No
Denmark	Yes	Yes	Yes
Finland	Yes	Yes	Yes
France	No	No	No
Germany	Yes	Yes	Yes
Greece	No	No	No
Hungary	No	Yes	No
Italy	No	No	No
Netherlands	Yes	Yes	Yes
Norway	Yes	Yes	Yes
Switzerland	Yes	Yes	Yes
UK	No	No	No

Seven European countries operating an FAN could be identified. The public availability of data is heterogeneous and varies between annual reports on the situation of forestry (e.g. Germany, Switzerland), a basis for official statistics (e.g. Austria) and no publication (e.g. Finland).

The endeavour to perform international comparisons between forest enterprises or the whole sector is by no means new. Back in 1967, Stridsberg and Algvere (1967) published the "Cost studies in European forestry" which tried to compare costs and revenues of forestry and forest industries of eight European countries.

Half a century later, the interest in international comparisons based on FAN results is still eminent. Comparing national results is challenging and requires profound knowledge of the respective research infrastructure. At least for the DACH-region (D: Germany, A: Austria, CH: Switzerland), a set of 148 harmonized key figures could be defined and comparisons for the years 2008-2013 were performed (Sekot et al., 2011, Bürgi et al., 2016).

Apart from Hungary and some regional initiatives in Germany, no European country has implemented an FAN during the last twenty years. However, the Hungarian as well as two FANs for jointly owned forests in Western Austria were shut down. In Italy information from a very small sample was collected around 2013 to test a methodology for research purposes but this did not result in establishing an FAN.

Discussion

Monitoring the socio-economic situation of forest enterprises is for sure a relevant task in forestry economics. It allows to assess the profitability of forestry as well as the economic consequences of impacts originating in the natural, economic, social or political environment of enterprises. Especially in regions with unfavorable conditions like mountains (Toscani and Sekot, 2017) or in combined farm forestry enterprises (Toscani and Sekot, 2015) knowledge about the economic impact of forestry is crucial. FANs are appropriate well suited research method for this purpose (Niskanen and Sekot, 2001). Nevertheless, the number of FANs in Europe seems to remain stable. Within the last two decades, no significant changes could be observed. Whereas the methodology of existing FANs is continuously refined so as to fulfill upcoming informational challenges, establishing new networks seems to be hardly possible. The most important hurdles for starting an FAN are setting up the sample and safeguarding the initial investment as well as financing the current cost for at least several years. Information about the cost of setting up and running an FAN is rare to find and might show high volatility due to different wages and frame conditions. Anyhow, a case study for setting up an FAN in the state of Brandenburg, Germany, (Spinner et al., 2006) shows that the expected annual cost for a sample of 39 jointly owned forest enterprises (230 observed forest owners) would be approximately € 160.000 whereas the setup cost were estimated almost four times as high.

International statistics such as the European Forest Accounts rely on valid information from the reporting countries. Those countries operating FANs are in the favorable situation to base their results on well-founded, empirical information. Frequently used alternative methodologies are surveys and estimations by experts. A possible future alternative for countries without an FAN might be the 'typical forest enterprise' approach as suggested for the intended network of *silvi benchmark* (Seintsch and Rosenkranz, 2017).

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Plantations investments in southern Europe.

A comparative analysis on returns, trends, and subsidy policies

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Keywords: *Planted forests, fast-growing species, timber investment returns, financial analysis, southern Europe*

Introduction

The importance of planted forests in the forest economy is increasing worldwide as well as the interest and opportunities for investments in their establishment and management. Planted forests cover an area of 278 million hectares, corresponding to the 6.9% of the world's forest cover, and have been growing at +4.9 million hectares per year between 1990 and 2015 (FAO, 2015; Payn *et al*., 2015). 76% of planted forests are considered established for productive purposes (Del Lungo *et al*., 2006); are contributing to one third of the global industrial timber supply (Jürgensen *et al*., 2014) and this contribution is expected to increase between 75 and 100% by 2050 driven by a globally increasing demand for wood and fibres (Carle and Holmgren, 2008, Buongiorno *et al*., 2012).

In spite there is a growing awareness for the potential of plantations to deliver ecosystem services (UNEP, 2009), timber production remains the main driver for the expansion of planted forests (Carle and Holmgren 2008). Productive forest plantations (FAO, 2012) with fast-growing species are a consolidated segment of investments in southern European countries, with an essential role in the timber production balance. For example, fast growing species, i.e. eucalyptus, maritime pine, radiata pine and poplar, provide over 75% of Portuguese and Spanish wood production, in France only maritime pine contributes to 34% of the softwood production (Martinez de Arano and Lasgourgues, 2014), and poplar plantations in northern Italy provide more than 50% of the industrial roundwood domestic supply (Assopannelli, 2012). In the near future, in southern Europe, on the one hand semi-natural forests are going to have an increasingly important multifunctional role showing a declining utilization rates (Forest Europe, 2015), and on the other hand the demand for timber and biomass is expected to increase, boosted by the European Union bioeconomy and bioenergy policies (UNECE/FAO, 2011).

The establishment of plantations requires a considerable amount of resources; therefore, the investment aspect is crucial to determine their development and management. The most important factor driving investments in plantations is played by the financial returns they generate. In recent years, periodic studies have been estimating the financial returns for the main plantation investments by species and regions (e.g. Sedjo, 1983; Sedjo, 2001; Cubbage *et al*. 2007; Cubbage *et al*., 2014). However, in southern Europe there is little scientific literature estimating and analysing investment returns from plantations. When data and indicators have been collected, information is rarely made publicly available or published in national/regional technical forestry magazines (e.g. Peupliers de France, 2016; Aunos et al., 2002; Borelli and Facciotto, 1996; Ragazzoni, 1993).

We will present the results of an on-going study where we intend to investigate recent trends of investment financial returns from the main plantations species and types in southern Europe, focusing in particular on Italy, Spain and Portugal. In specific, we aim to: 1) provide comparative estimations of investment returns; 2) analyse investment returns recent evolution, estimating *ex-post* how they have changed as a function of the evolution of investments costs and timber stumpage prices; and 3) analyse the role of the major policy and market factors such as subsidies, timber prices and land use costs in influencing investment returns.

Materials and Method

The methodology of our study followed a step-wise approach and it consisted in four general phases:

i) Identification of representative forest plantation models and management regimes. We identified representative forest plantations models and defined the management regimes following an approach similar to the one used in Sedjo (1983) and Cubbage *et al*. (2007). We considered different management scenarios in order to cover a significant range of situations related to establishment costs, timber stumpage prices and management intensity of plantations. In all cases, we assumed average site conditions and appropriate forest

management. In this phase information mainly relied on discussions with experts from forest owners' associations, industries and research institutes.

ii) Collection of data on costs, timber prices and growth rates. Input data were collected through literature and from direct semi-structured interviews with forest owners' associations, industries and research institutes (in Italy during Feb-Nov 2016, in Spain during March-May 2017 and in Portugal in October-November 2017). Input data includes three main components: investments costs, timber stumpage prices and growth rates. Investments costs (including site preparation, planting and management) are mainly derived from forest owners' associations, industries and from contractors' prices lists, timber stumpage prices from forest owners' associations, research institutes or public institutes (e.g. Chamber of Commerce), while growth rates were determined based on literature. In order to build the historical series of investments costs, where no real data were available, we used the Agricultural Producer Price Indexes from FAOSTAT (2017). Finally, in order to convert the nominal values into real values we used inflation indexes from national institutes of statistics.

iii) Financial analysis. We produced the discounted cash flow and estimated the returns using three typical capital budgeting criteria: Net Present Value (NPV), Internal Rate of Returns (IRR) and Land Expectation Value (LEV, or Faustmann formula). In some cases, we included also the Payback period among the criteria. References for such approaches in analysing forestry investments are found, among the others, in Davis *et al.* (2001) and in Zinkhan and Cubbage (2003). For the NPV and LEV we used discount rates suggested by literature for these types of investments, that range between 2% and 5% (e.g. HM Treasury, 2003; ECB, 2016, Snowdon and Harou, 2013) as well as a 8%, suggested by Cubbage *et al.* (2014) for the comparison of forest investment at global level. We firstly assumed a base case scenario, where no land use costs and subsidies are included. Taxes are generally excluded from the estimations.

iv) Sensitivity analyses. In this last phase, we simulated the effect on investments returns of different hypothesis on subsidies, timber prices and land use costs. Concerning the subsidies, we considered the potential contribution levels of the afforestation measures accompanying the European Union's Rural Development Policy. Considering that the majority of plantations have been established, either directly or indirectly, with public subsidies (Bull *et al.*, 2006), the inclusion of these incentives is particularly relevant. To simulate the effect of land use costs, we have generally used average land rent prices but, in the case of poplars in northern Italy established on high productive arable land, we analysed the opportunity costs as well, including missed revenues from alternative agricultural productions. For what concern timber stumpage prices, we have simulated the real variations in the timber market in recent years. Input data for the sensitivity analyses derive from literature and from the interviews to forest owners' associations, industries and research institutes.

Results

We will present the estimations of comparative investment return from poplar in northern Italy (Po Valley) and Spain (Duero Valley, Ebro Valley), eucalyptus and maritime pine in Portugal and north-western Spain (Galicia), and radiata pine in northern Spain (Basque Country). Financial returns will be presented referring to the base-case scenario as well as according to the sensitivity analyses.

For the cases of poplar in northern Italy and in Spain we will present also an *ex-post* analysis of the evolution of timber investments in the last 15 years.

Finally, we will present a comparison between monospecific and mixed plantations in northern Italy, based on potential investments returns and subsidy policy incentives. We compared traditional poplar plantations, high value hardwood plantations (walnut) and polycyclic plantations (Buresti Lattes *et al.*, 2014). We included in the analysis also the main alternative agricultural crops (e.g. maize silage and soy).

Discussion

The results and economic and policy outlook considerations drawn from the study will contribute to discuss the status of investments in plantations in southern Europe and the implications in the development of a European bio-based economy. In addition, our estimations will serve as a benchmark, that can support individuals, companies and new investors to make better investments decisions in this context.

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Analysis of stakeholders' interaction in the context of secondary Norway spruce stands conversion in the Ukrainian Carpathians

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Keywords: *forest conversion, experts' interview, stakeholder analysis, Venn diagram, Ukrainian Carpathians*

Introduction

Increasing anthropogenic pressures and changing climatic conditions stipulate changes in theory and practice of forestry drive them towards adaptive forest management based on the ecosystem services paradigm. Predicted climate changes in the Ukrainian Carpathians (Hlásny et al., 2016; Shvidenko et al., 2017; Kruhlov et al., 2018) show that changes in soil water conditions under increasing air temperature will become the most detrimental factor and will lead to a more restricted zone with conditions suitable for Norway spruce (Picea abies (L.) Karst.) and will to support a slow but continuous expansion of European beech (Fagus sylvatica). Therefore there is increasing the risk to a viability of secondary spruce stands, which were created for economic reasons.

According to the broad international scientific discourse of the spruce monocultures management (Spiecker et al., 2004; Keeton and Crow, 2009; Krynytskyy and Chernyavskyy, 2014; Lavnyy and Schnitzler, 2014) and our DPSIR conceptual model (Driving forces-Pressures-State-Impact-Response) of interactions between social and forest ecological systems in the Ukrainian Carpathians (Zahvoyska and Pelyukh, 2016; Zahvoyska et al., 2017), conversion of secondary spruce into similar to native, mixed uneven-aged stands is one of the effective ways to tackle the forest die-back problems. The possibility of these stands conversion is intensively examined in forestry literature (Slobodiyan, 2012; Krynytskyy and Chernyavskyy, 2014; Parpan et al., 2014), whereas interdisciplinary investigations and analysis of stakeholders' involvement, essential for this silvicultural process, are weak and rare. To gain a better understanding whether stakeholders would support such forests conversion and to identify their benefits and losses stakeholder analysis was conducted.

Material and Method

1. Study area. An expert survey of the stakeholders' interests concerning the Norway spruce conversion was executed in several cities and towns in the Ukrainian Carpathians, a part of the Eastern Carpathians. Secondary Norway spruce covers 184.3 k. ha or 28% of all Norway spruce stands in this region (Slobodiyan, 2012).

2. Identification of relevant experts. The preliminary list of experts was developed through analysis of key agents, involved into research and management of the secondary spruce stands, investigation of causes of the decline and ways to the conversion. One of the major selection criteria was the experts' professional experience in one of the following sectors: forest management and planning, environmental conservation and forestry economics. To identify a full list of relevant experts the snow-ball sampling method was used. During the interviews with the experts, conducted face to face during 15-25 minutes each, the interviewer asked a name of the other experts who could potentially be involved in the survey. In total, at the end of experts' analysis, 50 experts were identified and contacted for the survey.

3. Questionnaire design. The semi-structured questionnaire, applied for stakeholder analysis, consisted of four sections: general information, impacts of forest conversion on a well-being of stakeholders, stakeholders' influence on the forest conversion process and evaluation of the character and strength of the interactions between the stakeholders. The first thematic section focused on the personal characteristics of respondents such as name, location, expert's role in the community or organization. The second thematic section deals with the forest conversion impacts on a well-being of the stakeholders (do they win or lose from the forest conversion) and with estimation of the influence power using the 5-point Likert scale (from 1 = very low impact to 5 = very high impact) (Likert, 1932). The third thematic section focused on the character of stakeholders' influence on the decision about forest conversion like: Who influences and who is influenced by this decision? (from 1 = very low influence to 5 = very high influence). The fourth thematic section considered evaluation of the stakeholders' interaction strength (1 = very low strength to 5 = very high strength of the interaction).

4. Data analysis. The collected data were statistically processed distinguishing between groups of experts' interests. Results of the survey will be represented in the form of Venn diagram (Venn, 1881; Reed et al., 2009). This instrument allows synthesizing the information concerning the stakeholders' power and relationships. The space is divided by two axes (influence/be influenced and win/lose) into four clusters: 1: Those who can influence the situation and benefit from it; 2: Those who are influenced by the changes and will benefit from it; 3: Those who cannot influence the achievement of a goal and will be affected negatively by it; 4: Those who can influence but will lose from the achievement of the goal.

Results

We identified and interviewed experts from the different field of expertise, who has knowledge about social-ecological and economic features and consequences of the forest conversion process. The experts were structured into such groups: employees of natural conservation organisation (Carpathians Biosphere Reserve, Zacharovanyi Krai National Park) (13,33%), of logging and forest enterprises (16,67%), local people (6,67%), which live near to the forest conversion sites, representatives of environmental non-governmental organizations (ENGOs like «Ecosphere» and «Rakhiv.Tourist») (13,33%), representatives of government bodies (10%), scientists from the Ukrainian National Forestry University (Lviv) (30%), the State University of Ivan Franko (Lviv) (3,33%) and the Ukrainian Research Institute of Mountain Forestry (Ivano-Frankivsk) (6,67%).

According to experts' estimations, the main stakeholders of the forest conversion process are nature conservation organizations (NCOs), environmental non-governmental organizations (ENGOs), tourists, state forestry enterprises, harvesting companies, hunters, pickers of mushrooms, berries and other non-wood products (NWFPs), recreationists, scientists, local authorities, local people, wood processing companies, paper manufacturers (PMs) and almost all from the identified stakeholder groups receive the benefits from these silvicultural measures.

As a result of secondary Norway spruce stands conversion, forestry enterprises will have benefits in the long term run. However, in the first stages of the conversion process, forestry enterprises will bear significant financial costs, which are primarily due to a higher harvest costs, associated with the modernization of logging equipment, extension of the forest roads network, additional training of forest staff related to the practice of forest conversion etc. Also planting and protection of tree species (beech, fir) native to the study area but underrepresented in spruce monocultures, could be necessary if there is a lack of sufficient natural generation or mature seed trees. Planting and care for seedlings can cause especially high costs of the forest conversion. Taking into account all the above and emphasizing the significant economic and ecological risks of implementing this silviculture measure, the experts estimated the average benefit of forestry enterprises at 1 point using the Likert scale.

Wood industry typically requires a high amount and quality of a raw material which means a higher value of coniferous tree trunks with no branches and little crowns. But in uneven-aged forests conifer trees have longer crowns that deteriorate a wood quality. A higher proportion of broadleaved wood results in a lower wood price. Thus, experts estimate the loss of local small lumber enterprises at 2.44 points on the Likert scale.

At the same time PMs, despite the fact that high-quality paper is made from a mixture of fibers of deciduous and coniferous species, prefer the last one. Fibers of coniferous species are characterized by a much longer length compared with hardwood fibers. Such fibers add longer paper durability than the hardwood fibers, and such paper better passes through presses and other processing operations. Some types of paper, such as for sacks and bags, can be made of 100% coniferous fiber to increase their strength. Thus, the forest conversion process partially hurts PMs, so their losses experts estimated as 1.75 points on the Likert scale.

Harvesting companies are faced with many challenges resulted from the forest conversion. Because, is much harder conducting the forest conversion than harvested his by clear-cut. Such silvicultural measures require more attention to the preservation and protection of other trees and the new generation. The losses of harvesting companies experts estimated as 3.44 points out of 5.

Very strong change in teaching of silviculture paradigm at the universities and in vocational training is required. Holistic vision of benefits from forest ecosystem services, close-to-nature silviculture paradigm and triggered conversion processes should be well-articulated in the forestry curriculum. Pilot forest sites under conversion in the Ukrainian Carpathians should be used as study objects for students and trainees. Therefore, cooperation and field trips to such case studies and experienced staff and scientists will require more time and efforts. Therefore, further research and cooperation of experienced stuff and scientists as well as reflection of the findings in educational content will require more resources and efforts. Taking these reflections into account, scientists have many benefits which are estimated by experts at 3.69 points.

Pickers of NWFPs mainly lose from the conversion because the area under forest conversion should be fenced

to avoid damages for regeneration. In the short-run perspective, the forest conversion doesn't contribute to a dispersal of mushrooms and berries under the forest shelter. Thus, pickers of NWFPs have to look for other forest sites. The point of their losses estimated at 1.4.

In case of intensive hunting, a regeneration (especially a fir regeneration) can survive only if protection measures like fencing are applied. Thus, benefits or losses of hunters depend on a way of promoting the new generation on the sites under the conversion. Taking into account the fact that most of these areas are fenced, experts estimated the losses of hunters at 2.4 points.

Estimations provided by experts show that the rest stakeholders such as NCOs, ENGOs, tourists, recreationists, local authorities, local people obtain benefits from the forest conversion process.

In experts' opinion forest enterprises (4.23 points on the Likert scale), NCOs (3.52) and ENGOs (3.27) have the biggest influence on decision-making process concerning forest conversion. Scientists have a partial influence on this decision (2.6).

At the same time, wood processing and harvesting companies are mainly influenced by the results of forest conversion (experts estimate at 4.29 and 4.1 points on the Likert scale respectively). Other stakeholders also are influenced by the results of forest conversion, but a little bit less (according to expert estimates an average of 2.38 points).

Discussion

Stakeholder analysis conducted from the perspective of the secondary Norway spruce stands conversion in the Ukrainian Carpathians allows us to identify potential "supporters" and "opponents" of the forest conversion processes, as well as to predict the relationships between them and the nature of their impact on the decision-making. The presented results are significant to practitioners and forest decision-makers in at least two major aspects. Firstly, to understand advantages and disadvantages of the conversion process for different stakeholder groups in the Ukrainian Carpathians conditions. Secondly, to identify stakeholders who are the most influenced by the conversion process and to search a way to soften unwanted effects. This combination of findings provides some support for the conceptual premise of forest policy formation aimed at sustainability achieved through close-to-nature silviculture in conditions of the Ukrainian Carpathians. Research questions, which could be asked for a future investigation, including how to multiply "supporters" synergies of forest conversion process and balance trade-offs between of stakeholders' benefits and losses.

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Regeneration of declining spruce stands in the Czech Republic - economic view of an alternative species composition

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Keywords: *Birch, Economic Efficiency, Regeneration, Declining Spruce*

Introduction

In recent years, Czech forestry has been addressing an issue of spruce stands declining at lower and middle altitudes, especially in northern Moravia. This causes an increased volume of salvage felling, resulting in an increase in the volume and cost of silvicultural operations. It is necessary to implement more costly measures to afforest forest openings which often merge into large areas as a result of the increasing share of salvage felling in threatened areas. Devitalized spruce stands, thinned by salvage felling, often fall victim to destructive winds. Such quickly spreading disaster areas are exposed to natural seeding of pioneer tree species, especially the birch (*Betula alba* L.) The forest openings are not only more difficult and expensive to afforest with target production tree species, but the young forest stands become also more problematic to establish, requiring often multiple removal of weed tree species, including birch.

However, in the above-mentioned cases it is possible to use the "creative force of nature" and to regulate the self-seeded birch until its felling maturity. Lower average costs can be expected in birch management than in that of the main production tree species in the Czech Republic (spruce – *Picea abies* L., beech – *Fagus sylvatica* L., oak – *Quercus petraea* L., pine – *Pinus sylvestris* L.). When talking about the yield, it is necessary to take into account the shorter rotation period of the birch, resulting in earlier yields. Besides utilizing the birch wood for energy purposes, with a lower financial effect, the roundwood assortments can be used for furniture making etc.

Changing the view of the birch from a "weed tree species" to "worthy" alternative production tree species was analysed within a project of the Grant Service of the Forests of the Czech Republic, state enterprise, called "Evaluation of Forest Functions Fulfilment in Birch Stands, Birch Management Economy and Proposed Conception of Birch Management in the Czech Republic". The project examined birch management in four models of silvicultural management frameworks on three types of soil sites (Dudík et al., 2017). The paper focuses only on 60 years old birch monocultures on acidic sites (in Czech typological system, it is the 3K group of forest habitat sites).

Material and Method

The findings on the silvicultural and production potential of birch stands serve as the basis for differentiated modelling of economic efficiency of the stands' management. The management represents a whole production cycle comprising planting, stand establishment, tending, felling and the sale of the raw timber assortments. The birch timber sorting is based on assortment tables for acidic sites. We also model silvicultural and harvesting operations in birch stands, thereby considering the range of operations in technical units. Unit costs and yields represent average levels in the Czech Republic in 2017. The calculation is used to quantify costs and yields in particular economic models.

Two models of birch management are evaluated: B1 and B2. B1 is based on natural regeneration of birch, whereas B2 also includes the direct costs of seeding. Apart from that, both models are identical for the considered inputs,

The evaluation of the economic efficiency of birch management follows the concept of the "Forest Rent Theory". An economically balanced forest is the basic model for sustainable production in forestry. This means it generates similar annual yield/income (at a usual level of timber sale) and similar costs/expenses, with an average profit rate in the frame of regular management (and technologies used) based on a forest management plan. The only evaluation criterion for this approach is profit. This is generally defined as an annual average difference in yields and total costs. However, in the B1 and B2 models considered, the costs do not include overheads.

Results

The average annual gross profit of forest production per hectare is CZK 3,934 (EUR 149.41) in B1, where the

overhead costs and direct costs for the birch seeding are not taken into account.

In case the direct costs of birch seeding are taken into account as in B2, the annual gross profit per hectare amounts to CZK 2,053 (EUR 77.97).

The gross profit level of forest production of the two birch management models becomes more apparent when compared to models of standard tree species management on acidic sites (S1 and S2 models). The comparison is shown in Figure 1.

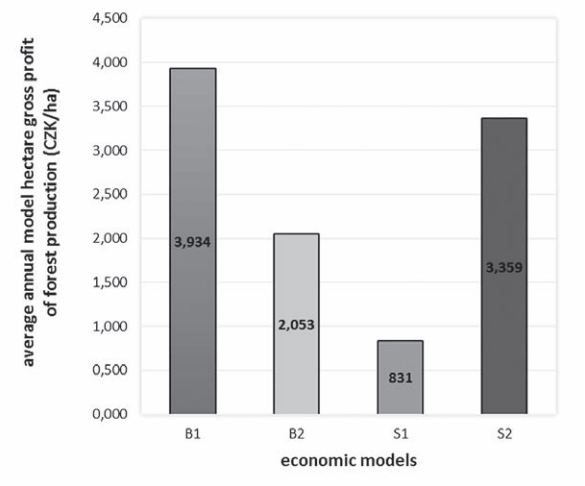

Figure 1: Economic comparison of birch management patterns (B1 and B2), pine (S1) and spruce (S2)

In this comparison, S1 represents a mixture of pine (70%), oak (20%), larch – *Larix decidua* Mill. (5%) and fir – *Abies alba* Mill. (5%) on a 3K acidic site. Model S2 is a mix of spruce (70%), beech (20%), larch (5%) and fir (5%) on a 3I acidic site. Models S1 and S2 were calculated in the same way as models B1 and B2. Gross profit of forest production of S1 (CZK 831; EUR 31.56) and S2 (CZK 3,359; EUR 143.98) is based on Pulkrab et al. (2017).

Discussion

The potential of the production and economy of birch stands has been observed for a long time especially in Scandinavia. Current surveys indicate a high production potential of birch stands and associated economic effects in Central European as well (Lockow, 1997; Unseld, Bauhus, 2012). A significant regeneration potential of most sites, an ability to produce pure stands and to grow in mixtures with other tree species, along with the pioneer growth strategy, underpin the potential for early economic yield (Hynynen et al., 2010).

Given the conditions of the Czech Republic, birch monocultures tended till rotation age are economically competitive with standard production tree species. Natural regeneration may further improve the economic performance provided that the stand is properly cared for up to the rotation age. If we consider natural regeneration of the birch, the result is economically the best of the four models mentioned above. If we consider artificial seeding of the birch, the S2 standard model with a stand mix with predominant spruce is more efficient. The S1 model with predominant pine shows the poorest results of the four models. The use of birch instead of pine can be an interesting economic alternative even in the case of artificial birch regeneration.

Notice: EUR 1 = CZK 26.33 (CNB, 2017).

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A study of the increase in unknown forest owners in Japan

Aging forest owners and segmentalized private forest

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Keywords: *household, aged forest owners, non-farmer forest owners, non-resident forest owners, holding size, segmentalized forest land, common forest, inheritance*

Introduction

The total population of Japan has decreased since the 2010 Population Census. The 2015 Population Census showed a population of 127 million, and it is estimated that the population will decrease a further 51 million by 2115 (National Institute of Population and Society Security Research, 2017). In addition, migration to urban areas has led to depopulation of mountainous areas over the past 50 years, and the number of non-resident and non-farmer forest owners is expected to increase in the future. Under such conditions, the area of forest land with unknown owners will increase, creating new concerns. For example, when forest owners' associations wish to create a forest management plan or construct forest roads, considerable time will be required to seek out these forest owners.

As a background to this issue, there are wide-ranging problems relating to forestry and the general population in Japanese society, including impacts of the population decrease. One of the basic reasons for the problem of unknown forest owners is the large number of very small forests, each representing a large number of forest owners. This paper discusses ownership of small forests and the household characteristics of forest owners based on a recount of government statistics. Next, the main reasons for the large numbers of small forest owners and the relationship between forest size and the issue of unknown forest owners will be discussed.

Method

A survey of forest owners listed in the Forestry Census up to 2000 was conducted. However, mainly due to budget cuts, only forest owners holding over 1 ha remained as a survey item after 2005. The survey target after 2005 was the limited number of forest owners who had conducted forest practices or created a forest management plan during the previous 5 years. In the 2015 Forestry Census, the number of forest owners with >1 ha was 829,000, and the number of surveyed forest owners was 87,000. Thus, it is difficult to obtain the total number of forest owners from the current survey. The final survey from which household information on forest owners can be obtained is from 2000 (Matsushita, 2017).

The 2013 Housing and Land Survey was used to estimate the number of forest owners and the characteristics of households who own farmland and/or forest land. The 2013 survey was conducted on about 3.5 million households. The total number of households in Japan was about 52 million at the time of the survey; thus, the survey targeted about 6% of all households. A new question was added to Sheet A of the 2013 survey: "Do you own any land other than the land for your current dwelling, such as farm land, forest land, etc.?" Using this survey, the households who owned farm land and/or forest land could be effectively identified for this study.

For 0.5 million of the 3.5 million households, a more detailed survey was conducted using Sheet B. The question was "Please fill in the names of the municipalities and the areas of farmland and/or forest land that are largest and second largest in land area." Thus, information on holding sizes and locations is available from Sheet B. However, it must be noted that the number of forest owners and the holding sizes calculated from Sheet B are sometimes underestimated because, although the question specifies "farmland and/or forest land," some owners may have reported only their farmland, as the economic and daily roles of farmland are generally greater than those of forest land. In addition, when forest owners did not know the area of their forest land accurately, they may have provided only the area of their farmland.

To determine the segmentation of forest land and the available databases on management of forest resources in local government, interviews were conducted with staff from the forestry department of local governments and with real estate professionals dealing with forest land.

Results

The recount of results from Sheet B showed the percentage of forest owners classified by holding size. Small-scale

forest owners who owned forests of less than 1 ha, the lower limit for counting forest owners in the current Forestry Census, constituted 68.5% of the total.

The Forestry Census began in 1960, and the definition of forest owners introduced at that time included those who owned forests of over 0.1 ha. Thus, the number of forest owners with holdings <0.1 ha is not available from the initiation of the Forestry Census.

Prior to the census survey, the Forestry Agency conducted a temporal survey of the number of forest owners classified by holding size, with the final survey in 1960. This survey did not have a minimum holding size. The percentage of forest owners with holdings <1 ha in the 1960 survey was 66.4%. As the 2013 Housing and Land Survey and the 1960 survey by the Forestry Agency used completely different survey methods, it is difficult to compare the results directly, and it is possible that the percentage of small-scale forest owners with <1 ha is increasing.

Under the current Forestry Census, forest owners holding >1 ha are counted. A comparison of the numbers of forest owners classified by holding size in the Forestry Census data from 2000 and 2015 revealed that the number of forest owners with <100 ha decreased, whereas the number with >100 ha increased. This means that the number of forest owners with large holdings is increasing. Overall, the numbers of owners with both very small and large forests are increasing.

The percentage of forest owners with <1 ha differed among prefectures. The percentage was over 80% in Okinawa, Kanagawa, Osaka, Tokyo, Chiba, and Aichi Prefectures, and, except for Okinawa, these prefectures all fell within three major metropolitan areas. The percentage of forest owners with <0.1 ha was over 50% in Kanagawa and Tokyo Prefectures, both located in the Tokyo metropolitan area. In metropolitan areas, the segmentation of forest land was clear.

Farmer forest owners, non-farmer forest owners, and non-farmer non-forest owners comprised 1.5%, 3.6%, and 89.9% of all households, respectively. The percentage of farmer forest owners in 2013 was 71.0% of all forest owners. At the end of the Second World War, almost all forest owners were farmers.

The percentages of households whose main earner was over the age of 65 years were 50.2% and 55.4% for farmer forest owners and non-farmer forest owners, respectively. These individuals can receive pensions. The percentages of households where the main earner was over the age of 80 years were 13.3% and 12.5% for farmer forest owners and non-farmer forest owners, respectively. Most of these people cannot visit their forests, and this situation has worsened.

As the gifting of forest land to children before death is uncommon in Japan, it appears that most legal forest owners are the oldest household members. The percentages of households where the age of the oldest household member was over 75 and over 85 years old were 52.5% and 20.0%, respectively.

Discussion

Generally, forest management is inefficient when there are a large number of very small-scale forest owners. In the 1960s and 1970s, the most important forestry policy implemented by the Forestry Agency was the planting of coniferous trees, and at that time, the number of small-scale forest owners was not a problem. However, these planted trees are now reaching their final planned cutting age, necessitating the construction of forest roads to cut the trees, and forestry companies and forest owners' associations must approach a large number of small-scale forest owners to proceed with these plans. In addition, demographic factors such as population aging, the decrease in population, and regional depopulation, together with long-term price decreases in domestic log prices and the number of unknown forest owners, have recently led to increasing problems in Japan. Here, I would like to explain three major patterns relating to segmented forests.

First, I would like to discuss historical changes in common forest land. In the Edo Period, the most important village forest utilized by farmers was managed as a common forest. With the introduction of an ownership system after the Meiji Restoration, a basic policy was implemented whereby common forest was transferred to various kinds of ownership, including private forest. After enactment of the Act on Advancement of Modernization of Rights in Relation to Forests Subject to Rights of Common (Act No. 126 of 1966), the Forestry Agency strongly promoted the creation of forest producers' cooperatives or division of common forests among the former common right holders.

One problem arising from this practice of "individual division" has been that areas of common forest were often small (Matsushita, 2013). The average size of common forest in the 1960 Census was 14.4 ha. After individual division, small common forests were often divided among a large number of individual right holders, with each obtaining only a very small area of private forest land. Another problem arose through the pursuit of complete equity during the division. In common forest management, the most important management principal since the Edo Period has been complete equity; division of common forest among right holders with complete equity necessitated the division of land

into long thin strips to ensure the area of each division was equal. In the case of broadleaved forests, the boundaries of such divided land became unclear, and after several generations, inheritors of this forest land no longer know the location and boundaries of their inherited forest. The management problems caused by individual division of common forest were explained by Takamura (2017) using anticommons theory; issues relating to the division of common property were analysed using anticommons theory by Heller (1998).

Second, after inheritance, small forest lands have often been divided into still smaller forests. In the prewar era, the first-born son inherited all family property under the prewar Civil Code; however, under the postwar Civil Code, all children have equal rights to inheritance of family property. In the 1950s and 1960s, when timber prices were high, some private forest owners conducted clear-cutting over a small area and gifted the cut-over area to their children to avoid payment of high inheritance taxes. For forests located near urban areas, the land price was generally high, and private forest owners considered various measures to avoid paying inheritance taxes. Although no data are available to clarify this, the number of individual forests seemed to increase with changes in inheritance after the war.

Third, various kinds of development activities in forests have also yielded increasingly small forests. One example is the use of forest sites for construction of second homes; such sites were frequently sold and developed in the 1970s and 1980s during the boom in resort development; however, many resort development plans were eventually abandoned. Each individual lot for sale was very small, often little bigger than a residential plot. Another example relates to forest management; when planting was conducted in one part of a forest unit, the remaining part was often neglected and was eventually forgotten.

In most of the cases noted above, the segmentation of forest land resulted because right holders, inheritors, or land purchasers wished to obtain forest land because of its perceived economic importance as a profitable plantation site, a residential construction site, etc. The large decrease in log prices has resulted in very low motivation to manage forest holdings, particularly for small area holdings that yield very low returns.

Even when forest owners live in the village where their forest is located, forest management activities have largely ceased; in particular, elderly owners are no longer able to visit their forests. Non-farmer and non-resident owners frequently do not know the location of their forests or have even forgotten the existence of a very small area of inherited forest. Simultaneously, the number of inheritances is increasing because of the ageing population of forest owners. Many people and agencies involved in forestry have recently become aware that unknown forest owners have been born over a long period, creating a serious issue.

The underlying reason for the high number of unknown forest owners is the serious delay in the land survey project, conducted based on the Land Survey Act (Act No. 180 of 1951). As a result of the aging of forest owners and the increase in non-resident forest owners, the land survey became very difficult to conduct in some areas. Once both information on forest owners and boundaries of forest land holdings became unclear, the problem of clarifying these issues became expensive; indeed, it may be impossible to recover much of this information. Although forest resource databases managed by the forestry departments of prefectural governments set the minimum area as 0.01 ha in some prefectures, some forest land holdings are under this lower limit. All forests must be included to avoid the issue of unknown forest owners.

Acknowledgement

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Forestry Cooperatives in Bulgaria

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Keywords: *forestry, cooperatives, credit cooperatives, cooperative legislation.*

Introduction

The importance of the cooperative movement, credit cooperatives and development of the business environment in forestry of Bulgaria initiated the need for this study. It aims to explore the historical development and operation of cooperatives in Bulgarian forestry, the creation and development of credit cooperatives and related to their work efficiency.

The main research objective of the study is to establish the importance and role of cooperatives, in particular credit cooperatives, for business development in forestry and to assist their members.

Material and Method

The object of investigation is history development of cooperative movement in Bulgarian forestry. There are analysed cooperative laws, laws for forests, documents about creation of specialized financing institutions, banks and literature about different types of cooperatives in forestry and agriculture.

Research questions

The problems that need to be solved can be presented as follows: *i*) what is the historical development of the cooperative movement in Bulgaria and especially in forestry and what is its place and importance regionally and globally?; *ii*) what is the experience of the country in the formulation and implementation of activities of credit cooperatives in forestry?; *iii*) in what direction was developing legislative activity related to cooperatives?; *iv*) what is the impact of external factors on the occurrence, functioning and development of credit cooperatives in Bulgaria?; *v*) what are the prospects for them in our country?

Hypotheses

In conducting the research, stemming from studies of literature on the topic, research question and emerging trends in the analysis of the cooperative movement at national and international level should be checked the following assumptions: *i*) with regard to the establishment and operation of cooperatives in Bulgaria has been accumulated a rich experience that can be used at present; *ii*) the credit cooperative is essential and gives space for development and expansion of the planned activities of cooperatives and to support its members; *iii*) in Bulgaria there are favourable environmental factors that can be used to extend credit cooperatives in forestry.

Results

Bulgaria is among the countries in Europe with a strong cooperative movement. Unlike countries in Western Europe Bulgarian cooperative movement appears initially in villages and later passed into the cities. The reason is that Bulgaria is mainly an agricultural country. Rural population at the end of the nineteenth century is over 80%. For agriculture, at this time it was typical small private production, which was a natural social basis for the emergence and development of the cooperative.

The first cooperative in Bulgaria was established in 1890, a first congress of agricultural cooperatives was held in late 1907. First forests owner's cooperatives appeared after the adoption of a special law in 1911 for the sale of some state forests in the region of Asenovgrad, and later in the region of Smolyan (Ivanchev, 1946).

In 1922 was established Forests Cooperative Union and new forestry act was accepted. This act provides for the exploitation of public forests and the processing of wood materials to be carried out by forest cooperatives, which at that time were 88.

The cooperative movement in Bulgaria was characterized by a wide variety of forms, types of cooperatives and their penetration in various sectors of economic, social and cultural life of the country. It was found that in Bulgaria were established production, labour and owner forest cooperatives, but many of them also worked as credit cooperatives.

During this period were accepted several laws for cooperatives and for forestry in which we found many articles, connected with work of forest cooperatives (FA, 1922, LC, 1948, LMUF, 1948, CA, 1953, ACO, 1983, CA, 1991, LRFFL, 1997, CA, 1999).

Till 1945 in Bulgarian forestry 260 forest cooperatives with 31456 members were registered. 205 of forest cooperatives were members of Forest Cooperative Union (Ivanchev, 1946).

After 1948 all forests and forest lands were nationalized and forest cooperatives stopped to work.

With adoption of Law for restoration of forests and forest lands (LRFFL, 1997) in Bulgaria the process of restoration of former forest cooperatives and their management structure has begun.

The restoration of forests and forest lands has created a new ownership structure. There were different kinds of property that imposed new requirements on governance and forest management.

The total area of forest areas on 31.12.2014 amounted to 4 202 015 ha, of which state forest areas have an area of 3 090 732 ha (73.6%) and non-State forest areas are 1 050 942 ha (25.0%).

Data on the distribution of the area of forest areas according to ownership shows that private forests are equal to 10.3%.

The number of properties of individuals amounted to 606 809 units, which means that the number of forest owners is more than 250 000 people since individual owners state several plots.

Predominant is the small size of individual forest plots (average size about 1 ha), which significantly hinders normal silviculture activities in these domains. Cooperatives and associations of forest owners have a very low share (about 6% of private forest lands), resulting in low efficiency of forest owners and need of economic support for proper stewardship of private forests.

Discussion

A brief summary of the distribution of forests owners depending on their parcels area size shows that in Bulgaria dominate the petty area forests parcels, where it is difficult to achieve economic efficiency and that the owners need support to carry its activities.

Most often, people are unwilling to engage actively in forests because of their low profitability, the difficulties in managing them, and the remoteness of their domicile.

The key to the active development of private forestry is held by many owners with thousands of small plots. This fragmentation makes an expensive process of efficient forestry, and nobody ultimately earns either the business or the owners (Stoyanov, 2001).

Credit cooperatives provide credit to the principle of mutual assistance. On this principle are organized and popular cooperative banks in Europe. Credit cooperatives operate on a regional basis where people know each other well. Cooperatives are the most democratic form of association because everyone who is a member of a credit cooperative has one vote, regardless of its capital. Under the current legislation the Credit Cooperatives are not allowed to lend to outsiders, but only to individual members. That helps to small businesses - support to the individuals who put money in their business.

Interest rates are determined for each cooperative individually, but the basic rate is fixed from National Cooperative Union. Some cooperatives set differential rates depending on the type of business and risk, as commercial banks (Stoyadinova, 2012).

The conditions under which credit cooperatives lend are very relieved, because they have not higher management fees on the loans. In practice, very often in cooperatives annual percentage rate of charge is equal to the interest rate on the loan, i.e. no additional burdens. Loans are granted very quickly, because people in a cooperative know each other. Each participant in the credit cooperative is entitled to the dividend, which is formed by annual profit, reported after payment of taxes. In addition to paying dividends, part of the net profit of the credit cooperatives is set apart in reserve funds (Miteva, 2006).

The disadvantage of credit cooperatives is that they cannot attract deposits, as in other European countries. The main drawback of current legislation in this area is that there is no way to develop existing ones and to base new ones credit cooperatives. Currently the only way to grow is to open branches of existing cooperatives and the new cannot be created. Several years ago in Bulgaria were created other credit cooperatives such as popular banks, but they were forced to register as limited companies. Over the years, the National Assembly has received a number of draft laws governing the activities of credit and deposit and savings cooperatives, but none of them is accepted (Stoyadinova, 2012).

If a special law on credit cooperatives passed, it will enable many more local people to be members of such credit structures. Each member of this cooperative is entitled to participate at the annual general meeting and in the decisions and policies of it. Each member participates in the distribution of profit - which means if paid as interest on the loan, is returned in the form of dividends. People need very small loans - from 1000-2000 BGN to resolve a small problem for one season. The granting of such loans is not attractive for banks but for owners of small forests is extremely necessary (Banks, 2012).

Conclusion

Based on the analysis of the historical development of the cooperative movement in Bulgaria and the advantages of credit cooperatives can be drawn some conclusions and recommendations:

Over the last century in Bulgaria there was a successful cooperative movement. It actively used the European experience that adapted to suit local conditions and peculiarities.

The cooperative movement in Bulgaria is characterized by a wide variety of forms, types of cooperatives and their penetration in various sectors of economic, social and cultural life of the country. Too large is the number of credit cooperatives - more than 77% from the all cooperatives (Zlatev, 1999).

In parallel with the creation of cooperatives was developed cooperative banking system that successfully performed the tasks for support and lending to members of cooperatives.

In the field of forestry initially are formed forest owner cooperatives, but then rapidly developed process of creating labour productive forestry cooperatives.

The cooperative activity is accompanied by active legislative work - development and adoption of specific laws on cooperatives, according to the specific conditions and specific clauses in other laws pertaining to cooperatives and their functioning.

After the restoration of private property and in particular that of forests, and the adoption of the Cooperatives Act in 1991(CA, 1991) and Law for restoration of forests and forest lands (LRFFL,1997) started even slower the creation of cooperatives in the areas of agriculture and forestry.

The conditions in forestry and rural characteristics of the property of forests owners and the economic indicators for the activities of small forest owners indicate that it is necessary to look for new models and forms of organization of the management of small forest estate and to seek opportunities for economic relief assistance to those owners.

The analysis of the law for cooperatives shows that in Bulgaria there is no special law on credit cooperatives, which does not allow a lot of local people to join such credit structures and benefit from the opportunities for support.

The purpose of the creation of credit cooperatives is to assist private forest owners to take care of them, to assist in the expansion and strengthening of their forests, to increase the quality of life and to improve the local economy.

There is a need to create conditions for development of the credit cooperatives in the country in order to receive the expected positive results from the creation of credit cooperatives, to create conditions for establishing a wide network of credit cooperatives, which will cover the most remote rural areas, where commercial banks have no interest and to develop credit sector as a durable, economically stable and efficient financial system for smaller settlements.

In examining the changes in the legislation on co-operatives in recent years it has been established that the legal conditions for the creation of credit cooperatives in Bulgaria are not favourable. If private forest owners have the opportunity to create forest credit cooperatives, they would improve the economic and social situation of the population in the mountainous regions of Bulgaria.

That is why it is imperative to develop and adopt as soon as possible a special law on credit cooperatives in Bulgaria.

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Private Forests and Woody Biomass for Energy:

Lessons from Two Studies in the Eastern U.S.

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Keywords: *Bioenergy, Private Forest Owners*

Introduction

A number of U.S. assessments, such as the Billion-Ton Study (U.S. Department of Energy, 2016) have estimated the capacity of U.S. forests to meet the potential demand for woody biomass for energy, based on the physical availability of wood residue, and to a lesser extent, standing timber. The most recently updated report of this study estimates that by 2040, as much as 60 million dry tons of biomass will be available from forest trees and additional 36.5 million dry tons can be expected from residues (U.S. Department of Energy, 2016). The vast majority of the projected increase in biomass supply is expected to come from short rotation woody crops such as eucalyptus and poplar. Additionally, several studies have evaluated the potential supply of woody biomass utilizing economic models of markets. Those studies have concluded that forest residues and non-merchantable timber may be the initial contributors of wood energy source but the demand for biomass may increase in future with new regulations and cleaner energy source polices in place (He et al. 2014). Similarly, Abt et al. (2010) cautioned that meeting bioenergy demand in some places such as Southeast U.S. may require biomass from beyond woody residues alone. This suggests more intensive management of forest as feedstock crop may be important in future.

This paper reports on findings from two surveys of private forest owners in the eastern United States designed to assess private forest owner (PFO) willingness to provide woody biomass for energy.

Material and Methods

The results presented below were collected in two studies (Figure 1). The first study consisted of a telephone survey of private forest owners from all U.S. states east of the Mississippi River and those bordering the western bank of the Mississippi River. More than 900 landowners were surveyed in 2015 to assess their knowledge in woody biomass for energy and their willingness to provide raw material.

Similarly, the second study involved focused on the same issues with a mail survey focused woodsheds of the two U.S. ports that ship the bulk of wood pellets to Europe – Virginia Beach, Virginia and Savannah, Georgia (indicated by the red x's in Figure 1). Questionnaires were mailed to approximately 3,000 PFOs in the fuelsheds in the summer of 2017; more that 700 were returned for a response rate of 24 percent. More details on the survey procedures, questionnaires, and response rate are available from the primary author (Hodges et al., 2016).

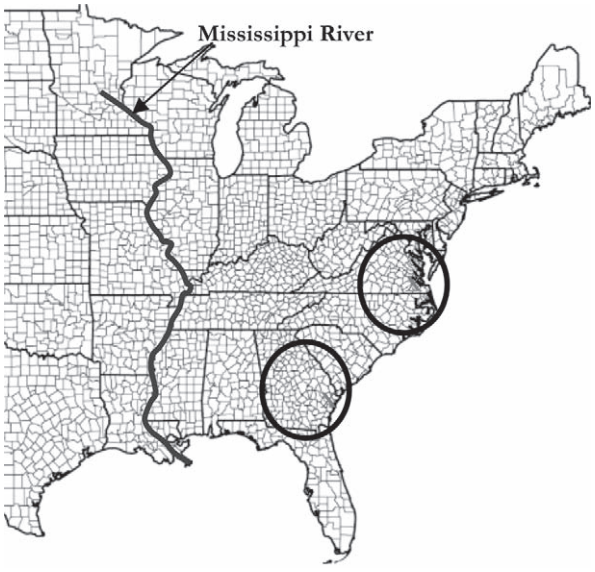

Figure 1: Study sites for the Telephone and Mail Surveys.

Results

The results of the two studies are not directly comparable for all questions in the two studies due to some minor differences in the research objectives by the funding agencies, but some general trends and differences can be identified. The first significant difference in the two studies was the willingness of the respondents to provide woody biomass for energy production. As Figure 2 illustrates, respondents in the eastern wide survey were evenly split in their willingness to provide biomass, while those in the two-fuelshed study were much more likely to provide material. Specifically,

while 50 percent of the eastern U.S respondents were willing to harvest, more than 44 percent were not. In the two-fuelshed study, however, almost 70 percent were willing, compared to less than 7 percent who were not. Much of this can be explained by differences in the two areas covered by the studies. The eastern U.S. contains a large portion of forests that are used primarily for non-timber uses, such a recreation. Even in areas where timber production is common, much of the emphasis might be on sawtimber-sized trees (dbh > 30cm). Conversely, the two fuelsheds surveyed have a long history of intensive timber management, most often for short pulpwood rotations. More recently, as the demand for paper, and pulp, has declined, these owners have found opportunities to provide material for wood pellet production and export. As a consequence, those in the two fuelsheds are more likely to have knowedge of woody biomass for energy markets.

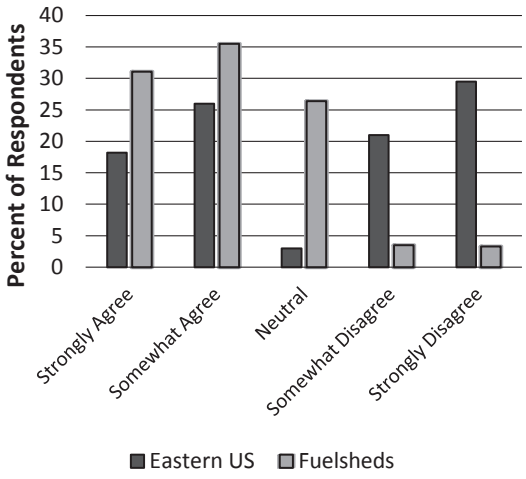

Figure 2: Distribution of Respondent Answers to "I would harvest/supply woody biomass for energy".

Focusing on those factors related to the decision to provide woody biomass for energy in the future, some similarities emerged (Table 1). Binary logit models were developed for both studies, although due to differences in the surveys, not all variables were included in both models. Still, some general themes emerged. First, stated objectives for ownership were only weakly related to willingness to provide wood for bioenergy. For the fuelsheds study, owning forests for wildlife habitat was the only objective related to biomass decisions, and was negatively related. Financial and timber objectives were not statistically significant. The ownership objectives were assessed for the eastern U.S. study as well, both individually and using classification to aggregate into consumptive and non-consumptive objectives. None were significant in either case.

Attitudes and perceptions were important. There were strong correlations between respondent attitudes toward climate change and bioenergy and their willingness to provide woody biomass, but none were significant in the logit model. In the fuelshed study, the respondents' perceptions of the viability of wood-based energy was positively related to their willingness to provide wood.

Interestingly, demographics were significant in both studies, albeit different variables. For the eastern U.S. study, income and education were positively related to willingness to harvest biomass for energy. The positive relationship runs counter to much of the literature pertaining to timber harvest decisions, but has been reported in other bioenergy studies. While higher income and/or more educated owners are less likely to harvest traditional timber products, they seem to be more interested in providing wood for a use can be linked to enhancing environmental quality through reduced carbon emissions (Joshi and Mehmood, 2011; Gruchy et al., 2012). Interestingly, however, Leitch et al. (2013) assessed the effects of educational material provided to increase awareness of wood-based energy and reported no effect. In the fuelsheds analysis, age was negatively related to biomass provision, while males were more likely to provide wood for energy, which again is similar to previous studies (Joshi and Mehmood, 2011; Gruchy et al., 2012).

Discussion

As the number of studies investigating private forest owner willingness to provide woody biomass for energy production increases, we are able to develop a clearer picture of what motivates landowners to consider this new market. While much of the knowledge we have developed from decades of modelling private owner behaviour with regard to traditional timber harvests can apply to biomass provision, some interesting differences are

Table 1: Binary Logit Regression Coefficients

Variable	East U.S.	Fuelsheds
Area	0.11	0.27**
Management Plan	-	0.24
Financial Objective	-	0.33
Wildlife Objective	-	-0.61*
Timber Objective	-	0.50
Wood Energy is Viable	-	0.81**
Future Plans for Harvesting	0.08**	-
Age	0.07	-0.87**
Male	0.10	0.69**
Income	0.18**	0.00
College	0.10**	0.05

emerging. Higher education and income levels, for example, may be linked to an increased willingness to supply wood to uses that could reduce carbon emissions from petroleum-based energy. In one of the studies examined here, the fuelsheds, owners of larger tracts were more likely to be interested in providing woody biomass, similar to many studies of traditional timber harvests and some biomass studies (Joshi and Mehmood 2011, Becker et al. 2013, Joshi et al. 2013). Conversley, Gruchy et al. (2012) reported contradictory results, linking this result to the fact that landowners with larger acreages were primarily interested in traditional timber management rather than alternative products.

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Potential consumer categories of wood products in Croatia

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Keywords: *wood products, furniture, consumers, tourism buildings, Croatia*

Introduction

Over the last 10 years, Croatia has made many economic and societal changes that either directly or indirectly impacted their furniture industries. In the areas of manufacturing and selling furniture, Croatia has experienced numerous important changes related to the development and application of marketing functions, which have made these markets more interesting for domestic and foreign investors, especially noting the entrance to 'EU family' in 2013. In 2015, the average net monthly salary in Croatia was approximately 750 Euro (EUR), the gross domestic product (GDP) growth rate was 1.6%, and the unemployment rate was 16.3% (58.7% of which were people between 25 years and 49 years old) (Croatian Bureau of Statistics 2016). In 2012, the ratio of the furniture consumption in Croatia to the total EU furniture consumption was 0.4% (Centre for European Policy Studies 2014). Additionally, the furniture consumption per capita in Croatia in 2012 reached approximately 81 EUR. When looking at the construction activity of legal entities employing five or more persons, the value of work that was done on residential buildings was approximately 250 million EUR, and 10000 dwellings for permanent residence were completed in Croatia in 2014 (Croatian Bureau of Statistics 2016). Wood product demand is a derived demand in terms of how it is created, e.g. furniture demand is derived mainly from the demand for residential and civil buildings, but in last few years sector of tourism is taking an important part in furniture consumption. When considering the continuous changes in consumer behaviour, understanding the furniture preferences of customers would provide information that is beneficial to the furniture industry.

Material and Method

The sample frame for this research were 317 business subjects of rural tourism in Croatia and 373 business entities belonging to Division 55 (Groups 55.1 to 55.9) – accommodation (according to statistical classification of economic activities in the European community (NACE Rev. 2). Business subjects of tourism buildings were taken from the first national catalogue of rural tourism subjects 'Rural Tourism of Croatia') from 2015 (****, 2015), while accommodation businesses were taken from www.biznet.hr data base. All business subjects were located in Croatia. An email survey was the method used for surveying respondents for this study. This approach was selected because it is the most cost-effective method for surveying (Dillman, 2000) and also insures data collecting over a wide geographic area and low-cost data conversion (Zahs and Baker 2007).The surveys were conducted during the spring 2016. The total number of usable surveys received was 47 (rural tourism businesses) and 43 (accommodation businesses), respectively.

Results

Respondents were requested to define wood products that they have in their rural tourism buildings. Of 47 respondents, 87.23% have interior wooden joinery (doors), followed by exterior joinery (85.11%), sitting furniture (82.98%), beds (76.6%) and closets in the form of cupboards, wardrobes, bookcases (76.6%). Wood products like, kitchen and dining furniture, venetian blinds, floor coverings were used between 55% and 65% of the respondents. Additionally, wooden wall coverings (38.30%), wooden facades (29.79%), and upholster furniture (29.79%) were products present between less than 40% of the respondents (Figure 1).

As shown in Figure 2 and Figure 3, almost ¾ of respondents (72.09%) noted *'quality'* as very important element, followed by *'product functionality'* (60.45%), and design of products (55.81%). Furthermore, between respondents 'safety' was also one of definitely very important factor in decision making process of buying wooden products. On the other hand, factor *'price'* was found not to be so important factor in decision process of buying wood furniture, only 29.73% of the respondents noted factor 'price' as very important element when buying wood products for their rural tourism buildings.

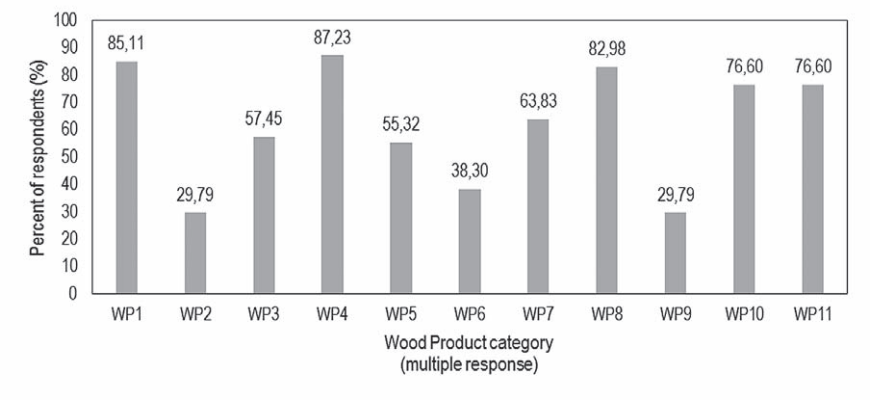

Figure 1. Wood product category in rural tourism buildings (n=47)

Legend: WP1 – exterior joinery (windows, doors, …); WP2 – wooden facades (fronts of the buildings); WP3 – venetian blinds; WP4 – interior joinery; WP5 – floor coverings (parquet, rustic flooring, decking); WP6 – wall coverings; WP7 – kitchen and dining room furniture; WP8 – sitting furniture (bench, chair); WP9 – upholster furniture (armchair; sofa); WP10 – beds; WP11 – closets (cupboards, wardrobes; bookcases).

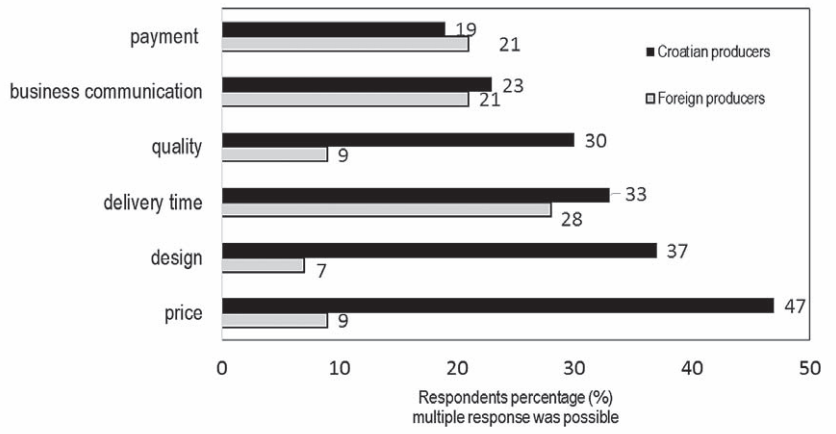

Figure 2. Disadvantages of Croatian and foreign furniture manufacturers in the opinion of business entities in the area of provision of accommodation (n = 43)

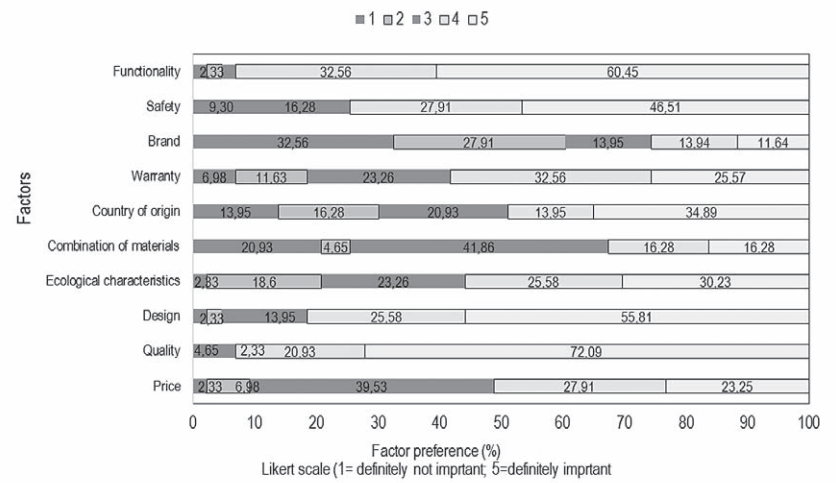

Figure 3. Factors in decision making process of buying wood products for rural tourism businesses (n=43)

Discussion

Quality of wood products was found to be very important factor in decision making process of buying furniture and wood products, followed by product design, safety, country of origin, environmental characteristics, warranty, price, material combination and as the most insignificant factor was brand. In making decision about foreign furniture majority of owners/stewards prefer Croatian wood products. When deciding about wood products 'made in Croatia', price, design, delivery time and quality were found to be the biggest disadvantages in comparison to foreign producers. Owners and/or stewards of the tourism buildings (rural tourism and hotels) were noted as potential buyers and users of wooden products.

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Policies affecting competitive advantage in forestry with apparent areal changes in respective forest ownership groups

Case Finland

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Keywords: *forest ownership, forest policy, taxation, competitive advantage, areal response*

Introduction

Forest ownership is often considered to stay relatively steady over time. However, in the long term ownership changes can be significant, even dramatic. In a country like Finland, forest land owner is typically changed inter-generationally within families, in land sales and nominally in ownership form changes (e.g. corporatization). In this case, even the short term changes can reveal interesting features, which in some other countries may stay less visible.

In many former socialistic countries, for instance, the dominating changes have been restitution and privatization, which have reduced the public forest ownership since the 1990's. In some countries, on the other hand, public forests form the majority of forest ownership and the changes are insignificant. In EU-28 (in 2010), public forest ownership varied from 3 percent in Portugal to 88 percent in Bulgaria and the overall average was 40 percent (Eurostat 2017).

Globally various investors have become increasingly interested in forest lands. This development began in the USA and has become more apparent also in Europe after forest industries adopted the International Financial Reporting Standards (IFRS). As a consequence, some forest industry companies decided to sell (part of) their forest lands or form separate forestry companies in order to lighten their balance sheets, where forests according to the IFRS had to be valued at their fair value.

Central bank responses after the financial crisis of 2007-2009 led to expansion of money supplies and to reduced interest rates. This has increased investments in forest lands and led to rapidly rising land prices. Achievable benefits in taxation and absence of public competitors in forest land markets have benefited expansion of private larger-scale forestry. In addition to available industrial forests, investors have also acquired forests under privatization and forests from family forest owners.

In this paper, we describe the Finnish forest ownership areal development as a response to simultaneous policy and economic factors. The emphasis is to update and refocus the ownership analysis on Finland presented in Živojinović et al (2015).

Material and Method

We employ data from the Finnish Tax Administration to construct time series of the forest ownership groups, which are relevant for applied policies. Constructed time series are analysed graphically and econometrically against policy and economic factors.

Results

In addition to global drivers, in Finland there have been some special features related to tax policies applied to different ownership groups, policies to enhance enlargement and establishment of jointly owned forests (private entities) and a policy to suspend commercial forest land acquisition by the state forests. The changes in ownership are interpreted to indicate the competitive advantage by forest ownership groups.

Discussion

The areal changes in ownership groups, when they are related to public policies, raise the question, whether the development is desired from the societal point of view. The minimum requirement is, that the development should be monitored and analysed for decision makers.

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Mechanisms of financing protected area management system in Serbia

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Keywords: *protected areas; mechanisms of financing; groups of managers;*

Introduction

Protected areas (PA) contribute to the environmental, social and economic goals of sustainable development through support of ecosystem functioning, promotion of sustainable use of renewable resources and provision of space for tourism and recreation (Philips, 1998).

Management of PA can be delegated to an organization, individual or community, which functions according to a set of laws, rules and/or traditions (Chape et al., 2008).

In the late 1990's of early 21st century in Serbia the management of PA was given for the first time to the of non-governmental organizations (NGO), i.e. private sector (PrS) (Nonić et al., 2015).

Conducted researches, until now, point out the fact that beside two types of PA managers (public and PrS), in Serbia there are numerous categories and subcategories of managers[1] (Đorđević et al., 2014; Nonić et al., 2015; Ђорђевић et al., 2017; Ђорђевић, 2018).

One of the important components of the PA management represents sustainable financing, which represents the basis for realization of nature protection. Sustainable financing is defined as "… *ability to provide sufficient, stable and long-term financial resources", in order to cover total PA costs*" (Emerton et al., 2006). Adequate financial resources are necessary to be provided at the appropriate time and form, in order to "... *cover the full PA costs*, *and ensure the effective and efficient management of the PA, in accordance with the objectives of protection and other objectives*" (Worboys et al., 2010). Providing sustainable financing can be achieved through the diversification of revenues (1998; Eagles et al., 2002; Bowarnick et al., 2010; Avramov et al., 2012), i.e. by introducing innovative mechanisms and continuous financing of activities in the PA.

Financing of PA in Serbia is directly defined through Law on nature protection (2009) and includes three sources (Đorđević *et al.*, 2013/b): budget of Republic of Serbia, revenues obtained by the organization that manages PA, and donations.

Research on the mechanisms of financing PA management system in Serbia has not been done so far. There are some studies on the financing of national parks (Šumarac, 2009; Đorđević et al., 2013 /a; Đorđević et al., 2013 /b), but no research dealing with other categories of PA, as well as differences in the financing of individual PA managers.

In this study, we aim to determine mechanisms of financing the PA system, within different groups of managers.

Material and Method

As the research method in data collection phase, structured interviews with standardized survey questionnaire are used. Kruskal-Wallis test is used to determine differences between all groups of managers, while Mann-Whitney U test is used for determination of differences between specific group of managers (Ђорђевић, 2018).

The survey consisted of three sets of questions (basic characteristics, structural characteristics and financing mechanisms) and for this paper, issues related to the mechanisms of PA financing were used. The population for this research is defined on the basis of PA Register (2012) from which 63 PAs were selected.[2].

[1] On the basis of these categories and subcategories of managers, groups of managers are defined (Ђорђевић, 2018).

[2] The criteria for the selection of PAs were: the existence of a PA manager, PA size (areas smaller than 10 ha were excluded) and PA categories (all PA categories are included in the sample, except for nature monuments and protected habitats).

Results

The mechanisms of financing PA management system were observed through the average number of financing sources and average amount of financing (*EUR·ha*$^{-1}$)[3]. Statistically significant differences are determined in average number of PA financing sources, within group of managers (Figure 1).

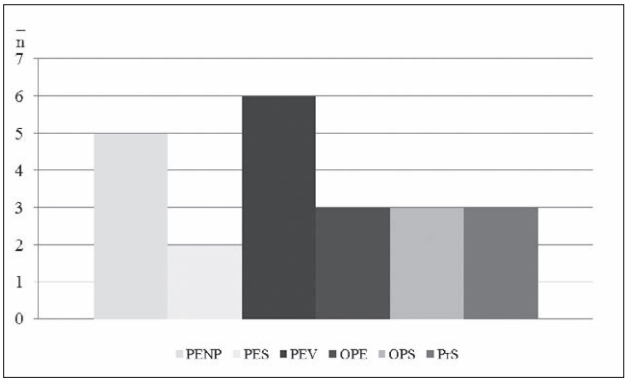

Figure 1: Average number of financing sources within group of managers

The public enterprise (PE) "Srbijašume" (PES) is separated with the lowest average number of financing sources (2), unlike PE "Vojvodinašume" (PEV). Observing the average amount of financing by area (*ha)*, own revenues are significantly more present, unlike other sources of financing (Figure 2).

Thus, other managers from public sector (OPS) have the largest amounts of their own financing (1.714 *EUR·ha*$^{-1}$), while other PE (OPE) records the least amount (76 *EUR·ha*$^{-1}$). Financing of local community, according to the amounts, is immediately behind own revenues. Local community is mostly financing OPE (426 *EUR·ha*$^{-1}$) and PES (81 *EUR·ha*$^{-1}$), while it is not present in the financing of PE that manage the area of national parks (PENP).

Behind these are revenues that are coming from the competent ministry for PA or secretariat at the provincial level. The competent ministry is significantly more financing PA to the PrS (122 *EUR·ha*$^{-1}$), as opposed to the PEV (7 *EUR·ha*$^{-1}$) and PENP (14 *EUR·ha*$^{-1}$).

Financing by international institutions is highest in PrS (62 *EUR·ha*$^{-1}$), and it is not present at PES.

The lowest financing of PA comes from various NGOs (associations), and is mostly present in the PrS (3 *EUR·ha*$^{-1}$), while this type of financing is not present in PES, PEV and OPS.

[3] The exchange rate of EUR is used from the end of 2015 (121,62 RSD for 1 EUR), when research was conducted.

Discussion

When observing the financing of the PA in Serbia, it was found that average number of financing sources is significantly higher with PEV, unlike other groups of managers.

As a comparison to Serbia, for instance, financing of the PA in Croatia is carried out through the competent ministry, regional and local self-governments, as well as through funds from the European Union (EU) (Martinić, 2010). A previously conducted research in Serbia indicates that revenues in the national parks are mostly generated by the sale of goods and services, while income from fees makes up only 12.4% of total revenues (Đorđević et al., 2013). Research on the amount of income generated by groups of management of PA has not been done, but some studies indicate that income from tourism in PA is of increasing importance (Dahmaratne, 2000; Eagles, et al., 2002; Nevenic, 2006; Eagles, Hillel, 2008).

Also, one of the sources of PA financing can be funds intended for the "Natura 2000" network. Thus, financing of this network in EU countries is carried out through several funds, i.e. programs (Kettunen et al., 2014). These sources of funding can be used in the future as a basis for the establishment of the Natura 2000 network, as well as additional financing sources for various activities in the PA, from research to education, but require partnership cooperation between different PAs.

Regarding the improvement of use of mechanisms for financing PA management system, additional training is proposed for the use of funds at the national and international level, as well as external, i.e. additional engagement of agencies that would prepare projects at the international level. It is also proposed establishment of a specific mechanism, fund for nature protection, which would have a continuous funding or be part of the existing Green Fund.

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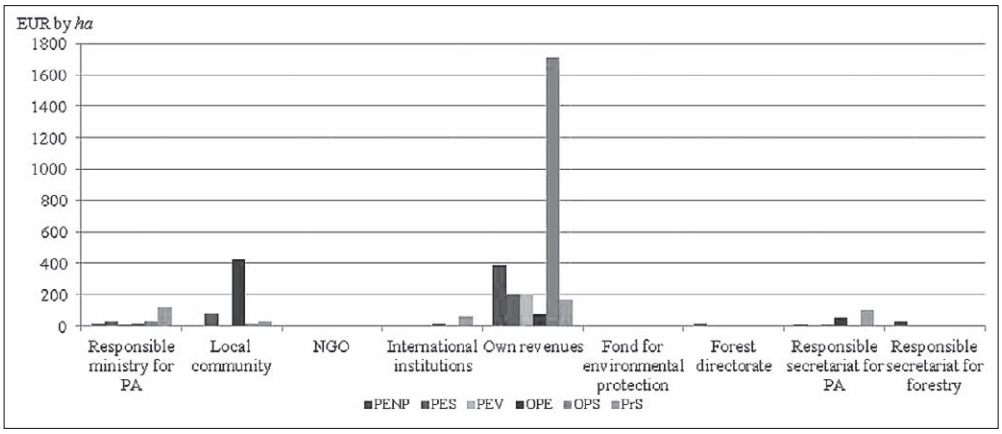

Figure 2: Average amounts of financing PA within group of managers

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Evaluation of Natural Forest Certification in Indonesia: Insight from Forest Stewardship Council Audits

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Keywords: *Forest Management, Corrective Action Request, Market Based Intervention, Indirect Assessment*

Introduction

Tropical forest degradation by unnecessarily destructive and often illegal selective logging is a major global environmental concern (e.g., Hosonuma et al., 2012; Tacconi, 2012). One intervention used to stem this tide of destruction is voluntary third-party certification of products harvested from responsibly managed forests (e.g., Auld et al., 2008; Romero et al., 2013). Here we provide an indirect assessment of the impacts of this intervention, forest management certification in Indonesia.

Forest management certification impacts are especially hard to evaluate due to the intervention being voluntary, which increases the likelihood of positive selection bias. However, certification's impacts can be indirectly inferred by assessing corrective action requests (CARs) reported by Conformity Assessment Bodies (CABs) in the public summaries of their audits (e.g., Blackman et al., 2013, 2014; Peña-Claros et al., 2009: Rametsteiner and Simula, 2003).

To study CAR evolution and the relationships between Forest Management Unit's (FMU) characteristics and CAR issuance for FSC certified natural forests in Indonesia, we employ and adapt the method developed by Blackman et al. (2013; 2014). Our intention is to reveal, to the extent possible with this indirect approach, under what conditions and how Forest Stewardship Council (FSC) certification affected forest management outcomes. We predicted that the meta-categories of CARs issued (environmental, social, economic/legal, and forest management) varied with FMU characteristics (area, age, number of workers, permit duration, vertical integration, principal market destination, and subcontracted logging).

Material and Method

CAR data extraction and categorization

We restricted our analysis to natural forest FMUs in Indonesia. A total of 933 non-conformities were extracted from public summaries of audit reports published on the FSC website (http://info.fsc.org/) from March 2001 through August 2016. We sorted the CARs into four meta-categories (environmental, social, economic/legal, forest management) that were then subdivided into issue categories (Table 1). We evaluated how CAR focus varied with FMU characteristics.

CAR Issuance

We also evaluated how the numbers and types of CARs varied with seven FMU characteristics with a multinomial logistic regression (Croissant, 2012) with the economic/legal meta-category as the reference. We used the economic/legal category for comparison, and log-transformed (log10) FMU area. All analyses were run in R.

Table 1: Corrective Action Request (CAR) meta-categories and issues (based on Blackman et al. 2014).

Environmental	**Social**
Aquatic and riparian area	Communication and conflict resolution
Sensitive sites and HCVF	Training
Threatened and endangered species	Worker safety
Landscape-level considerations of forest management	Non-Timber Forest Products (NTFPs)
Woody debris, snags, legacy trees	Worker wages and living conditions
Soil damage and erosion	Special cultural sites
Economic and Legal	**Forest Management**
Profitability	Roads and skid trails
Compliance with state, federal, and international laws	Regeneration and reforestation
Illegal activities and trespassing	Chemical use and inorganic waste management
Long-term tenure	Exotic species and pests
	Conversion to non-forest uses

Results

FSC certification of natural forest management in Indonesia

As of August 2016, 21 of the 22 natural forest concessions in Indonesia originally certified by FSC remained certified, for a total area of 2,459,397 ha. The FMUs vary by location, permit duration, area, CABs, and other characteristics. Most FSC-certified FMUs were established before 1998, are vertically integrated with a timber industry, and export most of their products. Additionally, less than one-third of FSC certificate holders hired logging subcontractors (Ruslandi and Romero, 2015).

FMU's Characteristics

The multinomial logit regression model with the economic/legal meta-category used as the reference, as per Blackman et al. (2014), indicated that none of the included FMU characteristics was associated with the meta-categories of CARs issued (Table 2). In contrast, when the other issue meta-categories were used as the reference, FMU area and number of workers were consistently identified as being correlated with the types of CARs issued.

Table 2: Marginal effects of FMU characteristics on the meta-category on which CARs focused (the complete variables) determined by multinomial logit regression with the economic/legal meta-category used as reference [significant effects noted with asterisks; n=933].

FMU Characteristic	Environmental	Social	Forest management
Log of area	0.8381	0.1005	0.6064
Age (established before 1998)	0.1596	0.7233	0.6619
Number of workers	0.1525	0.2592	0.8670
Permit duration	0.0521	0.1640	0.3538
Vertical integration (integrated)	0.8653	0.1096	0.3463
Principal market destination (domestic)	0.5844	0.0691	0.4889
Subcontracted logging	0.6911	0.1559	0.6815

Discussion

Common problems in FSC-certified forests

CARs assigned to FMUs in natural forests in Indonesia revealed that social and environmental issues were common. Social issues predominated in the study in Mexico (Blackman et al. 2014) as well as in the global studies by Newsom and Hewitt (2005) and Spillsbury (2005). CARs related to environmental issues were reported by many other researchers (Halalisan et al., 2016; Lewis and Davies (2015) and Rusli and Nabilah, 2009).

Influence of FMU characteristics on CARs

When the economic/legal meta-category was used as the reference in a multinomial logit regression, as per Blackman et al. (2014), none of the seven measured FMU attributes affected the representation of CAR meta-categories in Indonesia whereas Mexican CARs varied with FMU size, type of tenure, and whether natural forests or plantations were managed (Blackman et al., 2013; 2014). When the other meta-categories were used as the reference in Indonesia, in contrast, both FMU area and number or workers emerged as important correlates.

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Controlling Chinese Privet (*Ligustrum sinenense*) on non-industrial private forest lands in the United States Mid-South?

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Keywords: *Chinese Privet, Ligustrum sinenense, invasive plant species, control measures*

Since colonial times in the United States, introduced plant species have had both positive and negative impacts on the American forest landscape. How they have been introduced, why, and where varies greatly, but there has been a growing concern over the past several decades about addressing those species that are considered "invasive" given their negative impact on forests and other natural environments. The number of measures for eradicating these species vary greatly as does their effectiveness. This research focuses on one specific species and simulates alternative control measures found in the literature for Chinese Privet (*Ligustrum sinense*). In comparing alternative control measures, metrics such as land expectation value and control effectiveness are used to evaluate their impact for controlling Chinese Privet across common forest conditions in the United States Mid-South. These forest conditions vary by species composition, density, and have different infestation levels. Every approach evaluated in this study is found to be viable but their cost and effectiveness vary and depend on specific stand conditions and application technology. These findings will aid non-industrial private forest landowners in helping them select the best approaches and reducing any potential financial loss. Although the analytical framework used in this study focuses on only one species, it is applicable to forest landowners with other species in different regions.

How to see the forest for the trees? Stakeholders' perceptions of sustainable forest management in Ukraine

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Keywords: *attitudinal analysis, sustainable forestry, stakeholder perceptions, professional behaviour, ecosystem services*

Introduction

The sustainable forest management (SFM) theory is based on the principles of sustainable development and is seen as a new paradigm for forest management which aims to enhance multiple benefits from forest for present and future generations. A Club of Rome member Walter Stahel puts it the following way: 'Societal wealth and well-being should be measured in stock instead of flow, in capital instead of sales. Growth then corresponds to a rise in the quality and quantity of all stocks – natural, cultural, human and manufactured. For example, SFM augments natural capital of forest; deforestation destroys it (von Weizsäcker and Wijkman, 2018, p. 141).

The UNCED (1992) conference, where the Non-Binding Forest Principles were agreed, served as a catalyst for change. The principle that "forest resources and forest lands should be sustainably managed to meet social, economic, ecological, cultural and spiritual human needs of present and future generations" has been influential. The SFM paradigm is now accepted at the level of international environmental and forest policies and is supported by the joint efforts towards SFM, which have been formally implemented throughout Europe.

During the past decade the Government of Ukraine has been actively working to protect and sustainably manage forests, and to reform forest management bodies and regulations. However, SFM is not yet achieved and the reforming process is ongoing (Soloviy et al, 2017). A consideration of attitudes of forestry sector stakeholders is therefore important in the context of implementing sustainability and developing strategic responses from the sector to address multiple demands of the changing and rapidly evolving global bioeconomy. Successful implementation of the SFM strategies and practices relies on the "professional behavior" of forest associated stakeholders at different levels, which largely depend on their attitudes and perceptions.

A lack of their understanding of the new paradigms of forestry transformation to address manifold societal needs, such as those incorporated within the SFM concept, is a real challenge. A consideration of stakeholder attitudes is important in the context of forestry transition to a democratic and decentralized system of forest governance.

The majority of studies carried out to date (e.g., Pregernig, 2001; Leiserowitz et al. 2006; Egan and Jones, 1993; Soloviy and Dushna, 2009; Nijnik et al., 2010) addressed the public or forest landowners' attitudes and motivations, and less existing values, attitudes and perceptions of forestry professionals, especially in Ukraine; (Nijnik et al., 2017) whilst these regulate professional behavior. According to Leiserowitz et al. 2006, behavior refers to concrete decisions and actions taken by individuals and groups, which are often rooted in underlying values and attitudes.

In this paper, based on our study conducted in Ukraine, we identify existing attitudes of forest related stakeholders towards SFM. We argue that an improved understanding of their attitudes and perceptions can assist in understanding "professional behavior" in regards to managing forest ecosystems in a sustainable way at local, regional and national levels.

Material and Method

To gain a better understanding of perceptions of forestry professionals and other stakeholders associated with implementation of SFM initiatives in forestry a survey was implemented in Lviv region of the Ukrainian Carpathians.

The survey was conducted using a representative sample of 735 respondents (70% men and 30% women), including 74% of respondents working in state forest enterprises, 10% – private sector representatives, 8% - representatives of private entrepreneurs specialized in harvesting, wood processing or non-wood forest products processing, 4% – temporary unemployed former foresters, 3% – forestry related NGO representatives, and 1 % – students of forestry universities or colleges. The survey used quota sampling to ensure that the se-

lected sample is representative for forest professionals in the region. Our face-to-face interviewed respondents were generally related to forestry and had forestry related education and backgrounds. They were asked about obstacles for implementing the SFM paradigm and of their attitudes towards the processes of reforming of the forestry sector in Ukraine.

We applied statistics/econometrics to analyze the data collected. Based on the results of the survey among forestry professionals and other forestry stakeholders in Lviv region of Ukraine we can sketch a generalized picture of the attitudes towards SFM implementation.

Results and Discussion

Overall, we identified a low level of awareness of the SFM ideas among respondents. Only 12.7 % gave the answer that they knew precisely what the term meant. The majority of respondents (63.5%) knew in general terms of the term, but 23.8 % of respondents never heard about it. The lack of knowledge is a serious obstacle for SFM paradigm implementation. About 57.3% of respondents considered an economic role of forests and 60.7% recognized their ecological role as the very important factors of regional development. A substantial part of respondents recognized the economic and ecological roles of forests as important (33.2% and 38.1% correspondingly), and the rest of respondents do not consider forests to be of importance for development of the region. 81% of respondents stressed the need for further reforms in the Ukrainian forestry sector, the rest of respondents were satisfied with the present state of forestry and the current model of its development. The high percent of respondents with positive attitudes towards the processes of reforming of the sector confirmed the availability of favorable preconditions for further reforms and expressed their potential support.

Those respondents, who stressed the need to reform the forestry sector, were keen to first of all reform the system of financing (334 mentions; 45% of respondents who answered), the system of governance (239; 33% of respondents), economic relations (149; 20% of respondents). About 13 % of respondents emphasized that at the moment there was a need to reform human resource policies (mentioned 96 times); 18% of respondents (132 mentions) denoted the expediency of regulatory and legal frameworks' reforming. Nearly half of forestry professionals participated in the survey (48%) were well-informed with the content of the Forest Act, but only 45% of "well-informed" respondents admitted that the Forest Act fully corresponded to the principles of sustainable forest management. The results presented in Fig. 1 indicate that forestry professionals heavily rely on state support and depend on stable and sufficient level of public financing.

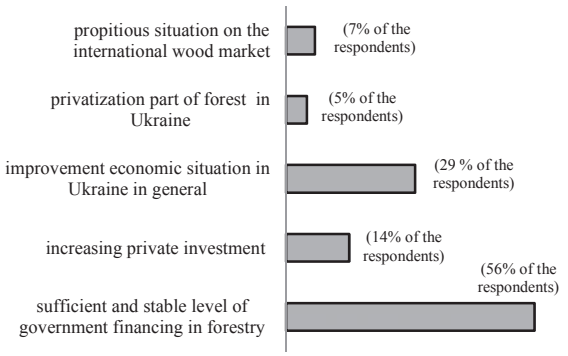

Figure 1: Illustration of the importance of economic factors for future development of forestry in the context of SFM.

According to the opinion of 29% of respondents, an improvement of the economic situation in Ukraine, in general, is a precondition for successful development of forestry. The only small part (5%) of respondents believe that privatization of forests is a determinant factor for such development. Forest certification is one of the most successful instruments of forest policy, but only 48.4% of respondents expressed positive attitudes towards forest certification, 45.9% –neutral attitudes, and 5.7% – were reluctant to certification.

Forestry professionals stressed the importance of the following measures to be implemented in course of the reforms: improvement of felling systems (38%, 173 mentions), improvement of tree-planting systems (38%, 281 mentions), improvement of the decision making in forest management (24%, 173 mentions), improvement of harvesting techniques (26%, 191 mentions), development of the network of forest roads (23%, 167 mentions), and improvement of nature protected areas (8.8 %, 65 mentions).

The results showed that positive attitudes towards implementation of the reforms in forestry are determined by cumulative influence (48.7%) of such factors as the level of knowledge about SFM, the level of knowledge about the Forest Act and general educational level.

The reality in Ukraine's forestry doesn't fully correspond to its high societal expectations. Illegal logging, corruption risks, not always sustainable management of ecosystem services, lack of transparency in the decision-making, economic consequences of the ban on round wood exports, and other observed phenomena have raised public concern, including of NGOs, mass-media and local communities (Soloviy et al, 2017; Melnykovych et al 2018).

The results of the study come along with the research results of Sarvašová and Dobšinská (2016). They show that while, in mountain regions of Slovakia, timber production remains the main ecosystem service, soil and biodiversity protection is considered there equally

important. This implies that provisioning and regulatory and supporting ecosystem services of forest should not be seen as alternatives in the implementation of SFM.

This study call us for the enrichment and diversification of policy instruments and towards the developing of coherent institutional frameworks and advancing, and broadening of informational instruments towards more efficient communication, social learning and building of trust among forestry professionals and the public, with a more active participation of relevant actors in the forestry policy-making processes. These measures, based on an improved understanding of stakeholders' attitudes and perceptions, would enable decision-makers to see the forest for the trees.

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The influence of financial leverage on company business

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Keywords: *financial leverage, effect of financial leverage, return on equity, return on asset, cost of debt*

Introduction

Company capital structure is most often referred to as a company's debt-to-equity ratio. In this sense, the key issues of capital structure can be transformed into the question of whether getting into debt influences the value of a company. Using a financial leverage is often used as a synonym for a company getting into debt, that is, financing a business with a high level of debt [Orsag, 2015; pg. 703]. An advantage of using a financial leverage is that funds borrowed at a fixed interest rate can be used for investments earning rates of return higher than the interest paid on the funds [Helfert, 1991; pg. 165]. Profitability ratios measure the profitability of the analyzed company. Profitability ratios are most often calculated as return on equity ratio and return on total assets ratio. The traditional method of calculating return on assets is determined through the net profit and total company asset ratio. It is a fairly imprecise approach in situations when the company, in addition to its own sources of financing, uses alternative methods of financing as well. The concept makes sense in situations when the company uses solely its own sources of financing as the indicator numerator in that case includes only profit available to investors of their own company capital. Therefore, indicators of net and gross return on assets are used when assessing the quality of using alternative methods of financing [Ježovita and Žager, 2014; pg. 4]. The effect of financial leverage (*EFL*) represent an achieved increase or decrease of return on equity while using alternative methods of financing. The effect of financial leverage is the product of financial leverage (*FL*) and the difference of the net return on assets (*NROA*) and the cost of borrowing capital (*CBC*). The negative indicator value represents the decrease of return on equity when using alternative methods of financing. On the other hand, the positive value of that indicator means the increase of return on equity when using alternative methods of financing. The greater the effect, the more significant the increase of return on equity [Ježovita and Žager, 2014; pg. 9 - 10].

Material and Method

Return on equity (*ROE*) puts net profit and own capital (equity) into ratio and shows how effectively a company's equity is used. Return on asset (*ROA*) puts gross profit and total assets into ratio, and shows how much profit a company achieves per unit of invested capital. If the rate of return on equity is greater than the rate of return on assets, the company should keep borrowing and using alternative methods of financing [Tipurić, 2009; pg. 155; Ravenšćak, 2011; pg. 81, 105].

Table 1: Profitability ratios

Indicator	Numerator	Denominator
ROA	gross profit	total asset
NROA	net profit + interest	total asset
ROE	net profit	own capital (equity)

Source: [Žager et al., 2008; pg. 253], [Dvorski and Kovšca, 2011; pg. 93].

Financial effect is calculated by using the following formula [Ježovita and Žager, 2014; pg. 10]:

$$EFL = (NROA - CBC) * FL$$

$$NROA = \frac{net\ profit + inerest}{total\ asset}$$

$$CBC = \frac{interest\ rate\ expenditure}{total\ liabilities\ (short\ term + long\ term}$$

$$FL = \frac{total\ liabilities\ (short\ term + long\ term}{equity}$$

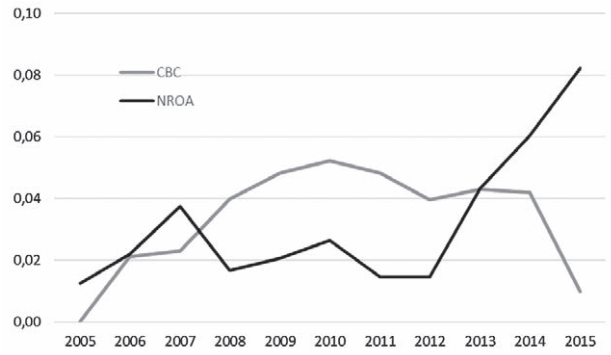
While determining the validity of using a FL and calculating EFL, public financial reports data and public annual business reports data of "Hrvatske šume" Ltd. co were used. The company manages most forests and forest land (2 mil. ha) owned by the Republic of Croatia. The company headquarters is in Zagreb. The subscribed capital is: 1.171.670.000.00 HRK. The analyzed data was for years 2005-2015.

The first part of the paper determines the justification of using a financial leverage (FL) in business by using

financial profitability ratios, and then EFL is calculated as a measure for increasing or decreasing the return on equity while using a financial leverage.

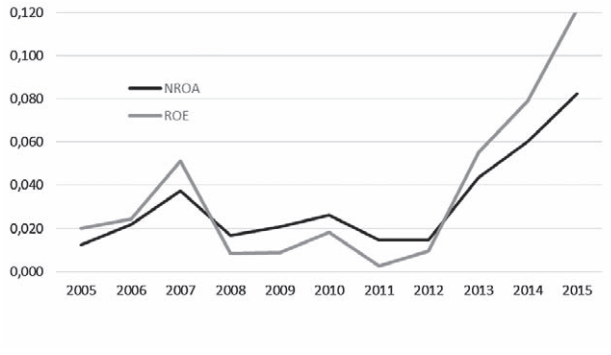
Results

Profitability ratios show whether a company should use a financial leverage, that is, if a company should borrow funds. If the rate of return on equity rate is higher than the rate of return on asset, it is worth using alternative methods of financing. In the analyzed period, ROE was higher than ROA, which leads to the conclusion that the Company was justified in using alternative methods of financing. *(Picture 1)*.



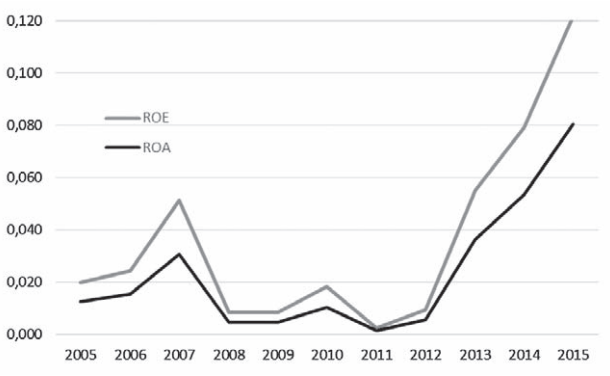
Picture 1: Ratio of ROE and ROA

EFL was negative in the time period from 2008 until 2012. In that period the difference between ROE and NROA was negative (*Picture 2)*, so, NROA was greater than ROE *(Picture 4)*. The situation of the negative effect of the EFL, that is, unfavorable debt, is reflected through the CBC, which is greater than NROA *(Picture 3)*.



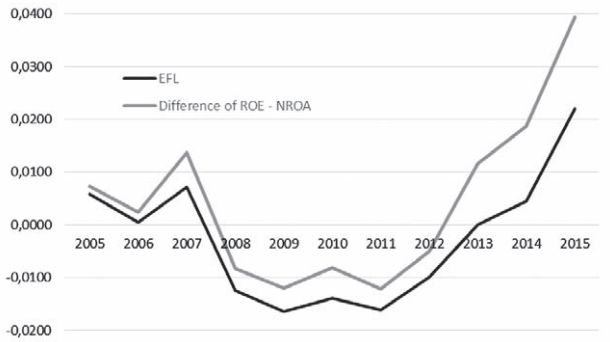
Picture 2: Ratio of EFL and the difference of ROE - NROA

In the mentioned period, the Company did not use the funds to create enough future economic benefits and the realized profit was reduced while using alternative methods of financing.



Picture 3: Ratio of CBC and NROA

On the other hand, EFL was positive in the two periods, from 2005 and 2007 and from 2013 and 2015. In those periods the difference between ROE and NROA was positive *(Picture 2, 4)*, and the CBC was smaller than NROA *(Picture 3)*. In the last year of the observed period, EFL significantly grew.



Picture 4: Ratio of ROE and NROA

Therefore, in case of positive effect of the EFL, alternative methods of financing are invested in assets that create positive economic benefits and are used effectively.

Discussion

The main idea of the rule lies in the fact that by relying on borrowing funds in order to finance a business and the operations of a company, owners can achieve greater effects for the company compared to those who would finance their whole company solely with their own equity. [Orsag, 2015; pg. 707]. The positive influence of the leverage can be seen in three important factors: *(i)* a greater share of alternative methods of financing reduces the share of a company's own equity and in line with an unchanged total return increases the return of equity, *(ii)* interest rates represent a fixed burden of financing so with higher level of business activity, their share in total costs is relativized, which then effects the

higher return on equity, *(iii)* interest rates represent a tax deduction in the business results so various tax cuts are possible for using alternative methods of financing [Dvorski and Kovšca, 2011; pg. 101]. In cases when there are no effects of a financial leverage, a greater part of income covers alternative methods of financing, that is interest rate expenses, the marginal part of profit remains with the equity owners, which means that the companies would achieve greater returns on equity without using alternative methods of financing and expenses they cause [Ježovita and Žager, 2014; pg. 8]. In the analyzed period, the return on equity (ROE) was greater than return on assets (ROA), so it is considered that a company should use alternative methods of financing. On the other hands, the effect of the financial leverage (*EFL)*, as a measure for increasing or decreasing return on equity while using alternative methods of financing was negative for the years 2008 to 2012 and the achieved profit was reduced due to using alternative methods of financing.

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Investments in small-scale forestry: Comparison between uneven- and even-aged stands in Croatia

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Keywords: *investment analysis, private capital, NPV, IRR*

Introduction

One of the main characteristics of forests as capital is having a long investment return period (Posavec, 2003, Beljan, 2015). Such an investment characteristic is not always acceptable from a private capital point of view. The internal rate of return (IRR) of state-owned forests in Croatia is within 2-3 % (Figurić, 1996), according to Partaš (1896) it is 3 %, according to Nenadić (1930) at least 1-2 %, Plavšić (1940) 2.5 % at most, Zelić (2006) 1.19 %, Beuk (2012) 1.9 %, Beljan (2015) 2.17 %. Therefore the expected rate of return ranges of 1-3 %. Investment in private forests implies the purchase of a forest property and its management. The aim of the research is to compare the economic effects of investing and managing two private forests of different characteristics. Economic advantages and disadvantages of investing in private uneven- and even-aged forests in Croatia were explored over the next 30 years.

Material and Method

Research area was divided in two parts. In Gorski Kotar region, private uneven-aged forest was analyzed (2,5 ha), while in wider Zagreb area, private even-aged forest was analyzed (3,0 ha). The two forests differ in quantitative and qualitative characteristics (Table 1.), whereas surfaces, although different, were presented on average 1 hectare.

Future management was simulated through MOSES 3.0 (Hasenauer et al., 2006), program package for simulation of growth and forest management. Management simulation for each private forest was done according to the rules of un-even aged and even-aged management. In un-even aged forest a cutting period is 5 years, and cut yield is determined according to Klepac (1953). In even-aged rotation period is 80 years, and cut yield is determined according to Matić (1989). More details on this segment can be found in Koren (2017), Posavec et al. (2017) and Gregur (2017). According to available market data, the assessed buying price of forest property of 0.13-0.54 EUR m^{-2} (1-4 HRK on March 3rd 2017) was used in this analysis. Forest property purchase costs occur once at the beginning of investment period. During the 30-year forest management period the forest owner realizes income from the sale of wood assortments (investor sells standing timber and does not have own machinery and workers). Cutting revenue was analyzed for each year using the Croatian Forests Ltd. price list. Investment analysis based on cash flow was made using the NPV- net present value (Klemperer, 2003) and IRR - internal rate of return (Damodaran, 2002). All elements of analysis were regarded in the 30-year time frame. During the analysis, a referent constant discount rate was used, which according to Beljan (2015) for Republic of Croatia forestry amounts to 2 %, although the possibility of applying 1-3 % rates was examined.

Table 1. Average initial assortment structure and financial value of forest stands

Timber assortments	Uneven-aged	Even-aged	Uneven-aged	Even-aged
	[m^3 ha^{-1}]		[EUR ha^{-1}]	
Veneer	2.42	49.11	239,69	6.988,94
Peeled veneer	3.02	40.93	168,94	1.811,37
Sawlog 1st	29.7	96.49	1.824,40	4.704,90
Sawlog 2nd	25.06	106.74	1.020,45	3.413,84
Sawlog 3rd	17.75	67.34	515,54	1.606,18
Thin roundwood	18.4	21.62	614,38	375,58
Long-meter firewood	18.27	36.28	318,24	531,50
One-meter firewood	101.36	192.76	1.544,67	2.115,27
Timber waste	132.58	97.36	1.634,91	1.024,60
Σ	348.56	708.63	7.881,20	22.572,19

Results

Cash flow comparison (Figure 1) is shown at the level of 1 average hectare. Dynamic of cash flow is direct result of simulated management plan. The cash flow from an uneven-aged private forest is more stable due to approximately constant cut of accumulated increment. However, even-aged forests have greater cash flow oscillations (Figure 1). Although the initial characteristic of even-aged forest is homogenous, the cash flow oscillations are the result of planned establishment of normal forest (normal balanced forest which is complex of stands with all ages, from 0 to 80 years). Even though on the surface of merely 3,0 ha is not possible to renew ideal normal forest, so in some time periods the investment profit is not expected (Figure 1).

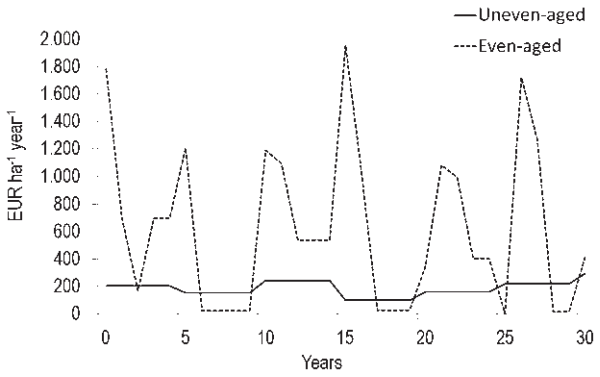

Figure 1. Cash flow

Using the basic economic analysis (Net Present Value), differences between investing in different forest stands were established (Table 2). From cash flow comparison (Figure 1) and qualitative characteristics of stands (Table 1.) it was shown that, as expected, even-aged stand is economically more favorable.

Table 2. Comparison of net present value with different forest property buying price and different discount rates

Investment cost [HRK m^{-2}]/[Eur m^{-2}]	UA*	EA**	UA	EA	UA	EA
	Discount rate					
	1 %		2 %		3 %	
1 / 0.13	3.530	15.182	2.908	13.212	2.402	11.593
2 / 0.27	2.183	13.834	1.561	11.864	1.054	10.245
3 / 0.40	835	12.486	213	10.516	-294	8.897
4 / 0.53	-513	9.791	-1.135	9.169	-1.641	6.202
5 / 0.67	-1.860	9.791	-2.482	7.821	-2.989	6.202
6 / 0.80	-3.208	8.443	-3.830	6.473	-4.336	4.854
7 / 0.94	-4.555	7.095	-5.177	5.125	-5.684	3.506

UA* uneven-aged, EA*even-aged

From the results of net present value (Table 2) and internal rate of return (Table 3), a decision can be made about higher or lower cost-effectiveness of investing in uneven-aged or even-aged stand.

Table 3. Internal rate of return

Investment cost [HRK m^{-2}]/ [Eur m^{-2}]	IRR	
	UA*	EA**
1 / 0.13	16.1	>100
2 / 0.27	6.0	60.3
3 / 0.40	2.3	23.9
4 / 0.53	0.3	14.9
5 / 0.67	<0,1	10.7
6 / 0.80	<0,1	8,01
7 / 0.94	<0,1	6,14

UA* uneven-aged, EA*even-aged

Although a wide range of potential buying prices of private forest was examined, IRR results can seem unrealistic (Table 3). It is important to emphasize that the price is defined by supply-demand relationship. For example, in this research in even-aged forest the IRR is 2,6 % with buying price of only 10 HRK m^{-2}/1,34 Eur m^{-2}.

Discussion

Initial differences of uneven-aged and even-aged stand are big and evident. Differences in growing stock are double, and in financial value triple (Table 1.). It can be assumed that buying price would be in that ratio (1:3 for even-aged forest). Stands of said characteristics attain average prices on actual local market of 2 HRK/0.27 Eur m^{-2} for uneven-aged and 6 HRK/0.80 Eur m^{-2} for even-aged stand. Realistic projection of economic cost-effectiveness and difference between investments should be made based on assumption that investment costs will have the aforementioned ratio. In Table 2, highlighted gray fields show which values to compare in order to obtain correct economic conclusion. With 1 % discount rate, NPV is higher at 3.8 (3.8=8.443/2.183), with 2 % the rate is 4.14, and with rate of 3 % it is 4.6 times bigger in favor of even-aged stand. It can be noted that investment in even-aged stand, which is three times more expensive, results in revenue bigger than the investment difference. In Croatia, investor can have influence on forest purchase price (through negotiations with seller), but has no or very small influence on market price of the produced product (logs, assortments) due to the fact that Government is defining prices. This is supported by the fact that it is not rare that state administrations regulate prices through their mechanisms (Leefers and Ghani, 2014, Beljan et al., 2017). Investment costs are the major factor that dictates the cost-effectiveness of investment. In other words, unrealistically large investment cost cannot be substituted by produced wood assortments. It is almost impossible to define realistic buying price that

mostly depends on the wood assortments market. IRR is under great influence of investment size, i.e. buying price, so the investor's ability to negotiate prices is crucial for all economic results. Along with the cash flow (Figure 1) that is the result of standing timber sales, other income sources can be considered: hunting, gathering of non-wood forest products, that can only have positive influence on financial projection of investment. Also, potential investors should consider the fact that in the Republic of Croatia there is a measure no. 8.5 currently in effect in form of *Subsidies for investment in improving the resilience and environmental value of forest ecosystems* (NN, 30/2015) which can be used by 2020 to finance works in private forest properties. It is clear from the literature that the expected IRR is within 1-3 %, but in this article as well as in practice there are cases of many times larger IRR.

Conclusions

Based on the conducted research, it is possible to conclude that in comparison of two studied stands, even-aged stand provides more favorable economic effects for the investor. The reason is that in this stand, more financially valuable wood assortments can be produced. This conclusion is not unique and universally applicable. It is valid in case when an investor is willing to invest a three times larger amount in order to obtain described economic advantages. Moreover, it should be emphasized that there are stands of various economic potentials present on the market that can generate higher or lower profit from the one shown here, as well as stands that have potential for larger income from non-wood forest products and services. However, current investment of capital into private forests in Croatia represents and investment with low risk premium and relatively high internal rate of return.

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Investment Appraisal in Forestry

Case study of poplar plantations in Serbia

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Keywords: *investments, appraisal, poplar, plantations, Serbia*

Introduction

Financial appraisals of forestry are based on standard investment appraisal techniques. In such an analysis we take in account the frequently long time period lapsing between initiating forest activity and obtaining returns from trees (Slee at al., 2004). Forestry schemes are generally characterised by heavy initial costs, low recurrent costs (an advantage which will tend to be discounted relative to initial costs) and delayed benefits (Livingstone and Tribe, 1995). Poplar rotation is one of the shortest in forestry, and production of poplar wood requires rational and well-planned management (Keča et al., 2011).

Material and Method

There are four main groups of values identified in forestry: forestry values derive from forest-related activity by forest managers and the upstream and downstream connections with other parts of the economy arising from such forestry activities; 'Shadow' values arise as a result of other economic activities benefiting or experiencing loss as a result of forestry; Non-market values are the external effects associated with forests and woodland; and social values (Thompson et al., 1997; Slee at al., 2004). While resource managers have been struggling with new (societal) views and values, forestry research has concentrated primarily on technical forestry or production-based forestry (Gillis, 1990).

This paper identifies a number of different kinds of investment decisions in which a long time horizon is involved and for which the application of the conventional, relatively high, discount rates used in less developed countries creates problems. The case study is related to poplar plantations in Serbia.

Critics of standard investment criteria based on discounting have argued that these introduce a bias in favour of investment projects which impose high private or social costs in the future, or after a long delay, but have lower capital costs now or in the near future (Livingstone and Tribe, 1995). Forestry projects of all kinds will be disfavoured relative to other types of projects of shorter term, because of the inherently long gestation period involved in tree growth (Snowdon and Harow, 2013).

The **aim** of the study was to conduct analysis of costs and receipts of artificial poplar plantations on different fluvisols considering a span of rotation between 25 and 42 years as well as in different discount rates (4-12%) (Keča et al., 2011). The **foci** of the article are: costs, receipts, different discount rates, etc. The primary methods used are dynamic methods of investment calculation (Gregersen and Contreras, 1979). These methods are: net present value - NPV, internal rate of return - IRR, pay back period - PBP, cost-benefit analysis - R.

The investigated plantations were established from *Populus* x *euramericana* cl. *I-214* in the north-western part of Serbia, with planting spacing 6 x 3 m (555 trees per ha), for technical wood production. Thirteen study plots id est 55 stands, aged 24-42 years, with a total area of 331.05 ha were assessed. The data collected is linked to different types of soil belonging to site classes I – V (Keča et al., 2011).

Results

The financial effects for sample plot plantations were estimated using different discount rates.

"For a discount rate r = 12%, all tested areas had a negative *NPV* of 11 088 to 23 676 €·ha^{-1}, regardless of age and site quality. The discount rate of 6% can be accepted by shorter production cycles in younger stands (to the age of 28 years) on better sites (alluvial semigley). *IRRs* varied in the range 4.32-6.94% (average 5.63%) at a discount rate of 12%. Internal rates were higher for plantations on good quality soil types and for shorter rotations and vice versa. The analysis showed that *PBP* is practically unacceptable for the investor under the discount rate of 6%. The most favourable situation is the discount rate of 2% in younger plantations. The average amount of *R* was 0.36 for all studied plots" (Table 1) (Keča et al., 2011, 2012).

The results clearly show an inverse relationship between the IRR and plantation age, and also a direct propor-

Table 1: Dynamic method of investment appraisal on poplar plantation sample plots.

Study plot no.	Soil Type	Site Class	Age	Area	NPV	IRR	PBP for p=4%	R
			years	ha	(€·ha^{-1})	%	years	
1.	RC/HGL	IV	24	25.00	–1 743.02	5.20	19	0.421
2.	AS/ASG	I	26	36.75	–1 838.60	6.94	19	0.349
3.	AS/ASG	I	26	2.33	–1 700.41	5.83	19	0.467
4.	AS/ASG	I	26	9.87	-1 585.84	6.18	19	0.407
5.	AS/ASG	I	26	1.32	–1 746.22	6.12	19	0.430
6.	AS/ASG	I	28	32.57	–1 813.10	5.41	19	0.373
7.	AS/ASG	I	29	28.82	–1 872.78	5.84	19	0.351
8.	LC/HFL	III	29	33.81	–1 877.35	4.32	19	0.388
9.	LC/HFL	III	29	51.49	–1 791.41	5.36	19	0.390
10.	LC/HFL	III	31	58.15	–1 940.66	5.35	19	0.323
11.	ASG	I	37	5.80	–1 999.57	6.10	19	0.310
12.	ASG	I	42	6.62	-2 161.99	5.51	19	0.240
13.	α / β-β gley	V	42	38.52	–2 134.80	4.43	19	0.242
Total/ Average				331.05				0.36

RC-fossil hydromorphic black soil (humosemigley) on loess-alluvium, HGL–humogley, AS ASG–alluvial semigley, LC–fossil hydromorphic black soil on loess-alluvium, HFL–humofluvisoil, α / β-β gley

tion with the soil type id est IRR are higher for plantations grown on stands suitable for poplar production (alluvial semigley) and for shorter rotations and vice versa (Keča et al., 2012).

Discussion

Investments can be directed in cost reduction for: soil preparation (stump chipping, deep ploughing, etc.), improvement of inter-row tilling, better plant protection against insect pests and phyto-pathogenic fungi (Keča, 2008).

While delays in start-up or, more generally, progressive or phased implementation, will reduce the value of the NPV/IRR (net present value / internal rate of return) by delaying returns and increasing costs, under standard discounting techniques (Livingstone and Tribe, 1995).

This paper shows that hybrid poplar plantations can be profitable if financed at interest rates in the range 4-7% (Keča et al., 2012).

Estimated financial rotation length of 17 years supports the conclusion that the prescribed rotation of 25 years should be shortened (Keča, 2017) in Serbia and investment calculation will show more acceptable results for potential investors.

The paper has examined the investments in poplar plantations in Serbia and has shown that age of stands, soil types and discount rates are important in the development of innovative ways of agroforestry.

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Barriers for entrepreneurship and innovation in non-wood forest sector:

Three-I's as precondition in non-wood forest sector in Macedonia

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Keywords: *entrepreneurship, innovation, NWFPs, Macedonia*

Introduction

The Macedonian forests are characterized by their extremely high species richness. The wealth in terms of biodiversity is mirrored in the abundance of Non-Wood Forest Products (NWFPs) collected from the forests by local (rural) population. The most utilized NWFPs in Macedonia are mushrooms, medicinal herbs, berries and honey which stand out as of particular importance - both in terms of subsistence value and potential for generating cash income in rural areas. The forest area in Macedonia is about 905.650 ha, and the forestry still traditionally oriented, focusing mainly on timber (Stojanovska et al. 2014).

In the region of South Eastern Europe (SEE) exists positive examples where trading with NWFPs can significantly contribute to rural communities and rural household economies (Zivojinovic et al. 2017). The marketable NWFPs (mushrooms, berries) can provide an important means for economic growth and sustainable forest management in local communities, unfortunately very little is known about NWFP collection, utilization, entrepreneurship and marketing of NWFPs in Macedonia despite the great potential they can have in order to positively affect communities and households.

Living in the dynamic world it is obvious that there is increasing pressure on forests to produce more therefore the national Macedonian economy to economically benefit from natural resources. In Macedonia there is missing knowledge regarding NWFPs due to lack of research and therefore it is starting point for this paper..

Material and Method

The paper analyzes the small and medium enterprises (SMEs) in NWFP sector in Macedonia. The main focus of the paper is to allocate what are hampering factors for entrepreneurship and innovation in NWFP sector. The methodology of this paper relies mainly on qualitative data collected by interviews with the mangers of 36 small and medium enterprises active in the NWFP sector in Macedonia and content analysis of main policy documents important for NWFP sector. The interviews are consisting of semi-structured questionnaire with open questions. The questions addressing issues regarding the history development of the enterprise, challenges, innovative activities, utilization of credit lines, subvention, implementation of innovation, relevant policies etc. The paper combines a deductive and an inductive approach. The innovation system theory was used as theoretical framework. The main goals of the paper are integration of innovations in NWFP sector and identification of the barriers for entrepreneurship and innovation.

Results

The content analysis of the main policy documents have shown that the jurisdiction over the NWFPs is spread between two ministries: The Ministry of Agriculture, Forestry and Water Economy (MAFWE) and the Ministry of Environment and Spatial Planning (MoESP). The results show overlapping in the jurisdiction between two ministries.. The both ministries obliged small and medium enterprises with separate permissions and licenses (for collection, for exporting etc.) which are timely and money consuming. According to the data the managers need few days (2-5days) for collection of the documents, regarding the payments 15euros per pickers/annually and fixed amount per kg for exporting and for the exporting license. Therefore they have negative impact on the price (increasing-higher prices) and quality (decreasing/low quality) of the products.

The analysis regarding the history development and reason for starting the business indicate that many of them (69,5%) were included in previous value chain system of NWFP as previous employees in Agricultural Industrial Combine[1], 22,2% inherited the companies from their

[1] In ex-Yugoslavia Agricultural Industrial Combines were clusters for agriculture (Земјоделски Индустриски Комбинати)

parents and 8,3% started the business as recognized possibility. For better understanding of the current situation it is necessary to explain the content of the NWFPs value chain. The value chain of the NWFP in Macedonia is consisted of four parts: 1. Pickers, 2. Buyers/traders, 3. Processors, 4. Exporters (Nedanovska 2012). The paper find out examples where the value chain is consisted of two or three parts where "bigger" small and medium enterprises had own picker lists and they appear as buyers, processors and exporters.

Regarding the challenges the managers has stated that NWFP as wild growing species are very dependent on the weather conditions and the process of picking are very important factors for NWFPs. For those purposes adequate training is needed and necessary equipment is required. The bigger and more serious companies had offered training courses for their pickers. The results indicate that 60% of the companies had mature equipment and mechanization.

Discussion

95% of the managers had mentioned the **Institutions, Information and Irregularity**[2] as major problem (barrier) for entrepreneurship and innovation in NWFP sector.

Institutions - inadequate legal framework overlapping and gaps reason for complex and time consuming procedure which is spread within two Ministries.

Information - improvement of the informational instruments regarding provision of financial instruments that can be used for replacing the old equipment with the new. The efficiency of the sector is also very depends on this issue.

Irregularity - unfair, unregistered competition. The companies are complaining that in position two of the value chain (2. Buyers/traders) appear physical persons that abuse their professional background (police officer, veterinary doctor, teacher, doctor). They use the power of their professional background and the image they have among rural population for buying large amount of NWFPs. Later they offer to market small and medium enterprises for higher prices. This is influence non-competiveness of the Macedonian companies on international market.

By solving the Three-I's (3-I's) challenges the possibilities for the innovation in NWFP sector in Macedonia will increased. Similar to Nedeljkovic et al. (2013) there is a need of one comprehensive policy for NWFPs

[2] Three I's – Institutions, Information and Irregularity

Conclusions

Based on the conducted research (interviews and content analysis) can be concluded that 3-I's are hampering factor for entrepreneurship and innovation in NWFPs in Macedonia. Jurisdiction for NWFP is relying between two Ministries and there is need for harmonization of the policies. The managers of the small and medium enterprises are willing to invest in improvement of the equipment but in reality the information regarding possible grants, schemes and credit lines are missing. The bureaucratic procedure of IPARD program is lacking policy brief for informing and helping entrepreneurs to apply for it.

The government authorities should also help companies against irregularity. Solving these issues is of mutual interest for both sides – to be competitive on the international market and increasing the local (rural) economies.

However by solving the 3-I challenges the possibilities for the entrepreneurship and innovation in NWFP sector in Macedonia will increased.

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Actual and potential value of black locust (*Robinia pseudoacacia L.*) forests in small-scale private forests in Croatia

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Keywords: *small-scale forestry, black locust, growing stock, wood biomass, non-wood forest products, forest ownership*

Introduction

In the last 15-year period private forests are most dynamic part of Croatian forestry (Paladinić et al. 2008). Due to restitution of seizd property and afforestation of abandoned agriculture land proportion of private forests has increased up to 620,000 ha or 24 % (Berta et al 2017), which presents valuable but insufficiently used natural resource. By establishing of public forest service for private forest in 2006 and preparation of forest management plans an activation of forest management in small-scale private forests was initiated. However, due to depopulation of rural area inhabitants, unfavourable age structure and low education of forest owners as well as unregulated land register, processes of the forest management activation are too slow. On the other side, conditions and structures of private forests are relatively well explored. The first comprehensive inventory of the private forests was conducted in 2006 within preparation of General forest management plan on state level. Also, in period 2006-2009 the first national forest inventory was conducted which provided detail information of forest resources including cut (Čavlović 2010). Forests in Croatia are mainly natural, where of non-native species black locust (*Robinia pseudoaccacia* L.) is most widely present. Generally, privately owned forests are characterised with high level of biodiversity (Schaich and Plieninger 2013). Black locust as fast growing and pioneer species of widely usable wood is mostly spread in small-scale private forests, where it has a significant role. Therefore, based on data of the first national forest inventory (NFI) the aim of this paper is to analyse and present potential and importance of black locust in Croatian private forests for production and supply of forest products.

Material and Method

The black locust is native species in eastern states of USA, which introduced in Europe in 1601 (Sitzia et al. 2016). In 18th and 19th centuries the species outspread in entire Europe and also in Croatia. At beginning of 20th century value of black locust has been recognized in forestry, resulting with species plantation even on sites of mixed oak, beech and hornbeam forests (Grünwald, J., 1915.). Large areas of black locust forests exists in Hungary (400,000 ha), Romania (250,000 ha), Italy (230,000 ha) and France (200,000 ha). Very fast growth is enabled with ability of nitrogen uptake from air. Vegetative regeneration is very intensive, as well as spread by seed is common.

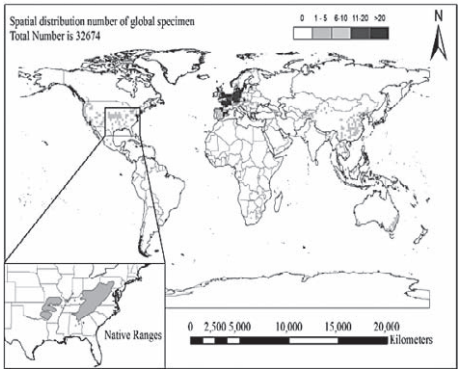

Figure 1: Black locust distribution on the World (Guoqing Li et al. 2014)

Black locust is exceptionally "honey-bearing" and decorative tree of valuable wood, and due to fast growth and simple regeneration it has a significant share in biomass production and cut in private forests. The NFI (field sample of 6,232 concentric circular plots of radii up to 20 m) provides data of growing stock, dead wood, health status, stand regeneration and cut according to tree species and units of administrative, ecological and management dividing of forests. Relative area of several tree species has derived from relation between basal area of sampled trees of several tree species and basal area of all sampled trees, and forest area within defined spatial unit. The obtained relative area of black locust used for analyses of cut intensity potential biomass production, and also for potential honey production in private forests. Data of honey-bearing per ha is used according to Farkas and Zajacz (2007).

Number of bee societies was taken from apiary register in Republic of Croatia. Data base ANFORRES of the NFI (Čavlović 2010) provided data of areas, growing stock, and cut in private forests according to tree species and several regions. Based on data of nectar production and honey price the value of non-wood products has been calculated. Based on volume cut, assortments structures and relevant wood products price-list the value of used (cut) black locust biomass has been calculated. Obtained variables were used for analyses.

Result

Naturalness and richness of tree species, especially native tree species are characteristics of private forests and generally forests in Croatia (Figure 2). Except European beech, hornbeam and more oak species, black locust with rate of 10.2 % present significant resource in private forests.

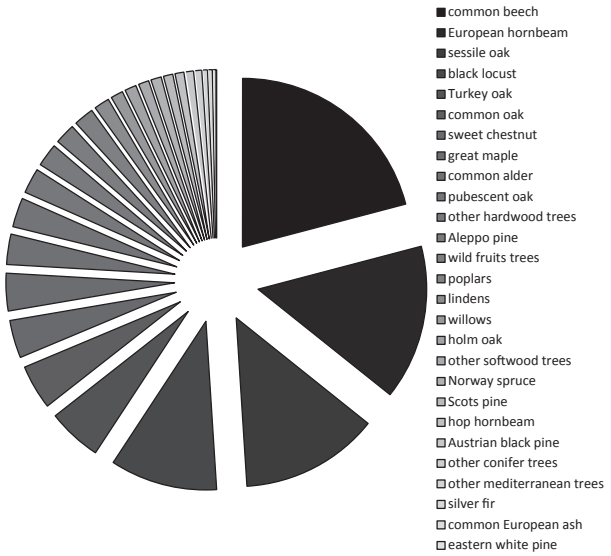

Figure 2: Distribution of growing stock by tree species in private forests

Black locust is distributed within almost all regions in Croatia (Table 1). There is total of 24.5 thousands hectares of private black locust forests in relation of 11 thousands hectares of state owned black locust forests. Considering total growing stock (13.1 mil. m^3) black locust forests are most presented in county Sisak-Moslavina and counties of North and Central Croatia, while regarding its ecological characteristics it is absent in Dalmatian counties (Figure 3).

With growing stock share of 2.5 % on national level (same as Norway spruce), black locust is important for private forestry because it is mostly distributed on northwest and central regions of Croatia (rate of growing stock above 30 %) where there is highest rate of

Figure 3: Distribution of growing stock of black locust by counties

Table 1: Area and growing stock of the private black locust forests and its potential of wood and non-wood production

regions		SL	GP_BG	ZA_ME	ZG	SI
a	1000 ha	34,2	29,4	58,6	39,2	63,5
b	ha	2488,4	4999,2	3882,7	1172,2	6887,2
c	1000 m3	5129,7	6077,3	17598,3	8961,9	14136,1
d	1000 m3	512,1	1308,6	1972,0	1519,8	1650,5
e	1000 m3	172,1	170,0	252,2	109,2	88,7
f	1000 m3	125,4	114,0	15,7	10,1	0,0
g	1000 kn	43872,6	44465,1	7698,0	3539,8	0,0
h	1000 m3	15,4	39,3	59,2	45,6	49,5
k	1000 kn	5376,8	15310,5	28988,1	15957,7	19806,1
l	1000 kn	62211,2	124979,8	97068,0	29304,2	172179,0
m	1000 kn	67588,1	140290,3	126056,0	45261,9	191985,1
regions		KA	GK_KV	IS	LI_SD	DL
a	1000 ha	75,5	56,7	48,5	31,7	89,7
b	ha	2566,2	561,8	1905,4	49,4	0,0
c	1000 m3	15597,9	6263,5	4074,6	1621,9	2869,8
d	1000 m3	749,2	136,7	359,1	3,8	0,0
e	1000 m3	130,6	23,5	66,8	21,9	8,8
f	1000 m3	3,17184	0,45392	7,47362	0	0
g	1000 kn	1046,7	190,6	3736,8	0,0	0,0
h	1000 m3	22,5	4,1	10,8	0,1	0,0
k	1000 kn	7416,7	1723,0	5386,8	47,9	0,0
l	1000 kn	64153,8	14044,6	47635,6	1235,8	0,0
m	1000 kn	71570,5	15767,5	53022,4	1283,6	0,0

Regions: Sl-Slavonija, GP_BG-Gornja Podravina, Bilogora, ZA-ME-Zagorje and Medimurje, ZG-Zagrebacka, SI-Sisacka, KA-Karlovacka, GK_KV-Gorski kotar and Kvarner, IS-Istra, LI_SD-Lika and Sjeverna Dalmacija, DL-Dalmacija, a-area of private forests (PŠ), b-area of private black locust (BL) forests, c-total growing stock in private forests, d-growing stock of BL in private forests, e-total volume cut in private forests, f-volume cut of BL in private forests, g-value of BL volume cut, h-potential average annual BL volume cut, k-value of potential average annual BL volume cut, l-value of potential production of honey, m-total value of potential production of wood and non-wood products in private BL forests

private forests (i.e. Zagorje, Medimurje, Bilogora, Banovina). According to NFI data volume cut is just highest in this regions (Table 1). This is a consequence of high rate of mature black locust stands in the regions and related needs for stand regeneration.

On the other side, low cutting intensity is present in regions of Banovina and Kordun where large black locust forests areas of almost 10,000 ha exists. Possible causes of low cutting intensity are depopulation during nineties (war), and age class structure of black locust forests originated by afforestation of abandoned agriculture land which are too immature to cut. Due to fact that NFI cutting data relate on period 2004-2009 changes to increasing cut intensity during last 10 years can be assumed. Potential annual cut of 250,000 m^3 (Table 1) based on area and annual increment of black locust forests would ensure sustainable management and optimal nectar production needed for apiculture in Croatia. According to beehive register there are in Republic of Croatia 450,000 bee societies from which 250,000 are productive. Annual production of honey amounted of 9,000 T with rate of black locust honey above 50 %. Potential honey production per ha in black locust forest is between 500 and 1,000 kg depending on site, climate and stand age (Farkas and Zajacz 2007). Consequently, overall value of black locust honey production amounts around 600 millions kn, while value of produced black locust wood amounts around 100 millions kn. Considering regions, this is especially important for continental region of Croatia where black locust forests have traditionally high importance for private forestry. Potential average annual forest production of 700 millions kn (Table 1) indicates a high value, however there is fact that the amount is based on very acquiring estimation of nectar production. If assumed value of produced black locust honey of 450 millions kn (except produced honey there is needed additional honey for functioning and development of bee societies), more realistic value of private black locust forest production is amounted for 550 millions kn would obtained.

Discussion

Recently, private forest management has been characterised with small and scattered forest property and absence of clear forest management model (Gluck et al. 2010). With introducing of multi-aged management system, associations of forest owners, establishment of public forest service for private forests and restitution of seized property, private forest management has initiated. Increase of demand and price of wood and allowance of clear cut on areas which are not forest according to land register caused increase of volume cut in large part of private forests including also private black locust forests. Black locust forests according to area and growing stock compose 10 % of private forests, and regarding its resistance, simple regeneration and usage value of wood present important forest resource. Although black locust is everywhere presented it is not equally distributed within regions in Croatia. Black locust is especially importante for the continental region, and in these regions, private forestry is the most prominent. There is yet higher importance of private black locust forests for Croatian apiculture relatively production of bee products. In Croatia annual production of honey amounted of 9,000 T with rate of black locust honey above 50 %. Overall value of black locust honey produced annually was estimated on 450,000 kn. The amount is multiple larger than black locust wood value of annual volume cut (100,000 kn). Therefore, establishment and maintenance of balance and sustainable management of private forests including black locust forests has a high importance. This includes also establishment of balanced age class distribution due to facts that grown trees better produce nectar and balanced age-class distribution ensure overall forest stability.

Besides black locust exceptionally as useful species it is also invasive tree species, which spreads very fast and threatens native species, and it is very hard to control it (Horvat and Franjić 2017). Thus, black locust forest management should be professionally based and in accordance with forest management plans, aimed to avoid undesired consequences and to achieve whole potential of the forests.

Acknowledgments

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Sale of forest assortments in the case of Forest Estates of „Južni Kučaj“ Despotovac

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Keywords: *Timber assortments, Sale, Forest Estates, SWOT*

Introduction

The volume of production and sale of timber assortments and their qualitative structure is conditioned by the condition of forests, the degree of forest openness, forest roads, the situation on the wood market, demand for certain types of wood and assortments, available of production capacities (Ranković and Keča, 2011). The plan for the sale of wood assortments is made on the basis of planned production (by types of wood, by sorting structure, by place of sale, by mode of sale). Forest assortments can be sold in two ways “on the stump” and in the form of timber assortments (Ranković and Keča, 2011). The amount of sales for wood is affected by two factors: price of wood according to its quality and amount of wood (Sládek and Neruda, 2007; Hood, 2014). On the other hand, stumpage prices of standing timber sales are affected by the market situation and harvesting costs (Kolis et al., 2014) and many other factos (Huang and Buongiorno, 1986; Niquidet and van Kooten 2006; Sydor and Mendell 2008). In Serbia there is the influence of the state on price formation of these products. Sale of wood on the stump have is mainly associated with less valuable assortments and has a local character (Yin 2002, Keča et al., 2017).

Material and Method

The methods used in the article were: comparative method, method of analysis and synthesis and description method in combination with other methods. In order to obtain the primary data, the questionnaire for the Forest Estate (FE) “Južni Kučaj” Despotovac was used. The following data was collected by the questionnaire: total sales by type, assortment structure and place of sale, total demand - customer requests for a public call for contracting the sale according to the price list; bidding for beech logs for year 2016; conclusions for the sale of wood assortments by customers and type of products are concluded; instructions, procedures and patterns that accompany contracting. SWOT analysis was used to assess internal strengths and weaknesses as well as external chances and threats (Kotler and Lane, 2009) in the trade of timber assortments.

Results

Based on the SWOT analysis, internal strengths and weaknesses, as well as external chances and threats within FE were identified:

Table 1: SWOT analysis

STRENGTHS	**WEAKNESSES**
favorable geographical position of the FE in relation to competitors and processing capacities	seasonal character of production and sales
accessibility of the raw material - good openness of the forest	low possibility of adjusting product range to market requirements
high demand for beech assortments that account for 92% of total production	age of existing forest and construction machinery
long presence in the wood market and established good business relations with customers	lack of production in its own and production labor (cutters, machinery operators)
negligible number of complaints	spatial distance of organizational parts of FE
financial stability in the business that provides timely payment of employees working on the production of wood	introduction of corporate governance and planning
OPPORTUNITIES	**THREATS**
non - wood forest products	natural disasters and climate change (floods, snow breakage, drying of forests)
procurement of new equipment	illegal logging in state forests - forestry
securing and hiring their own production workforce	illegal wood traffic from private forests, unfair competition and gray economy
restructuring of public enterprise, strengthening of corporate governance and business control	influence of the state on the formation of the price of the products
interest of local self-government for the development of forestry	changes in business conditions (VAT rate, local taxes, etc.)
possibility of export under conditions of insufficient domestic demand	reduction of state subsidies for capital projects

The most significant **strengths** are: the offer of certified products, the accessibility of the raw material and the good geographical position of the FE; the most signifi-

cant **weaknesses** are the seasonal character of production and sales, the age of forest and construction machinery, and the small possibility of adjusting the product range to market requirements; the most significant **opportunities** of purchasing new equipment, recruitment of production labor and increasing of qualitative structure of technical rounding by better tailoring and classification; the most significant **threats** to natural disasters, illegal wood traffic and changes in business conditions (see Tab 1).

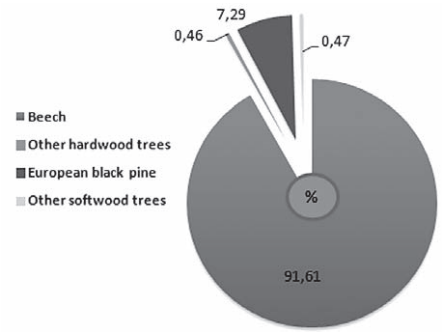

Figure 1: Participation of the type of wood in the realized sale of FE in 2016

The biggest share is beech with 91.61%, black pine with 7.29% and the share of other types of wood is negligible (Fig. 1).

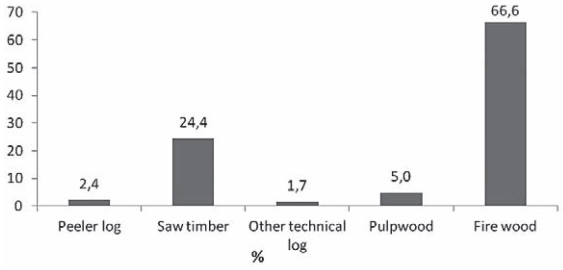

Figure 2: Participation of wood assortments in the sale of FE in 2016

In the sale of wood assortments, fire wood participates with 67% and saw timber with 24%. Beech logs account for 86%. As far as cord wood is concerned, about 80% is sold for the production of pellets, wood boards and others. The other amount sold is like a fire wood for the local population (Fig. 2).

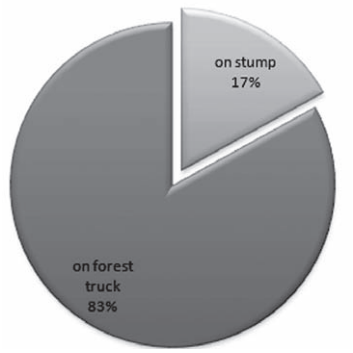

Figure 3: Participation of wood assortments in the sale of FE in 2016

Of the total sales of wood assortments FE in 2016, 83% were made on a truck road, while the rest was sold "on stump" (Fig. 3).

Discussion

The paper has examined the models of sale "on the stump" and in the form of timber assortments. In the sale of wood assortments, PE uses three methods: sales through contracting for successive delivery, bidding and retailing. In Serbia during the period 2002 - 2004, the number of auctions increases annually, but after 2005 the number of auctions fell drastically and contract became the dominant timber - sale method (Glavonjić and Vlosky, 2008). Sale of timber assortments is done on the basis of concluded sales contracts based on a uniform price policy and sale conditions. Market value is function of the characteristic of the timber and market conditions (Huang and Buongorno 1986).

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Socio-ecological and economic insights on forest management scenarios: case of Slovenia

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Keywords: *forest management scenarios, socio-ecological services from forests, public perception, surveys, multiple criteria hierarchical problem, multivariate analysis, group AHP*

Introduction

Due to rapid social, climatic, environmental, technological and other changes the demand on forest ecosystem services has increased; and hence, there is a strong need to develop an adapted (optimal) decision making process for forest management (EC, 2012, EC 2013). This decision process requires enhancing the resilience of forests for developing forest functions and supplying ecosystem services on which human well-being depends (Szedlak, 2017). Subsequently, forest management is shifting from timber production towards a more far-reaching, multifunctional management with an emphasis on social and ecological objectives (Martin-Lopez et al., 2014). Further, sustainable and multifunctional developments which must be applied to forest systems reveal different forest management scenarios. We are faced with a decision process in which the scenarios have to be determined, evaluated and finally ranked according to the goals and preferences of the end-users (Belton and Stewart, 2002). Incorporating local actors' (residents, visitors, etc., i.e., representatives of various groups who benefit or loose from the scenario undertaken) in the decision process is one of the most important goals when measuring social and ecological consequences of the implemented scenarios (Ananda, 2007).

While this issue has been frequently addressed, the majority of work has focused on experts determining scenarios on the basis of growth and yield, forest stand types, and other natural and technical issues, and on assessing ecosystem services in dependence of indicators in a multiple criteria context (Fontana et al., 2013, Segura et al., 2015). Relatively few studies have been conducted that integrate the public in the forest management decision process. We address this gap by including local actors in identifying the feasible forest management scenarios using brainstorming methods, surveys and multivariate statistical analysis, and also in assessing these scenarios where statistical and multi-criteria analysis are employed. Finally, the presented methodology is illustrated by the management of an urban forest in Slovenia (specific case study area) where three possible scenarios were generated and evaluated.

Material and Methods

To determine and assess the forest management scenarios from the economic, and above all, socio-ecological point of view the following steps were undertaken:

- the study area was depicted in detail using data from the literature, owners and different experts; special attention was devoted to land-use, determination of indicators and objectives;
- potential experts (actors) were identified and recruited through professional networks;
- a comprehensive list of possible activities in the study area was revealed by actors;
- actors used so called "soft" methods (Nutt, 2001), like brainstorming, CATWOE (customers, actors, transformation, worldview, owners, environ.), CAUSE (root cause analysis), post-it sessions, diagrams, decision trees, Delphi method (Novakowski and Wellar, 2008) and others, to create a questionnaire for activities in the study area; the questionnaire was then used to survey the actors;
- the survey results were analyzed using hierarchical clustering; each cluster group was interpreted as a scenario;
- to assess the scenarios, the objectives and criteria were determined and presented in a hierarchical structure (Fig. 1)
- the survey including questions about respondents' opinion (preference) on indicators and objectives (Likert scale), and comparisons between them (Saaty's scale, (Saaty and Vargas, 2001)) was constructed (Marsden and Wright, 2010); respondents were identified ("snowballing" process) and surveys were conducted;

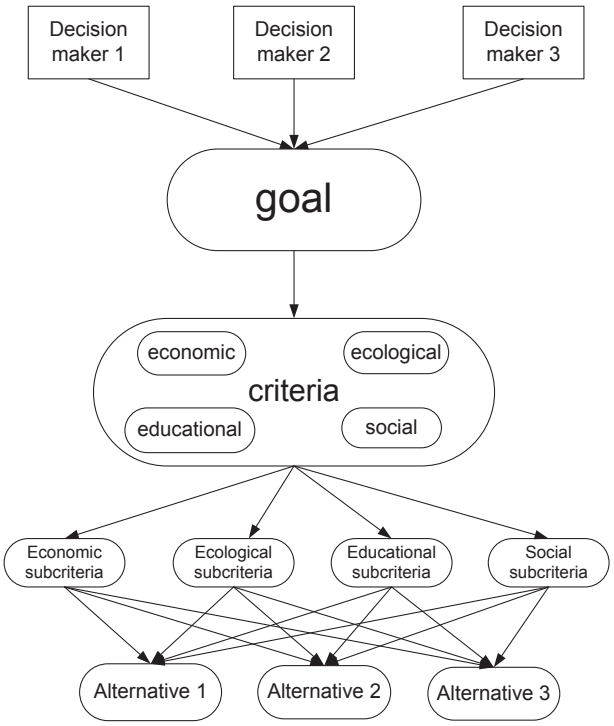

Figure 1: Hierarchical structure of scenarios (alternatives), and criteria (objectives) and sub-criteria (indicators)

- the results of surveys were analysed using statistical methods (descriptive statistics and factor analysis) and group analytic hierarchy process (Saaty and Peniwati, 2008).

Results

The methodology is illustrated on an urban forest in Slovenia for simplicity and with the aim as serving only for illustration. The forest is state owned and located in the vicinity of Nova Gorica, at the Slovene-Italian boarder. The compositional variety of species is very large (102 tree species – oak, pine, beech, ash are the main species, 869 fungi species, 7 game species, etc.). The area is used for timber, recreation, hunting, it is important for fresh water, air, health features, is part of Natura 2000, the built learning trail is used for education; sustainable and close-to nature management is performed (more details in Zadnik Stirn, 2004).

Nine actors were selected on the basis of selective sampling (forester, farmer, politician, manager, NGOs and local community representative, environmentalist, researcher, representative from the field of education). These actors generated 35 activities, assigned as P1, …, P35, (for example: a new 3 km trail should be constructed), and created 15 questions (assigned as I1Q1,…, I1Q15; for example: will solving the given problem have a positive influence on environment, education, will increase the employment, ….) to support these 35 activities The average results of all nine actors are gathered in Fig. 2.

	I1Q1	I1Q2	I1Q3	I1Q4	I1Q5	I1Q6	I1Q7	I1Q8	I1Q9	I1Q10	I1Q11	I1Q12	I1Q13	I1Q14	I1Q15
P1	3	4	4	3	3	5	4	2	2	5	4	4	2	3	4
P2	2	3	4	4	5	3	4	5	5	4	4	4	4	4	5
P3	2	3	4	3	4	4	4	4	4	4	4	4	3	2	4
P4	3	3	3	2	3	5	4	2	2	4	4	5	2	4	3
P5	4	3	3	3	4	5	4	2	2	5	4	5	2	4	3
P6	3	3	3	2	2	4	5	1	1	4	4	5	1	4	2
P7	4	4	4	4	4	5	4	2	2	5	5	5	2	5	3
P8	3	3	4	3	3	4	5	2	2	4	4	5	3	4	4
P9	3	3	2	2	2	5	4	1	1	4	4	5	1	3	4
P10	4	3	4	2	3	3	5	3	3	2	2	2	3	2	2
P11	4	3	4	3	4	3	2	4	4	2	2	2	3	2	4
P12	4	4	3	4	3	4	4	2	2	4	4	5	2	3	3
P13	4	4	3	4	3	4	4	2	2	4	4	5	2	3	3
P14	4	3	2	3	2	2	5	3	3	2	3	4	2	2	4
P15	3	4	3	4	4	4	4	3	3	5	5	4	2	4	3
P16	2	3	2	2	2	2	4	2	2	3	3	4	2	2	2
P17	3	3	4	3	4	2	3	4	4	4	3	3	3	3	4
P18	2	2	4	4	5	2	3	4	4	4	3	3	3	3	4
P19	3	4	4	5	5	2	3	5	5	4	3	3	4	4	4
P20	3	2	4	5	5	3	3	4	4	4	3	4	3	4	4
P21	2	4	4	5	5	3	2	5	5	3	4	3	3	3	4
P22	3	2	3	4	4	2	2	4	4	2	2	2	3	3	4
P23	2	4	4	4	5	4	2	3	3	4	4	4	2	4	4
P24	2	3	3	4	5	2	3	5	5	2	2	2	3	3	4
P25	2	4	4	5	5	2	2	5	5	2	2	3	4	3	4
P26	3	3	4	4	4	2	2	3	5	2	2	2	4	3	4
P27	2	4	3	4	4	1	2	5	5	2	2	2	4	3	5
P28	2	3	4	5	5	2	3	4	4	3	3	2	5	3	4
P29	2	3	4	4	4	2	2	3	3	3	2	3	3	2	3
P30	3	4	5	4	5	3	2	3	3	3	2	3	3	3	4
P31	3	4	5	5	5	4	2	2	2	4	4	4	2	4	4
P32	3	3	4	4	4	2	2	3	3	2	2	2	4	2	3
P33	3	3	4	4	3	2	2	3	3	2	2	2	4	2	3
P34	4	3	4	5	4	3	3	3	3	2	2	3	4	2	4
P35	2	3	4	4	4	3	3	4	4	2	2	2	4	3	3

Fig. 2: Results of actors' surveys for generating the scenarios

Clustering method (SPSS program was used) produced 3 reasonable clusters (the first cluster: P1, P4, P5, P6, P7, P8, P9, P12, P13, P14, P15, P16; the second cluster: P2, P3, P17, P18, P19, P20, P21, P23, P25, P28, P30, P31 and the third cluster: P10, P11, P22, P24, P26, P27, P29, P32, P33, P34, P35). The problems in the first cluster may be interpreted as economically oriented (EC scenario), in the second as educational oriented (ED scenario) and in the third ecologically oriented (ECO scenario).

To evaluate these three forest management scenarios a questionnaire with 20 questions, assigned as Q1,…, Q20, (for example: how appropriate is for you limited development, possibility to pick mushrooms, …) was generated on the basis of economic, ecological and social indicators/criteria (for example: entrance fee, roads, collecting fire-wood, mushrooms, conservation of plants, animals, water, recreation, education about nature, fresh air,…). Using a "snowball" procedure 48 users were interviewed. Correlation and Bartlett's test were implemented and indicated that the questions were not correlated. Through factor analysis (SPSS program was used) 7 factors were extracted. Five variables, i.e. questions Q6, Q9, Q10, Q14, Q17 loaded significantly on factor 1, another five variables, i.e. questions: Q2, Q4, Q13, Q16, Q20 loaded significantly on factor 2, and two variables, i.e. questions Q1 and Q15 loaded significantly on factor 3, 2 variables, i.e. questions Q12, Q19 loaded significantly on factor 4, 2 variables, i.e. questions Q3 and Q18 loaded significantly on factor 5, 3 variables, i.e. questions Q5, Q8 and Q11 loaded significantly on factor 6, and finally 1 variable, i.e. question Q7 loaded significantly on factor 7. If we observe the question distribution between the seven factors and the three scenarios assumed, we can state that factor 5 and factor 6 relate to EC scenario, factor 1 and factor 3 to ED scenario, and factors 2, 4 and 7 to ECO scenario.

The means and ranks for all scenarios based on statistical analysis and group AHP (weighted geometric mean method was used for aggregating the individual judgements) are presented in Fig. 3 and Fig. 4. The results show that the most appropriate scenario is ED. The second place goes to the ECO and the EC scenario is ranked third.

Scenario	1 (EC)	2 (ED)	3(ECO)	Rank of the scenarios
Method	Mean values			
Descriptive statistics	2.81	3.69	3.58	2 → 3→ 1
PAF with 7 fact.+pat. mat.	3.03	3.57	3.33	2 → 3→ 1
PAF with 7 fact.+rot. mat.	3.14	3.61	3.35	2 → 3→ 1
Post hoc for 3 groups	2.85	3.73	3.59	2 → 3→ 1

Fig. 3: Means and ranks for 3 scenarios based on statistical analysis (PAF stands for principal axis factoring)

Scenarios	priorities	rank
Economical (EC)	0.0933	3
Educational (ED)	0.5003	1
Ecological (ECO)	0.4064	2

Fig. 4: The results of group AHP (the means were rounded)

Discussion

Decision makers, experts, citizens and other users consider natural areas (forests) as a resource that must be managed in a sustainable and multifunctional way in order to provide for the well-being of society as a whole. As such, all environmental services are of great importance, but activities to improve one of them may result in other services waning, as they are in competition or even in conflict for scarce resources. This fact increases the complexity of forest management regarding economic and above all social-ecological needs and preferences of the end-users. To capture this complexity, an approach for developing and evaluating the scenarios based on surveys performed by experts and general public, and on statistical and multi-criteria methodology is presented. Viable management scenarios are revealed by experts, representing all categories of land-users. They generate and fulfil the questionnaires which address goals of forest management for economic and socio-ecological demands and local characteristics of the area, using "soft" methods (Delphi method, for example), and statistical methods (clustering). In order to evaluate the chosen scenarios the data are gathered from interviews with public. These surveys are based on Likert scale and Saaty's comparisons. The surveys are then analyzed by statistical and optimization methods. The combination of multivariate analysis (factor analysis) and multi-criteria methods (group AHP) has proven to be effective in evaluating environmental management decisions because it includes different opinions, views, preferences and competing programs of several stakeholders involved in decision making process, and a comparison of results sourcing from different methodologies.

For the case study (management of an urban forest), the selected strategy can contribute to better management plan of the area. Results also show that all users unified to support sustainable development. They prioritized educational development (modernization and innovations in forestry which should contribute to improved employment possibilities, increased productivity, and added value).

During the implementation of the selected scenario preferences of the public may change, or new ideas of experts may emerge. In order to control such changes the management process must be constantly monitored to ensure that the chosen parameters of the used scenario are still relevant. As soon as they change, the feedback to the presented paradigm should be observed.

The end-users of the study might be forest institutions or enterprises in charge of public woodland management, rural development institutions, private owners of woodlands, and farms using their land for both forestry and agriculture.

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Proposal for efficient economic data collection and evaluation for forestry: a case of the Czech Republic

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Keywords: *Accounting, International accounting standard; Economic Information System, Forestry, Czech Republic, financial statement*

Introduction

The paper deals an issue of collecting and evaluating economic data in forestry. It highlights the need to create a coherent system that is comprehensible, easy to apply and, above all, acceptable to all stakeholders in forestry. The objective of creating a framework for collecting and comparing economic data is to identify possible hidden problems, unnecessary costs or, on the contrary, to discover a way that would help to improve the efficiency of forestry management. Unfortunately, in the Czech Republic, the collection of economic data in forestry is not a tradition.

The economic data are not subsequently properly analysed and evaluated. The collection of economic results of forestry management is inadequate and it faces many other problems. The economic data that are collected do not have sufficient proficiency and they cannot be applied further to generate appropriate economic analyses. We encounter insufficient comparative data often. In the most cases, there are only data from dozens of operators, even if there are thousands of forest economic subjects in the Czech Republic. The system of statistical surveys used in forestry is currently the only source for information on economic indicators, but this situation is not satisfactory.

Material and Method

We used document analysis in order to analyse the impact of data from the reports that are regularly collected by the Czech Statistical Office, they are processed and converted to values for the whole Czech Republic. Then these results are reported annually in the Report on Forests and Forestry in the Czech Republic (Ministry of Agriculture of the Czech Republic, 2012). This data are used as a basis for forest policy and economics, for setting up the necessary subsidies, for specific support, as well as for different decision-making processes. They are used by the professional and non-professional public.

A questionnaire survey was also carried out. In preparation, 85 companies were originally willing to participate in the survey. The collection itself took place only in 34 companies willing to provide voluntary data and dedicate the timing of the questionnaires. The comments from the individual companies serve to complete the structure and evaluate the possibilities of obtaining individual items.

Results

The respondents were selected and divided by type of ownership (see Tab. 1)

Table 1: Structure of respondents by type:

Owners or entities directly managing the owner	Municipal and urban forests	Suppliers companies
7	17	10

When filling in our own questionnaires, there were some problems that were typical of most respondents. The overwhelming majority of respondents track satisfactorily the required data in units of measurement but often do not follow them in detail in terms of costs and returns. Therefore, some of the data filled in by them are a mixture of reality and operational estimates, which some respondents have openly admitted. Another, from difficult to overcome problems, was the reluctance of entities to provide some data, especially of a financial nature.

In the consultations with individual respondents, it was found that the proposed structure of the questionnaires is more suitable for owners and companies working directly with the owners.

Suggested structure of questionnaires:
1-Basic information about the subject; 2-Employees; 3-Assets; 4-Establishment and tending of forests; 5-Forest Protection; 6-Felling; 7-Transport and production of assortments; 8 -Wood production; 9-Subsidies; 10-Services; 11-Accounting indices; 12-Others

Discussion

It can be stated that the outputs or results, based on the existing economic data of a small set, do not provide sufficiently detailed economic information. The forestry sector, as compared to other related sectors, is subject to a lack of using data for this reason.

The other fact that complicates the possibility of assessing the functioning of forestry is that in the Czech Republic there is no sectoral economic research, which could be realized by a state or research institution from the point of view of the forest economy and politics. There should be a public interest and because of that, the sector would have to react. When the second national forestry program was creating in the Czech Republic, there was proposed that the establishment and functioning of the economic information system were established as a basic priority for the strengthening of forestry (Matějíček 2012). This economic information system would be able to differentiate the results of various forest owners in different natural and social conditions for the purpose of intercompany comparisons and the creation of a standard for economic evaluation.

However, it has to be emphasized that the amount of economic activities is already fully in the hands of forest owners (eg. certain impacts of the income situation of forest property by various rationalization measures, use of existing software support and digital forest management plans to support economic decision making, etc.).

However, forestry is a very complicated and interdisciplinary issue. Therefore, the economic information system can't be based purely on the reporting of the basic economic data. It is expected from the economic information system in forestry that will be the wider focus. Unfortunately, there is a wide range of information systems in forestry for own records and for due diligence. Compared to agriculture where, for example, the Farm Accountancy Data Network (FADN) is being applied in European Union countries. This system is often used as a basic source of comparable economic information that is binding for EU member states.

Because the European Accounting Concept has aligned itself with the International Accounting Standards/ International Financial Reporting Standards (IAS/IRFS) concept, their influence has also increased in the Czech Republic. IAS/IFRS were partially implemented in a major amendment to the Act on Accounting in 2001 and 2002. Detailed analysis is the starting point for the establishment of a forest economic information system. It is also for the current state of the forest management accounting, for an analysis of the IAS/IFRS approach to reporting in the forestry sector and the comparison of these approaches. One part of these approaches is also a comparison of the forest valuation methods (forest stands and forestland or estate), which are understood from the point of view of accounting as biological assets.

The basic framework of an economic information system should be to properly record all assets and liabilities arising from the operation of their business. One of the key issues of such a system is the determination of the monetary value of the total (and in time changing) timber volume (or total biomass) of forest stands on the forestland (including the value of these estates). That is why the requirements for the economic information system are very demanding. This system should, in its essence, contains comprehensive information.

The economic information system is understood as an objective tool for forest-oriented economic operators serving to support due diligence systems, efficient and sustainable forest management, good records of assets with the possibility of planning and modelling of economic, or other indicators (changing environmental conditions) with an emphasis on promoting adaptive management in relation to the change of environmental conditions. The creation of an economic information system should take into account causal links between the environment (or environmental changes), forest stands and economic activity leading to differentiation and modelling of economic objectives.

In the presented paper, therefore, the schematic forms and frameworks of the economic information system, the way of data collection and their evaluation are proposed for the above-described reasons in the results. In the discussion, there will be further highlights the criteria that should serve as a guideline for the design of the system and at the same time to form individual objectives of the system design with respect to legislation and traditional approaches to forest management in the Czech Republic. According Kupčák (2012) and Šmída (2004) it can be expected from the economic information system that it will be used to obtain an overview of the financial demands of particular processes in forestry; will allow the application of the acquired knowledge in the decision-making of the public administration. A comprehensive economic system can help, among other things, to increase the economic viability and competitiveness of sustainable forest management in the Czech Republic.

Conclusion

In the Czech Republic, the economic situation of forest owners has worsened over the 1990s and this trend continues even today. This situation is documented in a general way by a summary of the current statistical

surveys in the field of forestry. The data of the current investigations are not sufficiently representative and detailed, especially to find the causes of this trend, to formulate reasoned and structurally well-targeted measures, and for further in-depth analysis.

Due to the fact that the forestry sector is gradually getting into a difficult economic situation due to the depletion of comparative advantages, it will be necessary to ensure its sustainability with a meaningful set of measures. Accurate and statistically tested data on the economic situation of forest owners and other forestry entities are necessary for choosing the right approach to subsidy policy (from national and European sources) and defending the interests of forestry.

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An insight into forest owners´ response to extreme events

A case of Postojna sleet in 2014 and bark beetles in 2015 and 2016

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Keywords: *forest management, storm damaged forest, forest commons, sustainability*

Introduction

Sustainable management of natural resources is a long-term goal also covering understanding of forest owners. We address both aspects with examination of response to two extreme events – sleet in 2014 and bark beetles gradation afterwards.

Forest ownership once understood in dichotomy of Public or Private (UNECE, 2007) step by step takes into consideration intermediary institutions (Weiss et al., 2017) by recognition of municipalities, environmental NGOs, religious institutions, forest commons and others. Their response to eventual natural (e.g. climate) changes or socio-political development may be different from individual responses and is presumably more complex.

Extreme sleet in Slovenia in 2014 severely affected one of its regions, Postojna. It represents a well-documented case linking both – forest and forest owners (FO). Literature overview shows not only FOs situation for Slovenia (Medved, 2003), but also cases of intermediary form entitled forest commons (hereafter FC), factors affecting harvesting intensity (Poje et al., 2016) and those affecting associative behaviour of FOs (Krč et al., 2008). Forest management plans of the Slovenia Forest Service (SFS) documented procedures and response of FOs to both, sleet in 2014 and bark beetles damages that followed (ZGS, 2017). Analysis of mobilization forestry professionals and FOs at the regional level is a unique learning lesson for the future forest management response to eventual extreme natural events.

The aim of analysis is to understand response of FOs with particular attention to FC in the region as they represent original very old bottom up organizational form, still present in the territory, adapted to natural circumstances. This is the reason we hypothesise their better response in comparison with the other types of FOs in the area.

Material and Method

Both, quantitative and qualitative measures were taken into consideration. Main indicators of response were: 1. harvesting extents due to sleet and bark beetles damages in the period 2014-2016 in Postojna region; and 2. timing of response according to prescribed timings.

Quantitative data

We have used three traditional databases used in Slovenian forestry: 1) Forestry information system (FIS) based on forest management plans at different spatial scales (stand, compartment, landscape and region) regardless ownership; 2) Digital cadastral plan, and 3) "Legislation orders" of the SFS, prescriptive documents given to FOs with information about obligations to fulfil. The orders are divided to a part B for silvicultural/ protective measures and part C for sanitary and salvation forest operation. FIS describes the forests from their ecological and forest management point of view. Digital cadastral plan was needed for sociological data as it consists of title deeds and general identification of FOs (e.g. age class). Each title deed may contain more parcels. As FIS provides forest management objectives and measures for forest compartments while the base for SFS "legislation orders" are defined per owner /parcel, a problem of unequal informational units had to be solved.

Indicators used were: A) Ecological (damages extent, slope of the terrain, developmental stage of forest, wood stock etc.) and B) Sociological (age, co-ownership, property size, dispersion of parcels response time).

Initial delineating of data for Postojna region for a period 2014-2016 was followed by analysis of damaged stands according FO structure. Then we linked title deeds to stand characteristics. Finally, the difference between obligatory and recorded response was calculated for Legislation orders and both indicators. We calculated an average time difference for selected ecological (e.g. site characteristics) or sociological (e.g. age) groups.

Qualitative data

Since SFS generally communicates with forest owners through district foresters we have organized a focus group with regional district foresters directly engaged with FC in 2016. Literature analysis and meeting a lo-

cal study circle entitled *Forest guardians* proved to give additional insights into local activities and interpretations. An interview has been organized with the leader of Study circle. More about study circles at https://sk.acs.si. The work is in progress.

Results

Postojna region has different FO types among them FC, already observed in a case study (Bogataj et al., 2011) and national overview (Bogataj and Krč, 2014, Premrl et al., 2016, Bogataj, 2017). At the regional level there are 49 FC, owning 4,300 hectares of forest, on less productive (dry, poor) sites prevail. They differ in property size, number of shareholders, internal dynamics and forest management activities, but sleet in 2014 extremely affected all their forests, usually planted spruce.

Not only sleet was a cause of harvest but outbreak of bark beetles, which is understood secondary damage / sanitary forest operation. All in all more than a million cubic meters were cut in the area and period observed. Cuttings due to primary cause/ salvation forest operation heavily prevailed.

FOs did not react same way. FC among them seemed to react better, so further analysis was focused to their activity and eventual reasons of their success.

Linking of databases was only possible for 28% of all legislation orders which means for 41% of private FO. Response time, analysed regardless type of damages and type of FOs, shows that groups were late but younger individuals and younger co-owners severely passed the deadline (Fig. 1). It seems that generations behave differently, also in terms that younger FOs are not found in groups of co-owners or joint owners. Large groups (FC and co-ownership) show good response.

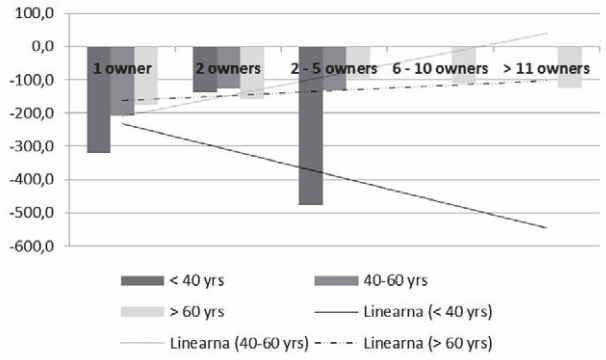

Figure 1: The difference between expected and real response time by age classes and number of co-owners

Parcel characteristic also seem to play a role. For example closer parcels with lower inclinations were cut faster. Dispersion of parcels and property/parcel size affect response time (Fig. 2).

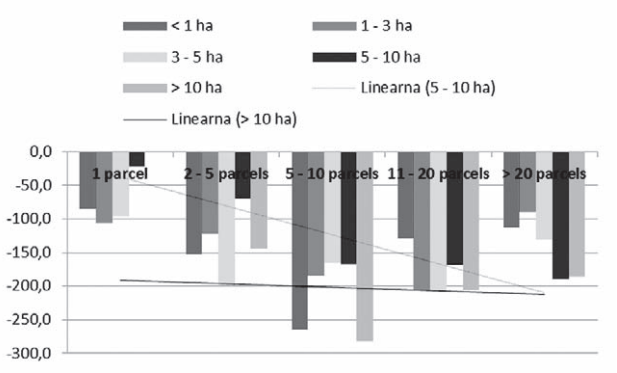

Figure 2: The difference between expected and real response time by size and fragmentation groups

As "economy of scale" might be important we have checked it and indeed an average harvest of FCs was higher in comparison with the other FO. FC have realized most of prescribed cuts and left only 4% of unrealized Legislation orders of SFS. The rest of FOs have left more wood (5,758 m3) in their stands after sleet and also more than FC after bark beetles attack (1,820 m3) (Table 1). The rest of FOs have left 57% of Legislation orders unrealized, so around half of their cuttings refer to the secondary damages.

The prescribed period for salvation cuts was longer for sleet than for bark beetles. In Table 1, a higher absolute numbers of days indicate quicker response. FC reacted faster since they finished their cuts before the deadline, while other FOs passed the deadline for four days in case of bark beetles.

Table 1: The difference between obligatory and realized CUTS/TIME after salvation (sleet) and sanitary (bark beetles) forest operations in Postojna region in the period 2014-2016

Ownership type/ Reason of damage	Forest commons	Other types	ALL
Sleet (m^3/days)	219 / 405	5,758 / 240	5,977 / 322
Insects (m^3/days)	8 / 8	1,820 / -4	1,828 / 2

Findings were generally confirmed in qualitative measurements. Quick and proper response is attributed to combination of the following reasons:

- trust among actors engaged,
- economy of scale,
- knowledge and experience needed and
- the cultural context of active cooperation and forest management.

This means that environmental, socio-cultural and economic factors indicate pillars of sustainable forest management. However, analysis has not been finished and methodological aspects still have to be examined (e.g. details of Legislation orders delivery, reporting control,

sequence of indicators). Variety is obvious since we have also found non-responsive FCs and study circles spontaneously focused to restoration of the local hill.

Discussion

The region of Postojna was pressured with extreme sleet in 2014. Its long-term effects consist also of bark beetles outbreak that followed. Both, professionals and FOs were heavily pressured to react. Situation, perceived as a "war", engaged not only institutions e.g. SFS and forests enterprises but also private FOs. Their initial analysis has shown that positive examples exist, namely FC, while majority was found unprepared. Results differ for sanitary and salvation forest operation and for FOs types, respectively.

An insight into regional response of private FOs provides information about strengths and gaps to be addressed in the future. Large FOs were very active, young FOs seem to be absentees. FCs already studied for the area observed (Gatto, Bogataj, 2016) in average proved to be better but only if few preconditions were satisfied e.g. their internal "associative life" and forest management experience. Their quick and – for conifers – intensive harvest while leaving deciduous trees to self-regenerate, seem wise as they have managed to reach 1. high realization of Legislation orders set by SFS and 2. low need of sanitary forest operations. Their response was qualitatively explained with combination of: organizational model, SFS encouragement, forest characteristics, economy of scale, (initially) relatively interesting market prices and general culture of active forest management. The latter is in line with findings of Lidestav et al. (2017) based on few very distant EU cases.

Response indicators are strong and support each other but analysis is still in progress. Its findings may enrich understanding of FCs but above all contribute to future forest management optimization. Traditional target groups' description at the national level may put more accent to contextual analysis. Understanding of reactions to extreme events at the regional level would fill the gap in approaching sustainable forest management prescribed in Forest Act. Criteria of good response found in our analysis might improve ICT based information flow for SFM potentially linked with learning tools developed (Krajter et al., 2018). Trust as prerequisite for active participation in forest management (Meerkerk et al. 2017) calls for more attention to face to face practices like the local traditions and study circles.

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Field trip NP Plitvice Lakes

The Plitvice Lakes National Park lies at the south end of the slopes of Mala Kapela chain at the height between 450 and 1280 a.s.l. This is an area of alpine topography that exerts a considerable impact on climatic phenomena and consequently, on the vegetation of the area. According to Koeppen's classification, the climate type prevailing here is Cfb. (moderately warm and humid, with hot summers), the climate where beech thrives. Average annual rainfall is 1550 mm. Apart from being defined by latitude, hight above sea level, ground inclination and sun exposure, the prevailing vegetation is also defined by geologic bedrocks, soil and the farming methods used. Limestone and dolomitic rocks of various ages (Triassic, Jurassic, Cretaceous) make up the geological bedrock. Considering the relief, climate and land farming in the recent past, vast forest surfaces in their various stages - from thicket to virgin forest (Čorkova uvala virgin forest) - have remained very well preserved (3/4 of the Park's surface area). Forests covering the National Park used to be managed in the past based on the so-called Rules of Forest Management (the first Rules for Ljeskovac Forest Management date back to 1883), until the time the today's Nature Protection Act was passed, according to which the forests are left to develop naturally (not in terms of forestry farming, but based on a Forest Action Plan).

The Plitvice Lakes National Park devotes special attention to scientific research. The most significant role with respect to launching, intensifying and coordinating scientific research was the establishment of the first research station - The Plitvice Lakes Biological Station in 1961. This research station has since changed its name and location, and has had a few brief interruptions, but today it operates as the “Ivo Pevalek Scientific Research Center” (Špoljarić and Belančić, 2009). The numerous published papers from various fields on the topic of the Plitvice Lakes indicate the enormous scientific value and attractiveness of this area. Scientific research of the Plitvice Lakes has a 160-year history.

http://www.np-plitvicka-jezera.hr/en/