IUFRO World Series Volume 17

Forests in the Global Balance – Changing Paradigms

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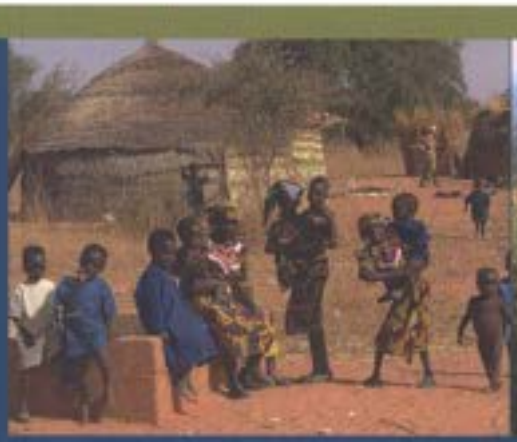
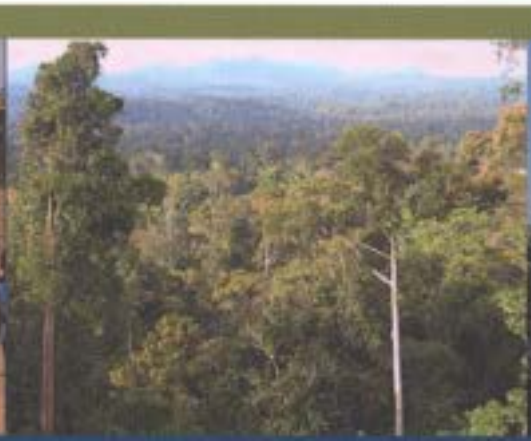
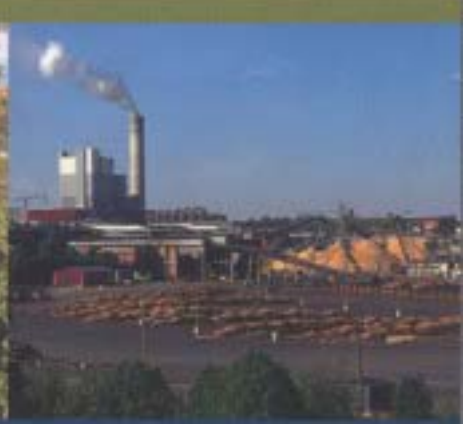
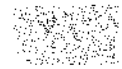
IUFRO



Foreword

The IUFRO Board decided in 2001 to accommodate World Forests, Society and Environment (WFSE) within its structure as a new Special Project. WFSE had already shown its collaborative and scientific capabilities by organizing an extensive global network and publishing three valuable volumes; however, there were some doubts whether the new project would create any net benefit to IUFRO.

After being part of the IUFRO structure for three and half years, the Project has provided a substantial contribution not only to IUFRO but also to the forest sector as a whole and to the forest research community. The Project has maintained, and through the IUFRO structure even intensified its collaborative network and produced several important reports. These publishing activities culminate in this volume.

Most valuable is the fact that the Project has not merely produced scientifically valuable material, but has also paid significant attention to the dissemination of its results and the interface between science and policy. The Project has commendably understood that if the scientific community is not able to communicate its research for the enhancement of the knowledge and expertise of policy and decision makers, the scientific findings will be of little practical value.

The 133 authors of the different articles and chapters have worked hard to produce this volume. It has been a challenging task but it is even more challenging to coordinate the work and edit a book like this. In addition to thanking the authors, I wish to extend my special gratitude to the editors. Gerardo Mery has led both the international editorial team and the WFSE Project. Together with his colleagues at the Finnish Forest Research Institute (Metla) and the IUFRO Headquarters he has looked after thousands of details that are often invisible, but critical for a creditable outcome. On behalf of IUFRO, I also want to thank the WFSE partner organizations, which have set an excellent example of successful collaboration for other IUFRO members. Finally, I thank the main sponsors of the Project, the Finnish Forest Research Institute (Metla) and the Ministry for Foreign Affairs of Finland.

Risto Seppälä

President, International Union of Forest Research Organizations

Preface

This book, *Forests in the Global Balance – Changing Paradigms*, is the third publication produced by IUFRO's Special Project on World Forests, Society and Environment (IUFRO-WFSE). The book will be launched at the XXII IUFRO World Congress that will be held in Brisbane, Australia, 8–13 August 2005.

The World Forests, Society and Environment research project led to three published volumes in the "World Forests" series during 1996–2001, in response to increasing demand for research information related to the world's forest issues. In the current phase of the project, 2002–2005, under the structure of the International Union of Forest Research Organizations (IUFRO), we are focussing our analyses on current concerns in forest related issues, approaching them from a broad and global perspective, whilst maintaining an independent and non-governmental point of view.

The present book gives cause for some reflection on the changing paradigms that have become apparent in the field of forestry over the past two decades. The new social values and perceptions have been integrated into a holistic approach for the study of forest related issues, from an intersectoral and wider angle including social, economic, and environmental factors.

The book intends to contribute to international scientific discussions and to reflect on how changing paradigms are resonating in global arenas, specifically concerning new concepts of forest governance, ecological services, planted forests and the contribution of forestry in rural development, and the livelihoods of rural inhabitants and the reduction of their poverty and marginalisation. The maintenance of healthy forest ecosystems and biological diversity has also been an important consideration in the chapters of this publication, as well as the role of several cross cutting issues in enhancing sustainable forest management. The repercussions of these on-going processes on different continents have also been addressed in the section that provides regional analyses. The compilation of all these analyses, presented in 17 chapters and 54 boxes, has been completed with the highest quality, objectivity, and scientific independence.

The contents of this book followed a unique and innovative path valuing the involvement and input of a variety of different contributors. The project was initiated at CIFOR's headquarters in Bogor, Indonesia in May 2002, when members of the Steering Committee identified globally relevant topics to be addressed by the project. At the next Steering Committee Meeting (SCM), at IUFRO's headquarters in Vienna in October 2002, the nine project partners nominated recognised scientists to lead the research teams engaged in the critical review of each chapter. The nominations of the Convening Lead Authors were ratified and completed in another SCM in Quebec, in September 2003. The outline of each chapter was requested from each research group, which received the first evaluation by the editors.

Three workshops were organised for the Convening Lead Authors and editors to present the proposed contents of their articles, and collectively discuss the guiding research principles and editorial focus of the project. In January 2004, the first project Workshop was organised in Helsinki, co-sponsored by the Finnish Forest Research Institute (METLA). The second Workshop was generously co-sponsored and organised by the United Nations University, Japan. An open, collaborative network of researchers was created, and numerous colleagues from different continents provided valuable contributions to the writing of the articles. The third workshop was generously sponsored by Natural Resources Canada (NRCan) and held in Victoria, Canada, in January 2005. Once the articles were finalised, they were evaluated by the editors. After a second evaluation by the editors, the chapters were peer-reviewed by anonymous external reviewers. The entire process was formulated to ensure the highest quality of the material.

In August 2005 we will initiate the dissemination of this book to a wide audience of scientists, professionals, policy makers, and the public. IUFRO will play a central role in the distribution of the publication, as will the following partners who will actively cooperate in the distribution of the book to numerous organisations and interested individuals: CATIE, CIFOR, EFI, INBAR, METLA, and NRCan.

In conjunction with this book, the authors of the chapters collaborated in the composition of a policy brief, *Forests for the New Millennium – Making Forests Work for People and Nature*. The policy brief was launched at the 5th session of the United Nations Forum on Forests (UNFF 5) in May 2005. The publication provides a consensual view of the policies required for forested land to be managed more sustainably for the benefit of both people and nature.

We would like to express our satisfaction as editors of this book for the successful completion of this unique experience. We think that the book will certainly make a contribution by presenting a most

interesting set of research findings emerging from the comprehensive and dedicated work done by 132 authors of this publication. We are indebted to all of them. We also wish to express our gratitude to the reviewers, prestigious scientists, whose names are listed in the following list, who proficiently contributed to further improving the level of the articles.

Gary Bacon	Misa Masuda	Peggy Smith
Bryan Belcher	Peter Mayer	Oudara Souvannavong
Edouard Bounkoungou	Anssi Niskanen	Dietmar Stoian
Ronnie de Camino	Pablo Pacheco	Larry Teeter
Ben Chikamai	José Rente Nascimento	Eric Teissier du Cros
Dean Current	Olli Saastamoinen	Victor Teplyakov
Allan R. Ek	Jobst-Michael Schroeder	Ilpo Tikkanen
Klaus von Gadow	Goetz Schroth	Ilan Vertinsky
Peter Kanowski	Olman Segura	Sen Wang
Guide Lund	Risto Seppälä	

Acknowledgements

Our gratitude to Pia Katila, doctoral student of Forest Sciences at the University of Helsinki, who devoted a large portion of her time for the copy editting of the chapters; her knowledge and advice on many matters made this volume a success. Samuel Chopo expertly designed the maps and many of the graphs, and assisted in the copy editting. Majella Clarke competently assisted with the administration of the project and Yared Admassu collaborated in work related to the edition. Pirjoritta Lind provided invaluable secretarial services. The English language revision was done by Dr. Kitty Hoffman, to whom we express our appreciation for her excellent work. The design and layout of the book was stylishly prepared by Seppo Oja. We acknowledge the diligent work of all of them.

We wish to sincerely thank the Ministry for Foreign Affairs of Finland for providing the funding that made possible to accomplish many activities of this project, including the publication and distribution of this book and the policy brief. We also express our gratitude to IUFRO for backing our endeavours and providing access to research networks in numerous fields.

We also wish to emphasise our recognition of the support provided by all the partners for their generous assistance to the project; in particular we want to thank their representatives in the Steering Committee for their guidance in administrating the IUFRO-WFSE project and their constructive advice in conceiving the present book. The project partners constitute a core group of nine institutions that mobilised the participation of the research community in the book-making process by creating a forum for compiling the relevant research findings and produce meaningful analyses. The partners are: Tropical Agricultural Research and Higher Education Center (CATIE), Costa Rica; Center for International Forestry Research (CIFOR), Indonesia; Centre de coopération internationale en recherche agronomique pour le développement (CIRAD-Forêt), France; European Forest Institute (EFI), Finland; International Network for Bamboo and Rattan (INBAR), China; Federal Research Centre for Forestry and Forest Products (IWF/BFH), Germany; the Finnish Forest Research Institute (METLA), Finland; Natural Resources Canada/ Ressources naturelles Canada (NRCan/RNCan), Canada; and the United Nations University (UNU), Japan. In addition, the project benefitted from the collaboration of many other international organizations and universities.

Many thanks to all the people and organisations mentioned above that allowed us to successfully complete the edition of this book.

June 2005, editors

Gerardo Mery *René Alfaro*
Markku Kanninen *Maxim Lobovikov*

Contents

Boxes

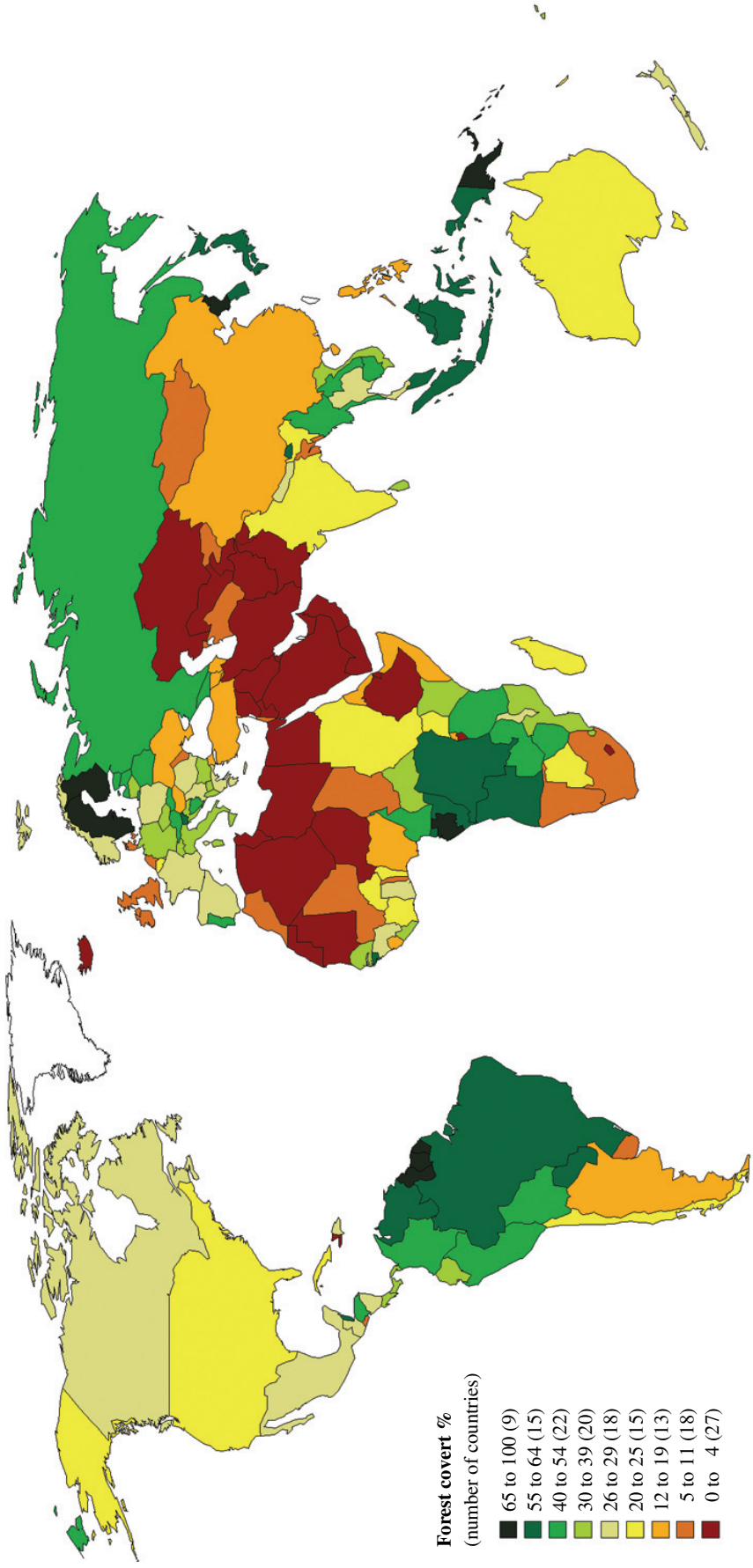
List of Maps

PART I

Forests in the Changing World

Matti Nummelin

Map 1.1 Global forest cover (percent of land area, countries over 1 500 000 ha)
(Data: FAO FAOSTAT 2005; map designed by Samuel Chopo)



1 Changing Paradigms in Forestry: Repercussions for People and Nature

Gerardo Mery, René I. Alfaro, Markku Kanninen, Maxim Lobovikov

Abstract: Timber and fibre production from forests, both natural and planted, make an important contribution to many national and local economies. Just as significantly, forests provide a range of environmental services that are, ultimately, fundamental for the survival of life on our planet. For example, they play an important role in stabilizing soils and protecting land from erosion by wind and water, and they help to maintain a steady supply of clean freshwater. Trees and forest soils also lock up atmospheric carbon; forests thus play an important role in reducing concentrations of one of the main greenhouse gases causing global warming. While in the past forests were seen primarily as a resource to be exploited, and cleared to permit agriculture, in recent years there has been a paradigm shift in society's attitudes towards forests; it is now widely recognized that forests can provide much more than timber, fuelwood, and non-wood forest products. Forests are increasingly seen as part of the human and natural landscape, and thus in need of a more holistic approach to their management, an approach that recognizes the complex links between forest, environment and society. In this chapter we briefly review the changing paradigms in forestry and describe their underlying causes as uncovered by the many authors involved in this book. These findings are grouped into five broad categories: forests as a source of livelihoods and human well-being; the importance of ecosystem health to preserve all values from forests in perpetuity; the need to integrate forestry with other economic sectors; the need to share forest benefits more equally; and the need to develop forest resource governance systems that enable society to reach its objectives. Finally, we provide concise policy implications of the findings in this book.

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1.1 Introduction

In 1996 the World Forests, Society and Environment (WFSE) research project was conceived and created by three partners: the Finnish Forest Research Institute (METLA), United Nations University (UNU) and European Forest Institute (EFI). In 2001, the Board of the International Union of Forest Research Organisations (IUFRO) accepted WFSE's proposal to become a Special Project of the International Union of Forest Research Organizations (IUFRO). Currently, the project's backbone consists of nine partners (see the back cover), who establish the guidelines and collaborate to perform agreed activities. Furthermore, the broad and open network, built by the project, of more than one hundred researchers and experts from around the world, is another of its valuable assets.

The IUFRO-WFSE project has several objectives. The primary one is to collate and critically analyse existing knowledge on selected issues related to the interrelations between forests, society, and the environment. In addition, the project provides an innovative forum for analysing changing paradigms, and challenging and testing new ideas using a scientific approach. Worldwide dissemination and distribution of the project's findings is another of its aims.

The IUFRO-WFSE process is an innovative and unique effort, based on high quality, objectivity, and scientific independence. The process has consisted of the following steps:

- The identification of globally relevant topics of current concern related to forests and their relation to the environment and societies.
- The identification of recognised scientists and research groups, who carried out the critical review.
- The preparation of objective assessments and critical analyses of the crucial issues, both globally and by regions.
- The dissemination of the output to a wide audience of scientists, professionals, policy makers, and the public.

The main outputs produced by IUFRO-WFSE are the book that we introduce here, *Forests in the Global Balance – Changing Paradigms* and the policy brief, *Forests for the New Millennium – Making Forests Work for People and Nature* (Mery et al. 2005).

1.2 Changing Paradigms and their Underlying Causes

The ways in which forests are perceived, used and conserved, have changed dramatically in recent years. Forests are no longer seen simply as a source of timber, but rather as complex ecosystems that sustain livelihoods and provide a range of products and environmental services. It is now widely recognised that forests can contribute to poverty alleviation, rural development, biodiversity maintenance, and healthy ecosystems.

These new views on the role of forests emerged due to increasing societal pressure for more equitable socio-economic development, without threatening local and global environments in the long term, and considering the well-being of present and future human generations. In other words, there has been a desire to promote sustainable socio-economic development through the pursuit of national interests, based on holistic collective agreements by all stakeholders.

This global concern originated with the dissemination of new scientific evidence on the critical situation of the planet's environment and the massive poverty affecting billions of people worldwide. Dominant scientific theories began to be seriously questioned in the early 1960s. The guiding paradigmatic notions that had prevailed for centuries, that "through science we will render ourselves the masters and possessors of nature" (René Descartes, published in Harvard Classics 2001) did not provide answers to important issues confronted by the scientific community and society as a whole. Well known scientists such as Ilya Prigogine pointed out that this old concept was fragile and did not offer valid solutions to the complicated development and environmental questions confronted by contemporary society. Prigogine explained that forest ecosystems are "more chaotic than linear, more full of surprises than predictable" (Prigogine and Stengers 1984). The old notion that humans act on nature, with no reciprocal influence, was challenged. A new set of assumptions, theories, and beliefs – or a scientific paradigm, according to Kuhn's formulation (Kuhn 1962) – was incubating. The primacy of new scientific views and theories, replacing the previously widely accepted concepts of "rationalism", required a scientific change that allowed "the successive transition from one paradigm to another via a scientific revolution" (Kuhn 1962). According to Fitsjof Capra (cited in Bromley 2005) the paradigm shift is a "profound change in thoughts, perceptions and values that form a particular vision of reality". In contemporary society, the thorough scientific debates led to the emergence of a new paradigm, namely that of sustainable development – the development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs.

In the field of forest related issues, the appearance of the new paradigm – the need for sustainable forest development – has not been a simple process, and normally its recognition and social validation would have taken time. However, news media and NGOs have played an important role in rapidly spreading the distressing news, presented in many scientific studies, which described the alarming progress of deforestation. During the last four decades, our planet lost over half a billion hectares of forests and at the same time the consumption of forest products rose by 50 percent (FAO 2001); this has contributed to biodiversity loss, alteration of natural cycles and global warming, unequal social welfare distribution, and increased vulnerability in rural areas. Criticism of the dominant development pattern was widely disseminated. The old perception of forests as a source of timber and other products – even under sustainable yield – was substituted by a new wider conception, the sustainable forest development: "Forest resources and forest lands should be sustainably managed to meet the social, economic, ecological, cultural and spiritual needs of present and future generations" (UNCED 1992). Therefore a new social perception was created of the correlation between equitable socio-economic development and sustainable nature utilization and conservation. Policy makers have been pressured by this new social paradigm – particularly during the last two decades – and have been compelled to adopt urgent agreements, plans, programmes, and plans of action for promoting remedies to these acute problems.

Numerous significant factors have been identified as underlying forces driving the paradigm changes in forest-related issues (Maini 2001, Mather 2000):

- Rapid scientific progress and technological advances, particularly in the field of informatics, have made possible a holistic view of complex natural processes and their interrelations, and a more comprehensive landscape approach is emerging strongly in land use science.
- Significant changes caused by increasing human population, and migration from rural areas to urban centres, have been apparent during recent decades. With increasing ur-

ban population and the change in age structure of human society, life styles, values, and attitudes can be expected to change. This is leading to profound alterations in social perceptions of the roles and functions of forests.

- Approximately 350 million people who live in or next to closed forests depend on them heavily for their subsistence or income, and 60 million indigenous people are almost totally dependent on natural forests. Most of these people are poor and disadvantaged. There is increasing public concern for their fate and the need to alleviate their desperate condition. A consensus at the United Nations has established the Millennium Development Goals, aiming to eradicate extreme poverty and hunger and achieving other significant social and development targets for the humanity.
- There is also wide concern about the uneven and inequitable distribution of the benefits that flow from forests and forest operations. Different groups benefit from forests as households, communities, small, medium, and large entrepreneurs, governments, NGOs, and groups working in conservation and recreation activities. However, a large number of people, estimated at 1.6 billion, rely on forests for their basic livelihoods (World Bank 2001). Particularly, threats to the livelihoods, culture, and rights of forest dwellers, indigenous people, and others who live in or around forests in many parts of the world, require profound changes.
- The noteworthy loss of social, environmental, and economic benefits caused by intolerably high deforestation and forest degradation processes has made evident the pressing need for significant alterations of policy and practices in the fields of forestry and other sectors. The paradigm of sustainable forest management presently has wide acceptance.
- Globalisation – the process by which private individuals, companies, social institutions, and governments became increasingly interconnected as a result of the accelerated progress of innovations in informatics, robotics, and telecommunications – has been an important driving force for the emergence of large transnational corporations, rapid capital flow, liberalisation of commerce, and concentration of research and scientific and technological innovations in a few developed countries. Heated debates on the social and environmental repercussions of this process have accelerated social unrest. It is controversial to demonstrate that globalisation is widening the gap between rich and poor or between nations, but it is evident the process has not contributed to halting or alleviating growing social disparities. This fact also calls out for regulation of the process.
- During the past two decades, the demand for forest products from sustainably managed forests has increased. This is a consequence of the new perceptions and social values demanding new practices in forests and forestry.

A group of approximately 200 scientists (see map of IUFRO-WFSE researchers network) analysed these issues and their consequences for society, presenting their reflections on the paradigm change and their recommendations for future actions. In the following pages, we summarise the main findings of Parts I–III of this book – Forests in the Changing World, Global Forum, and Cross-Cutting Issues in Sustainable Forest Management, respectively. We strongly encourage readers to focus as well on the articles in Part IV – Regional Forum – where the paradigm change is analysed at the continental level, and resulting specific global, national, and local repercussions are examined.

1.3 Forests as Source of Livelihoods and Human Well-being

Increasing awareness of the role of forests in rural development, and particularly forests' contribution to poverty alleviation, is emerging as a new important paradigm in rural development and forest-based development plans and programs.

According to the World Bank (2001), more than one billion people rely on forests for their livelihoods, many more use biomass – mainly fuelwood – for cooking and heating their homes, rely on traditional medicines collected from the forests, utilise numerous farm inputs supplied by forests, and obtain an important share of their protein requirements by hunting and fishing in forests. In addition, approximately 60 million indigenous people are almost entirely dependent on natural forests. Many small farmers depend on trees and forest products for subsistence and income. Public land is particularly important for landless families, especially for the poorest of the rural poor. Secondary and degraded forests are also a valuable resource for rural communities.

Forests, both natural and planted, make an important contribution to national and local economies. In 2003, the international trade in sawn wood, pulp, paper, and boards amounted to almost USD 150 billion, or just over two per cent of world trade, with the developed world accounting for two-thirds of the total. Up to 60 million people are employed in the forestry and wood industries. Large, capital-intensive forest industries, such as those producing pulp and paper, require comparatively small amounts of labour. Therefore, the number of jobs in large-scale forestry and forest-related industries is declining in the North and in many countries in the South.

However, small- and medium-sized forest-related enterprises provide large numbers of jobs, and have the potential to significantly improve the livelihoods of small farmers, agricultural workers, and the landless. The indirect employment created by small- and medium-sized enterprises is often not recognized or fully valued. The small-scale and informal sector, which also includes casual labourers and the self-employed, has become increasingly important, both in terms of providing jobs and in contributing to the economy in rural areas. Nevertheless, in the developing world in particular, terms of employment and working and living conditions in forestry and wood-based industries are often poor and unregulated.

Although there are trade-offs between the goal of supporting the livelihoods of the millions of people who depend on forests and conserving the unique biodiversity of these forested landscapes, opportunities exist for achieving both targets. However, in many areas the poor local communities are prevented from capturing the full benefits of forest based economic activities due to a range of unfavourable circumstances that include their low levels of education, low levels of capital assets, inaccessibility to land and forests, poor health, lack of power and voice, and restrictive institutional frameworks. The facts presented in this book highlight promising opportunities for forest-based poverty alleviation, and the prerequisites for their exploitation. Much of the evidence suggests that sustained welfare gains for the great majority of forest-dependent people will require broader macro-level investments beyond forests and natural resources. Multi-scale approaches that emphasize integration of key sectors, from local to global scales, could produce better results for effectively achieving poverty alleviation at the scale demanded by the Millennium Development Goals.

Forests often have significant cultural value and contribute to human well-being and health. In some parts of the world, forests have become increasingly important for recreation, especially around large urban centres. The recognition of the potential of traditional knowledge to assist in increasing the welfare of world societies is another emerging concept.

1.4 Healthy Ecosystems for Sustainable Forest Management

The new concept of ecosystem management appeared first in the United States of America in the 1990s, replacing the traditional multiple-use forest management doctrine. This ecological approach attempts to meet the needs of the population while conserving biodiversity and the non-timber value of the ecosystems; that is, it is an approach to balance the economic, ecological, and social values of forests (Franklin 1989; Kohm and Franklin 1997; Bergeron et al. 1999). The new concept emerged after forest ecologists and other forestry professionals suddenly realized that ecosystems are so complicated that the existing sustained yield, multiple-use approach did not guarantee sustainable ecosystems. These professionals concluded that it was impossible to arrive at sustainable ecosystems simply by limiting extraction of different ecosystem products and services, and that it is simply impossible to maintain biodiversity by taking care of the needs of every single species, plant or animal, living in the forest. There are too many species and too little is known about their life cycles and the complicated interlacing of the biological chains.

Landscape ecology, a relatively new discipline (Kohm and Franklin 1997), recognized that ecosystems are not islands, but are inserted in a matrix that evolves as a whole and is subjected to natural as well as manmade disturbances. Thus, the present mosaic of forest patches found across the landscape is the result of the recurrent action of manmade or natural disturbances that have shaped the landscape over the last several hundred years. Forest biodiversity during thousands of years adapted to these forest structures and disturbance regimes. Therefore, biodiversity levels and the array of structures (patch size, species composition, and the like) of virgin landscapes, before economic interventions, are considered the benchmark to which interventions under ecosystem management should be compared. Ecosystems are considered healthy if the various processes and disturbance regimes are operating within the historic range of variation (Attiwill 1994; Fule et al. 1997).

A concept that reflects more clearly the ecosystem management view is the concept of managing forests by imitating natural processes. Projects such as EMEND, or Ecosystem Management Emulating Natural Disturbances, (Spence 2001) aim to develop techniques for managing natural resources that imitate the way natural processes operate. Clear cutting, for example, may be practiced in a manner that imitates how natural forest fires clear the forest. Natural fires clear the land in patches that are irregular in shape, often skipping groups of trees. Biodiversity is able to survive in these patches and radiates from there to re-colonize the new forest that develops after fire.

Restoration of degraded ecosystems is now a priority for society. Past logging practices led, in some countries, to a dramatic transformation of the planetary landscape over a very short historical period. Virgin forests around new settlements were quickly cut down and replaced by younger and more simplistic structures with the basic purpose of wood production. The flora and fauna were not ready for such a radical change and sustained heavy casualties. In many parts of the world contemporary forest industry is based on a fragmented forest base and repeated harvesting of these relatively young forests prevent them from reaching old-growth stage. These practices leave behind less and less biodiversity by eliminating an increasing number of animal and plant species. It is now recognized the need for conservation not only in the reserves but also in the entire landscape. Protecting forest types, habitats, or ecosystems where species live is as necessary as protecting individual species, hence the requirements for large scale, landscape level planning to achieve this.

Biodiversity conservation may be advanced in young forests through interventions aimed at accelerated development of old-growth characteristics. Foresters believe that young forests may successfully imitate old growth with the application of certain forestry techniques that imitate natural processes (Oliver and Larsen 1990). Complementary non-tra-

ditional forestry measures, such as retaining large patches of old growth after removals, leaving coarse woody debris, artificially creating wild-life snags by killing healthy trees, maintenance of diseased and forked trees, and hollowed dead stems, will artificially accelerate the formation of some of the old growth characteristics. The major advantage of this approach is that it allows faster movement along the natural age phases imitating natural forest development. Hydrological, carbon sequestration, climate, and recreational functions of forests are achieved simultaneously.

Society will pay a high price for ecosystem management, but it is likely to be more environmentally efficient than conventional forest management. However growth, increment, and timber output are likely to decrease. Reduced logging creates a decline of forest income and industrial employment, and higher prices for wood. Substitution of the contemporary simplistic practices of removals and regeneration with more expensive and complicated ecosystem management systems will bring about growth of capital investments, qualified labour, and overall costs.

In the social context, to meet the demands of society for fibre and environmental services such as recreation, the practice of ecosystem management requires integration of the forestry sector with other sectors, and development of consultative methods of participation by the multiple stakeholders who obtain benefits from the forest.

1.5 Integrating Forestry with Other Sectors

Management of forests at large scales requires multi-sector integration as the economic, social, and environmental demands on forests have continued to increase. The key is integrating agricultural and forest land use. Many social and environmental problems are a direct consequence of conflicts between different economic activities. Many of these conflicts could be avoided if there were better integration between different sectors. Thus, what is required is a more integrated approach to land management through the implementation of large scale planning, where the potential impacts of antagonistic practices can be identified and plans for their mitigation can be prepared. Different sectors need to co-ordinate their activities, bring together a wide range of interests, and resolve conflicts in a participative manner.

Many of these conflicts do not only affect forest land; they are also apparent in other type of land uses. Decision-makers often fail to pay sufficient attention to what FAO terms "other wooded lands", which include *miombo* woodlands, savannahs, and *cerrados*. Farmers, pastoralists, miners, and others use these lands. They cover 10 percent of the world's land surface and provide significant amounts of timber, fuelwood, and various non-wood products, all of which are important for subsistence and local livelihoods. They also deliver a range of environmental services, including biodiversity, scenic, and other values.

Conflicts between urban dwellers and rural communities are common. Approximately 50 percent of the world's population now lives in urban areas, and practically all population growth over the coming decades will be concentrated in towns and cities. The loss of good agricultural land to urban development, and the expansion of the agricultural frontier to grow export crops or run livestock, has inevitably led to land-use conflicts far from the centres of population. This suggests that decision-makers need to consider indirect, as well as direct, impacts of any development activities.

Carefully created integration plans are needed to improve, through synergism, the livelihoods of forest-dependent communities, and the benefits to all stakeholders who participate in forestry activities and services as well as to those who are dependent on other economic sectors.

1.6 Sharing Forest Benefits More Equally

The desire for a more equitable distribution of the benefits from forests is emerging as an important guiding principle among decision makers in many parts of the world. Forests provide significant economic, social, and environmental benefits to a wide range of different groups. These include households and communities who use forest products; forest and wood-related enterprises; local and national governments; conservation and recreation groups – to name the more obvious. Furthermore, society as a whole benefits from the many environmental services that forests provide.

However, the benefits are frequently unevenly shared, with political processes and forest management strategies denying use and access to many of those who consider they have, or should have, a stake in the forests. Thus, the existing patterns of land ownership, access rights, and tenure have a strong influence on who benefits from forests – and who loses out.

The nature of the relationship between indigenous societies and forests is often based on customary laws that are not recognized by modern states. This has frequently led to conflict with the authorities. However, it is possible to develop management regimes that recognize a wide range of traditional uses and interests while at the same time allowing sustainable forest-based development.

Illegal logging is a major problem in many developing countries, especially when practiced on a large scale. Relatively few people profit, but many lose out. Local communities are deprived of

resources; governments fail to capture revenues from timber extraction; unfair competition reduces wood prices; critical habitats are often destroyed; and illegal logging and wildlife trading frequently lead to violence and conflict.

Cumbersome bureaucracies, corruption and lack of forestry development policies prevent an efficient application of the principles of sustainable forest management, challenging the achievement of the new paradigm.

1.7 Towards Better Governance of Forest Resources

Older models of forest governance, where decision-making is dominated by the state and is adopted and implemented in a "top down" manner, are no longer acceptable in many parts of the world. The new models of governance place a strong emphasis on participatory decision-making by civil society, with the state assuming the role of coordinator and catalyst. This involves steering participants towards sustainable forest management (SFM), and helping to resolve conflicts rather than creating them.

International deliberations on forests have agreed on the global goal of improving SFM, and on a global approach of monitoring, assessing, and reporting on the status of SFM using national criteria and indicators. The appropriate international governance regime for implementation is still under political negotiation. Furthermore, it is very important that policy formulation and implementation be based on solid information and scientific evidence. Consequently, sufficient resources should be allocated for research on forest related issues.

In theory, the process of decentralization should lead to empowerment of local governments and more effective forest management. However, too many decentralization programmes have been hampered by a lack of resources and training, corruption at many levels, and central governments' unwillingness to give up authority. Nevertheless, some countries have made significant progress, and the process of decentralization is set to continue. Furthermore, it should be noticed that community forestry and joint forest management have had a significant impact in several countries. Community forestry frequently adopts the customary management regimes that existed before the state assumed control of forest land. Local institutions may make better use of the forests, manage them more sustainably, and contribute more equitably to livelihoods than central government agencies. On the other hand, the devolution of public rights over natural resources to civil society and the private sector may improve the effectiveness of forest governance. However, the shift may sometimes result in a reduction of the quality of resource management.

Forest certification is a market-driven approach to improving forest management by linking consumer concerns about social issues and the environment to good practice. In 2005, nearly 200 million hectares – approximately 5% of the world´s forest area – of forest had been certified. Certification schemes provide consumers – governments, retailers, and individuals – with assurance, at least in theory, that they are buying products that come from forests that are sustainably managed in a socially responsible way.

Many remote forested regions suffer from high levels of violence and civil wars. The economic, environmental, and social costs are often considerable, and affect both governments and local communities. Other forested areas suffer from social disruption and lawlessness, or shelter large numbers of refugees. Poor governance permits a breeding ground that threatens national and world peace.

In conclusion, if we wish to achieve the ambitious goals of maintaining healthy forests and sharing the full range of benefits among different interest groups, better forest governance has to be established for facilitating the implementation of specific sustainable forest programmes at national and local levels. We should pay more attention and learn from "traditional knowledge" or the way hundreds of millions of people have perceived, governed, and used natural resources for many centuries. However, there has been a failure in our contemporary society to link useful traditional knowledge with "mainstream" dominant knowledge.

1.8 Policy Recommendations

Public resources for research on forest-related issues have declined significantly in recent years. As a result, policy-makers often make decisions that are not based on reliable information or sound scientific evidence. There is currently no global mechanism, analogous to the Intergovernmental Panel on Climate Change (IPCC), to raise issues of importance and give expert advice on forest-related issues. With this book, we have attempted to contribute to filling the gap between science and policy. Hence, based on the work of the authors of this book and the interaction with policy specialists, a set of policy recommendations were developed and published in a Policy Brief titled "Forests for the New Millennium: Making Forests Work for People and Nature" (Mery et al. 2005). These policy recommendations are summarized in the Box 1.1 below.

BOX 1.1 Policy Recommendations for Promoting Sustainable Development and Forest Management

[Extracted from the Policy Brief "Forests for the New Millennium – Making Forests Work for People and Nature" (Mery et al. 2005)]

Policy recommendations to improve livelihoods and human well-being of rural communities

- Governments should encourage and support the sustainable management of all forest and tree resources and promote the active participation of rural communities.
- Policies should encourage the development of small- and medium-sized forest based enterprises, for example through co-operation and partnerships among small-scale producers and between producers and processors.
- Improving market access for small-scale enterprises and their entrepreneurship will enhance the livelihoods of many people who use forests. Governments could also provide assistance to improve production processes of forest products.
- The production and commercialization of non-wood forest products (NWFPs) should be stimulated because of the role they play in supporting livelihoods – especially for women.
- Policies should encourage and facilitate the creation of markets in forest related environmental services in such a way that the new markets provide real livelihood benefits for rural people.
- Much greater attention should be paid to improving the safety and health of forestry workers, and ensuring that they receive adequate training and supervision.
- Governments should recognize the importance of secondary and degraded forests, which provide wood and non-wood products for a large proportion of the rural population. Similarly, trees outside the forest deserve special attention.

Policy recommendations for maintaining healthy ecosystems

- Two main guiding approaches are recommended for sustainable forestry practices. One involves the use of the criteria and indicators for sustainable forest management already defined by international processes. The other is the general ecosystem management approach.
- Preventing desertification and degradation, as well as restoring degraded land, should be high priorities. Planting trees for stabilizing soils and improving the social conditions that prevail in these areas, are important tasks to be supported.
- Natural regeneration can often be encouraged and implemented at little cost to society.
- Forest policies and programmes should recognize the importance of natural regeneration, and the importance of secondary forests, when rehabilitating degraded land. Proper management systems should be developed and applied.
- Industrial plantations will continue to expand, especially in the developing world. However, environmental issues should be taken fully into account when planning and managing plantations.
- The clearing of primary forests or other natural habitat to make way for intensively managed plantations should be discouraged strongly.
- Conservation strategies should look beyond the boundaries of protected areas. The creation of biological corridors can make an important contribution by connecting areas devoted to conservation.
- The creation of markets in forest-related environmental services should be promoted and supported by appropriate policies. The promotion of payment for environmental services could help local people to benefit from forests.
- Foresters and other land-use professionals need to broaden their range of skills and think more creatively about land management. The direct involvement of local communities in land-use management is required if conflicting interests are to be reconciled. Good communication skills are therefore essential.

Policy recommendations to integrate forestry with other sectors

- The successful implementation of regional sustainable development depends on good inter-sectoral coordination. Policies for agriculture, forestry, and other land uses should be consistent and mutually supportive.
- Designing and implementing well-coordinated policies requires capacity building and innovative development of new inter-sectoral actors.
- Land-use planning should involve all stakeholders and promote local and regional programmes. The focus should be on diversified land uses and on the interactions between different land uses within the same landscape.
- Planted forests should be seen as elements in the human and natural landscape. Policies need to recognize the interdependencies between planted forests and other landscape elements, and to foster synergies between them.
- Research and development institutions should contribute more effectively to the development of partnerships between different sectors. Consideration should be given to increasing the number of partnership projects at the interface between science and policy.

Policy recommendations to improve the sharing of benefits from forests

- As a general principle, the benefits of rural development and forestry should be more fairly distributed among all members of society. Measures that help the poor and marginalized should be encouraged.
- At present, there is often confusion about land ownership and access to forests. Processes should be implemented

which clearly establish who owns land and who has the right to use it, with particular emphasis on empowering marginalized groups, including women.

- International efforts to restrict the trade in illegal logging and the trade in protected wildlife should be strengthened further. Expanding the area of forest under certification would help to reduce the trade in illegal timber.
- The rights of indigenous people to use their traditional knowledge and exercise their customary laws should be recognised by governments. Policy-makers should consider new ways to ensure that the benefits from forest-related activities are equitably shared.
- To cope with today's demands, foresters and other professionals need to be not only technically proficient, but also well versed in the skills of mediation and capacity development.

Policy recommendations to enhance the governance of forest resources

- Governments should recognise that they have a new role as catalysts in policy networks: as convenors, sources of expertise, and providers of financial support. This role more than compensates for their loss of direct control over forest policy.
- Whatever the outcome of the current international deliberations on forests at the United Nations Forum on Forests (UNFF), national forest programmes (NFPs) or their equivalent will certainly be a core component of any international governance regime. However, careful monitoring and reporting must take place to ensure that the outcomes of NFP processes accomplish substantive and desirable policy changes, and are not merely symbolic.
- Decentralization in developing countries should be pursued when the conditions are right. However, to be effective, decentralization processes must overcome corruption and establish new structures of governance at the local level through participative democracy and self-management.
- International development agencies should provide local governments and communities with training and resources to improve their capacities for coordinated cross-sectoral rural development and sustainable forest management.
- Those involved with forest and development issues should recognize the importance of traditional knowledge. Mechanisms should be created to incorporate this knowledge into policy-making processes. Due respect must be given to intellectual property rights.
- If violent conflict and lawlessness are to be tackled in remote forested areas, governments need to invest in basic social services as well as infrastructure.
- Research and development funding must be maintained if policies relating to natural resource management are to be based on sound scientific evidence and reliable information.
- Consideration should be given to establishing a special expert panel on forests, similar in nature to the IPCC, which could support international forest policy deliberations, provide a quick response to emerging regional or international forest-related issues, and bring these issues to global attention.

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2 Responding to Increasing Social and Economic Demands on Forests

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Abstract: Forests and trees make direct contributions to the subsistence and income of well over a billion people. Many communities and nations enjoy the welfare and amenity services provided by forests, or the income or foreign exchange derived from forests. The global community is turning to forests for mitigation of climate change. The indirect impacts of forested lands are equally important in providing inputs and maintaining productivity in rural activities, especially agriculture. The view of forests is changing with continued population growth, urbanization, changes in values, demands for social and political equality, and increasing demand for environmental services, all adding to the demands on forests. The view is changing also with the movement of forests from public to private sector, of forest industries from North to South, and of timber production from natural forests to plantations. The increasing pressures on forests are balanced between environmental and economic sectors, with the UN Millennium Goals emphasizing reduction of poverty and hunger. Rural development demands adjusting the competing land uses of agriculture and forests and securing the supply of agricultural and forest products with sustainable resource management. The means for sustained development must be ascertained in the short, medium, and long term. Probably the greatest opportunity to meet the demands on forests and trees for people and rural livelihoods as well as the environment is the growing ownership or clear user rights of farmers, the landless, local communities, and forest-dependent people over land and forest resources. Good governance is an essential part of the enabling environment for sustainable forest management to contribute towards development goals.

Keywords: Livelihoods; subsistence; rural development; poverty; forest benefits; employment; small and medium enterprises; land use.

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2.1 The Growing Demands on Forests

Forests provide direct and indirect contributions to global society, to national and local economies, and to the well-being and quality of life of billions of people. These contributions are evident from a transformed way in which we – at present – perceive, manage, conserve, and utilize forest resources. These concepts have shifted sharply since the last three decades of the 20th century. While millions of hectares of forests have been lost, the consumption of forest products has increased considerably. People's perceptions of the value of forests, and the publicised facts of mismanagement, have mobilized public opinion at national and global levels. Public awareness is growing for tackling problems such as the increasing loss of forest area, global warming, loss of biological diversity, and the need for new agricultural land for the increasing human population. These phenomena with their social impacts, in particular for the large number of poor people that depend on these resources for their livelihoods and the urgent need to alleviate their poverty, have been the focus of much debate. Nowadays, forests are no longer considered only as a source of wood and fibres, but rather as complex ecosystems, inextricably linked with human society and other biological systems.

Simultaneously with these shifts of values and perceptions about the role of forests in benefiting

people and nature, there is a growing demand for their sustainable management. That makes it imperative to look at forests from a broader perspective, and to examine their contributions to enhancing the livelihood of rural inhabitants, to upholding and enriching biological diversity, and to providing environmental services. It is also urgent to look for a sensible integration of forestry with other sectors of the economy, to improve the governance of forest resources, and to share, in a more equitable way, the economic benefits provided by forests.

The set of multiple and new demands on forests requires solutions that take into consideration the diverse interests of numerous stakeholders, solve complex development conflicts, maintain nature sustainably, and satisfy the rising demand for goods and services providing welfare for people.

The broad conception of forests and their interdependence with people and the environment demands a wide definition of forestry. In this paper, therefore, the terms "forest" and "forest resources" include natural forests, planted forests, other wooded lands, and trees outside the forest (see glossary for definitions).

Peoples' Dependence on Forests

Rural people around the world, both in developing and developed countries, tend to have diversified livelihood strategies, combining on- and off-farm, agricultural and non-agricultural, and cash and subsistence activities. Non-agricultural activities – including forestry – account for up to 50% of rural employment and household income, even in many developing countries. In the developing world, non-agricultural salaried employment generally is associated with the richest income quintiles in rural areas, with self-employment in the middle, and with agricultural wages in the lowest (World Bank 2004).

It is not easy to measure the exact contribution offered by forest to people. In practical terms, forests and forestry contribute to livelihoods in providing employment, income opportunities, and goods for meeting basic needs. Forests also provide long-term livelihood security, by reducing vulnerability and improving resilience. Forests maintain biological diversity and contain more than half of all terrestrial carbon. Forests provide various spiritual and cultural services enhancing human wellbeing.

The World Bank has estimated that more than 1.6 billion people depend to varying degree on forests for their livelihoods (World Bank 2001), although only about 240 million people live in predominantly forested ecosystems (World Bank 2003). No exact assessment of the extent or rate of dependencies is available. Some rough figures illustrating people's dependency on forests and trees follow:

- as many as 350 million people living in, or next to, dense forests rely on them for subsistence and income
- as many as 1.2 billion people in developing countries use trees on farms or manage remnant forest or degraded lands to generate food and cash in varying degrees
- some 60 million indigenous people living in the rainforests of Latin America, Asia, and Africa are heavily dependent on natural forests for hunting, gathering, and shifting cultivation
- some 60 million people are employed in forestry and wood industries
- more than 2 billion people rely on biomass fuels, mainly fuelwood, for cooking and heating
- many of the world's 3 billion rural people benefit from the indirect inputs and environmental benefits of forests and trees in maintaining biodiversity and land productivity
- many people in the countryside and towns are dependent on the environmental services of forests, like clean water and clean air
- an increasing share of the world's 3 billion urban residents value the forest's welfare services, like recreational functions, and enjoy the environmental services, like clean water and air
- all of global society is affected by forests' role in the global climate system; especially affected are those in areas vulnerable to the effects of climate change. (Modified from Arnold 2002; Scherr et al. 2002; Dubois 2003).

We will argue, at the end of this paper, that the response to many of the increasing demands and challenges confronted by forests could be met through applying the guiding principles of sustainable forest management. In this way, we will follow the changing paradigm and make forests work for the benefit of people and nature.

2.2 Direct Benefits of Forests to the Society

Contributions of Industrial Forestry to the Economy

Forests provide us annually with over 2000 million m^3 of fuelwood and nearly the same quantity of industrial roundwood. In most countries, commercial timber production is the dominant forest use. Industrial forestry provides us, for example, with industrial roundwood harvested globally each year at 0.25 m^3 per person, and with paper and paperboard, of which over 50 kilograms is consumed per person each year. The global production of printing and writing paper today exceeds 16 kilograms per person (Zhu et al. 1998), even with just over 80% of the world adult population being literate.

In the global economy the share of the forestry sector in global Gross Domestic Product declined from about 1.6 to 1.2% between 1990 and 2000 (FAO 2005), mainly as growth in other sectors exceeded forestry's growth. Most of the sector's value added

comes from processing rather than wood production: pulp and paper production alone accounted for nearly half (48.8%) of the global value added. However, in recent years the share of forestry sector in GDP has been increasing in Latin America and the transition countries – partly due to slow growth in other sectors – and remained more or less constant in Africa. Even with extensive forest resources, forestry rarely creates any considerable share of national Gross Domestic Product (GDP) or of economic growth. Yet, for example in Asia, forestry contributes 10% or more to GDP, for example in Bhutan, Solomon Islands, Lao PDR, Papua New Guinea, Indonesia, and Malaysia (Brown and Durst 2003). In Brazil, forestry generates 6.9% of GDP; half of the annual revenues are from production in natural forests and the rest come from the rapidly expanding plantations (May et al. 2003).

Economic viability of the whole forest sector is a prerequisite to managing forests in a sustainable manner and safeguarding the environmental, social, and cultural benefits of forests. Forest-based industries can have high productivity growth, and they have the potential to contribute to the local and national economy directly and indirectly with multiplier effects by providing employment and income in the linking sectors. For example in Brazil, with abolition of fiscal incentives for tree plantations, companies started to develop extension programs to promote tree plantations by farmers. Through these programs companies give seedlings and technical assistance while the farmer provides the land and labour, and the company contracts to buy the wood produced. Employment in large-scale wood production or processing itself is very limited. An example is the world's largest industrial investment of USD 1.1. billion in Uruguay, the pulp factory being constructed in Fray Bentos. The factory will directly employ only 300 persons after the construction phase, with an estimated indirect employment of 8000 in related sectors, including farmers and contractors for timber supply. Yet the impact on Uruguay's GDP has been estimated to be 1.6% (Botnia to build... 2005). Large-scale industries may create new economic opportunities for smaller enterprises, induce savings and investments, and induce technical spillovers and modernization.

Even with extensive forest resources, the path to economic development through forest resources has not been successful – other than in exceptional cases. One success story has been Finland: the forest sector generated about one fifth of total production growth in the 1960s and 1970s, with forest-based foreign trade even today at 25% of total exports (see Box 2.1).

Macroeconomics, Development and Welfare

The trickling down of the benefits of increased production onto development and welfare depends on the structural interlinkages of the economy. The national and especially local economic, institutional, and social structures should be supportive and able to absorb the demands of the industrial sector, both in raw material supply and services and to prevent leakage to outside areas. In order to take full use of the potential multiplier effects, and to involve small-scale producers and attract entrepreneurship, the basic requirements of available human capital and capacity must be met. Human capital, built on basic education and health, is emphatically in the front line in increasing productivity and sustainable use of resources for development. In addition, prerequisites include a supportive investment and business climate, access to capital, and an adequate local infrastructure.

In general, national economic growth is not, as such, sufficient for local development and poverty reduction. Growth-poverty relationship at the regional level is sensitive to the region's degree of income inequality. For sustainable development and welfare, the society should be able to distribute the benefits of economic growth more or less widely, if not equally. That again depends on the prevailing social and economic structures, and the systems of decision making and governance. Unfortunately, in many countries in the tropical world and countries in transition, the social and power structures of the society do not favour equitable distribution of the economic benefits from timber trade.

Table 1. Estimates of global forest-based employment as full-time job equivalents (in millions; data late 1990s; the formal sector estimate excludes employment in establishments with less than 20 employees, government forest services, transport, marketing and trade personnel not employed directly by the forest industry firm; ILO 2001).

Subsector	Formal sector employment	Informal and subsistence employment	Total
Forestry incl. logging	4.7	13.6	18.3
Wood industries	4.6	9.1	13.7
Wooden furniture	3.5	6.9	10.4
Pulp and paper	4.6	na	4.6
Total	17.4	29.6	47.0

BOX 2.1 FINNISH FOREST SECTOR FACING THE FUTURE: A COMMENTARY

Jussi Uusivuori

Finland's path to a modern and stable welfare state cannot be analyzed without recognizing the importance of forests and forest-related industrial activity. The prominent role of forest industries and the whole forest sector in the early industrial development of Finland is widely known and has been documented (e.g. Palo and Uusivuori 1999). Forest resources in Finland took a central role in the poverty reduction of the nation from the late 1800s through a good part of the 1900s. It is safe to say that in many ways the history and current status of the Finnish forest sector represent a success story. They provide an example of how the strategic vision of industrialists combined with shrewd political will can contribute to utilizing a renewable resource and spreading economic benefits throughout the society. There are commentators who claim that the alleged success story has taken place at the cost of the natural environment in Finland. Most likely, however, the majority of environmental experts would agree that the environmental track-record of the Finnish forest sector is, even if far from snow white, at least reasonable, especially when considered in relation to the accrued economic benefits.

What makes the Finnish case interesting is the fact that nowhere else in the developed world has the forest sector gained such an influential role in the national economy and in the entire society (METLA 2004a, 2004b). This leads to two important questions. First, how well or how poorly does the Finnish case provide a model for those countries that own forest resources, and desperately need to strengthen their industrial base to earn foreign currency and to support equitable and sustainable economic development? In answering this question, one would need to analyze the parallels and disparities in time and place between forest resource-rich developing countries of today and the Finnish situation. The second question deals with the future of the forest sector not only in Finland but also in other developed countries with an established forest sector infrastructure. What can be said about possible future developments that the forest sectors in the Nordic countries are going to face? The remainder of this article will deal with this latter question. Many of the prospects that can be sketched for the Finnish case also apply to other countries that are traditionally strong in their forest sectors and have mature forest industries, such as Sweden, Norway, Canada, and the USA.

The Global Context Has Changed

There is little doubt that the main traditional sectors in forest industries, such as the pulp and paper, sawnwood, and wood-working industries, are mature industries. Within these industries, new products and marketing concepts are being produced, but the bulk of the business in these fields is based on old product concepts. The demand for basic forest products, especially in the mechanical industries, is steadily increasing, but in certain products in the paper industries the demand in most developed countries may have taken a downturn (Hetemäki 2005). Mainly because of technological advances in the information and communication sectors, consumers' behaviour patterns are changing. As a result, the positive connection between increasing income levels and increased paper consumption is not as obvious as before. For example, the evidence points to stagnant demand levels for certain paper grades in most affluent countries of the OECD family, while the demand for paper continues to grow in less developed economies. It is important to note that the main markets for the Nordic forest product companies have been in Western European countries, one of the regions that will experience a weaker demand pattern in certain paper products. The fastest growing markets in most paper products as well as woodworking industries are located farther away from the Nordic countries than before, most notably in Asia.

The ownership of the European forest industries has been rapidly restructured in recent years. This has led to fewer but bigger business units, typically owned by companies based in Finland or Sweden. This development has been motivated by a need to form strategic market, financial, and wood resource alliances. The global companies have operations in most continents, and their strategic planning takes place on a global level. The bigger corporate units have globalised the forest sector industry, to a point where traditional concepts such as "Finnish" or "Swedish forest industries" have essentially lost their meaning.

The truly global corporate units are independent of individual states and governments. At the same time, the interests of the global forest product companies and the nation states have begun to diverge from each other more openly than before. This reflects itself for example in the way public opinion and political will in the Nordic countries recognize the values of forests

Social and Economic Benefits from Employment

Employment is a key social benefit of forestry, and sustainable development is inconceivable without decent work and income. The available data is inadequate for reliable global estimates in forest-based employment. As stated by the author, the informal sector estimates are "mere 'guesstimates' in an attempt to get a sense of likely orders of magnitude, with no claim to absolute accuracy" (ILO 2001).

The 47 million full-time job equivalents means that the actual number of persons involved in forestry, wood, and paper industry employment are many more, possibly around 60 million people (World Bank 2001). While there are tens of millions of people employed in the forest sector, the quality of most jobs is rather poor in terms of income, and working and living conditions. Most forest work is unskilled, with significant health risks in logging and sawmills.

Mechanization of forestry operations, and lately new working schemes, have increased labour productivity and dramatically reduced formal sector employment; this has been further intensified by globalisation and relocation of industries. Formal sector employment has been falling in all industrialized countries except the United States. The downturn is expected to continue. As an example, employment in the formal forest industry sector in Europe and the Commonwealth of Independent States (CIS) is estimated to be further reduced by 7% from 2000 to 2010 (Blombäck et al. 2003).

The decline in formal sector employment is compensated by increases in informal sector forestry. The ongoing global trend is from directly and permanently employed workers and small forest-owners to contractors, temporary workers, and the self-employed. Outsourcing of forestry work – to forestry contractors, to individuals or firms – in logging, transport and lately also in silviculture, has become the more common mode of operation. This

in non-industrial use, such as conservation or recreation. The shares of forest resources left for industrial timber production have been tightened because of reformed forest policies, and this development will continue.

As the fastest growing markets will be located farther away from the Nordic countries, and as the wood supply sources of these countries are tightening, the global forest product companies shift their investment emphasis to other regions offering less costly raw materials and labour. The long history of continuously expanding forest industries, driven by scale economies and fuelling increased economic benefits throughout the Nordic societies, is coming to an end. As far as economic growth is concerned, these countries can no longer rely on the growth impetus emanating from the *traditional* forest product industries.

What Can the Governments Do?

This calls for a radical change in the design of policies concerned with furthering the economic use of forest resources in the Nordic countries. An emphasis on quantity needs to shift to an emphasis on quality. In fact, there are signs that changes in public policies have already begun. Finland, for example, is implementing technological and networking programs which strive to promote technological and marketing innovations based on more value-added products within small and medium size woodworking industries, and which are sponsored jointly by public authorities and businesses. Furthermore, regulations governing material use in construction are being revised to be less "discriminatory" against wood.

Using wood for value-added products and in refined construction applications places high requirements for the quality of wood as a raw material and for the entire wood supply chain; these requirements are higher than those which apply when using wood as a fibre source in pulp industries. Public policies can play a role in promoting silvicultural, harvesting, and logistics infrastructures of private forestry that help forest owners produce high quality timber and market the timber to highly specialized end-users.

New biomaterials and substances based on wood and pulp have also been developed within the chemical industries. For example, many "pulp derivatives" can be used for health and food products, and in paint and glue industries. As the commercialization of new products is a risky and lengthy process, it is clear that public funding will have a central role in the research and development process of these materials. At least in the medium term, however, production of these materials will not mitigate the declining wood demand caused by the decrease in the traditional pulp and paper industries in the Nordic countries. In this respect, the increased use of wood as a renewable energy source is more promising. Wood and wood-based fuels already form a high percentage of heat and power production in the Nordic countries; with political pressures from national and international climate policies, and with predicted increases in electricity prices in Finland and Sweden, the competitiveness of wood-based bioenergy will improve considerably.

Participation in sharing the risk of forest sector research and development investments should increasingly be the key role of public policies in Finland and other Nordic countries. But more importantly, public policies will be responsible for designing and implementing education and training, and the related basic research systems that secure the flow of knowledge and skills into the sector. Recognizing the value of education and research institutions as a source for endogenous growth within the forest sector is a natural change in public forest policies. This may be the only way to promote another episode in the success story of Finland's forest sector.

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shift from the formal to the informal sector most often leads to less secure employment, loss of social benefits, further decrease in income, and worse labour conditions.

Sustaining Small and Medium Enterprises

Small-scale forest-products processing and trade is often one of the largest non-farm sectors in the rural economy. In numbers of enterprises the forest sector continues to be dominated by small and medium sized enterprises (SMEs). For example, in the European Union over 90% of firms still have fewer than 20 employees (Hazley 2000). In Brazil as well, the forest and wood products industry is overwhelmingly composed of micro and small enterprises, with well over 80% of firms in harvesting and primary processing, in intermediate wood processing, and in furniture manufacturing having less than 10 employees. By 2000, enterprises with less than 20 employees had become the largest contributors to the increase in employment in Brazil as a whole, although medium and large firms were still responsible for 55% of all jobs offered (May et al. 2003). The social, economic, and environmental impact of SMEs is clearly enormous, although the very small enterprises may not be covered in national statistics.

Rural entrepreneurship is highly encouraged while the overall employment growth is sluggish in many countries, failing to offer enough jobs to match the expansion of the labour force and the reduction of jobs in larger firms. Interest in further processing of forest products is by no means limited to tropical timber exporters. Several Latin American countries, the northwestern states of United States, and the Scandinavian countries strongly promote the employment potential of secondary processing for local development. In the industrialized countries, wood-based entrepreneurship is further supported to increase the use of growing forest resources and to sustain the flow of income from timber sale to small private forest owners.

The Informal Sector

The informal sector is substantial, nearly half of GDP, in many developing countries. In operational terms, the informal sector is officially defined, in most instances, to include enterprises below a certain size of employment, most often below 10 persons. Informal economies are not unregulated, but the norms are mainly set by informal means. Forest-based enterprises were among the three most important branches of the informal sector, accounting for 13 to 35% of all informal sector enterprises and employment in surveyed countries in studies in Africa and Asia (Fisseha 1985; Arnold et al. 1994). Nearly half of these firms used non-wood products, like leaves, gums, resin, bamboo, or cane as their raw material. In these situations, there are local multiplier effects and trade-offs such as between agriculture or tourism and forestry. Interaction is direct, and forestry maintains the small-scale farming and farming landscapes, and supports the interchange of capital from and to agriculture.

Providing Subsistence for People

There is no clear borderline between informal sector small enterprise and supplementary cash attained from forest products. A product in excess supply may be sold for extra income or to meet a specific urgent need of cash. However, self-employed activities and small-scale enterprising generally require greater skills and capital than do bare subsistence activities.

By far, the largest numbers of rural households that use forest products consume them directly. This is particularly important in developing countries with regard to fuelwood, wild foods, and medicinal plants, although rural households also use forest products extensively for construction materials, furniture, and utensils. Markets exist for many of these products, even regional markets, e.g. for fuelwood and construction materials.

Cash to Supplement Family Incomes

Detailed studies in many parts of the world have shown that large portions of the rural population earn between ten and thirty percent of their total cash incomes from varied environmental resources (Arnold and Townson 1998; Monela et al. 2000; World Bank 2002). In a meta-analysis of 54 case studies, the majority of which were in Africa, the forest "environmental income" was about 22% of household incomes, half of that in cash (Vedeld et al. 2004).

The scale of supplementary forest activities varies with ownership and user-rights. A vast majority of the world's rural population live in non-forested environments or where forests are degraded or not accessible. Planted trees on farms and public land increasingly provide both employment and income. Numerous case studies have documented the growth of trees on farms near urban markets and wood-processing enterprises in Africa, Asia, and Central America, and also the importance of trees on farms as a source of forest products in countries with little remaining natural forest (Temu et al. 2000; Arnold et al. 2003).

Most of the income supplementing activities require a lot of labour and little capital or technical skills. Many studies have shown that poorer families obtain a larger portion of their total income from forest-based activities, although more wealthy families, assumedly with more capital, may earn more from these activities in absolute terms (Pérez et al. 1999; Arnold 2001; Nabangoa and Gombya-Sembajjwe 2001; Baikuntha 2002). This probably reflects in part the fact that many forest-based activities, both timber and non-timber, provide low returns to labour, and the people who engage in them tend to have few other alternatives.

A decreasing share of world forests is public, with free access. For example, the market demand for nuts, mushrooms, and berries has been so high in many Southern European countries that in Italy almost all regional administrators have introduced property right regulations to control the free-access collection of these products (Colpi et al. 1999).

Forests for Energy

Fuelwood can well be considered the most important subsistence use of forest products. Fuelwood contributes to a significant portion of total energy consumption, particularly in Africa and in South and Southeast Asia. For example, in Asia fuelwood consumption, as a percentage of total energy use, exceeds 75% in Lao PDR, Bhutan, Cambodia, and Myanmar (Brown and Durst 2003). The annual consumption per household can range from ten tons per household, as in Western Sichuan mountains in China (World Bank 2002), down to about 0.88 m^3 per person in North Africa (AfDB/EC/FAO 2003).

Shortages of fuelwood for subsistence users are becoming more pronounced, particularly for the landless and those with little land. Especially in Africa, formal and informal privatization of land holdings is reducing the areas available as common pool resources. The contribution of fuelwood collection to forest degradation is much debated. In the 1970s and 1980s, collection of wood for fuelwood or charcoal production was thought to lead to massive deforestation. Extensive research in Asia suggests that only about one-third of fuelwood comes from proper forests (Whiteman et al. 1999). The view held by many now is that biomass fuel collection is one among several contributors to forest degradation, but in specific locations only, for example near cities and major roads.

Matti Nummelin

Fuelwood is the most important energy source in developing countries, particularly in Africa and in South and Southeast Asia.

The developed – as well as a few developing – countries are looking for alternative new biomass sources of renewable energy, mainly to meet the CO_2 emission reductions of the Kyoto Protocol. Also high oil prices encourage forest energy use. Simultaneously there are political objectives to support rural employment and to create additional timber markets for forest owners. However, forest energy harvesting on an industrial scale occurs in only a few regions, where a developed forest sector, consisting of large-scale forestry operations and a forest industry, is combined with a large market for forest fuel (Richardson et al. 2002). In some developed countries, like Scotland and England, there are signs that the extraction of wood for energy use will increase the total pressure on forest resources.

Forests Providing Food and Medicines

Wildlife from forested areas provide a portion of the protein and fat in the diets of many rural families in many parts of the world. In at least 62 countries, bush meat and fish contribute more than 20% of the protein in rural diets (Bennett and Robinson 2000).

Wild fruits, berries, roots and tubers, palm hearts, nuts, and mushrooms constituted a regular part of the diet in many of the less developed parts of Africa and Asia's rural tropics a decade ago, and probably still do (FAO 1991; Scoones et al. 1992). Normally these are not families' main source of protein or calories, but they provide essential minerals and vitamins and complement the diet in other important ways. Wild plants and animals are especially crucial to poor rural households in times of hardship. These may be recurrent situations, such as the "hungry" seasons between crops, or they may be crises such as droughts, economic downturns, and violent conflicts. During such periods, forest foods often become the households' main sources of sustenance and their most important safety nets (Kaimowitz 2002). Recently, a global alliance on non-wood forest products has been proposed by several international organizations to promote the realization of the potential of NWFPs in alleviating poverty, ensuring food security and sustaining forest biological diversity (Non-wood NEWS 2005).

In the early 1980s, the World Health Organization estimated that 80% of the developing world's population met their primary health care needs through traditional medicine, based largely on medicinal plants. A large but unknown portion of those comes from forests. Some one billion Chinese people and 800 million people in South Asia relied principally on plant-based medicines in the early 1990s (Srivastava et al. 1996). Around the same time, Cunningham (1995) estimated that 70–80% of all Africans relied on such traditional health care systems.

BOX 2.2 Poverty and Human Well-Being

Heidi Vanhanen

Poverty is a multifaceted phenomenon, either chronic or transitory for individuals and households, and changing its face over time. Poverty touches on many aspects of the human condition, from economic and social to environmental, cultural, and political. Hence, poverty can be defined, and is manifested, in terms of consumption, nutrition, income or decent employment, human dignity, access to health or educational services, access to resources, or access to power and decision-making. There is no universally accepted concept of poverty that can be applied to any situation in any country. Nevertheless, it is generally agreed that the absolute measurement of USD 1 a day for extreme poverty is useful to evaluate how economic and social development affects people in poorer countries.

Worldwide 1.1 billion people live in "consumption" poverty (in 2000; consuming less than USD 1 per day; World Bank 2003) and 840 million people are undernourished (FAO 2002). Nearly half of Sub-Saharan population is "dollar poor", as are also about 30% of Southern Asians, 17% of Eastern Asians, and about 10% each in South-Eastern Asia and in Latin America and the Caribbean (in 2001; United Nations 2004).

Food insecurity is one of the obvious causes and consequences of poverty. Poverty is primarily, though not exclusively, a rural and agrarian phenomenon. Three quarters of the world's extremely poor, about 900 million people, live in rural areas (IFAD 2001). In Africa, rural poverty accounts for even more, namely 83% of the total extreme poverty (IFAD 2002a).

Land ownership or control is the key determinant of poverty. Wage labourers, especially the landless or casually employed farm-workers and marginal farmers and tenants, women, indigenous people, and scheduled castes are the major sub-groups of rural poor in Asia (IFAD 2002b); in Africa smallholders are the largest group.

Almost everywhere, the incidence and severity of rural poverty exceeds urban poverty. Even where poverty and hunger have fallen, the rural-urban poverty gap has not declined. By and large, large rural populations tend to be associated with higher poverty and the majority of the rural poor are concentrated in densely populated areas. Further, many poor live in marginal and degraded areas. For example, 40% of Asia's rural poor live in marginal, degraded, and arid areas (IFAD 2002b), with high vulnerability and intense poverty.

Overall, agricultural growth is critical for rural development and poverty reduction. As agricultural growth is necessarily driven – at least in some measure – by increased labour and land productivity, this growth only indirectly affects the landless rural poor through agricultural prices, while decreasing their employment opportunities even further. For landless and small-scale farmers, rural development with livelihood diversification, increased non-farm activities, and off-farm employment opportunities, is one of the few remaining alternatives, with the concurrent necessity to secure access to forests and wooded lands for household subsistence needs.

The different dependencies of the poor on forests, wooded lands, and tree resources denote different potentials, options, and limitations for well-being and poverty mitigation. In both high and low forest cover areas, forest and farm tree resources are the principal assets of the rural population, and the most proximate opportunity for rural development and poverty alleviation.

Improving productivity and sustainable management of land and forests – and of trees – adds to the assets of the rural population. In order to make full use of the development potential, however, the rural poor need to be enabled to take advantage of these opportunities. Incentive for land management and tree planting is possible only through clear tenure and user rights. Empowerment and human capital assets in the form of education and good health, entrepreneurial and technical skills, adequate infrastructure for small-scale enterprising, and good governance are likely to be more critical in sustainable rural development than even extensive local forest and tree resources.

Nevertheless, the contribution of forests – in the end – may be more essential and clear in long-term human welfare than in the absolute income increase of USD 1 per day. Forests and trees are part of rural economic, environmental, and social sustainability, and of safety nets. Beyond the everyday means, forests provide essential life-supporting medium and long-term indirect benefits, to people and to agriculture, through their diverse environmental services enhancing land productivity: soil conservation and fertility.

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2.3 Indirect Contribution to Rural Livelihoods and Quality of Life

Forests and trees provide environmental services that directly and indirectly benefit both rural and urban areas in a more complex way, such as for soil fertility, crop protection, and water quantity and quality, all contributing to land productivity and overall sustainability. As to carbon sequestration, which helps to prevent global warming, forests indirectly benefit especially the rural poor, since they are one of the groups that climate change is likely to affect most negatively. Yet, each year forest is lost to agriculture; most forest loss, especially in Latin America and Asia is caused by conversion to large-scale permanent agriculture, including livestock.

Indirect Contribution to Agriculture

Agriculture occupies more than one third of the land area in most countries of the world. Well over one

half of the economically active population in most of the developing world is active in agriculture. Each year farmers permanently convert several million hectares of forest to agriculture and in the process benefit from the nutrients, soil structure, and weed, pest, and disease control inherited from the forest and woodlands they replace. The benefits, however, are sometimes rather short-term.

Forests, wooded lands, trees, and the various farming activities work in close symbiosis. Biological diversity is fundamental to agriculture, both for productivity and for adaptation. Forested ecosystems provide soil nutrients and forage for crops and livestock in and near agricultural areas. Forests and trees also help to reduce soil erosion and runoff, provide shade, and protect crops from the wind. Conserving forests that are already in the landscape also reduces the risk of changing stream flow patterns or negatively affecting ground-water recharge. These contributions often make a critical difference for poor farmers working in marginal environments, since most cannot afford to buy fertilizer and other inputs or to feed their cattle from other sources.

On small farms soil fertility and water management are the main issues. Besides everyday subsistence needs, forests and trees provide these medium and long-term indirect benefits for productivity and sustainability essential to rural development and to reducing poverty and hunger (see Box 2.2).

Securing adequate food production is most often a national priority. In China shelterbelt afforestation by public funds in degraded agricultural areas covered over 7 million hectares in 2003, nearly 80% of all afforested area (State Forestry Administration 2004). In China's northern plains, large scale planting of intercrops and shelterbelts may have raised agricultural productivity by 10% (Yin and Hyde 2000).

Contributions to Other Economic Sectors

An expanding area of potential large-scale activity is nature-tourism, which has been promoted with diverse results in many countries. Wildlife-based tourism in forests, savannahs, and other wooded lands plays a key role in the national economies of several eastern and southern African countries and is expanding in Asia. Kenya and Tanzania received an estimated USD 502 million and USD 360 million respectively from international tourism in 2002, and some 480 000 people worked in the Kenyan tourism industry (FAO 2002).

Often nature-tourism is combined with conservation, for example in national parks. Conservation may have one of the key roles in preserving biodiversity. The general feeling is, however, that ecotourism has not yet generated sufficient direct revenues to local government, nor to local communities. The current protected areas and buffer zone management have not provided significant development opportunities to local communities and other stakeholders. In addition, there are many overlapping and conflicting claims to lands within protected areas, due to unclear borders and weak commitment of the stakeholders to biodiversity conservation efforts.

The scenic and aesthetic values of forested areas in all parts of the globe have attracted tourists and visitors from early times. With increased incomes, holiday cottages and even second homes mostly in forested areas are becoming more common – as one alternative to other outdoor recreation – in parts of Europe and North America. In the United States the various forms of recreation have been estimated as the economically most important use of national forests (Committee of Scientists 1999). Also holiday makers support many basic rural commercial services in some popular resort and holiday cottage communities, thus maintaining the services for the resident rural population.

Contribution to the Quality of Life

Nature, including forests and wooded areas, is often part of human welfare, and human lives are often enhanced in many ways by nature resource-related experiences. However, one should not be overly romantic about this aspect. Many people have negative impressions of forests and see them as dangerous and unhealthy places (Kaimowitz 2002).

Nature experiences are tied to the cultural surroundings and traditions, and these values are often intrinsic to one local ethnic group. Many people obtain great cultural and spiritual benefits from sacred forests and sacred groves, found in parts of Africa, Asia, and Latin America. The sacred forests are of cultural, religious, and sometimes economic importance to the people, and are often protected by local communities with either closed or open access. The remaining sacred forests are further valued for their great biodiversity which was possibly protected zealously for centuries. However, sacred forests are threatened by expanding cultivation and overexploitation of forest resources, infrastructure construction, and in recent times also by the increased disregard for their traditional institution.

Another aspect of the human welfare value of forests, possibly comparable to the spiritual and cultural values, is the recreational benefit from forests and forested landscapes. Recreational benefits are complex and multidimensional, depending on the kind of activity and environment, and whether immediate or long-term effects are weighted. With an increased percentage of urban population, expanding urban areas, and increasing incomes and leisure time, the value and importance of recreational areas is constantly increasing, even in the developing world. In addition, in urban areas the green patches of forests and vegetation have been well received.

BOX 2.3 GLOBAL TRENDS IN LAND USE

Heidi Vanhanen

Virtually all of world population growth between 2003 and 2030, 2 billion persons, is projected to occur in developing countries, and in urban areas, through migration and as rural settlements grow into urban settlements. Land use for urban and infrastructure development will grow rapidly with the heavy urban growth, often overtaking the agricultural productive land. The urban pressures extend well outside the urban limits. The borders between urban and rural are transient, especially as about half of world urban population will continue to live in urban settlements of fewer than 500 000 inhabitants (United Nations 2004).

Even with major ambiguities and variations in definitions and meaning of "cities", "urban" and "rural", rural areas are becoming increasingly differentiated, due to dynamics arising from changing demands on rural production and consumption relations. The relationship between decreasing rural population and increased demand on productivity is not straightforward. Some rural areas become more marginalised, some areas are influenced by city dwellers' values and become more "urbanised". Few areas will be able to maintain their rural prosperous life.

How to feed the 2 billion more persons on the globe in 2030?

With the slowdown in world population growth rate and hence in the growth of demand of food, the expansion of farm land for food production will be slower than in the past. However, an extra one billion ton of cereals will be needed each year by 2030 (World agriculture: towards... 2003), mainly consumed by the additional two billion urban dwellers, and in the developing countries. This extra food crop will presumably be produced by commercial agriculture, capable to manage the logistics for urban supply.

To meet the demand, developing countries will need an additional 120 million hectares for crops in the next 25–30 years. In most developing regions almost all suitable land is already in use. Virtually the only source of production increase could be by intensification through improved management and technologies. Is that possible? No more new irrigated land is available and the main challenge even this far has been to maintain the current yields. Thus, a considerable part of extra land needed will come from forest clearance (World agriculture: towards... 2003). The 120 million hectares is equivalent to 3% of the world forests or 6% of forests of the developing countries.

Today, agriculture and the forest sector are more inextricably linked than ever before in the dynamic processes, where required outputs, means of achieving them, and values may change over time. Both face similar challenges in coping with poverty and in securing production of basic needs: food, fodder, and various forest products. On one hand, land use must balance between local (rural) and regional (urban) needs. On the other hand, the challenge is to manage land – sustainably – for food security and energy supply, for tree resources for consumption and processing, and also for safeguarding the environmental services and biodiversity provided by the different land uses. Land-use planning and forest planning cannot be separated. The trend is clearly towards more integrated land uses including intercropping, agroforestry, and tree cultivation for wood and other products on farms and outside forests.

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2.4 Threats and Opportunities in Responding to the Demands

The contribution of forests to the people and their economic and social life changes over time. Some global trends threaten these contributions. Others represent positive opportunities. Forest loss and degradation, poor market access and competition, poor governance, and social inequality seem to be the main threats. The overall growing demand for forest products and the expanding urban markets provide opportunities. Further opportunities come from policies favourable to local communities, allowing for sharing the benefits from forests and trees.

Deforestation and Degradation

A vast majority of rural people live in non-forested environments or where forests are degraded. Deforestation – a permanent land use change – along with forest degradation – impoverishment of the structure and composition of forest – resulting from clearing land for agricultural cultivations, over-harvesting of forests, poor logging techniques, fires, and overgrazing have reduced the potential resource base and negatively affected many rural households and enterprises.

Rehabilitation and restoration of degraded lands and secondary forests is as pressing a task as curbing deforestation in improving livelihoods. Deforestation does not imply only the reduction of potentially productive forest resources, but also the loss of valuable wild species of flora and fauna. In addition, basic environmental services are seriously affected, and this matters to all people in all places. The area of net annual deforestation remains at an alarmingly high level in tropical forests – over 14 million hectares a year. Some may have benefited from forest clearing in the short term. However, in the medium and long term all individuals and the society as a whole have lost important economic, social, and environmental assets.

Since exchange rates and trade policies have great influence on agricultural and forest sector prices, they often have large impacts on forest clearing. Where deforestation and degradation continues, the changes in relative prices of agricultural products are a key aspect, since some agricultural systems use

Matti Nummelin

Rehabilitation and restoration of degraded lands and secondary forests is needed for improving livelihoods and restoring environmental services. Small-scale nurseries can also contribute to livelihoods through small-scale business and employment.

land more intensely than others. Thus, for example, even though higher agricultural prices – market or subsidized prices – usually favour deforestation, higher tree crop prices, with access to markets, may reduce forest clearing by inducing farmers to grow those crops.

Expanding Views to Forested Landscapes

When approaching forests from the perspective of benefits of people and environment, there is a clear call to view forests to include all resources that can produce forest products. This is a challenge equally to foresters and to agriculturalists, as the borderline between the sectors and sectoral land use overlaps. Forested landscapes comprise "other wooded land", and equally trees on farms and outside forests, as well as closed and open forests.

"Other wooded land", scrubs, and trees in non-agricultural areas, as defined in the Forest Resource Assessment (FAO 2001), expand the global wooded area base by one third. "Other wooded land" covers 10% of the total world land area in addition to the global forest cover of 30%. Wooded lands and trees outside of forests are not only important locally but often have national and global relevance in the supply of forest products and services. Wooded lands are an essential part of timber and non-timber resources, especially in Africa. There forest covers 22%, only 0.85 ha per person. Further, most of Africa's population lives in savannas, not in forests. In Africa other wooded land covers 13% of land area, including the miombo of central, southern, and eastern Africa, heavily used for subsistence and small-scale entrepreneurship. In Oceania, forests and other wooded land cover 23% and 50% of land respectively.

Trees outside the forests, in agricultural areas, are a resource about which little is known. They are an important source of wood supply in many South Asian countries, which have relatively limited forest resources. For example, India is the world's third largest producer of roundwood, much of which is believed to come from outside of forests. Trees outside forests are estimated to supply about 60% of Bangladesh's wood needs (Whiteman et al. 1999).

The projected rapid growth in demand for crops in the early 21st century, mainly due to continued population growth in developing countries, requires intensification of food production and increasing agricultural productivity – and logistics for distribution. Possibilities to expand agricultural area are often restricted due to degradation of lands, salination, desertification, and erosion. To meet the near-future needs, the intensification of production systems – including the necessary intensification of land use – is urgently needed, especially at the level of small producers. With less new agricultural land

available and with expanding closed access areas, after the failure of technologically driven approaches to small holder development, and the inability of most farmers to secure the necessary input, there are not many alternatives open for intensification except through a more holistic systems approach. The integrated production systems involve the horizontal and vertical integration of crops, livestock, trees, and even aquaculture. Integrated systems and agroforestry are not a new idea; various systems have been used since early times.

Market Opportunities and Constraints

An increasing share of industrial raw material is produced in planted forests. Prices for standard timber and some major forest products will be increasingly determined globally. Some part of consumers' demand for wood from natural or semi-natural forests may be reduced, if not acceptably certified for sustainable production. The income from sale of timber from private forests in industrialized countries may well be reduced, partly through changing values of both buyers and sellers, and for some timber qualities possibly through price competition with plantation wood.

The demand for value added forest products is growing, especially in developing regions, and an increasing share of demand is met regionally. Also the demand for construction timber will continue to grow with population growth and urbanization, especially in the developing world. Urban expansion and higher incomes also encourage production of furniture and housing materials.

In the medium term, the demand of wood fuel is expected to increase approximately at the same rate as demand for industrial timber, by 25% up to 2010 (Whiteman et al. 1999). With increased incomes, moving up the energy ladder into more "modern" household energy sources is not at all automatic, even with an alternative available as in urban areas (Heltberg 2004). Fuelwood and charcoal are also extensively used in traditional industries such as bakeries, brick-making, fish-smoking, tobacco curing, beer brewing, blacksmithing, and other cottage industries (Cambell 1996) – with equal slowness to change. Growing fuelwood on plantations has not usually been considered commercially viable; however, in some peri-urban areas of Ethiopia, Kenya, Tanzania and other countries the rapid expansion in the markets for charcoal and fuelwood has made it economically attractive for farmers to plant trees to produce fuelwood in places where only a few years ago that would have not been profitable (Arnold et al. 2003).

Some markets for non-timber forest products have become saturated, or are being replaced by cheaper and higher quality products. Many NWFPs with greater economic value are now domesticated and grown in more intensive production systems on farms. Many NWFPs previously extracted from natural forests compete with synthetics (Arnold and Townson 1998; Neumann and Hirsch 2000). Simultaneously, since many NWFPs are inferior goods, declining per capita incomes as have characterized much of Sub-Saharan Africa may actually increase demand, particularly in contexts of rapid urbanization (Kaimowitz, personal communication 2005).

Providing Production and Business Services

Small farmers and local communities are well positioned to take advantage of some promising markets for forest products, and also later possibly for environmental services. The importance of small-scale, even non-regular, producers of timber and non-timber products will be increasingly vital with increased local and regional demand. The competitive advantages of local producers, however, are location specific and depend on local conditions and market environment.

Small size enterprises can offer higher returns, although generally only to people with skills and resources. Productivity lays the base for adequate returns for any type of business. Small-scale forestry producers and manufacturers need help in improving their technical skills and the quality of their products, as well as financial services, and management and marketing training. These services should reach farmers, the landless, and those already in the business. Catching the market opportunities requires access to basic infrastructure, including access to communications. Updated market information, including prices, strengthen their negotiating powers, and also may impact their short-term production choices. However, incentives for longer-term investments in timber production are created only through clear national policies. Cooperation and value adding chains from sustainable rawmaterial supply to final product marketing often enhance the full utilization of small-scale producers' potential. As much as possible these approaches should build on spontaneous farmer adaptations and innovations. Often, it can be the villagers themselves who generate and disseminate most of the information, with professionals and technical staff simply facilitating the process (Kaimowitz 2003).

Employment for Development

In the next 10 years, over one billion young people, currently between the ages of 5 and 15, will enter the working-age population, mostly in rural areas in developing countries. Many of them will have no other option available but to migrate to towns, seeking employment. Rural non-farm opportunities must be created, to prevent the lurking social unrest and large national and international migration.

Forests and trees provide some options for a source of employment and income both in timber and non-timber production and in small-scale enterprising – also when integrated with other land uses, like agriculture. However, conditions, means, and alternatives available are very different in forested and non-forested localities.

The role of forestry is somewhat contradictory as a basis for rural employment. On one hand owners of small, private forests often derive a significant share of their income from their forests and trees, which can be a major complement to farming or off-farm income. Complementarity cannot be taken for granted, however. Where industrial, large-scale forestry competes with agriculture for land, increases in forest cover typically lead to substantial losses of employment (Poschen 1997; ILO 2001). There are a few exceptions, e.g. Uruguay, where forest plantations replaced extensive cattle rearing and degraded pastures. Moreover, many of the jobs offered are seasonal and short-term, and go to outsiders rather than locally available workers.

The expected further decline in formal sector employment in most producer countries will continue to reduce the visibility of the forest sector and its direct benefits to the society. The picture is brighter in those few developing countries that are not facing forest resource shortages. Several countries in Asia and Latin America have benefited from increased direct investments and expanding export markets. Employment there has increased – rapidly in some cases – and should continue to do so in the medium term (Blombäck and Poschen 2003). Yet, these are the exceptions.

2.5 Towards More Fair National and Global Institutions

Increased contracted work and outsourcing opens up more alternatives for small-scale operators, mainly in the informal sector, although in tight competition. Involvement in the extensive and strongly growing informal economy may pose some challenges. As many as 4 billion people, two-thirds of the world's population, live largely outside formal legal systems (ILO 2003), mainly in the developing and transition economies. The most fundamental safeguards, such as respect for contracts and recognition of title to property, are often not available in the informal sector to wage workers, the self-employed, or small businesses. The absence of appropriate frameworks for governance in the SME sector and labour markets creates an environment of insecurity, hindering the accumulation of physical, financial, human, and social capital. Thus, the entrepreneurial and productive potential of the labour force are partially untapped, acting as a brake on growth and as a source of increasing social tensions.

Globalisation and the South-North Balance

Globalisation is the process by which private individuals, companies, social institutions, and governments became increasingly interconnected. The accelerated progress of innovations in information technology – particularly in computing, robotics, and telecommunications – has been an important driving force of this process. As compared to other industries, forest sector was a late starter in international merges and acquisitions, but foreign direct investments have quickly transformed especially the pulp and paper industry into one dominated by large multinationals (see Box 2.4).

Several features characterise the process of globalisation: the emergence of large transnational corporations, rapid capital flow, huge speculative capital transactions, liberalisation of commerce, concentration of research and scientific and technological innovations in developed countries, and transference of raw material production and products of massive consumption in developed countries and many others. The pros and cons of the process is a theme of heated and vehement debates and social unrest. However, globalisation is a fact in a world of increasing inequalities. The impact of globalisation is to a large extent conditioned by the reactions of governments and firms. It is probably unfair to blame globalisation alone for the gap between the rich and the poor or between nations, but neither has the process contributed to halting or alleviating the increasing social disparities.

The main reason that globalisation has failed to benefit the poor is the social inequalities prevailing in the contemporary society. In the present circumstances, the poor obtain less benefit from economic growth. The positive forces that could be mobilized by globalisation should be under social control and national and international regulations. Given political will for the target of promoting a regulated globalisation, it is quite possible to benefit the whole society by increasing trade, investments, employment opportunities, scientific and technological progress, and social welfare.

At the present, the weight of industrial timber production is moving from the North to the South and from west to east, mainly supported by foreign direct investments. The future of industrial forestry will depend on the future structure and volume of demand. Pulp and paper industries are overwhelmingly shifting in the direction of greater vertical and horizontal integration. However, over the past decades, even small and medium-sized firms have increasingly been internationalised. With improved communications and access to markets, and with more specialized products, more possibilities are open for medium-sized and small producers of raw materials as well as small-scale processing and manufacturers. For small producers' cooperation, networking activities and alliances assist entering the markets.

BOX 2.4 Profitability of Multinational Forest Industry Companies and the Location of Production

Susanna Laaksonen-Craig and Anne Toppinen

The role of multinational companies (MNC) in the globalization of forest industry has increased significantly in the past decade. This is reflected clearly in the number of cross-border mergers and acquisitions (M&A) and through the sharp increase of foreign direct investments (FDI). For example, FDI by the US forest industry increased from USD 5 billion in the beginning of the 1980s to USD 19 billion by 2001 (BEA 2002). As compared to other industries, the forest sector has not been a forerunner in cross-borders M&As, but these developments are quickly transforming especially the pulp and paper industry from a highly fragmented industry into one dominated by large multinationals.

This increasing foreign production must also be seen as a part of companies' expansion and growth process (Pfaffermayr 2004). The increasing size of forest industry companies, especially in North America and Scandinavia, has been evident since the 1990s. For example, in 1996 the net sales of the 10 largest companies were 40% of net sales of the 100 largest companies, whereas in 2002 the figure was 47% (PWC 1997–2003). Of the top 100 forest industry companies, the largest by turnover in 2002 were four North American companies: International Paper, Georgia-Pacific, Weyerhauser, and Kimberly-Clark. The four largest Scandinavian firms, Stora Enso, UPM Kymmene, SCA, and M-Real, ranked 5th, 7th, 10th and 11th. In the increasingly global and consolidated forest products industry the role of individual companies has strengthened, making it more difficult to make any comparative analysis between different producer countries.

Structural Drivers of Globalisation

Structural drivers of the globalisation, i.e. worldwide convergence of markets, scale economies, and optimisation of country specific costs, including exchange rates, labour, raw materials, trade, and other government policies, increase global competition (e.g. Johnson and Scholes 2002). The same issues also drive globalisation in the forest industry. This is partially connected to consolidation in the industry, as the companies are seeking for economies of scale in order to increase their competitiveness, especially in the face of pressure from new low-cost producers in Asia and South-America.

Companies are also attempting to increase their regional market shares in order to gain more market power, as local production and market presence are increasingly important when targeting large customers that are often multinationals themselves. Exchange rates have significant effect on forest companies' profitability, and global production helps to alleviate the uncertainty related to exchange rates. A desire to ensure the quality and efficiency of raw materials, such as roundwood or wastepaper, has also motivated forest industry companies to produce globally.

Linkage between Location and Profitability of Multinationals

Firms' key strategic factors include diversification in product and market, firm size, research and development (R&D), and capital intensity, which eventually influence the export activity and economic performance of companies (e.g. Lee and Habte-Giorgis 2004). North American and Scandinavian forest industry companies have chosen different location strategies. Traditionally North American companies have been able to rely more on domestic consumer markets, while due to their smaller domestic population and consumption Scandinavian companies have always been highly dependent on international markets. These early market strategies have also been reflected in the globalization processes of these companies. For example, production capacity of the world's largest forest industry company, International Paper, is well over 70% in North America, while only 40% of paper production of Finnish forest industry companies is in Finland. However even among the Scandinavian companies, some of them, like M-Real, are highly dependent on the production capacity in Western Europe, while others like Norske Skog, SCA, or Stora-Enso have a more global location base. Genuinely global forest industry companies, with significant shares of production capacity on more than two continents, are still a rarity.

Previous research has shown that the degree of international diversification is positively related to production efficiency (e.g. Baek 2004). Internationalisation strategies are also likely to have impact on forest industry companies' economic performance, but the relationship between performance and location strategy is not well known. In order to analyse this linkage we compared the economic performance, measured by return on capital employed (ROCE), of multinational forest industry companies headquartered in Scandinavia and in North America. Specifically, the mean ROCE value of the ten largest companies in Scandinavia was compared to that calculated for the ten largest North American companies, using data by Price Waterhouse Coopers (PWC, various years). Although our sample is rather small and the number of companies is limited, these results should be indicative of the period most relevant for globalisation of forest industries.

As shown in Figure A, the average performance of multinational forest industry companies has fluctuated strongly between 1996 and 2002. Historical record highs in terms of product prices and industry profits were reached in 2000. At the individual company level, the return on capital employed (ROCE) of the twenty companies in North America and in Scandinavian countries has varied even more strongly, between 1% and 19% annually. According to average ROCE of twenty companies, firms in Scandinavia have on average performed slightly better than their competitors in North America during this period. Interestingly, Siitonen (2003) found that profitability of globalising North American companies outperformed European companies, based on data from 1990 to 1998. She also noted that North American companies are nevertheless better valued in stock exchanges than their competitors in Europe, where investors do not apparently put a premium on companies with a more global size.

Investigating the main reasons behind performance differences of companies goes beyond this article, but obviously the general economic developments affecting demand, prices, and exchange rates reflect the performance fluctuations. First, depending on the company's product mix, the highly volatile forest product prices could have had a significant impact on companies' performance figures. For example, the largest Scandinavian companies have a relatively high share of international trade in printing and writing papers, where long term demand prospects have been better than in other forest and wood product segments. In future research, the role of product mix on company performance should therefore be clarified. Second, there are other structural differences between Scandinavian and North American companies, e.g. in terms of company ownership structure or vertical integration to forestry (e.g. Sande 2001), that could have impact on economic performance.

Future Challenges for Globalising Forest Industries

The challenges that even the large multinational forest industry companies face are diverse and conflicting in today's global business environment. Traditionally, the conflicting pressures have originated from consumers, and particularly from the environmental movement, which has put heavy emphasis on sustainability issues (for a recent review, see Lehtinen et al. 2004). Today's environmental issues are related to, e.g., questions regarding illegal logging, or ensuring the sustainability of plantation forestry.

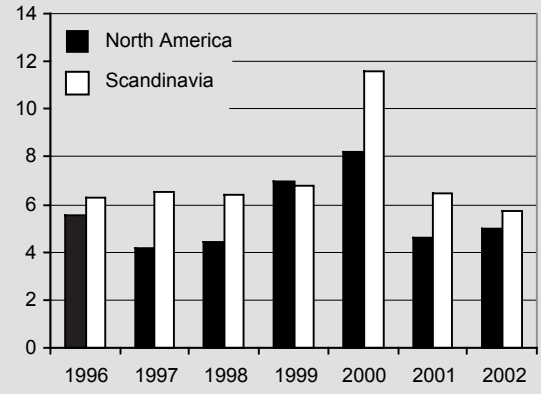

Figure A. Annual average return on capital employed of top 20 forest industry companies in North America and Scandinavia, 1996–2002 (PWC 1997–2003)

There has been an important paradigm shift in the forest industry outside North America, placing increasingly more emphasis on shareholder values. Today, investors and stock markets clearly value short-term performance, which is leading to streamlining of operations and cutting down smaller and less profitable production units. This phenomenon has a severe negative impact on the job opportunities and local livelihoods of rural communities in forestry dependent areas, and it has raised questions regarding corporate social responsibility. Emphasis on short-term profits is also likely to weaken the role of long-term business strategies and make the company and the product image more vulnerable.

Saturating traditional forest products markets in North America and Europe will put pressure on firms located mainly in these regions to diversify their location strategy in the future. Simultaneously, the large economies of Russia and especially China, where growth in demand for forest industry products is the highest, are opening up. Therefore, the critical issue is whether the core of future investments will go into these quickly growing markets, or whether plantation forests in the South will capture the industry. In the Scandinavian forest industry, both of these trends are currently evident. Pulp industry investments are being planned in South America with backward integration to ensure the roundwood supply, while at the same time the Scandinavian sawmilling industry is actively investing in Northwest Russia. All in all, in the future we are likely to witness more geographical diversification as well as more focussed product strategies due to streamlining. However, national and international competition authorities, especially the European Union, monitor the use of market power and its possible increase through the M&As of globalising companies. This could slow industry consolidation development, e.g., between Scandinavian companies within Europe, where the market share of these companies in certain printing and writing papers has already risen to substantially high levels.

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From Ungovernability to Governance

Good governance is an essential part of the enabling environment if sustainable forest management is to contribute towards development goals. Governance problems, including violent conflict in forested regions, can have widespread consequences, negatively affecting urban and rural people well beyond the forested regions. Often widespread corruption associated with the forestry sector has undermined corporate governance and limited investors' confidence. Good governance is essentially important for foreign investors.

Land Tenure, Access and Local Rights

Existing patterns of land ownership, access rights, and tenure have a strong influence on who benefits from forests – and who loses out. However, there is no such thing as right or wrong ownership or tenure. Probably the greatest opportunity for increasing the contribution of forests to people and rural livelihoods is the growing ownership and control of farmers, local communities, and indigenous people over forest resources. That can help ensure local people do not lose access to resources on which they depend to wealthier or more powerful outside groups. Still, the values of the different stakeholders may be contradictory. Even where ownership has been well established, as in private forestry in Europe, the societal demands on the biodiversity values of the forests and the economic benefits of owners may conflict.

Through the processes of forest reforms, local communities and indigenous people now own 14% of all forests in developing countries and have more or less permanent formal usufruct rights over an additional 8% (White and Martin 2002). In recent years, Latin American governments have recognized indigenous rights over extensive forested territories and have created large extractive reserves and community forestry concessions. Some countries have promoted various types of community forestry and "joint forest management". The Chinese have turned over large areas of forests and degraded lands to individual small farmers and collective enterprises. A number of African countries have also formally recognized community forest ownership for the first time.

Clear and secure rights over forests, woodlands, and trees, allied to stable rules and institutions encourage forest production and management. In some – though not all – contexts secure rights would lead local people to manage the forest sustainably and protect those resources from over-exploitation. Rights should also clearly allow rural communities and rural households to transport and sell their forest products. Even with general trade liberalization, the income from sale and transport of some forest products may be restricted by various local or regional taxes and fees. The small producers act rationally, and avoid investing in producing highly taxed forest products, often timber.

Transparency and Participative Governance

In designing and implementing forest tenure, benefit-sharing, and regulatory policies, decision-makers should recognize that communities are not homogenous. The people within each household, village, and district differ with regard to gender, ethnicity, wealth, status, and source of livelihood, and their interests reflect that. Thus, mechanisms established need to provide as much transparency, accountability, and representation of all relevant stakeholders as possible, and to create clear mechanisms for conflict resolution (Kaimowitz 2003). In some countries, addressing these problems may also require reform of national governance structures.

An issue to consider is the role and status of the small-scale entrepreneurs, middlemen, and traders – and also of institutional public sector operators. In the production-marketing chains, each party should ideally have equal information and equal negotiating powers. Some preferential rights – or even monopoly positions – in production and sale may disadvantage individual and small-scale producers and traders.

Logging for subsistence is often "illegal", for the simple reason that it is proscribed by the law. The ability of small-scale operators and individuals to harvest timber may also be restricted by cumbersome bureaucracies. Appropriate provisions in logging-licence regulations, and a reduction of bureaucracy, could favour "simple" procedures for local, small-scale operations. This, however, again demands transparency, clear and consistent rules, and stable institutions (Kaimowitz 2002). Over-regulation of forestry and limited accountability of public officials encourage corruption, which usually harms the small-scale operators and the poor.

2.6 Conclusions

In recent years, there has been a paradigm shift in many people's perceptions and attitudes towards forest resources: they have come to recognise the urgent need to assure their sustainable utilization and conservation. The new paradigm emerged as a reaction to the shocking loss of large areas of forests and as a way forward in promoting sustainable development in rural areas. In the UNCED meeting in Rio de Janeiro in 1992, a global consensus on a broad approach to sustainability was reached. Since then, numerous international processes and national initiatives have been created for defining the principles and operational guidelines – criteria and indicators – for applying and for measuring progress towards sustainable management of forest resources.

The adoption of this new approach in forestry can be interpreted as the application of methods that should be silviculturally and ecologically appropriate, economically profitable, and socially acceptable. Therefore, an important change to the old concept of a wood production oriented approach is underway. One of the important novelties of the new approach is the involvement of all the stakeholders in defining the goals and means of sustainable management of forests. As well as this participative feature, it calls for a more holistic view: to consider the management issues in a broader perspective, to develop and execute the plans in a landscape context, and to look for local solutions to local problems.

In spite of the valuable work already accomplished by different parties there is still a long way to go before obtaining the desired goals. Nonetheless, these approaches should be persistently developed, applied, and pursued. One of the prerequisites for their successful development and application is good knowledge about the complicated interdependencies among social and economic needs and the carrying capacity of natural ecosystems.

Forest resources, both timber and non-timber, contribute to people and communities at local, national and global level. This contribution can be tapped by good governance: transparent institutions and clear, consistent rules. Participation of all relevant stakeholders in planning and decision processes is needed for equitable benefit sharing. For sound policy decisions, a thorough understanding of the various types and activities of rural economic sector and social structures, and of forestry issues, is needed. It must be realized that forests and trees

are intricately tied together with other rural activities and land use. For any policy to work it is decisive to understand the local conditions, values, and operational structures. More information is needed on the contribution of forest resources to livelihoods, the effects of environmental degradation, market trends, policy and project impacts, local institutions, and the impact of management options on the resource base and on local innovations. Much of the information now available is out-of-date and incomplete, while the reality is highly dynamic and diverse. On many relevant topics, there is less data collection and research today than a decade ago (Kaimowitz 2002). More research and reliable data are needed for promoting forestry activities in rural development and reducing poverty, simultaneously maintaining healthy ecosystems for sustainability.

Acknowledgement: The authors appreciate the comments and ideas presented by David Kaimowitz on an earlier draft of this paper.

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3 Reinventing Forestry for the 21st Century

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Abstract: The emergence of democracy as the prevailing basis for national governance, and the increased ability of civil societies to communicate and exert influence on natural resource issues, have major implications for the way the world's forests are managed. We are moving from a centralised, "single best way" where forests are managed according to the prescriptions of national forest agencies to pluralistic, locally adapted approaches to forest management that are continually evolving and adapting as society's perception of its needs for forest goods and services changes. National and international attempts to establish norms for forests – such as different criteria and indicator sets and the promotion of "model" forests – are giving way to so called "ecosystem approaches" that recognise that every forest is different and that various approaches to management can meet our requirements for sustainability. These processes are giving greater weight to local values; this comes at the expense of the so-called global values of rare species. This is happening at a time when long-held assumptions about the watershed values of forests are being challenged and when there is wide realisation that measures in the forest sector will not save us from global warming. The needs for forest information are changing as broader-based management regimes are introduced and new arrangements for forest governance are emerging. All of this offers new challenges to forest institutions. They need to emphasise steering rather than rowing, management and dissemination of information and the convening of partners rather than hierarchical decision-making. Foresters will need to be eclectic and masters of interpersonal skills; they will cease to apply a single management model, but will refine the art of muddling through the intricacies of the complex social-ecological systems that constitute our forests.

Keywords: Forest management; governance paradigms; institutional arrangements; ecosystem approaches; international processes.

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3.1 Introduction

This chapter examines the changing role of forests and forestry in different societies. It is particularly concerned with the implications of globalisation and the emergence of participatory democracy as the predominant political model for issues related to forests. Its main hypothesis is that human societies will increasingly exercise control over forests at a local level, and that their needs and expectations will be constantly changing. The divergent agendas of different societies are likely to be particularly acute on the issue of forest biodiversity, and this chapter focuses on this particular aspect of forests as an objective of sustainable forest management. These emerging changes in the ways that forests need to be managed have implications for forestry institutions and for training and research to support forestry. Suggestions are made on how this may require the profession of forestry to reinvent itself in the coming century.

The concluding decades of the 20th Century saw fundamental re-examinations of the ways forests are managed and of the institutional arrangements for forests. This was a culmination of a long-standing tension between those who own or control forests (forestry agencies) and those who have a stake in the products and services provided by those same forests. It reflected a historic struggle between the rich and powerful, who own land and resources and who often value forests for timber and hunting, and the

poor and powerless, who value forests for a host of non-timber products and services. This is a struggle between those who seek to conserve the public goods values of forests – biodiversity, watershed protection, etc. – and those who are struggling to survive and who need land for crops and forest products for consumption or to augment their short term incomes. These struggles over access to and control over forest resources have been acted out in various ways and between different sets of stakeholders ever since forestry as a formal science came into existence in 18th Century Europe (Harrison 1992; Schama 1995).

At the end of the 20th century a combination of the emergence of participatory democracy as the prevailing political paradigm, the growth of active and independent media, and the possibility of rapid and cheap international travel and commodity transport, created conditions where this perennial struggle over forests could move to the global stage. We saw the first beginnings of global environmental governance with numerous international environmental conventions and processes – at least ten of which directly target forest issues. Forest products moved from being primarily locally used and sold to becoming widely traded global commodities. At the same time, activist environmental groups in North America and Europe could influence forest outcomes in South East Asia or the Amazon, and conservation organisations in the USA could take the US Forest Service to court – and win. Forests went from being the subject of local struggles for land and products, to being the subject of international negotiations and activism.

All of this has led to serious re-evaluation of all aspects of forest ownership, decision-making, and control in the majority of the world's countries (White and Martin 2003). Reforms in forestry have been driven by the desire to achieve economic efficiency in industrialised countries, and by the attempt to prevent asset stripping by elites in developing countries. Reform processes have struggled with the divergent aims of improving forest productivity by intensification of management at the scale of the "stand", and improving environmental and social outcomes by seeking multiple-use of the management unit and multi-functionality at the scale of the landscape.

These reforms have been debated and promoted at the level of national forestry programmes, national environmental action plans, and a plethora of other processes, some entirely national but many with international "sponsorship" mediated through institutions such as the World Bank or FAO. One lasting achievement of these multiple processes is to have lain to rest the myth that there is a single best way of managing forests. The view has emerged that there are multiple ways of managing forest lands, and that what is desirable at one location at a point in time may well be different from what is wanted at another place or a different time. We all make fundamental assumptions about forests that are deeply rooted in our cultures and backgrounds, but these assumptions may differ significantly amongst people from different origins (Forsyth 2003).

This fundamental re-examination of forestry has posed special problems for government forest agencies. Many of these agencies were designed to ensure the long-term sustainability of forest resources, and thus had a built-in conservatism. They were largely staffed by people who shared the same educational background, and they tended to develop strong internal cultures and to harbour entrenched views about how forests should be managed. They had a normative role: rooted in a vision of forestry as a "Steady-State" enterprise, they designed approaches to forestry at a national level and imposed these through hierarchical structures throughout their territories. They were resistant to change.

All these forestry debates took place at a time when societies were also changing. People were moving from the countryside to the cities, fewer people were employed in primary production and more in services and manufacturing, people in some parts of the world had greater leisure and disposable incomes.

Many of these issues form the backdrop for other sections of this book. This chapter attempts to explore the implications for forest conservation, especially the conservation of forest biodiversity, of the new agenda and institutional arrangements that are emerging as we enter the 21st century.

3.2 Normalisation and Pluralism

The 1990s were a decade in which the world sought normalisation of the management of forests. This process was driven by the reaction of forestry agencies to the pressures that began to be exerted by civil society. When forestry agencies were criticised for their excessive focus on timber production, and neglect of biodiversity and other environmental and social values, they responded by negotiating codes of conduct and criteria and indicators that defined the multiple forest attributes that needed to be addressed in management. The last decade of the 20th century saw the emergence of several sets of Criteria & Indicators defining a newer, broader, view of sustainable forest management. Model Forests were promoted at an international level, with strong impetus from Canada. Many development assistance projects sponsored other forms of model forests, often inspired by forestry practice in the sponsoring country. The non-binding principles adopted at the Rio conference, the UNCED, were in a sense an attempt at establishing a global set of norms for sustainable forest management. All these attempts rapidly indicated that forest management practices have to be very situation specific, and that global or national norms can only be useful at a very broad level of generalisation.

John Parotta

The UNCBD recognises that some biodiversity may need to be sacrificed if jobs and income are higher priorities for people living in and around the forests.

One outcome of the first phase of this process was the 1992 World Bank forest policy. The debate surrounding the issuance of this policy was strongly rooted in a northern rich-country preservation agenda and a "single best way" of managing forests. We begin the 2000s with a new World Bank policy that is much more development oriented – a strong focus on poverty and livelihood, and a much more pluralistic vision of how forestry should be tackled. The new World Bank forest policy is based on far broader consultation with the full diversity of forest actors and is less prescriptive – instead it places value on local processes in determining the forest agenda.

During the final years of the 1990s, the UNCBD developed its "principles for ecosystem approaches". These applied to all ecosystems, not just forests; they are interesting in that implicitly they value local environmental values more highly than global values. The UNCBD ecosystem principles are not prescriptive, they are process-based, and they recognise that diverse perspectives have to be reconciled in determining how to conserve biodiversity in any location. They implicitly recognise sustainable-use as a legitimate way of conserving biodiversity – a concept that was strongly contested at the time of the elaboration of the first World Bank forest policy. The UNCBD has now moved one step further and adopted its "Addis-Ababa Principles" for the sustainable use of biodiversity – a significant shift in conceptual approach from the prevalent discourse of the early 1990s.

The international debate has now shifted firmly to a pluralistic vision of forests, with interest in locally adapted solutions and "a thousand flowers blooming". Decentralisation, devolution, and subsidiarity are being actively pursued in many countries. It is being recognised that management regimes must vary in space and time. One symptom of this change was the move by CIFOR away from testing and developing global sets of normative C&I to working on "adaptive collaborative management" (ACM). ACM is a process of local learning and experimentation that recognises the need for situation specific solutions and the reality that these will change over time. All these developments pose major challenges for those whose mission is to conserve the global values of forests. It is going to be harder to escape the need to compensate those who incur the local opportunity costs of preserving forest attributes when the benefits accrue to society at large.

3.3 International Processes

In the early 1990s, many thought that ultimately a forest convention would legitimise certain approaches to the use and conservation of forests; there is now less enthusiasm for this as the best way forward. Even the leading international conservation organisations are critical of the "neo-protectionism" of some fundamentalist environmental groups. Responsible conservation groups recognise that they can no longer pursue visions of conservation that ignore the realities of the world's poor. The need to reconcile conservation and development has been apparent since the World Conservation Strategy was launched in the early 1980s. Many attempts to achieve this at the local field level have led to disappointment (McShane and Wells 2004). The dichotomy of agendas remains the central issue for most conservation organisations; the issue is not whether conservation and development should be reconciled, it is how this can be achieved and at what scale it is best tackled. Most conservation groups are now moving to look at conservation at much larger scales – landscapes, eco-regions, etc. Conservation organisations were strong advocates of a forest convention in the 1980s and early 1990s. At that time, they saw a convention as a measure to limit national sovereignty of forests and require countries to give more attention to global forest values. These same organisations are now advocating more balanced and situation specific approaches to forest management, and giving greater recognition to the importance of local values (Sayer et al. 2003).

Competing forces of globalisation and economic efficiency, and a diversity of local needs and desires, are having a major impact on the way forest problems are perceived. At one time people debated the

relative merits of different approaches to forestry. For the future of forestry, the intensively managed *Pinus radiata* plantations of New Zealand were seen as an alternative model to the complex "near to nature" woodland management of Western Europe. Now most observers would recognise that both of these approaches have their value, and the question is not which approach is best but rather which mix of approaches is appropriate in any given situation. There is at the same time a resurgence of interest in local forest uses and products, in parallel with major innovations in the application of cutting-edge industrial and bioengineering technology in the industrial forest sector. Major shifts are coming up in locations and ways of producing fibre, and these have complex impacts on biodiversity and the environment that we do not understand very well.

In addition to the inter-governmental processes where the future of the world's forests is debated, there are numerous other conferences and congresses addressing forest issues. This is leading to changes in the ways that forest policies are being set and decisions on forests are being taken. We are used to a situation where a forest agency conducts analyses, assembles arguments, and then enacts a policy directive. To some extent, this still remains the situation. However, in parallel to this, a less formal and less hierarchical decision making structure is emerging. Ultimately, policy agendas, statements, and documents exist to determine patterns of spending, processes of implementation, and activities on the ground. Many of the latter are now changing independently of the formal policy process. Instead, the various networks that are emerging, which generate the conferences and workshops that occupy much of the time of forest decision makers, are providing a "policy narrative" that evolves over time. The policy narrative may adopt new ideas and concepts more rapidly than the formal policy process, with the result that practice on the ground may change more rapidly than the policies that are intended to guide them. Thus many of the changes required by the new World Bank forest policy in 2002 were already mainstreamed into the activities that the Bank was supporting in its client countries in the late 1990s.

Many forest practitioners are becoming impatient with the proliferation of meetings that they are required to attend. However, these meetings are the fora where learning occurs and innovations are communicated. These meetings are responsible for the formation of networks of specialists who draw on them in deciding how they will react to situations on the ground. These networks may be starting to form the new informal institutions that will manage our forests. Thus, as we devolve more and more control over forests to private individuals, corporations, and communities, the role of centralised forest agencies has to change. Some of their functions are being taken up by informal networks that allow individual managers to access new technologies and markets, and to exploit or influence incentive mechanisms such as subsidies, tax breaks, etc. The proliferation of meetings of people concerned with forests cannot be seen outside the context of new institutional arrangements for forests in general. Some of the attributes of the new arrangements that are needed for forests are well articulated by Carley and Christie (1992):

"As the notion of self-sufficient organisations gives way to more complex networks, organisational and managerial skills in joint working become critical to environmental management and sustainable development, often as important as the substantive nature of any environmental issue. The development of localised management skills, entrepreneurial abilities and modes of partnership is therefore a critical but largely un-addressed aspect of environmental management. A key constraint in human resource terms, then, is insufficient skills in newer integrating styles of management. This is true both for lower and higher income countries, because where higher income countries gain in sophistication of training they often lose in terms of long-term entrenched compartmentalisation in bureaucracies."

It is interesting to note that some relatively weak developing country forest institutions have been more amenable to change than some of their stronger counterparts in developed economies. This is especially true in developing countries with low forest cover. Whenever forests become scarce commodities people mobilise to conserve them, and government forestry agencies operating in this environment have far more acceptance amongst the population than those who simply apply the laws in forest rich situations.

3.4 Local Successes

The dominant discourse at international gatherings about forests is that we are still facing something of a crisis. We hear that forests are being managed badly, deforestation is rampant, illegal activities are ubiquitous, and many other hazards jeopardise the future of our forest resources. However, one also observes that there are large numbers of locations on the planet where things are going quite well for the forests. Some of these are at the scale of countries, some of big corporations, and the majority at the level of communities. The interesting question is whether all of these good things are happening because of the level of international attention that they get, or in spite of it! The global policy narrative may have created the conditions under which positive local initiatives can prosper, but in many cases it appears more probable that these successes came because people confronted with a "forest problem" organised themselves to deal with it. In the case of companies it may have been the threat of loss of access to markets that required certified timber, in the case of communities it may have been the decline in supplies of a broad range of forest products. The review of the 1992 World

Bank Forest Policy, conducted towards the end of the 1990s, showed that projects and loans that had been made to forestry in countries with low forest cover had in general performed much better than those in forest-rich countries. Once forests become scarce the likelihood of people responding to opportunities to restore or improve them increases. As long as forests are perceived as super-abundant, it is difficult to promote improved husbandry.

Many of these local initiatives are subject to a bewildering array of criteria, indicators, guidelines, and other rules and regulations. Sometimes one wonders whether all of this is not a distraction from or even a deterrent to good local management. However, in an increasing number of situations the local owners and managers of forests are themselves part of the forest policy narrative, and are the driving force behind innovations at the policy level. As we move away from hierarchical, command and control forest agencies towards loosely affiliated networks of managers, the intensity of communication in all dimensions is increasing. Ordinary people from Tanzania to Scotland are having far more influence on forestry policies and practices than they did a few decades ago.

3.5 Current Issues in Forest Management and Conservation

Fundamental Divergences in Values

The decades of debate about forest conservation and management have made it clear to everyone that different human societies value forests in different ways. These values are deeply rooted in our cultures but are also a function of the conditions under which we live. It is perfectly understandable that people who are struggling to survive in a subsistence economy have different views of such notions as old growth forest and biodiversity than people whose basic needs are adequately covered. But even more prosperous societies who empathise with the desire to preserve old growth forests and their biodiversity may still be reluctant to forego the employment or income that might flow from more intensive management of such forests. The ecosystem principles of the UNCBD declare that ecosystem use must be subject to societal choice. Thus the UNCBD recognises that some biodiversity may need to be sacrificed if jobs and income are higher priorities for the people who live in and around the forests concerned. This admission by the UNCBD also has to be seen in the light of the increasing realisation, rarely stated, that not all biodiversity is essential for the functioning of ecosystems. In the 1980s there was much talk of keystone species and the ecosystem collapse that might result from the extinction of just a few species. Few people now believe this – it is clear that many ecological systems can function perfectly well (at least in terms of the products and services that they produce for people) with reduced species diversity.

Another difficult issue, especially given the present wave of interest in decentralised systems of forest management, is the fact that different forest values are manifest or are perceived differently at different spatial and temporal scales. A villager on the forest margins in Cameroon will not detect any benefits from the carbon sequestered in an adjacent forest as a result of her decision not to clear land for agriculture. The fact that a rare plant in a forest in Central America may yield a cure for cancer is unlikely to motivate a campesino to take protection measures unless someone pays him to do so. There are certain forest values that require management measures at very large scales and therefore collective action by large numbers of people. Extensive habitats for some large, wide-ranging species are the classic example. Such large scale management will only happen if the necessary laws are enacted and enforced – and laws that are not seen as yielding benefits to the people that have to obey them are notoriously difficult to enforce.

Decentralised forest management appears to be here to stay; indeed, it yields many benefits both to livelihoods and to the environment. Its advocates point out that under decentralised systems forests persist or are restored, while under centralised systems they are often lost. The forests in question are often heavily used agroforests rather than pristine "natural" forests. But for most environmental objectives any forest cover is better than no forest cover (Sayer et al. 2004). The harsh reality remains that under decentralised systems of management some forest attributes that are of a non-local character will be lost. There is a limit to which any local community will incur the opportunity costs of preserving a species of notional global value that has no value to the people whose forest it occupies. In these situations, it is hard to escape the conclusion that such species will only be maintained if those who want them conserved pay those who incur the costs of conservation.

Similar issues arise with payments for the carbon storage and sequestration values of forests. These will only be useful if they are paid on a sufficiently large scale – they will fail if forest maintenance or establishment in one location simply leads to forest loss in another location, the vexatious issue of "leakage". Environmental service payments for both biodiversity and carbon can work reasonably well in countries with clear land title arrangements and courts that enforce laws. In the numerous countries that lack enforceable laws and clear land tenure arrangements, they will be very difficult to implement. Making such environmental payments in highly decentralised situations with weak institutions will not work, and in these situations it is inevitable that much biodiversity will be lost and carbon will be stored or sequestered only to the extent that it is a co-benefit of other forestry activities. Payments for environmental services are widespread in developed economies.

The nature of forestry in developing countries in the future will depend very much on the extent to which such payments ever prove possible on an operational scale given the weak institutions that prevail in these countries.

How Much Biodiversity Can a World of 8 Billion People Afford?

Protecting biodiversity costs money, and parks and reserves often deprive poor people of the land that they need to expand their agriculture. Forests do not have to be pristine to be rich in biodiversity. Many agroforestry systems are very rich in species. Even some plantations can be valuable in conserving biodiversity (Carnus et al. 2003). But there are large numbers of species that are restricted to large expanses of relatively undisturbed or even old growth forests, and amongst these are many of the world's most endangered species. Again we face a dilemma; applying the precautionary principle (one of the principles of the UNCBD Ecosystem Principles) would require setting aside very large areas of undisturbed forest, much of it in areas where people are poor and highly dependent on the land for their survival. The opportunity cost for these people of attempts to conserve all biodiversity is exceedingly high. Environmental payments from rich countries on the scale that would be required to meet these costs are improbable.

The inevitable conclusion is that some of this biodiversity will be lost. This then raises the difficult question of who decides how to allocate the resources that are available for biodiversity conservation. Again, the UNCBD principles suggest that it should be largely a locally driven process. Alternatively, one could argue that those who have the money and who wish to conserve biodiversity should allocate their money to the biodiversity that interests them most. Since much of the money for international biodiversity conservation programmes currently comes from philanthropic sources, this is to some extent already happening. The so called "charismatic" vertebrates, large mammals and spectacular birds, get a larger share of conservation budgets than less visible species that might be of greater importance in supporting ecosystem functions.

Forests and Sustainable Development

Notwithstanding all the caveats outlined above, we do continue to improve the management and protection of our forests. We have better management systems, more protected areas, more agroforests and forests under community control. We also manage continuously to increase global output of most forest products. However, each time we obtain some local environmental or productivity gains we may at the same time be making forests, and the industries based upon them, just a little more costly. If we succeed in raising the standards of our management to very high levels and fulfil all the requirements of our ambitious sets of criteria and indicators for sustainable forest management, we increase the price that society will pay for forest goods and services. The relative cost of the renewable products of forests may increase relative to equivalent products, notably fossil fuels, from non-renewable sources. Thus in striving for high environmental standards, we run the risk of tipping the world in the direction of far more dependence on non-renewable sources of energy and fibre. For instance, climate change resulting from fossil fuel use may undo all the gains that we have obtained through our improved protection and management of forests. In assessing the costs of any investments in forest conservation and management, we should not lose sight of these issues related to the competitiveness of the sector.

Economic Integration

Globalisation is having impacts on our forests. Economic integration is a powerful force for increased efficiency, and this translates into more intensive production systems, greater dependence on inputs, perhaps on genetically modified organisms (GMOs), etc. There is a danger that we may move inexorably towards a world of homogeneous super-productive plantations and that the diverse, multi-functional forest systems that so enrich our lives may disappear – or be relegated to a few protected areas. Forestry institutions have to confront the challenge of managing forests to optimise the full range of forest benefits. There is a special need for affirmative action to preserve some of the rich and diverse traditional forest management systems that create the landscapes in which we live.

The current interest in landscape scale forestry and in "Forest Landscape Restoration" partially reflects a reaction against the forces of globalisation. It recognises that optimising forest functions at a larger scale cannot be achieved by simply maximising forest productivity at the scale of the management unit. There are complex issues of connectivity, downstream and offsite impacts, aesthetics, etc. that must be taken into account. The European Union is ambitiously experimenting with "multi-functional landscapes" and "multi-functional forests" to counter the negative impacts of intensification driven by the desire for economic efficiency. Again, achieving multi-functional landscapes and forests appears to be possible, but it requires very large transfers of resources (environmental payments) and can probably only work in situations with strong institutions and clear, defensible land-rights.

The inter-connectedness of the world's economy and global scale environmental measures are illustrated by the complexity of the potential impacts of some measures that have been initially conceived

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Fire is an important element in many natural ecosystems.

to improve the environment. The Clean Development Mechanism – in the unlikely event that it ever becomes a major factor in forestry – could result in pressure to establish forest plantations on a huge scale. If this were to happen, it would create even higher pressures on land and increase the costs of conserving natural forests. Similarly, the spectre of large-scale biomass fuel plantations covering large areas of the humid tropics with sugar cane or palm oil plantations is alarming for those who seek to conserve tropical rain forests.

Forest Assessments

As the objectives of forestry broaden, the needs for forest information change. In the past, a lot of attention at an international level was given to amassing statistics on the extent of forest cover and the rate of its loss. Global statistics on standing timber volumes and annual timber increments are widely available. Some effort has been made to evaluate the amount of carbon stored in forests and sequestered both by standing forests and through reforestation schemes. Data on fuelwood are also compiled by FAO. Many of these categories of information on forests have been shown to be subject to large errors, and to be of dubious utility in making decisions on forestry. They often extrapolate from small samples or make assumptions about per capita consumption, homogeneity of forest types, etc. Now that we are attempting to manage forests for an even larger range of products and services, the difficulties of global assessments are even more apparent. The Millennium Assessment has attempted an overview of forest resource information but has found it hard to provide insights that go beyond those provided by the Forest Resources Assessment team at FAO. It is becoming apparent that there are few attributes of forests that are amenable to assessment at the global level, and FAO has thoroughly evaluated these and probably reached the limits of what is possible and useful at that level. The challenge is to assess the multi-functions of forests at the local and landscape level. These are the levels at which management decisions are taken and for which information on status and trends is required.

The multi-resource assessments pioneered by CIFOR, and based as much on local perspectives of value as on "expert" opinion, are promising (Sheil 2001). The integrated regional assessments conducted under the umbrella of the Millennium Assessment are also innovative and provide useful insights into the issues surrounding broadening of management agendas.

One problem with many comparisons of global forest resource information is that different definitions are being used, and the trends and patterns that people claim to detect are often more a function of these differences than of realities on the ground. The problems of assessment are even further complicated where management is seeking to achieve multiple functions across a mosaic of forest and non-forest land. One of the problems of conservation and development projects of the current generation of landscape-level conservation planning is that there are no widely agreed methods for assessing the performance of large systems with multiple objectives. These issues are extensively discussed in Sayer and Campbell (2004). Essentially assessment and monitoring schemes where management trade-offs are inherent require multi-dimensional tools, and progress cannot be measured along a single axis of variation.

Forest Fires

We single out fire for special attention in this paper as it is symptomatic of a new generation of management challenges. It is interesting that every year seems to be the year of the worst fires ever. Each year huge resources are mobilised to fight these fires. As soon as they are extinguished, everyone forgets about them until the following year's fires erupt. Two observations are prompted by this. One is that fires are here to stay. With climate change and vast areas of disturbed forest, we are inevitably going to have many very bad fires in the future, and we should start to manage for that situation now. Foresters have traditionally treated fire as something to be avoided if possible, and most resources have always been invested in fire suppression and risk reduction. The second observation is that it is now realised that fire is an important element in many natural ecosystems, although the return period may be very long. The fire issue is complicated by the fact that climate change will change fire patterns – increasing risk in some areas and possibly decreasing it in others. In the future, forest managers will have to invest more in understanding the dynamics and consequences of fire regimes, and not simply in trying to control them. Most foresters understand this all too well, but it is a cause for concern that budgets are still predominantly allocated for suppression, often in response to media opinion, and little is often available for studies of different possible fire regimes. The problems are especially severe in the tropics, where climate change is combining with land-cover change and forest disturbance to create fire hazards of a type and in locations where there is no tradition of fire management (Cochrane 2003).

Climate Change

A lot has been invested in studying the potential of forests to mitigate climate change – mainly as a way of avoiding the issue of reducing fossil fuel use. Less has been invested in adaptation issues. Yet new pest and disease threats will emerge, and the adaptive management skills of foresters will be tested to the full as we end up with forests ill adapted to the environment in which they find themselves. Dealing with the uncertainty caused by climate change will be one of the major challenges for foresters and forest institutions in the coming century. It will require research and improved professional skills at the local level. However, it will be difficult to plan for climate change adaptation – there is too much uncertainty about the nature of the impacts. At present, we are already observing significant changes in the distributions of some forest species; some butterflies in the United Kingdom have extended their ranges by more than 100 km to the north. The ranges and impacts of some pests and diseases are already changing in response to climate change. Risks from invasive species are changing, new species are becoming invasive, and the susceptibility to invasion of some forest types seems to be increasing.

Water

Water is another big issue. Everyone talks about the importance of forests for future water supplies, but we still know rather little about how to manage forests to optimise water yields. Also, we are reluctant to face the fact that managing for water will not necessarily be the best management for timber or biodiversity. Difficult trade-offs will have to be made. Forest management for water is another example, like fire, where public and political perceptions of the problem often run counter to the empirical evidence accumulated by foresters. The result is that funds are often made available in counter-productive ways and in response to extreme events that may have little to do with the nature of the land cover.

Violent Conflict

Many of the planet's most remote and extensive forests are the scenes of violent conflict (Price 2003). These conflicts are causing enormous suffering and are destabilising whole regions. These remote areas need infrastructure and institutions – but developing infrastructure can also threaten the forests. So there is another dilemma: what is the role of forestry and forest industries in reducing the dangers of conflict and perhaps even building the prosperity and improved livelihoods that might reduce the dangers of conflict.

Many international conservation organisations are now confronted with the unpleasant reality that many of the areas that they have determined as priorities for forest biodiversity conservation are located in regions where armed conflicts are almost endemic. Forests fuel these conflicts both when their timber finances the military, and when they provide areas of refuges for armed groups concealing themselves from legitimate authorities or peace keepers. Building secure futures for people living in these conflict zones is essential both to conserve the forests and to diminish the risk of conflict; foresters cannot ignore their responsibilities in confronting these pernicious problems.

Governance

Illegal forest activities are rampant in many parts of the world. They are a major social and economic problem as well as an environmental one. As long as secure and equitable governance arrangements are not in place, technical solutions to forest problems will not work. This is another area where foresters and forestry institutions have to deal with problems

that they are often ill equipped to address. Some issues of forest governance are dealt with in a recent edition of Arborvitae (IUCN-WWF 2003).

Here there is a ray of hope. There are many places in the world where the struggle to achieve more sustainable and equitable management of forests is driving the process of the emergence of democracy. This is especially so in low-income countries where land tenure arrangements are still not enshrined in law. Local people organise themselves to obtain more just and balanced use of forests and to defend their access to them. Out of this organising grow the local institutions that are so important in driving the process of democratic government in many weak states around the planet.

Training, Research and Institutions

All this implies significant changes in forestry education programmes and in the structure, competencies, and cultures of the institutions dealing with forests. Forest agencies will need to be less hierarchical, more multi-disciplinary, and more able to work as teams. They will need more generalists with broad environmental credentials, but this must not come at the price of the fundamental skills of the local forest manager. Adaptive management means having professionals with excellent knowledge and judgment who are empowered to make decisions. They will need skills in facilitation and participation. They will need a deep understanding of the social and ecological system within which their forest is located (Berkes et al. 2003), and they will need to be able to call in specific technical expertise to deal with emerging threats and opportunities. All this adds up to make forestry an even more challenging and exciting profession in the coming century.

Forest research will no longer be conducted in controlled plots on research stations. Researchers will have to work on real life situations. All management will have to be considered experimental, and all research will be in support of practical adaptive management. Researchers will not be segregated from practitioners but will be integrated into the management structure of the institution (Sayer and Campbell 2004). Staff for forest institutions will be recruited from diverse backgrounds ranging beyond the traditional forestry schools. A range of specialists from the social, economic, and management, as well as the biophysical, sciences will be needed.

3.6 Conclusions

Forestry institutions are still criticised for excessive conservatism and for focussing too much on the production of timber. But an examination of the realities on the ground shows that many have changed radically in the past decades and are now strongly oriented towards broader environmental and social outcomes. They are still torn between the demands of mainly urban constituents who see only the recreational, aesthetic, and environmental roles of forests, and the mainly rural constituents who are concerned with incomes, livelihoods, and jobs. A divide between rich and poor countries parallels this division between rural and urban societies in the north. A decade of global meetings and inter-governmental processes has done something to soften these starkly opposed views of forests, but one cannot escape the reality that people's interests differ. Ecosystem approaches to forest management are an attempt to rationalise these conflicting demands on the resource. But it is a mistake to think that ecosystem approaches can eliminate all conflicts. They can perhaps make the trade-offs more explicit and create a more level playing field for negotiating equitable outcomes – but hard choices will always have to be made.

Perhaps the single most significant factor that will have to change is the profile of the professional forester. Foresters will no longer be able to claim that they know all the answers. They should, however, be able to contribute information and analysis and help society to find good technical solutions. Foresters in the future will need to be eclectic, receptive to points of view of widely divergent interest groups, builders of relationships, and brokers of deals. But one thing that cannot be sacrificed is foresters' comprehensive and detailed knowledge of the forests that they manage. We cannot allow foresters to evolve into generalists who know a little about everything. A thorough understanding of ecology, silviculture, and the social roles of forests will be even more important under the emerging paradigms for forests. Forestry in the future will be an even more challenging and rewarding career than it has been in the past.

All of this implies a thorough re-evaluation of arrangements for forest governance. The issues of forest conservation in the 21st century are extraordinarily diverse. Foresters and the owners and managers of forests will have to manage their resource in the context of dynamic and rapidly changing social and ecological systems. They will have to be alert to issues being played out in the global and political arenas but also maintain or even increase their deep involvement in local issues in and around their forests. It was never possible to manage forests according to formulae, and in the future this will be even less tenable. Criteria and indicators, and management models, will retain a role but adaptability, resilience, and alertness to changes and opportunities will come to be the dominant skills required. The need for transparency and equity in governance will be as strong as ever. Some elements of governance will best be decentralised to the local level; however, some forest values accrue to society at large and governments will have to retain a role in the governance of these attributes of forests. Laws will need to be based on the legitimate needs of society, but will still need to be enforced. Forestry will remain a

long-term public service but it will no longer consist of applying a single management formula – every forest is different, and management must always take account of this.

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PART II

Global Forum

John Parotta

GLOBAL FORUM

4 Changes in the Governance of Forest Resources

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Abstract: Until relatively recently, forest governance across the globe followed a "top down" or hierarchical approach. In this traditional model, policy goals were determined and developed within the confines of the nation state and implemented by state officials invoking a variety of "command and control" policy instruments. However, the limitations of traditional forest governance produced "bottom up" approaches, which emphasized interdependence, collaboration, and policy learning among state and societal organizations. New patterns of interaction, known broadly as "policy networks", have since led to the development of an array of new institutional arrangements within the forest sector, including international forest deliberations, national forest programmes, forest certification, decentralization, devolution of public rights, and forest self-organization. The causes of the shifts in forest governance are related to the increasing demands from civil society at national and international levels, as well as to the processes of globalization and internationalization. The strength of these shifts, and the reactions to them, differ between industrialized and developing countries, and between countries with low and high forest cover. New governance initiatives often encourage voluntary, self-regulatory, or market mechanisms that raise important issues of accountability and legitimacy. We argue that rather than reducing the role of nation-states, these initiatives create new challenges for them. The main issues for future research are the interaction between state and non-state authority, and the ability of new governance arenas to simultaneously promote democratic governance and address global forest problems.

Keywords: Network governance; legitimacy; international forest deliberations; national forest programmes; forest certification; decentralization; self-organization; civil society.

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4.1 Introduction

Until relatively recently, forest governance across the globe tended to follow a "top down" or hierarchical approach in which forest users and activities were directly influenced by policy goals determined and developed within the confines of the nation state. In this traditional model, state officials implemented these policy goals by invoking a variety of "command and control" policy instruments.

However, since the 1960s perceived limitations of traditional forest governance produced both descriptive accounts and prescriptive analysis of *"good forest governance"*. These "bottom up" approaches emphasized interdependence, collaboration, and policy learning among state and societal organizations. They have since led to the development of an array of new institutional arrangements within the forest sector, including international forest deliberations, national forest programmes, forest certification, decentralization, devolution of public rights, and forest self-organization. To direct these new institutional arrangements towards the goal of sustainable forest management, without destroying their innovative and participatory elements, requires a delicate balancing act among flexible patterns of interaction between state and civil society known broadly as "policy networks".

What explains the rise of these new types of governance mechanisms? Are they more effective than traditional approaches in addressing global forest problems? Are they more legitimate? To whom are these new arenas accountable?

We argue that the main causes of the shifts in forest governance are related to the increasing demands from civil society at the national and international levels, and to the widening and deepening of the closely related but separate processes of globalization and internationalization. However, the strength of these shifts and the reactions to them will differ from country to country. We argue that there are some general differences between the shifts observed in industrialized and developing countries, as well as between countries with low and high forest cover. In some regions, though not in all, changes in governance may be strongly influenced by large-scale changes in political systems, or by the political mobilization of forest-dwelling indigenous peoples.

The effects and durability of the new arenas of authority, which are often aimed at bypassing nation-states in favor of markets or industry regulation, are directly related to their perceived legitimacy and accountability. Because the new arenas have never succeeded in completely bypassing nation-states, attention must be paid to the new roles that governments can play in supporting these new systems. The main issue for future research is to understand better the interaction between state and non-state authority, and the ability of the new arenas to promote inclusionary (democratic) governance while simultaneously addressing crucial global forest problems.

This paper elaborates these arguments in six analytical steps. Following this introduction, the second section identifies why nation-states first intervened in forestry activity, and the traditional approaches they employed. The third section reviews tools and frameworks that assist in analysis of the new forest governance. This section describes policy learning, the emergence of the policy network concept, and the key problems of creating and legitimizing effective network management. The fourth section identifies specific forestry initiatives that have facilitated a variety of policy networks, all under the auspices of creating good governance. The fifth section describes broader global factors that underpin and explain the swift emergence of these policy networks and their associated forms of authority. The sixth section assesses the impacts of these networks, and the conclusion discusses areas for future research.

4.2 Why Nation-States Regulate the Forest Sector?

Characteristics of Forest Resources

Ever since the creation of the modern nation state, denoted by its sovereignty over a defined territory, authority to regulate forest resources has rested with national (or sub national) governments. In the last hundred years, governmental intervention has focused increasingly on steering the activities of forest owners and forest users toward socially acceptable outcomes. Governments have deemed it necessary to intervene because, unlike the air we breathe, most forest resources, from forest dependent species to timber, are "subtractible" – i.e. using them leaves less for another user.

Subtractible goods have been the focus of much government intervention, because without some mechanism to regulate their extraction they can be depleted. One strategy has been to assign individuals or companies "private property rights", on the assumption that they then have an economic incentive to sustain these goods over the long-term (since they benefit economically from such action). However, the nature of many forest resources makes it difficult or impossible to assign individual property rights to them. It is assumed that short-term "deplete and run" approaches can occur in common access regimes. Individual users of common pool resources may calculate that it is to their advantage to draw down the resource, leaving all the other users to share the resulting costs. As the other users try to anticipate this behavior and gain their own advantage, the result is rapid and possibly irreversible depletion, leading to the "tragedy of the commons" (Hardin 1968). In recent years traditional "command and control" approaches (stressing regulation or outright public ownership) to avert common pool resource depletion have given way to more market based, voluntary, and local or decentralized approaches (Ostrom 1990; Agrawal and Ribot 1999; Gibson et al. 2000).

Before the modern nation state began intervening in forest regulation, many common pool resources were governed (and protected) by customary common pool regimes of great ingenuity and very long standing. In these regimes, the access to resources was limited by kinship or community membership. Scholars now recognize that it was the breakdown or destruction of these customary regimes, largely promoted and supported by industrialized nation states that led to the unsustainable use of forest resources. In an ironic spiral of cause and effect, the unanticipated problems of state-centric attempts to address these unsustainable practices have led to calls for increased privatization of forest resources.

Recognition of these complex historical processes has also coincided with increasing attention to the effects or "externalities" of timber production on non-timber forest resources. It is increasingly recog-

nized that policy makers and institutions must ensure that timber production does not unacceptably reduce opportunities for non-timber uses, such as plant gathering, hunting, and so on. On the other hand, private property owners may need to be compensated for the external goods that they provide (such as maintaining forest habitat, etc.). New approaches are needed; they will need to ensure fair access to the multiple values created by forests without the cumbersome and expensive apparatus of regulation and subsidies that has characterized traditional governmental approaches.

Traditional Governmental Approaches

In order to address both the tragedy of the commons and the issues of externalities, traditional state-centered approaches invoked an array of policy instruments designed to regulate citizens' behavior and define their legal rights. Such mechanisms span a continuum from assigning outright private ownership to forest resources at one end to direct state control and administration at the other. In the middle of this continuum is the granting of specific private property rights to publicly owned resources for a specified period of time; these rights would include various kinds of usufruct, lease and tenure arrangements. Historically, the reliance on assigning private property rights has meant that governments are forced to intervene directly by creating incentives (both positive and negative) designed to maintain or conserve non-economic "common pool" resources within forests.

Substantive Policy Instruments

Efforts to promote conservation of common pool resources within private-timber regimes focused originally exclusively on what Howlett (2000) calls *substantive policy instruments*, i.e. direct government intervention that required or motivated a certain behavioral change. These comprise regulatory (e.g. prescriptions, proscriptions), financial (e.g. subsidy, taxation), and informational (e.g. education, public relations) policy means, which act *directly* on the addressees. Substantive policy instruments have to be supplemented by *procedural policy instruments*, which work *indirectly* through institutional and organizational means by which policy is created.

The costs of employing substantive policy instruments, and their ineffectiveness in addressing global forest deterioration, have led to frustration with "top-down", state centered policy initiatives. This has led non-governmental organizations and scholars to assess whether and how *strengthening procedural policy instruments* might produce more effective and enduring behavioral change from the bottom up. The next section reviews the key tools for analyzing this paradigmatic shift in forest governance.

4.3 Analytical and Conceptual Tools

Three interrelated factors have emerged from experiences with bottom-up policy making: policy networks as new concepts in forest governance; policy learning; and associated policy development and network management issues.

Policy Networks: New Concepts of Forest Governance

Since the 1960s, analysis of the limitations of the traditional mode of governing, and the administrative structures, policy instruments, and implementation styles associated with it, has become increasingly common in the social science literature (Kooiman 1993a; Mayntz 1993; Rhodes 1997). Most of the classic symptoms of "ungovernability" described in this literature are now found in forest policy. For example, in spite of all the effort that governments have put into improving forest management planning, *implementation deficits* are commonly observed in the form of disappointing results and unintended consequences on the ground.

The emergence of new social movements, especially issue-oriented environmental NGOs operating at a global level, has created *unorthodox forms of protest* against forest policies, such as consumer boycotts in timber importing countries. These protests have been sparked, in part, by open defiance of regulation in illegal logging or violation of international treaties on biodiversity conservation or by ignoring the rights of forest-dwelling indigenous peoples.

Two forms of governance have been distinguished in the literature: "old governance" and "new governance" (Kooiman 1993b; Rhodes 1997; Hirst 2000; Peters 2000; Pierre 2000; Rhodes 2000; van Kerksbergen and van Waarden 2004; Mayntz 2004). In *old governance*, the nation state "steers" society and the economy through political brokerage, and by defining goals and making priorities. *New governance* refers to sustaining co-ordination and coherence among a wide variety of private and public actors with different purposes and objectives (Pierre 2000).

The idea of new governance originated in the perceived failure of nation states' hierarchical, top-down style of policy formulation and implementation to address forest policy problems, characterized by complex issues and the presence of multiple actors seeking to achieve their own goals (Kooiman 1993b; Mayntz 1993; Rhodes1997; Mayntz 2004). New governance models seek to embrace complexity and turn the presence of multiple actors from a problem into a solution. They appreciate the participation of multiple actors in the identification and implementation of policy goals. Perhaps, policy goals can best be achieved by harnessing the creative capacity of

forest policy actors to be "policy makers", rather than heavy-handed application of the old fashioned instruments of regulation and subsidy to supposedly passive "policy-takers". New governance "can be seen as the pattern or structure that emerges in a socio-political system as a 'common' result or an outcome of the interacting intervention efforts of all involved actors. This pattern cannot be reduced to one actor or a group of actors in particular." (Kooiman 1993b).

Thus, in the new governance relationship, the complexity of the problem area is matched by a form of organization that copes better with complexity: the policy network. Networks are loosely coupled groups of private and public actors, characterized by the recognition of mutual dependence in achieving their goals. Mutual recognition leads, in theory, to rapid exchange of resources, especially information about policy impacts, unintended consequences, and unanticipated problems. In this sense, governance through policy networks ("network governance") is part of a more general effort to empower civil society to regulate itself. Network governance provides the essential element of coordination in all six new concepts of forest governance discussed below (part 4.4.).

Policy Learning and Trust

The great challenges and opportunities associated with policy networks lie in whether and how they might promote policy learning and build "trust" across an array of diverse interests. Policy learning and trust are important to "bottom up" governance, because the more a policy network promotes learning and trust among its members, the greater the chances for developing effective, efficient and long lasting policy outcomes. This implicit or explicit link from process to outcomes partly explains the work in "input" and "output" legitimacy identified below. As a result, political scientists have systematically studied policy learning across and within policy networks (Bennett and Howlett 1992; Lertzman et al. 1996), while sociological studies and macro-level, comparative political science have explored trust (Rose-Ackerman 2001; McDermott 2003).

Paul Sabatier and colleagues (Sabatier and Jenkins-Smith 1993; Jenkins-Smith and Sabatier 1994) have developed a widely followed framework for exploring *policy learning* (Elliot and Schlaepfer 2001; Wellstead et al. 2004). It is based on two observations that are germane to the new governance in general, and forestry in particular: that policy subsystems (networks) are delineated by at least two coalitions of actors; and that these coalitions, whose members cross state-society boundaries, are delineated by different belief systems. This raises the questions of whether and how policy networks are capable of including and facilitating policy choices across a range of stakeholders with diverse interests, and whether and how substantial change can take place in the face of strongly opposed values and interests. Certainly, if networks are to succeed in the forestry sector, they must facilitate processes where diversity of values and interests is commonplace.

Trust is, likewise, strongly related to network development, since policy networks and "bottom up" approaches often lack the certainty and precision of the old "command and control" governance framework. McDermott (2003) and Rose-Ackerman (2001) have both found that there appears to be an inverse relationship between "command and control" government interaction and the lack of trust. That is, the more decision-makers are distrusted, the stronger is the likelihood that there will be demands for specific and prescriptive "command and control" policy rules. Yet, foreshadowing our discussion on output legitimacy below, both McDermott and Rose-Ackerman reveal that command and control decisions are often sub-optimal, and less efficient and effective than approaches that emphasize process, discretion, and a high degree of trust. Whether and how networks facilitate learning and trust is an issue we examine in our empirical and review sections below (part 4.4).

Network Management: Legitimacy, Accountability and Responsiveness

The shift in the forest governance relationship, from the old top down direction to the novel attempt to harness the energies of civil society through policy networks, raises two kinds of questions. First, while spontaneity is the characteristic strength of networks, the aim of a *policy* network is to steer multiple actors towards public goals such as sustainable forest management. What instruments exist to steer networks in a desired direction; what institutional forms will these steering instruments take; what will be the role of governments in steering; and so on? Secondly, the diffusion of power and authority in policy networks raises difficult questions of accountability, responsiveness, and above all legitimacy. Who ultimately decides the policies that emerge from networks? Who is responsible for the decision? Are networks responsive to concerns raised by outsiders and ultimately by citizens at large? Are network outcomes deemed legitimate, and if so, how and by whom?

The legitimacy of old governance, in which governments directly intervene to manipulate actions of forest users, rests on the general foundations of any political system. In modern democratic states these foundations, sometimes distinguished as "input legitimacy" (Scharpf 1999), include a *system of checks and balances* (principle of the rule of law, periodic democratic elections, ministerial responsibility, and independence of the judiciary) to control the exercise of power, prevent its abuse and arbitrary application, hold power holders accountable, and protect citizens from them. In practice the actual development of

forest policy in many countries was contrary to the norms of democratic legitimacy, as closed policy communities of industry and technical experts, inside and outside government, tended to dominate. Growing awareness of this norm violation helped undermine the legitimacy of old forest governance in many countries.

However, the demand for new governance is also a reminder that the legitimacy of public policy rests on a second foundation. Modern citizens prize individual freedom and rights and, while they accept restrictions on those freedoms in order to achieve desirable public policy outcomes, they are unlikely to put up for long with policies that restrict freedom of action but are perceived as ineffective or even counterproductive. While the erosion of this "output legitimacy" (March and Olsen 1989; Skogstad 2003) has been a key feature in the failure of old forest governance, the same standards will be applied to the new governance relationships.

The shifts from traditional to new modes of forest governance have complex consequences for existing forms and mechanisms of governance, the locus of governance, governing capacities, and styles of governance (van Kerksbergen and van Waarden 2003). There is an upward shift from nation states to international public institutions (international forest regime), as well as a downward shift from national to sub-national levels (decentralization), and a shift from public to semi-public organizations and governance (national forest programmes, public private partnership). Policy making, implementation, enforcement, and control have been differentiated into separate functions; for reasons of efficiency and effectiveness some of these sub-tasks have been delegated to more autonomous private organizations, as in the case of forest certification. Each of these shifts poses problems of network steering and the legitimacy of policy outcomes.

4.4 New Concepts in Forest Governance

Experiments with institutionalizing new governance relationships attempt to *coordinate* the activities of a wide variety of old and new actors and to *establish coherence* in the outputs that result in effective public policy. Experiments with new forest governance have resulted in a series of different but related institutional forms. Those most relevant to contemporary forest policy are governance by:

- international forest deliberations,
- national forest programmes,
- non-state market driven forest certification mechanisms,
- decentralization,
- devolution of public rights, and
- self-organization.

International Forest Deliberations

Within the framework of its international obligations, each state has the sovereign right to manage, protect, and develop its forests according to its own policies. For example, a state may convert its forest to more efficient land uses or to draw on competitive advantage in wood production and trade, and neglect non-wood benefits in forest management when their market price is zero. Regional or global forest problems may arise when the effects of forest management are trans-boundary, for example, large-scale deforestation can affect carbon and oxygen cycles, or cause soil erosion or changes in hydrology and climate. Similarly, airborne pollutants generated in one country may be transported into neighboring countries and cause forest decline.

It is clear that forest management in one part of the world affects the well being of people in other parts of the world. Because of this, fundamental changes are needed in the existing national decision-making system that affects natural resources. In contrast to the situation at the national level, governments have very little coercive power to resolve forest issues at either regional or international levels. Because of national sovereignty norms, regional or global forest problems can only be managed when sovereign nation states *voluntarily decide to co-operate*. There are usually few short-term incentives for an individual country to establish strict performance standards for ensuring SFM on its own, unless all competitor countries in the world wood market do the same. Relatively free world wood markets mean that the efficiency of a single state's measures can be undermined by competition from countries with non-environmentally friendly production methods. Economically rational behavior of individual states can thus lead to a result that is undesirable for all.

Nonetheless, a legally binding international forest convention does not exist despite the development, since the 1980s, of an international forest policy network of nation states and environmental NGOs. In the absence of a forest convention, international legally binding agreements focusing on special subjects (e.g. trade of tropical timber, use and protection of biological diversity, climate change), as well as non-legally binding instruments ("soft law") on forests (Tarasofsky 1995; Glück et al. 1996; Humphreys 1996) have been developed, and constitute a complex *international forest regime*. Its key components include the International Tropical Timber Agreement; the Convention on International Trade in Endangered Species of Wild Flora and Fauna; the Convention on Biological Diversity; the Framework Convention on Climate Change; the Convention to Combat Desertification; other global treaties, such as the Ramsar Convention and World Heritage Convention; regional treaties, such as the Mountain Protocol of the Alpine Convention; and soft law (e.g. the Forest Principles, Chapter 11 of Agenda 21, IPF/IFF Proposals for Action, and reso-

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In the UN World Summit on Sustainable Development in Johannesburg 2002 governments agreed on significant commitments to improve the lives of people living in poverty and to reverse the continuing degradation of the global environment.

lutions of the Ministerial Conferences on the Protection of Forests in Europe in Helsinki 1992, Lisbon 1998 and Vienna 2003).

The UN Conference on Environment and Development (1992) was a milestone in forest policy; an agreement was achieved on important preconditions of a freestanding international forest convention. These preconditions included the principle of sustainable management, conservation and sustainable development of all types of forests, and a number of norms (e.g. prohibition of deforestation, maintenance of natural forests) that encouraged the participating states to continue the international deliberations on forests through the IPF (1995–1997), the IFF (1997–2000), and the ongoing UNFF (since 2001). By now, these negotiations have resulted in more than 270 IPF/IFF Proposals for Action, whose implementation is being followed up by UNFF through *a monitoring, assessment, and reporting system* based on voluntary contributions of the participating states – states are invited to report on their progress in implementing the IPF/IFF Proposals for Action and their national forest programmes.

Monitoring and reporting will provide a basis for assessing the effectiveness, by the year 2005, of the International Arrangement on Forests (UNFF and Collaborative Partnership on Forests, CPF) for developing parameters for a legally binding instrument on forests, and for defining the future role of the international forest dialogue beyond 2005. Standardized questionnaires to responsible national authorities, and sequential monitoring, have gradually increased transparency and comparability among individual national forest policies. These international policy actions should improve the future likelihood of agreeing on a legally binding instrument on forest management. This kind of consensus is gradually becoming possible through the exchange of information, formalized commitments, and periodic meetings facilitated by UNFF.

The Statement of Forest Principles contains the following definition of sustainable management, conservation, and sustainable development of all types of forests; in short, *sustainable forest management*: "Forest resources and forest lands should be sustainably managed to meet the social, economic, ecological, cultural and spiritual needs of present and future generations. These needs are for forest products and services, such as wood and wood products, water, food, fodder, medicine, fuel, shelter, employment, recreation, habitats for wildlife, landscape diversity, carbon sinks and reservoirs, and for other forest products. Appropriate measures should be taken to protect forests against harmful effects of pollution, including air-borne pollution, fires, pests and diseases, in order to maintain their full multiple value." This definition is not very concrete; its vagueness is a result of the negotiations between public and private actors from different territorial levels and the interplay among these levels. The participants operate on at least two levels of co-ordination and have to comply with two basic considerations: they have to co-operate in decision-making in a given arena and to strive for commonly acceptable solutions;

BOX 4.1 Possible Common Global Criteria

Peter Glück

1. Extent of forest resources
2. Biological diversity
3. Forest health and vitality
4. Productive functions of forest resources
5. Protective functions of forest resources
6. Socio-economic functions
7. Legal, policy, and institutional framework

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and they have to pursue specific interests defined by their responsibilities to their own constituency. Agreements in one arena may reduce the chances for consent in other arenas, because actors are committed to previous deals. At worst, interdependence may lead to a deadlock. In such multi-level bargaining situations, actors tend to resort to conflict-avoiding strategies. Agreement is often found on *"soft norms"* that minimize direct interference with relevant interests (Hogl 2002).

There is another reason why the definition of SFM can only be very general. Both the ecological variety of boreal, temperate, and tropical forests, and the socio-economic, political, and cultural differences of the states where they are situated, must be taken into account. Thus, nation states are engaged in regional deliberations to develop appropriate operational definitions of SFM and *a set of criteria and indicators* for the national level. Today there are nine forest C&I processes (e.g. the Montreal Process, the Central American Initiative, and the Ministerial Conference on the Protection of Forestry in Europe, MCPFE), as well as a number of forest-related indicator sets developed as part of broader sustainable development objectives of different international organizations, such as the World Bank, UNEP, OECD, UNCBD, and UNFCCC.

About 150 countries worldwide are engaged in one or more international processes to develop national level C&I for SFM. The regional processes have had the political purpose of providing a tool for monitoring progress towards SFM. This tool could be useful in public relations and in responding to the criticisms of environmental NGOs. However, the processes have evolved to serve a more important purpose: enabling governments and international bodies to monitor, assess, and report on the status of SFM in a country or region (Rametsteiner and Simula 2003).

A common set of seven national-level criteria has emerged from these government-led C&I initiatives; they were acknowledged by UNFF in its fourth session in 2004, and define a global approach to SFM (Box 4.1). Within the regional processes, indicators of progress towards meeting the criteria have also been developed, many of which show similarities across different regions. Especially in the socio-economic criteria, the choice of indicator involves a significant political component, and agreement was usually reached through a participatory process managed by governments in consultation with technical experts and environmental NGOs (Rametsteiner and Simula 2003).

However, while the convergence on regional criteria and indicators is a significant step towards a common understanding of SFM, the current limitations of these instruments should be carefully respected. At the national level, much work remains to be done to ensure common standards of measurement and evaluation, before regional C&I can be used as information instruments in comparing progress among countries. Moreover, regional measures are "coarse filters", and thus quite inappropriate for comparing performance at the management unit level.

National Forest Programmes

A significant experiment in the practical realization of forest governance by networks is being conducted through the formulation and implementation of national forest programmes (NFPs). The objective is the sustainable management, conservation, and sustainable development of a country's forest to cope

BOX 4.2 Principles and Elements of NFPs

Jeremy Rayner

A national forest programme is based on the following key principles:

- National sovereignty and country leadership in programme formulation and implementation
- Consistency with the constitutional and legal framework of the respective country
- Consistency with international agreements and related national commitments
- Partnership and participation of all interested parties in the NFP process
- Holistic, cross-sectoral approach to forest development and conservation
- Long-term and iterative process of planning, implementation, and monitoring

Other principles of national forest programmes include:

- Decentralization and empowerment of regional and local levels
- Recognition of and respect for customary and traditional rights of, inter alia, indigenous people and local communities
- Secure land tenure arrangements
- Ecosystem approaches that integrate the conservation of biological diversity and the sustainable use of biological resources
- Adequate provision and valuation of forest goods and services

Core elements of national forest programmes are:

- A national forest statement, detailing the political commitment to sustainable forest development as a contribution to sustainable development
- A sector review as an assessment of the forest sector and its interrelationships with other sectors
- Political, legal, and institutional reforms, both within and outside the forest sector
- Objectives and strategies for the forest sector, including a financing strategy for sustainable development
- Plans for action and investment for the implementation of the agreed measures, including capacity building and monitoring and evaluation, as well as mechanisms ensuring co-ordination, participation, and conflict resolution

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with local, national, regional, and global needs and demands of present and future generations (Forest Principles 1992). Since UNCED, the formulation and implementation of NFPs has been a permanent demand of many international documents on forests, because a NFP would be the core piece of a legally binding instrument for implementing SFM at the national and sub-national levels.

NFPs are policy-planning instruments, striving to render politics more rational, more long-term oriented, and better coordinated by a series of *basic principles and elements* that replace the principles of traditional technocratic planning (Glück 1999). Some of the principles guiding the formulation and implementation of NFPs are participation of the relevant actors in the policy making process; adaptive and iterative learning processes instead of long-term, scientifically poor forecasts; comprehensive ("holistic") and inter sectoral coordination of actors to internalize externalities; and decentralization in order to facilitate the implementation of policy outputs (Box 4.2). The implementation of these principles requires

the establishment and maintenance of a climate of mutual trust, keeping the participants prepared to remain at the negotiation table and to regard the dialogue on forest issues as an open-ended process.

Empirical evidence to date indicates, however, that those sectors that could become potential losers in the process are reluctant to participate. Participation is necessary to reveal existing conflicts of interest; when compromise cannot be achieved through negotiation, dissenting positions are recorded and have to be considered in future negotiations. Even if only symbolic outputs can be expected in the beginning, the NFP formulation process may change the discussion culture and policy style, which is an important precondition for substantive successes on SFM in the future. What matters is that the process of negotiation continues.

The history of NFPs – the TFAPs (Tropical Forestry Action Plans, later renamed Tropical Forests Action Programmes) (Liss 1999) and the first Finnish NFP (Ollonqvist 2004) are salient examples – reflects the move from traditional governance to governance by networks. Hierarchical co-ordination was no longer possible, and deregulation was limited because of the failure of markets to provide non-wood forest services in sufficient quantity and quality. The governments sought cooperation with other sectors within policy networks in order to achieve the objective of SFM. The concept of self-regulation (Rayner and Howlett 2004) based on policy networks instead of a hierarchy, relies on a new understanding of policy planning. "For decades and almost worldwide, the forest sector was characterized by hierarchical, centralized and even para-military government structures. The focus was on large-scale timber production. Since the 1980s the focus has shifted towards more participatory approaches aiming at reconciliation of conservation and sustainable development of forest resources" (BMZ 2004).

The formulation and implementation of NFPs is no guarantee for policy change towards SFM. In many industrialized countries, particularly in those with high forest cover, forest policies have a long history and are supported by entrenched policy communities. Depending on the power relations of the participating actors and other policy legacies, it is quite possible that NFP processes will not occur at all (as in France or Greece) or, if they do, the outcome will be purely symbolic. According to John Kingdon's (1995) seminal Multiple Streams Approach, the time is not ripe for a certain policy unless the streams of problems, politics, and policies correspond. These three streams develop more or less independently from each other, and Kingdon refers to their convergence as the opening of *a policy window*. However, political actors can influence each of these three streams and thereby improve the chances for a certain policy option to arrive on the policy agenda. Following Kingdon (1995) and Kern et al (2001), Rayner and Howlett (2004) analyzed NFP processes in Europe and Canada and found that institutional factors, and the unpredictable opening of policy windows, are the most important explanations for uneven adoption of new environmental instruments like NFPs.

Recent European research on the formulation and implementation of NFPs has yielded better insight into the necessary preconditions for substantive NFPs; ongoing or future NFP processes may benefit from these findings. In what follows, some examples of these propositions are provided (Glück et al. 2003).

Before a NFP process begins, one of the basic questions is: "Who participates?" The answer depends on several factors, among them the potential actors' abilities and willingness to engage. Participation requires citizens' collective organization. Groups affected, but not appropriately organized, run the risk of remaining unheard. The more actors invest time and effort, the more they can expect to influence the outcome. The likelihood of substantive agreements seems to increase with adequate representation of the affected actors. If some of the participants have no clear mandate to negotiate, the probability of substantive agreements decreases.

Participation in an NFP process will normally be time and resource consuming. This implies that actors who are well endowed with resources are likely to be favored. Furthermore, process management and facilitation also require adequate resources. In particular, employing external consultants and/or independent moderators to run a NFP process might help to achieve widely accepted compromises. Other procedural aspects of NFP processes refer to goals, principles, and clear decision rules to be covered in a "code of conduct" or "process guidebook", which is a necessary precondition for long-term, iterative collaboration processes between multiple stakeholders.

Analyses of NFPs have increased our understanding of the mechanisms that facilitate policy learning. We have learned, for example, that the success of a NFP process depends on internal procedural aspects such as government commitment, and on external factors constituting the environment of a NFP. External factors are the country specific characteristics of the political system, and they may be supportive or impeding. These lessons reinforce our discussion below on the need to assess and address both input and output legitimacy. A neo-corporatist policy style, i.e. a tradition of close co-operation between the government and a small number of selected interest groups, is an impeding factor, whereas the government's proactive and consensus-seeking policy style can be seen as a supportive factor. Existing political culture can hardly be influenced in the short and medium term. By contrast, a clientele dominated forest administration often impedes intersectoral coordination; this must not be taken as unalterable. A legally binding framework for a NFP could support the institutionalization of an adaptive, continuous, co-ordination process.

Forest Certification

Markets are not spontaneous social orders that flourish best in the absence of intervention; they have to be created and maintained by institutions, such as governments and voluntary associations. Forest and timber certification are examples of new market instruments created by voluntary associations. Forest certification is the process whereby an independent third-party (called a certifier or certification body) assesses the quality of forest management in relation to a set of predetermined requirements (the standards) on SFM. The verifier gives a written assurance that a product or process conforms to the requirements specified in the standards (Rametsteiner and Simula 2003).

The certification of forest products realizes, at least potentially, one of the central ideas of governance: *civil society governing itself*, without the involvement of states, or without legitimization from the political authority. Cashore (2003) has urged the characterization of at least some certification programs as examples of pure private regulation. He locates the certification movement in the general trend towards international private governance. Non-state market driven (NSMD) policy instruments aim to manipulate customer preferences in the supply chain, creating a demand for forest products from sustainably managed forests. Certification will thereby bypass conventional regulation altogether, and provide market incentives for producers (Cashore et al. 2004).

The impacts of certification as an NSMD system are complicated by several factors. For example, certification is likely to provide effective market incentives to producers only in situations where round wood or its derivatives are marketed in environmentally sensitive markets. It is estimated that worldwide some 53% of all round wood is consumed as fuel wood, and only some 6–8% of total round wood production enters international trade (Sarre 2003). Of the small proportion that is internationally traded, increasing amounts are destined for markets that are not especially environmentally sensitive (e.g. China). Even in markets with well-developed consumer preferences for sustainably produced forest products, customers and/or consumers need to be made aware of such schemes, and be convinced that the claims of sustainable management are credible.

Consumers may be confused by the large number of competing certification programs, which are based on different approaches to sustainability. Finally, most of the literature on certification underestimates the extent to which traditional governing capacities are used, and the amount of network governance that is needed to support NSMD instruments. Unintentionally or intentionally, many existing certification programs use procedural instruments developed in full or in part by states.

The increasing importance of nation-states in NSMD systems was not the vision of the oldest program, the *Forest Stewardship Council*, which certainly comes closest to the ideal type of NSMD. The FSC grew out of discussions in Toronto in 1993, after the failure to create an international forest convention at UNCED. Some environmental organizations, notably WWF and Greenpeace, felt disinclined to renew their efforts to reach a consensus on a forest Convention, and were even concerned that a weak Convention might make a bad situation worse. They determined to develop an eco-labeling program that could harness their power to influence consumer preferences. The beauty of such a scheme would lie in its ability to bypass the governments that were preventing or preparing to water down the international forest Convention.

The organizational structure of FSC was heavily influenced by its founders' analysis of the role of industry and government in blocking forest policy reforms. Government is excluded altogether from FSC decision-making. The influence of the forest industry, which for obvious reasons could not be completely shut out, is strictly limited to one third of the votes within a complex, multi-chamber, double voting decision-making system. Originally FSC conceived of certification that would require certificate holders to conform to relatively stringent performance standards – similar to the regulations that environmentalists had urged, without much success, in the reform of national forest laws and in the international convention discussions during the 1990s.

Along with this cumbersome and demanding set of procedures, nine (later ten) guiding principles and criteria of sustainable forestry were established (specific standards were left to national and regional initiatives). However, the creation of a new policy instrument that curtailed the actions of the key target groups, forest owners and industrial forest companies, limited FSC's ability to gain support. The forest industry and private forest owners have responded to FSC by developing *competing certification programs*, usually with the implicit, if not explicit, support of governmental forestry and resource agencies.

While some of these programs were originally little more than transparent attempts to resist the influence of the FSC, they have evolved into important forms of forest sector self-regulation and created new programs to compete directly with the FSC. Examples include the American Forest and Paper Association's Sustainable Forestry Initiative (SFI) program, which was converted from a voluntary code of practices program into one that developed "on the ground" standards and a third party auditing process to assess whether companies were in compliance. Often NSMD alternatives, including the Canadian Standards Association SFM Program in Canada, Indonesia's LEI Program, the Finnish Forest Certification Program, Brazil's CEFLOR, and Malaysia's Tropical Timber Council (MTTC) program, were developed with the assistance of the very govern-

mental agencies the FSC consciously excluded. Other programs, such as Program for Endorsement of Forest Certification governance systems (PEFC), originally created by European forest owners as a response to the FSC, serve as "umbrella", "mutual recognition" program for national initiatives that have been developed to compete, or pre-empt, the FSC model. National initiatives can take on the PEFC name directly or they can be mutually recognized, as occurred in November 2004 with the Australian Forestry Standards (AFS), after the industry developed its own standard.

From the beginning, most of these alternative programs relied more heavily on process rather than performance standards, and were based on the popular environmental management system model (EMS), ISO 14001 being the most familiar. In this model, a company or an individual can be certified as practicing good forest management when they have developed a policy to increase positive and mitigate or eliminate negative impacts, and have established processes for monitoring environmental impacts.

The arguments for process over performance standards usually emphasize that the former cultivate awareness of environmental impacts and, together with criteria and indicators of SFM, engage producers in constant internal dialogue aimed at improving performance. Performance standards are seen as appropriate for governments, which are in a position to enforce them. In fact, all certification programs of this kind refer to the role of forest law and policy in providing a basic standard for environmental protection, a backdrop against which individual producers' improvement efforts take place. In Europe, for example, national certification programs were developed, coincidentally, at the same time that national forest laws and policies were changed to promote SFM. Certification thus operates in the *"shadow of hierarchy"* (Scharpf 1999) and is an important example of the mixed mode of governance.

Cashore's (2003) useful characterization of certification as a NSMD policy instrument must be seen as an ideal type, rather than a description of any particular certification program. This characterization highlights a number of the key features of forest certification as a governance instrument. First, consumers have to be made aware of the idea of sustainable forest management. Second, they have to be convinced of the importance of their own actions when seeking and purchasing certified products. Third, distributors and retailers have to be convinced of the commercial advantage of finding and stocking such products. Finally, producers have to be made aware of the standards they must meet in order to be certified as sustainable producers, and of the advantages of doing so. All this is, to a large extent, independent of those aspects of forest certification that have attracted the most political attention: the development of the standards, the process of granting the certificate, and the verification of compliance with its conditions.

Decentralization

One of the most promising directions for the creation of interdependent bottom up "policy networks" is in attempts to increase decentralization of forest resources management (Larson 2004; Ribot et al. 2004). Agrawal and Ribot (1999) define decentralization "as the transfer of powers from central government to lower levels in a political-administrative and territorial hierarchy". The growing demand for decentralization stems largely from the documentation of widespread corruption and illegal practices in the forest sector. Such practices are particularly a problem in developing countries and in countries with economies in transition, where there is generally weak governance capacity to implement and enforce regulations over forest resources management. Illegal logging and corruption, with their widespread negative effects on the social and economic development of these countries, are viewed as major threats to the achievement of SFM (e.g. the Philippine's president asserted that illegal logging was the cause of the December 2004 land slides that had a high death toll and a negative impact on the country's development).

Existing research has found that corruption and illegal practices in the forest sector have serious effects, which:

- Jeopardize the livelihoods of the poor forest dependent populations;
- Distort markets for timber and discourage responsible forest operators to practice SFM;
- Reduce tax revenues of the government;
- Encourage illegal activities in other sectors of the economy, and thereby jeopardize national monetary and exchange rate policies;
- Threaten ecosystems, biodiversity and environmental services, particularly in parks and protected areas; and
- Jeopardize the intended beneficial impacts of forest sector projects. (Kishor and Rosenbaum 2003).

By creating new bottom up policy networks, decentralization efforts can destroy, or sidestep, the corruption and/or weak enforcement capacity at the central state level. This is achieved by establishing new administration structures at the sub-national level, closer to those affected by central mismanagement of the forest resource. Those advocating decentralization believe that well-informed, more accountable modes of sustainable policy governance will be achieved by creating bottom up policy networks, emphasizing interdependent local actors who are directly affected by policy decisions. This will in turn create favorable conditions for successful implementation and enforcement of SFM. The underlying logic is that local authorities represent local populations better because they have better knowledge of local needs. When they are endowed with powers, in particular with discretionary powers over public resources, they are more likely to respond to local needs than

BOX 4.3 Decentralization of Power in Indonesia

Benjamin Cashore

Decentralization in Indonesia began in January 2000 and aimed at transforming Indonesia into one of the most decentralized countries in the world. The responsibilities for agriculture, land, industry and trade, capital, and labor were shifted to some 360 local governments (districts). This step had a positive influence on the general political climate in Indonesia. However, the new decentralization law did not define the local governments' functions, for example, leaving unclear the responsibility for mining and natural resource management. In addition, local governments did not receive adequate financial resources to fulfill their new tasks.

The most significant decision in the forestry sector was that districts gained the authority to grant 100 ha logging concessions, in order to provide poor people with land for subsistence farming, and to compensate them for the loss of indigenous land rights. Clear-cut concessions of this type did not require reforestation and were only valid for one year. In the end, ambiguous, overlapping, or conflicting decentralization laws, as well as the need for revenues, have led local governments to issue larger concessions, which often overlap with centrally-issued logging concessions. In addition, the forest related legislation in Indonesia consists of some 500 pieces of legislation, many of which are overlapping or conflicting.

References

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a distant central authority (Ribot et al. 2004). Hence, decentralization efforts must be judged as successful when they curtail illegal practices and corruption and facilitate policy implementation, and as failures if they simply create another arena for corruption and illegalities.

Corruption and illegal practices in the forest sector are symptoms of a broader phenomenon. In many developing and transitional economies, where violence or the threat of violence, clientelism, and corruption are key determinants of political power, cultural capital is more important in shaping the practices of political actors than in more mature democracies. In this environment, cronyism and patronage are widely used means for obtaining and rewarding political support. Recognition of these broader factors have led a range of actors and organizations to reconsider the role of the central government in administering forest resources, and to put more emphasis on the roles of local governments and local communities' rights and responsibilities.

In fact, in developing countries and countries with economies in transition, decentralization of government responsibilities has an important influence on forest governance and the social processes in which related institutional arrangements are negotiated. A recent World Bank study found that more than 80% of all developing countries and countries with economies in transition are currently undergoing some form of decentralization (Manor 1999). Developing countries where decentralization has now been initiated include Mali, Bolivia, Nicaragua, Bolivia, Guatemala, Indonesia, Honduras, Uganda, Mali, Senegal, the Democratic Republic of Congo (DRC), and Brazil. These recent efforts stand in contrast to the more entrenched systems of decentralization and/or community forestry found in India (Kant 2001), Mexico (Alcorn and Toledo 1998; Mery et al. 2001), and to a lesser extent China (Bruce et al.1995).

Unfortunately, most of these decentralization processes have failed to live up to their promise because democratic local governments have not been empowered (Box 4.3). Agrawal and Ribot (1999), Ribot (2004), Ribot et al. (2004) and Agrawal (2004) have found that in the vast majority of cases, central governments and environmental ministries resist the choice of appropriate local institutions, fail to transfer appropriate and sufficient powers to them, continue to work through non-representative local institutions (local forestry offices, NGOs, etc. that are not systematically accountable to local institutions, and are often accountable to central authorities), and devolve only limited and overly specified powers (e.g. controlled through excessive oversight and management planning requirements).

Specifically, in the cases noted above, most countries failed to provide for meaningful decentralization because they maintained control over commercial operations and collection of tax revenue (although, in the case of Honduras, Bolivia, Nicaragua, Guatemala, and Indonesia, central governments "gave" a portion of the collected taxes to local units). In some cases, as in Uganda, control was limited by the small amount of land ceded to local units. As Larson (2004) notes, where decentralization was formally implemented, other factors presented key obstacles. For example, decentralization in Brazil's Acre state occurred in forest areas that were further way from commercial timber markets than central government controlled land, and in Honduras the decentralized "Ejidos" system allegedly comprises more degraded land than the lands over which the central government retained control.

Decentralization is often truncated because of an array of interacting factors that limit meaningful decentralization efforts, including fear that policy makers and civil servants may lose economic benefits gained through the control of natural resources, and concerns about maintaining standards, social and en-

vironmental well-being, and political stability (for details of a specific case, see Box 4.3). Given that existing efforts for decentralization face such fundamental hurdles, Agrawal (2004) has argued that "if decentralized institutions sometimes yield positive outcomes, and at other times create outcomes that are less desirable in relation to policy objectives, it becomes more important to analyze the conditions that lead to variable outcomes before pursuing decentralization as the strategy of choice."

In order to fulfill the promise of decentralization in promoting SFM, its advocates argue that the following three basic elements are critical (Ribot 2004):

- *Accountable, representative local institutions*: For the management of public resources such as forests, accountability should run from local groups through elected local bodies to the people.
- *Meaningful discretionary powers*: Discretionary powers enable local authorities to respond flexibly to local needs and aspirations, making them relevant to their constituents.
- *Secure power transfer*: Means of power transfer are manifold; they can be constitutional, legislative, ministerial decrees, or administrative orders. Constitutional transfers are the most secure and sustainable, because they are more independent of government changes.

In addition, for decentralization to be effective, accompanying measures and appropriate central government roles are necessary. These include a strong central state, minimum environmental standards, uniform minimum standards for all corporations that manage forests, additional measures for poverty alleviation, local mediation activities, etc.

Devolution of Public Rights

Another mechanism through which "bottom-up" policy networks have been developed, and one that sidesteps central governments' concerns about losing power, is the creation of public/private partnerships. In this approach, governments maintain authority to create policy, but delegate implementation to businesses and the non-profit sector. The idea behind these networks is that the efficiency and effectiveness of governance can be improved by the devolution of public rights over natural resources to the private sphere, by *privatization* and/or commercialization of forest and/or forest management.

This trend is shifting the balance of power from the public sector towards the private sector, and requires a greater involvement of private sector actors (e.g. through industry and professional associations) in processes that determine the normative framework and incentives for participation. For negotiating public private partnership arrangements between different societal groups (e.g. central or local government, the private sector, and local communities) specific processes that focus on concrete partnership arrangements are necessary. Linder and Rosenau (2000) define *public-private partnerships* (PPPs) as "the formation of cooperative relationships between government, profit-making firms, and non-profit private organizations to fulfill a policy function".

PPPs have become an increasingly common means of devolving forest management responsibilities and user rights to the private sector and civil society in general. PPPs range from broad agreements on cooperation and traditional public contracting of services and joint-ventures, to equity investment, debt guarantees, and outright grants given to the private sector and civil society for performing certain functions and providing services. Commonly they include such legal arrangements as contracts for services, management and/or leasing, contracts to build, operate and transfer or own and operate, and joint contracts. The contract parties may include central and local governments, international organizations, private companies, business and other associations, NGOs, and private individuals.

In the forest sector PPPs involve partnerships between the central and/or local government and private companies (e.g. in the case of long-term forest concessions), partnerships between central and/or local government and local communities (e.g. in the case of joint forest management agreements), and partnerships between the central and/or local government and NGOs and/or private companies as service providers (e.g. in the case of outsourcing of such functions as extension services, information services, research, etc.).

Self-Organization

Arguably one of the most important forms of "bottom up" networks, which has also received significant scholarly attention, is the effort to return forest management back to the "common pool regimes" that had, as we noted above, managed forest sustainably for decades before the onset of the rapid social and economic transformation associated with industrial expansion. Central government's well-intentioned efforts to address sustainable forest management through nationalization of the forest resource have tended to exacerbate problems and dislocate forest dependent communities. As a result, self-organization initiatives, which we envision as one of the most important forms of interdependent policy network, are enjoying a renaissance in many developing countries.

Elinor Ostrom and her associates have spent considerable effort in exploring the favorable and impeding conditions for the evolution of effective self-governing resource institutions, designed to avoid the pitfalls associated with the decentralization efforts noted above. She developed ideal conditions (eight "design principles" and eight "threats") for robust common property regimes (Ostrom 1990,

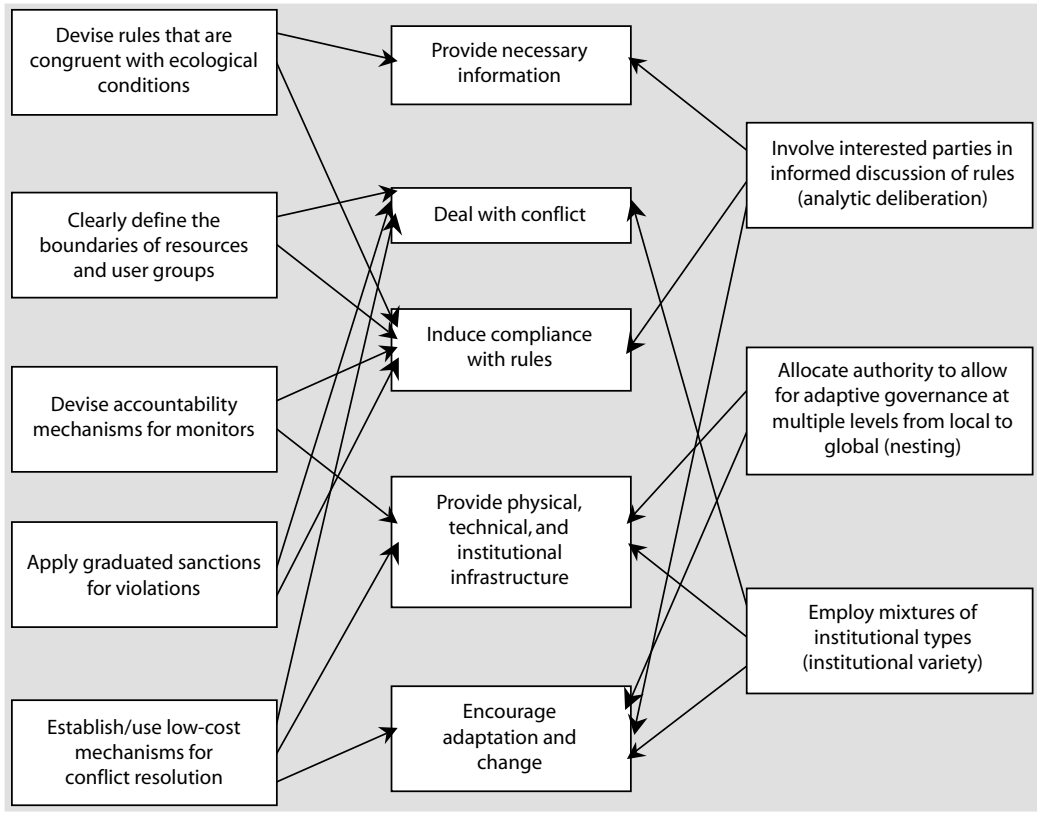

Figure 1. General principles for robust governance of environmental resources (Dietz et al. 2003).

1998), which are summarized in the left column of Figure 1.

Due to the absence of ideal conditions in the real world, additional requirements for adaptive self-governance have to be met in complex systems (center column of Figure 1). In the case of forestry, at the self-organization level information about forest stock, growth, health, annual allowable cut, biodiversity etc. is needed for SFM. Successful common property regimes will usually need this information for the formalized forest management plan. Moreover, the most effective self-organization institutions are those that produce interactions between the different values and interests of the forest policy network, so that power conflicts facilitate learning and widespread network agreement on appropriate policy development. A key condition of such an approach is that self-organized common property regimes need to have either a coercive or a normative system for rule enforcement that is deemed to be effective and legitimate by resource users. (Dietz et al. 2003). Financial incentives to achieve compliance with environmental wants (e.g. forest reserves) may be backed up by the threat of coercion.

In short, these particular forms of "bottom up" forest policy networks must create an arena conducive to change that encourages and facilitates adaptation to new requirements. Drawing on a range of research on common property regimes in India, Nepal, Latin America, and Africa, Dietz et al. (2003) identify three strategies for meeting these adaptive governance requirements (right column of Figure 1).

4.5 Causes of the Shifts in Forest Governance

The debate on what is driving the observed shifts in forest governance has barely begun. In the preceding discussion of the new modes of governance, many potential causes of the shifts were noted in passing: new forest problems, such as deforestation, forest degradation, loss of biological diversity, illegal logging practices; better democratic representation; increased efficiency and effectiveness of policies, etc. As drivers of change, they all reflect the fact that the variety of actors, the diversity of their interests, and the complexity of the relationships between the various actors have increased. In addition to the unique impacts of local and regional factors, the new complexity may be attributed to two major trends characterizing the socio-economic environment in which the forest governance debates of the 21st century take place. First, we have witnessed an increasing role for civil society at all levels of governance, sub-national, national, and international. Second, the closely related but separate processes of globalization and internationalization have widened and deepened (Bernstein and Cashore 2000). That is,

as the value of global trade in forest products continues to grow, bringing more countries and regions together in trading relationships, and increasing the importance of multi-national corporations (globalization), the transnational actors and international institutions redouble their efforts to promote their ideas and to maintain some control over trade and its impacts on the sustainability of global forest resources (internationalization).

Globalization and Internationalization

The dynamics of globalization and internationalization create many important new linkages that in turn promote the importance of civil society's expanded role in forest governance. For example, multinational or transnational corporations are increasingly turning to plantations of fast-growing non-native species, like eucalyptus, to meet pulpwood needs. The implications of this for the world's remaining natural forests have to be taken into account in attempts to monitor international trade by certifying forest products coming from sustainably managed sources. For example, FSC began by excluding plantation forestry from possible certifiable sources but latter added a tenth principle of SFM, which enables the certification of wood products from plantations. The broadening and deepening of certification in this way raises issues of transparency and accountability in corporate governance, and has helped to strengthen the NGOs, who as a response are developing certification and eco-labeling.

At another level, donor countries and multilateral donor agencies have tried to link aid, including aid for forestry projects, to the sustainability agenda. Such linkages raise issues concerning the recipient governments' transparency and accountability. While the donor community has sometimes pressed governments to improve their governance capacity, it has often preferred to bypass governments entirely and worked directly with communities and NGOs. Such a strategy has not only furthered the decentralization of forest governance noted above, but also provided a powerful impetus for the development of civil society institutions in countries where they have remained dormant or been actively repressed.

Civil Society

The increasingly important role of civil society in forest governance has its roots in the limitations of traditional governance instruments in a globalized forest economy, and in the dawning realization that outside government there is capacity for innovation to overcome these limitations. Dissatisfaction with traditional instruments came to the fore in 1992, at UNCED in Rio de Janeiro, when the long-running deliberations aimed at achieving a global forest convention finally failed. The representatives of the nation states had failed to draw due attention to the rise of "a sphere of social life that is public, but outside the sphere of government" (Meidinger 2003), which in modern academic discussions is generally called "civil society". It may be defined as follows (Diamond 1996): "It is distinct from 'society' in general in that it involves citizens acting collectively in a public sphere to express their interest, passions, and ideas, exchange information, achieve mutual goals, make demands on the state, and hold state officials accountable. Civil society is an intermediary entity, standing between the private sphere and the state. Thus, it excludes individual and family life, inward-looking group activity (e.g. recreation, entertainment or spirituality), the for-profit-making enterprise or individual business firms, and political efforts to take control of the state."

Civil society relationships are usually voluntary or un-coerced. Although they lack the sanctions associated with government directives, they play a powerful role in governing society by controlling public opinion. The statements of civil-society entities fall into three groups (Gosewinkel et al. 2004): statements against the super-powerful, enticing, restricting state; statements against the omnipresence and superiority of markets; and statements emphasizing public spirit with communitarian elements, arguing that the state overestimates its capabilities, that the market is too powerful, and that the society is fragmented (e.g. civil society in Bangladesh).

In the course of the 1980s, various civil society movements from different regions gradually grew together, forming a transnational and even global civil society. Some key factors played a crucial role in the globalization of civil society (Haufler 2003; Meidinger 2003):

- *Global information technologies* for gathering information and communicating it by telecommunication systems, television, internet, etc.
- *Transnational economic structures* for increasing the scope of both transnational interdependence and the externalities associated with market activities
- *Reduced roles of governments* in environmental and social policy as a consequence of the growth of the transnational economic system. "The reduced ambitions of governments have made room for expanded ambitions of civil society organizations" (Lipschutz 2001 quoted in Meidinger 2003).

The larger issues of contemporary forest policy emerge at the intersection of these two socio-economic trends. That is, the development of civil society at sub-national, national, and global levels brings new actors and new ideas into forest policy, while the broadening and deepening of global forest trade and international institutions creates a rapidly changing context for action. For example, in the industrialized nations, civil society interest in forest policy issues has been closely related to broad, intergenerational

value change, identified by Ronald Inglehart (1990) as a movement from materialist to post-materialist values. Thus, civil society has become concerned with such issues as forest die-back in Europe, the loss of virgin forests in North America, and deforestation in the tropics.

The impact of post-materialist values, however, should not be exaggerated. Their influence has been much weaker in countries where questions of material development and even mere survival are important for most of the population. Even in some countries where post material values have made inroads, the forest products industry continues to be important. In countries where the timber industry is important in national development, governments and industry have advocated governing models that help to develop a competitive timber industry and to meet other community needs by ensuring access to round wood at reasonable cost. Through the broadening and globalization of the "forest agenda", the linkages between forest management and development are situated in a more diverse policy environment, ranging from conservation and national sustainable development strategies to the UN Millennium Development Goals and the Poverty Reduction Strategy Papers (PRSPs) in the case of developing countries.

Global Trends and Local Impacts: Four Ideal Types

Combined with the increasing diversity of participating actors, the complex linkages discussed above have led to a different emphasis in the forest policy debates of different countries. Figure 2 attempts to summarize the focus of these debates. The discussion is based on two variables: forest cover (high forest cover versus low forest cover on per capita basis), which functions as an indicator of the relative importance of the forest industry to national development goals in the context of globalization; and the socio-economic status of the country (industrialized vs. developing), which functions as an indicator of the relative importance of materialist and post-materialist values in the context of the role of civil society.

The *industrialized countries with low forest cover* tend to see forests from an environmental sustainability angle, focusing more on forest services, including recreational uses and aesthetic landscape values, than timber production. Forest policy tends to be a sub-category of environmental or rural sustainability policy. While open conflict over forest uses tends to be unusual, there are significant issues of inter-sectoral coordination that need to be addressed if forest sustainability goals are to be realized.

In the case of the *industrialized countries with high forest cover*, the views of different interest groups are generally more polarized, and debates tend to focus on the level of environmental standards in forest management and the amount of forest land

	LOW FOREST COVER	HIGH FOREST COVER
INDUSTRIALISED	ENVIRONMENTAL SUSTAINABILITY (e.g. United Kingdom, Netherlands, Japan, Denmark)	SUSTAINABLE DEVELOPMENT (e.g. Canada, USA, Australia, Finland, Sweden)
DEVELOPING	SUBSISTENCE AND POVERTY REDUCTION (e.g. India, China, Kenya, Somalia)	ECONOMIC DEVELOPMENT (e.g. Gabon, Indonesia, Russia, Papua New Guinea, Brazil)

Figure 2. Focal areas of forest governing debate (Glück et al. 1996; Maini 1996)

to be allocated for productive vs. conservation purposes. The core issue is how forests and the forest sector can best contribute to sustainable development goals in a particular country (or within a region, such as the EU). Due to the importance of the timber trade in many of these countries and their well-developed civil society networks, international NGOs are involved in the forestry debates.

In *high-forest cover developing countries* the focus is on timber production, but issues related to equity and local rights, environmental conservation, and the protection of non-timber forest products for local use and employment generation are also important. Because forests in these countries are key contributors to global biodiversity and climate-change goals, forestry debates tend to have prominent international links. These links are also promoted by the trade-related aspects of timber production. Illegal logging and trade in illegal timber are also important issues in the debates. The international NGOs and the trans-national timber companies participate directly in forest debates, but they also influence these debates indirectly through local and national interest groups.

In *developing countries with low forest cover* the main issues tend to focus on the contribution of forests and trees to local livelihoods (e.g. through farm and village forestry and wood based energy) and local environmental uses (e.g. soil conservation and watershed protection). As in the case of the low forest cover industrialized countries, there is more consensus regarding policy objectives than under the other two ideal types. However, policy must be carefully coordinated if the surviving forest, which is often heavily fragmented or in sensitive mountain terrain, is to meet the multiple demands that are placed upon it.

Governments in each of these four ideal-typical situations face complex and novel issues that have strained the traditional governing instruments to a breaking point. While the precise actions of government, industry and civil society actors will depend upon a host of contextual factors that are specific to region, country, or even locality, a general com-

mon aspect can be identified. Whether by accident or design, sometimes willingly and at times with a great deal of resistance and obstruction, both national governments and international institutions have tried to mobilize the creative energies of civil society to solve the new forest policy problems, thus making a historic transition from traditional to new modes of forest governance.

We have noted above the challenges posed by the new socio-economic environment to traditional forest governance. However, forest network governance has problems, too. Each of the focal areas of forest governance debate, identified in Figure 2, will tend to generate distinctive problem sets that challenge forest network governance capacity.

In *industrialized countries with relatively high forest cover*, problems in opening up well-established forest policy communities of administrators and technical experts, who are often suspicious of new actors and new ideas, are common. In *countries with relatively low forest cover, whether industrialized or not*, formidable coordination problems arise from the existing subordination of forest policy to other goals. In industrialized countries these goals may be rural development and community sustainability or larger strategic land use planning objectives. In *non-industrialized countries with low forest cover*, international organizations are interested in a wide range of factors, from environmental issues like biodiversity conservation to broader social and economic concerns like Poverty Reduction Strategies, land reforms, administrative capacity building programs, and tariff and trade policies. To the extent that forest policy is recognized as a distinct policy at all, it will tend to be the residual outcome of these other processes, requiring international networks to monitor and steer the processes towards forest sustainability goals.

In *non-industrialized countries with high forest cover*, where the development of a flourishing forest products sector is a national development goal, the additional problem of vested local interests, which may be working against policies of local capacity building or land reform, cause the forest sector to obstruct reforms in other sectors. In these circumstances, the ability of network governance to solve these problems remains very much an open question, as the rather uneven record of certification efforts in tropical forest management and timber trade clearly indicates. The development of a more sophisticated theoretical analysis of the available network governance instruments, and the rapid diffusion of best practices based on real world experience, will be critical tasks for forest governance in the immediate future.

4.6 Impacts of New Forest Governance on Legitimacy

New forest governance raises important and difficult questions regarding the critical dimensions of input legitimacy, especially accountability and responsiveness (Ribot 2004). Faced with a lack of empirical data on the impacts of forest governance shifts on accountability, responsiveness, and legitimacy, only some general assertions can be made. This will likely become an important topic for future research.

Will New Forms of Forest Governance be Legitimate?

In spite of many differences, all new forest governance institutions have profound implications for the ways that governments establish and maintain their legitimacy. Governments are generally regarded as legitimate if citizens acknowledge their right to rule, even while disagreeing with particular policies and other government actions. Such acknowledgement is derived from approval of the procedures by which policies come about (input legitimacy), and the performance of governance institutions (output legitimacy). *Input legitimacy* refers to the rules of the game; *output legitimacy* refers to the success of the political system.

In one sense, all the new modes of forest governance increase input legitimacy. Generally, network governance employs participatory approaches to policy formulation and more actors have the chance to take part in negotiated policy making through processes like NFPs. In governance by an international forest regime, for example, legitimacy is enhanced by the promise to solve international forest issues through voluntary negotiations by nation states and international civil society. In decentralization, the legitimacy of sub-national units depends on their democratic representativeness and on clear power sharing with the central government.

Similarly, output legitimacy is improved to the extent that network governance succeeds in dealing with issues of complexity and rapid change which undermined the old, top-down national forest policy regimes, and addressing recurrent and persistent forest policy problems.

In a number of other respects, however, new modes of forest governance pose challenges to legitimation. The use of NSMD instruments, such as certification and eco-labeling, is an excellent case in point. For the success of NMSD instruments it is essential that there be no hint of compulsion or other legal requirement to certify; otherwise, they will be identified as illegitimate barriers to trade. A successful certification scheme, by its very nature, will impose significant costs on producers who refuse to certify and provide material advantages to those who do. As Cashore and his associates have shown,

states have generally not stood idly by while private certifiers battle amongst themselves (Cashore et al. 2004). For example, governments' use of information instruments to make consumers aware of SFM and their own responsibilities in finding certified forest products has been a critical feature in the success of certification in many countries.

Cashore et al. (2004) reveal many other ways, in which governments have directly or indirectly enhanced the legitimacy of NSMD programs. A government may promote ecological goals by law, or by acting in a consensus-building role without determining how the goals will be reached; within these discussions, it can mobilize new actors and marginalize others. Arguably, the failure or inability of some governments to use information and procedural instruments effectively has critically weakened the impact of certification in parts of the world.

The ingenious ways in which governments have become involved in certification, allowing certification to become a familiar element of new forest governance without enacting it as public policy in the old sense, may be welcomed as a shining example of the looser kind of coordination required by new forest governance. On the other hand, certification raises acute legitimation problems. The cooperation and coexistence of state, corporate, and civil society actors that are involved in new governance disperses decision-making authority across a complex network of relationships. If citizens do not like the outcomes of network governance, how can they trace those who were responsible for the decisions and how can they hold them accountable for their actions? If they try to hold governments responsible, the latter can reply in all sincerity that the decisions were not theirs to take.

Because the international forest regime has many of the same characteristics as network governance, many of the same considerations are relevant. For instance, as international fora they are outside the old national governance system of checks and balances that provided explicit accountability mechanisms. Nobody can hold the actors in international fora responsible if they fail to produce public goods after many years of negotiations. Their success in implementing resolutions on international forest issues largely depends on the voluntary monitoring and reporting systems of the countries participating in the deliberations.

Even in domestic forest policy, where states once confidently proceeded on the basis of their ability to regulate and subsidize, we now find equally ambitious uses of procedural instruments. For example, many forest managers are now painfully familiar with new participatory planning mechanisms that focus on facilitating the emergence of policy goals from the planning process itself, rather than handing them down to the participants as pre-ordained objectives. As the North American experience with these processes illustrates, participatory planning tends to change the character of a policy network from one that seeks to enable a rapid flow of information to a network that is actively engaged in questioning what counts as "information". Struggles over knowledge claims and voice become dynamic new elements in network politics (Shannon 2002).

Learning to "let go", to engage in governance rather than government, has been hard for policymakers and forest managers alike. Those dissatisfied with the outcomes have often resorted to challenging the legitimacy of the processes themselves, resulting in the civil disobedience, timber boycotts, and other forms of unconventional political protest that characterized forest politics in much of Canada and the United States in the 1990s.

Many other governments around the world are struggling with this fundamental paradox of voluntary, non-state, or self-regulation: bringing new actors with new ideas into forest policy networks increases both the creativity of forest policy-making and, potentially at least, the output legitimacy of the solutions, while simultaneously making policy networks harder to steer in the direction desired by the state and other traditional policy actors. Efforts are needed to control the risks of driving new actors out of the networks and increasing support for private self-regulation or even law-breaking and other forms of protest. The key feature of the shift from traditional to new modes of governance is that the legitimacy and effectiveness of government involvement in network steering seems to be increasingly based on government's ability to successfully harmonize key actors' different agendas and negotiate some form of workable consensus, rather than on its ability to impose close control (Hajer 2003).

Co-Existence of the Old and New Form of Governance

By drawing attention to the challenge of legitimating policies that are the outcome of new governance arrangements, we do not want to overemphasize the difficulties. Sometimes the solutions are simply novel uses of familiar instruments. For example, while the nation state retains the primary responsibility for the enforcement of international resolutions on forests, additional accountability mechanisms are being developed through efforts which institutionalize disclosure and transparency, thereby enabling civil society to assess whether businesses are living up to the commitments that they have made, and to engage in direct targeting and corporate "shaming" if they are not. The popularity of benchmarking as a tool of international comparison, while clearly open to the kind of misuse of C&I noted above, is nonetheless a promising development when used at appropriate scale.

In other cases, what appears to be a problem may contain its own solution. For example, depending on how the network structures are managed, they

Marko Katila

Participatory forest management planning in a pilot project area in Laos.

may facilitate input and output legitimacy through policy learning across an array of interests. Many of the forest and non-forest C&I processes have drawn upon expert groups or technical bodies for developing an initial set of criteria, in what looks like the old technocratic manner. Subsequently, through opening up the network, not only were the criteria refined, but also the process itself was broadened and deepened. A similar shift can be observed in some NFPs that were originally conceived as expert consultations, but now operate as genuinely participatory and process-oriented networks. "Thus information exchange and disputation itself becomes part of the system of checks and balances within the network administration and the network economy. It works also as a mechanism for mutual learning … In this way, networks may be producing their own system of mutual control." (van Kerksbergen and van Waarden 2004).

We expect experiments with the mix of old and new forms of governance, which have with only slight irony been called regulated self-regulation (Knill and Lehmkuhl 2002), to continue. With all their faults, the political-administrative structures of modern democratic states are products of considerable reflection and long political struggle around certain issues, such as accountability of decision-makers to the wider citizen body, transparency of public processes, predictability provided by the rule of law, and so on. The challenge is not merely that decision-making in networks may turn out to be unpredictable, unaccountable, and opaque. Even more serious is the possibility that *traditional political structures* may be the precondition for the effective functioning of networks, just as they are for markets.

Policy networks will never include everyone. How will their decisions be accepted as legitimate by citizens unless they conform in some respects to the general norms of legitimacy in democratic societies? Thus, as with markets, effective policy networks may require a certain minimum of political-administrative capacity in order to function, and may not be easily applicable in states lacking that capacity. Even when capacity is present, we may need to acknowledge more openly the importance of traditional governing values, such as democratic accountability and the rule of law, in order to avoid a situation where network governance undermines its own foundations.

There are hopeful signs that governance will eventually evolve to governing in contemporary forest policy and politics. For example, there has been a retreat from the extreme position that rejects the use of substantive policy instruments completely. Regulatory failures are not inevitable, in this view, but caused by the adoption of "one size fits all" regulatory instruments (Gunningham and Grabosky 1998; Gunningham and Sinclair 2002). Self-regulation, in the form of an industry-led scheme for certifying sustainably produced wood products, may be combined with government and NGO involvement in drawing up standards, regulatory relief for those who comply with or go beyond the standards, and closer regulatory supervision for those who fail to reach the standards or refuse to participate in the scheme. Many of the weaknesses of the existing forest certification schemes can be traced to a refusal to mix instruments in creative ways.

Fortunately, this kind of self-regulation "in the shadow of hierarchy" is becoming more common in many other policy fields and, of course, relies on the traditional governing capacities of states as much as it does on the governance skills of network actors. For example, as the competing certification schemes begin to converge on common approaches, especially C&I of SFM, some form of state involvement may be acceptable to critics who are rightly concerned about the weak enforcement capacity of private self regulation. The experiences of forest development aid agencies with the formulation and implementation of NFPs demonstrates that government commitment to NFP implementation is probably the most important factor for a successful NFP process (BMZ 2004). In the process, governments acquire a whole new range of policy instruments and steering capacities with which to address the challenges of the new forest policy environment.

4.7 Discussion and Conclusions

Following UNCED in 1992, there has been worldwide agreement on the goals of the Statement of Forest Principles: to ensure sustainable management, conservation, and sustainable development of all types of forests in order to meet the economic, ecological, social, cultural, and spiritual needs of present and future generations. The accomplishment of these goals requires forest-related governance to adapt to

far-reaching changes in the political processes of the forestry sector.

As the Forest Principles show, the diversity of interests in forests has increased. Although timber production will not lose its importance in the future, the demand for non-wood products and services has increased considerably. In addition, the variety of actors in forestry has increased. Forestry is no longer the focus solely of forest associations and forest administration, but also of a multitude of governmental and non-governmental organizations, dealing with activities that either affect or are affected by forest management. As a result, the relationships between the various actors with diverse interests and powers have become more complex, with the relationships compatible over some issues and not over others.

Furthermore, because many forest policy issues are trans-boundary, the bargaining on forest issues no longer takes place only at the sub-national and national levels, but also at the supra-national and international levels. The impressive number of formal international instruments and initiatives aimed at implementing elements of improved forest governance (e.g. IPF/IFF/UNFF Proposals for Action; Poverty Reduction Strategy; national forest programmes; forest and timber certification; bilateral and multilateral arrangements on Forest Law Enforcement, Governance and Trade) need implementation at the national and sub-national levels. How sustainable and equitable the use of forests will be, will depend on context and vary from country to country. There is thus no blueprint for good forest governance, but rather a series of arguments supporting a general openness to policy learning and change.

States Find New Roles

At the beginning of the 21st century, the nation state seeks a new role in governing forest resources worldwide. In the past, the main successes of the traditional hierarchical state revolved around the formulation of substantive policy means, such as forest laws and subsidy programs, for ensuring the sustainable timber production. However, the implementation of increasingly complex forest laws exceeded the capacity of government and bureaucracy even in the developed world, leading to the familiar implementation deficits of top-down regulatory regimes. In addition, new demands on forests arose, many of which could only be accomplished at the cost of timber production. As a result, the new demands were systematically undervalued in many forest programs, which failed to deliver socially acceptable outcomes. Both program as well as implementation deficits are tackled with the same approach in the developed and developing world: *power sharing by the state* with civil society and regional or local networks.

The new forms of governance are characterized by different *degrees of participation* of the civil society at *different spatial scales*. At local and regional scales, decentralization and devolution to civil society and the private sector of forest management responsibilities and use rights, are major tools for improving forest resource governance, in terms of both social and environmental outcomes. This is the case especially in developing countries, where most of the forest production is for local consumption, and market based self-regulation instruments can be applied only in special cases. Preconditions necessary for success are that the mechanisms for decentralization and devolution be transparent, that sufficient attention be given to strengthening capacities at the decentralized levels simultaneously with handing over rights and responsibilities, and that institutions (whether local government, communities, NGOs, or combinations of these) be representative, accountable, and responsive to local needs.

The success of decentralized ownership and administration, however, also depends to a large degree on the development of supportive and complementary institutions and programmes at national and international levels. At the *national level*, governments have to be willing to accept the loss of centralized control that community or private sector empowerment implies, and find ways to replace the income previously derived from direct management of forest resources with indirect sources of income like effective taxation. The latter will be especially difficult in countries where income from forests never reached the state directly, but was channeled into the political system through corruption and patronage. Transparency and accountability at the national level will be enhanced by the development of national level criteria and indicators for SFM, and by engagement in NFPs with substantive rather than symbolic outputs. The international technical community can play an important role through supporting the development of C&I, and also through credible monitoring and reporting and the rapid diffusion of NFP best practice.

At the *international level*, support for decentralization and devolution also means providing the appropriate structure of financial incentives for practicing SFM at the local and regional levels. Certification is obviously a potentially important tool, especially well adapted to the management unit level. The creation of a significant market that offers premium prices for forest products from sustainably managed sources under a credible eco-labeling program would be a major step forward. We have argued that the existing developments in certification fall a long way short of this goal, and may never achieve it. Nonetheless, the emerging consensus around a common set of standards, caused by the intense competition between different certification programs and the parallel development of national level C&I systems, is encouraging. Not only will convergence answer the charges that certification is a form of disguised protectionism, but governments may step back into the picture and provide support for the kind of monitoring, reporting, and consumer education that would greatly im-

prove the effectiveness of pure NSMD certification. Again, international organizations, the international technical community, and international NGOs could usefully support these developments.

A common theme in the literature on globalization is that the related developments of a globalized world economy and the empowerment of civil society add up to the *hollowing out of the state.* Competencies that were once clearly wielded by the nation state are now found at the local level, where local knowledge is superior, or at the international level, where there is a realistic prospect for mastering the impacts of the globalized economy. To some extent, the picture of forest governance we have presented, with its focus on decentralization underwritten by the international community, supports the conclusion of a hollow state and emphasizes the need to build local and international institutions to replace the older form of state management now rendered obsolete. However, even a most cursory glance at contemporary forest governance will show that states, while no longer so directly involved in forest management, are still prominent actors in forest governance. Rather than disappearing, states must perform new functions and acquire new competencies in a world where private and international governance capacities have become much more important than in the past.

Change in Forest Governance Will Vary

Understanding the new functions and competencies requires some simplifying of the complex, multi-level linkages that we have identified as the characteristics of contemporary forest governance. Our approach is based on the distinctions between industrialized and non-industrialized countries and between those with high and low forest cover (Figure 2). The resulting four categories are ideal types of problem sets that pose a common challenge for similarly situated actors, whether governments, the corporate sector, or civil society. Of course at this level of generality it is not possible or intended to predict the particular governance patterns that will emerge in different countries or regions, which will depend on a host of contextual factors not captured by these relatively simple distinctions. Nonetheless, we can sketch the governance challenges that each group of countries will face.

In *industrialized countries with low forest cover*, the protection and enhancement of remaining forest cover, in the face of the various threats it still faces, is an important priority, requiring careful coordination of policies on urban and rural development, recreation, and tourism and ecosystem restoration. There is ample opportunity for experimentation with different governance instruments and with the encouragement of local initiatives. However, the principal challenge for these countries arises from their role in the world economy as importers of forest products. How they will tackle this challenge – by supporting certification, by closer bilateral links through programs and projects in the major timber exporting countries, by support for a new international regime based on a convention, or by a combination of all three – is unclear. However, leadership from this group, demonstrating that the world's wealthiest citizens are prepared to make sacrifices to support the goals of SFM, is an essential precondition for demanding restraint in developing countries.

Industrialized countries with high remaining forest cover have similar challenges and responsibilities. The declining relative importance of forests and forest products in economies increasingly dominated by the service sector should make it easier for governments to remove the last trade-distorting subsidies from the forest sector and address the issues of regulatory capture in forest policy communities, where the health of the industry has become the goal of public policy. However, one of the paradoxes of the democratic political systems in these countries is that identifiable groups of voters, with an interest in rent-seeking at the expense of the larger public interest, are a magnet for vote seeking politicians, leading to a challenge to overcome the often tangled legacy of politics and policy in these countries. Where forest management and ownership are already highly decentralized, the strengthening of governance tools for pursuing a common purpose is more relevant than further decentralization. Most members of this group have in the past been proponents of a legally-binding convention, which could address their concern that reductions in their own production in the name of sustainability merely create opportunities for even less sustainable logging in other parts of the world. However, they must now address a well-founded suspicion on the part of other actors, especially NGOs, that any such convention would entrench a status quo in which this group of countries would be the major beneficiaries.

In both *developing country* groups, the governance challenges are obviously more profound and less likely to be resolved in the short term. Simply establishing workable policy networks, which we have carefully distinguished from the old government institutions, is a challenge in its own right. In these countries, governing institutions have often been weakly developed, and the observations of Zürn et al. (2000) seem most pertinent: agenda setting and policy formulation will increasingly take place outside the nation state, whereas the national political system will work as a form of territorial interest representation, which is accountable for the implementation of nationally formulated guidelines. If this is the case, the challenge is both to improve the representative character of "territorial interest representation" in these countries and to support their technical capacity to use the new instruments of information and monitoring, which will be the key components of any new guidelines. In the absence of more traditional representative institutions, decentralization and community empowerment are

critical elements of improving representativeness. In relation to the new instruments, the international technical community and NGOs are well placed to help realize the potential of monitoring and reporting as tools of international forest governance.

Legitimation of New Governance Relations – an Urgent Problem

It is easy to overstate the extent to which the old governance arrangements lived up to their own standards of democratic legitimacy even before the development of mature civil society institutions. Theorists of democracy have long criticized the idea that, together with the granting of a new mandate based on well-formed preferences for a particular policy platform and a clear causal understanding of the consequences of voting one way rather than another, periodic elections provide a retrospective judgment on the performance of a government. Nevertheless, citizens and theorists alike did at least share a common idea of democratic legitimacy, however imperfectly it was realized in practice. It may be true that policy networks, the kind that we have shown to be emerging rapidly in almost all aspects of international forest governance, begin with a considerable advantage in output legitimacy, even if only because of the perceived failure of the old governance arrangements. Nonetheless, providing a similar conception of input legitimacy, in which the practices of network governance are reconciled with contemporary demands for participation and the protection of rights, is an urgent task that goes far beyond the issues of international forest governance.

Forest governance, however, may provide some important clues about how to proceed. As we have emphasized throughout, the development of new governance institutions for the world's forests has been a less spontaneous and "self creating" process than the admirers of international civil society have sometimes assumed. At almost all times, successful new forest governance arrangements have emerged as the result of traditional national and international actors seizing the opportunity to work with the creative energy of new forces in civil society rather than impeding them. The result has been a distinctive pattern of new forest governance, in which old and new actors work side by side in new relationships, rather than one supplanting the other. Thus, the problem is not how to legitimate a new governance arrangement, but to determine the appropriate forms of coexistence between old and new governance, each with its own distinct sources of legitimacy. One indication of this is the popularity in recent policy sciences literature of concepts like "boundary spanners" and "policy brokers", which are exploring new forms of coexistence between the old and new governance institutions (Papadopoulos 2003).

4.8 Epilogue

A precondition necessary for the coexistence of different governance forms is the acceptance of a frame for forest governance that is encompassing enough to provide some common purpose regarded as legitimate by all concerned. Sustainable forest management may ultimately provide such a frame, by raising the question of how to address what is perhaps the most important but also clearly the most demanding set of linkages between international, national, and local levels: the *problem of social justice*. While a full consideration of the issues would take us far away from forest governance, the fate of the world's forests cannot be divorced from the facts of poverty, inequitable income distribution, and indebtedness. All three provide powerful motivations for short-term, unsustainable exploitation of forest resources to the detriment of SFM. We have noted some of the evolving linkages between poverty reduction programs and improved forest governance, and the interest of the international donor community in decentralized SFM. There is an urgent need to ensure that the underlying causes of the assault on the world's forests are addressed before we find ourselves reduced to managing the symptoms of a terminal illness.

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GLOBAL FORUM

5 Forests-Based Livelihoods and Poverty Reduction: Paths from Local to Global Development

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Abstract: The central role of forests in rural livelihoods, especially for the poor and the marginalized, suggests that when exploited to full potential these resources could facilitate rural poverty alleviation. However, this is constrained by the factors that characterize the poor, including low levels of education, low levels of asset holding, poor health, lack of power and opportunities to be heard, weak local institutions and unfavourable institutional frameworks. In some areas, forests have lifted rural people out of poverty by enabling significant income generation, mobilization of savings, capital accumulation, and asset-building. This chapter highlights promising opportunities for forest-based poverty alleviation, and the prerequisites for their exploitation. Much of the evidence suggests that sustained welfare gains for the great majority of forest dependent people will require broader macro-level investments beyond forests and natural resources. Multi-scale, integrated and holistic development approaches will be needed to achieve poverty alleviation at the scale of the Millennium Development Goals.

Keywords: Rural livelihoods; forest-based development; poverty alleviation; integrated approaches; timber trade; payment for environmental services; small enterprises; devolution.

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5.1 Introduction

Forests constitute about 90% of terrestrial biodiversity and contribute to the livelihoods of over 1.2 billion people. The majority of these people are poor and depend significantly on forests for their livelihood (World Bank 2002). Timber and non-timber forest products provide these households with energy, food, structural materials and medicines, both for their own subsistence and for sale. Traditional biomass fuels like fuelwood and charcoal are the main sources of energy for an estimated 2 billion people around the world. According to the World Health Organization, 2 billion people rely on traditional medicines from forests for their health. In 62 developing countries, forest-based activities such as hunting and fishing provide over 20% of household protein requirements (Kaimowitz 2003). A range of fruits, vegetables and mushrooms collected from natural forests are important components of the diet in rural areas, especially for poor households or during times of food shortage.

Forests also contribute significantly to national and regional economies, although this is usually underestimated in national income accounts. In developing countries, forest-based enterprises provide about 13–35% of all rural non-farm employment, equivalent to 17 million formal sector and 30 million informal sector jobs (Angelsen and Wunder 2003). The timber industry in these countries produces something in the order of USD 30–40 billion worth of timber and processed wood products each year, although only a small portion currently benefits poor households. In 1999, Sub-Saharan Africa exported nearly USD 3 billion worth of forest products, representing about 5% of regional exports.

Forested landscapes also provide a range of environmental services, including watershed protection, biodiversity conservation, carbon sequestration and landscape preservation. These environmental ser-

vices are highly valuable to both forest dependent households and off-site beneficiaries (those that live far from the forests) whose activities depend on the continued production of these services. During the past decade, these environmental services have gained recognition as vital functions of forested landscapes but little progress has been made in rewarding resources managers who ensure the continued supply of these services.

World population has been estimated to reach 7.7 billion by 2020, with over 80% in developing countries. More than 1.1 billion people live within the world's 25 biodiversity hotspots and population growth in tropical wilderness areas is 3.1% per year, almost twice the global average. Thus, dependence on forest resources in the hotspots could grow very quickly if alternative livelihoods are not found (McNeely and Sheer 2001).

Despite the central role of forest resources in both local and global welfare, forested landscapes coincide to a large extent with high incidences of poverty among the local people. Not only are the local people deprived in terms of material income, they are highly vulnerable and prone to risk because they often lack key livelihood assets, have low levels of education and health, and also lack power and opportunities to be heard. Prevailing unfavourable tenure arrangements and other institutional weaknesses also expose local people to the danger of loosing access to multiple components of biodiversity (e.g. bush meat, wild fruits and vegetables, and medicinal plants). Local people are often faced with a diminishing resource base as well as limited capacity to engage in more rewarding livelihood activities. For these communities, forests act as the employer of last resort, ensuring poverty avoidance or mitigation (Angelsen and Wunder 2003; Sunderlin et al. 2003). Forests serve as safety nets that prevent these economically marginalised groups from slipping deeper into extreme poverty. Does this suggest that forested landscapes are poverty traps or offer few pathways out of poverty for local people? Whether sustainable utilisation of forests has potential to lift rural people out of poverty by enabling significant income generation, mobilisation of savings, and asset-building, is a subject of heated debate.

Very little empirical evidence is available to suggest that forest-based activities could lead to sustained welfare gains for large numbers of people across many areas in developing countries. There are several reasons why the role of natural forests in the lives of the poor is currently underestimated or even ignored in macroeconomic development programs: lack of basic data on forest-poverty relations, weak understanding among decision makers of the links between forestry and poverty alleviation, and lack of concrete proposals for policy reforms and investment (Oksanen et al. 2003). For example, many developing countries are in the process of developing Poverty Reduction Strategy Papers (PRSPs); unfortunately, most of the first versions of the PRSPs hardly recognized the potential of forests in poverty alleviation. However, as countries continue to implement subsequent iterations of their PRSPs, the potential of forests in poverty alleviation is increasingly receiving attention and articulation in national development plans.

The current global focus on poverty issues has revived the debate on how significant improvements in the well-being of forest dependent poor people can be achieved while conserving forest biodiversity. A number of studies have documented the deficiencies of previous efforts to conserve landscapes and improve livelihoods, and the need to adopt new approaches to natural resource problems (McNeely and Sheer 2001). Most international conservation initiatives and development agencies, such as the World Bank, the United Nations Convention on Biological Diversity, the Global Environmental Facility and the UN Convention to Combat Desertification, have policies that strongly commit to new approaches to environmental and livelihood issues. For example, the World Bank noted that to meet the UN Millennium Summit target of halving extreme poverty by 2015, forests must play a far greater role in new approaches to eradicating poverty (World Bank 2001).

This chapter discusses some of the current ideas and approaches to understanding the forest-poverty nexus. Key issues on the subject of forest-based poverty alleviation are also brought to the fore by exploring the potential of available options and some emerging approaches to capturing the full value of forest goods and services to support local livelihoods. Understanding rural livelihood systems, the subject of Section 5.2, is a *sine qua non* for formulating concrete proposals for pro-poor economic development strategies in developing countries. The widely used Sustainable Livelihoods approach to understanding rural livelihoods is critically reviewed in this section, using experiences from various studies. Global and bigger-picture issues that shape forestry business, and the implications for forest use and people's livelihoods, are discussed in Section 5.3. We devote considerable attention to current arguments on forest-based poverty alleviation and critically assess promising options. On-going debate suggests that forest-based poverty alleviation can be achieved in three ways: by preventing the forest resource base from shrinking, by redistributing forest resources and by making them more accessible, and by increasing the value of forest production (Sunderlin et al. 2003). According to this argument, some of the forest-based activities that may contribute to poverty alleviation include exploitation of timber (Section 5.4) and NTFPs (Section 5.5); rural labour employment (Section 5.6); payment for environmental services (Section 5.7); conversion of forests to arable lands (Section 5.8); and devolution of forest resources to local communities (Section 5.9). We also argue that to meet the challenges of the Millenium Development Goals societies will need to go well beyond forests and natural resources (Section 5.10).

John Parotta

Agricultural land, agroforestry systems, forest and trees outside forests are an essential part of the natural assets in Himachal Pradesh, Northern India.

5.2 Understanding Livelihoods and Poverty

Sustainable Livelihoods Approach

The notion of sustainability provides a key approach to understanding livelihoods. The "sustainable livelihoods" approach was developed by the UK's Department for International Development (DFID) in the late 1990s to provide an analytical tool for thinking about poverty in a holistic manner, and for identifying entry points for poverty reduction initiatives. While the framework was developed by DFID, it now builds on the work of a range of organizations, from research groups such as the Institute for Development Studies to NGOs such as CARE and Oxfam and to other development agencies such as UNDP (Carney 1998). The work of Chambers and Conway in the early 1990s, drawing to a large extent on participatory research practices and ideas, contributed to the formulation of this framework. The key word in the framework is "livelihood", which according to Chambers and Conway (1991) comprises the capabilities, assets (including material and social resources) and activities required for a means of living. A livelihood is sustainable when it can cope with and recover from shocks and stresses and maintain or enhance its capabilities and assets both now and in the future, whilst not undermining the natural resource base. According to the framework, household assets and entitlements are categorized into "five capitals" namely natural, physical, financial, human and social capital.

The framework places people at its centre and seeks to highlight the complex and dynamic ways in which individuals' well-being is determined. Emphasis is placed on the sustainability of people's asset base, which may include natural, physical, social, financial and human capital. The approach also promotes a multi-dimensional understanding of well-being, which includes income, health, education, and vulnerability. Critically, the framework makes explicit the role played by context in determining the extent to which sustainability and welfare goals are achieved (Landell-Mills and Porras 2002).

The concept of sustainable livelihoods is now widely applied by scholars and practitioners in different aspects of development policy formulation and planning. Ellis (2000) and Farrington (2001) articulate the value of the approach as a means of fully understanding the components of livelihoods. Campbell et al. (2002) used the sustainable livelihoods framework as the entry point for data collection and analysis in Southern Zimbabwe. The authors conclude that using the framework to guide analysis and intervention leads to the search for integrated development options, and that this approach is more appropriate than *ad hoc* piecemeal approaches. However, the authors express concern with the lack of logic and consistency in the framework regarding scale. For instance, physical assets can be household assets (such as ploughs) and district-level assets (such as road infrastructure), while social capital is largely a "community" level construct. In contrast, institutional arrangements at district and higher levels are not part of "capital" but are considered in the "institutions" component of the framework as part

of the processes that mediate the conversion of assets into livelihood outcomes. Angelsen and Wunder (2003) and Campbell et al. (2002) argue that social capital appears better placed under the "institutions" component of the framework ("transforming structures and processes") than as a capital asset. They conclude that "social capital" is better perceived as one of the many factors that influence the deployment and transformation of financial, natural, physical and human capital.

A number of authors argue that the use of the term "human capital" is problematic because of its narrow focus on the productivity of labour, though this is largely a problem of application rather than conception (Sen 1997; Campbell et al. 2002; Angelsen and Wunder 2003). They suggest that the focus should instead be on enhancing "human capability", that is, the ability of people to change their circumstances, and where necessary on empowering people to exploit opportunities. From this viewpoint, human capital becomes a means to deploying and transforming financial, natural and physical capital, rather than a capital asset in itself.

Work conducted by Scoones et al. (1996), Mortimore (1998), and Campbell et al. (2002) with various communities reveals that households constantly have to deal with a whole host of shocks and stresses. Foremost amongst these are the often-marginal environmental conditions for many forms of agriculture, created by low and erratic rainfall, frequent droughts, and generally poor soils (Scoones et al. 1996; Mortimore 1998; Frost and Mandondo 1999). In addition to poor agro-ecological conditions, most rural livelihood activities are adversely affected by a range of socio-economic factors that include underdeveloped and inaccessible markets, lack of access to credit, poorly developed and maintained infrastructure, limited access to appropriate extension advice, and non-functional institutional arrangements for environmental resource management. According to the sustainable livelihoods literature, a livelihood is sustainable when it can cope with and recover from stresses and shocks and maintain or enhance its capabilities and assets both now and in the future, while not undermining the natural resource base (Chambers and Conway 1991).

Despite the countless adverse factors that impinge on livelihoods of rural households, these households have "coped" and continue to "cope." Although there have been reductions in some components of the system, especially natural capital, this is not necessarily a problem as processes of redeployment and conversion of one asset form into another are merely intermediate steps (Boserup 1965). Thus, on the basis of the definition of sustainable livelihoods, households who have lived through these shocks and stresses could be said to have "sustainable livelihoods", or if they have not achieved sustainable livelihoods yet, it may be argued that it is only a matter of time before they develop along the Boserupian pathway. However, widespread and unacceptable poverty is still common. This suggests that research and development endeavours that aim for "sustainable livelihoods" appear to set the target too low. Eliminating poverty will require bold approaches that go beyond just sustaining livelihoods. Key elements of these new approaches include the need to support local people's "adaptive capacity" (ability to drive and adapt to change) (Lynam et al. 2002; Sayer and Campbell 2004), rather than focusing on productivity gains; multiple scales of intervention (from local to international where appropriate); and bridging the gap between research, extension and development (through action research). Embracing these elements will also require new kinds of organizations to deal with complex systems without getting lost in the details. A range of specifically forest sector elements would also need to be addressed, including market and skill development for forest product and services delivery; development and integration of forest-and-wood-product supply chains; and increased competitiveness of the forest sector in general.

Definitions of Poverty and Its Alleviation

This review would be incomplete without a discussion of the concepts of poverty and poverty alleviation that have shaped the debate on forest dependency and rural livelihoods. The simplest conception of poverty that dominated traditional thinking on the subject is summarized in Webster's Dictionary, which defines poverty as "the lack, or relative lack of money or material possessions." Until recently, poverty was largely perceived within this materialistic construct that emphasized income and wealth as the measure of well-being. The growing focus on issues of poverty worldwide has seen substantial evolution in the scope of the concept to include a number of human development aspects (such as education, health, food security and nutrition), and more recently, empowerment and institutional aspects like freedom of choice, control and security, and self identity (Angelsen and Wunder 2003). This broader conception has enriched the analysis of forest-poverty linkages, especially given the critical constraints of forest dependent populations such as poor integration with markets due to remote locations, low levels of education and health, unfavourable institutional factors, and lack of power to make decisions that shape local livelihoods (Campbell et al. 2002). Although measurability and comparability of the "soft" aspects of poverty still present problems to practitioners, the concepts have proved to be extremely valuable in understanding rural livelihoods and identifying possible pathways out of poverty.

Other widely used terminologies related to poverty and forest dependent populations include poverty reduction, poverty prevention, and poverty alleviation. Angelsen and Wunder (2003) use the term poverty reduction to describe a situation where

people are "lifted out of poverty", climbing above a predefined poverty line and thereby becoming measurably better off over time, in absolute or relative terms. The term poverty prevention is used in relation to the role of forests in helping people to maintain a minimum standard of living (even when this is below a given poverty line) and helping them to avoid slipping deeper into poverty. Poverty prevention in this respect thus refers to the "insurance" or "safety net" functions of forests in mitigating against extreme poverty. Achieving both poverty mitigation and lifting people out of poverty constitutes what has been referred to as poverty alleviation (Angelsen and Wunder 2003; Sunderlin et al. 2003).

5.3 Globalisation and New Opportunities

Key Trends

Development theories that guide the development of human welfare are continuously shaping the contribution of forests to rural livelihoods. In the 1960s and 1970s, economic development was largely guided by the Keynesian approach that placed great emphasis on growth centres, the industry and multiplier effects. Macroeconomic and other public policies were largely designed to promote economic development through industrial growth (Tikkanen et al. 2003).

However in the last three decades developments in institutions, technology and innovation, as well as in environmental consciousness, have significantly modified the Keynesian approach. They have changed the way the world conducts business, and have far reaching implications on the poor. For example during this period, macroeconomic policies in many countries in the tropics encouraged increased private sector participation in production and commerce and less government involvement in these areas. Markets and trade were extensively liberalized, with the market increasingly becoming a tool for allocating resources for economic development. The world economy is also becoming more globalised; it has become evident that the livelihoods of individuals and the fate of local communities cannot be viewed in isolation of national and international structures and processes (Hyden 1997). Other key trends include the devolution of forests to local communities, with a concomitant advance of community forestry; increased global trade and advance of bi- and multilateral free trade agreements with direct and indirect impacts on trade in timber and other forest products; increased market transparency through new information and communication technologies; and increased importance of environmental services provided by forests (though related payment schemes are still in their infancy).

On the other hand, the World Bank (1997) reports that interest in rural development has been declining mainly due to the waning interest of international institutions in rural issues, poor commitment and capacity of relevant countries, and poor commitment and weak performance of the Bank itself. The international community's external assistance to agriculture is also reported to have declined by about 50% since 1986, partly due to donor fatigue; the assistance has been mainly for process issues like economic and institutional reforms and less for production. For example, World Bank credit to agriculture in Africa amounted to 39% in 1978, but dropped to 12% in 1996 and to 7% in 2000 (NEPAD 2001).

Further, the impact of the "green revolution (1960–2000)" in developing countries has been minimal for Sub-Saharan Africa. The subcontinent benefited little from the development of modern or high-yielding crop varieties, an effort that has been championed mainly by international agricultural centres in collaboration with national agricultural institutions. Yield growth made only marginal contributions to growth in crop production, and the share of improved crop varieties to yield growth was also low. Production growth is reported to have been almost entirely based on extending the area under cultivation (Evenson and Gollin 2003).

Implications for Forests' Role in Economic Development

With increased markets and trade in forest products, as well as globalisation of the world economy, some new opportunities are emerging for enhancing the contribution of forests to local economies. However, some characteristics of forest resources and distribution of markets appear to be decisive in exploiting such potential.

Approximately half of the wood production in the world is used as fuelwood, the rest being used as timber or industry wood. However, the percentage distribution among these uses can be utterly different at country level. Indeed, about 80 % of the wood consumption in many developing tropical countries is for energy. Furthermore, since the 1960s the wood consumption of developing countries has continuously increased from 1.2 to 2 billion m^3/year today; this is directly linked to population increase. By contrast, in developed countries consumption has stabilized since the 1980s below 1.5 billion m^3/year, and energy uses constitute only 20 % of wood consumption. (Roda 2001; FAO 2004).

Conversely, less than 30% of non-tropical woods but more than 80% of tropical woods (approximately 1.3 billion m^3) are used for energy purposes. In other words, tropics provide more than 70% of the fuelwood in the world, and less than 20% (approximately 0.28 billion m^3) of the timber or industry wood (Valeix et al. 2003).

The reason for this divide between tropical and non-tropical timber lays in the fact that roundwood and less processed (semi-processed) wood products

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Small-scale forest-based enterprises can contribute significantly to local livelihoods and poverty reduction.

are heavy and essentially consumed on the spot, and have very limited potential for international trade. For instance, less than 1% of the non-tropical fuelwood and less than 0.1% of the tropical is exported. As well, nearly 9% of tropical and 7% of non-tropical raw timber and industrial wood is exported. The international trade in tropical logs, sawn timber, and plywood remains low, and represents only 3 to 4% of world consumption (in roundwood equivalent) (Roda 2002).

There is also a significant differentiation between markets and demand along the tropical and non-tropical timber divide. For instance, with respect to hardwoods, Asia and Latin America (altogether accounting for approximately 55% of the world population) consume 92%, 90% and 80% of tropical logs, sawn timbers and plywood respectively. Even if Europe and North America are theoretically more lucrative markets for tropical forest products, these markets are increasingly becoming selective and competitive, and the global demand for these products is relatively low. At the same time, industries within tropical countries often experience an unfavourable industrial investment climate, lack qualified labour, and public infrastructures are often weak and insufficient. In such conditions, these industries ideally can gain more from selling to Asian markets, since these markets are less demanding in terms of product quality, specifications, level of processing, and at times even deadlines for deliveries.

On the other hand, the key trends described earlier are "disrupting" the classical and old-fashioned views on global forest economics, by dramatically changing the approaches forestry can use to enhance livelihoods. Economic development based on the Keynesian approach in the 1960s and 1970s limited the forest sector's contribution to economic development mainly to industrial timber harvesting and processing, thus ignoring development based on non-industrial forest products that support the livelihoods of many forest dependent communities.

Technology and innovation have increased the menu of products from forests and forest industries, pushing forward the market frontier for industrial forest products as well as the investment envelope in forestry. They have also increased labour productivity; this has led to labour retrenchments in older establishments and/or reduced employment in some product lines.

Environmental concerns, largely due to deforestation and industrial growth, have raised the profile of international public goods and services the forests can produce. The emphasis on developing new and improving existing national and local institutions, in tandem with growing state democratic processes, have precipitated a large number of stakeholders in forestry, as well as a growing necessity to involve stakeholders in decision making. The institutional emphasis has seen the emergence of local communities as forest owners and partners in forest management. Further, property rights and equitable distribution or sharing of forestry wealth are receiving more weight. All these factors have combined to shift the focus in forestry away from trees and forests to meeting the many demands of local people and the community at large.

Macroeconomic policies, and especially economic reforms implemented by many developing countries since the 1980s, have at times increased rural poverty, deforestation and environmental degradation. For example, in the Sahelian region of Africa these policies have eliminated many public agricultural support programmes (and the private sector has not filled this vacuum). They have also made it

difficult for Sahelian farmers to access agricultural inputs due to their high costs, and have therefore stalled or reduced their use in increasing agricultural productivity on already poor land. This has reduced food security and incomes to farmers and has encouraged farmers to resort to coping measures, such as increasing peanut seeding densities to improve yields and incomes, which in the absence of fertilizers leads to soil mining and jeopardizes seed quality over time. This creates a vicious cycle that entrenches poverty (Reardon et al. 1997). In Sub-Saharan Africa fertiliser price increases could either increase deforestation (especially for subsistence farmers) or reduce it, while in Latin America they may reduce deforestation. As well, in Latin America increased availability of agricultural credit, especially for cattle, appears to be positively correlated with deforestation (Kaimowitz and Angelsen 1998).

The increasing globalisation of the world economy comes with mixed results. Wade (2003) notes that evidence from many years of globalisation confirms the neo-liberal economic theory, which asserts that more open economies are more prosperous and that those economies that liberalise progress faster while those that resist economic liberalization usually act out of vested or rent-seeking interests. The World Bank (2002) claims that over the last two decades the number of people living on less than USD 1 a day has fallen by 200 million, after rising steadily for 200 years. The same view is echoed by Dollar and Kraay (2002), who claim that globalisation has promoted economic equality and reduced poverty. However, Mazur (2000) cited in Wade (2003) reports that globalisation has dramatically increased inequality among and within nations. Wade (2003) shares this view.

The combined result of the developments characteristic of the key trends is that rural poverty has increased in many tropical countries and it has been accompanied with increasing dependency on natural forest resources for survival through consumption and income from the forest products and/or exercising forestland for increased crop production. The market led economies generally fail to recognise many forest products and services that are important to rural livelihoods. Further, in the tropics the natural forest estate has declined due to massive deforestation for both industrial and domestic consumption, increasing the scarcity of the natural forest resources. In compiling the State of the World's Forests 2003 the FAO (2003) notes that in about 70% of the countries surveyed agricultural land was expanding, and in two thirds of these countries forest area was decreasing. Growing populations and rural poverty, increasing demand on diminishing natural forest resources, and industrial pollution, have all combined to exacerbate environmental problems, including global warming, droughts and floods. These events have the potential to create a vicious cycle that entrenches poverty, especially as it may mean that forest resources have less capacity to serve as safety nets.

5.4 Will Timber Trade Improve Livelihoods?

Asia as an Engine of the Tropical Forestry Sector

Trade in tropical timbers has consisted of imports by industrialized countries of primary products coming from the rest of the world. This situation has been changing rapidly, mainly because of worldwide competition for labour together with the growing capacity in developing countries to supply and demand manufactured goods. This change has led to growth in the production of secondary processed products based on tropical wood in exporting countries. This development has been notable after the Second World War and particularly with the economic recovery in Eastern Asia. Japan was the nucleus for phenomenal growth in wood trade until its imports peaked in the 1970s. For example, in 1974, Japan accounted for 55% of world imports of tropical logs and primary/semi-processed products. Until the beginning of the 1990s, Japan was the essential driver of the demand for tropical woods, while Malaysia, Indonesia and the Philippines were the main suppliers. Since the 1990s large scale industries, that were essentially the monopoly of Japan and Korea, were re-located to Malaysia, Indonesia and India (Roda 2003; FAO 2004).

In the last two decades, European consumption of tropical woods has been relatively low (between 4 and 5% of world consumption of tropical logs, sawn timbers and plywood, in roundwood equivalent, hovering around 11 million m^3/year), while trade in these products continues to evolve in the context of globalization of the world economy. Developing countries or countries in transition (and Asia in particular) largely dominate the scene, with Brazil being the highest consumer of tropical sawn timber, and the second for tropical logs after Indonesia. Nevertheless Asia dominates the use of tropical wood, since it consumes nearly 70% of raw wood or products of primary process (in roundwood equivalent). Yet imports of raw tropical wood for the relatively developed Asian countries have decreased since the 1980s, due to decreasing availability of the resource in tropical Asia (that is, increased scarcity of natural forests of high value in terms of commercial timber species). Despite this, demand has not decreased. For example, since the market reforms in China in 1993, imports from developing Asian countries have grown exponentially, notwithstanding the Asian financial crisis in 1998. The increased demand in Asia continues to affect world trade and has promoted increased timber exports from Africa or South America to Asia, which is increasingly becoming the worldwide crossroad for trade in tropical timbers (that is, raw products imports and final products exports) (Roda 2003; FAO 2004). The development of the new pattern and conditions of international trade fuels the

development of firms and industrial networks. These latter, in addition to their flexible and competitive characteristics, bring forest-based livelihoods closer to the global scale. For example in Kalimantan, the complex network of brokers who collect the natural latex from local people allows them to be as competitive on the global market as industrial companies and their plantations (Gouyon1995).

Timber Harvesting

Timber is one of the most valuable products from forests. In 1998 the value of internationally traded roundwood, sawnwood and wood panels from developing countries was estimated at about USD 10 billion (FAO 2001). Sub-Saharan Africa produces some 65 million cubic meters of industrial roundwood annually, employing an estimated 300 000 people. Annual exports of timber and other forest products from the region are estimated at about USD 3 billion. Despite the high value derived from forests in developing countries, local forest dependent communities have not benefited significantly. They have been excluded from the timber industry, both as a result of unfavourable policies and also by what have been termed "anti-poor" characteristics of the industry (Angelsen and Wunder 2003; Sunderlin et al. 2003).

The capital, technology, and skill intensive nature of the timber industry makes small-scale operations unviable. Lack of secure tenure over forests by most poor communities, and the continued reluctance of some governments to devolve control over forests to local communities, also reduce incentives for long-term investments that are required in the timber industry. Invariably, poor local communities which lack power and voice in decision-making have been excluded from the lucrative timber industry by rich and influential outsiders. These trends are beginning to change as governments are under pressure to pass pro-poor forest tenure regimes that are intended to grant local communities access to the timber trade. In a few cases where genuine devolution of control over resources has occurred, weak local institutional frameworks for resource management have allowed local elites and even outsiders to appropriate most of the benefits. The more sophisticated down-stream activities (processing, marketing), which capture most of the benefits, remain out of reach for local communities. In areas where significant forests with high quality timber still remain, prospects for forest-based poverty alleviation are bright provided barriers to entry into the lucrative timber industry are overcome.

Radically New Evolution – Firms and Industrial Networks

The phenomenon described in the preceding section arises out of two different dynamics. First is the growth of the middle class in small and big transition countries, which increases local demand for construction timber, as well as for medium quality and affordable wooden furniture. The local industry has reliable and efficient infrastructure and a skilled workforce that is still cheap. Second is the role of people in diaspora acting as middlemen in passing on to other countries the demands of their home countries. This is done through commercial and industrial networks specific to these communities. For example, Indian and Chinese communities living overseas facilitate putting Asian tropical wood demands in global perspective. However Brazil, which has its own growth dynamics and its own gigantic supply pool, functions in quasi autarky, in that its enormous local supply directly feeds its huge demand, while in Asia the demand is partly met from sources outside the region.

At the same time, globalization of the world economy is gradually materializing through trade in various goods among the nations. However, some of the decision-making parameters are gradually slipping out of individual state control, and are increasingly becoming decentralized to disparate groups of economic and/or non-governmental organizations. Tropical forest resources and products are particularly sensitive to this evolution, and are subject to increased competition for their control.

With regard to trade in tropical forest products, western countries are increasingly facing competition from countries that produce cheaply. However, such countries are in turn disadvantaged by the low quality of their products. Consequently, while western markets for raw tropical forest products are evolving into specific market niches, Africa is increasingly dependent on Asian markets, many of which can accept "all qualities" of raw material. This increased dependency on Asia becomes even more important when western non-tariff barriers develop faster than the competitiveness of African systems of production.

Furthermore, the increased interdependence of timber markets, their fast evolution, and their difficult predictability in the short-term, favour certain modes of production systems based on the optimization of information exchanges, as demonstrated by the growing importance of firm or industrial networks in the tropical forest sector. These networks are flexible and mobile, and therefore perfectly adapted to current conditions. They consist of small and medium scale enterprises (SMEs) cooperating with bigger companies. Instead of being organized into localized "industrial districts", as was observed in many industrial sectors throughout the world since the "second industrial divide", these groups of firms

BOX 5.1 Discovering a New Source of Income

Manyewu Mutamba

Twenty or thirty years ago people thought most poor rural families earned their living by farming. Then studies showed that off-farm income from wage labour, craft work, small-scale trading, and money sent by relatives was actually more important. That cast rural poverty in a rather different light. Now, a new World Bank report called "Counting on the Environment, Forest Incomes, and the Rural Poor" (Vedeld et al. 2004) has highlighted a third major source of income – collecting fuelwood, wild foods, and other forest products. On average, such activities provide roughly one fifth of poor rural families' income.

A number of other studies have also show that income from forests is more important to rural livelihoods than previously perceived. In Sub-Saharan Africa alone, an estimated 15 million people earn a major portion of their cash incomes from forest-related activities (Arnold and Townson 1998; Kaimowitz 2003). The work of Cavendish (1997) Campbell et al. (2002) in semi-arid Africa reveal that rural populations depend on forest activities for up to a third of their income, with the poorer households having the highest share of their income from forests. Monela et al. (1999) also found that wild honey, charcoal, fuelwood, and wild fruits contributed 58% of farmers' total cash income in six Tanzanian villages. A report by Munishi et al. (1997) revealed that two thirds of all Tanzanian households in seven administrative regions studied obtained at least 15% of their incomes from forest products. In South Africa, Shackleton and Shackleton (2000) found that woodland resources also contributed significantly to the incomes of small farmers in three rural settlements.

The report by Vedeld et al. (2004) synthesizes data from 54 household income studies from 17 countries, mostly in East and Southern Africa and South Asia. Wet, semi-humid, and dry forest areas were about equally represented among the studies, although most humid forest cases involved indigenous peoples in Latin America. About two-fifths of the income from forests comes from harvesting wild foods (bushmeat, insects, and wild fruits and vegetables), while another third comes from fuelwood. Fodder, medicinal plants, and timber provided much of the rest. The income is about evenly split between cash and products consumed directly. Wealthier families harvest more forest products. However, these activities generate a much higher proportion of poorer families' total income. Villages farther away from markets and with lower educational levels get more of their income from forests.

Despite the seemingly low income share of forest products, reviews by Byron and Arnolds (1999) argue that for most users the importance of forest products income is usually more in the way it fills gaps and compliments other income sources, than in its absolute magnitude or share of average household income. Forest products are especially crucial to poor rural households in periods of hardship. During these periods, forest foods often become one of households' main sources of sustenance, particularly for women and children (Kaimowitz 2003).

Many authors acknowledge the fact that many of the studies reviewed had weak methodologies and say more high-quality work is needed. That will require additional funding. Nonetheless, based on what we know already there is little doubt that rural incomes are higher than existing statistics suggest. Poverty Reduction Strategies need to help ensure that rural households don't lose this crucial source of income.

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are organized into strong service and sub-contracting networks that become diluted or less prominent at the trans-continental or global levels.

The members of these networks benefit from accelerated and extended information exchanges, which bring them strong comparative advantages when competing with other companies. These advantages are determining factors when economic and institutional predictability is difficult, and thus where the level of information asymmetry between sellers and buyers is high, as is often the case in many tropical countries, where the need for flexibility of production is also very high.

At the same time, such networks have complex links with sustainable management principles. The producer countries are in many cases politically or economically unstable, making these networks' search for quick profit a rational undertaking. This essentially induces a predatory behaviour in the networks. However, when they are confronted with situations where the future of their investments can be ensured in the long term, these networks follow a path of sustainable development and management. This is, for example, now the case in Malaysia.

The overseas Indian and Chinese communities, whose propensity to form "ethnic businesses" is an

BOX 5.2 MARKETS IN THE TRADE OF NON-WOOD FOREST PRODUCTS

Paul Vantomme, L. Alberto Gonzáles, Lou Yiping, Hiroyasu Oka and Majella Clarke

NWFPs have received increasing attention from international organisations and regional bodies, in an effort to use their benefits to enhance forest community livelihoods and implement poverty alleviation strategies. Moreover, NWFPs have been identified as an important area requiring concerted action to maximise their potential for contributing to economic development, employment, and income generation, in an environmentally sustainable manner. Given the vast array of possible products that could be included or excluded in the definition of a NWFP, it is important to put the definition in a context that aligns with the objectives and focus of the discussion. This box will focus on the market characteristics, information, and commercialisation of the NWFPs sector.

Many terms have been used to capture the wide range of forest-based plants and animals from which products, other than timber or wood, and services are derived. *Non-timber forest products* encompass all biological materials other than timber, which are extracted from forests for human use (De Beer and McDermott 1989). *Non-wood forest products* consist of goods of biological origin other than wood, derived from forests, other wooded land, and trees outside forests (FAO 1999).

The primary difference between NWFPs and NTFPs is that NWFPs exclude chips, charcoal, and fuelwood, small woods used for tools, household equipment and carvings, as well as environmental services (Vantomme cited in Belcher 2003). NWFPs include for example honey, nuts, mushrooms, truffles, spices, fish, wild meat, grasses and roots, plants for medicinal purposes, oils for pharmaceuticals and cosmetic products, as well as rattan manufactured goods.

Currently, there is a lack of information about the value and use of NWFPs. As exploratory research continues, the information on the variety of NWFPs is also expected to increase. Small enterprises and subsistence use of NWFPs continue to escape statistical recording systems and thus quantitative information on NWFPs' informal sector is quite sparse (Arnold 1995). The economic valuation of these products can also be problematic. Some studies on the economic importance of certain NWFPs have produced different results even in the same areas (Gram 2001). Other problems include a lack of market transparency and insufficient quality standards. The lack of information contributes to the major intricacies in this sector, i.e. the neglect of NWFPs in developing policy, legal rights, incentives, health and safety considerations, as well as capacity and administrative support (Chandrasekharan 1994).

Markets

NWFPs are sold in a variety of markets at local, regional, national, and international levels. In less developed countries, local markets are often small, informal, and imperfect, lacking the infrastructure necessary to give a formal framework to business practices. Informal and imperfect market characteristics mean that these markets often occur mostly in rural areas, where transport is limited. The products that are sold are diverse, vary in quality, and are collected in small quantities. Prices depend solely on a few buyers, which leads to difficulties in regulating markets to ensure a "minimum unit price" payment to primary collectors (Mahapatra and Mitchell 1997). In informal markets, taxes and wages are also difficult to regulate and enforce.

In contrast to a formal market, informal markets lack form (Eatwell et al. 1988), and are therefore often perceived as irregular and unpredictable. Price formulation for NWFPs within the informal market is quite different from the formal market. Often prices are formulated through a process of bargaining and haggling between the collector (seller) and the trader (buyer). The collectors' bargaining power will depend on several factors (Ndoye et al. 1997):

- Whether the product is perishable or not
- The quantity of NWFPs available at the markets
- The sellers' financial needs (immediate income vs. extra income)
- The number of traders present at the market
- Prices that prevailed on previous market days

Seasonality of the product is an important factor in determining the size and characteristics of the market. For example, in South Africa local informal markets for Marula beer (made from Marula fruit) only exist from December to mid-March, and the number of traders depends on the location of the market and the time of day (Shackleton 2004).

The role of the "middleman" is quite important and can make or break small scale producers of NWFPs. Middlemen can provide small scale NWFPs producers with three essential services: immediate credit, speedy and non-bureaucratic payment for products, and good organisation. They can also centralise supply among a diversified group of producers and absorb the risk in markets, which require product volumes that are too large for individual producers to supply. However, middlemen can also act against the producers if they exploit the producer's lack of price awareness (FAO 1995).

The existing information on NWFPs is found in highly relevant formal markets where NWFPs are traded and processed. However, the formal market also consists of products originating from the informal market. An example of this is presented in Figure A. Indonesia is the main producer of rattan, and the forest department regulates rattan harvesting through licensing. About 40% of the price of rattan goes to cover the traders' cost of handling and transportation (Iqbal 1993).

There are a variety of problems inherent in the valuation methods for NWFPs. However, some information exists for important products at a national level. The potential value of NWFPs also varies considerably according to conditions like geography, climate, soil etc. and generalizations are thus difficult. For example, according to a study of dry deciduous forests in East India, the timber harvested was estimated to have a potential revenue of USD 268/ha. It was also estimated that the value of NWFPs in the form of plant species only, was USD 1016/ha in the coastal areas, and USD 1348/ha in inland areas. It was concluded that NWFPs had a competitive advantage over timber, and that there is a need to develop a new valuation protocol for allocating land to alternative uses (Mahapatra and Tewari 2005). In another study in the Peruvian Amazon on two local villages' extraction of NWFPs, the yearly per hectare values ranged between USD 9–USD 17. These figures could be higher if they included unrecorded results of townspeople's extracting NWFPs. Overall generalisations are difficult as the per-hectare values depend very much on the locality (Gram 2001).

International Trade

Some NWFPs are export commodities, and data on their trade is included in international trade statistics (Comtrade UNSD 2004). These NWFPs include rattan, bamboo, cork, forest nuts and mushrooms, gum Arabic, essential oils, and medicinal plants. An overview of selected important commodities traded internationally that can be considered as, or include, NWFPs is displayed in Table 1. Most of these commodities are exported in a raw or semi-processed form by developing countries. The main trend in the flow of NWFPs is from developing to developed countries. The USA, EC, and Japan import approximately 60% of the total value of NWFPs.

The declared value of NWFPs by importing countries is usually double the declared value by the exporting countries; this is usually because exporters understate export values in

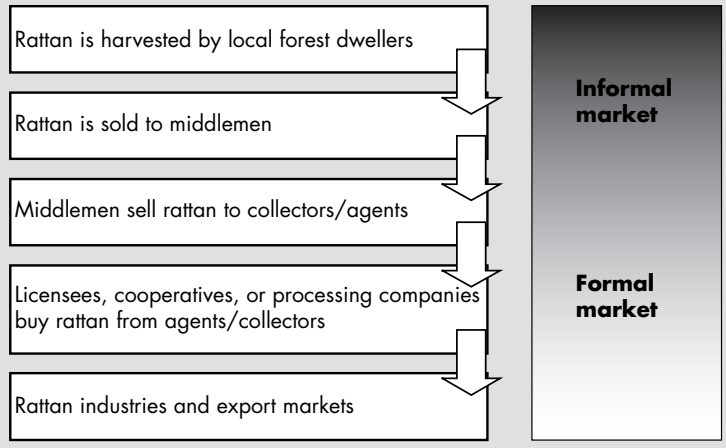

Figure A. Market chain for commercial rattan in Indonesia (Iqbal 1993)

Table A. Global import values of selected NWFPs for 1992 and 2002 (FAO 2005)

Commodity description	Global import value (USD x 1000)	
	1992	2002
Mosses and lichens for bouquets, ornamental purposes	9 352	25 476
Truffles, fresh or chilled	4 201	23 656
Mushrooms other than *Agaricus*, fresh or chilled	n.a.	364 412
Mushrooms (excl. 071331/33) & truffles, dried	n.a.	219 458
Plants & parts, pharmacy, perfume, insecticide use	689 926	777 980
Rattan used primarily for plaiting	118 987	51 327
Maple sugar and maple syrup	43 632	116 202
Ginseng roots	389 345	221 435
Palm hearts, otherwise prepared or preserved	16 082	67 514
Oak or chestnut extract	8 653	917*
Gum Arabic	101 312	105 510
Natural cork, raw or simply prepared	7 874	110 702

order to evade taxes. In the case of Indonesian rattan, for example, these reporting discrepancies are of the magnitude of 91.3% (Iqbal 1993). Thus, import data is considered as a more accurate indicator of the trade values and volumes for some products. The values of internationally traded NWFPs listed in Table A should be used with much caution, and they can undervalue the real contribution of NWFPs to international trade for several reasons, such as:

- Only a small number of NWFPs are listed separately as commodities, the rest are grouped with other, mostly farm-based, products;
- Countries do not report their exports/imports for a given commodity;
- Mostly NWFPs used as raw materials are reported in the international trade commodity descriptions, and it is not possible to assess NWFPs that are a part of semi-processed goods;
- The international commodity descriptions do not differentiate the origin of products, i.e. between production from forests or from farms.

The relative declining value of NWFPs in international trade corresponds to the preliminary findings of declining production at the national levels. Many NWFPs are "local" products, occurring in a few countries only, while international trade is increasingly becoming global. Global trade requires products in quantities and qualities that can no longer be met through local/artisan production schemes. Thus, a clear fragmentation is an inevitable feature in the NWFPs sector. NWFPs will continue to be traded in domestic informal markets, while on the other hand those NWFPs that have become commercial face competition from farmed and synthetic products. For the production of commercially viable NWFPs, there are two distinct options:

- Extraction and harvesting based on natural regeneration
- Domestication through cultivations such as plantations or agroforestry systems

In Table A, the value of Oak/Chestnut extract has declined significantly because of its substitution with synthesised products. Truffles on the other hand, are a delicacy (price range of about USD 2000/Kg) harvested mainly in the wild. The current wild supply is not meeting the current market demand, and thus the price for truffles has increased. Cultivations of inoculated trees can take several years to produce truffles after inoculation occurs, but since cultivation methods are improving, they may replace the wild harvest in years to come ((New World Truffieres 2003). Natural cork, raw or simply prepared is an

essential component in the wine industry, and 60% of the cork market is devoted to stoppers for wine bottles. While the cork industry has benefitted from a growing wine industry, it is also at risk of being replaced in the near future (FAO 1999).

Sudan produces 70–80% of the world's supply of gum arabic. Many of the major users of the substance have switched to newly developed modified starches, because of the unstable gum arabic production base that has been affected by droughts; as a consequence, the demand for the substance has been steadily declining over the last 20 years (Iqbal 1993). Ginseng is an example of how cultivation can slowly influence the price of the product, in order to prevent over-harvesting. The price of wild dried ginseng roots has actually doubled over the last decade; however, the price of cultivated ginseng roots has declined by 75% over the past 10 years. The major reason for the price decline on the ginseng market is that China has increased its production of cultivated ginseng roots (Hankins 2000).

Commercialisation and Outlook for the NWFP Sector

The potential of NWFPs to enhance livelihoods and to contribute to poverty alleviation has received increasing attention. To capture the potential of contributing to economic development, employment, and income generation in an environmentally sustainable manner requires holistic development of the NWFP sector. Markets, trade, information, and commercialisation of the NWFPs sector are crucial factors in this process.

One of the drawbacks experienced in the NWFPs sector is that once a product has achieved commercial importance, the industry has often replaced supply from wild resources with supply from plantations or synthetics in an effort to acquire market power while minimising production cost; as a consequence, prices fall and the market for the product declines (Arnold 1995). However, Ruiz-Pérez et al. (2004) found that cultivations have higher values for labour, use more intense technology in production, and produce more per hectare. Moreover, it was found that situations where cultivation was used generally enjoyed a stable resource base in comparison with situations, frequently associated with declining resources, where natural extraction was used.

Commercialisation of NWFPs has caused a dilemma in how to proceed in the most sustainable manner, taking into account social, ecological, and economic values. On one hand commercialisation is a way in which products can be recognised in the formal market, but ultimately it can lead to adverse environmental impacts. Commercialisation can lead to overexploitation by collectors and traders when market demand is high, and thus compromise the sustainability of production (Mahapatra and Mitchell 1997). Wild harvesting appears viable only in cases where a strong regulatory framework exists and is enforced. Enrichment plantings are recommended for replacing the trees lost to harvest (Stewart 2003). The factors undermining success for commersialising NTFPs are discussed in Chapter 12.

The domestication of NWFPs can alleviate over-exploitation, but may also have impact on local livelihoods, if the product is domesticated in a different locality and the benefits are redistributed. Several studies conclude that balance lies in diversification of NWFP harvest management strategies. A combination of protection of wild populations, enrichment plantings within forests, and small to large scale cultivation techniques, is necessary to meet current and potential market demand (Stewart 2003). Moreover, agroforestry systems integrating suitable species must be promoted for the commercialisation of NWFPs to provide social benefits to communities (Mahapatra and Mitchell 1997).

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BOX 5.3 Jiri Forest Conservation in Nerumedzo, Bikita District, Zimbabwe

Abisha Mapendembe

The Nerumedzo area in the Bikita district of southeastern Zimbabwe is a typical communal area. Communities in the area extract edible stinkbug (*Encosternum delegorguei*) from communal woodland. The stinkbug contributes significantly to the livelihoods of the communities, not only as a safety net for the poor but also as a significant source of household income.

The Jiri Forest showcases an alternative model of protection, albeit under the direction of customary rules. In legal terms, like all communal lands, the Nerumedzo area is neither completely state-owned nor completely customary. Because of its status as a reservoir of an important resource, local rules designate the forest as a protected area in which no cultivation is allowed. Several measures are in place to ensure sustainable extraction of the resource. At the start of the harvesting season, one of the local headmen is elected as the custodian of the forest. A representative cadre of over 30 guards is also elected from the surrounding 30 villages to take residence in the woodland together with the elected custodian. The woodland is then divided into seventeen divisions to ensure equitable access and to spread the pressure of extraction. During each bug-extraction trip, the monitors remind and advise extractors of prudent harvesting techniques. The rules prohibit the felling or damaging of trees in order to gain enhanced access to the bugs. The monitors are accorded privileged access to the bugs as an incentive.

The *locus* of use and benefit is the individual household. The magnitude of benefit at the household level is conceivably high enough to mitigate the transaction and other costs associated with the collective management of the woodland in which the resource occurs. On average, the community of 30 villages gets between Z$ 20–26 million (USD 3770 to 4900) per year, with the average household income from the bugs amounting to about Z$ 1 million (USD 190) per year. By Zimbabwean peasant standards, this is considerable income; it is not surprising that the relevant rural district council is reportedly considering imposing a bug levy on those commercializing the product. So far, the marketing chain spans from the local through the national to the international levels, with the last being mainly the northern province of South Africa.

In summary, the system appears to be working mainly because it is demand driven, it is attuned to the intricacies of local social capital, and it results in accrual of benefits at the individual household level. Unfortunately, such a system still lacks unequivocal legal recognition by way of decentralized powers. The Nerumedzo case is a clear example of a working *de facto* decentralization initiative that still lacks *de jure* acknowledgement and legitimation. The role of external actors in production and regulation is less emphasized, with such actors appearing to be more emphasized in processing, storage and marketing.

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ancient one, are naturally the principal nurseries of firm and industrial networks with global strategies. These networks have significant potential for most of the tropical forest industry in the world. On this basis, the industrial evolution could be due to the Asian domination of tropical timber economics.

However, one could note that many of the performing and competitive companies of the forest sector are implicated in networks of similar organization, but with different cultural influences. In west and central Africa, for example, the members of the Lebanese and Italian communities form the main part of the firm and industrial networks, operating exactly as described above. There may be a cultural denominator in these networks, but all of them essentially arise from communities inclined to networking and cooperation. The development of these networks goes beyond the initial specific cultural area, and in particular tends to include local SMEs in its exchanges of services and subcontracting, even when some of them do not share the "initial culture" of the network that created them. In Latin America such networks already exist and have been studied in detail in different sectors (e.g. footwear), but not in the forest sector. In this sector Asian networks have an increasing influence, especially in the Amazon.

One can also note that the majority of these firm or industrial networks are connected to pre-existing industrial districts, located thousands of kilometres away, where industrial processing does not take place. For example, the majority of the Italian firms in the woodworking sector which are installed in tropical countries, are all without exception connected to the same industrial districts in northern Italy that provided the material for a great part of the literature about "post-Fordism" and the "second industrial revolution". In the same way, the Sino-Malaysian, Indian, or Lebanese firms are also connected to different but similar industrial districts.

There are many unknowns about these networks. For example, is the "second industrial divide" only extending to the forest sector? Or is it a new system of production with transcontinental groups of firms directly connecting local SMEs to the international market? Will these systems, which certainly provide opportunities for the economic development of local SMEs, be able to reconcile competitiveness and sustainable management?

5.5 Non-Timber Forest Products and Local Livelihoods

Considerable literature exists on the relationship between forest resources and local livelihoods (Box 5.1). For example, Wollenberg and Ingles (1999) document methods for assessing forest uses and their potential impact, with a view to conserve and develop these resources. FAO (2001) reports on approaches for assessing the forest resources that contribute mostly to rural livelihoods, specifically the non-wood forest products. Colfer and Byron (2001) add the link between these forest resources and human well-being and resource sustainability, specifically raising the profile of gender and diversity, rights, and access to forest resources in forest management. The commercialisation of NTFPs is very well documented (see for example Neumann and Hirsch 2000, Shanley et al. 2002). Kusters and Belcher (2004), Sunderland and Ndoye (2004), and Ruiz-Perez et al. (2004) provide global accounts of important patterns and key issues regarding non-timber forest products. This literature collectively serves as an important starting point in understanding the resource base and its sustainable exploitation in ways that improve human welfare. They add much value to earlier studies, like that by Townson (1995), which document traditional uses of forests in livelihood support.

NTFPs are the most accessible forest products for poor communities because their utilization requires little or no capital. For most communities, NTFPs are freely available in communally owned forestlands with few or no collection restrictions. A number of studies have documented how households rely on NTFPs for both subsistence use and cash income generation (Cavendish 1999; Campbell et al. 2002). Unfortunately, much of the work shows that most of these products (with some exceptions) do not take households very far on the poverty alleviation path. Angelsen and Wunder (2003) note that the very same characteristics that make NTFPs important and attractive to the poor in the first place also limit the potential for further income growth. Moreover, most of the measures designed to elevate the poverty reduction potential of NTFPs usually result in marginalization of the poor, as they lose their comparative advantage as suppliers. Well-resourced competitors are bound to take over from poorer households as soon as NTFPs become more valuable.

Foremost among the weaknesses of NTFP-based development is the lack of well-developed markets on which these products can be traded, so that these products often fetch low prices (see Box 5.2). Cheap and more formally marketed substitutes for some of the forest products have also forced the price of NTFPs down. The remoteness of most locations where NTFPs are found makes access to lucrative urban markets more complicated, especially for individual households operating with small volumes. Only more organized and well-resourced outsiders are capable of penetrating urban and foreign markets where marketing margins are significantly higher than in local markets. The seasonal nature of most of these products also makes market development more difficult and income flows inconsistent, as supply is not guaranteed. Most households only allocate their time to extraction of NTFPs when they are not engaged in other enterprises that are regarded as more lucrative, like cropping. Although some NTFPs have potential to *significantly* improve livelihoods of local communities, these remain isolated cases involving a few villages. Significant poverty alleviation for poor forest dependant communities through extraction and trade of NTFPs is likely to remain limited to a few unique cases. The example in Box 5.3 demonstrates how NTFP extraction can co-exist with forest conservation.

5.6 New Approaches to Small Enterprises Support

In an intellectual and policy-making context, dominated by theories that assumed that large-scale mass production of standardized commodities for large homogeneous markets was the key to economic productivity and growth, the "discovery" of the exceptional success of small industrial districts in Northern Italy and in other parts of the world has attracted considerable attention. The districts, and later industrial clusters and networked production systems (localized or not, spread into almost all the possible economic sectors, including woodworking and forestry), excited the interest of social scientists and policymakers all over the world for several reasons. First, because they seemed to demonstrate the viability of alternative models of economic success and their prospects even in advanced industrial countries. Second, the industrial districts showed that certain kinds of small firms and specializations could survive in a world of rapid technological change and growing international competition. Indeed, these networks of cooperating and competing small producers seemed especially versatile at achieving what large-scale "Fordist" industries could not do well: satisfying consumer demand in affluent societies for more diverse and higher-quality goods. These industrial districts, clusters, or networked production systems, are important because they challenge prevailing assumptions about how societies gain competitive advantages.

Finally, these production systems attract interest because they are seen both as alternatives to large-scale modes of production and as more humanly satisfying forms of social order. In contrast to inequalities of income and power and the steeply hierarchical authority ladders of the "Fordist" system, the networked production systems represent, at least in the eyes of some of their observers, a more

egalitarian set of arrangements, with more cooperative relations between labour and capital.

Taking into account these new insights about what can be seen as a significant change in the necessary conditions for increasing economic productivity and improvement of livelihoods of all the actors, the neoclassical economic theory has received updates from various contributors. Examples include: Piore and Sabel (1984) highlighting the "flexible specialization" new paradigm in their book "the second industrial divide" (…virtual networks emerging among rival firms, and that manage to cooperate…); Mills (1992) with his views on spatial externalities and agglomeration economies; Saxenian (1990) with her analysis of "networks of relationships rather than a collection of atomistic firms"; and Porter (1990) with his generalization of the concept, among others. All these "updates", theorizing upon rivalry and information flows, path dependency and technologic lock-ins, market discontinuities, venture capital, dynamic externalities, etc. form a "post-neoclassical cluster theory" that aims to identify the potentials for development brought by network-based industrial systems.

In order to seize the opportunities for development that these new insights have made possible, development agencies, policy makers, and researchers have since the 1990s tried to develop new methodologies and approaches that could take into account the complexities and integration of all the factors and stages that characterize such systems. This goes beyond just sustaining livelihoods, because it develops relationships among most of the actors of a local system (that is included in a macro-system). It also goes beyond just forest livelihoods, because it combines livelihoods and economics in all the production systems, that is, from the local forest and its dependent communities to the final international markets, policy environment, actors, and customers.

Various approaches have been developed. Among the better known are:

- the "industry cluster" approach (a group of business enterprises and non-business organizations for whom membership within the group is an important element of each members firm's individual competitiveness – binding the cluster together are the buyer/supplier relationships, common technologies, common buyers or distribution channels, or common labour pools),
- the "regional cluster" approach (a group whose elements share a common regional location, where region is defined as a metropolitan area, labour market, or other functional economic unit),
- the "value-chain" approach (a group identified as an extended input/output or buyer/supplier chain – it includes final market producers, and first, second and third tier suppliers that directly and indirectly engage in trade and is comprised of multiple sectors or industries)
- the "business-network" approach (a group of firms with restricted membership and specific and often contractual business objectives likely to result in mutual financial gains – networks develop more readily within clusters, particularly where multiple business transactions have created familiarity and build trust)
- the "actor-network" approach (a group of visible and hidden actors whose cooperation – competition interactions form a coherent socio-complex of collective efficiency, flexibility and international competitiveness – it includes a multi-scale set of interactions from global to local levels, and localized as much as non-localized networks).

All these approaches have in common the fact that they encompass a wide variety of factors of the livelihoods and societies that they try to develop. In that sense, these approaches are integrated, multi-scale, holistic, or a combination of these qualities.

These approaches have been developed for various sectors of activity, and only the "actor-network" approach has had a special focus on the forest sector. Within the forest sector, the network-based economies have seldom been studied, and even fewer development projects following this new paradigm exist. For instance, the database of the Harvard Institute for Strategy and Competitiveness inventories 874 clusters or cluster development projects known in detail throughout the world, among which only 21 belong to the forestry or forest products sector, and 20 belong to the wooden furniture sub-sector. While these approaches can be traced back to the 1970s in some sectors, such as footwear or textile, there is still room for development of the concept with respect to forest livelihoods. The complex relationships between environment, societies, and economics present many contexts for forest-based livelihood opportunities under various modalities, types, and extent of interventions. A few experiments already exist, some projects are ongoing, and some are completed. We need to examine the potential for their replicability and their impacts, and assess their efficiency.

Although millions of people are employed in the forestry sector worldwide, local people have largely been engaged as informal workers, while more lucrative opportunities in downstream industries have rarely been accessible to local people. It is highly unlikely that significant numbers of rural households could lift themselves out of poverty through gaining employment in local forestry activities. In Sub-Saharan Africa, the rapid growth in the number of small-scale forest-based enterprises suggests that they could contribute significantly to local livelihoods and poverty reduction. Unfortunately, high capital and technology requirements have limited the number of entrants to better-off households and individuals. If deliberate policies and programs are put in place to support these rural based enterprises with credit and training, significant growth in this sector could potentially benefit large numbers of rural households.

5.7 Payment for Environmental Services

The search for solutions to problems of persistent rural poverty and continuing loss of unique forest ecosystems in the tropics remains one of humanity's most daunting challenges. In recent years, it has become increasingly clear that natural "win-win" situations in tackling these interlinked problems are the exception rather than the rule (Angelsen and Wunder 2003). In order to satisfy basic livelihood needs, the only feasible land use options to many local people will result in the clearance or degradation of forest. Increasing forest conservation will secure forest environmental services for both the global and local beneficiaries, but this often comes at a high cost to local people, either in terms of resources invested or in terms of foregone opportunities. Yet if the potential gains from forest conservation are large enough, the winners can afford to compensate the losers. This has led to emerging payments for four types of services: carbon sequestration, watershed protection, biodiversity, and aesthetic values. The basic principle of payments for environmental services (PES) is that forests provide positive externalities that off-site beneficiaries value, but which may not be taken into account by on-site landowners or users unless the beneficiaries pay them. However, off-site beneficiaries will only pay forest owners who continue to provide the services, which are monitored on a periodic basis.

PES schemes thus have the potential to turn "win-lose" or "lose-win" into "win-win" situations. Local people stand to benefit from their investment in the conservation of forested catchments. The huge potential offered by forest-based tourism could be tapped to benefit local households who maintain the forests. The increasing scarcity of resources, such as water, will also encourage downstream users to compensate upstream catchment managers in order to guarantee both the quantity and quality of water supply. Besides benefiting directly from the compensation payments, households also stand to benefit from better managed forest landscapes.

Payments for environmental services have the potential to improve the livelihoods of forest dependant households and contribute to poverty alleviation if some of the challenges of implementing these schemes are overcome. Recent reviews of existing schemes reveal that a number of problems need to be overcome in order to effectively develop markets for environmental services (Smith and Scherr 2002; Angelsen and Wunder 2003). Some of the challenges to be overcome include: how to minimise trading risk, especially in the face of weak local institutional arrangements and powerful offsite beneficiaries of environmental services; building genuine partnerships among stakeholders; drawing up agreements that are both equitable and flexible enough to deal with changes in social and economic circumstances and environmental conditions; reducing the transaction costs of setting up and fostering PES schemes; dealing with unclear and sometimes insecure property rights over forests; creating relevant institutions at different scales to ensure equitable distribution of benefits; demonstrating the links between people's activities and provision of environmental services; and changing the attitude of stakeholders who have always benefited without paying for environmental services (Angelsen and Wunder 2003).

The big question is whether PES will lead to poverty alleviation for significant numbers of people. As already pointed out, the success of PES schemes will hinge on establishment of functional institutional frameworks at various scales to deal with tenure issues and distributional problems, and to enforce commitments of various stakeholders. The transaction costs of establishing PES for smallholders could be enormous. In areas where extensive degradation has already occurred, prospects of local people benefiting from PES are low, as massive investments may have to be made in restoration of the landscape before offsite beneficiaries can start compensating for environmental services.

5.8 Can Deforestation Improve Livelihoods?

Forests continue to give way to crop and livestock production. Ramankutty and Foley (1999) estimate that since 1980, global expansion of croplands has converted some 6 million km^2 of forests and woodlands and about 4 to 7 million km^2 of savannas, grasslands and steppes. McNeely and Scherr (2001) report that about half of all tropical forests were cleared in the last four centuries for agriculture and other human activities. They also report that in Southeast Asia cropland expansion from the early 1980s to the early 1990s was by 11 million hectares, mainly excised from the forests, and that since 1972 about 13% of the entire Amazon region (some half a million square kilometres) has been converted to crops and pastures. Forests are important in supporting wetlands that are essential to irrigated agriculture. However, wetland conversion to cropland and pastureland has changed the condition of wetlands in more than half of the 1000 Wetlands of International Importance listed under the Ramsar Convention (McNeely and Scherr 2001), and therefore undermined irrigated agriculture.

Further, the suitability of forestland for crops is questionable in some cases. For example, the woodlands and dry forests of Africa are on fragile soils of low inherent fertility, in areas characterized by low and erratic rainfall and long dry seasons, which limit surface water and soil moisture and encourage migration of animals and people. These conditions dictate low agricultural potential, and as a result agricultural production in these areas is risk-prone and less likely

to result in significant improvements in the livelihoods of large numbers of people. Whereas an initial crop following forest clearing could be good, successive crops will need many inputs that the poor communities can hardly afford. These factors, combined with reduced water supplies that often accompany forest-clearing, further limit the scope for irrigated agriculture to complement extensive rain-fed agriculture. Generally, clearing forestland for agriculture might boost crop production in the short term, but it has, in some cases, the potential to undermine agricultural production in the long term.

In most cases the remaining forested landscapes also provide vital support functions to agriculture (e.g. grazing and browse for livestock and wildlife). Converting these forests to agricultural land could have adverse effects on some vital components of livelihood portfolios. For most households, the use of products from the forest (fuelwood, construction materials, and medicines) is the only strategy for meeting basic livelihood needs, and clearing forests would seriously undermine their welfare. In most circumstances therefore, prospects for poverty alleviation through conversion of forests into agricultural lands seem rather unlikely. Rather, improving productivity on existing arable lands could result in more sustained welfare gains.

5.9 Devolution of Forest Resources to Local Communities

Until relatively recently, forestry in many parts of the world largely took the form of top-down government programmes and projects that centred on the introduction of new technologies. Frequently, especially in developing countries, this involved establishing village woodlots, planting fast growing species, and demarcation of protected forest areas from which local people were excluded. Indigenous species, local agroforestry systems, and traditional resource management practices, as well as institutions for communal forest stewardship, were often ignored. Typically, decisions about forest management were taken in centralized government offices, far from the people affected by changes in forest management.

In the last few decades, social issues and the need for communities to assume more active roles in resource management have come to the fore. Social forestry emerged, challenging conventional management regimes that relied on the authority of the state to hold unilateral power over management decision-making. With increasing pressures on forest resources and fiscal constraints on government forest agencies, it is now clear that many governments in developing countries are no longer able to manage and protect public forestlands on their own. Forest dependent communities are often the best positioned logistically to develop and impose the intensified use controls needed to sustain natural forest ecosystems. At the same time, worldwide trends towards democratization and decentralization have put the spotlight on communities' demands to play a central role in forest management. While conventional management approaches emphasized exclusion and marginalization of local communities and indigenous peoples from forest programmes, current approaches now centre on active involvement of forest dependent communities and incorporation of local people's social and cultural concerns in decision-making on all aspects of forest management.

Governments worldwide are beginning to recognize the legitimate rights of forest dependent peoples, ancestral domain claims, and the opportunities community involvement provides in helping sustain natural forest ecosystems. The motives for these moves to decentralize vary, but most stakeholders hope that the process will help reduce bureaucracy, make decision-making more democratic, distribute the benefits derived from exploiting resources more fairly, and make their use and exploitation more efficient.

While there is an observable worldwide shift to policies and programmes supportive of community involvement and decentralization in forest management, the challenge has often been to determine how this transition should take. Critical to this transition is the establishment of adaptive institutional arrangements, policies, and programmes to facilitate devolution of greater authority to forest dependent communities while supporting new partnerships among communities, governments, and the private sector. In practice, community involvement would have to move beyond "invited" participation, which frequently means invitation to comply with preset objectives. The challenge is to move beyond rhetoric and encourage management approaches that do not obscure the experiences, perspectives, and political and material interests of the poorest forest users.

Through strengthened participation, not just in policy but also in science, poorer forest users can genuinely shape forestry and conservation agendas. This could take the form of participatory research strategies and deliberative procedures in which poorer forest users help to set agendas and questions, allowing perspectives from local settings to feed upwards into and shape terms of policy debate. Such procedures would need to promote aspects of political and legal culture that enable critique, build people's confidence and adaptive skills, and make space for people's own perspectives, knowledge and interests to inform policy debates.

Although the last two decades have witnessed a paradigm shift in conservation and natural resource management (NRM) away from costly state-centred control towards approaches in which local people play a much more active role, the reality rarely reflects this rhetoric (Shackleton et al. 2002). In a detailed study based on cases from three Asian countries and eight southern African countries, Shackleton and others (2002) examined the extent to which devolution has transferred control over NRM deci-

BOX 5.4 Improving Devolution Policies

Sheona Shackleton

Shackleton et al. (2002), drawing on case studies from Africa and Asia, drew up suggestions for promoting positive livelihood outcomes from devolution efforts:

- Start with what resource users know and do. All too often, "community-based" projects are driven by the interests of the external agencies.
- Promote flexible approaches rather than tightly worded contractual agreements. Because local people are able to implement or take control over projects, a good deal of trial and error is necessary. Tightly worded contractual arrangements can limit the options of local people.
- Create opportunities for pluralistic decision-making by establishing platforms for discussion, debate, and planning. Such forums can facilitate the interaction of local people with the various decision makers.
- Improve legal literacy so that local people can make informed responses to existing policy. Local people have to come to understand the legal frameworks that govern their actions.
- Improve larger-scale popular mobilization over natural resource issues by, for example, encouraging the formation of federations. All too often, local people have low capacity to influence decision makers. Federations can help alleviate this constraint.
- Assure accountability of local organisations and assist in conflict management. External agents of change need to develop the capacity of local organizations.
- Monitor policy impacts so that constraints and opportunities can be identified.
- Create fuller and clearer property rights at a local level. Problems associated with property rights are often the root cause of failure in local initiatives.
- Make livelihoods enhancement central to devolution policies. Short-term benefits are imperative in community-based natural resources management, and thus livelihood options must be part of the development initiative.
- Build local capacity in technical skills, marketing, organizational development, communications, and political mobilization. Two areas needing particular attention are: dealing with local inequalities and exploitative social relations, and addressing inter-community problems and opportunities.
- Shift focus of state and NGO interventions to issues of political process and away from technical and managerial aspects. Support the building of democratic organizations that are representative, accountable, and transparent. Technical choice in natural resource management should be left to users.

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sion-making to local people, created the space to accommodate local interests and livelihood needs, and empowered resource users to benefit from and influence the outcomes of these new policies.

The study recognizes that the state has a legitimate role in devolved NRM, but questions whether in practice a balance has been achieved between local and "wider" interests and objectives. The authors observe that too often the notion of conservation as a "public interest" area or the need to achieve national economic development goals have been manipulated to serve the interests of NR departments and to legitimise their actions, usually to the detriment of local livelihood systems and the real choices available to people. "Scientific management" is often used to justify continued central control over valuable resources, when it is really about controlling profitable opportunities, often for individuals who are not entitled to them (Shackleton et al. 2002).

Across most sites in Asia and southern Africa, local people's views were that devolution policies had yielded only limited benefit for them. In most instances, the state provided benefits as an incentive to encourage people to support activities that met government revenue or conservation interests rather than local livelihood needs. Thus, although access to some subsistence products improved, access to other important local resources such as fuelwood, timber, or game often continued to be restricted. The bias towards products and species favoured by forestry departments (e.g. timber) at the expense of species valued by poor people for medicine, fodder, craft materials and wild foods, was usually promoted. In most cases, the lack of authority to make decisions locally to deal with various issues was a major area of local discontent.

Financial benefits from devolved management generally fell short of local expectations. Income distribution shares were generally decided at the central level, but governments often failed to deliver on their promised share of incomes, or returns were far less than anticipated and inadequate to maintain local enthusiasm. In cases where financial benefits accrued from revenues, licences, permits, and leases, a disproportionate amount of this income was retained by the state at district or higher levels, or it was captured

BOX 5.5 Elements of an Approach for Complex Landscapes and Livelihoods Issues

Jeff Sayer

Integrated approaches to research on agriculture, resource management, livelihood improvement, and landscapes have to accomplish seven critical changes in order to achieve a paradigm shift to both increase poverty reduction and enhance ecosystem and human health.

- *Acknowledge and analyse the complexity of natural resource systems:* We must acknowledge systems complexity and bring to bear the concepts and tools of systems analysis to deal with complexity.
- *Use action research – become actors in the system:* We must become part of the system in a cycle of action research.
- *Consider effects at higher and lower scales:* We must routinely conduct cross-scale analysis and action. This means that our action research will invariably consist of cycles within cycles, and we will have to interface these with simulations of longer-term processes.
- *Use models to build shared understanding and as negotiating tools:* We must confront complexity with conceptual and systems models, but a new type of model is needed. We must have models that can facilitate discussion and stakeholder interaction – "working" models that may be thrown away after a short period of use.
- *Be realistic about potential for dissemination and uptake:* Is the detailed knowledge about a specific research and development site of any significance beyond the site? Anderson (1998) believes not. He has portrayed natural resource management as an area for research of little strategic value, unlikely to produce internationally useful public goods and not worthy of significant levels of public sector investment. We believe otherwise – dissemination of the processes involved in successful integrated approaches will yield widespread benefits.
- *Use performance indicators for learning and adaptation:* We need tools to monitor and evaluate system performance. But this is not "impact assessment" as envisaged for "transfer of technology". Performance indicators will be essential in the learning process of adaptive management.
- *Break down the barriers between science and resource users:* We will have to change the organisation of science. Elite, monolithic research centres will be of less value for integrated research. Research organisations will need to reflect on their *modus operandi* and scientific culture (including scientist incentive systems), and rise to the challenge of re-organising for maximum effectiveness in a more inter-connected world.

Our contention is that the case for more "integrated" approaches to natural resource management is compelling. The ultimate integration of the elements of management of any natural resource may not be achievable. However, an attempt to modify existing research and development efforts to achieve higher levels of integration does, on balance, seem to be a sensible thing to do.

by local and outsider élites. Only in a few cases did communities receive substantial financial benefits.

Despite the various weaknesses, devolution brought a number of positive changes that included: recognition of local people previously considered poachers, criminals and squatters as legitimate resource users; opened channels for rural dwellers to communicate their priorities to government decision-makers and in some places improved community-government relations (although in many sites suspicion continued to exist); contributed to villagers' organisational capacity and political capital by encouraging local people to join new networks and forge new relationships; in areas where devolution has been in place longer, local populations were demanding more autonomy, bringing about reforms that promote local people's interests; addressing equity issues and making inroads to enhancing participation of marginalized groups and women in decision-making.

Negative impacts of devolution policies in some countries included: damaging existing organizational capacity, local enterprise, and equitable social relations; decreasing local participation in "community-based" NRM, as disillusionment set in as bureaucracies failed to meet the expectations raised by new devolution policies; curtailing local rights and *de facto* access to resources. Box 5.4 summarises the recommendations of the study for improving the outcomes of devolution.

5.10 Going beyond Natural Resources for Poverty Reduction

The last three decades have seen significant and promising outcomes for world development. In order to consolidate these, and contain the shortcomings of previous policies, a Millennium Declaration was signed by 189 countries in 2000 that led to the adoption of the Millennium Development Goals (MDG). These goals facilitated setting clear targets for eradicating poverty and other sources of human deprivation, among other commitments (World Bank 2004). It is in this context that livelihoods support from forests has to be examined. To facilitate this at global level, a number of processes exist, notably the United Nations Forum on Forests, which is a successor to the Intergovernmental Panel on Forests

(1995–1997) and the Intergovernmental Forum on Forests (1997–2000).These are all forums employed by the United Nations Commission on Sustainable Development, and have all along focussed on livelihood contributions of forest resources (Chipeta and Kowero 2004). The UNFF processes have to contribute to the achievement of the MDG.

Much of the focus in improving well-being of forest dependent people has been on increasing their incomes. However, there are also non-income dimensions to well-being. These are more of the nature of public goods and include access and rights to natural forest resources. They should be emphasized in the poverty reduction equation so that when we improve well-being through natural forest resources we at the same time increase the different components that constitute it. In this way improving livelihoods of rural people using forest resources essentially becomes a component of a larger rural development undertaking.

The contribution of forests and other natural resources to rural livelihoods is unquestionable. These resources have helped large numbers of poor people to avoid extreme poverty, or even eliminate poverty in some cases. Research efforts should enable identification and development of promising opportunities for forest-based poverty alleviation and circumstances under which these are applicable. Innovative ways of overcoming obstacles to realizing greater livelihood gains from resources should also be pursued where possible. Where forest-based poverty alleviation is clearly unlikely, this should be emphasized to avoid poor people being drawn in initiatives that could keep them in the poverty circle.

It is clear that concentrating efforts in the search for poverty alleviation on limited rural based development options will not be enough. Investments to achieve widespread poverty elimination at the scale of MDG will have to go beyond forests and natural resources. The strong links between rural livelihoods and the urban sector (through off-farm employment, markets) means that a vibrant urban sector will generally lead to positive links with the rural sector. Rural non-farm investments will also help overcome some of the barriers to successful natural resource-based initiatives. Rather than emphasizing forestry, natural resources, or rural development as separate agendas, successful development endeavours will have to be all encompassing. Integrated, multi-scale interventions from the local through to regional and global scales are required to lift significant numbers of poor people out of poverty. Successes of such approaches have been acknowledged in different sectors, as in the Indian knitwear sector or in the Nicaraguan agro-industrial sector (UNIDO 2001).

To understand the full complexity of livelihoods in landscapes, and to develop appropriate interventions, is a massive challenge. There are currently huge efforts in diverse fields to move towards approaches that capture the complexity of livelihoods and landscapes, such as the ecosystem approach, the landscape approach, and integrated natural resource management (see Sayer and Campbell 2004 for a review). But we have to recognise that many attempts to integrate complex sets of knowledge and the interests of diverse sets of actors into a common framework have yielded disappointing results. The desire to achieve integration persists, but our seeming inability to translate the theories of integration into practical achievements on the ground is leading to widespread disillusion. In frustration, we abandon one set of integrative buzzwords and replace them with others. What is surprising is not the improvement of integrative methods over the past 40 years – rather it is their fundamental similarity. The words have changed but the paradigm remains similar (Sayer and Campbell 2004).

Getting researchers from different disciplines to work together with resource managers from different sectors seems sensible and easy enough. In practice, however, there seem to be language and cultural barriers that often bedevil attempts to get diverse groups of people to work together on a common problem. This is not the case in all areas of human endeavour. Large teams of diverse scientists collaborate to launch space probes, develop stunningly complex computer technology, and unravel the complexity of life-threatening diseases.

The elements necessary for successfully tackling large complex problems dealing with landscapes and livelihoods are outlined in Box 5.5. While a focus on livelihoods is essential, to achieve success one needs to go well beyond the sustainable livelihoods approach into fields of systems analysis, social learning, organizational management, etc.

5.11 Conclusion

The sustainable livelihoods approach has arguably been one of the most important approaches to realign research and development towards having a clear livelihoods focus. The arguments presented above indicate that there is room for moving well beyond this approach and well beyond the forestry sector if we are to tackle the big challenges facing humanity.

Although there are trade-offs between the goal of eliminating poverty among the millions of people who depend on forests and conserving the unique biodiversity of these forested landscapes, opportunities exist for achieving both targets. In many areas the poor local communities are prevented from capturing the full benefits of forest-based economic activities due to a range of unfavourable circumstances that include their lack of power, voice and capital assets, and restrictive institutional frameworks. Many of the developing countries are actively engaging with a number of processes that could lead to pro-poor forest management regimes.

There are several promising approaches that can be used to focus attention on forest commodities,

including, for example, the "value-chain" and "actor-network" approach. These kinds of approaches make our analyses more integrated, multiscale, and holistic, and give focus to more than local livelihoods. With such approaches, we begin to examine the multiple sectors or industries, the business networks, and the multiple actors centred around particular forest commodities. This gets us into analyses, for example, of social capital that go well beyond the social capital at a local community level.

The central role of forests in rural livelihoods, especially for the poor, demands that successful macro-level strategies to alleviate poverty in the developing world must identify concrete pathways through which the full potential of forests in improving rural well-being can be captured. Although some promising forest-based options are available for improving the well-being of forest dependent communities, getting many people out of poverty in many areas will require approaches that go beyond the limited focus on either forests or natural resources or rural development. Research and development endeavours for poverty alleviation that aim to merely sustain local livelihoods are unlikely to achieve meaningful improvements in people's well-being. Rather, new approaches that emphasize integration of key sectors, from local to global scales, could produce better results. We call for a new brand of research that requires the reorganization of research, changed incentives for scientists, and the embrace of complexity.

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GLOBAL FORUM

6 An Integrated Approach to Forest Ecosystem Services

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Abstract: Forest ecosystem services (FES) are fundamental for the Earth's life support systems. This chapter discusses the different services provided by forest ecosystems and the effects that land use and forest management practices have on their provision. It also discusses the role of markets in providing an enabling environment for a sustainable and equitable provision of FES, and describes a standardized approach for designing effective PES (Payment for Environmental Services) that takes into consideration the biophysical, demand (beneficiaries) and supply (providers) components, as well as institutional requirements of a PES scheme. The chapter assesses some potential limitations and challenges in the use of market mechanisms in general, and PES schemes in particular, for sustaining the provision of forest ecosystem services, such as difficulties to demonstrate that services are actually being provided, lack of an effective demand for the services or restrictions from the supply side, as well as other limitations related to institutional capacity and scale. The main challenge is probably in establishing long term, sustainable financing mechanisms that effectively internalize environmental services in the appropriate institutional frameworks. To overcome these challenges, research and management need to take into consideration larger temporal and spatial scales, as well as integrate the different components in the landscape and in the policy and decision-making processes.

Keywords: Forest ecosystem services; sustainable forest management; forest functions; environmental services; market-based instruments; payment for environmental services (PES); standardized methodology for PES design; limitations of PES approach.

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6.1 Introduction

Forest ecosystems, both natural and those established by afforestation and reforestation, are among the most important providers of environmental services that are fundamental for the Earth's life support systems. Services include the maintenance of good air quality and a favorable climate, the protection of hydrological functions and provision of good quality water for consumption, generation and maintenance of soils and their fertility, the protection of biological diversity, pollination of economically important crops, biological control of agricultural pests, provision of timber, a wide range of non-timber forest products, genetic resources used in crop breeding programs, and the numerous other social, cultural, spiritual, aesthetic, recreational, and educational benefits that forests provide. (Daily et al. 1997; de Groot et al. 2002; Nasi et al. 2002).

Historically, the nature and value of these services have largely been ignored until their disruption or loss has highlighted their importance (Daily et al. 1997). Based on available scientific evidence, it is clear that humanity is highly dependent on the flow of forest ecosystem services, yet this flow is dependent on the way in which ecosystems are affected by human activities. Forest ecosystem services are above all affected by forest removal and degradation. While economic forces have been given as one of the major drivers behind such loss (Geist and Lambin 2002), forest management for timber production as an income and employment generating activity has not been able to slow the rate of this loss (Niesten and Rice 2004), except for cases where several enabling conditions are met (Louman and Stoian 2002). In this chapter therefore we propose that the sustainable

management of forest ecosystems should incorporate the payment for ecosystem services approach, since one advantage of this approach is that it focuses on managing natural assets for the value they provide to humans, rather than on the problems that result from inappropriate natural resource management. At the same time, it broadens economic options and pays for goods and services that provide benefits without necessarily altering the ecosystem's potential to generate them. The focus on the value of services, rather than on control, is in itself a new paradigm that has great potential for shaping sustainable forestry in many parts of the world.

Ecosystem services are the products of ecosystem attributes and functions that benefit humanity; in this respect, functions only become services to the extent that humans acknowledge them within their social systems of value generation. Ecosystems are dynamic complexes of plant, animal, and micro-organism communities and their non-living environment, interacting as a functional unit; humans are an integral part of ecosystems (Nasi et al. 2002). Human activities having significant impacts on the structure and function of natural systems have become so extensive, particularly during the last century, that all ecosystems on the planet have been altered to some extent. These alterations range from local changes in species population caused by harvesting and habitat destruction, to global changes in atmospheric chemistry and climate resulting from industrial emissions (Costanza and Farber 2002). According to Daily et al. (1997), the most serious human impact on ecosystems is the irreversible loss of native biodiversity, which exceeds the rate of evolution of new species by a factor of 10 000. The annual loss of forest at the global level has been estimated at 0.2%; this includes over 9 million hectares of tropical forests lost each year (FAO 2001). These alterations can significantly affect human welfare now and in the future (Daily et al. 1997; Costanza and Farber 2002; Nasi et al. 2002).

A major goal of human interaction with natural ecosystems is the support of human welfare, including the sustainability of such welfare across generations and its distributional fairness (Costanza and Farber 2002). This is the overarching goal of SFM. One challenge that has to be addressed in SFM is that, unlike forest products, most forest ecosystem services are not paid for. This means that too often, those who own, control or manage forest resources where those services are generated do not capture the economic benefits that result from those services, thus reducing incentives to conserve these ecosystems, particularly the natural ones (Nasi et al. 2002; Niesten and Rice 2004). Some of the challenges in implementing schemes for payment for ecosystem services include identification and quantification of the different services that the forest ecosystems provide; establishment of sustainable financing mechanisms; design and implementation of payment systems that provide adequate incentives to land managers; development and adaptation of institutional frameworks that suit local circumstances; and, finally, ensuring equitable distribution of the costs and benefits among stakeholders (Pagiola et al. 2002).

Market mechanisms are said to balance distribution of costs and benefits according to the needs of producers and consumers. However the market, without intervention, is unable to capture and value ecosystem services; hence there are no financial incentives for forest managers and decision-makers to take them into account to achieve sustainable forest management and sustainable development. Therefore, there is a need for innovation in existing market systems in order to be able to conserve ecosystem services.

The use of market instruments as a means of incorporating the economic value of forest ecosystem services into the financial decision-making process of producers and consumers is a recent tool to resolve longstanding market failures that have had undesirable economic outcomes (Rojas and Aylward 2003). There are several countries where payments for ecosystem services are being implemented. In Costa Rica, for example, a nationwide system has been implemented since 1996, based on recognition by the Forest Law of four services provided by different forest ecosystems in private lands (Campos et al. 2001). In North America, New York City is restoring the natural water purification services of the Catskills watershed (Daily 1999). In many countries different approaches are being developed and tested, for example in Brazil see Box 6.1.

If markets are ultimately to produce welfare improvements, they need to be designed to provide the correct incentives. This in turn requires clear understanding of the relationship between land-use alterations and the ecosystem services provided (Landell-Mills and Porras 2002), as well as sound knowledge of human and ecosystem interactions (Rojas and Aylward 2003). In this chapter we stress the need for further research on the characterization (biophysical and economic) of ecosystem services, and development of the most suitable institutions and policies for implementing payment systems.

Both research and management of ecosystem services will demand integrated approaches that take into consideration larger temporal and spatial scales, as well as the different components in the landscape (actors, land uses, sectors and disciplines) and policy and decision-making processes (Sayer and Campbell 2003).

In this chapter, we will discuss the most relevant issues in an integrated approach to the new paradigm of forest ecosystem services. The chapter is divided into six sections (including this Introduction). In Section 6.2, we briefly discuss the different services provided by forest ecosystems. Section 6.3 discusses the role of markets in providing an adequate environment for a more sustainable and equitable provision of forest ecosystem services. In

BOX 6.1 Selling Carbon Sequestration in Brazil

Ina T. Porras

The Ilha do Bananal/Ecológica Initiative

The Brazilian NGO Instituto Ecológica implements, without mediation, two projects of predominantly developmental character. The main objective is to generate experience with carbon projects that may link the needs of the local communities to eventual carbon credits and social responsibility image of transnational companies. The Carbon Sequestration Project of Bananal Island is located in the Brazilian Amazon. It comprises Bananal Island itself (approximately 2 100 000 ha) and its surroundings to the north and east of the island and part of the APAC – Environmental Protection Area of Cantão.

The project was initially prepared as an international tender organized by Natural Resources International on behalf of the AES Barry Foundation. The tender specified that AES Barry, a gas energy facility, was seeking a project to offset 6 million t C, the estimated amount of emissions throughout the company's expected lifetime, and the focus of the project was to be the social component. However, AES Barry foundation was not able to honor the initial agreement of about USD 1 189 500 (£ 650 000), of which only about USD 183 000 (£ 100 000) were disbursed. Additional funding had to be obtained from the Natura Foundation, the municipality of Bozzano in Italy, the World Bank Millennium LBA program, and an environmental compensation for the construction of the airport at Palmas, the state capital.

The Bananal Project aims to develop and implement an innovative, equitable and sustainable system to offset greenhouse gas emission, through the preservation of existing forests, reforestation, regeneration and implantation of agroforestry systems, development of methodologies for carbon monitoring, and an important social component through environmental education and generation of alternative sources of income. The project worked with two indigenous villages with the objective of introducing beekeeping and indigenous ecotourism. Social effects are difficult to measure at this early stage; however, one important aspect is their effort to involve local communities in discussion and participation in project activities. The main impacts are summarized in the following table:

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May, P., Boyd, E., Veiga, F. and Chang, M. 2004. Local sustainable development effects of forest carbon projects in Brazil and Bolivia. A view from the field. Environmental Economics Program. International Institute for Environment and Development (IIED), London. 115 p.

Table A. Impacts of the Bananal Project in Brazil (May et al. 2004)

Sustainability and Impact levels	Impact description	
	Positive Effects	**Limitations**
ENVIRONMENTAL		
Global		¤ Not effective in carbon sequestration, only 0.8% of the proposed amount
National/regional	¤ Use of market instruments to support federal and state protected areas; ¤ Avoided deforestation in region of high deforestation rate.	¤ Lack of more robust institutionalization of partnership with government environmental agencies
Regional/local	¤ Development of research in ecotonal region for environment conservation.	
Local	¤ Contribution to environmental awareness.	
SOCIAL		
National	¤ Leveling of research through networking; ¤ Contribution to generation of scientific information on local ecosystem; ¤ Introduction of "sustainable livelihood" approach in social assessment.	
Regional	¤ Provision of support by the Canguçu research center to other researchers.	
Local	¤ Financial support to community income generation micro projects; ¤ Establishment of 4 nurseries with 5 staff; ¤ Distribution of seedlings to community; ¤ Support of establishment of agroforestry; ¤ Capacity building and environmental education for school teachers and community in general; ¤ Assistance to indigenous groups in beekeeping and ecotourism;	¤ No registry of distribution and follow up; ¤ Yet to start in the 2002/2003 rainy season; ¤ Activity suspended due to interruption of funding.
ECONOMIC		
Macroeconomic National/Regional	¤ Carbon projects as alternatives to degrading agricultural systems in the region;	
Macroeconomic Regional/local	¤ Project contributes to attracting other carbon investments in the region; ¤ Job creation during building of the research center.	¤ Not significant employment generation ; in the research center (4 staff) ¤ Temporary employment during building period;
Microeconomic Enterprise	¤ Social responsibility image to AES Barry and Natura.	¤ Insolvency of investor AES Barry interrupted funding

Section 6.4, we propose an approach for designing payment schemes for ecosystem services that considers beneficiaries and providers as well as institutional requirements. Section 6.5 assesses some potential limitations for the use of market mechanisms in sustaining the provision of ecosystem services, such as difficulty in demonstrating that services are actually being provided, lack of an effective demand for the services or restrictions from the supply side, and other limitations regarding institutional capacity and scale. Case studies in Boxes 6.1 to 6.3 describe examples of payment schemes from different regions of the world and the main lessons learned.

6.2 Forest Ecosystems' Goods and Services

Definition of Forest Goods and Services

Forests are valuable for much more than the goods they produce, such as timber, latex, fruits, medicinal plants and other non-timber products, and game animals that are important for food security in many parts of the world. The existence of forests, their components, and their interactions and functions, also influence water quality, climate, soils, effects of natural phenomena like strong winds and heavy rainfall, nutrient cycling, waste decomposition, esthetic beauty, and cultural and religious values. These services have been defined as "the range of conditions and processes of the (forest) ecosystems and their components that help sustain and fulfill human life" (adapted from Daily et al. 1997), while Nasi et al. (2002) provide a more utilitarian definition: "the outcome of ecosystem functions that benefit human beings".

Although at least some of these services have been discussed for several decades, only recently has a more systematic approach to their valuation and characterization been attempted, linking ecosystem functions to ecosystem goods and services (de Groot et al. 2002; Nasi et al. 2002). The functions have been defined as "the capacity of natural processes and components to provide goods and services that satisfy human needs, directly or indirectly" (de Groot 1992, cited in de Groot et al. 2002). Thus, de Groot et al. (2002) recognize four groups of functions: regulating functions that maintain essential ecological processes and life support systems; habitat functions that provide a suitable living space for wild plant and animal species; production functions that provide goods, such as timber and non-timber products; and information functions that provide opportunities for cognitive development. The regulating and habitat functions are essential for the maintenance of ecosystems, and without them the other two functions would not exist. For example pollination, a regulating function, does not directly benefit people, but it provides the service of pollination of fruit trees (for example by insects and bats), without which fruit production would not take place.

These four groups, outlined in Annex 1, bring together at least 15 functions, each of which may provide one or more goods and services. At the same time, some goods and services may require more than one function for their maintenance or provision. A continuous supply of timber, for example, will depend directly on production functions, which in itself will depend on habitat functions (a space for the timber species to live) and regulating functions (e.g. climate regulation, pollination, seed dispersal). While providing timber as a good, maintenance of these ecosystem functions will also contribute to the provision of services, such as maintenance of both a favorable climate and suitable living space for other plants and animals (thereby maintaining biological diversity).

The same grouping can also be used for the services provided by ecosystems. Thus, regulating functions lead to regulating services, and habitat functions to the maintenance of biological diversity for current and future provision of other services and goods. Production functions lead to tangible goods, while the information functions lead to reflection, inspiration, knowledge, recreation, and the maintenance of social, cultural, and spiritual traditions and values associated with forests. The most discussed and more generally appreciated services are the regulation of the carbon, nutrient and water cycles (regulating), maintenance of existing and restoration of degraded ecosystems (habitat), scenic beauty (information) and the provision of goods (production).

It should be kept in mind that while ecosystems functions may exist everywhere, they do not necessarily result in the provision of goods and services of the same quality or quantity at every location. Thus, regulation of the water cycle is a function of all forest ecosystems, but only becomes a service if its results are directly felt by people. In many mountainous areas forests may contribute to the provision of drinking water and reduce the risks of flooding. While in many remote areas of the Amazon basin this function is important, it does not provide direct services if there are no people to benefit from them. Similarly, regulation of the carbon cycle is a function of all forests, but the service of maintaining a favorable climate through carbon sequestration and storage may be better provided by forests that show rapid biomass accumulation and permit long term storage, such as araucaria (*Araucaria* sp.) and eucalypt (*Eucalyptus* spp.) forests in Australia, and teak (*Tectona grandis*) plantations in Indonesia or Costa Rica, which may produce timber volumes of up to 20 m^3/ha/year for periods of 20–40 years. Following harvest, this timber can be used in buildings for a long period of time.

Maintenance of biological diversity, recognized as an ecosystem service by the government of Costa Rica, and one of the benefits for which international

organizations are prepared to pay (Rodriquez 2002), in itself is not a service except under conditions where forest biological diversity provides timber and non-timber goods and services, such as pollination and pest control, in adjacent agricultural areas. Rather, it is often a *condition* of forests that may provide new products, new knowledge, and future opportunities to adapt to diseases, pests and changing environmental conditions. As such, it is closely related to the habitat services. In that respect, the maintenance of biological diversity could also be considered as a "supporting service". While greater biodiversity may reduce future economic and ecological risks, it is not a prerequisite for increasing the value of the forest. Indeed, less diverse forests have proven to have a greater current economic value than more diverse forests: the natural pine forests of Central America and Mexico, for example, have greater harvestable timber volumes than the highly diverse neotropical rainforest. They are, however, more susceptible to pests, diseases and invasive species, as the recent outbreaks of a bark beetle (*Dendroctonus frontalis*, Coleoptera: Scolytidae) in Belize, Honduras and Nicaragua have shown.

Services from Other Relevant Ecosystems

In the above paragraphs, functions and services of forest ecosystems were discussed. A number of these functions and services, however, can also be found in other ecosystems, although to a different degree. Wetlands, for example, are known to play an important role in preventing flooding, since they serve as temporary storage areas for large masses of water. They also can be major sources of food and biological diversity, while algae and woody vegetation contribute to the fixation and storage of carbon. In many countries, wetlands have been modified to become major food producing areas, showing the potential contribution of wetlands to improving and maintaining soil productivity. Wetlands also often function as migratory habitats for bird and fish species, so that their loss may have strong negative effects on other populations and ecosystems. At the same time, they often are located in the lower parts of watersheds, and any removal of forest vegetation resulting in soil loss and contamination or changes in peak and base flows will affect the wetlands.

Coral reefs are known for their potential to reduce the force with which waves arrive on the shore, thus reducing the impact that storms may have over the land in terms of erosion and flooding. They are also a rich food source, and provide very specific habitats for a large number of fish and other sea animals. In addition, coral reefs are an attractive tourist destination.

Agricultural systems may increasingly contribute to the provision of ecosystem services. Incorporation of trees as live fences or as shade contributes to the fixation and storage of carbon, as well as providing habitats and corridors for many insect, bird and small mammal species. Combining trees with perennial crops, soil conservation measures and a very restricted use of chemicals, agricultural systems may also contribute to maintaining water quality for consumption use and reduce the risks of flooding. Trees, shrubs and non-commercial herbaceous plants in agricultural systems may also contribute to pollination and the reduction of crop damage due to pests and diseases. On the other hand, they may also be the cause of some damage, and it is important to know which plants and animals can be tolerated and which not.

Much of what has been discussed in the previous paragraphs can also be relevant for other types of ecosystems, and the approaches for their management and valuation described in this chapter can at least partially be applied to these other ecosystems.

6.3 Market Efficiency and Market Failure

From an economic perspective, most forest ecosystem services are regarded as positive externalities. In general, externalities are defined as unintended side-effects of the consumption or production decisions of an economic agent. These "side-effects" will in turn affect the consumption or production decisions of other agents. For example, a farmer facing a decision to convert a forest land in order to use it for agriculture will base his or her decision on the potential profitability of the different alternatives. But in his or her decision, the farmer might not take into account that, by converting the forest, he or she is also putting an end to or reducing the flow of services derived from the forest ecosystem. Indeed, it is easy to imagine that, as a side-effect of the owner's decision, other agents will be affected and hence forced to consume or produce differently. If the farm is located in a small watershed used as a source of potable water, the increased run-off and erosion rates from the agricultural activities might force the water company to incur additional costs to restore drinking water quality, for example. Additionally, if the forest was regarded as having high biodiversity conservation value, the farmer's decision to clear the forest might negatively affect important ecological functions and services at the local or global levels and hence hamper efforts to protect this resource elsewhere. Alternatively, if the farmer decides to keep the natural forest cover, he or she will be generating a flow of positive externalities in addition to the private benefits that accrue to him or her as owner of the land.

In essence, the presence of external effects – either positive or negative – introduces a gap between the benefits expected by the private decision-maker and the benefits expected by society as a whole. Con-

sidering the example described above, although the landowner's decision to convert the forest might be correct from a private perspective, it might be inefficient from a social perspective, once the total costs and benefits from all the affected agents are factored into the equation.

Somewhat more complicated is the analysis of the farmer's decision to keep the natural forest cover. Since forest owners consider only the private flow of benefits enjoyed by maintaining the natural forest cover in their land, disregarding the other social benefits that follow (water and biodiversity protection, for example), then these forest environmental services would still be undersupplied compared to the optimal benchmark case in which decisions follow a social welfare maximization criteria (Costanza and Farber 2002). An obvious solution to the problem outlined above is to sell those forest environmental services, just as any forest owner might sell goods like timber, or non-timber forest products like fruits.

The problem with this solution lies in the nature of the good or service to be sold. In the case of timber, the private nature of the good (i.e. all benefits from the good are enjoyed solely by the owner) allows for markets to be established and to work properly in reaching an equilibrium price that balances the needs of consumers and producers alike (there are exceptions to this, for example in cases where illegal logging takes place).

Unfortunately, many forest environmental services are not private goods, but rather can be categorized as public in nature. One of the main characteristics of public goods is non-excludability, i.e. it is impossible or prohibitively expensive to exclude somebody from benefiting from them. In such a circumstance, it is unlikely that somebody will pay for a good or service if it can be enjoyed anyway, with or without payment. This is then a typical situation in which free functioning markets fail to work properly or even exist, due to potential free riding. In summary, although forest ecosystem services are produced in land that is privately owned, they are *de facto* free to everybody, i.e. property rights to these services are not well established.

Any solution to the problem outlined above must then go first to a process of establishing property rights to goods and/or services previously regarded as free. In cases where "few" agents are involved, i.e. where free riding is unlikely and transaction costs are low, one could in principle argue in favor of a solution along the lines above, in which suppliers and beneficiaries of environmental services effectively negotiate a joint solution. If property rights to the services are assigned to the forest owner, he or she could then argue for compensation for providing those services. If property rights initially belong to the beneficiaries of the services, then they could impose restrictions on the use of the land and relax them in exchange for compensation. This way of approaching the problem of externalities is known as a Coasian solution (Coase 1960). Alternatively, if property rights to the environmental services are assigned to a community, or more generally to an organized collectivity encompassing providers and beneficiaries alike, one could in principle consider a common property approach to solving the problem of externalities – provision of environmental services – in which the optimal private decision is aligned with the optimal social solution through a set of rules and a suitable redistribution of duties and rights (Ostrom 2002). This is a very promising option for small rural communities regarding water services.

In many cases, though, the number of affected agents and high transaction costs, among other factors, will make it impossible to reach a solution via the mechanisms proposed above, forcing the government to intervene. Historically this intervention has taken the form of direct regulation. There are two broad forms of direct regulation. The first one involves direct provision of environmental services regarded as important, via the expropriation of land and the establishment of natural protected areas, among other tools. Following our previous discussion, the government is then basically buying the property rights to the environmental services by acquiring the natural ecosystems that provide those services. Notably this is a policy that can and has achieved good results, provided that funds are available to the government to purchase the land and effectively manage those protected areas.

The second type of direct regulation can basically be described as setting restrictions on the decision making process of the forest owner. Prohibitions or legal limits on how to use the land are probably the most typical examples. In Costa Rica, for instance, forest conversion has been prohibited by law since 1996, and land owners are not allowed to harvest trees along water courses or in steep slopes inside their property, in an effort to reduce vulnerability and erosion (Campos et al. 2001). This example serves well to illustrate the pros and cons of this type of regulation. On the one hand, prohibitions and legal limits to the use of land might very well achieve important results in terms of preserving or even increasing the flow of ecosystem services. They are simple to design and comparatively easy to monitor, and hence have tended to be the preferred tool for policy-makers in the environmental arena. However, particularly in developing countries, monitoring efforts have been hampered by lack of financial and technical resources. Moreover, these sorts of restrictions tend to be costly to implement from the perspective of the forest owner. Not only is the owner obliged to follow certain restrictions in the use of his or her land, but he is also required to assume all the costs related to complying with the restrictions, including not only the additional costs (mitigation measures and infrastructure, for example), but also notably the forgone profits. In essence, the landowner is subsidizing the provision of environmental services for the benefit of the whole society.

In light of the shortcomings of direct regulation

and declining government budgets, there has been in recent years an increasing interest in and use of what economists call market-based instruments (O'Connor 1999; Serôa da Motta et al. 1999). Instead of imposing restrictions on the decision making process, as in the case of direct regulation, market-based instruments hope to affect decisions by introducing new elements into the equation. Notably, the intention is to tilt the balance in favor of an optimal provision of environmental goods and services by affecting the relative profitability of the different options available to the agents. Producers and consumers are left free to make their own decisions, while taking into consideration the signals sent by the government regarding the value of different environmental resources. The most traditional market based instrument is a tax on emissions (Pigou 1932), by which firms are left free to pollute as much as they want, provided that they pay a tax on each unit of pollutant emission. In particular, one way to adjust to the regulation is to develop new, cleaner methods of production (Porras 2001; Pagiola et al. 2002).

A mechanism of payment for environmental services falls into the category of market-based instruments in the sense that it attempts to tilt the decision of the landowner towards practices that maintain or enhance the flow of environmental services, and away from unsustainable activities. As mentioned above, since all the costs of sustainable practices are borne by the landowner but only part of the benefits are captured privately – social benefits are basically public – land owners are justifiably adopting too few sustainable practices compared to the social optimum. As long as these social environmental services are provided for free, owners will not give them much attention when making land-use decisions (Nasi et al. 2002; Pagiola et al. 2002; Ortiz 2003).

Returning to the initial concept of externalities, the provision of environmental services will no longer be an uncompensated, positive side-effect of the landowner's decision to maintain forest cover on his or her land, but rather will be a conscious effort to increase profits. If the payment is correctly designed and implemented, one can expect an optimal provision of environmental services for society. Additionally, since the beneficiaries of environmental services will be required to pay to finance the provision of these services, they will also stop considering these resources as free, and will therefore hopefully make better use of the available resources.

A final issue remains to be discussed. In a previous paragraph we mentioned that markets without intervention will fail to achieve an optimal provision of environmental services due to the public nature of these services and the free riding problem. A payment for environmental services mechanism requires the creation of a market for environmental services in which providers and beneficiaries of those services interact in pursuit of their interest, but it can by no means be a non-intervened market. A third party, for example an NGO, the government, an international organization, or a water company, to name a few, needs to intervene to bring the beneficiaries to the table and make sure that they do not free ride. The exceptions to this statement are cases in which a Coasian solution (described above) is possible. In those cases, rather than establishing a market for environmental services, the parties get involved in direct negotiations in order to define the suitable payment for the services exchanged.

6.4 Designing Payment Schemes for Environmental Services

As mentioned above, an institutionalized market for environmental services is a powerful tool for achieving a better use of environmental resources and the services they provide. Such markets do not appear spontaneously; rather, they require the careful intervention of a regulatory body. This regulatory body might take different forms depending on the type or

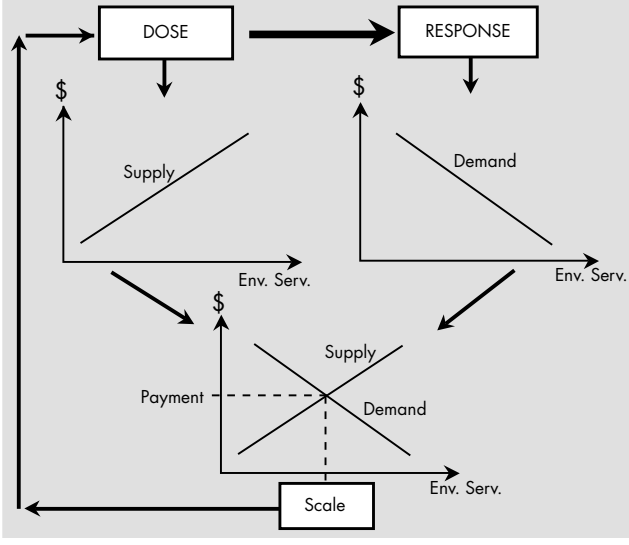

Figure 1. The required "dose" of activities that generate environmental services, i.e. the "response" and their corresponding costs (supply) are balanced against the amount of environmental services demanded to establish market equilibrium.

BOX 6.2 SELLING WATERSHED SERVICES IN PIMAMPIRO, ECUADOR

Ina T. Porras

Water problems have been common in Pimampiro, a small municipality in the Andean region of Ecuador. Until 2001, domestic water users received the water service two days a week for only two hours per day; and the quality of the distributed water was lacking. In 2001 the Municipality, with support from FAO and the Inter-American Foundation, embarked on a series of projects oriented towards improving infrastructure and capacity of delivery.

The main water source for the town of Pimampiro is the River Palaurco, which is used for irrigation and for drinking water, and has its headwaters in the Páramos de Angococha. Without proper hydrological studies to back it up, common perception in the area was that water flows could be ensured not only by improving infrastructure (a new treatment plant and tunnel were introduced in 2001, ensuring 24h service for the town), but also by protecting the forests and páramo located in the headwaters, as it was believed that forests ensure water flows, particularly during the dry season, and water quality by preventing erosion (personal communication, representatives of CEDERENA). A new system of Payments for Watershed Services was introduced in 2001; in which downstream water users pay upstream landowners to protect existing forests and páramos.

Description of the Scheme

The main water uses in the area are irrigation and household use. Nevertheless, the scheme only includes 1350 families residing in the Pimampiro City. The town consumes 12 l/s, and tariffs are USD 0.80 for 17 cubic meters (Luis Paspuel, September 2002, in Ecodecisión 2002) and USD 1.80 for industrial or commercial uses. While water is heavily subsidized by the Municipality, the majority of people in the city agreed that it is important to protect the watershed.

The "sellers" of the environmental service of watershed protection are organized under the Nueva América Association, that groups 24 individual property owners (although land was initially bought as an unit) comprising a total of 638 hectares, of which 62% is covered by forest, 26% by páramo, and 12% is dedicated to agriculture and livestock. The forest is located in the buffer zone of the Ecological Reserve Cayambe Coca, and approximately half of it is still primary forest. Even though access to the area is difficult, it faces strong deforestation pressure.

Property sizes range greatly, from 12 to 120 hectares with an average of 43. Most families are mestizos, with an average of six children. The main economic activities include agriculture and livestock, complemented with wood extraction, and harvesting crops in lowlands, that pays an average of USD 2–3 per day. Slopes are very steep, and slash and burn practices are a common denominator for agricultural activities.

The initiative springs from an ongoing community forestry management project organized by DFC. It is funded by FAO, the Inter-American Foundation (IAF) with USD 15 000 seed capital, and with the 20% fee increase on the water bills collected by the Municipality of Pimampiro. CEDERENA, an NGO that evolved from DFC and the Environment and Tourism Unit (UMAT) of the Municipality of Pimampiro acts as an intermediary (see Figure A).

Payments are between USD 0.5 and USD 1 per hectare depending on land use (see Table A). The final figures are not based on economic analysis of the value of the environmental service, but are the result of a political negotiation and the Municipality's capacity to pay. The 20% increase in water

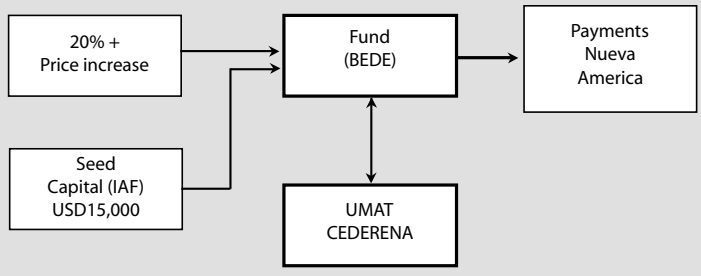

Figure A. Institutional arrangements in Pimampiro (Echavarría 2004)

types of environmental services regarded as relevant (e.g. case studies in Boxes 6.2 and 6.3 from Ecuador and Costa Rica).

Irrespective of the type of regulatory body involved in the creation of markets for environmental services, an integrated approach is required if these markets are to function properly. This section is an attempt to outline a standardized methodology for the creation of markets for environmental services. As such, it draws on many documented experiences in different countries (among others, Landell-Mills and Porras 2002; Pagiola et al. 2002; Rojas and Aylward 2003; FAO 2004) and some work in progress by the authors (CATIE-GEF 2002; CATIE-Focuencas 2004). Although we attempt to present a general approach, the proposed methodology is clearly more suitable for regional or local initiatives, rather than for establishing a national program for environmental services.

The proposed methodology has four basic components, namely: (i) a biophysical analysis of the provision of environmental services; (ii) identification and measurement of an effective demand for environmental services on behalf of the potential beneficiaries; (iii) measurement of the costs of providing environmental services; and (iv) construction of the appropriate institutional setting for the selected scale of intervention. It is important to note that the proposed methodology will utilize a cyclical approach in which the size of the required "dose" of activities that generate environmental services and their corresponding costs are balanced against the

fees produces roughly USD 500/month, and this defines the maximum amount of money that can be paid. The total money available is then divided according to land uses within the area under Nueva América Association.

Table A. Payment Categories in Pimampiro (USD/month/ha)

Payment Categories	Payment
Páramo without human intervention	1.00
Intervened *Páramo*	0.50
Primary Forest	1.00
Intervened Primary Forest	0.50
Secondary Old Forest	0.75
Secondary Young Forest	0.50
Agriculture and Livestock	0
Degraded Land	0

Sustainability Impacts of the Pimampiro Project

Payments begun in January 2001 and so far approximately 20 families have benefited. While it is difficult to assess socio-economic impacts of the project, a recent survey by Ecodecisión and Ecociencia show the following:

- Median value of payments is USD 21.1 per month, which is slightly less than half the family's income. Most participants indicate that the payment is the main motivation to conserve the forest and paramos.
- While it is very difficult to completely verify it, most payments seem to be used to fulfill short-term family budget requirements. For example, payments were used mostly for education at the beginning of the school year.
- On the demand side, the majority of those interviewed are willing to pay for water provision and maintenance of forest cover.
- Despite the good impacts, the Municipality also faces problems related to its limited capacity to make the payments, which are made after a form of "blackmail" from landowners who are not receiving payments ("if you don't pay me, I will deforest"), despite the fact that deforestation is illegal in Ecuador.
- Transaction costs are rather high, and so far have been subsidized by the Municipality and CEDERENA, but the initiative is trying to become self-sufficient and cover costs of technical assistance and monitoring. The strategy is to try to include other water uses, such as irrigation, to expand the pool of demand and the capacity to pay.
- The environmental impacts of the initiative are very difficult to ascertain, as the project began with rather nebulous hydrological information and no measures were obtained before or during the current life of the project. At a more subjective level, existing forest and paramo are being conserved, and land practices are improving in the area.

References

Echavarría, M., Vogel, J., Albán, M. and Meneses, F. 2004. The Impacts of Payments for Watershed services in Ecuador: Emerging Lessons from Pimampiro and Cuenca. Environmental Economics Program, IIED, London. 61 p.

Ecodecisión 2002. Evaluación de Impacto de los Servicios Ambientales en las Cuencas en Ecuador. IIED, London. 55 p

amount of environmental services demanded (desired response, Figure 1). The regulatory body should provide the necessary institutional arrangements for a "market equilibrium" to be established. This market equilibrium will in turn provide information about the amount of environmental services to be traded and the payment required to provide those services. The logic of the proposed methodology is summed up in Figure 1.

Biophysical Component

The cornerstone of a system of payment for environmental services is a dose-response function relating land use and management with the provision of environmental services. The importance of establishing a clear cause-effect relationship is twofold. On the one hand, the type of response, measured in types and quantity of environmental services is a fundamental piece of information in order to determine the beneficiaries of these services and how much are they willing to pay to enjoy their benefits. On the other hand, the activities involved in the "dose" will determine the minimum required payment (see Figure 1). The parallel with any other productive activity is obvious. The manager of a shoe factory needs to know what he or she will produce, boots or sneakers for example (i.e. the response), and what to do to produce it (the dose of technology, inputs, etc.). In that way, demand and cost functions can be established.

The fact that we are dealing with complex ecosystem functions constitutes the first point of departure from the simple example above. As mentioned in Section 6.2, ecosystems are inherently complicated, multi-product "factories", and our understanding of how each particular ecosystem works is very limited. In the ideal case, we would like to reach a level of understanding where we can accurately predict that if A, B, and C are done to manage an ecosystem, then the provision of a given environmental service will increase by 15%, for example. This is the level of precision required by any shoe factory manager, but we are unfortunately far from that point when it comes to understanding nature. Furthermore, given that ecosystems are highly dynamic, changing systems characterized by discrete changes from one status

to another, and a high exposure to unexpected random events, it is very likely that we will never have the amount of information and analytical capacity to establish such a clear dose-response relationship (Limburg et al. 2002).

Consequently, any effort to establish a scheme of payments for environmental services must accept this uncertainty and go beyond available scientific information, and has to make the necessary provisions in those cases where uncertainties are large. At the very least, we need to make sure that the predicted dose-response reaction is in the correct direction, and we need to inform the potential beneficiaries about the risks and time frame involved in their payment. For example, if we intend to increase the availability of water in a reservoir, at the very least we must make sure that our proposed "dose" does not act against our stated purpose, and we must avoid making promises that are not backed by scientific evidence.

The second point of departure with the shoe factory example above has to do with the importance of the provided good. The risks involved in failing to provide crucial environmental services like biodiversity protection, regulation of climate or provision of drinking water, to name just a few, can be very great. Hence, one should aim at erring on the side of caution and encourage the implementation of practices that, given our imperfect knowledge and experience, will most likely contribute to increasing the provision of crucial environmental services even if the dose-response function is not clearly established. This precautionary approach, although perfectly justified on the side of the beneficiaries, should not serve the wrong purpose of reducing efforts spent in obtaining the information needed to improve our understanding of the cause-effect relationships in ecosystem management.

Obviously, diverse environmental services require the establishment of their corresponding dose-response functions, and the complexities involved might be very different from one case to another. In some cases, the same dose can increase the provision of several environmental services. A few examples are provided below.

One of the potentially simpler cases is the global service of carbon sequestration. Natural ecosystems contribute to carbon sequestration either by active absorption in new vegetation or by avoiding emissions from existing vegetation. The "doses" in this case are thus simple: to increase the vegetation cover with species capable of sequestering carbon at high rates, and to avoid deforestation and land use changes that result in increased carbon emissions. Although not a simple task, one could measure the carbon content in plant biomass and associated soils, thereby creating a relation between the dose and the response. Furthermore, since carbon dioxide is a perfectly mixed pollutant, we do not need to be concerned about the location of the carbon offsets (Bishop and Landell-Mills 2002).

The case of biodiversity is more complicated. Not only is there not enough information relating vegetative cover and biodiversity, but also the protection of biodiversity is a highly site-specific service and depends on the location of the plot within the landscape. Two equally-sized plots with the same vegetation might have dramatically different relevance with respect to biodiversity, depending on their location and the composition of the landscape surrounding them. Another layer of complexity is added by the difficulties in actually defining the appropriate unit of measurement for improvements in biodiversity, forcing decision-makers to use approximate, often too simplistic measures (a simple counting of the numbers of butterfly species, for example). Despite the above, there is clear evidence that agricultural landscapes that retain a high and diverse tree cover and that maintain landscape connectivity are more likely to sustain higher levels of biodiversity than those landscapes that have very dispersed and fragmented tree cover (Harvey et al. 2004). Linking this to a suitable prioritization of protection of areas based on, for example, connectivity and proximity to biodiversity-rich or highly threatened areas can justify making a payment to land owners in those areas, assuming an acceptable value of biodiversity can be established.

Finally, our last example is the provision of hydrological services. In the following sections we refer to hydrological services as if it were a single service instead of treating each of the hydrology related services separately. Note that, besides being site specific, these hydrological services might require different treatment depending on the target service. Although this service is certainly of the utmost importance, several unfounded myths prevail, particularly regarding the relation between forest cover and watershed protection (see also Kaimowitz 2001). Most scientific studies attempting to establish this relation have shown that it is highly site specific (soil, vegetation mix, alternative cover, and climate, among several others). Still, most documented cases of PES have followed what is perceived as common knowledge without attempting to gather more solid evidence regarding the true relationship between forest cover and water quality and availability. In an interesting exception to the previous claim, Aylward and Echeverría (2001) and Aylward et al. (1998) show that for an important multipurpose watershed in Costa Rica (Arenal watershed), conversion from pastures to forest might not only be economically unjustified due to losses in livestock income, but would also cause negative effects for the large hydropower plant. The benefits from reduced erosion and sedimentation are very small compared to the costs of reduced water due to increased infiltration and evapotranspiration. Although this might be a particular case, it still serves well to illustrate the importance of gathering appropriate site and purpose specific information for the watershed in which we plan to intervene, in order to define a truly effective approach to the provision of one or several of the hydrological services desired

(Kaimowitz 2001).

A somehow different picture arises from studies relating sustainable agricultural practices and hydrological environmental services (CATIE-GEF 2002; PASOLAC 2004). The correct use of agrochemicals and the adoption of farming technologies with a more permanent soil cover are two simple practices that can have an important effect on chemical runoff and erosion rates from agriculture, particularly for small catchment areas. Note that although the "dose" and the direction of the response are clearer for the case of sustainable agriculture, this does not imply that the exact quantity of environmental services is known. Furthermore, for large watersheds (larger than 1000 km^2) there is scientific agreement regarding the dominance of climate related factors (for example, amount of rain, frequency and variability of large events) over land use factors in determining water availability, erosion rates and water recharge (Tognetti 2000). This may be different over very large land masses (e.g. the Amazon basin), where forests are an important link in the water cycle, and their disappearance may be more important because of their influence on the climate in neighboring regions than because of any direct effects on local water courses.

In summary, although the available information is not enough to establish a clear dose-response function for most, if not all environmental services generated in complex ecosystems, every attempt has to be made to gather as much site specific scientific information as possible through research and monitoring, in order to increase the likelihood of delivering the services promised to those beneficiaries paying for them. Some qualitative information is provided on the effect of different land uses on the forest eco-system services in Annex 1. The more solid the information underpinning the scheme, the more likely the scheme will survive. Moreover, the regulatory agency has to carefully acknowledge the existing limitations underlying the PES scheme in order to avoid disenchantment of the participants (Rojas and Aylward 2003).

Given that we find enough justification to launch a system of PES, a related question has to do with the unit of measurement of those services. As mentioned above, many environmental services are notably difficult to measure in the first place, let alone predicting marginal increases in the provision of these services due to management intervention. This is certainly not a new issue for environmental policy-making. For example, if emissions of a pollutant are not observable, one of the standard solutions is to move backwards along the production process until we find a variable that is related to those emissions yet easy to monitor by the regulator (a particular input, for example).

A similar approach should be used in the case of environmental services. Our proposed solution to this problem is to use a system of indexes that should serve as proxies for the dose-response functions identified for each environmental service, and if several services are involved, one could construct a composite index (CATIE-GEF 2002). This index will use all the available scientific information to relate particular activities in a farm to a standardized scale, so that those activities that are expected to make a large contribution to the conservation of biodiversity will be rated higher on the biodiversity index than activities expected to contribute less. A similar approach will be used for other services. Once a baseline is established, payments could then be related to the index.

Demand Component

The second component of our proposed methodology is the identification and measurement of an effective demand for environmental services on behalf of the potential beneficiaries. After establishing an appropriate dose-response function, the existence of a measurable demand for the services to be provided is the second most important key to the success and to the sustainability of a PES scheme. Only after funds have been secured can we start to think about determining the scale, i.e. spatial (prioritization of areas) and temporal dimension, of our intervention so that the available funds are enough to pay the providers.

Two interlinked tasks need to be completed in order to establish the existence of a demand for one or several of the services provided by a managed ecosystem. Firstly, we need to establish the potential beneficiaries from a program to increase or sustain the provision of environmental services, and secondly we need to be able to measure how much they value those services. For both tasks, the approach used will inevitably be anthropocentric (Farber et al. 2002), since ultimately our intention is to gather funds to finance a given program. For example, the sustainable management of forest and agriculture in a watershed providing drinking water to a populous city will have a much larger economic value than a similar effort in an isolated watershed. For the first case, we could think of establishing an ambitious, large scale, PES scheme (e.g. Catskills watershed for New York City; Daily 1999), whereas for the isolated watershed other tools will have to be devised. Poverty of the potential beneficiaries of environmental services might lead to very low willingness to pay estimates, forcing us to reduce the spatial and temporal scale of the scheme and ultimately to look for other alternatives to a PES scheme. This pragmatic approach to economic valuation is justified by the fact that we are using valuation tools only as inputs into the design of a very particular policy instrument, a PES scheme, and are therefore not interested in obtaining total values or intrinsic values. Notably our estimates will always be below the true value of the resource in question. Although simple to digest for the case of hydrological services, this anthropo-

centric approach is harder to accept, for example, in the case of biodiversity. We may find ourselves claiming that a PES scheme cannot be based on the protection of biodiversity, no matter how much biodiversity is protected, simply because this service has little or no economic value. We are not thereby affirming that biodiversity has no value in general, we are simply saying that funds for a particular case cannot be raised based on the selling of services related to biodiversity protection.

A closer look at the motivations for demanding environmental services will show that such an anthropocentric approach might not be as restrictive as it seems at first glance. Obviously, the beneficiaries from different environmental services will most likely be different. The first obvious distinction is their location. Some ecosystems provide global environmental services whereas others are more regional or local in nature. Carbon sequestration and hydrological services are prime examples of the former; if we plan to sell carbon sequestration we need to look at the international community as potential beneficiaries, and particularly to Annex 1 countries under the Kyoto Protocol. Hydrological services, on the other hand, are site-specific and user-specific. If we plan to sell hydrological services in a watershed, we need to look on-site for the beneficiaries, and those beneficiaries might be different depending on the service provided. For example, a hydropower plant might be interested in quantity of water and reduced sedimentation, whereas consumers of drinking water might be interested in quality rather than quantity. For other environmental services, we might find that beneficiaries are both local and global, as is the case in biodiversity protection. A recent study showed that rainforest bees pollinating coffee account for a 7% increase in a coffee farm's income (Taylor et al. 2004). In addition, international NGOs acting as representatives of the global community of beneficiaries are able to raise large sums for the protection of biodiversity. These last beneficiaries might be willing to contribute to the protection of biodiversity for its intrinsic value alone.

Information plays an important role in determining who the beneficiaries are and how much they are willing to pay. In some cases, those affected by reductions in environmental services lack the necessary knowledge to realize that a beneficial change is possible provided they are willing to contribute to finance it. In such circumstances the regulator has to make an effort to inform the potential beneficiaries of the possible solutions and their costs, and of the potential risks of inaction. In addition, other potential benefits can be explained, for example a water consumer might be supportive of the idea that investing in forest protection and sustainable agriculture will not only provide hydrological benefits but also other environmental, social and aesthetic benefits. As mentioned above, ecosystems are complex and the provision of environmental services might be severely affected by irreversible changes in their functions after a given critical threshold of degradation or stress is surpassed. The economic value of a program to sustainably manage an ecosystem might change dramatically when we approach these critical thresholds (Farber et al. 2002; Limburg et al. 2002). On the other side, lack of information certainly can play a role, particularly in those cases where risks can be reduced through the implementation of a program to increase the provision of environmental services. In Costa Rica, several hydropower plants are investing heavily in watershed protection using a PES scheme, mostly following a precautionary principle given the lack of solid data. The risk of losing their large investment needs to be reduced by any reasonable means (Alpízar and Otárola 2003; Ortiz 2003).

Once the beneficiaries of the different environmental services are clearly identified, the next step is to measure their actual willingness to contribute to the provision of those environmental services. The use of economic valuation tools can provide the information necessary to determine the funds available for alternative programs or scales of a given program, and the maximum willingness to pay for different amounts of a given environmental service (Tognetti 2000; Alpízar and Otárola 2003; FAO 2004). This measurement in itself constitutes an estimation of the benefits achieved with a given program, and should therefore be considered the upper limit for any potential payment scheme. Still, as mentioned above, in most reasonable cases it constitutes a lower boundary for the true social value of the services provided.

Several methodologies are available to the regulatory agency in pursuit of demand information; the selection of the most suitable method should be guided by the information already obtainable, the type of environmental service at hand and the funds available to do research. The following table contains a list of the most frequently used methods and the context in which their use is recommended.

Irrespective of the method selected to estimate the demand for a given environmental service, particular attention has to be spent on making sure that the object of our effort is the marginal or the discrete change specifically associated with the planned intervention. A common mistake is, for example, to value all hydrological services obtained from a given watershed, instead of the planned improvement from a well-defined baseline.

Supply Component

The third component of the proposed methodology is the measurement of the costs of providing environmental services. Simply put, we need to determine the cost of the "dose" (see Figure 1). This information would then be referenced to demand information in order to determine how ambitious our intervention using a PES scheme should be. Once again, this component needs to start with the identification of

Table 1. The methods used in the valuation of environmental services

Type of methodology	Recommended use
Contingent Valuation Method –CVM (Mitchel and Carson 1989; Whittington 2002)	This is a survey based method in which the respondent faces a hypothetical situation describing a good or service and the particular setting in which that good or service is to be provided. The respondent is asked to state his willingness to pay (WTP). This method is widely used because it can deal with a broad range of situations, including those where no prior experience or information is available
Choice Experiments (Alpizar et al. 2003)	Although similar to the CVM, in this case respondents have to choose their preferred combination of attributes of a given program, including their WTP. This method is particularly useful to design an optimal project or intervention
Replacement or avoided costs method (Freeman 1993)	A decrease in the natural provision of environmental services might require the investment in new technology or additional inputs to compensate for the loss. The sum of all those expenditures is an approximation to the value of reinstalling the natural provision of environmental services. This method needs prior information.
Changes in productivity (Freeman 1993)	A decrease in the provision of environmental services might inevitably have an impact on the production capacity of an economic agent, thereby reducing profits. The reduction in profits is a measure of the damage caused by deteriorated environmental conditions or of the benefits to be attained if environmental conditions are improved. Again, this method requires prior information.

the actual and potential providers of environmental services. Secondly, we need to determine the costs associated with each management practice encouraged to increase the provision of those services. As mentioned in Section 6.3, the whole idea of a PES scheme is to alter the private land use decision of a producer in favor of sustainable practices. Hence, beyond identifying those practices (i.e. the dose-response function) we need to know how much the costs will be and how much to pay in order to achieve the desired switch away from unsustainable practices. Note that in some cases the lack of funds might not be the critical factor hindering adoption; in-kind payments, for example technical assistance, might go a long way in promoting sustainable practices.

Obviously the providers of environmental services will most likely change depending on the type of service we intend to obtain. As discussed above, the provision of hydrological services is site- and user-specific, and therefore requires an extremely careful selection and prioritization of areas in which to intervene. Farmers in priority areas should be characterized according to type and profitability of his or her productive activity, type of property rights (private, communal, insecure), family size, and land availability, among other sorts of information required to understand the decisions and motivations of the land owner, i.e. their livelihood strategies. Other site-specific environmental services like biodiversity and reduction of vulnerability to climatic events also require such information, the critical factor being the lack of substitution possibilities. Since the contribution of each farmer located in the priority areas is fundamental for the provision of the site-specific services, every effort has to be made to understand their decision-making process.

In all cases, though, we need to make sure that the proposed land use and management practices to be implemented in order to increase the provision of environmental services are clearly defined and understood by all participants involved. These practices should be realistic and suitable for the farms involved. Nobody can expect that farmers will adopt a technological package that makes no sense to them, or that is unacceptable given the particular circumstances of their farms. In this sense, a PES scheme might very well be complemented by technical assistance programs.

Once we identify the potential providers of a given environmental service, the next step is to estimate the actual supply curve for it. This requires the ability to measure in monetary terms the costs of marginally increasing "doses" that will in turn generate marginal increases in the supply of environmental services.

In order to quantify the costs associated with the provision of environmental services, the regulatory agency has to identify the impact that the required management practices have on the profitability of the farms. In most cases, a combination of economic valuation methods is needed in order to fully measure all the costs involved. The provision of environmental services might require changes in the technology of production and a combination of inputs that can ultimately result in changes in productivity. These changes, valued using market prices for inputs and final outputs, can give us a measure of the costs involved in supplying environmental services. For the analysis to be complete, we would need to add all additional investments necessary to provide environmental services and/or related to the new required technology. A different approach is needed if the pro-

BOX 6.3 PAYMENT FOR ENVIRONMENTAL SERVICES IN COSTA RICA

Bastiaan Louman and Ina T. Porras

In Costa Rica, timber production takes place in small private forests and plantations (both forest management and plantation establishment and management have received fiscal incentives since the 70s, mainly in the form of allowing property and rent tax deductions (Rodriquez 2002). In 1990 forest legislation was modified, adding a forest credit certificate (Certificado de Abono Forestal o CAF) to promote reforestation and again in 1992 for the management of natural forests (CAFMA) (Solis Corrales 2001). A credit certificate, the value of which relates to the value of the final timber stand (CAF por adelantado), was added to promote reforestation in small and medium sized properties of rural organizations (Rodriquez 2002), and in 1996 a fourth certificate was established to promote forest conservation (CCB, Costa Rica, Presidencia de la República 1996). All of these certificates are titles with a nominal value that can be sold or can be used to pay taxes or other national tributes.

With the new forest legislation of 1996 the approach towards promotion of plantations, forest management and forest conservation changed. Although certificates are still issued, from 1997 onward a system of payments for environmental services (PES) was introduced, through which owners can also be paid in cash for the maintenance of biodiversity, protection of water resources, storage and sequestration of carbon, and maintenance or enhancement of scenic beauty. The amounts paid for the four services combined are related to the opportunity cost of land in remote rural areas, using the value of cattle production on marginal lands in 1996 as a reference value. The amounts paid during 2001 and 2004 are illustrated in the following table.

While funding for the old incentive system came almost completely from the government's own resources, the new system allowed for innovative financing mechanisms. A first important step was the creation of a capable institutional framework created to deal with markets for environmental services (see Figure A). The framework is under constant evolution and change. Succinctly, the Ministry of Environment, through the National Forestry Fund (FONAFIFO), is charged with channeling government payments to private forest and protected area owners. Payments vary according to the activity undertaken: reforestation, sustainable management of forest and forest preservation (see Table A). Payments are made over a five-year period. In return, landholders cede their environmental service rights to FONAFIFO for this period. When the contracts expire, landowners are free to renegotiate prices, or sell the rights to other parties. They are, however, committed to managing or protecting their forest for the length of the contract. Their obligation is recorded in the public land register and applies to future purchasers of the land.

Having purchased rights to clearly identified environmental services, FONAFIFO can then sell them to buyers at local, national and international levels. Local level buyers to date include hydroelectricity companies (e.g. the Costa Rica National Power and Light Company, La Manguera, Energía Global) who are interested in watershed services, and tourism agencies (e.g. Hotel Melia, rafting companies) interested in landscape beauty. At the international level, FONAFIFO has developed a system to transfer carbon sequestration rights as Certified Tradable Offsets, or Certified Emission Reductions, to buyers via the Costa Rican Office for Joint Implementation (OCIC). The Office for Joint Implementation negotiates with international investors and donors. Certified credits could be purchased attached to a particular project, or as a standardized credit which is drawn from a pool of investments. In addition to income from sales of particular environmental service rights, FONAFIFO receives regular income from a share of fuel tax revenues.

In 2002 the PES in the forest management context was replaced by one for payment for tree planting within agroforestry systems, as a result of the argument that forest management

Table A. PES (in USD) paid per hectare in 2001 and 2004

	2001 (Campos et al. 2001)			2004 (FONAFIFO 2004)		
	Protection	Plantations	Management	Protection	Plantations**	Agroforestry
Total	221	565	344	223	570	0.82/tree
Year 1	44.20	282.50	172	44.60	285	0.533
Year 2	44.20	113	68.80	44.60	114	0.164
Year 3	44.20	84.75	34.40	44.60	85.50	0.123
Year 4	44.20	56.50	34.40	44.60	57	
Year 5	44.20	28.25	34.40	44.60	28.50	
Period of commitment*	5	15	10	5	15	

* Minimum period over which the owner has to commit himself to maintain the forest or plantation in order to receive PES.

** In addition 222 USD/ha is available for plantations that have been established with personal funds, to be paid in five annual installments of 44.40 USD/ha.

vision of environmental services requires changes in the current land use in favor of more environmentally friendly practices – including areas set aside for biodiversity protection, for example. In such cases, we should use the opportunity costs as a measure of the forgone benefits of changing the use of land. Once again, initial investment costs should be added to the final cost of providing environmental services.

A final issue remains to be discussed, namely the relation between the costs of providing environmental services and the proposed index relating a dose – a combination of practices that increases the provision of those services – to a particular response. Since payments will be related to the provision of environmental services inasmuch as that "response" is reflected in the index, one could obviously expect that a farmer will adopt a given technology only if that will result in an increase of the index large enough to raise enough funds to at least cover the costs of adoption. Each point of the index will then

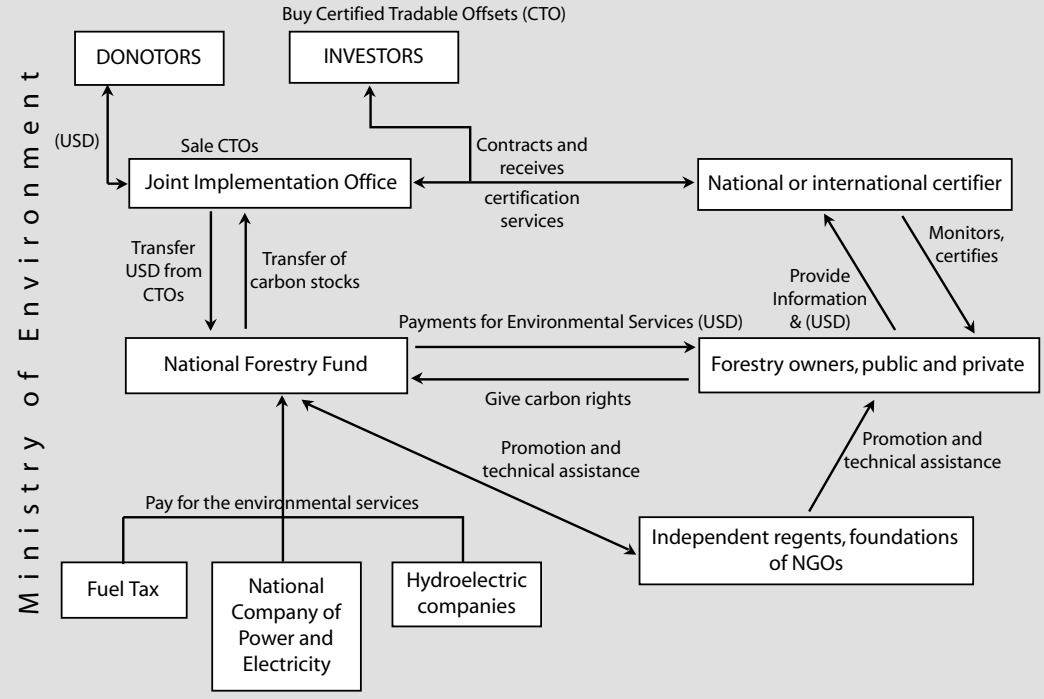

Figure A. Institutional framework of the PES in Costa Rica (Landell-Mills and Porras 2002)

contributes little to the generation of environmental services, and tree harvesting should generate sufficient income to pay for impact mitigating measures oriented at maintaining the forests' environmental services. Until the end of 2003 more than 370 000 ha were submitted to the PES system, 87% of which were protected forest, 7% were under forest management and 6% were plantations (FONAFIFO 2004); this amounts to between 18 and 26% of the total forest area of Costa Rica, or 7.3% of the national territory.

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also be related to the average costs of adopting the necessary practices for increasing the provision of environmental services. These costs will then be the lower bound for establishing the equilibrium payment for a given environmental service.

Institutional Component

The last component of our proposed methodology is the construction of the appropriate institutional setting for the selected scale of intervention. The demand and supply information gathered should now be combined in order to establish an intervened "market equilibrium" (see Figure 1). The regulatory agency interested in using the PES scheme will need to determine both the scale and scheme and the payment required, before establishing this equilibrium. The potentially available funds (demand side) and the costs of providing additional environmental services will ultimately determine how many of those services will be provided. For example, in the case of carbon sequestration the regulatory agency should determine the number of hectares to reforest. In the case of hydrological services, the regulatory agency needs to start from top priority areas and move downwards until the available funds are exhausted. Notably the funds available are obviously related to the quantity of hydrological services demanded and ultimately enjoyed by the beneficiaries, so a step-

wise convergent approach is required to reach the equilibrium.

Related to the above is the issue of defining the amount to pay to those adopting sustainable forestry or agricultural practices. In previous paragraphs, we have hinted that this payment is somewhere between the maximum willingness to pay of the beneficiaries for a program of a given scale, and the minimum payment required by the providers of such a program. The decision to set the payment closer to one or the other boundary is basically non-technical. The lower the payment the larger the potential scale of the program, but the smaller the incentives to adopt the desired management practices. In addition, the available funds collected from the beneficiaries will be larger than the funds ultimately paid to the providers, where the difference should cover administrative and operative costs.

The construction of the most suitable payment scheme requires a careful analysis of the local conditions, the legal framework and the potential incentives that such a payment will create. Notably, we need to avoid the creation of perverse incentives. For example, by paying for environmental services in just one part of the farm – say that part that is a top priority for erosion reduction – we might be causing a reshuffling of land uses within the farm, with the farmer converting natural forest cover towards pasture land in some parts of the farm and establishing reforestation plots in those areas where he or she is receiving a payment. Such a situation might force us to include the whole farm into the PES scheme. Most authors agree that payments should include the baseline provision of services – in order to avoid the farmer's cutting the forest in expectation of higher payments – and should be permanent or ongoing as long as the service continues to be provided (Pagiola 2001; Nasi et al. 2002; FAO 2004). Finally, although a PES scheme is not a tool specifically aimed at reducing poverty, we should make an effort to guarantee that such schemes do not exacerbate poverty and/or introduce further social and economic inequities (FAO 2004).

The institutional background required to make such a PES system operational will ultimately be defined by the scale, i.e. the spatial and temporal dimensions of the proposed intervention, and the type of environmental service. Although for carbon sequestration a nationwide initiative might make sense, a more logical approach to hydrological services is to foster local initiatives. Transaction costs are likely to increase with the size of the organization, particularly with respect to operating costs (salaries, monitoring costs, legal costs related to PES contracts, etc.). On the other hand, the costs of establishing an organization (e.g. legal costs) might be fixed irrespective of its size. In any case, these elements might change from one situation to another and a case specific analysis is required in order to determine the most appropriate type of institution. In addition, other things need to be considered such as the level of organization existing in the target area; if farmers are highly organized, for example, a PES scheme might require a smaller institutional capacity (Pagiola et al. 2002).

In its simplest form, the institutional and legal background needed to implement a PES system should consider coordination, the transfer of funding between beneficiaries and providers, the operational aspects of the system and its control and monitoring, which should enable the institution to react to new information and unforeseen changes in the demand or supply of the services. It is important to stress that the institutional framework does not necessarily require the creation of parallel organizations or additional legal normative, as was done in Costa Rica (see Box 6.3). The institutional framework can easily be constructed within a municipality or as a subunit of a water or electricity company. Moreover, establishment and operational costs might be lower if the PES scheme can use an already functional organization. This is particularly true for financial issues. If the organization has well-recognized accounting and auditing practices and is respected by the beneficiaries and providers of environmental services, much can be gained from attaching the PES scheme to it.

6.5 Restrictions to the Proposed PES Approach

Though we have supported the use of market-based instruments such as PES as effective mechanisms for promoting sustainable forest management and hence sustaining the provision of ecosystem services, we acknowledge that in some situations difficulties might arise that would limit the design and/or implementation of such mechanisms. In many of these cases, other solutions might be more efficient, but they are beyond the scope of this chapter.

Restrictions might include the failure to demonstrate that services are actually being provided, the lack of an effective demand for the services, limitations from the demand and/or the supply side, as well as other limitations regarding institutional capacity and scale. The FAO (2004) research that assessed different payment schemes for hydrological services, found several difficulties in the schemes, such as: doubtful cost-effectiveness of the methods, i.e. some programs were not based on studies on demand and supply using economic valuation but were rather politically imposed; schemes were based on "conventional wisdom" and not on sound scientific knowledge on the relationship between land use and hydrological services; unclear definition of the hydrological services and of the service providers and beneficiaries; lacking or ineffective monitoring and control; high dependence on external funding; and finally, concerns regarding possible development of perverse incentives to land users. Some of these restrictions could be overcome by sound design of the schemes as proposed in Section 6.4.

John Parotta

Forests provide a wide range of goods and services, which can be classified into regulating, habitat, production and information services (see Annex 1).

As was mentioned in Section 6.4, a very critical limitation for developing markets for FES is the difficulty in clearly showing that the FES are being provided and to what degree, particularly in establishing a clear relationship between land use practices and the resulting provision of FES. This is probably more evident for hydrological services. Some helpful generalizations can be drawn (Bruijnzeel and Vertessy 2004). According to Pagiola et al. (2002), the main weakness of most markets for watershed protection (and indeed of most other forms of watershed management) is the lack of good information on the relationship between land use and water services. None of the cases reviewed by these authors devoted much attention to clarifying these relationships, and they concluded that markets for watershed protection generally do not involve directly trading water quantity or quality; rather, they usually involve "selling" land uses that are thought to generate the desired water services. A proposal to overcome this restriction was discussed in the previous section, by using indices as surrogates for such relationships.

For a scheme of PES to succeed, it is also necessary that property rights over service commodities are clearly defined and well established. This is a condition that is not always found in many developing countries. In those situations the designers of the payment schemes will have to develop innovative ways to ensure that payments are received by those actors who generate the services or make the decisions that affect the level and quality of the services provided.

Probably the most critical limitation to market-based mechanisms for forest ecosystem services is the lack of an effective demand for those services. The value of FES depends not only on their nature and magnitude (e.g. biodiversity in the Amazon), but also on the uses to which they are put, as well as the magnitude and preferences of the people using them. Initiatives that pay insufficient attention to demand tend to run into problems (Pagiola et al. 2002). For example, the nationwide payment scheme implemented in Costa Rica since 1997 was based on overly optimistic expectations of the development of carbon markets through the Clean Development Mechanism (Campos et al. 2000).Ecosystem services that benefit society at the global level (i.e. carbon and biodiversity) might require complex negotiations, and implementation may require high transaction costs which could exclude small scale initiatives from taking advantage of these opportunities.

Similarly, limitations may arise if the beneficiaries of FES are unable to actually pay for these services, such as could very often be the case for the use of potable water by poor communities, or if there is not sufficient information available to the actors that benefit from the service, resulting in lack of awareness or biased priorities. In contexts where there is a highly unequal distribution of power or income, for instance, market instruments usually are not capable of solving social conflicts, and may at times exacerbate them. On the other hand, in many social groups water is considered as a right rather than as a market good. In these cases, it is not appropriate to "internalize" the environmental externalities in-

fluencing water supply through a market price, since other mechanisms can be more effective and enjoy greater public support, such as community management and territorial planning (FAO 2004).

On the other hand, different difficulties could be experienced if the suppliers' ability to offer the quality and quantity of the services required is limited; for example in the case of high-yield agricultural crops or when other competing land uses, such as urbanization, exist, the opportunity costs could be too high for implementing a feasible PES scheme.

Finally, certain conditions related to the institutional capacity required to effectively implement PES schemes should exist or be created. These institutional conditions are required to resolve property rights problems, to develop appropriate monitoring and enforcement mechanisms, and to support the whole network of regulatory and institutional arrangements that might be necessary for markets to function effectively. Establishing and sustaining this infrastructure is not easy and is rarely cheap; this might require significant time and financial resources, and investments in staff recruitment, sound information from scientific and policy research, proposal development and consultations and participatory processes with key stakeholders, as well as conflict resolution mechanisms.

6.6 Conclusions

In this chapter we have discussed the use of PES schemes as a suitable market-based instrument to achieve sustainable use and management of ecosystems regarded as important, due to their contribution to human welfare in its many expressions. PES schemes are inevitably a long-term alternative in support of the general objective of sustainable development, and paradoxically our main concern lies in the sustainability of the proposed solution itself. Pagiola et al. (2002) stress that the sustainability of this mechanism is even harder to assess than its effectiveness and suggest three dimensions that are critical: a continued demand for the environmental services being sold; a continued ability to supply these services; and the sustainability of the institutional structure created to make the mechanism work. To this we would add the need to constantly improve the "dose-response" function underlying any PES scheme so as to ensure that additional services are provided.

In summary, the paradigm of PES is certainly a promising mechanism for advancing towards the sustainable management of forest and other natural resources. However, its effectiveness requires from designers the careful assessment of the particular social, economic and institutional conditions where these mechanisms will be applied and the willingness to make use of the best scientific information.

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Annex 1. Classification of forest ecosystem goods and services (adapted from de Groot et al. 2002) **and the direction of possible impacts by different land use types in relation to undisturbed forests (from +++, very positive, to – – –, very negative)** (based on Brown and Lugo 1990, Parrotta and Turnbull 1997, Rice et al. 2001, Parrotta et al. 2002 and a revision of RIL studies by Louman 2005).

Goods or services provided	Role of forest ecosystems	Expected impacts of different land uses in relation to undisturbed forests		
		Forest conversion	New forests	Harvesting of timber and other products *
REGULATING SERVICES				
Maintenance of favorable climate	Reflection of solar radiation and gas regulation	– – –	+ –	+ –
Maintenance of (good) air quality	Gas regulation (absorption, storage, release, for example CO2)	– – –	+ –	+ –
Prevention of diseases	Biological control of vectors	– – –	–	+ –
Flood prevention and mitigation, avalanche prevention, natural irrigation	Regulation of run-off and river discharge; mitigation of coastal impacts of tropical storms and tsunamis (mangrove forests)	– – –	+ –	+ –
Maintenance or improvement of water quality for consumptive use	Filtering and retention of freshwater	– – –	–	+ –
Maintenance or restoration of natural productivity of soils	Retention and formation of soils, nutrient regulation, and improved soil fertility and structure	– – –	–	+ –
Waste control and disposal, buffering and filtering pollutants	Filtering and breakdown of xenic nutrients, compounds and pollutants	– – –	+ –	+ –
Pollination of useful plants	Provide habitat for biota	– – –	– –	–
HABITAT SERVICES				
Provide habitat for (potentially) useful plants and animals	Structure, composition and diversity of forests	– – –	– –	–
PRODUCTION SERVICES				
Production of food, wood and non-wood goods	Conversion of solar energy into edible and other useful plants and animals	+ + +	+ +	+
Genetic material for crop improvement, health care, etc.	Genetic material and evolution in wild plants and animals	– –	–	+ –
Pollination	Provide habitat for pollination agents	– –	–	+ –
INFORMATION SERVICES				
Scenic beauty for ecotourism and recreation	Variety of habitats for a variety of plants and animals	– –	–	–
Inspiration for arts and other cultural and spiritual activities	Existence of specific features	– –	–	+ –
Information for science and education	Existence of habitats	– – –	–	+ –

* Assuming application of RIL techniques and planning of non-timber forest products harvests

GLOBAL FORUM

7 Diversifying Functions of Planted Forests

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Abstract: Planted forests are much more important than their share of the forest area indicates, and their importance will increase with time. They fulfill different functions, e.g. roundwood, fibre and fuelwood production, carbon sequestration, combating desertification and rural landscape diversification, and they contribute to biodiversity, and environmental rehabilitation for soil and water conservation. This article presents statistics and trends related to planted forests area development and global supply from plantations. Ongoing changes in the definitions of plantation and planted forest makes it almost impossible to derive precise global trends regarding future plantation area development. In addition, there are a great variety of drivers and constraints to planted forests in different regions. Because of the widening of the definition and changes in the use of plantations, plantations such as rubber, coconut and oil palm will be included in the statistics as plantations for wood production. The use of exotic and indigenous species in planted forests is also discussed, as well as the advantages of planted forests with mixed species. Changes in plantation size and ownership are favouring smaller plantations maintained by communities and smallholders. We discuss the mechanisms of plantation development, including the transformation of natural forests, plantations in degraded areas, natural grasslands, and open areas, as well as the reasons for forestation and methods of plantation establishment. The benefits of plantations for industry, society, and local people are shown. We present examples of plantation forestry in the context of forest management systems, ecosystem management, and biodiversity in plantations.

Keywords: Forest plantation; planted forest; mixed plantation; native species; exotic species; restoration.

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7.1 The Reasons for Planting Forests

Industrial and Non-Industrial Plantations

The global trend is towards increasing establishment of plantations and growing reliance on them as a source of industrial wood. In the tropical countries, for example, plantations will be a particularly important future source of raw material for the pulp and paper industry.

In a few countries, plantations have superseded natural forests as a source of wood. In New Zealand, Chile, Indonesia, Myanmar and South Africa, for example, the establishment of extensive plantation areas has enabled these countries to meet almost all their domestic wood needs and also to support a significant export industry (FAO 1999). In some Asian countries, such as China, Japan, and the Republic of Korea, and in a number of European countries, plantation establishment has served primarily as a means of increasing or replenishing the forest estate.

Industrial plantations (e.g. those supplying raw materials for industry) account for 48% of the global

plantation estate, while non-industrial plantations (e.g. those grown for fuelwood, soil and water conservation, and wind protection) account for 26%, and the remaining 26% are unspecified (Table 1, p. 122). The countries with large industrial plantation areas are China (37 million ha), the United States (16 million ha), and India (12 million ha). These three countries account for 73% of all industrial forest plantations. The countries with a significant proportion of non-industrial plantation areas are India (21 million ha), China (8 million ha), and Indonesia and Thailand (4 million ha each), which together account for 75% of all non-industrial forest plantations in the world (FAO 2001).

While plantation forestry has a long history in some countries, the development of a globally significant plantation estate is a relatively new phenomenon. FAO (Brown 2000) estimates suggest that in 1995, about 54% of the global area of industrial plantations were comprised of stands less than 15 years old, with 21% having been planted between 1990 and 1995. The plantations more than 50 years old were located almost exclusively in temperate and boreal regions.

The Functions of Planted Forests

Planted forests can have a number of functions; they have in many areas been established for environmental rehabilitation and for soil and water conservation; in other areas, wood production has been the overriding objective (for examples see Boxes 7.1 and 7.2). The role of forest plantations in sustainable forest management has been the subject of considerable attention. One reason for this is that plantations are predicted to supply most of the future increase in wood demand. They are considered an efficient method to produce forest products on a relatively limited land base, and it can be argued that they thus help to mitigate deforestation and degradation of natural forests. However, if current land uses are not considered when plantations are established and if they are poorly planned and managed, plantations can have negative environmental and social impacts.

About 14.6 million ha of world forests are lost every year to deforestation, while an annual increase of 5.2 million ha is achieved through the expansion of natural forests (3.6 million ha) and plantations (1.6 million ha of afforestation). Serious environmental problems have resulted from deforestation. Plantations can be important in preventing the loss of forest resources, including wood, biodiversity, and water resources (Carnus et al. 2003). Therefore, reforested area should exceed deforested area in order to safeguard forests. It is estimated that an additional 9.4 million ha should be reforested every year worldwide (FAO 2001).

Many improvements in silvicultural techniques promote sustainable and environmentally sound forest management, and these techniques can be applied in afforestation and reforestation. Also, interest in native species, particularly in their role in the conservation of biodiversity, has led to efforts to provide protection for natural forests and to reforest existing plantations. Through restructuring plantation systems into multi-storied and natural-like forests, plantations are expected to play an increasingly important role in the future.

In recent years, planted forests have increasingly been established on private lands to serve farmers' own needs or as cash crops (e.g. Pasicolan et al. 1997). In Malawi, for instance, the law requires tobacco growers to leave or plant forest to obtain the fuelwood needed for tobacco curing. This has led to a significant increase in the area planted with eucalypts. Various incentives can also be used to promote planting on private lands (Enters et al. 2003). Private planted forests can be small and in many inventories they are not even counted as being forest. On the peasant farmers' lands, trees may replace a previous forest or woodland, but often trees are also planted on the boundaries of plots as boundary marks. They function mainly as windbreaks, but may at the same time provide fodder for animals, fuelwood for the household, and cash income when timber and other wood products are sold.

Grasslands, caused by land degradation, are considered as wastelands. Converting these areas into forests, apart from being regarded as quite easy, is considered to result in more productive land-use. In situations where plantations are established on initially open land, e.g. South American pampas, the challenges are different than in situations where plantations replace forest. On the other hand, in India, "wastelands" are in many cases more of an institutional definition than a reality for poor local people, whose livelihoods often depend on these lands. Usually there is no strong resistance against afforestation, as there is against converting existing indigenous forests into planted forests. When trees are planted to prevent or mitigate environmental hazards, the resistance to changing the ecosystem is not great. If the main target is not to grow trees and gain direct economic advantage in industrial plantations, but to enhance local livelihoods, the attitudes of the local people to planted trees tend to be positive.

7.2 Statistics and Trends of Planted Forests

Global Plantation Area

Trees have been planted for centuries, perhaps for millennia. The first observations of planting *Cunninghamia lanceolata* in China date back over 1000 years (Fung 1994). In Central Europe, most forest regeneration has relied on planting for centuries. However, the importance of planted forests has risen globally over the last forty years. The FAO has had a

BOX 7.1 Plantations in Korea

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In the 19th century, the forests of the Republic of Korea (ROK) were rich in old-growth stands. However, these stands were totally destroyed by over cutting and illegal cutting for fuelwood and building material throughout the chaotic periods of the Japanese occupation (1910–1945) and the Korean War (1950–1953). During this time, the average stand volume declined from 100 m^3/ha to 10.6 m^3/ha (KFS 2001). Deforestation was so extensive that reforestation became a national priority.

Since the end of the Korean War, the ROK Government has promoted the search for alternative fuels for domestic use. In 1960, there were about 2.4 million households in the country. The estimated need for forestland to produce fuelwood was 0.5 ha per household, totalling about 1.2 million ha of total fuelwood plantation required to meet the needs (Yoo 1997). As a means of rehabilitating deforested areas and creating fuelwood plantations for resolving the problem, large-scale plantation programs were initiated in 1959, and expanded with a series of national Forest Development Plans with strong government leadership and participation of various groups such as local communities, families, and schools. As a result of these programs, over four million hectares of new forest have been re-established in Korea, and 97.4% of the deforested areas were recovered by 1999 (KFS 2001; Lee et al. 2004). This marked the end of government-led plantation activity; from this point on, the program became more self-regulated with less government involvement.

As a result of the successful completion of the national Forest Development Plans, the Republic of Korea has become a model country with regard to rapid reforestation of denuded lands; but because of the relatively short plantation history (average tree ages being 30–40 years), it has largely depended on imported timber products. In 2000, domestic forests supplied only 10% of total timber consumption, representing a roundwood equivalent of 25 million m^3 (KFS 2002). For securing its long-term timber supply sources, the Republic of Korea has established overseas plantations and systematically supported companies that develop forest resources in foreign countries.

Deforestation is causing serious environmental problems throughout the world. In north east Asia, international collaboration focuses on combating desertification and restoring degraded forest ecosystems. In the 21st century, society is characterized by people's participation as well as by the roles of non-governmental organizations (NGOs). The NGOs in Korea follow the global trend, and since the 1980s have become involved in both political and more practical aspects of supporting sustainable development. One of them, Northeast Asian Forest Forum (NEAFF), was established in 1998 to conserve sustainable forest ecosystems in north east Asia by strengthening the networks among the countries concerned, e.g. China, Mongolia, Russia, and the Democratic People's Republic of Korea (DPRK). The NEAFF has supported plantations for combating desertification and for promoting restoration of degraded forests in China and Mongolia. Forest for Peace (FFP), a sister NGO to NEAFF, is a national campaign organization working to restore degraded forest ecosystems of the DPRK, and ultimately to help increase its food production by fund-raising and supporting NEAFF. The FFP has provided planting materials and equipment, such as seeds, spray machines, branching shears, plastic sheets, and fertilizers. It will also support the establishment of about 200 forest nurseries in the DPRK, which will produce tree seedlings for reforestation of about 2 million ha of degraded forests. The growing interest of NGOs in plantations implies that plantations contribute not only to the economy and the environment, but also to the social structures of society.

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key role in compiling statistics and developing definitions on planted forests and plantations.

Despite some restrictions and discrepancies, the FAO's Forest Resource Assessment (FRA) 2000 data on plantations is commonly held to be the most comprehensive and accurate. One problem in area calculation is the accumulative character of the statistical data. In FRA 2000, gross forest plantation areas were given for all countries reporting plantations. In developing countries, a maximum of eight classes, including *Acacia*, *Eucalyptus*, *Hevea*, *Pinus, Tectona*, *Other broadleaves*, *Other coniferous* and *Unspecified,* were reported by purpose (industrial, non-industrial) and ownership (public, private, other, unspecified). However, for industrialized countries in the temperate and boreal zones, this information was not reported. The global plantation area by region, purpose, and ownership is presented in Table 1.

In 2000, the global plantation area was estimated to be 187 million ha, of which 116 million ha were in Asia (Table 1). According to Varmola and Del Lungo (2003), data on the area of different tree species were incomplete and no data on ownership or purpose were reported for most of the countries. The comparison between successive assessments is difficult because of different classifications used for forest plantation areas, and differences in which tree species are included in planted species.

Trends

The FAO's Forest Resources Assessment (FRA 2000) presents the results of three successive plantation assessments (1980, 1990 and 2000) (FAO 2001). These results show an overall increasing trend in

BOX 7.2 Tree Planting and Afforestation are Increasing China's Forest Cover

Heidi Vanhanen and Yukun Cao

Before 1978, China's forests were managed in roughly equal proportions by collectives and state-owned forest bureaus. Following the reforms in rural and forest tenure in the mid 1980s, most of the collective forests – 58% of all forested land – are managed and used by rural households through different contractual arrangements. The increases in China's forest cover and standing forest volume over the last 15–20 years are mainly due to household-based forestry and private investments, while collective ownership was officially maintained.

According to the 1998 Chinese inventory data, man-made forests cover nearly one third or 46.7 million hectares of China's forest area. The increase in private sector planting of commercial tree crops and orchards (the so-called "economic trees", included in forested land in China) is one of the most noticeable changes in rural China. Economic trees have increased forest cover and rural incomes.

Afforestation Rates Reflect the Policy Changes

Timber Forests

The leap-up in annually reported industrial timber planting (Figure A) in the early 1980s resulted from state-forest enterprises' policy towards sustainability and replanting in the harvested state-owned natural forests, mainly in China's major forest regions in the northeast provinces. These traditional timber-producing areas are now declining, due to over harvesting and the logging ban.

The roles of collectives, joint ventures, forest cooperatives, and private forests continue to increase in industrial timber production, managing three quarters of timber plantations in 1998. The north-central region with the fast-growing, high-yield, collectively managed plantations has emerged in the 1990s as a new source of timber.

Shelterbelt or Protection Forests

1998 was a turning point in Chinese forestry. Forest policy shifted towards one clear goal: environmental conservation. The central government activated several huge forestry programs, mainly to improve the environment. Due to the key forestry programs, the share of forestry in gross national investments (GNI) nearly tripled in the late 1990s, but it is still far below one per cent of GNI (State Forestry Administration 2001).

Since the late 1980s, the planting of shelterbelts clearly shows the change in strategy: to expand environmental protection to areas outside the traditional forest provinces, to the ecologically sensitive areas along the Yellow River and upper Yangtze River. In the last few years, well over half of all afforestation has been implemented within the six key forestry programs, and over 70% of all afforestation has been for shelterbelt purposes.

The newly streamlined afforestation programs have attempted to generate greater private sector involvement. Private resource tenure is encouraged, and people planting trees on barren lands are awarded rights to these resources.

Economic Forests: Tree Crops and Orchards

Individuals, or groups of individuals, plant "economic trees", while planting shelterbelts is financed by central government. Producing non-timber forest products on farms, as by "economic trees", is unusually important in China. Even though at the national level forestry contributes only 2% to farm-derived rural cash income, economic tree crops, such as various bamboo products, dry and fresh fruits, and nuts and oil, contribute up to 80% of farmers' income in forested counties, create rural employment, and also provide a source of taxation for the local governments. At the national level, the import and export values of non-timber forest products have accounted for one quarter of foreign trade in forest products.

The area of small-scale economic forests expanded from 6.1 million ha in 1978 to 20.2 million ha according to the 1994–98 inventory, covering nearly half of all China's plantation forest area. Farmers looking for earlier and more frequent returns on their land rather turn to non-wood products instead of timber. Non-wood products are considered agricultural products, thus carrying much lower taxes, while sale of timber may carry various fees up to 60–70% of the sales price.

In the middle of the 1990s, planting economic trees was further supported by several reforms, such as providing long-term tenure – up to 30–50 years, securing ownership to planted trees and their produce, and liberalization of trade and investment.

Other forest types are *fuelwood forests* for energy needs in rural areas and *special purpose forests* covering national parks, reserves, and other special sites.

Forest Diversity and the Environment

Despite, and also because of, extensive afforestation, the functions and diversity of Chinese forests continue to decline. The remaining natural forests, 30% of total forest area, are highly degraded. While new plantations are established on barren land or on scrub-covered hills, large areas of mature plantations and natural or old growth forests have been logged and not fully replanted, although logging was restricted by the logging ban in 1998. The main efforts in tree planting, however, are aimed at alleviating the paramount environmental problems of land erosion and desertification, to secure food production.

Table A. Forest resources in China (State Forestry Administration 2001; Nation Sees More ... 2005)

Forest inventory	Forested land million ha	Timber volume billion m^3	Forest cover	Plantation area million ha
Fourth 1989–1993	133.7	10.1	13.9 %	34.3
Fifth 1994–1998	158.9	11.3	16.6 %	46.7
Sixth 1999–2003	175.0	12.5	18.2%	53.0

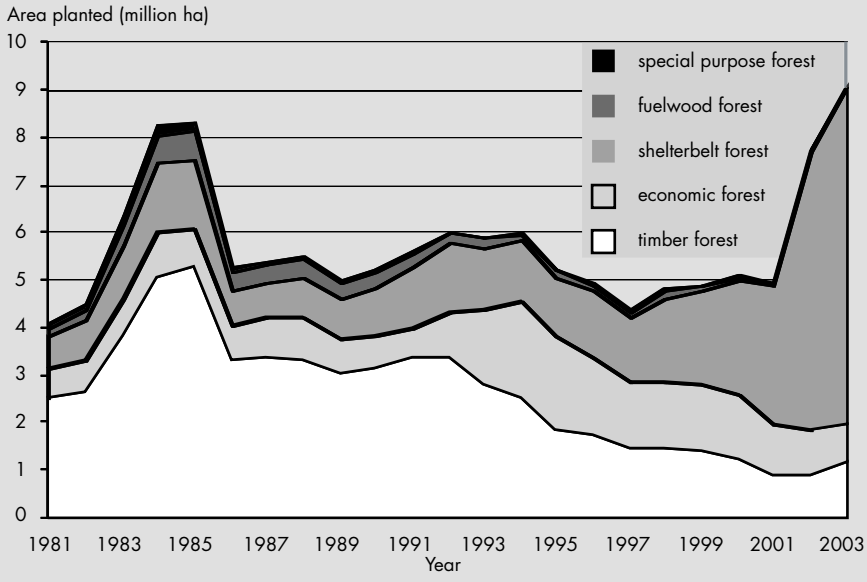

Figure A. Reported annually afforested area by forest type in China, 1981–2003 (State Forestry Administration 2001, 2004). Note: Afforestation preserving rate estimated below 30% up to 1984–88 (Xu et al. 2004).

Challenges

The problem of poor survival rate still prevails: "The idea of attaching more attention to planting rather than management [is] still prevailing in most areas" (State Forestry Administration 2001).

The overall national goal is to increase the country's forest cover from the present 18% to 26% in the next 30 years. However, the costs are high and poor planning, technology, and management lead to poor forest quality and low standing volumes. To attain the national goal will require adjustments to the current major impediments of high taxes and fees on trade of timber, poor administration, logging quotas, persistent land tenure insecurity, and land-use conflicts. The challenge is to find a balance among environmental protection, domestic timber supply, and rural development.

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global plantation area. However, because of the new definition of net plantation area introduced in 1990, and the lack of data in FRA 1990 from some important developed countries, e.g. Australia, Japan, and New Zealand, plantation area trends cannot be drawn with accuracy.

FAO has also compiled the information from successive plantation assessments and from other sources in a transparent database (PFDB, Planted Forests DataBase). Preliminary analysis of the PFDB provided the following observations on plantation trends (Varmola and Del Lungo 2003):

- Most countries with large plantation areas (over 1 mill. ha) are in Asia.
- All countries with large plantation areas are expanding their planting area, i.e. the gross planting area is increasing.
- In Africa, in many countries with medium plantation areas (0.1–1 mill. ha), the planting area is stable/constant or even decreasing.
- Of the countries with medium plantation areas on other continents, planting rates have decreased only in Colombia.
- In most of the countries with small plantation areas (less than 0.1 mill. ha), the planting area is stable/constant or decreasing.
- Many countries in which plantation areas are decreasing have been afflicted by serious economic or political problems or civil wars in recent decades.

In conclusion, plantation development appears to be polarizing – the large are becoming larger and the small are becoming smaller.

Another way to analyze planting trends (or rate), based on the PFDB, was used in Del Lungo's study

Table 1. Regional plantation area by purpose and ownership (FAO 2001)

Region	Total area	Industrial purpose (1000 ha)					Non-industrial purpose (1000 ha)					Purpose unspecified
		Public	Private	Other	Unspec.	Subtotal	Public	Private	Other	Unspec.	Subtotal	
Africa	8036	1770	1161	51	410	3392	2035	297	611	330	3273	1371
Asia	115847	25798	5973	27032	–	58803	17177	17268	9145	72	43662	13381
Europe	32015	–	–	–	569	569	9	6	–	–	15	31431
N Amer. & C America	17533	1446	15172	118	39	16775	362	58	16	35	471	287
Oceania	3201	151	14	–	24	189	2	3	–	19	24	2987
S America	10455	1061	3557		4827	9445	251	528	–	225	1004	6
WORLD TOTAL	187086	30226	25876	27202	5871	89175	19836	18161	9772	680	48449	49463

(2003), where annual planting data was transformed into percentage of a country's total land area in order to compare countries of different sizes. Annual planting varied considerably within and between regions; in Asia the planted area is growing by 2.5%, but in Africa it is growing by only 0.2% of the total land area. In Asia and Temperate Oceania (Australia and New Zealand), regional trends in planting area development are increasing quickly; in North and Central America and Tropical South America they are slowly decreasing; and in Temperate South America they are increasing. In Africa's Northern sub-region the trend is negative, but in other African sub-regions it is slightly positive.

Supply from Plantations

FAO's first global outlook for future wood supply from forest plantations was based on data from 1995 (Brown 2000). The share of plantation area at that time was estimated to be 3.5% of the global forest area, and that of industrial plantations even less. It was estimated that in 1995, 22% of industrial roundwood (330 million m^3) was produced on industrial plantations on an area of 103 million ha. The outlook also included different extrapolations of industrial roundwood consumption and potential industrial roundwood production from forest plantations. The global values for the proportion of plantation-produced industrial roundwood for 2050 ranged from a minimum of 19.7% to a maximum of 64.0%.

According to ABARE – Jaakko Pöyry (1999), the share of industrial roundwood supply from plantations was estimated at 35% (620 million m^3) in 2000, 44% (970 million m^3) in 2020, and 46% (1040 million m^3) in 2040, of the global industrial roundwood supply. These scenarios were based on the assumption that the industrial plantation area was 116 million ha and the total effective area 94 million ha in 1995. Tomberlin and Buongiorno (2001) estimated that of the total global timber supply, the share of industrial roundwood from plantations (not including Canada, Western Europe, and former Soviet Union) would increase from 33% (300 million m^3) in 1995 to 42% (470 million m^3) in 2010. Plantation production and total roundwood production estimates were obtained from FAO (Brown 2000). James and Del Lungo (2004) used the Planted Forests Database to estimate the potential of fast-growing commercial plantations to supply high quality roundwood. They estimated that in the 30 countries with the largest planted areas, production from fast-growing (mean annual increment, MAI > 14 m^3/ha and rotation length between 20–40 years) plantation areas could rise from 250 to 430 million m^3 during the period 2000–2020.

From these figures it can be concluded that:

- The importance of roundwood supply from global forest plantations is much higher than their share of forest area.
- The importance of forest plantations to global roundwood supply will increase in the future.
- Outlook studies, databases, and scenarios differ greatly from each other.

From Plantations to Planted Forests

In developed countries, the varying definitions of plantation have, in many cases, led to a situation where the country itself does not want to be identified as a "plantation" country. In the FRA 2000 inventory, Austria, Canada, the Czech Republic, Finland, Germany, and Liechtenstein did not report any forest plantations. Germany, for example, had reported 134 000 ha of exotic *Pseudostuga menziesii* plantations already in 1985 (Hermann and Lavender 1999). In Finland, 25% of the forests are planted or seeded (Parviainen 1998) but all Finnish forests are classified as semi-natural.

In the next Global Forest Resources Assessment 2005, forests will be classified according to their density (forest/open wooded land), naturalness (primary/modified natural/semi-natural/plantation), and purpose (productive/protective plantation). This clas-

sification is based on the ideas presented by Carle and Holmgren (2003). They distinguish three types of forest: natural forests based on natural regeneration, semi-natural forests based on natural regeneration or assisted by planting or seeding, and plantations based on planting. So in the future, only plantation forests, a subset of planted forests, will have precise area estimates. For definitions of plantations and planted forests see Box 7.3.

7.3 Changes in Plantation Size and Ownership

Plantation Size

As an overall trend, plantation size has changed from large (mainly state-owned), to medium-size (at village or commune level), and small (at individual property level). At least in Western Africa, this change has followed a general historical trend (Goudet 1992). The plantations under state control date mainly from the 1950s to the 1970s, and were established under projects mainly promoted and financed by the World Bank. At that time, the main policy in the Sahelian regions was to create "green barriers" to combat desertification, and to establish large plantations that would provide cities with fuelwood and timber. In the more humid regions, the main plantation policy was to supply factories with raw material. Usually these plantations replaced forests or savannas. They have not been very effective; instead, they have been expensive to manage. In these countries, the governments have also had general difficulties in managing all their public services. In addition, land tenure issues in these large plantations are problematic, and can cause resentment among local people whose farming, herding, or collecting land is deprived.

Community or village plantations have progressively replaced large plantations in the 1980s in many parts in Africa and Asia. However, plantations of this kind, despite being easier to manage (less expensive in terms of management costs and easier to protect) can also lead to biodiversity loss and difficulties in land tenure issues. The spread of "agroforestry" and "social forestry" practices from about 1985 onwards has favoured individual plantations. The promotion of these practices has partly solved the question of land tenure, but not the one of loss of biodiversity following forest clearing.

The shift from large to small and individual plantations is probably a positive change, as nowadays it is risky to invest in long-term ventures, such as forest plantations, without land security and without a minimum assurance that the investment will be profitable. However, the question of the environmental impacts of these individual plantations has not been resolved. Biodiversity management on a global scale and the Clean Development Mechanisms issues, for example, are confronted by the question of plantation scale: should we favour the co-existence of large and individual plantations, or the association of individual plantations under an "umbrella" project?

State Owned Plantations

State-owned plantations are normally large. They have been established either for protection or for commercial purposes, as in Australia, China, and Vietnam. Because in many countries the input from the state comes only at the establishment stage, management and future regeneration are expected to be done partly or fully by the beneficiaries. However, the beneficiaries might be poor peasants who have very few means to succeed in carrying out these tasks. If the benefits achieved by state plantations are large enough, the transfer to local communities may succeed and plantations become sustainable.

The commercial plantations established with funds from the World Bank and other donor organizations have usually been well established and managed, but only to the point that funding has been available. Thereafter plantations in countries like Zambia, Malawi, and Burkina Faso have gradually deteriorated, and the only management has been cutting while the establishment of a new generation plantation has lagged behind or been totally neglected. In some cases, the management of state-owned plantations has been transferred to state-owned companies, as in Zambia, where such companies are run like private companies and the effectiveness of plantation management has improved. In some other cases, as in Malawi, the management is auctioned and the land is rented for long periods to those responsible for the management.

Community Plantations

Community plantations have been established in areas where land ownership has traditionally been vested in the community or group of people. The purpose of these plantations may be to serve the needs of the community by providing fuelwood or other locally needed products. The control and management of collectively owned plantations needs special attention, as all inhabitants may think that they have a right to utilize the products, but no one will make any effort to manage the plantation. If the management is implemented properly, plantations can produce wood and other forest products including fodder in a sustainable way. However, problems related to land tenure can severely restrain the development of community plantations.

BOX 7.3 Definitions of Plantations and Planted Forests

Martti Varmola

FAO launched the first global plantation assessment in 1965 (FAO 1967), and defined *man made planted forests* as follows:

"A forest crop raisen artificially, either by sowing or planting. This could be interpreted to include all forms of artificial regeneration but not natural regeneration."

In the next global plantation assessment, the Tropical Forest Resources Assessment Project in 1980 (FAO 1981), *plantations* were defined as:

- "Forest stands established artificially by afforestation on land, which previously did not carry forest;
- Forest stands established artificially by reforestation on land, which carried forest during the previous 50 years or within living memory, and involved the replacement of the previous crop by a new and essentially different crop."

Plantations did not include "stands established by artificial regeneration and essentially similar to those they were replacing".

The Forest Resources Assessment 1990 (FAO 1995) defined *plantation forests in developing countries* as:

- "Forests established artificially by afforestation on lands which previously did not carry forest within living memory;
- Forests established artificially by reforestation of land which carried forest before and involving the replacement of the indigenous species by a new and essentially different species or genetic variety."

The concept of *Net area = Gross area × Reduction factor* (=0.7) was applied to FAO's forest plantation publications during the 1990s in order to try to get as comprehensive and realistic a picture as possible of the amount of plantations in the developing countries. The idea of net areas was subsequently abandoned and gross areas were used in the Global Forest Resources Assessment (FRA 2000) in which *forest plantations* were defined (FAO 2001):

"Forest stands established by planting or/and seeding in the process of afforestation or reforestation. They are either:

- Of introduced species (all planted stands); or
- Intensively managed stands of indigenous species, which meet all the following criteria: one or two species at plantation, even age class, regular spacing."

New plantations were defined as:

- "*Afforestation*: Establishment of forest plantations on land that, until then, was not classified as forest. Implies a transformation from non-forest to forest; and
- *Reforestation*: Establishment of forest plantations on temporarily unstocked lands that are considered as forest."

In 2002, the Second Expert Meeting organised by the FAO on harmonizing forest-related definitions for the use of various stakeholders (e.g. CIFOR, IPCC, IUFRO, UNEP) considered the FRA definition of forest plantation to be precise and recommended it for consideration by other organizations, forums and processes (FAO 2002). At this meeting the following determinations were accepted:

- "*Planted forests*: non site-typical species, indigenous or exotic, planted or seeded
- *Forest plantation*: intensively managed, commercial production, even spacing, exotic or indigenous; and
- *Extensively managed planted forest*: protection, conservation."

Thus, the work done by the FAO was accepted widely as the basis for plantation and planted forest definitions.

In a paper presented at the UNFF Inter-sessional Expert Meeting International Steering Group on "The Role of Planted Forests in Sustainable Forest Management" in March 2003, the FAO affirmed and finally endorsed the concept of *Planted Forests* defined as (Carle and Holmgren 2003):

"Forests that have been established and are (intensively) managed for commercial production of wood and non-wood forest products, or to provide a specific environmental service (e.g. erosion control, landslide stabilization, windbreaks, etc.)."

Planted forests established for conservation, watershed, or soil protection may be subject to little human intervention after their establishment. Changes may occur in the purpose, degree of management intensity, time scale, and potential reversibility to other land uses. With the new broader concept of planted forests, forest plantations have become a subset of planted forests.

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Private Plantations

Companies have established plantations on a large scale to supply raw material for pulp mills and other industries (e.g. Aracruz in Brazil, Stora-Enso in Indonesia). The land can be owned by the company, but is often leased from the government under long-term contract. Company plantations consist of a few or maybe only one species. As the plantation wood is used by the company and forms an important part of the business, the plantations are effectively managed, and environmental issues are normally taken into account. This means proper management plan, proactive silviculture, protection, and cuttings, and no delays in the regeneration and silvicultural treatments of young stands. Due to the need for maximum profits, the selection of species and varieties or clones of species is quite strict and includes risk analysis. Often, biodiversity issues at a landscape scale are also taken into account by leaving some portion of the plantation area unmanaged (Carnus et al. 2003).

Smallholder Plantations

Smallholders can usually plant only small areas (less than 1 ha), which are not needed for crops. Since 1980s, many governments and international organisations have promoted smallholder tree planting with campaigns or by providing free seedlings and training. Because the support has often been restricted to planting, many farmers have not continued to manage plantations after their establishment, and plantations have failed. However, in some cases markets may have encouraged smallholder plantation management. For example, in Western Cameroon, the demand for electricity and phone poles stimulated small scale Eucalyptus plantations. When plantation establishment has been followed by proper extension and training, the results have been much better. When a plantation is small, planted trees can often be individually managed. Another typical phenomenon for smallholder plantations is that indigenous trees are planted more often than in large plantations.

Ownership and land tenure issues can in many cultures hinder effective tree planting and management. The more individual the land ownership, the more effectively trees are taken care of (Eboh 1999; Urgessa 2003). In cases of land shortage, communal land ownership is disappearing and being replaced by individual ownership.

In most cases, smallholder tree planting needs to be promoted by training, by offering free seedlings and other planting materials, or by direct financial incentives. In addition, there is a need to show the future benefits for the farmers' livelihood. In the past development aid agencies directly promoted smallholder plantations, but today local NGOs, with support from international NGOs, have increasingly taken on this role.

7.4 Development Mechanisms and Current Trends of Planted Forests

From Natural Forests to Plantations

In some cases, plantations have replaced natural or former man-made ecosystems. A forest plantation is in many cases established on previous forest or woodland whose earlier tree cover has just been removed. This was frequently the case in the 1960s and 1970s in Africa (e.g. in Zambia, Malawi, Tanzania). The conversion was based on the assumption that the planted tree species are better growing, yield better economic results and are easier to manage than existing forests. In many cases, as in Zambia, the old miombo woodland was felled using heavy machinery, and the wood was left to local people for charcoal making or it was burned on site before new exotic species were planted. The ecosystem change from forest or woodland to plantation is very similar to that of forest clearing for intensive agriculture.

The establishment of plantations on pristine or almost pristine forestlands is not recommended, nor is it done on a large scale anymore, but many plantations were established in that way in the 1960s and 1970s. Patches of natural forest (along river banks, areas with rocky or shallow soil, fallows) often remained in a natural state within plantations, mainly because such sites were unsuitable for planting. However, these patches are important sources of biodiversity. Nowadays, when new plantations are being established in natural forest areas, many governments (e.g. Brazil) require that large portions of the land be left in a natural state. This guarantees the maintenance of biodiversity to some degree. The preservation of natural forest and possible increase in biodiversity can often be achieved when pristine forest patches are retained within plantations; this way they are also better protected than if they were outside plantations. There are good examples in tea estates in Tanzania and Malawi, where natural forest patches within the estates are rich in biodiversity because of long-term protection by the tea estate owners.

When large commercial plantations are established, local people may lose part of their ancestral lands and the rights to utilize forests that belonged to them in earlier times. New job opportunities in the plantations have seldom compensated these losses, and local people can therefore adopt quite hostile attitudes towards plantation owners. They may even react by harming plantations and their management; this has happened for example in Zambia.

From Degraded Forests to Plantations

Presently, a more frequently used and more ecologically sound practice is to establish plantations on sites where former forests or woodlands have been

degraded by human use (cattle grazing, shifting cultivation, and so on, in places like Aracruz in Brazil, in Central America, in Indonesia). In these cases, an earlier artificial ecosystem is replaced with another artificial ecosystem (Maginnis and Jackson 2003). The plantation can also be a preliminary stage towards recuperation of natural forests by providing a better environment (e.g. crown cover) for indigenous trees to establish themselves (Fimbel and Fimbel 1996). For instance, the raw material sources for a pulp mill in Brazil (Stora Enso/Aracruz) are planted on degraded forestland that was mostly abandoned pastureland. Almost half of the total area is left in its natural state, to return to a coastal rainforest. These areas will form the largest natural coastal rainforest in the area. If the patches of natural forest within a plantation are kept intact, they will in the future contribute to the restoration of biodiversity.

The trend towards using former forestland in reforestation is increasing as the productivity of pastures is decreasing. In countries like Malawi, legislation prevents the establishment of tree plantations in areas that are suitable for agriculture. As there is a shortage of land, the herds graze in forests that otherwise would be suitable for tree plantations, and compete with tree planting as a land management option.

From Natural Grasslands and Old Open Areas to Plantations

Plantations can also be established on land that has never (natural savannas) or at least never during historic times had a tree cover (e.g. man-made alang-alang areas in Indonesia). Open savannas and grasslands have been converted into plantations, and planted trees have been used as windbreaks to protect adjacent agricultural lands. In Indonesia, about 15 million ha of former rainforests have long ago been converted by frequent man-made fires into permanent grassland called alang-alang, dominated by *Imperata cylindrica* (locally alang-alang) grass. Wood industry companies (e.g. Stora Enso) have started reforesting these areas under concession contracts. The raw material from these plantations will be used in planned pulp mills. The production possibilities of these areas are great and plantations reduce the pressure to use pristine rainforests as sources of raw material.

Methods of Plantation Establishment and Consequences of Planting

Most plantations are planned to be permanent, meaning they will sustain successively planted tree generations. The establishment of the first tree generation differs from the succeeding ones. The next generation can, in the easiest case, arise from coppice, and only thinning of the shoots is needed to get the new forest to grow. However, the coppicing ability of trees decreases with each coppice rotation, and the forest has to be regenerated from seedlings after two to three coppice rotations (Kaumi 1983; Schönau 1984). The use of coppicing is only possible with a few tree species. In most cases, as with conifers, every generation has to be planted separately. The first plantation generation is mostly established on well-cultivated (tilled) soil, which has been cleared from previous vegetation and tree stumps. The new tree generations are often planted after burning or after merely removing the debris. The results of studies on wood production in successive generations vary (Evans 1998), but in most cases, the growth rates remain stable as long as sound management practices are followed.

The cutting of trees usually removes considerable amounts of nutrients from the site. This nutrient loss depends on the species and type of harvesting, but it is always likely that natural processes cannot adequately replace or release lost nutrients. With increased knowledge about the nutrient balance of planted trees, more environmentally friendly methods for plantation management have been developed (Evans 1999b). However, burning is still a common method for clearing the land, both at the time of plantation establishment and after each clear-cut. Lack of nitrogen in the soil is a common problem, and losing it through burning reduces the growth rate of the next plantation generation.

Especially in large-scale plantations, the use of cloned seedlings is increasing, although this may lead to greater vulnerability to disease. The gains in production and quality make up for the greater protection costs. The trend seems to be towards the use of more specialised varieties and/or clones that will require special management skills, and a conversion of the ecosystem into a high-tech production field. Environmental groups strongly oppose the use of genetically modified trees, which so far have not been deployed on an operational scale (Cossalter and Pye-Smith 2003).

7.5 Composition and Structure of Planted Forests

The Use of Exotic and Indigenous Species

Exotic tree species tend to predominate in both industrial and rural development plantations worldwide, *Eucalyptus* and *Pinus* being the most common species (Evans 1999a; FAO 2001). Exotic trees are often preferred in plantations for a number of reasons: there is generally more silvicultural information available on exotic trees and their management techniques have been tried, well tested and popular-

ized; it is often possible to obtain seeds of known genetic makeup and certified origin, and in some places they have been and still are the main tree species available to local people; the markets for exotic plantation products are generally well established; and on the sites available for afforestation (which may be inherently unproductive or degraded), exotic species perform usually better than natives in terms of the products sought and/or production systems feasible. However, in several regions, native species are preferred due to their timber value and their function in environmental restoration, or because local farmers favour them for their multiple uses and the services they provide.

Native trees can be more appropriate than exotics because they are better adapted to local environmental conditions; their seeds or propagules are locally available; and farmers are familiar with them and their uses. Besides, the use of indigenous trees in production systems helps preserve genetic diversity and provides habitats for local fauna. There are several possible disadvantages to using native species: uncertainty concerning growth rates and adaptability to different soil conditions; general lack of management guidelines; lack of genetic improvement for most species; high incidence of pests and diseases (e.g. *Hypsypilla grandella* attacks on mahogany and cedar species); lack of established markets for many species; and need to collect seeds because they are not often commercially available.

Several exotic species that do not have local enemies grow free from pests. However, local pests have in some cases adapted to exotic species and caused serious problems, e.g. the yellowing of china berry trees (*Melia azederach*), stem cankers in Australian cedar (*Toona australis*) in NE Argentina and Paraguay, and stem rotting of *Acacia mangium* in Costa Rica.

In some regions, commercial forestry is based on preferred native species. For example, loblolly pine (*Pinus taeda*), which has a broad natural range in the United States, is the dominant timber species in the majority of commercial forests in the country's southern states, and it is harvested from both managed forests and plantations (Schultz 1997). In Misiones, NE Argentina, the native *Araucaria angustifolia* is preferred for its timber value, but plantations of exotic species of pines or eucalypts are predominant (Eibl et al. 2000).

In many tropical regions, the strongest arguments for planting native tree species are the high value of the wood of these species, their increasing scarcity in commercial forests, and a more complete use of all tree parts by local people. Many native tree species with valuable timber grow well in open plantations, with rates of growth comparable or superior to those of exotic species on the same sites. Examples of this are the native tree species *Vochysia guatemalensis* in Costa Rica, whose growth rate and value are similar to those of the exotic *Gmelina arborea*, and the native *Terminalia amazonia* in Costa Rica and Panama, with growth rates similar to those of teak, which is broadly grown as an exotic in both countries (Piotto et al. 2003). Some private companies, with major investments in plantations of exotic species such as teak, also plant native species as part of their environmental programs, as an experiment, or to obtain future profits (Piotto et al. 2004a).

Native species are often preferred for land restoration purposes, especially when the environmental services of plantations are considered more important than timber production. In some regions of the humid tropics, indigenous plantations are established when reforesting degraded land on small and medium-sized farms both for obtaining tree products (fuelwood, timber) and for soil restoration (Piotto et al. 2003). In Sahelo-Soudanian Africa, native species are well adapted to being planted along waterways, and to protect and restore the soil. These species have an ability to survive the dry season and to resist damage caused by grazing animals. In addition, most of the native species that are technically easy to reproduce are leguminous. Plantations of *Faidherbia albida* are nowadays favoured in development projects (Peltier 1996; Boffa 1999), linear plantations of *Acacia nilotica* are used in restoration along waterways and in providing garden protection, while *Acacia senegal* and *Acacia polyacantha* are used in planting fallows (Harmand 1997).

Even though native species have many ecological advantages and local people know and appreciate them, native species are not necessarily requested by local people. In Sahelo-Soudanian Africa, for example, exotic species are used in establishing plantations for several reasons. One common explanation is technical: exotic species come with the "technique", i.e. the needed information on silviculture and genetic performance is available. This is partly explained by the fact that both state and various development organizations, including NGOs, have proposed exotic trees for planting for decades. Techniques for growing exotic species are nowadays far better established than those for local species, although the use of some local species, such as *Acacia nilotica*, *Acacia senegal* and, to a lesser extent *Faidherbia albida*, has increased.

Another reason for the use of exotics in planting is socio-cultural. People in the Soudano-Sahelian countries generally consider Nature to belong to everybody. They often think that God has created it and takes care of it. It is commonly believed that "the trees and the 'bush' will always be present". Even though this perception is changing due to resource scarcity, it is still predominant. Consequently, local people take a major risk when they plant native tree species because other people may consider that these trees belong to Nature, and therefore to everybody, and may use them at will. Thus people prefer to plant exotic species, which carry a "sign" that they belong to someone. In addition, exotic trees may imply a mark of dignity, and their planting may thus increase the social prestige of their owners.

Social dimensions, which may affect plantation development, also include gender-based differences in tree ownership and management. Women's rights to the land and trees are usually quite restricted. Thus, although women are the main users of wood as fuel for cooking, they have to collect fuelwood further away in the savannas, while men manage the trees in the fields. This gap between women, who are the main tree users but have little rights to them, and men, who have rights to land and trees, but who are not directly interested in fuelwood supply, does not favour the development of forest plantations.

Mixed-Species Plantations

Most plantations worldwide are planted with one tree species of commercial value. In single-species plantations, the main interaction between individual trees is in competition for nutrients, water, and light. In mixed-species plantations, differences in the utilization of resources spatially and in time may lead to greater primary production. When combining tree species that differ in growth requirements and production, the inter-species competition may be reduced and output can exceed that of single-species stands (Kelty 1992). Stratified mixtures that include rapidly growing over storey species and slow-starting but higher-producing species, are likely to yield greater total productivity than pure stands of shade-intolerant species (Smith 1986). Mixed stands can also improve the survival and growth of a particular species on nutrient-poor soils (Binkley et al. 1992).

Mixed-species plantations have been established at several locations with varying results (Wormald 1992). Data from several field experiments suggest that mixed plantations can be more productive than single-species systems (Montagnini and Porras 1998). Mixed plantations yield more diverse forest products, thereby helping to diminish farmers' risks in unstable markets. Even though there are certain technical difficulties in establishing and managing mixed plantations, farmers may prefer them as a way to spread their investments and as a potential safeguard against pests and disease (Piotto et al. 2003). Mixed stands can also support a greater variety of wildlife and contribute to higher landscape diversity.

Mixed plantations can have many productive and environmental advantages over monocultures. However, their main disadvantages lie in their more complicated design and management. Thus, mixed plantations are often restricted to relatively small areas or to situations where diversifying production is of great advantage, as in the case of smallholders with limited resources. For example, about 12 000 hectares of mixed plantations had been planted by the year 2000 in Nicaragua. The average size of these plantations was 1.8 hectares. Farmers used more native than exotic species in reforestation, preferring the following fast growing species: *Azadirachta indica*, *Caesalpinia eriostachys*, *Eucalyptus* spp., *Gliricidia sepium*, *Leucaena leucocephala*, and *Tectona grandis*. The most common plantation system consisted of a mixture of timber and fuelwood species, both of which were planted and managed to satisfy farmers' domestic needs (Piotto et al. 2004b).

Gerardo Mery

Large scale plantations – like this 2 years old Radiata pine plantation in Valdivia, Chile – are increasingly producing industrial roundwood for the world markets. Intensively managed plantations are likely to supply over 60 % of industrial roundwood by 2050.

Some private companies are also willing to establish mixed plantations, but dedicate most of their land for planting single species of higher commercial value. For example, in the Peninsula of Nicoya in Costa Rica, a private company has reforested most of its land with *Tectona grandis* (exotic) and *Bombacopsis quinata* (native) (Piotto et al. 2004a). In the Chiriqui region of Panama, a company is buying abandoned pastureland to establish pure and mixed plantations for foreign investors. Since 1994, the company has mostly used native species in reforestation; these species produce fine high value tropical hardwoods, carbon credits, and non-timber forest products. Mixed plantations have also been used in forest restoration projects, for example in reforestation in tropical Australia (Kanowski et al. 2003), in the restoration of bauxite mines in the Amazon (Parrotta et al. 1997), and along the banks of the Panama Canal (PRORENA 2003).

New Definitions – New Plantations

Increased awareness of the multiple products and services forests provide, and new commitments to address rural poverty, have converged in efforts to link conservation and development through the commercial development of forest products, in particular NTFPs (Belcher et al. 2003). Some of the areas plant-

Markku Kanninen

Teak plantation in India produces high value wood for local and international markets. Planting native tree species can be more appropriate than exotics because they are better adapted to local environmental conditions; their seeds are locally available; and farmers are familiar with them.

ed with non-forest tree species have been included in plantations because they can serve as sources for both NTFPs and timber. The total reported area of non-forest species plantations by 1995 was assessed to be 26.5 million ha, 90% of which was in Asia and the Pacific region, 7% in Latin America, and the remainder in Africa. About 80% of these plantations were concentrated in five Asian countries, namely Indonesia (33), Malaysia (17%), Philippines (12%), Thailand (9%), and India (8%). In the other two regions, the countries having a significant area were Brazil, Colombia, and Mexico in Latin America, and Nigeria, Tanzania, and Cote d'Ivoire in Africa (FAO 2002).

According to FAO (2002), Coconut palms (*Cocos nucifera*) covered the largest area, about 42% of the non-forest species plantations, rubber trees (*Hevea brasiliensis*) 36%, and oil palms (*Elaeis guineensis*) 22%. The largest areas of coconut palm plantations were in Indonesia (33%) and in the Philippines (28%), the largest rubber tree plantations in Indonesia (34%), Thailand (21%), and Malaysia (18%), and those of oil palms in Malaysia (43%) and Indonesia (29%). Much of this expansion has been associated with the conversion of tropical forest into non-forest species plantations. If the definition of plantation expands to include other "non-forestry" species in addition to rubber trees, the global plantation area is expected to increase by 17.1 million ha. This would include coconut palm, oil palm, bamboo, rattan, and nut species plantations. For example, according to the fifth national forest inventory of China (1994–1998), 2.74% of the total forest area is bamboo, that is 4.21 million hectares, of which 2.90 million ha is planted (Lobovikov 2003).

7.6 Benefits of Planted Forests

Industrial Plantations

Plantations can directly benefit both the individual investors who are involved in the development of industrial plantations, as well as the general public, through job generation and other economic activities that result from these developments. Industrial plantations can also directly benefit local farmers, who may have opportunities to participate in rural development projects with external financial aid, or who may establish plantations using government incentives. In addition, plantations can benefit societies as a whole through their positive environmental impacts.

Industrial plantations can bring economic development to a region or to an entire country. The benefits must be weighed against their potential negative environmental effects, especially when plantations replace natural forests. The development of industrial plantations based on the exotic *Pinus radiata* in New Zealand and Chile, contributes greatly to the economic development of these countries. *Pinus taeda* is a major plantation species in the southern United States, where it is harvested both from plantations and from natural forests, where it grows as a native over a broad range (Schultz 1997).

Other outstanding industrial plantation developments include *Eucalyptus* spp. in Congo, Brazil, and other countries in the tropics. For example, Aracruz Cellulose in Brazil is the world's leading producer of bleached pulp, producing 30% of the global supply. The pulp is used in the manufacture of high value-added products, such as tissue paper, printing and writing paper, and specialty papers. Aracruz's forestry operations involve some 242 000 ha of eucalypt plantations, intermingled with 121 000 ha of company-owned native forest reserves. The company exports almost all of its production, currently 2.4 million tons per year, and it is one of the largest earners of foreign currency in the Brazilian manufacturing sector, making a substantial contribution to the country's balance of trade and overall development.

In Misiones, NE Argentina, plantation development has largely been the result of government incentives promoting commercial pulpwood plantations (principally *Pinus elliotii* and *P. taeda*). The issues favouring pulp and timber industry development in the area were high yield, relatively short rotation of the selected species, and availability of high-quality labour. This type of large-scale plantation development has attracted much criticism from the environmentalists. For example, some authors (Cossalter and Pye-Smith 2003) have expressed concerns about the potentially deleterious effects of eucalypts on downstream water yield. In addition, industrial plantations have frequently replaced natural forests. For example, Aracruz's hybrid eucalypt plantations replaced parts of the Atlantic rainforest, one of the most endangered forest ecosystems of the world. However, deforestation was already very severe in that portion of the Atlantic forest region, and plantations were established on previously deforested, degraded pastureland. The company's environmental division also emphasizes that areas of native forests are interspersed with plantations as a way to mitigate the negative environmental consequences of growing large monocultures of exotic trees.

The forest inventory of 1850 revealed that, at that time, the total area of natural forests in Misiones, Argentina was 2 600 000 ha. The subtropical forest

BOX 7.4 Plantation Forestry in a Variable Retention Forest Management System

C. Mario Di Lucca and James W. Goudie

Forest management in British Columbia, Canada, is in transition from a traditional plantation forestry cycle of clear-cutting, replanting, and growing forest crops, towards a new timber-harvesting paradigm that emphasizes ecological as well as economic objectives. The variable retention approach to harvesting is an adaptive management strategy required to facilitate conservation, ecosystem function, and biological diversity. This approach retains structural diversity characteristics – trees of varying sizes, snags, down woody debris, etc. – from the original stand after harvest, thereby maintaining some of the original forest attributes (Beese et al. 2003). The harvested portion of the stand is then regenerated or replanted following ecological site-specific prescriptions.

The level and spatial retention pattern is very flexible depending upon management objectives and site-specific conditions (Franklin et al. 1997). The Scientific Panel first introduced variable retention in British Columbia for Sustainable Forest Practices in Clayoquot Sound (CSSP), to develop new ecosystem management practices for the rainforest ecosystems of Clayoquot Sound of coastal British Columbia. The panel was formed by scientists and aboriginals for the purpose of developing a strategy for harvesting old growth forests while maintaining some of the structural elements of the existing stands. The ecological objectives of this strategy were: to provide immediate after-harvesting habitat for biodiversity; to enrich current and future forests by maintaining some remaining structural features and organisms from the previous stands; and to improve connectivity between cutting units and forest areas (CSSP 1995). This strategy also meets social objectives by protecting culturally important sites, visual quality, and recreational values.

Based on recommendations from this panel, Weyerhaeuser and other forest product companies adopted variable retention harvesting as the standard for stand and forest level planning in coastal and interior British Columbia forest ecosystems. The potential long-term implications of this new paradigm needed to be addressed; therefore, several research projects were established to investigate, for example, how shading and competition of the retained trees will influence the newly regenerated or planted area of the stand (STEMS 2003). Other technical implementation issues, such as block layout, workers' safety, wind throw losses, pests and diseases incidence, and economics, were also considered.

Furthermore, the effects of this strategy on growth, yield, and timber supply are unknown because little or no long-term data exist in British Columbia. The acceptance of this approach increased requests for its incorporation into growth and yield computer programs, such as the Table Interpolation for Stand Yields (TIPSY), to allow yield predictions of regenerated managed stands after variable retention harvesting (Di Lucca et al. 2004). TIPSY is the primary source of yield tables for managed stands used for timber supply analysis in British Columbia. The Tree and Stand Simulator (TASS) (Mitchell 1975) generated the TIPSY

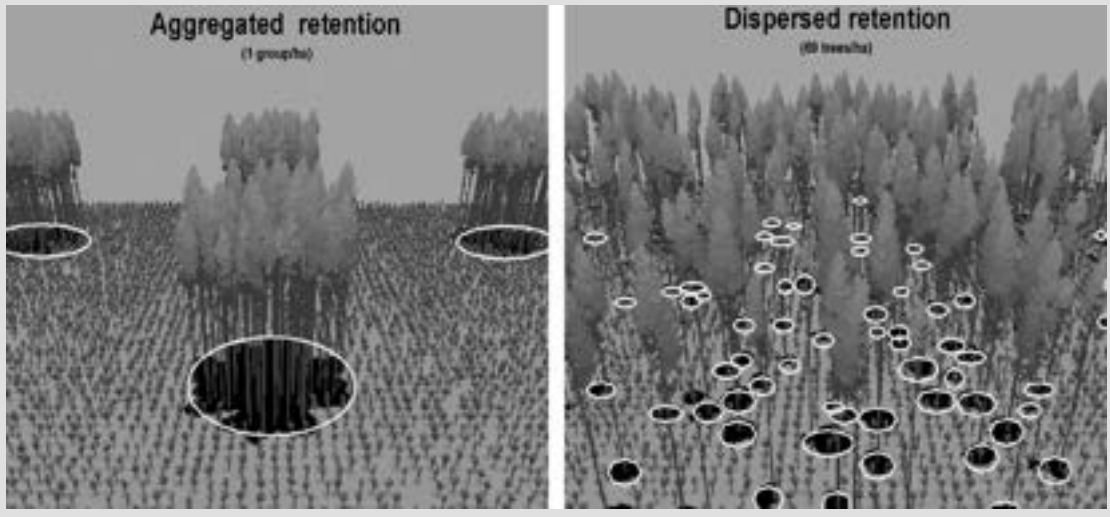

Figure 1. TASS images for plantations under 10 % retention, 10 years after variable retention harvesting for 1 aggregated group (left) and 69 dispersed trees (right) per ha

database, and simulated the growth and yield of the retained and regenerated portion of the stand for aggregated and dispersed retention patterns. These generated data were analyzed to develop models that predict variable retention volume adjustment factors (VRAFS), and other variables for simulated managed stands of coastal Douglas-fir, western hemlock, lodgepole pine, and white spruce.

The VRAFS were generated by determining the merchantable volume of the regenerated or planted trees after variable retention harvesting, relative to yields after a traditional clear-cut at different harvesting ages, site indices, and retention levels. The yield of the retained trees was not included in the analysis. The retention level was defined as a percentage of the projected crown area retained from the original stand. The edge length and the percentage crown cover were the main drivers in the variable retention adjustment model, therefore ancillary models were developed to predict these variables if they are not available.

Edge length is one of the key factors differentiating variable retention regimes because it numerically accounts for the pattern of the retained trees. Figure 1(a, b) are TASS generated images representing a 10% retention as either aggregated or dispersed trees 10 years after variable retention harvesting and planting. The circles around the retained trees represent the vertical projection of the open crown edges on the ground. In this example, the total edge length ranged from 118 to 910 m per ha for the same number of retained trees.

Edge length is directly related to the ability of the retained trees to occupy growing space and affect the productivity of the regenerated or planted trees in the harvested portion of the stand. Goudie (1999) demonstrated that the volume of the planted stand decreases as the edge length of the retained stand increases.

Forest managers in British Columbia are facing a new timber harvesting and plantation challenge to address ecological and economic objectives. The variable retention approach to harvesting and plantation will provide conservation, ecosystem function, and biological diversity. This new paradigm also meets economic and social objectives by protecting culturally important sites, visual quality, and recreational values. The variable retention growth and yield implications are an important component of long term timber supply planning.

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BOX 7.5 Ecosystem Management and Biodiversity in Plantations

Biodiversity in Tropical Plantations

Florencia Montagnini

Plantations can have different effects on landscape biodiversity depending on their characteristics and management, and on the type of ecosystem replaced by a plantation. If plantations are established on land carrying natural forests, they result in a decrease in biodiversity. However, if plantations are established on degraded or barren land with poor natural regeneration, they may result in an increase in biodiversity.

In many tropical regions physical or biological barriers may significantly delay forest regeneration, and the recovery of degraded landscapes through natural regeneration processes will not take place within a time frame acceptable to the foreseen human use. (Kuusipalo et al. 1995). The establishment of plantations may overcome some of these barriers by attracting seed dispersal agents into the landscape and by ameliorating local microclimatic conditions within the area, and thereby accelerating the recovery of these lands (Montagnini 2001).The establishment of tree plantations in degraded areas may facilitate regeneration of native species that could not otherwise become established in open microsites or in competition from herbaceous species (Lugo 1992). Plantations promote understorey regeneration by shading out grasses, increasing the nutrient status of the topsoil (through litterfall), and facilitating the influx of site-sensitive tree species. In addition to promoting biodiversity, forest regeneration can restore soil fertility, reduce erosion, reduce fire hazards, and restore biological productivity (Montagnini 2000).

Several authors report on the role of tree plantations as catalysers in natural succession. In South-East Asia, Kuusipalo et al. (1995) reported on the spontaneous and fast growth of indigenous tree species under exotic trees plantations. On the other hand, in northern Queensland in Australia a greater diversity of species was found in the understorey of plantations of native species than in plantations of exotic species (Keenan et al. 1999). In Puerto Rico, in the understorey of plantations of *Albizia lebbek*, twenty-two species of trees and shrubs were found, which is in strong contrast with just one species in control plots without trees (Parrotta 1992). At La Selva Biological Station in Costa Rica, the results of some studies also suggest that tree plantations have good potential for accelerating the processes leading to the recovery of biodiversity on degraded soils (Cusack and Montagnini 2004).

Mixed plantations may offer a more favorable environment for natural regeneration than pure plantations, due to their multi-strata architecture. Mixed plantations may also offer a higher variety of environments for seed dispersers and potentially create a greater variety of ecological niches allowing for the establishment of diverse regeneration. At La Selva Biological Station in Costa Rica, mixed plantations with native tree species had a relatively high abundance of regenerating species in their understorey in comparison with pure plantations. Natural regeneration was higher in understories with low or intermediate light availability. Most of the seeds entering the open pastures were wind-dispersed, while most seeds entering the plantations were dispersed by birds or bats. This suggests that the plantations facilitate tree regeneration by attracting seed-dispersing birds and bats into the area.

The different species in the plantations create different conditions of shade and litter accumulation, which in turn affect forest regeneration (Carnevale and Montagnini 2002). Competition from grasses is a major factor influencing woody invasion under plantations. High accumulation of litter on the plantation floor may help diminish grass growth and thus encourage woody invasion under the planted species' canopies. On the other hand, high establishment and maintenance costs are potential disadvantages of the use of plantations for accelerating natural regeneration, given the intensive management that is needed especially in the first 2–3 years (Montagnini et al. 1995).

Plantation management can greatly affect the role of plantations in recovering or preserving landscape biodiversity. Species choices and plantation design are the two most important factors affecting the role of plantations in promoting biodiversity. Pure plantations of exotic species lie at the low end of biodiversity. Mixed plantations with native species can be more favourable to plant and animal diversity, as is shown in the example above.

Biodiversity in Temperate Plantations

Susan Iremonger, Paul Giller, John O'Halloran, Daniel Kelly and Fraser Mitchell

Forest covers nearly 10% of the Republic of Ireland, and over 85–90% of this forest is in intensively managed commercial plantations. Forest policy aims to increase the country's forest cover to 17% by 2030, mainly by planting new commercial forests. This represents a high proportion of the land area and will have huge environmental, economic and sociological implications. Knowledge of the nature and extent of biodiversity in plantations and how it is affected by anthropogenic activities is vital to sustainable development and indeed to life. However, very little is known of the biodiversity of these forests, and to address this information gap COFORD (the National Council for Forest Research and Development) and the EPA (Environmental Protection Agency) have supported a multidisciplinary project using funds from the National Development Plan.

BIOFOREST (see http://bioforest.ucc.ie) is a large-scale research project running from 2001 to 2006 providing much-needed basic information on biodiversity in Irish plantation forests.

The BIOFOREST project set out to focus on forest biodiversity with the following three sub-projects:

- Biodiversity assessment of afforestation sites
- Assessment of biodiversity at different stages of the forest cycle
- Investigation of experimental methods to enhance biodiversity in plantation forests.

The BIOFOREST Project has studied more than 100 sites, distributed around the country. The forests were mainly dominated by Sitka spruce (*Picea sitchensis*, a non-native species) and ash (*Fraxinus excelsior*, a native species), which are currently the most widely planted conifer and broadleaf species, respectively. Key indicator organisms studied in the forests were:

- Animals: Birds, hoverflies, spiders and to a lesser extent moths and beetles.
- Plants: Higher plants, ferns, mosses, liverworts and lichens.

Results to date have shown that these intensively managed commercial plantations mainly dominated by non-native tree species can support diverse species assemblages over the forest cycle. Although these contain a large proportion of generalist species and few species of conservation importance, mature stands develop a characteristic woodland flora and support forest specialist spiders and hoverflies. Spruce forests containing ash as a minor component in a non-intimate mix were more species-rich than those with no ash. The results support many of the management recommendations in the Forest Service's *Forest Biodiversity Guidelines*, including the choice of site location and design of open spaces and boundary habitats at the forest planning stage. Key issues for forestry management were the importance of thinning in opening up the forest canopy, the retention of standing and fallen dead trees and the retention of scrub habitat (Gittings et al. 2004; Iremonger et al. 2004).

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of Misiones formerly covered more than 100 000 km^2 in parts of Argentina, Paraguay, and Brazil, but has now been reduced to less than 10% of its original size. However, pulp and timber plantations are generally established on relatively flat land, along the Paraná River, while most of the upper elevations of the watersheds and riparian areas in the province are still covered by natural forest. The relatively large proportion of forest under protected status ensures conservation of the diverse ecosystems of the region. Their use in ecotourism also contributes to diversifying the economy of the province.

Benefits to Society

Plantations provide general benefits to society as a whole because they can serve in combating desertification, protecting the soil and water resources, rehabilitating degraded lands, providing rural employment, and sequestrating carbon to offset carbon emissions (Evans 1999a; Montagnini and Jordan 2005). Plantation management can greatly affect the role of plantations in providing social and environmental benefits (see Boxes 7.4 and 7.5). The economic and social benefits of plantations have been debated as much as their environmental impacts. For example, it may be claimed that plantations generate employment, but it may also be argued that this is true only in the first phases of plantation establishment. Plantations can bring economic development to a country: exports may contribute to the balance of payments, taxes may flow to the national treasury, and plantations may generate jobs and prosperity. The governments of several countries – most notably China, Japan, and the Republic of Korea – have invested in medium- and long-rotation plantations precisely because they are seen as a means of creating jobs and stimulating rural development (Cossalter and Pye-Smith 2003).

From a regional development point of view, plantations can also result in economic losses. Some industrial plantations are established with financial support from the state, and thus public funds are used to finance private economic ventures. The economic benefits of plantations must be publicly recognized in order to justify the investment of public monies. The advantages of plantation-based economic development must also outweigh the potential negative environmental effects of plantations for them to be considered a successful development venue.

Benefits to Local People

In addition to providing timber products, tree plantations can be a source of cash, savings, and insurance for local farmers (Chambers and Leach 1990; FAO 2003). Tree planting in plantations or in agroforestry systems have formed an important component in many international development projects, especially on degraded lands in the tropical regions, where they have been introduced as an alternative to slash-and-burn agriculture, and to provide timber and fuelwood for local farmers. Rural farmers often respond positively to government reforestation incentives (Evans 1999a), planting portions of their farms with species recommended by local technical personnel. Planting these tree species is an attractive alternative for farmers, and fuelwood from thinning is an additional source of income.

In Costa Rica, the forestry legislation includes incentives for the establishment and management of plantations, especially on abandoned pastures and other deforested lands. Because of these incentives, interest in establishing plantations has grown among farmers. Nicaragua has also begun to expand its reforestation programs in response to the deterioration of its forest resources. The Social Environment and Forest Development Program began to establish forestry plantations for the benefit of farmers, using species recommended by the National Forest Service of Nicaragua (Piotto et al. 2004b).

Individual or community forest plantations can be necessary for supporting local livelihoods, but the need to establishing these plantations, and their functions, vary among regions. In "wet" regions (more than 900 mm of rainfall/year), fast growing plantations may be established in order to provide industries with forest products, and to raise the local people's living standards. In the drier regions, plantations may be necessary in the long term for providing energy and other needs in the countryside.

However, while industrial "plantations to promote livelihoods" are quite well spread, due to the fact that they are linked to trade processes, the "plantations to survive", established mainly for fuelwood, are very limited, especially in Africa. Over the years, states have tried to reduce the exploitation of natural forests and woodlands and at the same time fostered the use of new sources of energy for reducing the use of fuelwood. However, at the beginning of this third millennium, fuelwood is still the most important source of energy in the world; this fuelwood comes mainly from natural forests and woodlands, not from plantations. In addition, the process of decentralization and the transfer of management of natural ecosystems from the government to local people, has increased tree cutting. The "plantations to survive" are becoming a more important issue, and we should promote tree planting for multiple benefits.

7.7 Conclusions

The importance of roundwood supply from global forest plantations (35%) is much higher than their share of forest area (3.5%). In 2000, the global plantation area was estimated to be 187 million ha, of which 89 million ha were industrial plantations. The importance of forest plantations to global roundwood supply will increase in the future and can reach 50% before 2050. Non-industrial plantations (48 million ha in 2000) are important in many regions, especially for fuelwood and non-wood forest products, as windbreaks, and for water conservation. However, outlook studies, databases, and scenarios differ greatly from each other. The estimation of plantation-origin roundwood supply, and the differentiation between industrial and non-industrial plantations, should be improved. The statistics on plantation area and their development vary greatly among countries and regions. This means that in many of the most important plantation countries, the estimates on plantation area are very uncertain.

More exact plantation area estimation by national forest inventories and programmes is necessary. Plantation area statistics should also be given at provincial (sub-national) levels in the most important plantation countries. Many definitions exist for plantations and planted forests. The many changes in definitions have complicated the comparison of plantation areas and supply from plantations, and even the concept of plantations, on a country level. The definition and concepts of planted forests must be harmonized. It is suggested that planted forests should be the main definition, and that the work by FAO in harmonizing forest-related definitions for use by various stakeholders be the basis.

Plantation development appears to be polarizing – large plantation countries are increasing their plantation area, and smaller ones are decreasing. This means that large industrial plantations are dominating the wood supply in many countries. Policies should particularly encourage the development of smallholder and multi-purpose plantations, which require tenure security and subsidies to be profitable. Large plantations, established as raw material sources for pulp and paper mills, are increasingly using genetically improved planting material. The resulting gains in productivity and quality of timber are achieved partly at the expense of narrowed genetic base. A wide genetic variability is needed in plantations to minimise the risks of using monocultures.

Native species can be as productive as, or even more productive than, exotic species in many locations. Native species are often preferred by local people, because they know their uses and markets. Native species plantations can have better environmental effects than plantations with exotic species. Policies should encourage the establishment of plantations preferentially using native species, chosen from those that are known in each region for

their good growth and economic as well as environmental benefits. Mixed plantations can have several advantages over pure species plantations, especially when planted on degraded lands. Mixed plantations hold greater biodiversity, and can encourage natural regeneration from nearby forests. Mixed plantations can have more beneficial effects on the soil fertility of degraded land. Policies should encourage the establishment of mixed plantations with species that can grow well in these conditions, following recommendations of local technical personnel.

Restoration of degraded forest areas is desperately needed to prevent soil erosion and other harmful effects of land clearing that often lead to permanent changes in productivity. Planting trees, exotic or indigenous, reverses the degradation process and often creates conditions for original forest species to recover. Policies should improve both the economic and social conditions for restoring degraded areas. Forest conditions created by both planted exotic and indigenous species enable the reintroduction of original species to degraded areas.

Land and tree ownership issues are crucial in the promotion of tree planting. As long as ownership is not clearly defined, and income from sales from planted trees guaranteed to those who actually take care of the planted trees, permanent increases in the scale of the planting are difficult to achieve. Policies should emphasise and clarify land tenure issues, and especially ownership of the planted trees and tree plots. Particular attention must be paid to underprivileged people.

Tree plantations may be considered one element of a landscape that has ecological as well as social functions. Mixed-plantations, or a range of monospecific plantations belonging to one production system, should be favoured. At the local level, a farmer or herder will consider the interest of a plantation if he or she has some guaranties of land access, but also if this plantation is well integrated in his/her production system and in the rural system he/she belongs to. Despite ethnobotanical practises that can be connected to the multiple use of forests, there is still a gap between the management recommended by forestry professionals on the one hand, and the indigenous use of forests on the other. The policy recommendation is to consider forest plantation not for and by itself, but as an element of a landscape and a human construction, individual and collective. Multi-use plantations should be promoted according to local people's practises.

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PART III

Cross Cutting Issues in Sustainable Forest Management

Lauri Mäenpää

8 Forest Assessment for Changing Information Needs

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Abstract: Forest assessment aims to meet the information needs of forestry for management decisions. It was introduced more than 500 years ago, when an increasing demand for continuous wood supply led to the idea of sustainable forest management. Since then, along with the evolution of planning from timber maximization to holistic ecological management, several changes in paradigms have occurred in the evolution of forest assessment. Today, forest assessment has been implemented worldwide with different intensities and at different scales, ranging from the stand level to the national, multinational and global scale. Paradigms are changing to differing extents in most of these forestry systems. Multinational systems based on collations of national results, as well as on harmonized transnational monitoring grids, assess indicators on forest health, climate change, carbon sequestration, biodiversity and sustainable forest management. However, even basic quantitative information on the forests of many developing countries and nations with large territories is founded on estimations. Remote sensing can contribute to closing gaps in knowledge, especially when combined with terrestrial assessments. Harmonization of assessment methods, standards and reporting systems among different countries enhances the comparability of results. This is a precondition for multinational assessments, utilizing synergies and avoiding duplications. Any forest assessment system must have clearly defined objectives, must rely upon a statistically sound survey design and must be subjected to strict procedures of data quality assurance.

Keywords: Forest assessment; forest inventory; information needs; sustainable forest management; remote sensing; quality assurance.

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8.1 Introduction

Forest inventories and assessment aim at providing the basic information needed in forestry. The first documented systematic collections of forest information were carried out in Central Europe as a result of an increasing demand for fuel wood and timber, e.g. for mining and ship-building. One of the first known forest assessments is that of a forest area in Austria, from 1499 to 1510, under Emperor Maximilian I (Zöhrer 1980). The demand for a continuous wood supply led to the idea of sustainable forest management, which was first mentioned in the 16th century in Saxonian forest law. H.C. von Carlowitz described the principle of sustainability in 1713 as follows (Speidel 1983):

"…Therefore the highest skills, science, efforts and planning will be founded on how the conservation and growing of wood has to be organized in order to achieve a continuous constant and sustainable utilization; this is an indispensable thing, without which the nation can not exist."

From these beginnings, as other social values related to the forest such as recreation, aesthetics, conservation, and indigenous land management increasingly came to the fore, new information needs began slowly to evolve. Information is needed for various purposes, and varies over space and time. Strategy related information on the size, condition, and development of forest resources is needed for broad planning and investment considerations. Man-

Table 1. Timeline: National forest inventory and technology development
(Zon 1910; Brack 1997; Natural Resources Canada 1997; Lund 1998; The History of Belgian ... 2005)

TECHNOLOGY AND INNOVATION	
1600s	First systematic collection of forest information in Europe
1846	Early forest statistics in Belgium – Ocular estimation
1850	Tree volume tables developed, random and strip line surveys
1900	Forest mensuration relationships increasingly used
1920s	Stratified sampling, aerial surveys pioneered in Canada
1950s	Variable probability sampling (plotness cruising)
1957	1st satellite launched by USSR
1975	Sophisticated models (taper model), use of sonic and laser technology
GIS becomes available	
1980–90s	First multi-source inventory developed
2000	Multi-phase, multi-stage inventories – Linear & non-linear regression models, Expert systems
DEVELOPMENT OF NATIONAL FOREST INVENTORY PROGRAMMES	
1617	Forest legislation is formed by the Edikt "in honor of and in the interest of the woods"
1846	Canada beginning of forest tenure/ license policy
1854	Belgium Forest Act
1882	American Forest Congress, Montreal
1892	Sierra club founded
1900	Canadian Forestry Association established
1910	First report on the world's forest resources by US Forest Service
1920s	1st NFI New Zealand 1921–23
1920s	1st NFI Finland, Sweden & Norway 1921–24
1930s	1st NFI for the USA commenced
1947	1st Forest Resources Assessment (FRA) by FAO
1961–85	1st NFI Mexico, but only partial cartographic coverage
1963–67	1st NFI Nepal, assisted by USAID
1981	First survey of India
	FAO publish "Manual of Forest Inventory"
1983–85	1st NFI Italy
1986–90	1st NFI Germany
1988	1st NFI Switzerland
1988	1st NFI Australia

agement related information on specific properties and functions of forests is required for afforestation, thinning and harvesting. Problem related information on the presence and intensity of damage and risks is needed for such things as pest control, soil amelioration, and fire fighting. Information related to global issues such as forest health, effects of air pollution and climate change, carbon sequestration, growth, and biodiversity is demanded by international processes on environmental policies and sustainable forest management.

The present chapter analyzes the degree to which changing paradigms in forestry have influenced or are influencing existing forest assessment systems. Recommendations are given regarding the further development of forest monitoring to meet future information needs. Forest monitoring systems have been implemented world-wide in different intensities and at different scales, ranging from the stand level, to the national, multinational, regional and global level. Paradigms are changing in all of these forestry systems to differing degrees. This chapter focuses on the important global and multinational forest assessment systems. In some cases, national systems have been included as long as they cover large territories, such as continents or subcontinents, but even this approach does not permit covering the whole globe. For example, much of Eurasia, Asia and Africa are omitted. In many parts of the former Soviet Union substantial inventory systems are in use, but at the same time, there are considerable information gaps in the remote areas. Similarly, in India and China there are functioning national forest inventory systems, but they are beyond the scope of the present chapter. It is hoped that the selected examples of national to global level systems will help the reader to travel through the changing paradigms in forest inventory and assessment.

8.2 Changing Paradigms in Forest Assessments

Along with the evolution of forest management from timber maximization to holistic ecological planning, several paradigm changes in the evolution of forest inventories and assessments can be identified

(Table 1). Such changes in paradigms occurred with respect to:

- Information needs
- Assessment scales
- Assessment periods
- Assessment methods.

With respect to information needs, the first paradigm related to information on forest area from around 1500 onwards, reflecting an increasing demand for fuel wood and timber. After 1700, the idea of sustainable timber supply created the need for information on standing volume and growth. Within the first half of the 20th century the most advanced national forest inventories compiled information on plant composition of forest stands and on the succession of species. In the second half of the century, these initial efforts evolved into full-fledged forest health monitoring, considering the effects of insects, diseases, fire, and air pollution. This development was fostered by growing concern about environmental pollution. Following the spread of the idea of sustainable development, towards the end of the 20th century information on inter-relationships between forests, other natural resources and society became ingrained in forest monitoring. Criteria and indicators for SFM were developed, and the necessary information is often aimed to be assessed within existing forest monitoring systems. At the heart of SFM is the consideration of social as well as timber values in forest planning. The past 15 years have witnessed the introduction of an ecological approach to SFM, which has gained increasing attention through international processes such as the Kyoto Protocol and the UNCBD. This new approach to planning considers social and economic values as well as the ecological functions and processes associated with the ecosystems under consideration. This highlights a broad paradigmatic shift, from merely forestry related information needs to multisectoral information needs of the whole society, related especially to land use monitoring. A good example is the variety of information needs related to changes in land use and the effects on carbon stocks and greenhouse gas emissions in the IPCC (Penman et al. 2003).

As regards scales of space and time, the development of multi-scale inventories may be considered a paradigm change in the evolution of the scale of forest inventories. The first applied scale was the forest stand level approach, with aggregation of stand level inventories. The second entailed the development of sampling techniques that adequately depict the entire forestland base, and broadening the scope to national levels. In the last decade or so, inventories providing information at continental and global scales were carried out. A further changing paradigm is related to the interpretive time span of the inventories. One of the important aspects of forest assessment and ecosystem monitoring is change detection. Change detection is important for understanding human influences on the ecosystem. Initially, the inventories described the present status of the forest. In the 20th century, inventories were designed to estimate forest conditions a decade or two into the future. With issues such as global warming, future interpretive scenarios can span hundreds or thousands of years.

The paradigmatic shifts in the scope and scale of forest inventories have presented and continue to present major challenges for methodologies and assessment procedures in the interpretive integration of economic, ecological, social and cultural aspects. Concentrated on the supply of timber for ship building, for mining and for iron smelters, the earliest inventories focused on the immediate forests surrounding these industries. During the industrial revolution, more timber was needed for increased industrial purposes as well as for fuel wood. More precision was needed to assess the potential timber supply. The industrial revolution and the development of the pulp and paper industry were catalysts for national-level inventories in Europe. The need to inventory forests at the national level at lower costs led to the development of sampling-based inventories. At the same time, data requirements were increasing. For differing industrial uses more accurate information was needed not only on timber supply but also on the quality of timber.

With the advent of aerial photography in the mid-20th century, photo interpretation became a mainstay of forest inventories. Aerial photography and satellite based remote sensing are now integral to forest inventories (see Figure 1). Remote sensing can be adapted to various scales of management from broad overviews to stand level delineation. The development of the space-borne remote sensing methodologies makes it possible to monitor large areas and detect changes in forest landscapes. Remote sensing products include general forest maps on multinational areas. Such maps and multiple thematic maps based on detailed ground data can be converted into digital databases for modeling by means of GIS. Modeling, as well, has evolved over the last 25 years and has become an integral tool at different scales from tree level to stand and landscape levels. It is also invaluable as a predictive tool when considering various planning or operational scenarios. Criteria and indicators of sustainable forest development have evolved depicting the spectrum of forest ecosystem values. Many indicators of interest, e.g. carbon sequestration, cannot be measured directly, necessitating reliance on modeling and other interpretive techniques. Sophisticated modeling and expert systems, coupled with multi-phase and multi-stage inventories, are now required to address the abundant criteria and indicators that depict status and progress towards SFM.

Many developing nations anticipate that forestry will provide a change in livelihoods. Ecotourism, agroforestry, and non-timber forest products are just a few of the more recent benefits that have affected the livelihoods, and altered the value communities

place on their forests. However, one of the more challenging tasks facing forest researchers is the lack of quantitative information and assessments regarding non-timber forest products. FAO forest resources assessment of 1990 noted the depressing state of forest inventory in the tropics, pointing out that no country had carried out a complete assessment on the status of NTFP resources. Moreover, the critical values for NTFP inventories differed from forest inventories that concentrated on wood volumes.

8.3 Forest Assessment Systems Worldwide

One of the most important and traditional periodic country level assessments of forest resources and their trends for the whole world is the Global Forest Resources Assessment (FRA) of the FAO. The parameters assessed globally are (FAO 2001):

- Forest area and its change;
- Wood volume and aboveground woody biomass;
- Extent and main species of forest plantations;
- Trees outside the forest;
- Biological diversity;
- Areas under forest management;
- Areas of forest in protected areas;
- Information on forest fires;
- Wood supply and removals;
- Non-wood forest products.

The ongoing harmonization of terms and definitions within FRA (or related to FRA) is a precondition for the presentation of consistent and comparable information from countries all over the world (FAO 2002). To assess the change in forests area of the tropical countries, remote sensing surveys were applied. Reflecting the development of the forest sector over the last decade, FRA is evolving into a more comprehensive collection of data and information required by several processes of international forest and environmental politics. Within the FRA system, information on countries of the temperate and boreal region is summarized by the Temperate and Boreal Forest Resources Assessment (TBFRA) of the United Nations Economic Commission for Europe (UNECE) and FAO (2000). TBFRA 2000 was compiled by means of a detailed inquiry within 55 participating countries, and all the information and necessary adjustments needed to achieve the comparability between national level information came from the countries themselves via National Correspondents.

Altogether there are more than 80 information tables available from the TBFRA. However, even with TBFRA, the availability and accuracy of the information varies considerably among countries, several countries did not reply to the last TBFRA 2000 questionnaire. The situation is even more diverse with the global FRA, even though the information required is limited. In Africa, Asia and Latin America the FRA information is based on expert evaluation if a functioning national forest inventory is not available. In the upcoming FRA 2005, the aim is to increase the amount of globally assessed information to 16 data tables, applying information on factors like employment to forest and other wooded land. In addition, the FRA 2005 will put more emphasis on capacity building for national forest inventories, and following the model of TBFRA it will be based more on country questionnaires. The tropical forest area changes will be assessed by remote sensing. A new part added to country questionnaires will be thematic reports addressing specific topics, such as mountain forests. In addition to FRA good examples of the global or regional mapping efforts are the global land cover and tree cover maps. These are based on globally available satellite imagery such as NOAA-AVHRR (NOAA-satellite – advanced very high resolution radiometer) or Spot Vegetation, and are commonly produced at 1 km resolution (e.g. Mücher et al. 1998). For forestry purposes, the 1 km resolution data set is available for tree cover percentage and broad forest classes (Defries et al. 2000). Global Land Cover 2000 including broad forest classes is another example of these types of mapping efforts.

Europe

The FAO forest assessments do not confine themselves to quantitative assessments, but are extending their scope to include qualitative assessments of forest resources. A good example is the inclusion of the large-scale results of the International Co-operative Programme on Assessment and Monitoring of Air Pollution Effects on Forests (ICP Forests) in TBFRA 2000. ICP Forests was established in 1985 under the Convention on Long-range Transboundary Air Pollution (CLRTAP) of the UNECE (Lorenz et al. 2003). Since 1986, it has been conducting continuous forest condition assessment in Europe jointly with the European Union (EU). With 40 participating countries, ICP Forests and EU are pursuing the following objectives:

- To provide a periodic overview of the spatial and temporal variation in forest condition in relation to anthropogenic and natural stress factors, in particular air pollution (achieved by means of a large-scale systematic network of low monitoring intensity, referred to as "Level I");
- To contribute to a better understanding of the relationships between the condition of forest ecosystems and stress factors, in particular air pollution (achieved by means of intensive monitoring of a number of selected permanent observation plots spread across Europe, referred to as "Level II");
- To contribute to the calculation of critical levels, critical loads and their excedance in forests;

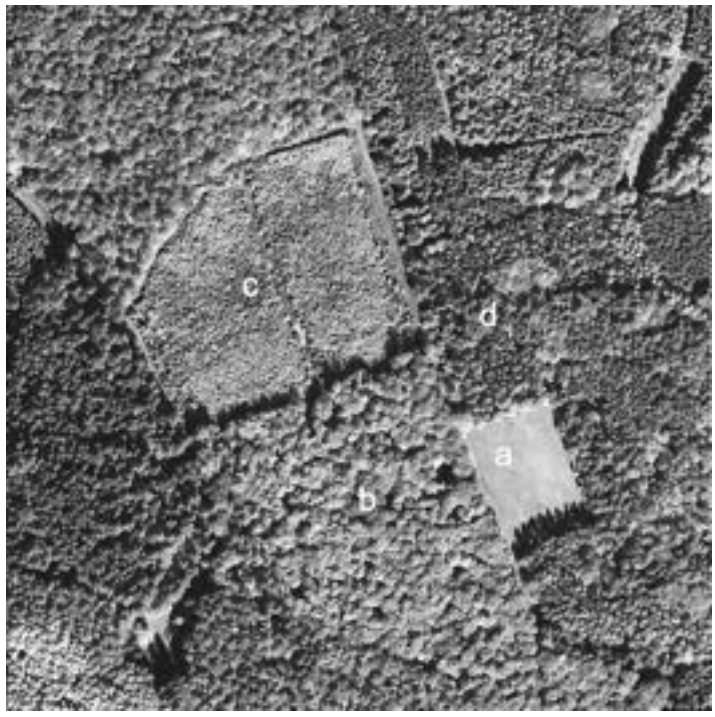

Figure 1. "Quickbird" satellite image utilized in a German pilot project evaluating the potential of remote sensing techniques for the national forest inventory. The photo allows a determination of land use and forest types such as unforested land (a), mixed deciduous forest (b), regeneration (c), and mixed conifer forest (d).

- To collaborate with other environmental monitoring programs worldwide in order to provide information on other important issues, such as climate change and biodiversity in forests, and thus contribute to the sustainable management of forests;
- To compile information on forest ecosystem processes, and to provide policy makers and the public with relevant information.

To achieve these main objectives, a systematic large-scale monitoring network (Level I) and an Intensive Forest Monitoring Programme (Level II) have been set up. The strength of the Level I network is the vast extent of its approximately 6000 permanent plots, arranged in a 16 × 16 km grid, throughout Europe. At Level I, annual crown condition assessments are carried out. In addition, soil and/or foliage surveys were conducted on many plots. A repetition of the soil survey is foreseen. For intensive monitoring, more than 860 Level II plots have been selected in the most important forest ecosystems of the participating countries. This intensive monitoring includes crown condition, soil condition, soil solution chemistry, foliage chemistry, tree growth, tree phenology, ground vegetation, meteorological conditions, ambient air quality and deposition. On 155 of the Level II plots, remote sensing methods are applied. All monitoring methods are described in a manual (UNECE 1998). The latest amendments to ongoing surveys include test phases for ozone measurements, injury assessments, and potential methods for forest biodiversity assessments. The data collected enable case studies on the most common combinations of tree species and sites. For ICP Forests, in accordance with its political mandate, air pollution effects are a priority.

Under its new Regulation "Forest Focus" EU plans to extend its monitoring activities towards questions of climate change, carbon sequestration, biodiversity and sustainable forest management.

The European Commission (EC) established the information system "Coordination of Information on the Environment" (CORINE) in 1985 to facilitate the planning and execution of the EU's environmental policies. CORINE gathers information on the state of the environment for use in priority community applications. It strives for consistency of nomenclatures and definitions in order to ensure the comparability of data. Main results are procedures and methods for the collection, standardization, and exchange of data at the European level, as well as an information system capable of providing policy-relevant information on the European environment. Relevant for forest assessments are CORINE's inventories on land cover, biotopes, soil quality, soil erosion, and water resources. The CORINE Land Cover (CLC) inventory is composed of 44 classes, covering the agricultural as well as the urban and natural sectors. Data are mainly acquired through satellite imagery, and evaluated by GIS. In contrast to the mapping approach of CORINE, the Land Use/Cover Area frame statistical Survey (LUCAS) produces harmonized land cover information based on systematic plot sampling (Bruyas 2002). LUCAS assesses data by means of annual field surveys and farmer interviews. Information related to forestry is provided by assessments of forest area (broadleaved, coniferous, and mixed), other wooded area, poplars and eucalypts, shrubland and grassland.

North America

As in Europe, forest assessment systems in North America are no longer confined to the quantification of forest area and timber supply, but have been widened by the factors of air pollution, climate change, biodiversity, and sustainable forest management.

In Canada, forest management is a provincial jurisdiction. Thus, all provinces carry out forest inventories at various management scales. Industry is also involved. Canada's current national forest inventory is comprised of a periodic compilation of existing inventories from across the country. To address current weaknesses and to meet new demands, the Canadian Forest Inventory Committee (CFIC) – a group of inventory professionals from federal, provincial and territorial governments and industry – has developed a new approach for a national forest inventory. Instead of a periodic compilation of existing information from across the country, the CFIC decided on a plot-based system of permanent observational units located on a national grid. The Canadian Council of Forest Ministers has endorsed this system. The new plot-based National Forest Inventory (NFI) design will collect accurate and timely information on the extent and state of Canada's forests, to establish a baseline of where the forests are and how they are changing over time. A core design has been developed with the following essential elements:

- A network of sampling points across the population;
- Stratification of the sampling points by terrestrial ecozone with varying sampling intensity among the strata;
- Estimation of most area attributes from remote sensing sources (photo plots) on a primary (large) sample;
- Estimation of species diversity, wood volumes and other desired data from a (small) ground-based sub-sample;
- Estimation of changes from repeated measurements of all samples.

The new inventory covers all of Canada. All potential sample locations reside on a countrywide 4 × 4 km network designed to survey a minimum of 1% of Canada's land mass, which translates into approximately 20 000 sample photo plots for Canada. Plots will be identified by conventional, mid-scale, aerial photography, and will be delineated and interpreted according to land cover classes and other forest stand attributes. Satellite imagery will be used as a surrogate for aerial photography to provide attribute data for areas otherwise not covered by photo or ground plots (e.g. Canada's north). The flexibility of the design allows the sampling to be more intense to achieve regional objectives, or less intense for non-forested or remote areas, such as Canada's north. The new NFI design also calls for a minimum of 50 forested ground plots per forested ecological zone. Attributes and data collected in ground plots will complement and enhance the attributes and data from the photo plots. A new related project, Earth Observation for Sustainable Development of Forests (EOSD), is designed to provide complete coverage of the forested area of Canada with satellite data at regular intervals, to produce information on land cover, biomass and change.

In Canada, provincial governments carry out forest health monitoring to varying degrees. Nationally, forest health attributes are being integrated into the new NFI. CFS is also taking an issue-based monitoring approach to forest health. For example, in the East there is the Forest Indicators of Global Change (FIGC) Gradient study. This study comprises 26 eastern Canadian, forested, permanent sample plots arranged across land characterized by both high levels of acidic deposition (sulfur/nitrogen) and ground-level ozone.

In the United States, there are several systems for forest assessments that pertain to or can provide information on forest air pollution impact. For the United States Department of Agriculture (USDA) Forest Service, a primary program is the Forest Inventory Analysis (FIA). The program covers forests on all forestlands within the United States. FIA consists of a nationally consistent core program that can be enhanced at the local, regional or state level to address special interests. The national core consists of three phases (USDA Forest Service 2002):

Phase one consists of remote sensing classification of the land into forest and non-forest, and spatial measurement of variables such as fragmentation, urbanization and distance. This phase has historically used aerial photography, but is changing to a satellite imagery based system. Phase two consists of a set of field sample locations distributed across the landscape, with approximately one sample location (FIA plot) in every 2500 ha. Field crews visit forested sample locations to collect a variety of forest ecosystem data. Non-forest locations are also visited as necessary to quantify rates of land use change. Phase three is a subset of the phase two plots (approximately 1 every 39 000 ha). These plots are visited during the growing season in order to collect an extended suite of ecological data, including full vegetation inventory, tree and crown condition, soil data, lichen diversity, coarse woody debris, and ozone damage.

Under a new approach, the FIA collects data on a subset of plots in all states every year. Ultimately the goal is to annually sample 205 field plots in every state. Another new approach is the FIA sister or companion program, Forest Health Monitoring (FHM). FIA and FHM aim to determine the productivity and health of forests through collection of a set of consistent core data and indicators, which can be compared across administrative boundaries and different land ownerships (e.g. federal, state, private) and provide meaningful analyses in a timely manner. FIA currently provides updates of assessment data every five years. FHM is a national program designed to determine the status, changes, and trends in indicators of forest condition on an annual basis. It uses data from ground plots and surveys, aerial

surveys, and other biotic and abiotic data sources, and develops analytical approaches to address forest health issues that affect the sustainability of forest ecosystems.

Perhaps the largest and oldest monitoring network which applies to forest health and air quality in the USA is the National Atmospheric Deposition Program/National Trends Network (NADP/NTN), which incorporates approximately 200 cooperative sites that collect information on wet atmospheric deposition used in forest assessments. The objective of NADP/NTN is to determine atmospheric wet deposition trends and status in the United States in a manner scientifically defensible and useful to air quality policy decisions, scientific investigations, ecosystems management, and management of national parks and wilderness areas afforded special protection from air pollution effects (Clean Air Act Class I Areas). It collects data on the chemistry of precipitation for monitoring of geographical and temporal long-term trends. NADP/NTN provides baseline information that is often used in conjunction with short-term forest area studies to calculate critical loads and other forest health guidelines. For dry atmospheric deposition, the federal Environmental Protection Agency (EPA) has established the Clean Air Status and Trends Network (CASTNET), which has been extremely successful in helping to assess existing or potential forest impacts from large stationary sources.

Under the auspices of the North American Forestry Commission (NAFC) of the UN-FAO, Canada, the United States and Mexico are working together to develop North America -wide protocols for forest inventory, monitoring, assessment and reporting. A current NAFC initiative is the identification of a common set of compatible inventory and monitoring data to produce the first North American report on the nature and status of the major forest ecosystems of the continent. An ecological reporting framework (Ecoregions of North America) is being used, rather than a framework based on country jurisdictional boundaries. Recently, NAFC conducted a study to determine and demonstrate the capabilities of the three countries to create a North America database. Currently, however, NAFC has to rely on existing information, and some harmonization will be required until new inventories in Canada and Mexico are complete (Lund 2003).

Latin America

In Central and South America continent-wide forest assessment, information or monitoring systems are not yet established. Therefore, forest information for the entire continent comes from a compilation of national data and from other global assessment studies. The International Tropical Timber Organization supported projects to establish and implement forest information centers in four Latin American countries (Bolivia, Colombia, Panama, and Peru), and concluded that these activities "have added significantly to the ability of the countries to collect and analyze reliable forestry-related data" (ITTO 2003). Moreover, a regional FAO project, the Latin American Forestry Sector Outlook Study (LAFSOS), produced a "status of the forest information" report for 17 Latin American countries between 2001 and 2002. This report covers topics such as forest resources, land use change, forest management and trees outside the forest, timber and non timber forest products, energy wood, socioeconomic conditions with respect to forests and forestry, and forest information systems (FAO LAFSOS 2001–2002). Also, in a set of FAO FRA working papers, specific information is given on studies of forest cover change in 11 Latin American countries (FAO 2001). FAO is also implementing national forest monitoring systems through its FRA program. The corresponding inventory activities are more closely linked to the national institutions, so that a higher level of "national appropriation" of the monitoring systems may be expected. In Latin America, FAO FRA carried out these projects to "Support National Forest Monitoring Systems" in Costa Rica and Guatemala (as of 2004). Other countries such as Honduras and Colombia are likely to follow. This program has developed a core assessment methodology with a core suite of attributes/data to be collected. It might, therefore, be the basis for future continent-wide forest monitoring systems.

The situation of forest information and forest information systems is highly diverse among countries. Data collection and analysis procedures vary, as does the timeliness of the available information. In the course of the past 30–40 years, most countries had some national forest inventories, many of which were funded and technically supported by FAO and bilateral technical cooperation projects. A secretarial note of FAO's 15th COFO session (FAO COFO 2001) states that of the 17 Latin American countries evaluated, three did not have any forest inventory (as of 2001), and only four had repeated inventories that allowed statistically based monitoring of changes. Many national forest assessment studies in Latin America were not "full-blown" forest inventories (i.e. where a broad set of forestry and ecological variables had been collected), but were mapping studies with an explicit focus on status and change in forest area, forest type area and spatial distribution of forests.

Mexico is probably the country with the longest and most continuous history of national forest monitoring activities. There, the forest service is currently conducting a new cycle of its national forest inventory in close cooperation with the Forest Inventory and Analysis Unit (FIA) of the USDA Forest Service (Subsecretaría de Gestión 2002). It will be the fourth such inventory cycle. The first national forest inventory in Mexico was carried out between 1961 and 1986. An overview of these forest-monitoring

activities is given, for example, in Velazquez et al. (2000). In Brazil, the Space Research Institute INPE (Instituto Nacional de Pesquisas Espaciais) carries out a satellite image based forest cover survey of Amazonia on an annual basis, and presents figures for forest cover and forest cover change for that region (INPE 2004).

Chile is a good example of the national level inventories in Latin America. In Chile, the national land survey (Catastro), is a governmental program devoted to monitoring land use and its changes, ranging from natural forest to exotic plantations and agricultural land. The Catastro is based on a physiognomic approach to vegetation (Long 1974), in which the natural vegetation formation is characterized by a set of variables (in discrete classes) related to vegetation structure and botanical composition. The mapping is based on terrestrial point-related information extrapolated to the rest of the stratum, using direct photo interpretation on available aerial photographs. The Catastro covers the whole country, classifying any single stand to a resolution of 6.25 ha. The results are nation-wide 1:50 000 maps on forest types, based on a combination of small-scale aerial photography and satellite photos.

The Forest Research Institute (INFOR) is currently performing continuous forest inventory (CFI) in a pilot study over a total area of 3.0 million ha. INFOR proposed the CFI approach for solving the multiplicity of questions regarding the status and conditions of Chilean forest ecosystem resources and their sustainability. Thus, a sample-based approach was applied as a multilevel and multi-resource forest inventory. It is implemented in a systematic sampling design covering the whole country in a five-kilometer (east-west) by seven-kilometer (north-south) grid.

East Asia

The Acid Deposition Monitoring Network in East Asia (EANET) implements a multinational forest-monitoring program in cooperation with ICP Forests. After a preparatory phase (1998–2000), EANET started its regular-phase activities in 2001. Acid (wet/dry) deposition monitoring and monitoring of its impact on ecosystems (soil, vegetation and inland aquatic environment) are carried out by the twelve participating countries, namely Cambodia, China, Indonesia, Japan, Lao PDR, Malaysia, Mongolia, Philippines, Republic of Korea, Russia, Thailand, and Vietnam. Forest monitoring is carried out as part of the soil and vegetation monitoring. EANET's ultimate objective is to assess the impact of acid deposition on terrestrial ecosystem in a comprehensive and systematic manner, by establishing and maintaining a good quality database. In order to achieve this objective, a step-by-step approach was adopted, and the following initial objectives were instituted: establishment of baseline data, and early detection of the possible impacts of acid deposition on plants and forest ecosystem.

Forest monitoring comprises a description of sample trees (species, diameter at breast height, and height), a survey of under storey vegetation, a survey of tree decline, and analyses of soil chemical properties, such as pH and exchangeable cations. The surveys are carried out at three to five year intervals. Ten countries have started their forest monitoring activities. In order to attain the ultimate objective, comprehensive evaluation of the terrestrial ecosystem, one of the planned methodologies is catchments analysis, including simulation modeling.

Australia

In Australia, forest management is a state responsibility, while international treaties or agreements and export authorization are federal responsibilities. The National Forest Inventory (NFI) was established in 1988 to provide a single authoritative source of data at the national level. The Federal Government provides funding for NFI staff and core activities, including the collection of data and the dissemination of value-added information. The States and Territories undertake on-the-ground collection of forest data. However, the scales at which information is collected, and the methodology used, often differ among agencies and according to the purpose of collection and land tenure. The NFI attempts to assemble and standardize the data so that they can be combined to develop an overview of the nation's forests and to make direct comparisons within and between States and Territories. Despite the attempts to standardize data across the nation, it has been difficult to use the NFI to accurately monitor change in the forest estate. A new framework, the Continental Forest Monitoring Framework (CFMF), is being developed. The CFMF is planned to incorporate remotely sensed data (including Landsat TM and other satellite imagery) and systematically located ground-based measurements, to allow comprehensive monitoring of trends for a range of forest values across all land tenures. The CFMF is being piloted in a region that exceeds 10 000 km^2 and includes a range of forest types, land uses and tenures, to ensure that the sample size (resulting from a 20 km × 20 km Continental grid) and parameters measured are adequate and appropriate.

An alternative monitoring approach is provided by the National Carbon Accounting System (NCAS), which is responsible for providing information on biomass stock continentally, and on the change in that stock, at a sub-hectare spatial resolution. The NCAS accounts for stock change through a highly integrated digital map-based information system that combines remotely sensed land cover change, land use and management, and climate and soils data (including mapped information from thousands of

Erkki Oksanen

Forest inventories and assessment provide information to support policy and management decisions at stand, national, multinational and global levels.

satellite images) with greenhouse accounting and ecosystem modeling. By mapping landscape change, the NCAS provides a dynamic 30-year (1970–2000) perspective on the nature and extent of human-induced change in land systems across the Australian continent. Early development work for NCAS determined that the fine resolution required made a sampling approach impractical and a model-based approach was adopted. The digital map-based information is used in a physiological growth model to predict an asymptotic maximum biomass, while management information and disturbance history are utilized to predict the stage of progress towards this maximum point. Published data on biomass for specific locations are compared against model predictions to determine the reliability of the estimates.

8.4 Conclusions and Recommendations

Forest inventories and assessment are needed for the provision of quantitative and qualitative information to support political and management decisions at various scales, ranging from the stand to the national, multinational and global levels. The evolution of forestry from timber maximization to ecological management caused several paradigm changes in forest assessment with respect to information needs, assessment scales, and assessment methods. The availability of information, particularly of qualitative information meeting the changing needs resulting from paradigm shifts, differs greatly among different regions of the world. Quantitative information on forests (e.g. on forest area, wood volume, and increment) is abundant for the developed countries and is increasingly becoming available for some developing countries. In the best case quantitative information is based on NFIs and can be aggregated on the global scale by FRA/TBFRA. As well, qualitative information (e.g. on forest health, biodiversity, and sustainable forest management) is being assessed by multinational systems such as FRA/TBFRA, but especially by the joint forest condition assessment of ICP Forests of UNECE and under the EU-Regulation "Forest Focus" in Europe, and by EANET in East Asia and several similar large-scale monitoring systems in North America. However, basic quantitative and especially qualitative information is lacking or based on estimations for some countries with large territories and for many developing countries. In the developing countries, information is lacking due to economic, social and environmental history. Politicians and forest scientists should identify the new information needs, establish new concepts for forest assessments, and adjust existing systems in order to comply with the new challenges resulting from changed paradigms.

Information needs exist for the current international processes of environmental politics, such as the Kyoto Protocol, CBD and MCPFE. These processes must be provided with scientific information on global climate change, carbon sequestration, forest growth, forest health, biodiversity, and sustainable forest management. Such information can only be provided through the implementation of new and the extension of existing multinational forest monitoring systems. However, at the same time unnecessary duplication should be avoided and resources should be coordinated. This is difficult because very few donors finance self sustaining global inventories and national inventories are financed nationally. Forest monitoring systems have to be integrated into political structures, assuring that the scientific information provided by them can lead to political action. A good example for such a structure is the CLRTAP. CLRTAP set out 25 years ago to reduce air pollution in Europe. Based on monitoring programmes such as ICP Forests, legally binding protocols were adopted by the Signatory States that led, for instance, to a reduction of sulphur depositions in Europe by approximately 70%.

In the establishment phase of any forest monitoring system, several requirements crucial to its future success have to be fulfilled. Politicians and scientists have to mutually formulate clear and realistic monitoring objectives. In order to meet these objectives, politicians should assure long-term and continuous availability of financial, human and technical resources from the beginning. Yet, the monitoring design must permit arrival at statistically reliable results within a reasonable timeframe.

Multinational assessments can be realized by means of compilations of data from existing national assessments as well as by means of uniform transnational monitoring systems. Mostly, the first option is more feasible than the latter. The precondition for both approaches, however, is a strict harmonization of definitions, standards and methods among the participating countries. For instance, the definition of forest varies according to the types and functions of forests within and among countries. Such conceptual differences yield incompatible assessment results. Resolving such differences often proves difficult as countries have long established procedures that meet their needs and as they are hesitant to compromise to meet international standards or recommendations. It is for these reasons that international standards and methods are more easily accepted when countries are developing their inventories in the course of capacity building.

The best example of the compilation of data from existing national assessments is FRA/TBFRA. It relies on the best available national information that is harmonized by national experts, as well as capacity building where national systems are weak. It requires only marginal extra costs at the international level, and it does not entail duplication at the national level. As regards harmonization, FRA/TBFRA still has concerns with respect to spatial inconsistencies and changes in information needs, which make comparisons among assessments difficult (Holmgren and Persson 2002). In total, however, FRA/TBFRA demonstrates that compilation of global results can work up to some level, though accuracy and reliability vary.

An example of the development of a uniform international system is provided by the monitoring of forest conditions in Europe by ICP Forests and the EU. This approach was costly and time consuming, but eventually led to a very high degree of harmonization. Harmonization was realized not only with respect to definitions, standards and procedures of field assessments but also with respect to data submission, management, evaluation and the reporting of results.

Both approaches of multinational assessments are suitable for using synergies and avoiding redundancies among national and international surveys. Braatz (2002) and Prins (2002) describe ways to overcome redundancies in national reporting and point out synergies between forest resources assessment and indicators of sustainable management. A good example is provided by the synergies between TBFRA 2000 and the Ministerial Conference on the Protection of Forests in Europe (MCPFE) (MCPFE 2000). Data on quantitative indicators for the third Ministerial Conference in 1998 were not collected by MCPFE, but in the context of TBFRA 2000, ICP Forests and other international arrangements. The close cooperation between ICP Forests and the EU is another example of synergies. The EU-Regulation "Forest Focus" covers the wide field of sustainable forest management. ICP Forests is also partly engaged in this field, but focuses on the effects of air pollution on forests. Despite their different scopes, EU and ICP Forests are sharing the same monitoring system and are cooperating in data bank management. There are also, however, examples of redundancies in multinational assessments. In Europe, for instance, the lack of consistency in multinational assessment efforts has even led to a situation in which a forest component has been included into CORINE Land Cover and LUCAS. This is an unnecessary overlapping, and we may ask why the required information was not gathered by e.g. national queries.

There has been discussion about the possibility of developing one single international assessment process, which would fulfill most future international information needs. Such a goal would be extremely difficult to reach, particularly at the measurement level. More attainable is harmonization at the reporting level. IPCC is a good example of such reporting. This kind of approach can to a large extent fulfill global data needs, but it has to be combined with capacity building where there are no functioning inventories. Lund and Iremonger (2000) describe the development possibilities either from the bottom up based on a combination of national information sources, or from the top down through methods such

as multinational sampling, described above. They highlight the importance of sharing existing information at the international level, and developing joint global assessment objectives.

Global data and reporting needs do not necessarily have to rely on full coverage of ground-based national inventories, as such coverage is not achievable in the foreseeable future. What is needed is a much more attainable goal: the determination or identification of a common global lowest denominator for data. Some kind of expert evaluation or remote sensing approach may be needed for filling the most severe data gaps in this denominator. With time, and improvements in technology and country capacity building, this baseline may shift to reflect additional interpretive capability. As a good start, it may be that global vegetation mapping efforts and sampling based on remote sensing can be used in a harmonized way to produce globally consistent data sets and interpretive products. Remote sensing is already a well-established method, but it may gain additional importance for both quantitative and qualitative assessments with the ongoing development of sensors having higher resolution or operating at previously unstudied frequencies. They permit the provision of data for less accessible areas (such as tropical forests), and even for countries not providing data by themselves. This advantage, and the relatively low costs, make remote sensing a good choice for forest assessments in developing countries or countries with very large territories. Though the limited set of assessable parameters constitutes a restriction (Kleinn 2002), remote sensing can complement or even replace terrestrial assessments, depending on the information required. In Canada, for instance, remote sensing is applied successfully at all scales. A concern may exist for global scale monitoring, as resolutions achieved with current technology may not be acceptable for information needs. Also remote sensing may not provide information for all needs. Original hopes that remote sensing could eventually replace large areas of terrestrial assessments (FAO 1968) have turned out to be overly optimistic. In several cases, the abandonment of terrestrial assessments has been found to lead to a lack of information (Holmgren and Persson 2002). Combining terrestrial assessments with remote sensing remains the best choice.

Multinational forest assessments need efficient institutional management for planning, for making and implementing strategic decisions, and for evaluating. Comparability of results among the participating countries cannot be reached by harmonization alone. Program management also has to implement strict procedures of quality assurance. The necessary efforts for quality assurance are all too often underestimated in the planning stage, resulting in a disproportion of costs and benefits. Data errors are inherent in monitoring design, field assessment, data evaluation and the reporting of results. The reliability of results depends strongly on the measures taken to keep errors within tolerable limits during each phase of the monitoring program. Also, an effective data and information management system has to be established. Moreover, program management has to make sure that the program is regularly evaluated by independent parties with respect to its efficiency and compliance with objectives.

Currently global forest assessments are stand alone activities, not considered with other social and economic needs. However, forest assessments and sustainable forest management need to be considered together with assessments of other resource needs like need for cropland, grassland, urbanization, etc. (Lund and Iremonger 2000). This has recently become very apparent in carbon accounting, where forests, croplands, grasslands, wetlands, settlements, and other land classes must all be considered jointly for effective national and international carbon accounting (Penman et al. 2003). Globalization and technological development have been strong driving forces in shifting society's attitudes to and perceptions of the environment, and in developing the role of forest assessments. The first two are linked. Technological development can solve problems as well as generate new paradigms, such as the application of genetically modified tree breeding material, the consequences of which may have to be monitored in future assessments. Factors for future assessments, raised by changing values and globalization, include:

- Sustainability
- Ecology
- Economy
- Social and cultural values of forestry
- Ecosystem function
- Better understanding of ecosystem processes and the effects of anthropogenic influences including forestry
- Intrinsic value of all the ecosystems
- Importance of forests and forestry to ground water supply
- Value of non-timber values and services compared to timber production
- Increasing conflicts in land use.

Consequently, one of the most dominant paradigms in the future could be the provision of increasingly global level information for scenario modeling, considering the effects of global change, desertification, water production, and their interaction with the biosphere.

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9 The History and Future of Agroforestry Research and Development: Policy Impacts and Needs

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Abstract: Agroforestry systems (AFS) research and development (R&D) has evolved dramatically over the last 30 years in four major ways. The emphasis has shifted from the description of systems to understanding how they function; from simple mixtures of few components at field and farm levels to more complex consideration of diversity at landscape and regional levels; from researcher-designed practices to farmer-designed practices (local knowledge); and from the quantification of their productivity to the economic valuation of the environmental services they provide. As these developments have unfolded, participatory methods have been developed to involve local people more fully in the R&D process, and models and modeling paradigms have been developed to integrate results across disciplines and scales. Greater understanding of how agroforestry systems function, coupled with a consideration of social processes that influence the behavior of people whose livelihoods depend on farming and forest resources, have paved the way for the development of policy geared towards more sustainable natural resource management. The quantification and valuing of environmental services from AFS, studies of actual and potential markets for AFS products, and efforts to integrate the results in the development and testing of new policies and regulations are now at the cutting edge of AFS R&D. Examples of emerging research foci that these developments have spawned include the role of farm trees in mitigation of, and adaptation to, climate change; plant genetics in relation to conservation, improvement and the domestication of new commercial components; environmental sustainability; biological pest control; and landscape planning and management.

Keywords: Agroforestry development; agroforestry research; environmental services; scale issues; selection criteria; sustainable rural development.

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9.1 The History of Formal Research and Development of Agroforestry Systems

Agroforestry is a term for practices where trees are integrated into farming, as well as for the interdisciplinary subject area embracing land use systems, from field to global level, that involve interactions amongst trees, people and agriculture. There is a long tradition of agroforestry practice in many parts of the world, but it has developed as a formal scientific discipline only during the last three decades. Agroforestry systems research and development (AFS R&D) began as a key innovation and new paradigm by uniting the two subject areas of forestry and agriculture, and has been at the forefront of much recent innovation in sustainable natural resource management. The principal forces driving this innovation have been the introduction of a more human perspective from the agricultural tradition into forestry, paralleling developments in social forestry, while emphasising a more ecological as opposed to agronomic perspective in agriculture, including longer time horizons and larger spatial scales. Its progress as a science has been marked by dynamism and shifts of emphasis (Box 9.1).

Initially agroforestry research consisted of little more than the documentation of the empirical research and development (R&D) results from thousands of years of trial-and-error experimentation carried out by both tropical and temperate farmers, and

BOX 9.1 DIRECTIONS IN AGROFORESTRY RESEARCH AND DEVELOPMENT* (1970S UNTIL 2004)

John Beer, Muhammad Ibrahim and Fergus Sinclair

- Description (Emphasis: on-farm. Scale: system, farm, regional): farmer knowledge of agroforestry systems (ASF); ASF profile diagrams; case studies; surveys of farmers; local and regional inventories.
- Quantification (Emphasis: on-farm. Scale: plant and/or animal, system): biomass and commercial productivity; above-ground nutrient cycling; AFS effects on soil variables; component dimensions; formal experiments (e.g. alley cropping).
- Interactions (Emphasis: on-station. Scale: micro, plant component, plant and/or animal): adaptations of results from other disciplines to predict tree-crop and other interactions; mechanisms of interactions; below-ground studies (e.g. root distribution, mycorrhizae, rhizobea); relationships between trees and animal behaviour; process modelling; applied problem solving research (e.g. erosion control with contour hedgerows).
- Socio-economics (Emphasis: on-farm. Scale: system, farm, regional): traditional economic analyzes (cost/benefit, etc); local knowledge of component characteristics /AFS management; farmer decision making processes (e.g. land use allocation to different systems); novel economic approaches to understand farmer decision making (e.g. economic risk analysis); distribution of labour and decisions between gender; marketing studies of AFS products.
- Integration (Emphasis: on-farm and on-station. Scale: system, farm, regional): integration of bio-physical with socio-economic variables to classify AFS; AFS economic models based on bio-physical sub-routines; indirect interactions (e.g. tree → micro-environment → pest → crop damage); regional level studies of fragmented landscapes (e.g. land use mosaic → tree cover→ pasture productivity and animal physiology → animal productivity).
- Environmental services (Emphasis: on-farm and on-station. Scale: system, farm, regional): biodiversity (indicator groups) in AFS *vs.* other land uses; effects of AFS on water quality and quantity; quantification of Carbon reserves and capture at the plot level; soil and nutrient conservation; valuation and certification of environmental services.
- Markets (Emphasis: NA. Scale: regional, national, global): niche markets (e.g. specialty coffees); focus on quality of products, not just productivity; certification ("Organic"; "Environmentally Friendly"; "Shade Grown"; etc); value chains; chain of custody; studies of local, national and international markets for AFS products.
- Policy (Emphasis: NA. Scale: regional, national, global): inventories (e.g. biodiversity); intellectual/germ-plasm property rights; development and testing of reforestation incentives; land use change in response to different policy interventions; payment methods for environmental services; consequences of market liberalization on competitiveness of AFS components/systems (e.g. of ALCA).

* Although these directions were not strictly sequential, their ascending order reflects the timing when each has come into prominence and the gradual shift over three decades towards the points at the end of this listing. Emphasis refers to the relative attention given to on-farm *vs.* "on-station" research (the latter meaning research totally managed by scientists irrespective of where it was carried out). Scale refers to the relative attention given to studies focussed on the following levels: micro, plant component, plant and/or animal, system (or field), farm, regional, national and global.

theoretical speculation about how more structurally diverse farming systems involving trees might be more ecologically sustainable (Huxley 1983). Hence the dominance of descriptive studies of tropical agroforestry systems (AFS) in the early volumes of the Journal *Agroforestry Systems*, which first appeared in 1982 (also see Nair 1989), mirrored by emerging practical texts on temperate agroforestry, particularly based on experience from Australia and New Zealand (Reid and Wilson 1985). Quantification of these traditional AFS, and of some novel AFS developed through formal research (particularly alley cropping; Kang and Reynolds 1989), was soon on the agenda, though initially limited to the evaluation of commercial and biomass productivity and of nutrient cycling (above-ground). In terms of producing practical results, this initial on-farm "descriptive phase" was very important as a counter weight to the "alley cropping phase" which produced some interesting scientific results but technologies that were largely not adopted by farmers. The change in focus from researcher-designed systems to the study of complex systems and practices developed by tropical farmers, considering the social and economic factors involved in such practices, was another key shift; e.g. the work on Indonesian agroforests (Michon and de Foresta 1999).

In New Zealand, the widespread development of grazing systems under widely spaced and high pruned radiata pine (*Pinus radiata*) led to the de-

velopment of empirical models and decision support tools for managing the system for mainstream use by extension staff and farmers (Maclaren 1988). The design of AFS shifted from simple (e.g. alley cropping) to more complex systems (e.g. multi-strata silvopastoral systems), which include leguminous and non-leguminous tree and shrub species to optimize resource use (Cajas and Sinclair 2001). Once researchers got over the initial enthusiasm and exaggerated claims, which sometimes seemed to suggest that AFS were the panacea for all farming problems, the focus shifted to the host of interactions that have to be understood in order to manage and reduce the potentially negative consequences of including trees or shrubs in farming systems, especially competition for light, water and nutrients (Ong and Huxley 1996). Initially above ground interactions were more tractable than those below ground, but during the 1990s research on soils and root processes in AFS were emphasized (Schroth and Sinclair 2003; van Noordwijk et al. 2004).

In the late 1980s and early 1990s, there was a gradual shift in the emphasis of agencies and donors, and available resources for research and technical cooperation, towards social and economic studies, including the marketing potential of AFS products. Socio-economic studies of AFS had been carried out from the beginning but the rigorous evaluation of their profitability, based on classical approaches (e.g. cost/benefit and internal rate of return; Sullivan et al.1992) and novel modeling techniques (e.g. economic risk analyses based on simulations of future price probabilities; Ramírez et al. 2001) was delayed until there was a more complete and in-depth appreciation of their complexity. In retrospect, it is clear that meaningful characterization of AFS and their economic, as opposed to financial, evaluation requires that information from both the socio-economic and bio-physical fields be integrated (Mendez et al. 2001).

The results from the early research that emphasized description, quantification and study of interactions, contributed to the later analyses of the environmental services provided by AFS. For example, the earlier evaluations of organic material (carbon) and nutrients in different components of various AFS, including the soil, contributed to quantifying and hence valuing the environmental services of carbon capture and maintenance of soil fertility. In contrast, reports on biodiversity in AFS were scarce until recently (Perfecto et al. 1996; Schroth et al. 2004) and still are with respect to the potential positive effects of AFS *vs.* monocultures on water availability and quality.

Parallel with the efforts to value and pay for environmental services, efforts to identify and develop all the marketing opportunities that AFS provide have increased rapidly in recent years. A plethora of niche market and certification schemes have appeared, from organic and "Bird Friendly" coffee and cocoa production in Central America (Gobbi 2000; Wheeler 2001) to worldwide marketing of cosmetics based on the oil from nuts of parkland trees such as marula (*Sclerocarya birrea*) in southern and shea butter (*Vitellaria paradoxa*) in West Africa (Boffa 1999; Hall et al. 2002). This has diversified but also complicated the range of outlets for producers. The size of these markets, consumer acceptance, increasingly complex import and certification requirements (e.g. in the USA, bioterrorism regulations), value chains and chains of custody, all need to be considered to determine the future potential of AFS in an increasingly dynamic and inter-connected world.

Finally, in this overview of how the direction of AFS R&D has evolved, policy issues have become the latest key focus. The impact of AFS on policy has been growing gradually since the 70s. Early attempts to develop and test reforestation incentives (e.g. via tax reductions for corporations) and to model land use changes in response to different real or hypothetical policy interventions, were important precedents for the actual efforts of the AFS R&D community to influence agricultural, rural, and natural resource ministries with policy studies; e.g. for the development of indices of land degradation and/or environmental services and methods to pay farmers for the environmental services that their AFS provide. At a global level, the development of AFS is now seen as an important land use to achieve the Millennium Development Goals and the WEHAB initiative thematic areas identified in the Johannesburg World Summit on sustainable development (Garrity 2004).

Another major change that has occurred in tropical AFS R&D over the last 30 years is in funding and collaboration mechanisms. Many public sector institutions that have made significant contributions to AFS R&D (e.g. the national coffee institutions) have been partially or completely privatized and have seen budgets and research personnel slashed. International and regional research organizations (e.g. the CGIAR institutes and CATIE) have had to enter competitive bidding processes and to learn to work with the international banks on a new basis; e.g. competing for World Bank and Inter-American Development Bank contracts. This has forced these research and educational organizations to rethink the way they manage integration of education and research: e.g. learn how to "translate" the monitoring and evaluation, as well as the base line studies, of a Global Environmental Facility (GEF) project, into a series of research topics that can even lead to postgraduate degree opportunities. Private sector funding for research (e.g. for domestication of tropical fruits and processing with a focus on quality) is also becoming increasingly important.

The independence of researchers (e.g. sustainability of medium and long-term support for a specific research area) is diminishing, creating problems for specialists. Information technology, public-private-partnerships, new organizational/management models for R&D institutes, and the increasing speed of change everywhere are all contributing to a new

R&D framework that demands new paradigms. One answer is to form or join decentralized thematic groups with a variety of donors, supporters and collaborators (e.g. Silvopastoral Systems to develop sustainable livestock systems in tropical Latin America), which work with a medium or long-term plan in a number of countries. Such thematic groups have to have the flexibility to take advantage of opportunities consistent with their plan without being tied to a strict sequence of activities; for example, have a flexible annual work plan that defines goals but not specific activities. If well managed (e.g. adequate delegation), the gains through access to financial, logistical and human resources, including real integration in an interdisciplinary team and a fertile framework for creativity, more than compensate for the partial loss of independence of each researcher.

Another development drawn out by this new R&D environment, is the improved integration of higher education and research programmes in tropical countries; e.g. arranging that a sequence of graduate students, with thesis topics that build on the earlier work, are associated with an applied research team in a pilot area. The increasing appearance of joint graduate degree programmes in Latin America (MSc/PhD), which truly integrate the educational offerings of long established universities in temperate zones with new opportunities developed by universities in less developed countries that until recently only offered pre-graduate education, is another example of the dynamic changes that have occurred during the last 10 years.

9.2 Future Key Areas for Agroforestry Research

Divining the future is notoriously difficult, as is trying to identify and group the key emphases that should be included in future research programmes for a highly diversified field of work such as agroforestry. In this section, seven emerging thematic areas are discussed, together with two of the previously identified directions that should receive continuing emphasis (Box 9.2). There is no doubt that R&D should and will also continue in the other areas catalogued in Box 9.1, but in this section the emphasis is on areas of work that need greatly increased resources and the ingenuity of agroforestry researchers to elucidate and develop the full potential of AFS. Rather than general research thrusts, these new areas are more specific research topics.

Climate Change

Agroforestry will play a role in the two key dimensions of climate change; i.e. *adaptation* to changing environmental conditions and *mitigation*, especially substitution of greenhouse gas emissions. Substitution measures may help slow global warming but farmers already have to deal with the consequences of climate change; e.g. increased frequency of droughts and/or intensive rainfall. In seasonally dry tropical areas, where poor basic grain producing farms are often found, the inclusion of a limited number of deep rooting trees and shrubs (limited to avoid excessive competition with crops) can provide emergency food resources (e.g. green mango) in drought years when grain crops fail. Trees and shrubs also can provide forage for animals, helping to reduce loss of assets by preventing high mortality of animals during prolonged drought. The promotion and development of "water harvesting" AFS technologies, that reduce run-off and increase infiltration and retention of water in the arable soil (e.g. by increasing mulch as well as soil organic material) could increase food security and the resilience of the poor with respect to climate change and other stresses in arid and semi-arid zones.

Agroforestry was recognized by the IPCC as having a potential for sequestering carbon as part of climate change mitigation strategies (Watson et al. 2000). However, there is need for more in-depth analysis to understand the carbon sequestration potential of different AFS in different ecosystems. Work is needed on the design of AFS that will enhance productivity and carbon sequestration, as well as to develop methodologies that will reduce transaction costs for the monitoring and evaluation of carbon in AFS.

Genetics and Plant Improvement

During the last century tree crops such as cacao, coffee and tea were the backbone of the economies of many tropical countries, but the value of these commodities is declining. There is an urgent need for a global programme to diversify these AFS with different species of high commercial value. Already in some AFS, indigenous fruit trees are considered more valuable than the tree-crops that they are associated with, such as *Dacryodes edulis* in the multistrata cocoa agroforests of southern Cameroon (Simons and Leakey 2004). Biotechnology has revolutionized fields such as forestry, agriculture, and medicine and presents new options for AFS. Nevertheless, in the case of AFS there is still a need to use traditional plant improvement techniques (and varieties) to take advantage of market opportunities and allow localized control of tree and crop improvement for heterogenous polycultures. The selection and genetic improvement of coffee varieties in the 1980s and 1990s was designed to increase productivity and disease resistance in intensively managed environments ("green revolution" focus), often with no shade trees. However, to compete in Arabica coffee markets, quality has become the key issue, and a small but rapidly increasing demand for coffee

BOX 9.2 FUTURE DIRECTIONS FOR AGROFORESTRY RESEARCH (MAIN AREAS OF WORK AND SOME EXAMPLES OF EACH)

John Beer, Muhammad Ibrahim and Fergus Sinclair

- *Climate change (adaptation)*. Crop diversification with drought resistant components (e.g. certain fruit tree species); water harvesting with AFS (e.g. management interventions using AFS to reduce run-off and increase infiltration).
- *Genetics*. Selection and improvement of: cultivars for mixed (not mono-crop) plantations (e.g. shade tolerant varieties of grass species; crop cultivars with limited root extension); varieties producing higher quality (e.g. traditional coffee varieties for AFS); local varieties of tropical fruit species; timber species provenances with good stem form, limited branching and forking in open grown environments.
- *Ecosystem sustainability*. Development of AFS that reduce contamination (e.g. buffer strips to protect water courses); AFS that maximize build up of soil OM; matching AFS characteristics to soil characteristics to protect soil surface, reduce leaching and soil slippage (localized superficial landslides); windbreak design for livestock as well as crop systems; manipulation of root systems by fertilizer placement, spatial design and use of competing root systems (e.g. aggressive grasses); design of multi-strata live fences to increase connectivity for the conservation of biodiversity.
- *Micro-flora/micro-fauna*. Biodiversity of micro-flora / micro-fauna in AFS (identification, and classification in functional groups as well as species); elucidate the complex biophysical interactions in the soil (e.g. indirect effects of trees on nutrient release cycles *via* effects on soil organisms); rhizosphere chemistry and biology.
- *Biological control*. Modelling the relationship of micro-climate (i.e. shade, humidity and temperature) with the incidence of plant diseases to design optimum shade levels for different climatic and site conditions; viability and persistence of bio-control agents in mixed *vs.* monocrop plantations; effects of trees on phytophagous soil organisms (e.g. relationship litterfall → soil organic material → parasitic nematodes of phytophagous nematodes); relationship AFS → biodiversity → biological control (e.g. natural pest control in mixed *vs.* monoculture fruit tree plantations); effects of trees on animal pests *via* micro-climatic effects (ticks; screw-worm, etc).
- *Productive components*. Novel fruit species and root crops suitable for mixed systems (system design and testing but also market studies); rural agro-processing (economic potential; production [value] chains); selection of shade tolerant species (e.g. grasses and legumes); silviculture of lesser known timber trees in open grown environments (i.e. in AFS); quality evaluations (e.g. of timber produced in AFS where low density (fast grown), increased knottiness and stress timber may be limitations).
- *Landscape planning and management*. GIS mapping and denomination – certification (e.g. specialty coffees); management and conservation of biodiversity in fragmented landscapes; agro-eco-tourism; AFS as a tool for watershed management; remote sensing to map land use and system degradation (e.g. pastures/silvo-pastoral systems); mapping, planning and incentives for better land use at the farm level (e.g. promotion of AFS/diversification); integration of information from different levels of scale.
- *Policy*. Macro-economic effects on the financial viability of traditional (e.g. shade coffee) and novel AFS (e.g. tree/shrub protein banks for cattle); design and testing of incentives to pay for environmental services; synthesis of site specific case study results to develop sub-regional recommendations and policy interventions; consequences of international treaties (biodiversity, climate change, etc) for traditional AFS; certification and chain of custody supervision for AFS producing multiple products; consequences of different support systems (incentives) for the viability of different land use alternatives (e.g. support for basic grain producers led to elimination of multi-strata AFS in parts of Mexico).
- *Socio-economics*. Development of decision support models for complex mixed systems; consequences of HIV/AIDS and labor movements to cities for the viability (labor demand) of AFS; gender equality with respect to AFS products.

from traditional varieties grown under shade now exists. These traditional varieties had been neglected in recent plant improvement programmes. Likewise there is a need to select and develop cultivars of other crops for mixed shaded plantations as opposed to monocultures, including developing shade tolerant varieties and cultivars of: cereal crops to be grown in association with trees (Tiwari et al. 2004); the principal grass species for pastoral systems that include trees; and root crops for home gardens and other multi-strata AFS.

The silvicultural options of using competition from neighboring trees and then thinning to improve timber tree quality are limited in AFS because the tree planting densities are too low to permit agricultural activity amongst the trees although clumped arrangements have worked in temperate silvopastoral systems (Teklehaimanot et al. 2002). Selection of tree provenances with good stem form, as well as limited branching and forking *in open grown envi-*

ronments, is a neglected area in tree improvement programmes, as is the selection of provenances that have favorable characteristics for understorey crops; e.g. sparse tree crowns and deeper rooting of the trees to reduce light and nutrient competition with the crop (Boshier and Beer 1997). This is the opposite of the aim of site capture proposed by forest geneticists focussed on tree plantations.

The increasing market demand (especially in industrialized countries) for products labeled as "exotic", "healthy" or "natural" suggests that the identification, selection (improvement *in situ*) and registration of local varieties, of the multitude of little known tropical fruit species found in traditional AFS (Nair 1989), is another promising research area for plant genetic improvement. Native medicinal trees are the source of treatments for many diseases and ailments of the poor throughout the developing world (Rao et al. 2004). However, the vast majority of these tree products come from the natural forest, and some species are so depleted that their gene pools are greatly eroded; e.g. *Prunus africana* (Simons and Leakey 2004). The domestication within AFS of species with medicinal properties and of wild fruit bearing species would reduce over-exploitation, and farmers could be empowered to manage trees for higher income and on-farm management of biodiversity. However, research partnerships between agroforestry and medicinal sciences is crucial to ensure that the key medicinal species are effectively developed for on-farm cultivation, and the question of intellectual property rights of local communities (e.g. for locally developed varieties of fruits with specific properties) needs to be seriously addressed (Simons and Leakey 2004).

Ecosystem Sustainability

Agroforestry researchers have made a significant effort to quantify and value some of the environment services of AFS, but little effort has been made to manipulate AFS design to maximize these services. Examples include the comparisons of different grass, AFS and crop buffer strips to reduce contamination of water courses by run-off from cattle feed lots and silvopastoral systems (Wood et al. 1989). Manipulating AFS design to increase the protection of the soil surface and reduce leaching and soil slippage (e.g. by including deeper rooting trees that anchor the soil when fracture planes are superficial) is another example. The role of farm trees as keystone landscape elements that increase water infiltration in agricultural areas is being explored in both temperate and tropical contexts (Garrity et al. 2002; Udawatta et al. 2002; Carroll et al. 2004). While above-ground biomass is relatively easily manipulated (e.g. by pruning tree crowns), few options exist to manage root extension and hence below ground competition in mixed plantations such as AFS. Schroth and collaborators (Schaller et al. 2003) have provided examples of the latter that need wider testing: i.e. directed fertilizer placement, spatial distribution of components and the use of narrow grass strips with aggressive root systems to limit superficial tree root extension.

Soil Micro-Flora and Macro/Micro-Fauna

Although nutrient cycling in AFS was one of the first topics discussed in this new field (Mongi and Huxley 1979), initially the soil compartment of the resulting descriptive models was treated as a "black box". Total reserves, flows in (e.g. litterfall), and flows out (e.g. leaching) were measured in some studies, but the processes and cycles within the soil, such as the decomposition of the soil organic material fractions, the fixation and release of nutrients from organic-mineral complexes, and the role of micro-flora and macro/micro-fauna, were ignored. The identification and study of these soil components has increased (Schroth and Sinclair 2003) in order to classify them (biodiversity goals) and to determine the role of each species in soil biology/chemistry. Alternatively, researchers focus on functional groups, since the high diversity of macro/micro-fauna and micro-flora, and complexity of the interactions/cycles in the soil, exceeds existing research capacity. Related work on fine root characteristics, nitrogen fixation, rhizosphere chemistry, and biology (Schroth and Sinclair 2003) has also increased in the last decade, but in most AFS the soil is still treated as a "black box". This limits the possibilities for designing management interventions to increase short-term profitability while ensuring economic and ecological sustainability of these AFS.

Biological and Cultural Control in Agroforestry Systems

The rapid increase in demand for food products certified as being healthy and innocuous, including but not limited to organic certification, has increased farmer interest in and demand for biological control methods. Nevertheless the main use of biological products is in conventional farming systems in order to reduce costs (>90%; Roettger, U. pers. com. 2004).

One of the least studied AFS research fields is pest and disease control. Empirical observation, of both the positive and negative effects of tree shade on the principal pests of associated crops, has led to contradictory and site specific conclusions. For example, the effect of tree shade on coffee and cacao diseases and on coffee berry borer depends on shade intensity, altitude (temperature), rainfall, relative humidity (which affects berry borer dispersal as well as coffee and cacao diseases), cultivars, and of course

management intensity (Krauss and Soberanis 2001; Staver et al. 2001; Feliz 2002). Research needs to go far beyond studies of pest and biological control agent life cycles. The effects of the tree component, and the opportunities to manage the pest or disease by managing the trees, are complex and often indirect. They may occur via an effect of the tree on micro-climate (see the example of coffee berry borer above) and interact with localized site factors. For example, soil organic material concentration, which is influenced by litterfall quantity, quality, and site conditions, is thought to be positively correlated with the concentrations of parasitic nematodes that can control phytophagous root nematodes, a major pest of *Musa* (bananas, plantain), coffee, and other crops.

Since more than one pest or disease is usually of economic concern in a given plantation, and shade and other tree effects vary for each pest or disease, the design of appropriate silvicultural interventions to control co-existing pests and diseases is complex, often requiring a trade-off (Schroth et al. 2000). For example, coffee brown leaf spot (*Mycena citricolor*) generally increases with greater shading while another important coffee disease (*Cercosphora coffeicola*), which occurs in the same zones, decreases with greater shading (Staver et al. 2001). Add to this the fact that the intensity of the correlations (e.g. of shade levels with pest incidence) can be site specific, and one can conclude that computer modeling and development of expert systems will be of value to improve existing management, and to extrapolate successful interventions to new zones.

Another valuable new R&D area, is the study of positive and negative effects of trees in silvo-pastoral systems on animal physiology (e.g. reduced heat stress) and production, and on diseases and pests of the animals as well as of the pasture species. For example, in Central America researchers are studying shade effects on ticks (*Boophilus microplus*) and screw-worm (*Hominivorax de Cochliomyia*), which in addition to being parasites also may transmit diseases and lead to secondary infections, and on spittlebug (*Aeneolamia* sp) incidence, which reduces the viability of some of the important introduced pasture species (e.g. *Brachiaria decumbens* and *B. ruziziensi*; Lapointe et al. 1992).

Value Chain Analyses

Successful introduction of novel species into international markets, such as the little known fruit trees mentioned above in the section on genetics and plant improvement, has rarely been achieved. In these cases, the main initial focus of R&D should be on marketing (starting with national markets), production (or value) chain needs, and agro-processing rather than on bio-physical, horticultural, and ecological topics. Often local producers or collectors of such novel species get very modest payment, and products are exported in a raw state with much of the value added and realised through processing, packaging and branding in industrialized countries (e.g. *Prunus africana*, marula, and shea butter, mentioned above). However, much of the processing could be done locally, as has been shown by a recent pilot plant in Ghana for processing fruit from the wild under-storey herb *Thaumatococcus daniellii* (Waliszewski et al. in press). This species is the source of thaumatin, a substance five thousand times sweeter than sugar that is used as a natural sweetener, and sold on the London market in 2003 at over USD 6400/kg. The cultivation of *T. daniellii*, which grows well under mature rubber and in association with cocoa, may represent an opportunity to diversify and stabilise smallholder tree-crop systems but at the same time threaten established markets for collectors, so the identification of winners and losers should precede promotion of the cultivation of wild plants. It is, therefore, important that chains of custody are established concomitantly with market expansion, to ensure that benefits accrue locally and nationally.

Landscape Planning and Management

There is increasing recognition of the importance of managing protected areas in the context of the broader surrounding landscape and of biodiversity conservation in agricultural areas; e.g. in the Convention on Biological Diversity (Glowka et al. 1996). The management and conservation of biodiversity in fragmented landscapes, a new priority for international initiatives such as the Meso-american biological corridor, requires the integration of the data generated (for different organisms) at the plant, plot, farm, regional, national, and international levels. Studies of other environmental services also have demonstrated the need to integrate information from different levels of scale. For example, to design policy interventions in respect of payment for carbon credits in AFS, information must be integrated on carbon capture by and reserves in various components (e.g. plants, soil), system design (e.g. variations in planting density of each component), farm structure (e.g. land use allocations to AFS, monocultures, etc.), and regional variations in site characteristics (e.g. soil, climate).

There is also a need to study land use planning and allocation within a farm to reduce degradation and improve profitability through better matching of potential land use systems to site characteristics. The information needs for watershed management and agro-eco-tourism, well developed in Costa Rica and identified as an important potential activity for rural areas in many parts of Central America, are another reason for increasing R&D efforts at a landscape rather than merely farm and community level. For example, research is required on how different farming

systems and their configuration in a landscape affect infiltration of water and sustainable water harvest, as well as their impacts on livelihoods of farmers in both upper and lower watersheds. In general, there is need for more in-depth knowledge of how to best achieve a balance between production and various environmental objectives when considering different levels of scale.

These objectives indicate that more research is needed on the use of GIS; for example, in designing the biological networks that could permit the management and conservation of biodiversity at a landscape level, including both protected areas and biological corridors through agricultural zones. Moreover, recent development of techniques for rapid remote monitoring of land quality, such as the reflectance spectroscopy method (Shepherd and Walsh 2002), can be used to monitor land degradation.

Policy

Policies and incentives, as well as institutional mechanisms, have to be designed to enhance the adoption of AFS and hence soil, water and biodiversity conservation. Although research on policy issues, and the links between AFS researchers and policy makers, have increased (e.g. in GEF and World Bank projects and FAO initiatives), decisions are still often based on limited or even no relevant information. In the past, this has resulted in perverse incentives (e.g. subsidies to replace forest by pastures) that led to land degradation and exacerbated rural poverty. In some countries, regulations are still a barrier to greater investment in trees; e.g. the municipal land taxation system in Nicaragua dissuades farmers from adopting agroforestry technologies since local taxes increase when AFS improvements are made. In contrast, work is now underway with local municipal leaders (GEF silvo-pastoral project) to develop incentive schemes that offer differential taxation depending on land use, whereby well managed silvopastoral systems have a lower tax rate than degraded pastures.

While agri-environment schemes with a biodiversity focus have been developed and implemented in Europe over the last decade and are now being expanded (Berendse et al. 2004), the number of farmers in developing countries who have received payment for an environmental service is still minute. Sustainable financing mechanisms for the payment of environmental services over large areas have yet to be developed. Regulations that permit payment for environmental services generated with agro-silvicultural and silvo-pastoral systems, additional to those that already exist for forested land, are rare; even Costa Rica, a recognized leader in this field, has only recently achieved this objective. Efficient and cost effective methods for channeling payments for environmental services to farmers, including supervision and ensuring that a minimal level of the service function is indeed provided, have not even been tested in most countries. What is required is the development of reliable integrating indicators that permit rapid, low cost estimation of several environmental services from the same AFS.

Payment levels, timing and duration of payments to leverage positive land use change for different socio-economic groups of farmers, are themes that need to be studied in most zones for most AFS. Sub-regional adjustments may be needed to tailor such payments depending on the value of the services provided; e.g. in one location biodiversity may be a priority while in another it would be flood risk mitigation. Among locations with high biodiversity potential, some may best conserve biodiversity by encouraging more live fences that are not all pruned simultaneously; others may be better served by maintaining and regenerating trees within pastures. Hence, there is a need for spatially explicit models and policy instruments that can calculate trade-offs so that sensible incentive levels can be set for different circumstances.

Decision markers need integrated and synthesized research results (e.g. from site specific AFS case studies and isolated experiments, together with traditional knowledge) to support these policy recommendations at a sub-regional level. Likewise, there is a need for models and predictions of the effects of macro-economic changes (e.g. Free Trade Agreements) on the viability of traditional AFS (e.g. coffee farms in Central America) and on novel AFS (e.g. tree/shrub protein banks to intensify tropical livestock systems). The integration of new international conventions and the trade-offs between them will also provide valuable information for judging the future viability of AFS. A simplistic example to demonstrate these trade-offs is provided by the fact that maximizing tree diversity in a degraded pasture may maximize compliance with the Convention on Biological Diversity (by creating niches for all kinds of organisms, not just plant diversity), while converting the degraded pasture to a pine mono-culture would maximize carbon capture. In these kinds of cases, more bio-physical and economic information is needed, as well as methods to integrate and predict the consequences of each policy intervention.

Rural areas typically have markets with high transaction costs, making diversification of production a favorable choice (Omamo and Lynam 2002). Policy research with a gender focus should be conducted to identify and promote AFS that improve the livelihoods of poor rural families. Finally, policy reforms to integrate production, and market chains to increase competitiveness of farmers (and realize added value of farm products, as described above) would have significant impact in all tropical countries.

Socio-Economics

This broad title, included to cover the need for additional research in the social and economic fields, also reflects the need for more integrated R&D focussed around real world issues rather than along traditional disciplinary lines. The rural population is facing rapid changes caused by global integration, information technology, changing markets (e.g. certification requirements, increased focus on quality), and new global epidemics with especially acute consequences for tropical countries (e.g. HIV/AIDS). The challenges are not particular to AFS but the viability of AFS technologies and the adoptability of AFS systems, developed or improved by new research, are going to depend on an understanding of these new limitations and opportunities. As an example, AFS generally require higher labor inputs per unit land and product than the corresponding monocultures (but not necessarily per USD earned). Hence the viability of AFS in parts of Africa may be reduced by adult mortality (HIV/AIDS), while in Central America the adoption of more profitable but labor demanding silvopastoral systems is expected to benefit the poorest rural group (landless) by increasing opportunities for paid labour. Another example where social and economic scientists are needed to complement the work of bio-physical scientists (agronomists, foresters) occurs when commercial tree species (often timber trees) are promoted in multistrata AFS. While the modified system may appear to be more profitable, cash income from timber trees (used by men) may be at the expense of fruits, medicines, fibers, etc. from multipurpose trees (used by women and children) that have been replaced by the new commercial component.

9.3 Conclusions

The focus of AFS R&D, the interest groups involved, and the success in applying the results at all levels from policy reform to individual farmers' decisions on the management of AFS components have changed substantially over the past 30 years. The number of stakeholders and the relationships between the actors in this process (e.g. the paradigms that provide the framework for the AF R&D process) have been evolving concomitantly with the evolution of this new scientific discipline. This has taken us from a narrow focus on quantifying a few biophysical variables to broad inter-disciplinary R&D. AF researchers now seek to influence policy and regulations at international as well as national levels, while still developing socially acceptable and economically viable alternatives for farmers in both tropical and temperate regions. Different stakeholders (farmers to politicians) now have corresponding new information needs (e.g. genetics and biotechnology, social aspects such as gender access, quantification and valuing of environmental service functions, biological control, certification and marketing). These information needs are derived from data taken at different scales (plant components to watershed to global change). They have forced AF researchers to form truly interdisciplinary demand orientated teams. The increasing use of electronic tools (e.g. GIS, simulation models, expert systems) and of methodologies developed in other disciplines (e.g. statistical sampling designs developed by social scientists to characterize AFS), are other results of the changing paradigms for AFS R&D.

There are many examples of AFS that provide food security and income, especially for the rural poor in the tropics, as well as ecosystem functions. However, an even greater focus on inter-disciplinary research is needed to determine which combinations of AFS will optimize the trade-offs when different stakeholders (e.g. farmers *vs.* community) are involved. Studies are required to quantify the positive and negative effects generated by different land use options, and the multiple ways that they affect the welfare of all the different stakeholders, with the objective of identifying win-win AF technologies; examples include AFS that provide an acceptable level of profitability for farmers while maintaining high levels of ecosystem services. This requires development of spatially explicit policy instruments that can take into account the variable priority of different productive and environmental services in different places. Multi-strata AFS containing perennial crop species are good examples for further development (Muschler and Beer 2001), while it is still a priority to conduct research on how different options to pay for environmental services affect land use changes and the livelihoods of farmers and the rural poor.

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10 Capacity Development for Sustainable Forest Management

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Abstract: This paper presents examples of typical capacity development activities in the forest sector, illustrating the variety of initiatives and approaches to capacity development from around the world. The examples are grouped according to five broad areas of application: (a) capacities to manage forests on a sustainable basis; (b) capacities to formulate, implement, and evaluate policies; (c) capacities in forest research and development; (d) capacities in forest education; and (e) capacities for networking, communication, and information exchange. An evaluation of these capacity development initiatives shows that a fundamental paradigm change has taken place over the past 10 to 20 years, particularly with regard to the definition of capacity development, subjects considered important for sustainable forest management, and the concept of partnership in implementing capacity development activities. Based on this analysis, recommendations are made with regard to strategies, partnership, and necessary resources.

Keywords: Capacity development; forestry education; sustainable forest management; forest science; forest policy; forest management; information sharing.

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10.1 Introduction

Following the United Nations Conference on Environment and Development (Rio de Janeiro, 1992) the issue of capacity building has become one of the major elements in the global debate on sustainable development. According to Principle No. 9 of the Rio Declaration on Environment and Development "States should co-operate to strengthen endogenous capacity-building for sustainable development by improving scientific understanding through exchange of scientific and technological knowledge and by enhancing the development, adaptation, diffusion and transfer of technologies, including new and innovative technologies." In its Agenda 21, the conference further highlighted the crucial role of the science and technological community in decision-making processes related to environment and development, particularly referring to technology transfer, scientific support for sustainable development, forest-related education as a means of raising awareness, capacity building at the national level, and access of information for decision-making (Earth Council et al. 2002). Previous and current policy processes on forests (i.e. IPF/IFF/UNFF) recognise capacity-building together with transfer of environmentally sound technologies and finance as the three most important means to achieve sustainable forest resources management (UNFF 2001).

Capacity development is a very broad concept. First used by the World Bank in the 1980s to train policy specialists needed to pursue policy reforms in African countries, it has developed into a multidimensional concept applied to virtually all aspects of bringing about changes to society.

Although not universally accepted, the definition of capacity development by UNDP is frequently used in the international debate. In this definition capacity development is seen as "the process by which individuals, organisations, institutions and societies develop abilities to perform functions, solve problems and set and achieve objectives. It is about promoting learning, boosting empowerment, building social capital, creating enabling environments, integrating cultures, and orientating personal and societal behaviour." (UNDP 1997).

As a multidimensional concept, capacity development today is basically perceived in three ways: (a) as *a tool* (i.e. means to an end) in certain programmes and projects; (b) as a *process* that evolves over the long-term; and (c) as *an objective* to be achieved, particularly in the context of development co-opera-

tion (GTZ 2003). A commonly accepted conceptual framework for capacity development consists of four levels of capacity – individual, organisational, network/sectoral, and the enabling environment (Bolger 2000). *Individual* capacity to accomplish tasks and solve problems is a core requirement. Education, on-the-job training, and formal and non-formal skills development are important means for every person to build individual capacity. Capacity of *organisations* relates to the organisational arrangements that well-trained, productive persons need to perform adequately. These arrangements include access to finance, information, technology, and infrastructure. *Networks* concern organisations and groups that interact with others for a common purpose. *Enabling environment* is required to build sustainable capacities for individuals, entities and systems for addressing cross-sector issues relevant to all parts of society – the state, corporate sector, and civil society.

Successful development of adequate capacity for sustainable forest management requires training individuals, enhancing the structure and performance of institutions and organisations, and addressing constraints in the enabling environment. The latter includes the socio-political context with internal and external power structures, organisational and institutional arrangements, and economic framework conditions.

In the international debate on forests, technology transfer is regarded as an important aspect of capacity development. According to the IPCC (IPCC 2000), "technology transfer is a broad set of processes covering the flows of know-how, experience and equipment for sustainable forest management amongst different stakeholders, such as governments, private sector entities, financial institutions, NGOs and research/education institutions. The broad and inclusive term 'transfer' encompasses diffusion of technologies and technology cooperation across and within countries."

This paper presents examples of typical capacity development activities in the forest sector, illustrating the variety of initiatives and approaches to capacity development in a wide range of contexts and regional settings. This collection does not constitute a comprehensive assessment of relevant capacity development initiatives around the world, but it does make use of first hand experiences of the experts contributing to the paper. The examples are grouped according to five major areas of application. The first group presents technical and managerial capacities needed to operate sustainable forest management systems. The second group deals with capacities required for developing and assessing policies, thus broadly addressing issues relevant to an enabling environment. Capacity development approaches in research and development, and in education, are covered in the third and fourth group of examples, respectively. Group five addresses capacity development related to networking, communication, and information sharing. At the end of each section, the results of the examples are briefly evaluated. The paper concludes with discussion of the change in paradigm of capacity development that has taken place in recent years, and makes recommendations for future action.

10.2 Capacity to Manage Forests on a Sustainable Basis

Capacities discussed in this section are broadly related to managing forest resources on the ground. In addition to field operations, forest management planning, monitoring, and evaluation, these capacities also include factors like commercialisation and marketing, accounting and administration, and benefit sharing and conflict resolution.

Community Concessions in Guatemala

Political, legal, and social processes, described in the Latin America section of this book, led to the creation of forest concessions under community management in the Mayan Biosphere Reserve (MBR) in Peten, Guatemala. Capacity development in the broad sense (promotion of learning, empowerment, enhancement of social capital, creation of an enabling environment, etc.), has played a major role in the advancement of this process, which has resulted in over half a million hectares under SFM, most certified by the Forest Stewardship Council. The MBR encompasses the world's largest certified forest area under community management (Carera and Prins 2002).

The political decision to share and delegate the management and conservation of vast areas of the MBR to community groups and private firms has created a strong need for capacity development since the inception of the process. Capacity development has been directed to diverse beneficiaries at different levels, and the orientation of these efforts has evolved over time. Early in the process, capacity development in the National Council of Protected Areas (CONAP) was necessary for creation of the legal political framework for forest concessions. At the same time, support was provided to interested community groups on the legal requirements for securing a forest concession, and on means to strengthen their organisations to better assume this responsibility. Capacity development was also directed to local NGOs, selected to provide technical and organizational support to both communities and private firms with an interest in participating in the process. Although these efforts can be considered successful, the process is still quite young and far from consolidated.

SFM is clearly a complex endeavour involving social, economic, cultural, institutional, technical, ecological, and policy dimensions. Advances to date in the creation of organizations capable of

meeting legal requirements, in carrying out reduced impact logging, and in protecting vast areas of forest from illegal logging, fire and the expansion of the agricultural frontier, have given rise to new capacity development challenges. Several evaluations of community concessions in the MBR indicate that communities require greater knowledge and capacity in business management (e.g. business plans, accounting, administration, conflict resolution); marketing and commercialisation, including of lesser known species; efficiency and quality of processing of forest products; diversified management of goods and services from the concessions; and distribution and utilization of income generated from forest management within the communities.

Sustainable Forest Management Model in Sabah, Malaysia

In the 1950s, more than 70% of the land area of the East-Malaysian State of Sabah was covered with primary tropical forests. In the late 1980s, after decades of unsustainable timber exploitation for the purpose of agricultural expansion and selective exploitation of the permanent forest estate, the Sabah Forestry Department (SFD) decided to develop a model for the sustainable management of its tropical forests. With assistance from the German Government, the Deramakot Forest Management Project was implemented in the period from 1990 to 2000 to develop an operational model for a management unit of 55 000 ha of logged-over, natural lowland *dipterocarp* forests. (Udarbe et al. 1994). After 11 years of capacity development activities, the Deramakot Forest Management Unit (FMU) operates without external assistance. SFD manages the unit, in cooperation with private contractors who carry out operations, such as reduced-impact logging and silvicultural operations including tree planting, road construction, and maintenance. The FMU obtained a FSC-Certificate in 1997, and currently operates in the second cycle after renewal of the certificate in 2002.

Capacity development activities have targeted operational staff of the FMU and decision-makers of the Sabah Government, forest industries, and environmental NGOs. Field personnel have been trained in forestry operations, while planners and managers have been upgraded in forest management planning, monitoring and evaluation, timber marketing, management standards, and certification processes. Decision-makers of the Sabah Government have been exposed to policy aspects of sustainable forestry related to resource allocation, tax and revenue issues, environmental management, and macro-economic analysis and planning. Different types of capacity development activities primarily promoted learning by experience, whereby local staff in close cooperation with foreign experts jointly adapted new technologies and "best practices" to local conditions, and worked out solutions to problems based on experiences from elsewhere in the tropics.

Today, the SFD and collaborating private companies have the necessary technical and managerial capacities to operate SFM in the model area. However, extending this system to all other forest areas in Sabah is constrained by insufficient political will, lack of incentives for large-scale forest rehabilitation, land-use competition due to financially more profitable agro-industrial options, and still very limited SFM-trained human resources.

Remote Sensing and GIS Technology

The use of remote sensing and GIS has expanded in tandem with the development of computer and satellite technology, and the forest sector has been quick to take advantage of the new opportunities. Remote sensing is routinely used in forest resource assessments, and GIS applications in forestry serve both operational and research purposes. Tropical countries use remote sensing widely for forest resource assessment. GIS has principally been used for research studies and only to a limited extent to formally support policy formulation, the planning process, or management decisions (Apan 2000).

In remote sensing the available applications range from such widely adopted systems as assessments of forest cover and timber volume, to more recent innovations like monitoring forest fires and the spread of invasive species, wildlife resources, grazing pressure, and illegal logging etc. The most common use of GIS is for planning forest management, timber transport, and timber harvesting schedules. Newer applications deal with fire prediction and response, ecological landscape planning, wilderness area design, predicting evapo-transpiration and surface runoff, providing support to resolution of forestry/wildlife conflicts, etc. Log tracking systems are a new innovation linking GIS and use of GPS (Global Positioning System) and they are likely to spread rapidly in the near future.

The benefits of remote sensing and GIS are often obvious but difficult to assess in quantitative terms. With regard to environmental management they include, *inter alia*, better monitoring of forest condition, easier distribution of environmental data, improved coordination of productive and conservation activities, and enhanced capacity to analyse the environmental impacts of alternative courses of action.

GIS and remote sensing have been substantially promoted in developing countries with mixed results. Evaluations show that in addition to the well-known problems with capacity and human resources, institutional and organizational constraints constitute a significant hindrance (cf. Eastman and Toledano 1996; de Gier et al. 1999). Restricted institutionalisation of GIS projects in the public sector is caused by weak links to decision-makers and their data needs,

lack of incentives for GIS staff, and lack of funds to enable continuation of externally supported projects. Because of the high costs of computer hardware and most GIS software, rapidly changing technology, and lack of adequately equipped and staffed training institutions, the technical skills to operate and manage GIS projects are largely absent in the forestry sector. The markets for remote sensing data are limited by high costs of data acquisition and processing and restricted utility of the data for timber companies. This has caused a lack of raw data for GIS and a lack of digitised infrastructure data (e.g. digitised road maps in support of transport applications). All this in combination with inadequate data distribution mechanisms, including insufficient standardisation, lack of structures for decentralised data management, and restrictions on free access to information for strategic, political, economic or other reasons, has restricted the access of policy makers and practitioners to existing data.

Evaluation

The examples in this section show that technical, managerial, and organisational core capacities for SFM can rather quickly be built at the level of individual projects and initiatives. Usually external assistance provides sufficient incentives, at least in the short term, for actors to participate and rapidly acquire new knowledge and skills. Unfavourable framework conditions are much harder to change. As in Guatemala, the political and legal framework has been influenced by working closely with policy makers and influencing their decisions. The political decision in favour of community concessions created a strong demand for capacity development at various levels of beneficiaries. In contrast, the forest management model in Sabah, Malaysia has been set up to demonstrate to policy makers and the private sector the feasibility of SFM in the Southeast Asian context. Similarly, setting up GIS and remote sensing technology units in developing countries is a smaller problem than their long-term sustainable utilisation. To make these systems work at a larger scale, constraints in the enabling environment need to be addressed. This requires capacities related to policy, research and development, networking, communication, and information sharing. Most of the pilot and model forest projects have lacked feedback mechanisms to the policy level, which are needed in order to make feasible solutions mainstream. As suggested by Simula et al. (2004) feedback mechanisms could be linked to national forest programmes to ensure policy adjustment in practice.

10.3 Capacity to Formulate, Implement and Evaluate Policies

Today it is commonly accepted that sound scientific information is required to shape forest policies that help bridge the current situation to a sustainable future. Analysis has shown that available scientific information has only limited influence on policy decisions. Results of the work of the IUFRO Task Force on the science-policy interface have shown that specific capacities can help to improve understanding between scientists and policy makers. These capacities include knowledge about the difference between scientific and policy processes, the type of communication that match means and message to the audience, and collaboration to build trust and influence policy (Guldin 2003). Because of the importance of these capacities, training in effective communication and engagement in policy processes are increasingly offered to forestry researchers and practitioners.

National Forest Programmes – Experience of German Development Cooperation

Following the UNCED (1992) in Rio de Janeiro a comprehensive international forest policy dialogue (i.e. IPF 1995–1997, IFF 1997–2000, and International Arrangements on Forests, IAF) has taken place. One of the most important outcomes of this policy dialogue has been the adoption of the concept of national forest programme (NFP). According to the IAF, the NFP concept provides an overall forest policy framework for country-specific approaches to sustainable forest management. The objective is the conservation, management, and sustainable development of a country's forests to meet local, national, regional, and global needs and demands of the present and future generations.

Over the past several years, developed and developing countries have revised and elaborated forest policies and strategies under the framework of national forest programmes. German development assistance has supported these processes in 15 countries and three regions in Africa, Asia and Latin America (BMZ 2004). Experience so far has shown that the NFP process is in place in most countries but can be risky for some stakeholders because it depends on transparency, participation and partnership, political will, and preparedness for change. Many countries still lack these basic principles, and significant portions of their societies are not fully involved in democratic processes. In order to be successful and make NFP processes work, support to developing countries must address the three major aspects of NFPs, i.e. national political commitment, clear objectives, and continuous support by the donor community. One

Ping Zhou

Researcher interviewing a villager about the traditional uses of forest in China.

of the means to promote political commitment and clear objectives is through capacity development activities targeting different groups of stakeholders. IUFRO-SPDC (IUFRO's Special Programme for Developing Countries) in cooperation with the GTZ-IWP Project (International Forest Policy Dialogue) offers training courses that are designed to address topics such as international arrangements on forests and their implementation in the context of national forest programmes, financing sustainable forest management, and the role of science in NFPs. The courses are intended to create awareness and motivate forest stakeholders to actively participate in NFP processes.

FAO's Contribution to National Forest Programmes in Asia Pacific

With the aim of achieving a workable social and political framework for the conservation, management, and sustainable development of all types of forests, FAO has initiated a major initiative to support the development of NFPs in the Asia Pacific region. FAO provides advisory services and technical assistance to increase awareness of the issues, strengthen country capacity, improve participatory processes in policy formulation, and undertake additional studies and surveys relevant to policy and institutional development. From 2002 onwards, FAO started a series of workshops for awareness creation in the Asia Pacific region. The topics treated included: (i) formulation of national forest policies and NFPs (China, Mongolia, and Thailand); (ii) strategies and new directions in implementation of NFPs (India); and (iii) implementing IPF/IFF Proposals for Action through NFPs. In addition to these core activities, FAO is also supporting the Asia-Pacific countries through the NFP Facility arrangement. The work undertaken so far include activities such as strengthening the NFP Secretariat and supporting the decentralization process in the forestry sector (Indonesia), reviewing the forestry sector at provincial levels and supporting development of forestry websites (China), developing NFP processes in parallel with ongoing institutional changes, strengthening capacity of stakeholders in NFPs, and supporting civil society participation in forestry.

Evaluation

Overall, the NFP process presents a wide range of opportunities that have potential for learning and adding value to efforts towards SFM. Besides training courses and workshops, capacity development takes place in the form of learning by doing (i.e. participants in the NFP processes continuously enhance their capacities through their engagement in the process). In this context capacity development can be regarded as a "two-way street" between actors within a process, rather than a more traditional "top-down" model of capacity development from "trainers" to "trainees". This new type of capacity development is gradually emerging because of the need for relevant capacity to organise and implement NFP and other policy processes in a manner that is well adapted to a unique context.

10.4 Capacity in Forest Research and Development

All over the world, research and education play fundamental roles in developing innovative solutions to sustainable forest management problems. With the broadening demand for forest goods and services, and the shift to more comprehensive landscape management, forest research and higher learning institutions are changing the way they work. These changes are evident throughout the world.

While in industrial countries forestry research institutions are down-sized and forest science is integrated with other scientific disciplines, forest research in poor countries and countries with economies in transition continue to struggle with more fundamental problems of resources and capacity. Analysis of forest research capacity in Africa revealed general problems and weaknesses in forestry-related research in developing countries (Kowero and Spilsbury 1997; Spilsbury et al. 1999; Spilsbury et al. 2003). Major constraints are insufficient research capacity and inefficient use of the little capacity that does exist; unstable research effort, partly due to very limited local funding, and sporadic and unpredictable donor support; and frequently changing research agendas, partly caused by dependence on fickle donors. Due to limited interaction with users, poor research and development linkages cause incompatibility between research agendas and needs. The situation is further aggravated by inadequate flow of information and access to scientific literature, associated with unsatisfactory library facilities and access to electronic information. Many of these constraints have been addressed in the past, and continue to be the focus of various support programmes provided to developing countries by the international scientific and development community.

Expanding Research Management Capacity in Developing Countries

Over more than 20 years, IUFRO's Special Programme for Developing Countries (IUFRO-SPDC) has provided capacity development services to forest scientists in Africa, Asia and Latin America. As part of its programme, IUFRO-SPDC offers training courses in research management and in preparing and writing research proposals. These courses aim to assist forest scientists to improve their capacities to plan and implement research projects, and to prepare better research proposals for submission to national and international funding agencies.

Courses have been implemented in close cooperation with different partners, such as GTZ Germany (German Technical Cooperation Agency), ODA Japan (Official Development Assistance), regional forestry research networks (e.g. Forestry Research Network of Sub-Saharan Africa, FORNESSA and Asia Pacific Association of Forestry Research Institutions, APAFRI), and local universities and research institutes in the partner countries. In the past 6 years, more than 800 scientists, primarily in Africa and Asia, and to a limited extent in Latin America, have participated in this training (IUFRO-SPDC 2004).

The International Foundation for Science (IFS) operates a similar programme on conceptualising research proposals that started in early 2000 with courses in close cooperation with IUFRO-SPDC. The courses specifically aim at training potential applicants for IFS research grants in the science methodology required to prepare research projects (IFS 2004).

Building Research Capacity through Partnerships

Partnerships are becoming an increasingly common mode of operation in forestry development initiatives and in research. At CIFOR, for example, capacity development is considered to be an objective and an integral component of research partnerships and collaborative arrangements; it can yield benefits that enhance individual scientific expertise, build institutional research capacity, and provide support for networks and other links within and between national systems. Whilst much of the capacity development activity in partnership research goes unseen, CIFOR estimates that the time allocated to capacity development of partners from developing countries in research-related workshops and planning meetings alone, amounted to well over 4400 person days (63%) in 2003, whereas the time devoted to capacity development through formal training was approximately 2500 person days (37%) over the same period.

A similar approach towards research and development partnership is pursued by ICRAF. In working towards improving human welfare through improved agroforestry systems, ICRAF is working exclusively with national partners. The research agenda is developed jointly with these partners and implemented on farmers' fields or on national research sites. The basic elements of this process essentially include the participatory identification and prioritisation of research issues, and implementation of research on farmers' fields or national research plots. In this way, farmers can adopt and adapt to innovative solutions more rapidly, and scientists can advance their knowledge through experiential learning and capturing second-generation problems. Working at national sites helps to contextualise the research problem within the community that is experiencing it, and also ensures national ownership. The strategy provides opportunities to build national capacity for research.

Regional Thematic Networking in Asia Pacific

Rehabilitation of logged over natural forests is one critical area for research and development in Asia Pacific. In 1997, Asia Pacific Forest Rehabilitation Network (APFReN) was established to facilitate exchange of information and collaborative research, review the past experiences regarding rehabilitation, including enrichment planting, and establish demonstration sites to showcase rehabilitation efforts in the region. The Forestry Research Support Programme for Asia Pacific (FORSPA) managed by FAO, provided training and research support to the network. This support helped to establish large rehabilitation demonstration sites (ca. 100 ha), one each in Cambodia, Laos, Papua New Guinea, Sri Lanka and Vietnam. Information on forest rehabilitation issues are being disseminated and shared through APFReN's website, expert meetings, and seminars. The network further promoted the compilation and distribution of authoritative documents and manuals on rehabilitation of degraded forests and assisted natural regeneration.

Value-Added Research Products through Science Cooperation

Over a period of two years, forest scientists from Africa joined hands to work on a scientific synthesis about the rehabilitation of degraded lands in Africa. The initiative aimed at demonstrating the added value of scientific output that can be achieved through enhanced collaboration and information sharing among scientists working in different countries and environments. Senior scientists from Burkina Faso, Ghana, Kenya, and Tanzania acted as theme leaders for the main geo-ecological regions, namely "dry", "humid", and "sub-humid" forests. The authors, with assistance from other scientists, brought together 14 case studies describing forest rehabilitation projects. Critical analysis of the lessons learned from these cases studies was synthesised and used to formulate recommendations for policy makers, forest managers, and rural communities. These results provide the basis for the dissemination of good rehabilitation practices among potential users at all levels (Blay et al. 2005).

Evaluation

Developing individual capacity in various aspects of forestry research, such as research methods and project management, is fundamental in building efficient research organisations. Partnership arrangements among research institutions and with local communities, as demonstrated by ICRAF in agroforestry, have tremendous potential to increase the efficiency of research work and contribute to resolving issues of rural poverty and livelihood. The formation of successful partnerships is of critical importance for research undertakings. Effective partnerships share the organisational features indicative of a strong research capacity. They include efficient organisation, good governance, clear priorities linked to resource use, high staff motivation, and fruitful interaction with research users and other external stakeholders.

Synergy among capacity building initiatives is vital, otherwise capacity building efforts tend to dissipate and can become futile exercises. To be effective, individual capacity development initiatives must be framed within a broader strategy of enhancing the capacity of research systems in national and regional networks. Working through partnerships at the interface of science and policy also helps to shift research agendas towards national and regional priorities.

10.5 Capacity in Forestry Education Programmes

Experts around the world agree that over the past several years the state of professional forestry education has been declining. In response to declining demand for forestry graduates, funding to educational institutions has declined significantly, and student enrolment has gone down. Educational institutions react to these developments by downsizing, and integrating with associated fields like agriculture and nature conservation sciences. This development is caused by structural changes in economies and societies. The number of professional forestry jobs is declining because of productivity increases, advances in efficient wood processing, and low commodity prices.

In developed countries, forestry will become even less attractive than other fields in terms of remuneration and working conditions. Through increasing integration of forestry activities with other land uses, and reliance on technology transfer processes, general forestry jobs will likely decrease (Nair 2004). Against this background, many educational institutions have embarked on adjustment processes and pursue innovative strategies to cope with the new realities.

Training of Scientists in Central America

In Central America CATIE has made a major contribution to the strengthening of capacities in research and development in natural forest management, forest plantations and agroforestry (Finegan 2000). CATIE is a unique regional institution dedicated to graduate education, research, and outreach activities in the fields of tropical agriculture and the management and conservation of natural resources. Several attributes of CATIE's graduate program have enabled

Zenebe Mekonnen

Building capacity for SFM is effected through formal, non-formal and informal education involving a wide spectrum of approaches and contents. Here stakeholders assess the management of a wood lot in Ethiopia.

its contributions to capacity development in research and development.

Generous, uninterrupted support from several international donors has enabled CATIE to devote considerable time and effort to forestry development in a sustained fashion throughout the region. During the implementation of research and development projects, results and lessons learned are fed back into CATIE's graduate education. Many professionals who have participated in CATIE's Graduate Program occupy important positions in universities, institutions devoted to research and development, and other public and private sector entities. These active professionals have contributed to the creation of a "school of thought", for example, in the management of lowland, humid tropical forests. CATIE also offers intensive, strategic courses to provide up-to-date concepts and experiences to professionals from throughout the region.

Building Educational Capacity in Africa

In many tropical developing countries, as much as 70% to 90% of production is smallholder based. Because of limited land resources, low productivity, and population growth, farmers have over the past several decades developed agroforestry innovations, such as fallow, use of green manures, and cultivating trees and shrubs that improve soil fertility. In order to find ways for educational institutions to better integrate agroforestry knowledge in agricultural and natural resource teaching programmes, ICRAF assisted African Universities to form the African Network for Agroforestry Education (ANAFE, formed in 1993).

The objective of ANAFE was to assist colleges and universities in their efforts to incorporate multidisciplinary approaches to land use education. It was then observed that agroforestry was not taught because it was new to both agriculture and forestry education (Kung'u and Temu 2003, 2004). With support from Sweden, ANAFE was able to assist 68 colleges and universities in Africa to incorporate agroforestry in their educational programmes, including the development of teaching materials, creation of agroforestry field demonstration plots, and training of lecturers (Temu et al. 1998).

Networking as implemented by ANAFE is now established as a very powerful mechanism for communicating and sharing experiences among African educational institutions. Network management is devolved to the grass-root levels, and democratic processes are applied to leadership election and decision-making, including allocation of network resources. Due to changes in education policies in several African countries, agroforestry is currently accepted as an important component of college and university education.

A similar network for Agroforestry Education has been launched in Southeast Asia (South East Asian Network for Agroforestry Education, SEANAFE), by bringing together agriculture and natural resource sciences through agroforestry at 35 universities in six Southeast Asian countries.

Carol Colfer

Devolution of forest management responsibilities to the local level requires capacity building in social, institutional, financial, technical as well as ecological aspects of forest management. Here extension officer is visiting a village in Jambi, Indonesia.

Evaluation

As these examples show, the integration of education with practical field application, involving forest stakeholders, is an important step in providing the knowledge needed to solve problems on the ground. There is also much more emphasis on social, cultural and economic research helping to address many of the immediate forestry problems, particularly related to issues such as land tenure and resource allocation, governance, and livelihood. Building networks also enhances the abilities of individual institutions to establish new curricula and find adequate teaching faculty. Increasing numbers of educational institutions have integrated forestry with other disciplines, such as biological and social sciences, agriculture, and landscape management. In this way concepts and methods of other scientific disciplines can better be incorporated into the forest-related curriculum.

10.6 Capacity for Networking, Communication and Information Exchange

The rapid development of communication and information technology over the past decade has had a significant impact on the work of forestry professionals at all levels. Because of increased stakeholder participation in forestry decision-making, networking among individuals and institutions within countries and regions and across continents has become an important activity in day-to-day work. This in turn requires special skills and knowledge, described in this section.

Networking Among Forest Stakeholders in Central America

In Central America, tropical forest conservation requires that forests are integrated into the local economies of rural communities and indigenous groups. The achievement of this integration is a complex endeavour, involving diverse technical, sociological, cultural, biological, economic, and political concerns. To better address the complexities involved, over 140 entities with interests in tropical forest management and conservation joined together in Honduras and Nicaragua in four operational networks (Galloway 2001, 2002). Network members have included public sector entities, NGOs, communities and producer groups, universities and technical schools, projects, and private companies. From the perspective of capacity development, these operational networks have provided several advantages. Network members have undergone shared strategic planning to establish common strategic visions and objectives, and cooperated in operational planning, resulting in shared research, technical assistance, and training agendas. Networks have sponsored regional fora to discuss political, institutional, social, and commercial constraints to tropical forest management and conservation.

Important tangible benefits from this operational networking have been observed: shared training increases program efficiency and reduces costs for participating entities; cooperation in training leads to greater conceptual and methodological uniformity within a given region, and technological and methodological advances are disseminated rapidly among network members; and diverse network members recognize and benefit from the increased local capacity. Gradually local trainers (including community members who are directly involved in forest management operations) take responsibility for a greater array of training exercises. Courses in applied pedagogy are important to enhance the capacities of these local trainers.

Capacity development priorities in operational networks reflect the status of forest management and conservation within a given region, and have been seen to evolve over time. Initially at the community level, emphasis may be placed on organizational concerns and planning. Later, greater emphasis is usually placed on operational efficiency, quality concerns, and managerial matters, including administration and accounting. Several problems, especially inadequate financial autonomy, have limited the effectiveness of the operational networks in Honduras and Nicaragua. In some cases, the participation of public sector institutions in the networks has been weak. Uncontrolled illegal logging, corruption, and bureaucratic obstacles can greatly reduce the success of forest management initiatives, even when a wide host of different entities collaborate together in operational networks.

Building Development Capacity among Farmers in Africa

In 2001 farmers and development organizations in Western Kenya realized that despite the large number of institutions involved in disseminating agricultural and natural resources management (NRM) innovations to farmers, the problems of hunger and natural resource degradation persisted. It was found that the key obstacle to development was the lack of coordination among forest stakeholders, and the "Consortium for Scaling up Options for Increasing Farm Productivity" (COSOFAP) was established.

COSOFAP's objective is to enhance the efficiency and effectiveness of research and development organizations to meet the livelihood and environmental needs of farmers in Western Kenya. The consortium achieves this by convening fora for exchanging knowledge and experiences, including flow of information vertically and horizontally amongst partners; by capacity building measures; by developing strong and effective links with policy makers; and by promoting value adding and marketing of farm produce. Interactive learning sites (ILS) are purposefully selected at different locations, and jointly developed by consortium members to provide services such as exchange visits, training, technology demonstration, germplasm production, and rural knowledge services. Similar learning platforms have been promoted in Asia by the Regional Community Forestry Training Centre for Asia and the Pacific (RECOFTC). RECOFTC has adopted an innovative approach, based on the concept of forest management learning groups, to the development of silvicultural practices within community-based forest resources management regimes (Miagostovich 2004).

Communication and Public Relations in Forest Science

Public interest in forest-related issues has increased tremendously at national, regional and global levels. Because many different forest stakeholders directly or indirectly influence decision-making, adequate communication of scientific information to policy makers, forestry professionals, rural communities, and the general public is indispensable. In the past the forestry profession, including the forest science community, has not been very successful in communicating their agenda to society. This is gradually changing through a number of initiatives and projects. IUFRO's Task Force on Public Relation has developed a manual on PR for forest sciences that brings together success stories of PR and communication initiatives from around the world (Kleinschmit and Krott, in press). The manual, which will be used in IUFRO-SPDC's training programme, also offers a set of guidelines and tools for successful approaches to communication and PR activities.

Networking for Information Exchange in Africa

The Global Forest Information Service (GFIS) is an international initiative within the framework of the Collaborative Partnership on Forests (CPF), and aims to enhance accessibility and sharing of information on all types of forests and their sustainable management. This internet-based system (www.gfis.net) allows users to search and access a wide range of forest-related information resources from around the world. Pre-requisite for developing such a global system are networks of people and institutions that provide adequate information in terms of quantity and quality. In Africa, the Forestry Research Network of Sub-Saharan Africa (FORNESSA) has established five GFIS Centres that act as focal points for the mobilisation and dissemination of scientific forest-related information. Capacities within these centres have been built for discovery and mobilisation of relevant information resources. Particular emphasis is also given to communication and coordination skills, in order to keep network members interested in the service and motivate new information providers to actively contribute to and use the GFIS service.

Evaluation

The initiatives on networking, communication and information sharing described here are very important, serving to prepare forest stakeholders at all levels for a future more connected and interactive global society. Upgrading knowledge and skills in information sharing and communication techniques

are relatively straightforward processes. In contrast, expanding capacity in networking is more difficult, and requires learning by experience through applying skills in communication techniques, conflict resolution, mobilization of community knowledge, and participatory planning and decision-making processes. With networking, communication, and information exchange many of the prevailing constraints to SFM in the enabling environment can effectively be addressed.

10.7 Changing Paradigms in Capacity Development

Sustainable forest management is clearly a complex endeavour involving social, cultural, institutional, technical, ecological, and policy dimensions. As highlighted in this paper, this complexity is reflected in the diversity of capacity development initiatives that are being implemented around the world. Building the necessary capacity for SFM is effected through formal, non-formal, and informal education programmes involving a wide spectrum of approaches and contents. As experience in many parts of the world over the last decade has shown, managing the transition towards a sustainable future for forests and safeguarding their vital services to society requires long-term processes of attitudinal changes of individuals, institutions, and entire social systems. Thus, sound understanding of the socio-cultural and economic context in which capacity development takes place, is critical for selection of the appropriate content and approach to achieve successful outcomes effectively.

Fundamental paradigm changes in capacity development have taken place over the past 10 to 20 years. Most prominent are the broadening of the definition of capacity development, changes in the contents and subjects considered important for SFM, and the shift in emphasis towards networking among stakeholders. In addition, the concept of partnership has become central to any capacity development initiative.

The narrower term of capacity *building*, which was confined to training of individuals, has been expanded to the much broader field of capacity *development*. The latter encompasses the skills and abilities of individuals, institutions and entire systems to perform functions and set and achieve objectives. This broad concept provides the basis to address the complexity of SFM in all its dimensions.

With the broadening of the capacity development concept, new dimensions and fields of expertise have been introduced. Traditional subjects like ecology, forest management, and economics have been complemented by new areas like policy, governance, livelihood, environmental services, and information and communication technology. The trend to learn from other disciplines and introduce new fields of expertise provides the basis to address the many constraints in the enabling environment hampering SFM implementation. Inter-sector as well as national, regional and global environmental and economic policies, for example, need to be shaped in such a way as to support SFM. New knowledge, new skills, and new institutional arrangements are needed in order to contribute effectively to such policies.

The capacity to network, encompassing a wide array of skills related to communication and interaction among stakeholders between all sections of civil society, has become the predominant paradigm shift. The skills and capacities to interact are important in all the major areas of capacity development application described in this paper. Achieving sustainable forest management requires continuous interaction within the forestry sector at the local and national levels, with other economic sectors addressing broader cross-sectoral issues, and at the international level dealing with global concerns and objectives.

As a consequence of these changes towards more comprehensive capacity development involving many actors, long-term partnerships have emerged as an important strategy in resolving the complex problems of natural resources management. As demonstrated in this paper, many different players are involved in capacity development initiatives. Networking among forest stakeholders, science cooperation, long-term forestry development projects, and educational networks are only a few examples where partnerships play a central role. Building and maintaining partnerships, however, requires adequate skills in communication and public relations, problem resolution, moderation, and the management of networks.

Recommendations for Future Capacity Development

- While new skills, such as networking, communication, information sharing, and policy analysis and formulation must be promoted, the advancement in knowledge of biological production and management systems should not be neglected.
- Partnerships should be implemented through networking, including face-to-face meetings, joint field trips and working sessions, etc. This requires adequate financial resources.
- Capacity development must be mutually reinforcing and truly demand driven. This can be achieved through broader strategies involving networks at local, regional and global levels.
- Partnerships should be further expanded in capacity development, particularly in developing countries, through better integration of existing networks.

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11 Traditional Knowledge and Human Well-Being in the 21st Century

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Abstract: In this chapter, we highlight the most important issues pertaining to traditional knowledge. We see these as 1) intellectual property rights; 2) internal community differentiation; 3) differing epistemologies; 4) potential exchange between multiple use forestry and traditional knowledge systems; and 5) links among knowledge, livelihoods and land. In our view, "traditional knowledge" and "cosmopolitan" or "scientific knowledge" could contribute to each other in a much more constructive way than is now the case – to the benefit of both environmental and human diversity and well-being.

Keywords: Traditional knowledge; indigenous knowledge; epistemology; intellectual property rights; intra-community heterogeneity; multiple use forestry; indigenous technical knowledge; policy.

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11.1 The Importance of Traditional Knowledge

There are two main ways in which traditional knowledge is important to those interested in sustainable development and social justice. One has to do with our interest in expanding the global knowledge base; the other has to do with our interest in contributing to environmental and human well-being. In this chapter, we first discuss the importance of traditional knowledge as a means of enlarging our understanding of local environments. This will be linked to the impacts such "external" attention might have on local communities. We will then discuss some of the issues that emerge as one examines traditional knowledge systems, with some examples of pertinent traditional knowledge and its uses.

Understanding of the potential contribution of traditional or indigenous knowledge has grown in recent years. Beginning modestly with the elicitation of local taxonomies of plants (Conklin 1957), firewood (Metzger and Williams 1966), colors, (Berlin and Kay 1969) and other domains, this field of study has grown to address complex issues like representing the underlying logic of indigenous knowledge on computers (cf. Colfer et al. 1989; Joshi 1997; Sinclair and Walker 1999). *The Indigenous Knowledge Monitor* is a journal devoted entirely to documenting such knowledge. The Intermediate Technology Development Group in the United Kingdom has an extensive field program of direct community involvement in Asia, Africa, and Latin America, as well as a series called Studies in Indigenous Knowledge and Development. There is a Center for Indigenous Knowledge for Agriculture and Rural Development at Iowa State University in Ames, Iowa. This kind of information has relevance both for understanding local human systems (the anthropological concern), and for linking local people in a more mutually beneficial way with "non-local" actors and institutions (a more pragmatic need related to human well-being and protecting the environment).

Jordan (1997) discusses the difficulties in integrating indigenous knowledge into "mainstream" knowledge. She introduced the concept of "authoritative knowledge." Those in power have knowledge that is generally recognized as authoritative; the knowledge of those without power is not recognized in this way (cf. Foucault 1980; Escobar 1995; Nygren 1999). This concept is especially relevant to the traditional knowledge of forest peoples in many developing countries (cf. Banuri and Apffel-Marglin 1993).

Expanding our recognition of forest peoples' detailed knowledge of their environments can serve both to enhance management and to strengthen the voice of local people in making policies more appropriate to their needs and those of the environment. Formal, governmental, and other large-scale resource management has typically been carried out with such managers blissfully unaware of local people's po-

BOX 11.1 Pigs, Palms, Primates and the Penan Benalui hunters

Rajindra Puri

Penan Benalui hunters in Indonesian Borneo use a method of entrapment known as *nedok* to capture their favorite prey species, the bearded pig (*Sus barbatus*). *Nedok* requires the hunter to mimic the movements, sounds and calls of the pig-tailed macaque (*Macaca nemestrina*) as it travels on the ground in search of fruit. The hunters know that pigs will follow the monkeys to find fruit, especially fruit that is only available if picked and dropped by arboreal animals. Hunters, hidden by shrubs or tree trunks, cunningly entice the pigs toward them and when the pigs are close enough they are killed with guns, spears and even machetes. Catching pigs in this manner requires the hunter to remain in character for long periods of time, and the skills of a mimic in moving and sounding just like a monkey. The wrong sound or sequence of calls alarms the pigs and they quickly depart!

Underlying this knowledge of the behavior of animals and their interactions with each other is a deeper understanding of forest ecology and the varying importance of certain food sources from season to season. Monkeys help pigs find fruit when most trees are not fruiting (Borneo's forests are seasonal), and often these include figs and a variety of palm species that fruit seasonally. An important food source for both animals is the hill sago palm (*Eugeissona utilis*), which produces a soft ectocarp eaten by the macaques and hard oily nuts eaten by the pigs. These sago palms grow in thick groves, known as *birai* to the Penan, and are also managed by Penan and others in Borneo for both palm cabbage and palm stem starch (known as sago), which is the traditional staple starch of all forest foragers in Borneo. Thus, Penan hunters may forgo collecting the pith so that the palm stems will bear fruit, and thereby provide food for animals and thus prey for hunters in a known location, potentially throughout the year. Managing palm groves, in some cases protecting them and actively encouraging vegetative reproduction too, allows hunters the options to use the area for vegetable or animal foods, or both, depending on their seasonal needs. (Puri 1997).

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tential contribution to their work. We have ignored a huge human resource by not recognizing forest peoples' capabilities to participate in development processes, including the wider use of their knowledge (Clay 1988). Conversely, the wider recognition of the value of such knowledge can contribute dramatically to the self-respect and self-confidence of the people whose knowledge is thus recognized.

Despite the rich literature on the utility of traditional knowledge, some difficult barriers have prevented its widespread use. The most obvious is the fact that much traditional knowledge of forests is available only in a language known by very few people. Forests tend to be sparsely populated, almost by definition, and tropical forests (the kinds about which we, as a global scientific community, know the least) are often inhabited by many small and diverse groups – each speaking a different language. Thus, the well-known problems of translation form a straightforward barrier to access traditional knowledge.

Some kinds of knowledge are easier to access than others. Scott (1998) has written of "metis," a Greek term, referring to the kinds of knowledge needed to respond to changing circumstances, the kind that involves skill, flexibility, and adaptability, and applies to a particular location. He contrasts this kind of knowledge, embedded in local experience, with the more general, abstract knowledge acknowledged by states and technical agencies. Puri (1997) calls this "performance knowledge" and shows how Penan hunters in Borneo's tropical forests integrate their past experience of hunts and their vast knowledge of wildlife, landscape, tools, and techniques to adapt to a variety of circumstances and thus ensure a regular catch for their family's subsistence (see Box 11.1).

A less widely recognized but equally daunting problem is that of underlying differences in epistemology, or ways of knowing. Different knowledge systems have different standards and ways of assessing validity. They have different assumptions from which people reason (cf. Leach and Mearns 1996). All of these differences may be important when outsiders want to understand and make use of traditional knowledge.

There are many areas in which traditional knowledge can fruitfully contribute to more "universal" forms of knowledge. Forest dwellers typically have detailed knowledge of the geography of their community's territories; they already work with zoologists, botanists and ecologists, sharing local knowledge of wildlife, plant habitats, seasonal variation, and the like. Anthropologists and economists build on local environmental and other knowledge to fill in their own understanding of ecology, subsistence patterns, division of labor, seasonal variation in income, etc. (Colchester 1981; Posey 1983; Bird-David 1992; Balee 1993; Colfer et al. 2000). The most obvious areas in which forest peoples contribute to western or "cosmopolitan" science derive from their knowledge of medicines, fibers, wood, food, and wildlife, and the habitats, seasons, growth patterns, and nutritional needs of these products and organisms. Much of the knowledge that forest people have of these topics is directly compatible with conventional scientific knowledge, and is in fact often included without much recognition when "modern" scientists analyze and write up their findings about tropical forests. One valuable way forward is the linking of traditional

knowledge with the kinds of knowledge foresters and other environmental scientists have (Clay 1988; Colfer et al. 1997; Donovan and Puri 2004).

There are a number of important issues that emerge when we examine traditional knowledge. We focus on five of them here: 1) intellectual property rights, 2) internal community differentiation, 3) different standards relating to knowledge and validity, 4) multiple use forestry, and 5) traditional knowledge systems and links among knowledge, livelihoods and land. The question of intellectual property rights is a recurrent and thorny one. Whereas stakeholders with power and influence, such as multinational companies, have the capacity to deal effectively with the formal institutions that strive to protect intellectual property, local communities almost never have such capabilities.

Daniel Tiveau

Woman collecting *Pilostigma reticulatum* pods, they will later sell as high quality animal feed. These pods are a good example of an underutilised resource in the savanna woodlands of Burkina Faso.

11.2 Indigenous Property Rights

Many of the questions about the "intellectual property" of traditional communities are not easily answered. To what degree is a community's knowledge about the plants and other resources in its territory private? And to what degree should it be? Many indigenous organizations now reject the idea that their knowledge is property, arguing instead for alternative means of securing their rights to their cultural heritage. In a perfect world, knowledge would be shared freely (as indeed many communities have done). However, multinational drug companies sometimes use traditional knowledge to simplify their search for natural substances that they then develop and commercialize with sometimes-obscene profits. Meanwhile the originators of significant parts of that knowledge may receive none of the benefits from their contribution (cf. Dorsey 2003).

Dealing with these questions can raise serious ethical questions. When working on the Kenyah Dayaks' traditional knowledge system, Colfer asked the people their opinion on the publication of their knowledge. In this case, the people were proud of their knowledge and pleased that others might make use of it. In another case, also in Borneo, she was given access to the individual knowledge of a traditional healer about a forest plant believed to function as a contraceptive, only after undergoing a formal exchange that granted Colfer rights to that knowledge, under their system. Promising to do her best to ensure that any benefits that might come from that knowledge would be returned to the healer, Colfer was confronted with the dilemma of how to determine the value of the product without knowing the trustworthiness of those who might be able to turn the healer's knowledge into a saleable product. In this case, the issue was never resolved, as the plant was lost when one of the people trying to identify it was involved in an automobile accident.

Often it is very difficult to identify the "real" owner of traditional knowledge. Similar innovations have been made in different parts of the world, and there has been active sharing of knowledge between different groups throughout the history. For example, the same plant might have been used to heal a certain illness in many different communities. Traditional knowledge tends to be invented, renewed and reinterpreted in a collective way; thus it is often impossible, or even irrelevant, to determine to whom the knowledge belongs.

Traditional knowledge encompasses a wide range of different types of knowledge. Some may relate directly to aspects of the environment. Some may relate less directly, consisting of knowledge about what the environment means to people and how it should be managed. Other knowledge is used to order the way people interrelate and deal with each other, which will in turn affect how they allocate rights and relate to their environment. Such knowledge often encapsulates norms of social interaction and customary values, many of which are deeply embedded in myth, ritual, and religious "symbolism," often related to plants and animals. For many indigenous peoples, "nature" tells a person how to relate to each other, just as much as people tell each other how to relate to "nature" (Colchester 1982a, 1982b).

Protecting such knowledge is not a simple task. One line of defense promoted by lawyers has been to propose knowledge registers. By putting knowledge clearly into the public domain, it is harder for others to copyright or patent elements of that knowledge for exclusive commercial gain (Nijar 1996). An alternative approach promoted by FAO, through its policy on Farmers' Rights, is to propose benefit-sharing regimes whereby trust funds are established in an

BOX 11.2 Situated Knowledges among Migrant Peasants in Nicaragua

Anja Nygren

In the migrant communities of Río San Juan, Nicaragua, the characterization of local knowledges as internally uncontested systems arising from a communal commitment to consensus does not hold true. The knowledge systems of these migrant peasants are made up of diverse elements and composed of dynamic articulations between various knowledge systems. The local environmental knowledge includes practices of traditional slash-and-burn agriculture mixed with modern agribusiness, pre-Columbian metaphors of the earth as a symbol of life mixed with postcolonial resistance to Western images of local people's affinity with nature, traditional concepts of soils as hot and cold, mixed with modern insights of soil mineralogy.

Even in the knowledge repertoire of the local healers, significant variation was found as a result of such factors as age, gender, religion, and personal experience. One local healer, Don Sefarino, had constructed his healing practices by combining techniques he learned from his uncle who was an excellent healer, from the Catholic monks in Central Nicaragua, from the indigenous herbalists in the Atlantic Coast, in the training courses organized by the Ministry of Health, when serving as a guide for foreign ethnopharmacologists, and when practicing as a healer in the local communities. His medicinal knowledge thus consisted of a complex repertoire of native herbs and vines, cultivated medicinal plants, and "modern" medicine, with their discrepant epistemologies.

To point out the character of knowledge production as a process, local people themselves used the term *conocer* (to be acquainted with), instead of *saber* (knowing). People's knowledge about the forest could not be seen merely as simple knowledge about useful forest products. It also included symbolic meanings of the forest as an uncultured space, something intact and wild that remained beyond human control. In this regard, the practices of forest utilization and the symbolic significations of environment were intrinsically interwoven. People also transformed their knowledge by means of innovative insights and new epistemologies. In this light, the view of local knowledge as static and inherently opposed to modern knowledge seemed arbitrary. Only by examining the traditional within modernity, and the specific and situational within heterogeneity, could the more profound significance of local knowledge systems be revealed (Nygren 1999).

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effort to ensure that funds flow back to the communities from which innovations flow (Baumann et al. 1996). Some pharmaceutical corporations have promoted this approach through charitable trusts (Moran 1997). However, compensation for knowledge transfers is a much more complicated matter than a simple sharing of economic benefits and profits. Traditional knowledge also has important links to people's social and cultural identity, their rights to livelihood, and their relations to nature, aspects that are difficult to compensate through monetary payments. As a consequence, several researchers have argued that securing indigenous control over territory and recognizing their customary laws are the best lines of defense for protecting traditional knowledge (Simpson 1997; Schroeder 2000). These and other approaches are not mutually exclusive. An emerging consensus is that any efforts to publicize or commercialize traditional knowledge should be based on the principle of free, prior and informed consent.

11.3 Intra-Community Differences in Knowledge

The second challenge related to wider use of traditional knowledge derives from the lack of homogeneity in traditional communities. Getting the formal forestry community to attend to human issues at all has been an uphill battle, and there has been a tendency to consider communities as monolithic groups of very similar, almost interchangeable people. However, there is a huge amount of diversity both within and among different communities (Agrawal and Gibson 1999). For example, CIFOR has conducted adaptive collaborative management research in four communities in Nepal: the number of major castes and ethnic groups in one, Bamdibhir, is 11; in another, Deurali-Baghedanda, 6 (Dangol et al. 2001). Manakamana, a third site, has 8 ethnic and caste groups, plus 5 households of "other," while Andheribhajana has 9 ethnic/caste groups (Nepal ACM Team 2001). The Nepali government has recognized over 60 groups of indigenous peoples in Nepal, each with different traditional roles, practices, expertise, and associated knowledge.

Even in communities that are ethnically homogeneous, such as a group of Baka pygmies in Cameroon or a village of Guarayo Indians in Bolivia, significant differences related to age, gender, religion, social identity, and political position are reflected in the individuals' levels and types of traditional knowledge. Among the Kenyah of East Kalimantan, women tend to have a fuller repertoire of knowledge about medicinal plants (Leaman et al. 1991); men know more about the behavior of forest animals (Puri 1997). Both sexes are good at finding forest foods, "shopping" opportunistically in the forest on the way home from other activities. In many Central American rural communities, the knowledge of timber products is considered a specialty of men, because of the perception of the forest as a place that remains outside the range of women's activities. The women's special

BOX 11.3 The Amate Paper of Mexico's Otomi Peoples

Citlalli Lopez

Amate paper made from bark has been manufactured in Mexico since pre-Hispanic times (ca. 300 A.D.) when it was regularly used for many purposes – ritual offerings, priestly attire, payment of tribute, and as a surface for the elaboration of codices. Although its production was banned during the Spanish colonization, clandestine manufacture and use continued among the Otomi people living in the Sierra Norte de Puebla. In the 1960s, the Otomi started to sell their *amate* production as a handicraft. Today *amate* paper is one of the most widely distributed Mexican handicrafts at national and international levels, whilst within the Otomi village it continues to be used for traditional rituals.

For the Otomi, *amate* paper, trees and the landscape are linked. Within the rough landscape surrounding the Otomi village, the remaining forest patches are found at the top of mountains and hills, seen as the keepers of the "seeds" and the places of worship. The seeds are kept in the form of *amate* paper, which is cut-out by the shaman in the shape of maize, bananas, beans and other plants, and worshiped. If this is not done, the gods may be offended and leave. Trees are a symbol of potency, with their sap containing the vital force. This force's name, *khi*, is the same word used for blood, and the bark is believed to carry the energy transmitted by the earth element. Thus the bark paper becomes the upholder of this force; it is the symbol of richness.

This perception of the significance of landscape and resources can contribute to the conservation of the remaining forest patches, which are now under pressure due to major land use changes in the region. Specific tree species have now been over-harvested for paper handicraft production; and the people's knowledge is vanishing. Neither Otomi youth nor development and government groups are aware of this loss as they try to improve the manufacture of *amate* paper and manage trees for bark production; nor do the tourists recognize their impacts as they buy *amate* souvenirs.

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prestige is, instead, associated with their gendered knowledge of domestic healing, mixed gardening, and firewood gathering (Nygren 1999, 2000). In her study of the community of Lepaterique in Honduras, Nygren (2003) found that local people's traditional knowledge on forests was strategically linked to their occupational specialty. Although the majority of the local inhabitants depended heavily on forests for their livelihoods, and had rich knowledge of forest resources, their knowledge of forest products varied depending on whether the person was a resin tapper, a charcoal producer, a logger, a slash-and-burn cultivator, a craftsperson or a healer (see Box 11.2).

Significant differences in people's level of local knowledge are also based on age. In many forested areas, the old bemoan the fact that young people, in school for much of their time, never learn the knowledge and skills of their parents. Older Kenyah complain that the young no longer understand the "theory" of paddling a canoe under a variety of water conditions. Reed Wadley reports that young Iban adults, having grown up in boarding school and college, come home to farm, and make mistakes that their elders never would have, like planting swamp swiddens in a too frequent succession. In Africa, where CIFOR researchers have found generational antagonism to be comparatively pronounced, these differences may be even more striking. Russell and Tchamou (2001) describe the different understandings of the relationship between soil and social conditions in Cameroon, reflecting very different worldviews that diverge still further as the young are increasingly exposed to non-traditional influences.

Another important consideration is simply the different interests of individuals within a community. Inevitably, there are certain people who know more, whether from natural inclination or the opportunity to learn, about forest plants and animals and their habitats. This variation in local knowledge should not be viewed negatively as an indicator of ignorance or cultural breakdown, but rather as the normal state of knowledge in a dynamic culture where knowledge is constantly being acquired, transformed and transmitted (Ellen et al. 2000). Diversity of knowledge among a group of people is generally considered adaptive. Understanding processes of learning and transmission, especially where knowledge loss is evident or suspected, or where different forms of knowledge interact with each other in a complex way, has become a significant field of study among anthropologists and ethnobiologists (Nygren 1999; Stepp et al. 2002; Novellino 2003).

11.4 Epistemological Differences

The third issue, pertaining to different ways of knowing, is more philosophical, but is nonetheless a powerful factor in efforts to bring together traditional knowledge and what some call cosmopolitan knowledge. Some have argued that men and women have different ways of knowing (Gilligan 1993), but there is even stronger evidence that people who grow up in different cultural settings "know" things differently.

Traditional knowledge is often based on practice, on livelihoods related to the land, on long-honed skills of environmental use (Ingold 2000), as well as on peoples' distinctive histories and cosmologies (Colchester 1982b). Our assumptions vary and affect the way we look at the world (see Box 11.3). If we compare the situations of a western scientist and a third world forest dweller, it is not surprising that we see things from very different perspectives.

Some of the most important differences that can characterize different knowledge systems include: the role of supernatural explanation, the nature of acceptable evidence, the assumptions inherent in the dominant world view, preference for single or multiple causation and interpretation, the significance of authority and acceptance of "authoritative knowledge," standards for proof of validity, and avenues for acquiring knowledge. However, it is important to remember that there is as much difference among traditional systems as there is between "our" systems and traditional systems in general.

Many have argued that the worldview of reductionist science is inadequate for understanding a changing and complex world. It is time to take seriously some of the other ways of seeing and understanding the world, and look for means to integrate these diverse ways of knowing – both traditional and modern – in a more mutually beneficial way.

John Parotta

Medical plants on sale at a local market in Shahdol District, Madhya Pradesh, India.

11.5 Multiple Use Forestry and Traditional Knowledge Systems

Traditional systems have typically looked at entire forest habitats, while the focus of much, though not all, of formal forestry has been a single crop (see Scott 1998; Sivaramakrishnan 2000). Though the field of forestry has "discovered" multiple use forestry in recent years, traditional knowledge systems have known about it for a long time, and could thus significantly contribute to it. Joshi's work has focused on local knowledge of natural science (Joshi et al. 2004a). Local people's knowledge of the properties of various elements in forests and fields (descriptive) and their knowledge of the natural interaction (explanatory or "cause-effect") between these elements can both be articulated. A natural science perspective on traditional knowledge among farming communities in diverse agro-ecological domains has revealed the traditional farmers' rich and sophisticated understanding of the ecological elements and processes in their agro-ecosystems (Sinclair and Walker 1999; Sinclair and Joshi 2000).

The literature on traditional knowledge has not always recognized the distinction between local people's knowledge and practice or action. This is most notable with respect to the body of work on Indigenous Technical Knowledge (ITK) that often describes people's actions rather than the underlying rationale driving them. Although his/her understanding of the ecosystem influences what a local farmer does in the field, farmers' decisions are also often affected by additional factors (cultural norms, religious obligations, and economic and policy circumstances). Although simple observations can reveal people's practices superficially, it takes more effort to understand the underlying knowledge or rationale behind these practices.

The development and wider use of traditional knowledge raises another important aspect – its dynamic nature. As mentioned above, no knowledge system, including traditional knowledge, is static and unchanging. Local communities augment their knowledge by interacting with other people and the media. Joshi et al. (2004a) argue that the ubiquitous use of words such as "traditional" or "indigenous" to describe rural people's knowledge ignores, and perhaps even undermines, its evolving nature. Indeed, many of the crops now cultivated by smallholder farmers are exotic and have been introduced, together with some knowledge regarding their cultivation, from other parts of the world. For example, in

Carol Colfer

A woman preparing forest fibres for weaving in Jambi, Sumatra.

the jungle rubber system in Indonesia, smallholders now cultivate a South American tree introduced by colonial governments about a century ago. Local smallholders use technology that is, in part, derived from colonial plantation management (e.g. tapping techniques), but also from smallholder innovation (e.g. high-density planting and allowing secondary forest to regenerate around the rubber trees instead of clean weeding) (Dove 2003).

Recent studies of local ecological knowledge indicate that local people's knowledge is neither heuristic (based on rules of thumb that may have no explanatory basis) nor "culture-bound" but often involves mechanistic explanation of natural processes comparable with, and often complementing, scientific knowledge (Richards 1994; Sinclair and Walker 1999). Recent work on local ecological knowledge about natural resources has often been driven by development imperatives. Examples include hill farmers' management of fodder trees and tree fodder in eastern Nepal (Joshi 1997); farmers' management of their soils in Ghana (Waliszewski and Sinclair 2003), in the middle hills of Nepal (Shrestha 2000), in coffee-based systems in West Lampung, Indonesia and in the Luong Son district in Hoa Binh province, northern Vietnam (Joshi et al. 2004b); as well as smallholder rubber farmers' practice of traditional jungle rubber in Jambi, Indonesia (Joshi et al. 2003). In these efforts, researchers first explore local people's ecological knowledge and enhance the local knowledge by adapting external knowledge (including what is generated through conventional scientific research). The overall aim is to improve the local peoples' ecological knowledge, enabling them to make better decisions in their natural resource management.

11.6 Traditional Knowledge, Land Rights and International Policy-Making

The final topic we address here is the role of traditional knowledge as a significant element in international policy-making related to development, environment, and trade. Forest peoples themselves have been directly engaged in these debates. The international trade agreements' requirements for countries to develop intellectual property rights regimes have led to proposals from the UN's World Intellectual Property Organisation for protection regimes based on the principles of copyrights, patenting and benefit-sharing. While agreeing on the need for regulation to prevent "bio-piracy" – whereby discoveries based on traditional knowledge are claimed as novel inventions and patented for commercial ends – many local

communities have opposed the proposed measures as a process that will commoditize their knowledge and heritage. They seek instead recognition of their traditional or collective rights to land, self-governance, control of the resources on their lands, and recognition of the knowledge based on living from these resources, according to their customary laws and institutions (Colchester 1996a, b; Posey and Dutfield 1996; Simpson 1997; Dutfield 2000; Laird 2002; Bellmann et al. 2003).

Indeed, one of the main risks that many local communities see in international policy-making about traditional knowledge is that it is treated as a discrete "resource" that can be documented and used, in much the same way as some anthropologists have tended to treat "culture" as something abstracted from everyday life and from the agency of social interaction (Samson 2003). As a result, we can lose sight of the real links between traditional knowledge, practice, livelihoods, and rights in land. For example, debates about "Traditional Forest-Related Knowledge" at the UN Forum on Forests, and the preceding discussions under the Commission for Sustainable Development (the Intergovernmental Panel on Forests and the Intergovernmental Forum on Forests), have tended to treat knowledge as a set of information that can be used by foresters to improve forest management, whereas what forest-dwellers have been seeking is recognition of their rights to land in order to pursue their forest-based ways of life (Leticia Declaration 1996; Griffiths 2001).

It may be that the UNCBD provides a more congenial forum to secure recognition of these connections between knowledge, livelihood, and land. Admittedly, when assessing the implications of Article 8j of the Convention, which requires States to "respect, preserve and maintain knowledge, innovations and practices of indigenous and local communities embodying traditional lifestyle," government discussants have focused on intellectual property rights protections and benefit-sharing procedures and have so far resisted admitting the need to connect such protections to land rights. However, UNCBD Article 10c, which requires State parties to "protect and encourage customary use of biological resources in accordance with traditional cultural practices that are compatible with conservation and sustainable use requirements," has been interpreted by the UNCBD secretariat as implying that governments should recognize indigenous peoples' customary laws, corresponding systems of governance and administration, land and water rights, and control over sacred and cultural sites (CBD 1997). Forest peoples have argued that compliance with the UNCBD requires States to adopt and apply national laws that secure indigenous peoples' customary ownership and control of their territories, so that they can continue to manage their forests by their own institutions, knowledge, and skills (Colchester et al. 2004).

11.7 Conclusions

In this chapter, we have outlined the five main ways in which we consider traditional knowledge to relate to forestry. The complexities of intellectual property rights have been described, including both the inequities in the current system and the dangers of viewing traditional knowledge as a "plug-in" commodity. We have stressed the important differences within communities along such dimensions as gender, ethnicity, caste, class, and age, and the implications of these differences for traditional knowledge. We have also outlined the kinds of epistemological differences of which outsiders are often completely unaware – differences that often account for outsider views that forest peoples are irrational. Different assumptions, different standards of evidence and different worldviews can lead to completely different, but still logical, conclusions. We have indicated some of the complementarities between multiple use forestry and traditional knowledge systems, including classification and more structural, cause-and-effect aspects of knowledge systems. In this realm, we have reminded readers of the dynamism of "traditional" systems; just as our knowledge changes over time, so does that of forest peoples. Finally, we have stressed the links among traditional knowledge, indigenous land rights, and international policy in global efforts to make forest management and use more equitable and just.

In sum, we argue that traditional knowledge, interpreted broadly, represents a vastly under-recognized and under-utilized global good. If addressed respectfully, its increased recognition by the forestry community (and others) has the potential to improve conservation and development efforts, to protect and strengthen traditional ways of life (including livelihoods and rights to land), and to increase the prestige and feelings of self-worth among forest peoples. Such feelings can in turn stimulate greater creativity and further knowledge generation among them. We urge readers to engage with forest peoples; they are often the *legitimate* managers of the forests we find ourselves mandated by law or regulation to manage. The marriage of traditional and scientific knowledge is potentially the most potent combination for both environmental and human well-being.

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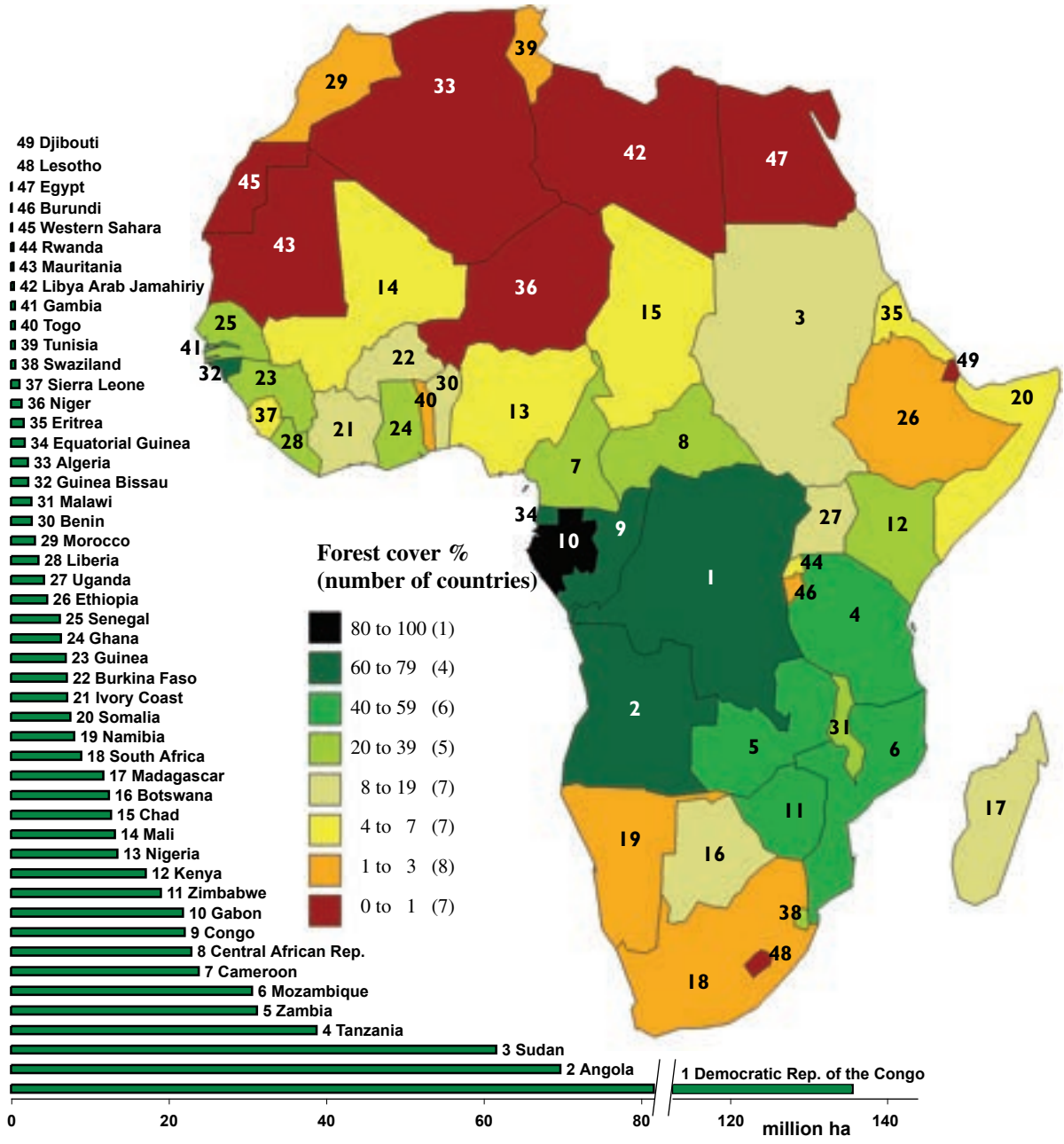
PART IV

Regional Forum

Martin Lorenz

Map 12.1 Forest cover in Africa (percent of land area) and total forest area per country (countries over 1 000 000 ha) (Data: FAO FAOSTAT 2005; map designed by Samuel Chopo)



REGIONAL FORUM IV

12 From Poverty to Prosperity: Harnessing the Wealth of Africa's Forests

Coordinating convening lead author: Yemi Katerere

Convening lead author: Jennifer Clare Mohamed-Katerere

Abstract: Africa is a continent with tremendous potential. Its forests are a vast source of goods and services, which can be used to generate much needed wealth. This chapter examines trends and drivers affecting the prospect of moving from poverty to prosperity. Supporting the informal sector and developing entrepreneurship are critical for maximizing opportunities. Local people's control and access over forests and other natural resources is central to improving their livelihoods. This remains true despite the trend towards decentralisation. Radical overhauling of law, policy, and practice is necessary if local people are to capture the benefits of SFM. Whilst the lack of capacity is a challenge to SFM, extra-sectoral constraints such as poor infrastructure and inadequate access to markets and finance stifle any meaningful forest-based wealth creation. Several factors, including health, undercut SFM. Urban-rural-urban migration is placing new demands on forests, but also creating market opportunities for forest goods and services.

Keywords: Forests; forest wealth; rights; equity; governance; capacity building; HIV/AIDS; deforestation; local people; poverty; Africa.

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12.1 Introduction

Africa has embarked on a new path of self-defined development with a stronger focus on governance and political reassertion, as it seeks to break the stranglehold of global economic and power inequalities. The challenge is not just to arrest growing poverty but also to create a path of prosperity. Africa must build on the progress it has made in the last few years. In 2003, it achieved a growth rate of 3.7%, the highest in the last four years and significantly higher than the 2.9% achieved in 2002 (AfDB 2004). Sub-Saharan Africa (SSA) must grow an average 7% per year to reduce poverty by half by 2015 (AfDB 2004). The relationships between forests, people, and growth must be redefined to establish a role for forests in the African transition. This requires understanding Africa's forest resources and the natural systems of which they are part, as well as Africa's past, priorities, values, and ambitions. It underscores the need to re-define the science-policy interface to respond more effectively to Africa's challenges.

Several fundamental paradigm shifts are taking place, which have implications for policy, management, economic strategies, and research. Key drivers include externally driven economic development, globalisation, a problematic science-policy nexus, a policy and governance regime that excludes local perceptions about framing problems and defining solutions, population growth, under-performing economies, and ill health. These crosscutting factors shape livelihood options, forestry development priorities, understanding of environmental services, investment, trade, and forest conservation. In addition, these factors play out in complex and sometimes contradictory ways; for example, globalisation exacerbates poverty while simultaneously creating new opportunities.

The last half century has seen various foreign driven interventions to address poverty and development. Overall, these have intensified Africa's problems by creating net outflows of economic and social capital as well as governance systems that protect the self-interest of foreign governments, donors, international organisations and, sadly, African elites. The positive side of this is that Africans are becoming more forceful and strategic in their demands for leadership that can drive a truly home grown development agenda and seek appropriate support from international partners. Greater transparency and

accountability from partners, as well as from African governments, are seen as crucial. There has been a marked surge in civil society organisations active in rights and development areas.

12.2 Overview of Forest Sector

FAO (2003a) estimates total forest cover at 649.9 million ha (see Table 1); this represents 21.8% of Africa's total land area and 16.8% of global forest cover. Total forest area in SSA in 1990 was 29.5%, and in 2000 it was 27.3% of total land area (World Bank 2004).

Variable growing conditions lead to uneven forest distribution and considerable differences in the extent and type of forests (see Map 12.1). North and West Africa have only 7.2% and 14.3% respectively of their land under forests. In contrast, 44% of Central Africa's land is forested; this accounts for 37% of Africa's forests (FAO 2003a).

Natural forests make up 99% of total forest cover. The area of natural forests under sustainable management, though increasing, is negligible. Historically, management focussed on protected forests; these constitute about 5% of Africa's forest cover (FAO 2003a). In addition, many protected areas set aside for wildlife management are forest ecosystems; protected areas cover about 6.6% of total land area or 207 million ha.

Africa's estimated 8 million ha of plantations, of which 50% are found in Algeria, Morocco, Nigeria, South Africa and Sudan, account for just 4.3% of the global total (FAO 2003a). Limitations to expansion include low investment due to inadequate incentives, and poor security of tenure. Several countries have legislative incentives to promote investment in plantations. Benin, Kenya, Madagascar, and Zimbabwe all give tax exemptions. Proposed laws in Mozambique, Uganda and Zambia will introduce new incentives.

East Africa

Forest cover in this region is estimated at 85.6 million ha, which represents about 21% of its total land area (FAO 2003b). Forest distribution is uneven, with Djibouti and Ethiopia having very little while Tanzania boasts 44% of its land area under forest cover.

East Africa has several forest types. Savannah woodland and thicket are the most widespread, constituting 63% of forests and supporting the rich wildlife that sustains a vibrant tourist industry. *Miombo* woodlands amount to 20% of forests and provide diverse products, such as fuelwood, thatching grass, medicines, and food, as well as environmental services. The *montane* forest of Eritrea, Ethiopia, Uganda, and Tanzania is 12.8% of forest cover (FAO 2003b).

Table 1. Forest cover by region (FAO 2003a)

Region	Land Area (million ha)	Forest Area	(%)
North Africa	941.4	68.2	7.2
East Africa	411.1	85.6	20.8
Southern Africa	591.1	183.1	31.0
Central Africa	551.5	240.7	43.6
West Africa	505.3	72.2	14.3
Total Africa	2978.4	649.9	21.8

Growing demand for forests products, such as wood fuel, and the expansion of agricultural land has accelerated forest lost. Between 1990 and 2000, the rate of deforestation was about 10% with the highest rates recorded in Uganda (FAO 2000).

Despite civil unrest, wars and limited capacity in forest departments several countries, including Madagascar, Tanzania, Uganda and Zanzibar, have taken steps towards decentralising forest management and establishing some form of community management. Additionally Djibouti, Ethiopia, and Tanzania recognise some pastoral tenure rights.

Southern Africa

This region is generally dry with uneven rain distribution. The wetter northern parts support more closed canopy forest while the drier countries are predominantly woodlands and savannah (UNEP 2002a). Forest cover is about 185.3 million ha, which amounts to 31% of the total land area; just less than 2.2 million ha are plantations (FAO 2000).

Indigenous forests management varies across the region and investment in it is generally limited. In countries with commercial species, such as Angola, Botswana, Mozambique, Zambia, and Zimbabwe, the forests have been overexploited since the colonial period. Agricultural expansion is a serious threat to the region's forests. Since 1997 many countries including Lesotho, Mozambique, South Africa, Zambia, and Malawi have adopted new forest laws (Mohamed-Katerere and Matose 2002). The Southern African Development Community (SADC) has adopted a forest protocol that recognises the value of transboundary approaches.

The region's huge wildlife resource supports a vibrant eco-tourism industry; this promotes forest conservation in state and private areas. Following the success of Zimbabwe's Communal Areas Management for Indigenous Resources (CAMPFIRE) in the 1980s, several countries, including Botswana, Mozambique, and Namibia, adopted policies to empower communities to manage and benefit from wild resources. All of the above initiatives have had some success. In addition to achieving community

benefits, they also demonstrated recovery of wildlife. These initiatives were the inspiration for developing participatory SFM in Lesotho, Zambia, South Africa, Malawi, Mozambique, Namibia, Zimbabwe, and Botswana; projects include managing for fuelwood, reforestation, and benefit sharing. The skewed land and natural resource tenure regime inherited from colonialism continues to constrain effective community forest management and equitable forest industry development.

The high incidence of HIV/AIDS – Botswana, Lesotho, Swaziland, South Africa, and Zimbabwe are severely affected (see Table 3) – has significant impacts on forestry.

Central Africa

Central Africa is an important forested region with about 45.5% of its land, 240.7 million ha, under natural forest (FAO 2003c). It contains the largest remaining contiguous expanse of moist tropical forest on the African continent; this is the world's second largest tropical forest after the Amazon forest. It stretches across Gabon, Equatorial Guinea, Congo Brazzaville, Cameroon, the Democratic Republic of the Congo (DRC), and a small part of the Central African Republic (CAR). The DRC contains about 56% of the region's forest and 20% of total forest cover in Africa. Gabon is Africa's most forested country with 85% forest cover.

Forest use is diverse and includes timber and non-timber forest products. Harvesting varies from low impact household collection to high-intensity commercial logging. More than 70% of the population is rural. With the exception of Gabon and Equatorial Guinea, Central African countries are among the poorest in the world (FAO 2000). They also have the lowest population densities (apart from Rwanda and Burundi) in Africa (FAO 2003a). The region's forests abound in biodiversity, which if protected could help strengthen national economies.

Forest resource information, though improving, remains poor. Most inventories cover only part of the productive forests (Cameroon, the Congo, Gabon, Rwanda, and the CAR) and SFM planning is negligible (FAO 2003c). Recently some countries (Cameroon, Gabon, and DRC) have made efforts towards adopting forest strategies and action plans.

The Congo Basin countries have weak forest legislation due to unfavourable technical, financial, and institutional conditions. In some countries, corruption and weak law enforcement make it difficult to control illegal logging. The conflicts in the DRC and Great Lakes Region (Burundi, Rwanda, and Uganda) hamper effective management and deter investment in the forests. In the DRC, the Security Council found that over 100 private companies, foreign and multinational, were involved in illegal extraction (United Nations Security Council 2002). These conflicts have displaced hundreds of thousands of people who have destroyed forests through settlement, uncontrolled logging, and fire.

Throughout the region, civil society organisations are weak and there has been no significant shift to community or decentralised management. Cameroon's forest law recognises the right of communities to exploit high value timber resources (Brown et al. 2002) and provides for a 10% share in tax revenue (Fomete 2001). However, the success of these decentralised forest initiatives is disputed (see Box 12.4). In Rwanda, local communities benefit from tourist revenues in the Ngungwe Forest Reserve.

West Africa

West Africa has a total area of 72 million ha or 14% of its land area under forests. For generations farmers have retained, nurtured, protected, and planted trees on their land for a variety of purposes (Chouin 2002). These and other wooded lands amount to nearly 44 million ha (FAO 2003d). Forest cover varies greatly between countries. Guinea-Bissau has about 60% of its land under forests whereas Niger has only about 1%.

The region can be broadly divided into two ecological zones, the dry and humid zones. The humid zone stretches across nine countries from Guinea all the way to southern Nigeria. The dry zone is essentially the Sahelian belt stretching across Niger, Mali, Burkina Faso, Mauritania, Gambia, Guinea-Bissau, Senegal, and Cape Verde; it is characterised by low rainfall and a dry season of six to seven months. Although accurate data is not available, the division is roughly 60% of forest and woodland in the humid zone and 40% in the dry zone.

Dry West Africa

Most of West Africa's protected areas are in the arid zones (FAO 2003d). Plantations are mainly for non-industrial use, except in Senegal. Many are established to halt or reverse desertification, the main ecological problem (FAO 2000), and to stabilise coastal dunes.

For most countries forest knowledge and information are dated and inadequate to support SFM. Burkina Faso last carried out a national level evaluation of its forest resources during the 1990s. Forest resource information in Mauritania and Niger are based on estimates. Insufficient financial resources undermine the implementation of forest policy reforms. In general, forestry programs are poorly funded. Private sector investment is at its lowest ebb.

Participatory forest management models developed in the 1970s and 1980s in the Sahelian belt, following global research and development trends, focussed on tree-planting to counter the perceived

fuelwood crisis. In the 1990s, structural adjustment programmes (SAPs) led to a focus on decentralisation. Decentralisation was driven mainly by the desire of governments and donors to improve management, rather than by concern about restoring rights to local people. Today, most countries have embarked on some form of decentralisation and enacted new laws and policies to support this. In Mali, Burkina Faso, and Senegal decentralisation initiatives have focussed on fuelwood management (Amanor 2003). In most of these projects, government forest services continue to play a central role. The Gambia has relatively well developed initiatives supporting community management, dating from the 1990s. These include pilot projects in several national parks and state forests (Alden Wily 2002).

Humid West Africa

Although these humid forests are less diverse than those of Central Africa, and endemism is relatively low (Sayer et al. 1996), species diversity far surpasses that of the dry zone. Cote d'Ivoire, Ghana, and Nigeria are among the 50 most bio-diverse countries (WCMC 1994).

This region's forests are highly fragmented with two thirds classified as open (FAO 2003d). In Ghana, of the total 6 million ha of forest, only 1.6 million ha are closed; in Nigeria, the situation is worse, with less than 1 million ha of the total 13.5 million ha of forest remaining closed. Deforestation is high; total forest loss from 1990–2000 was over a million ha (FAO 2003d). These high losses are caused by conversion of land to agriculture, logging, mining, and infrastructure development. Over 70% of the population is engaged in agriculture. Additionally, conflict around tenure undercuts local rights and thus promotes deforestation. In Ghana timber, by virtue of a 1962 law, is considered the property of the chief who exercises authority in the area. Forest concessionaires may harvest timber on farms without compensating farmers; instead, royalties are paid to chiefs and the district council. This has led to farmers destroying trees on their farms (Brown 1999; Amanor 2003). Public and private sector investment is inadequate to support SFM. In Ghana and Cote d'Ivoire, this has contributed to the conversion of natural forests into plantations of exotic and indigenous species, and in particular tree crops such as cocoa, coffee, palm oil, and rubber. Public information on investment opportunities and potential in the NTFP sector has been inadequate.

There is inadequate information on management and planning in the natural forests; FAO (2003d) suggests that the area under planning is negligible. Only 19% of Cote d'Ivoire's and 6% of Nigeria's forests are said to be under sustainable management (FAO 2000).

There has been a policy shift towards decentralisation. Ghana, Togo, Guinea, Benin, Cote d'Ivoire, and Nigeria all have some form of community involvement, ranging from consultative mechanisms to benefit sharing. However, these initiatives remain weak. In several countries, there is an inadequate supporting legal framework (FAO 2003d), while in others, like Ghana, there is a disjuncture between law and practice. Ghana's 1994 forest policy creates a framework for participatory management and recognises the importance of farmers in the forest industry; however, tenure law reform to support this policy was resisted mainly because of the commercial value of these forests. As a compromise, the Social Responsibility Agreement commits concessionaires to pay communities 5% of stumpage value. Throughout the region, the high value of timber militates against governments' devolving more authority to communities. In some areas, multi-layered tenure systems make it difficult to establish community and decentralised management regimes. Countries face the challenge of having to reconcile rights of migratory people with those of fixed dwellers.

North Africa

This region is dominated by desert and semi-desert conditions. Forests and woodlands are restricted to coastal areas of western Mediterranean countries, the Atlas Mountains and the tropical zone that extends into Sudan (UNEP 2002a). These cover an estimated 68 million ha, about 7% of the total land area. Only in Sudan does forestry contribute significantly to the national economy; its contribution has been estimated at 10% (UNEP 2002a). A large part of the region's industrial wood requirements are met through imports, primarily from Europe.

Sudan's forest loss, at the rate of 1.4% per annum, is one of the highest in Africa (FAO 2003e). In all the other countries in the region, except Mauritania, there has been successful re-afforestation and afforestation. For example, 202 000 ha of trees have been planted in Tunisia since 1956. Algeria has planted 718 000 ha of trees (FAO 2003e).

In North Africa, trees' environmental functions tend to be more important than their productive functions, due to serious water stress and soil erosion. Southern Sudan has a long history of forest management and together with central Sudan it has the highest extent of productive forest (FAO 2003e). However, effective management has been seriously undermined by war.

12.3 Economic, Social and Environmental Values of Forests

The way forests are valued influences the policies and priorities of governments, foreign and local investors, and donors as well as choices about how to use forest resources and forestland. Value is affected

by biophysical factors such as forest type, extent and species; economic factors including markets and associated benefits and costs, livelihood opportunities, and income; social relations including land tenure, government-civil society relations, and institutional arrangements; and cultural considerations. Time and space are undoubtedly important considerations – proximity and prevailing conditions, particularly the lack of options, determine priorities and approaches.

Forests' commercial value as reflected in GDP is low. However, the formal forest sector is important; it contributes to employment and generates wood products. The complex and diverse role forests play in local livelihoods is poorly understood and accounted for. Economic methodologies, such as those that attribute a monetary value per unit area, tend to neglect the local use regimes and values. In particular periodic consumption, such as building or nutrition, may not be taken into account. Additionally, environmental services are hard to quantify and are thus often inadequately taken into account. Income provides some indication of the significance of forest resources; forest based activities such as energy, grazing, and NTFP-harvesting contribute 15 to 35% of all household income in southern Africa (Cavendish 1997; Shackleton and Shackleton 2000). In Tanzania about 58% of farmers' cash income is derived from honey, fuelwood, and wild fruits and at least 60% of people obtain some of their subsistence from forests (Mohamed-Katerere and Matose 2002).

Many poor people rely on forests for food and medicine. With the feminisation of poverty, women and children can be expected to rely more heavily on forest resources. In many countries, children gather and eat wild fruits; these are an important source of nutrients. Forest dependent people obtain a significant proportion of their protein from the forests. In some countries, this dependency is even more widespread. In the DRC and Liberia about 75% of the population eat wild meat. Wild meat trade in Liberia has an estimated value of USD 24 million (Hoyt 2004). Forests' complementary nutritional role is particularly important when agricultural production is insufficient due to recurring droughts, civil strife, HIV, and pests. In South Africa, local medicinal plant trade is about 19 500 tonnes with a value of USD 35 million; secondary uses generate about USD 30 billion. In Burkina Faso, the Niger, Nigeria, and Ghana more than 80% of the population use medicinal plants; and over 40% of the urban population are dependent on them (FAO 2003d). As the noose of poverty tightens, communities are likely to turn increasingly to forests for food and medicines.

Ninety one percent of Africa's timber is used for energy. It is the main energy source for 70% of the population and constitutes about 65% of all energy used (African Union et al. 2003). In many areas traditional management systems, which prohibited the use of live wood, have broken down. Population growth and continuing poverty are likely to increase the demand for wood fuel. Consequently, it is important to promote sustainable fuelwood-harvesting methods, investment in other forms of energy, and the modernisation of the wood energy sector.

Although forests have many benefits, they may in certain circumstances pose threats to neighbouring communities, particularly by increasing the risk of wild animals raiding crops and of diseases, such as yellow fever and sleeping sickness (Sheil and Wunder 2002).

Growing Forest Loss

Between 1990 and 2000, Africa lost about 52 million ha of forest annually; this is about 56% of the global reduction in forest cover and it is the highest rate in the world (FAO 2003a). There is considerable variation in the extent of forest loss between different regions (see Table 2) as well as between countries. In some countries, including Algeria, Egypt, and Libya, forest cover has increased. Forest loss is highest in Zambia, the DRC, and Sudan.

Ironically both "high" and "low" forest values contribute to forest loss and degradation. Several factors are pertinent. First, the high value placed on indigenous hardwoods by an extractive timber sector, which focuses on primary production, promotes indiscriminate harvesting. Second, poor agricultural yields, due to droughts and low investments in agricultural technologies, contribute to extensification of agriculture. Ten years ago, SSA's forestland was shrinking by 2.9 million ha per year while cropland was expanding by a million ha per year (Cleaver and Schreiber 1994 cited in Hill et al. 2000). It is significant that opportunities for agricultural loans exceed those for small-scale forest enterprises. Third, the instability of war makes management, monitoring, and enforcement difficult as is evident from the high levels of plundering in the DRC and Liberia. Proceeds from illegal logging have been used to finance warring factions. The high number of internally displaced people, close to 7.3 million (FAO 2003b), creates locally concentrated demand on forest resources

Table 2. Forest cover changes in Africa
(FAO 2003a)

Region	Forest cover 1990 (million ha)	Forest cover 2000 (million ha)	Annual change (%)
North Africa	78	68	–0.94
East Africa	91	86	–0.51
Southern Africa	199	183	–1.62
Central Africa	250	241	–0.93
West Africa	85	72	–1.26
Total Africa	703	650	–0.80

and militates against investment in forest management. Fourth, the SAPs of the 80s and 90s resulted in job cuts, forcing the unemployed to migrate to rural areas and clear new land for agriculture. Fifth, institutional and managerial shortcomings result in failure to prevent illegal logging and to adequately regulate the forest industry. Sixth, growing urbanisation and lack of investment in alternative energy forms increase demand for fuelwood and charcoal. By 2030, urban dwellers are predicted to reach 785 million (54.5% of 1406 million) up from 297 million (37.9% of 800 million) in 2000 (UNEP 2002a; FAO 2003b). Seventh, the lack of access to markets, low forest product prices, poor infrastructure, and inappropriate policies limit the potential for sustainable forest-based livelihoods. Eighth, externally driven forest activities, including conservation projects and commercial extraction, threaten local livelihoods and undercut local investment in forest. For example, the customary rights of the Ogiek people to the 290 000 ha Mau Forest in Kenya are not recognised because this forest is the largest remaining continuous block of indigenous mountain forest in Africa. Ninth, a lack of shared forest values, whether between the state and citizens or within communities, generates conflict, which may undermine management and promote forest loss. When forests are economically valuable, governments are often reluctant to recognise community rights and values. In Cameroon, local forest people have lost their rights to the culturally and economically valuable species, *bubinga* and *moabi*, as these species are earmarked for commercial extraction. Tenth, demographic distortion due to diseases, particularly HIV but also malaria and tuberculosis, and population growth has resulted in a lack of social cohesion. This factor, together with a younger population – over 40% are below the age of 15 (FAO 2003a) – may mean the demise of traditional values associated with SFM.

Until the underlying structural and policy drivers of deforestation are addressed, the current rate of forest loss can be expected to continue; the capacity of the forests to provide forest products will decline. In this scenario, trees outside forests will become more important.

12.4 Harnessing the Forests' Wealth

Realising the potential contribution of forests to wealth creation requires understanding how development trends impact on Africa and how Africans are responding to them.

First, the 1980s ushered in the now widely accepted objective of sustainable development. In 1993, the United Nations Conference on Environment and Development put sustainable development firmly on the global agenda, and through a series of multi-lateral agreements increased pressure on countries to adopt this approach, thus strengthening the existing trend to protect natural resources and restrict use. From 1990, the global area of protected land grew by over one million square kilometres (World Bank 2004). New approaches to business and trade emerged including the certification of forest-derived products, environmental conditionality in trade, and scepticism about infrastructural development projects, such as roads, that could lead to increased extraction of forest products.

Second, trade liberalisation and structural adjustment in the 1980s marked the beginning of growing vulnerability of poor communities. The SAPs resulted in a decline in state service provision and an increase in privatisation. While this had some positive outcomes, overall the rural people became poorer. In the 1980s, income per capita in SSA declined at 2.4% per annum and Africa's GDP fell by 14.3% (AfDB 2004). World Bank (2004) figures show that between 1990 and 2001 the number of people living on less than USD 1 a day rose by 87 million or 38%. In 2001, 46.5% of people in SSA lived on under a dollar a day and 76.3% on less than two dollars a day. Coping strategies, and in particular the traditional support mechanisms between urban and rural people, like remittances, broke down due to high urban unemployment. Additionally, the removal of subsidies on key agricultural inputs, such as seed and fertilisers, rendered subsistence farming less viable for newly retrenched urban workers.

Third, the HIV/AIDS epidemic has devastating social and economic consequences. In many areas it has wiped out the most economically productive, placing increased burden on the aged and the very young. Between 1985 and 2003 some 7 million agricultural workers died, affecting production at 60–70% of farms and resulting in the loss of agricultural knowledge (UNAIDS 2003). Industry has been affected by illness-induced absenteeism. In contrast to global trends, life expectancy in most SSA countries has fallen to below 40 years (see Table 3), reversing the gains of the previous 15 years (UNEP 2002b). In 2003, about 3 million people became newly infected and 2.2 million died (UNAIDS 2004). At the end of 2004, some 25.4 million people in SSA were living with HIV. The 2004 Human Development Index (HDI) shows that 13 SSA countries suffered dramatic reversals in human development since 1990, largely due to the AIDS pandemic. This puts pressure on already scarce financial resources, making investment in areas like forestry less likely while simultaneously increasing dependency on forests. It undercuts market opportunities for forest products as disposable income declines and makes the achievement of skill and capacity targets unlikely.

Fourth, globalisation has widespread impacts on various factors, including trade patterns, investment flows, technology, and our sense of time and space. It is possibly the most significant external change driver in the forest sector and poses special challenges for Africa. The pace of change is much faster than before

Table 3. Life expectancy and HIV/AIDS rates in selected Sub-Saharan African countries

Country (HDI rank)*	Life expectancy 1990	Life expectancy 2002**	HIV/AIDS prevalence (% ages 15–49)***
Central Republic of Africa (169)	47.2	39.8	13.5
Lesotho (145)	53.6	36.3	28.9
Mozambique (171)	43.1	38.5	12.2
Swaziland (137)	55.3	35.7	38.8
Malawi (165)	45.7	37.8	14.2
Zambia (164)	47.4	32.7	16.5
Zimbabwe (147)	56.6	33.9	24.6

(UNAIDS 2004)
* HDI 2004, 175 countries plus Hong Kong and the Occupied Palestinian Territories
** Latest available verified data, incorporating 2004 HDI
*** UN AIDS 2004

and requires a new cadre of professionals, with a broad range of skills and competencies, able to analyse complex policy trends and engage strategically with a broad range of stakeholders. The capacity to handle this new level of complexity is seriously undercut by the impact of HIV/AIDS and the governments' limited resources to halt its spread.

Fifth, Africa has weak capacity to handle its forest-related problems and achieve its goals without significant external support. It requires aid, foreign direct investment, technology, and research support. Globally, an additional USD 40–70 billion is needed to achieve the Millennium Development Goals (MDGs); that is twice the aid given in 2001 (World Bank 2004).

Sixth, trade is essential to further stimulate Africa's economy. Forestry provides opportunities for extending trade internationally and domestically. Several regional initiatives promote inter-African trade. Creating better opportunities for global trade, however, remains a challenge. Skewed economic policies, such as the European Union's (EU) and US's agricultural subsidies, undermine Africa's ability to engage effectively in the global market. The EU, for example, is asking African countries to liberalise 90% of their markets over ten years, while at the same time refusing to discuss its own highly protectionist Common Agricultural Policy (CAP) (CAFOD 2004). This conflicts with the Africa Commission's proposal that opening markets for Africa should not demand reciprocity. The existing imbalances between the EU and African, Caribbean, and Pacific (ACP) countries are staggering. The EU's CAP spending is more than twice Africa's agricultural exports (CAFOD 2004). Although EU tariff escalation rules give duty preference to wood products, other forest products like honey and liqueurs attract restrictive non-tariff barriers.

Seventh, smallholder productivity and efficiency is a cornerstone of sustainable development. In many countries, moves towards making policy and law more responsive are under way.

Africans have turned with a new urgency to address the issues of poverty. Multiple level strategies are evolving. The Africa Union's (AU) New Partnership for Africa's Development (NEPAD 2001) seeks to strategically position Africa to take advantage of the opportunities presented by changing global events while promoting good governance, allocating resources efficiently, and exploring partnerships with the private sector. It combines neo-liberal economic reforms with technology transfer and support for social services, in particular health and education. This is complemented by the strategies pursued by local entrepreneurs and communities that could potentially reduce the absolute number of poor people.

Prospects for Expanding Plantations

The potential for expanding Africa's plantation industry will depend on resolving a number of technical, institutional, and economic issues. Increased investment, improved processing facilities, increased value adding, secure tenure, and the development and diversification of markets are necessary for the plantation industry to grow. In the short-term Africa, with the exception of South Africa, is unlikely to become a major supplier of plantation wood.

Most countries have poor infrastructure and distance to markets tends to be great with high transportation costs. In SSA, freight costs are about 20% higher than those in other regions (AfDB 2004), making its products less competitive and suppressing demand. Plantations have been most successful in countries, such as South Africa, where they are vertically integrated with value-adding processing and where tenure is secure. In Zambia, where integration with processing is unlikely to happen since the plantations are state owned and the processing facilities are privately owned, the potential for growth seems limited. The uncertainty of raw material supply due to erratic state investment in plantations also constrains growth.

With globalisation, Africa will need to compete globally and thus should closely follow global trends regarding forest products and prices. The booming economies of India and China could present opportunities for expanding the plantation industry. Africa's total exports to Asia only amount to 20% of total exports (AfDB 2004), even though this is now the world's largest market with approximately 2.5 billion people. This market might become more important given the slump in growth in the EU, which is currently Africa's largest trade partner (50%). Opportu-

BOX 12.1 Out Grower Schemes

Jennifer Clare Mohamed-Katerere

KwaZulu-Natal, South Africa

The South African private sector, particularly South Africa Pulp and Paper Industry (SAPPI) and Mondi, supports a flourishing out grower scheme. By 1999, there were more than 12 500 small growers who had established Eucalyptus woodlots covering nearly 27 000ha. These out growers supplied over 200 000 tons of wood to industry (FAO 2003). These schemes enable companies to limit their land holdings, spread the risk of fluctuations in timber demand, and reduce land-based conflicts with neighbouring communities. Communities benefit from having a ready market and some financing for their plantations.

Zimbabwe

In Zimbabwe, two companies, Border Timbers and Zimboard Products operate out grower schemes. The Border Timbers scheme started in 1996 for the production of eucalyptus poles. A key driver for was achieving greater flexibility in production from its own land. It intends to extend the scheme from its current size of 450 ha to 2000 ha so that it meets 60% of its wood requirements. The five out grower schemes, operated by Zimboard Products began between 1997 and 1999, to supply eucalyptus for its chipboard mill given the uncertainty of pulpwood supply.

Although the arrangements for the schemes operated by the companies are similar there are some important differences. Both companies offer growers loans at 15% interest (this is much lower than commercial rates), undertake to purchase the harvest at market prices, and provide some technical support; however, the level of responsibility growers have varies. In the Border Timbers' Scheme growers, on company advice, determine the production tasks for which they want to accept responsibility; the Zimboard Products' schemes are managed by project committees, which include both company and grower representatives. This co-operative approach might be attributable to the fact that landholders, who wanted to generate income for agriculture or community development, initiated three of the five schemes. Growers in the Zimboard Products' schemes buy their own seed and manage the plantations. (The text has been adapted from Desmond and Race 2000 cited in Meyers and Vermeulen 2002)

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nities exist for export of fast growing short rotation species as well as for hardwood species, such as teak grown in Ghana, Nigeria, Togo, and Cote d'Ivoire. With increased regional co-operation, intra-African trade will probably increase; currently it accounts for only 10% of exports (AfDB 2004). African countries are likely to face increased competition from eastern European countries in supplying wood to the timber deficient North Africa region. As plantations expand worldwide and in the Pacific Rim, timber prices might fall, possibly undercutting African countries' market potential (FAO 2003a).

There is increasing use of out grower schemes; these typically provide loans for seeds, fertilizers, pesticides, and agricultural equipment and produce buying agreements. While such agreements guarantee income and finance inputs they also promote new levels of insecurity (SLSA Team 2003); companies may place restrictions on the use of the land. Globally, over 60% of pulp producers source some of their materials from out growers. This trend is likely to continue, particularly in southern Africa, where corporations experience land insecurity due to land reform (see Box 12.1). In the short-term, out grower schemes are unlikely to develop into equitable partnerships between communities and companies. In South Africa, companies have used their engagement with out-growers to leverage benefits from the state such as investment in road development; in contrast growers have not been able to secure similar benefits from companies (Meyers and Vermeulen 2002).

The value of plantations is controversial. Plantations may replace biodiversity-rich grasslands and woodlands. For example, South Africa's grasslands biome is home to around 4000 plant species. In some countries, such as Swaziland, the replacement of grasslands with plantations has dire consequences for local livelihoods, especially for livestock production. Another concern is that some plantation species are invaders. In some areas, farmers report reduced down stream water flow from eucalyptus and other exotic species' plantings (Meyers and Vermeulen 2002). On the positive side, forest industries provide employment and alternative timber thus reducing dependence on natural systems.

Possibilities for Value Added Wood Products

In 2003 wood production, including wood fuel and industrial roundwood, stood at 699 million m^3, up from 340 million m^3 in 1980 (FAO 2003a). Despite this dramatic increase the value of Africa's share of global trade continues to decline; this is because products have low added value. SSA share of world exports shrunk to 1.3% by 2000 (FAO 2003a). Many countries in East and Southern Africa are net importers of wood products. In 2000 Zambia, a country with around 42% forest cover and 37% of other wooded land, exported forest products valued at USD 590 000 while it imported over four times that amount, USD 2 479 000 (FAO 2002). West Africa's exports exceed imports; most imports are for paper and paper products (FAO 2003d). Ghana, Cote d'Ivoire, and Liberia have substantial surplus production and are major

BOX 12.2 Big Bucks from Baobabs

Jennifer Clare Mohamed-Katerere

The Phiri family lives in Ngwenyama village in southern Malawi. Until recently, Mr Phiri's main way of supporting his family was by selling charcoal to passing motorists for USD 2 a bag. Due to land pressure and poverty, trees have become increasingly scarce consequently the charcoal business is not what it used to be.

Harvesting and marketing baobab pods have given the Phiris family new opportunities. They make extra cash from collecting surplus baobab pods and processing the fruit pulp to make Malambe, a fruit drink that is now sold all over Malawi. Even more exciting, for the Phiris, is the fact that baobab products look set to hit the European market. The Phiris have also acquired useful business and technical skills. Mrs. Phiri was appointed chair of the local Malambe Producers' Association. Having an alternative source of income means the Phiris are less dependent on charcoal production. This is good for the Phiris and good for the trees. (The text has been adapted from PhytoTrade Africa web-page).

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exporters of wood and wood products. Nevertheless, the margin between imports and exports has steadily been closing due to low investment in value-added products; in 1990, surplus production amounted to USD 496 million, but by 2000 it had fallen to USD 131 million. Production potentials have not been met and the market opportunities in Africa have not been utilised. Value adding activities and diversification are important for countries like Ghana, where processing capacity (sawn timber, panels, and matches) exceeds supply (FAO 2003d). Given the generally low prices for primary commodities and African's low-income elasticity, the challenge is to increase the production of value-added items while ensuring that wood continues to be sustainably harvested. This requires high capital investment.

Several countries restrict log exports in an effort to promote value adding with varying success. Powerful interests sometimes lobby against such initiatives. For example, in 1994 Cameroon banned log exports. As this threatened the interests of French timber companies, which export over 50% of Cameroon's logs for processing in France, the French government intervened and pressured Cameroon to withdraw the ban (Brunner and Ekoko 2000).

Africa has considerable market potential for wood products. By 2020 population is expected to have more than doubled from 2000, and will have reached about 646 million. Whether markets grow as a result, will depend on overall patterns of growth and earnings. Although Africa has 13% of the world's population, it accounts for less than 2% of the world's GDP. Per capita income is low and is likely to remain that way even with optimistic growth rates. Even in relatively well off countries, such as South Africa, opportunities are limited; per capita income figures hide the extreme disparity between rich and poor people.

Inadequate access to improved technologies, particularly for wood processing, is an impediment to investment. Although many countries have made significant investments in education, research, and development, these have been insufficient to create a vibrant local technological research and development sector. Given declining public resources and an unsupportive FDI (foreign direct investment) and development aid climate, this scenario is not likely to change.

Seizing the Opportunities for Commercialising NTFPs

Global and regional trade in NTFPs has been important for centuries, dating back to 1214. Historically it included pepper (*Aframomum* spp. and *piper guineense*), shea butter (*Vitellaria paradoxa*), ivory, palm oil, kola nuts (*Cola acuminate* and *C. nitida*), tamarind, rattan, and rubber (*Funtumia elastica*). Contemporary trade, in addition to these products, includes exudates (such as gum arabic from *Acacia senegal*, myrrh from *Commiphora myrrha*), tannins (*Acacia mearnsii*), and medical plants (including *Prunus africana* and *Cinchona* spp.). With growing tourism, trade in forest based art and crafts, particularly carvings and baskets, has increased. Due to incomplete data, the full extent of NTFP trade is impossible to gauge.

Despite this long history in NTFP trade, Africa has not been able to capture its full economic value. In part this stems from inadequate control over collection, absence of value-adding processes, and weak market access. Africa has paid a heavy price for bio-piracy, which has appropriated genetic wealth and related traditional knowledge; this has cost billions in the loss of potential earnings. Although the range of traded products has increased significantly in the last twenty years, economic benefits to rural people have remained small (Marshall et al 2003). Ecological and community benefits, such as empowerment, improved organisation, social justice, and human wellbeing, are difficult to quantify (Marshall et al. 2003).

There is a drive to commercialise a wider range of NTFPs, including honey, wild fruit jams, fruit based beverages, aromatic oils, resin, rattan (Defo 2004), shea butter (Schrekenberg 2004), exudates (FAO 2001), woodcarving, and basketry, to increase

the potential earnings of local producers (see Box 12.2). Given global prices, earnings from cosmetic and pharmaceutical products could be significant. Key species include *Prunus africana* (Ndam and Marcelin 2004), devil's claw (*Harpagophytum* spp.) (Wynberg 2004), *Griffonia simpllicifolia* (Gbewonyo 2002), and Yohimbe (*Pausinystalia johimbe*) (Sunderland et al. 2004).

The success of commercialisation varies across products and countries. Box 12.3 lists factors limiting the success of production, collection, processing, storage, transportation, marketing, and sale of NTFPs. Several African case studies show that the distribution of property rights, the ability to claim and enforce such rights, resource scarcity, and market transparency are also important constraints (Byron and Ruiz Perez 1996; Romero et al. 2002; Defo 2004; Wynberg 2004).

As with other community initiatives, the promotion of NTFPs has been motivated by efforts to reverse deforestation and land conversion activities (Sunderland et al. 2004); this has driven organisational form and in particular the centrality of government or NGOs. The involvement of multiple intermediaries and external product developers, especially for pharmaceutical products, is problematic. Trade in devil's claw, a traditional medicinal plant, supports a USD 100 million industry but most benefits accrue to processing and transformation actors along the marketing chain and only a very low proportion go to domestic producers. In Namibia, harvesters that sell to intermediaries receive only 0.36% of the retail price, those in an NGO facilitated marketing chain receive 0.64%, while those with direct contact with the exporter receive the most, 0.85% (Wynberg 2004). In the absence of direct investment in community skills and opportunities, communities will continue to enjoy only minimal benefits. An AU treaty seeks to control harvesting, ensure fairer distribution of benefits, and recognise local intellectual property rights, but implementation remains weak. Opportunities are also curtailed because much of Africa's genetic resources are freely available in gene banks, herbariums, and museums so that there is no need to go to the natural source. Many plant species are available across communities, regions, and countries, thus lowering the marketing opportunities of any one community and raising issues of how benefits should be distributed. Africans need to consider whether the "one-stop-shop" approach adopted in the Philippines and Costa Rica can overcome these problems.

Marketing presents special challenges and securing global markets is critical to the success of commercialisation. The European consumer has a particular interest in natural products, and with fewer barriers this market could become more important. The African Diaspora is also an important potential market. The Asian market remains untapped. International regulatory regimes may impose market restrictions; one problem with this is that some treaties do not make adequate provision for local variation in species' status. Under CITES devil's claw is listed as endangered, however, there is no local scarcity in Namibia. Requirements for certification place an added cost on poor communities.

In commercialising special attention needs to be given to promoting sustainable harvesting methods. Harvesting some NTFPs requires the felling of entire trees. In general, producers have responded to scarcity by extending the harvest range or by species substitution; domestication has not been actively adopted. Better species-based information is needed to develop appropriate harvesting regimes and ensure SFM (FAO 2001; Sunderland et al. 2004).

Eco-Tourism

Many African countries are investing heavily in ecotourism. Ecotourism has become the fastest growing sub-sector of the tourist industry, with an annual growth rate of 10–15% worldwide. At the same time, international tourism to the global south is increasing by 6% per year, compared to growth in developed countries of only 3.5%. Ghana, for example, has an annual growth of 12% in tourist revenues; these are expected to reach USD 1.6 billion by 2010 (Vieta 1998).

However, in general, tourism has had minimal community and conservation benefits. Impacts on local communities have been profound: wide scale eviction from their lands, economic dislocation, breakdown of traditional values, and environmental degradation. Eco-tourism is intended to address some of these shortcomings, however, several challenges are still evident. First, eco-tourism is generally private sector driven and is not concerned with the economic, social, and ecological well-being of the host communities. To break with this there must be a focus on building equitable partnerships that go beyond benefit sharing and improve the capabilities and opportunities of communities. Strategies for achieving this are discussed below in the section on building entrepreneurship. Second, war, civil strife, and severe health problems all undermine tourism. In the Great Lakes Region the outbreak of war in 1994 stopped gorilla based tourism in Rwanda and the DRC but pushed up demand to view gorillas in Uganda's forests.

Most eco-tourism initiatives have focused on wild fauna and little attention has been given to forests. Nevertheless, with good infrastructure and stable government, such initiatives can offer opportunities for new investments and economic growth and have positive spin-offs for forest conservation and local opportunities. A growing number of initiatives focus on forests and their role in biodiversity maintenance. These include initiatives in Kenya's Arabuko-Sokoke Forest, South Africa's Knysna Forest, Tanzania's Budongo Forest Reserve, Congo's Odzala National Park, and Uganda's Kibale and Bwindi Forests.

BOX 12.3 Factors Undermining Success for Commercialising NTFPs in different phases of the process

Jennifer Clare Mohamed-Katerere

Production
- ¤ Lack of technical support
- ¤ Lack of a favourable normative context
- ¤ Lack of financial instruments
- ¤ High opportunity costs
- ¤ Inadequate quality control

Collection
- ¤ Lack of financial instruments
- ¤ Lack of technical support
- ¤ Lack of community organisation

Processing
- ¤ Lack of processing skills and knowledge
- ¤ Lack of infrastructure, equipment and appropriate technology
- ¤ Lack of financial instruments
- ¤ Lack of technical support
- ¤ Lack of community organisation
- ¤ Lack of access to information
- ¤ Inadequate sharing of experience

Storage
- ¤ Lack of financial instruments
- ¤ Lack of appropriate storage facilities

Transport
- ¤ High unit cost of transport
- ¤ Long distances from point of sale
- ¤ Lack of transport infrastructure
- ¤ Lack of community organisation

Marketing (identification of market and product promotion)
- ¤ High cost of product promotion
- ¤ High availability of substitutes
- ¤ Lack of access to market information
- ¤ Lack of contact with final consumers
- ¤ Lack of financial instruments
- ¤ Lack of technical support
- ¤ Lack of community organisation
- ¤ Lack of market value
- ¤ Lack of adequate quality control
- ¤ Lack of attractive product presentation
- ¤ Lack of management capacity
- ¤ Lack of knowledge about consumer demands and needs

Sale
- ¤ Low product price
- ¤ Low returns to consumer
- ¤ High producer dependency on market intermediaries
- ¤ Lack of market value
- ¤ Lack of financial instruments
- ¤ Lack of technical support
- ¤ Lack of community organisation
- ¤ Lack of favourable normative context
- ¤ Poor relationship between final product price and production cost

(Adapted from Marshall, E., Newton, A.C. and Schreckenberg, K. 2003. Commercialisation of non-timber forest products: first steps in analysing the factors influencing success. International Forestry Review 5(2): 128–137.)

Marketing of Environmental Services

Globally, there are growing markets for environmental services. International NGOs and governments are key drivers. One intention is to use market mechanisms to encourage environmental protection, reduce public spending, make large corporations pay for the benefits they extract, and reward communities for the environmental services they provide, and thus promote sustainable development. In the forest sector, these services include carbon sequestration, forest protection, watershed protection, and landscape beauty.

In Africa, there has been relatively little use of markets for environmental services other than in the tourism sector. The payment of fees to enter protected areas is well established. Several eco-tourism projects seek to create mechanisms to reward communities for the role they play in conserving and maintaining the natural asset base. There are also growing numbers of market initiatives in the water sector. In South Africa permits for land-based activities, such as plantation forestry, that reduce the availability of ground water have been introduced. Zimbabwe has established Integrated Catchment Management in the dry zones, which introduced watershed protection contracts. In Ghana "time-debt" swaps have been introduced. Debt-for-nature swaps have been adopted in some countries, notably in Kenya. In West Africa, trade networks have been established to promote marketing of sustainably managed wood, largely under the auspices of the FSC. There are also several initiatives that focus on Certified Emission Reductions for projects in the developing countries.

Thus far interventions focus predominately on services traded through formal markets and other services, such as soil quality, sacred sites, and aesthetics, which do not enter formal markets, tend to be excluded. Other constraints exist to developing

Table 4. Impacts of markets on key assets held by poor households
(Adapted from Landell-Mills and Porras 2002)

Potential benefits	Potential costs
Natural assets	
¤ Forest conservation due to new market opportunities and better management.	¤ Lost access and use rights due to increased competition for resources.
¤ Increased value of natural assets where markets regularise land tenure.	¤ Lost use values (e.g. Timber and NTFP) where new harvesting regulations imposed.
¤ Positive spin-offs for other natural assets, e.g. soil fertility, water flows and quality, air quality due to reduced forest fires, and forest loss.	¤ Negative spin-offs for other natural assets, e.g. worsened water quality due to replacement of natural forests by fast growing plantations for carbon sequestration.
Physical assets	
¤ Improved infrastructure development – transport, market infrastructure, research, health care.	¤ Dismantling of local infrastructure, e.g. roads, to ensure sustained environmental services supply.
	¤ Greater inequality as infrastructural investment is targeted at certain market participants.
Human assets	
¤ Training – enterprise development, marketing, project and environmental management, negotiation skills.	¤ Inappropriate education diverts spending away from broader skills development.
¤ Improved health – more varied diets, improved water supply (quantity and quality) and air quality, investment in health clinics, increased disposable income for medical treatment.	¤ Poor capture few educational and skills development opportunities as they are offered only menial jobs.
	¤ Reduced health where poor are excluded from collecting NTFPs for domestic consumption, and lost disposable income.
Social assets	
¤ Increased tenure security where markets promote rights formalisation.	¤ Increased tenure security where markets promote rights formalisation.
¤ Increased community management and organisational capacity.	¤ Less cooperation due to increased divisions between those who gain and lose.
¤ Protection of forest based cultural heritage.	¤ Threats to cultural heritage where markets and commercialisation undermine local values.
Political assets	
¤ Increased participation due to improved organisation capacity and contacts in private and public sector.	¤ Loss of political representation where markets lead to increased competition for resources and exclusion of poor from forest areas.
Financial assets	
¤ Income from sales of environmental services.	¤ Poor suppliers excluded by high transaction and opportunity costs of bringing services to market. New restrictions reduce forest-based income.
¤ Income from secondary employment (e.g. NTFPs, fuelwood, timber, eco-tourism, transport).	¤ Poor people excluded from new markets since they lack necessary skills and assets.
¤ Improved security and stability of income due to diversification.	¤ Reduced security where contract design is inflexible and unable to respond to changes.

pro-poor markets (see Table 4). Insecure tenure rights limit rural people's opportunity to enter the market as the sellers of services. When faced with other powerful interests and economic pressures, governments may place little value on the rights of local peoples. The commoditisation of services could exclude communities from benefits they have traditionally enjoyed.

Private Sector

The private sector, though growing, is still weak in most African countries and has focussed on activities that have immediate benefits, such as logging; long term investment has generally been limited (FAO 2003a). This may be attributed to the insufficiently supportive institutional, legal, and policy

Matti Nummelin

Many African countries are investing heavily in ecotourism, which is the fastest growing sub-sector of tourism industry. A growing number of ecotourism initiatives focus on forests and their role in biodiversity maintenance.

frameworks. Equity measures, such as land reform and developing an indigenous private sector in southern Africa, have had a negative impact on long-term investments by the established private sector. However, this insecurity might spur new approaches. For example, in South Africa the private sector opted for out sourcing agreements with communities to lower investment costs and minimise risk (see Box 12.2).

Most governments see the private sector as an important potential actor in the forest sector and many are committed to promoting opportunities for the private sector. Many countries, including Ghana, Kenya, and Zambia, have restructured the public forestry sector by privatising public enterprises and transforming forest departments into semi-autonomous public enterprises. NEPAD makes a specific commitment to building the private sector.

From Community Participation to Entrepreneurship

Across Africa, there is growing focus on the value of multi-sector livelihood options and local entrepreneurship. The success of trade and market initiatives requires a shift from treating communities as recipients of "development" to enabling them to be effective drivers of their futures and to move beyond subsistence livelihoods. Several factors are driving this.

Many parts of Africa have valuable forest resources yet a high incidence of poverty. An important response was the development of community-based natural resource management (CBNRM) initiatives – an approach based on promoting conservation through increasing earnings at the local level – to address local poverty. To do this CBNRM shifted the locus of "management" to the community level while the state retained authority. The promise of prosperity led to numerous projects in various natural resources sectors. Local participation and "poverty alleviation" became operative terms to secure local support. To a large extent, the state's interest – whether sustainable use or environmental protection – continued to underline these initiatives; they only partially tally with local users' visions (Emerton 2001; Hulme and Infield 2001; Hulme and Murphree 2001; Kangwana and Mako 2001; Murombedzi 2001; Katerere and Mohamed-Katerere 2002).

Perceptions of success depend on how the actual, and not just legal, relationship to wild natural resources has changed. Impacts on local users' rights are important. Where these are not given priority or protected, support for CBNRM may be undercut. At times despite benefit sharing arrangements, forest departments prioritise commercial production over local use. Many countries continue to impose restrictions on use, for example on timber harvesting rights (Mozambique, Zambia and Zimbabwe) and by limiting extraction methods, such as the ban on chain saw use in southern Ghana. Additionally, in many countries the state is at the apex of forest planning; thus some communities see CBNRM projects as a means for the state to further extend its reach and control (Katerere and Mohamed-Katerere 2002).

Despite the trend to support local management initiatives that ensure greater returns to poor people, there has not been a focus on creating a supportive legal and institutional framework. Many local activities, including fuelwood harvesting, charcoal making, and the sale of NTFPs, continue to be treated as "informal", essentially representing marginalised economic activity with limited investment that borders on illegality. In some countries, such as Burkina Faso, Senegal, and Niger, governments and donors both continue to resist allowing rural people to engage in forest production and give licences only to urban based merchants (Ribot 2001). This is in contrast to the significant investment in time, labour, and financial resources that local people make in forest management. Globally, their investment amounts to USD 1.3 billion–USD 2.6 billion (White et al. 2004), which is as much as investment by national governments and exceeds ODA. Borrowing capital remains almost impossible for poor people, given that few have anything to offer as security.

Several other pertinent factors need to be addressed. These include inadequate infrastructural development, communication systems, resource and marketing information systems, access to markets and finance, and low capacity and skills.

Building Community-Private Sector Partnerships

Partnerships in development are a growing trend. Increasingly, entrepreneurs and others at the national and local levels are forging partnerships with business and NGOs to more effectively use the resources available to them.

Community-private sector partnerships (CPSP) are seen as a way to promote investment in rural areas. For example, in South Africa the awarding of forest concessions has been linked to company obligations to increase local benefits through community equity stakes, pay lease fees, give communities shares for the use of their land, provide preferential employment to local people, locally out-source procurement and contracting, and offer local enterprise opportunities, business training, and support (Wolmer and Ashley 2003). In Ghana, forest concessions are linked to companies making socially responsible investments.

To ensure equity a cautious approach to CPSPs needs to be adopted. Creating secure land rights is one way in which the balance of power can be swung towards communities. When a community is the land holder it is necessarily also a contractual partner rather than just a recipient of charity, and thus better able to influence development choices. How rights are interpreted in practice depends on several factors, consequently safeguards to protect local rights should be developed. Experiences show that when community interests are in conflict with more powerful interests, such as those of the state and conservation lobby groups, rights may be interpreted restrictively. For example, in the much acclaimed Makuleke land claim in South Africa's Kruger National Park, community rights were restrictively interpreted in line with dominant conservation policy (Mohamed-Katerere 2001). In the absence of strong lines of accountability, many partnerships give rhetorical rather than real rights to poor people.

Given an unsupportive institutional and regulatory framework, CPSPs are not likely to become a major trend. Transaction costs may be too high; companies need to make additional investments in capacity building, and the processes of negotiating such deals are often cumbersome. Communities may lack legal personality, have weak tenure rights, and low organisational capacity. In general, the financial sector is reluctant to provide them with loans. The market pressure to move to economies of scale also weakens the prospects for CPSPs.

Bilateral and Donor Partnership

Although recognising that Africa must become self-reliant, a major focus of the NEPAD strategy has been to try to increase the flow of development assistance and FDI. Several other initiatives support this objective, including the G8 and the UK Africa Commission. However, two years into NEPAD the prospects for meaningful external support seem slim.

Despite some recovery after the 1990s downward trend in ODA, aid levels still fall far below those needed to achieve the MDGs. Increasingly, Africa has to compete for development assistance with emerging demands in Eastern Europe, Afghanistan, and Iraq and the global war on terrorism, as well as agricultural subsidies paid to developed country farmers. Africa is a marginal recipient of FDI receiving only about 2% of the global tota1 (AfDB 2004). Countries in SSA share less than one percent, of which half goes to South Africa (Oxfam 2003). Although FDI increased in the 1990s (FAO 2003a), it has now taken a dramatic downward swing. In 2002, FDI inflows declined from USD19 billion in 2001 to USD10.9 billion, which is a staggering 41%; this affected 23 countries (AfDB 2004). Most FDI goes into oil and gas projects in Angola, Algeria, Sudan, Nigeria, and Gabon, and into gold mining in Tanzania and South Africa. Africa's share of FDI to developing countries is only around 4% compared to 45 to 50% for Asia and 30% for Latin America (AfDB 2004). A large percentage of FDI earnings are externalised. The prospect for less predatory FDI is slim, and thus even increased foreign investment may not bode well for Africa's development.

Africa has only 5% of the developing world's income but it carries about two thirds of the Global South's debt burden – over USD 300 billion. Despite extreme poverty, it transfers almost USD 15 billion a year to rich nations in debt repayments. The average African country spends three times more on repaying debt than it does on basic services provision. By the end of 2004, Africa will spend about 70% of its export earnings on external debt servicing (Africa Recovery 2004). Debt repayments are a major impediment to growth. Much of the debt is believed by Africans, and others, to be unjust, thus prompting calls for debt cancellation.

In 1999, the World Bank and the IMF introduced Poverty Reduction Strategies (PRSs) as a mechanism for countries to qualify for debt relief and donor assistance. Consequently, some see PRSs as a new form of economic SAPs and donor conditionality. The review of PRSs (PRS paper or PRSPs) provides a basis for debt relief under the Heavily Indebted Poor Countries (HIPC) Initiative, concessional lending, and the World Bank's Country Assistance Programme (Bojo and Reddy 2002). At least 60% of the PRSPs are from SSA. The PRSPs are purportedly designed to be country driven with participation of all actors, to link public action and poverty outcomes, and to achieve outcome-related goals for poverty reduction. PRSPs are also intended to integrate environment and natural resources, such as forests, into poverty analysis and national planning. Countries have different capacities to develop PRSPs that can address these complexities. Many need support to ensure the better integration of forests and other natural resources into

national plans, policy, and legal reform.

Implementation of PRSs has been slow both in pace and magnitude. In SSA, 24 countries have received some debt relief: Benin, Burkina Faso, Cameroon, Chad, Democratic Republic of Congo (DRC), Ethiopia, Gambia, Ghana, Guinea, Guinea-Bissau, Madagascar, Malawi, Mauritania, Mali, Mozambique, Niger, Rwanda, São Tome & Príncipe, Senegal, Sierra Leone, Tanzania, Uganda, and Zambia. Debt relief can have significant impacts. Tanzania has received USD 3 billion in debt relief, and has been able to increase spending on education and eliminate school fees for elementary education. Almost overnight, an estimated 1.6 million children returned to school. Mozambique increased health spending by USD 13.9 million.

The entire relationship with external actors must be recast. The donor sector has historically been a major driver of forest sector change. There is growing concern in the local NGO sector about double standards and, in particular, the unwillingness of donor countries to support significant debt cancellation. Against the backdrop of development corruption involving multi-lateral institutions, such as in the Lesotho dam fiasco, African governments are more likely to demand greater transparency and accountability.

Pan Africa Partnership

Throughout Africa there is a shift in thinking, a widening of the perspective from national economic interests to the opportunities of regional co-operation, as is evident in the transformation of the politically motivated Organisation of African Unity to the AU.

Distance to ports, small populations, relatively small markets, and the many landlocked countries are motivations for economic integration and joint investments in energy, communications, and transport. Many African countries inherited transport and communication systems that were designed to serve the interests of their former colonial masters; many infrastructural systems do not facilitate cross-border trade and often result in high transport costs. Recognising the real limits to economic growth of national efforts, NEPAD has as one of its guiding principles, the acceleration of regional and continental integration (NEPAD 2001). Africa has 18 regional trade agreements, including SADC, Economic Community of West African States (ECOWAS) and East African Community (EAC). As regional bodies mature, intra-African trade can be expected to increase.

Greater regional cooperation is also evident in the natural resource sector with a growing number of agreements related to the management of transboundary natural resources, such as wildlife and water, and the establishment of transboundary management areas.

12.5 Protecting the Asset Base

Since UNCED, global policy has increasingly focussed on conservation at global, national, and local levels. This conservation-action driver has at times led to inappropriate strategies to protect the environment while neglecting livelihood issues and local priorities and approaches to problem solving. The challenge is to turn around the focus on protection and develop an approach that supports African aspirations while ensuring resource sustainability.

Science – Policy Failures

A fundamental problem in developing approaches to protect environmental resources and services lies in the troublesome relationship between science and policy. Powerful networks of policy makers, including both national and international actors such as non-governmental organisations, research agencies, donors and governments, often frame inconclusive science into "stories of crisis" that demand immediate intervention (Keeley and Scoones 2003). The receptiveness of governments to scientific recommendations lies partly in the fact that education, and in particular science, is highly valued and is seen as essential to development and transformation. This places scientists in a dangerously influential position and marginalises local users in policy-making. One consequence is that science is used to consolidate state control over commercially valuable natural resources and to exclude the majority of rural dwellers from enjoying its benefits (Ribot 2001).

The oversimplification of scientific findings often results in policy recommendations that focus on just one element in the overall system, resulting in inappropriate solutions; this is evident in such diverse arenas as slash-and-burn agricultural strategies, fuelwood supply, bush meat, watershed protection, and climate change. These policy failures demonstrate the need for processes that encourage debate and allow different perspectives to be presented, rather than simply implementing pre-determined global policies. Throughout Africa, there is a growing appreciation of the value of inclusive processes.

These dilemmas are evident around the forest-hydrology nexus, which over the last ten years has become an important policy focus at the global and national levels. Deforestation, climatic conditions, and livelihoods are increasingly seen as linked, this creates an impetus for forest conservation. A key problem has been a one-size-fits-all approach to solutions and policy. However, as Nelson and Chomitz (2004) demonstrate, scientists still poorly understand the hydrology-deforestation link. Although broad conclusions can be drawn, the actual link depends on such specific local factors as soil structure, topography, the land cover that replaces the forests, the spatial-temporal patterns of rain (Nelson and

Chomitz 2004), and settlement patterns. Research should consider local priorities, including whether forests are the best land use for watershed protection. Catchment-based approaches to watershed have become an important focus across southern Africa; the potential opportunities need to be considered. It is also important to understand the patterns and drivers of deforestation, how these are linked to local livelihoods, and where and how the impacts are experienced.

A further difficulty in the science-policy interface is declining investment in African research and extension. Although local, national, and regional actors play a crucial role in policy development, the lack of adequately inclusive processes and research capacity means that often international research and other external processes drive policy (Shiel and Wunder 2002; Amanor 2003; Keeley and Scoones 2003). Funding dependency, in the absence of partnerships, has contributed to the central role of international research organisations, such as the Consultative Group on International Agricultural Research (CGIAR), and the United Nations technical agencies, and foreign governments in the construction of policy. International research priority setting is often driven by development fashions, has little regard for localised priority setting, is not accountable to local constituencies, and is motivated by the need to sell its research (Keeley and Scoones 2003). For example, long-term ecological research required to develop sustainable harvesting models for high value NTFPs from wild populations is notoriously "unsexy" to donors (Sunderland et al. 2004). In this context, African forestry does not always benefit from new research findings.

Global Values and Economic Trade-Offs

The tension between preserving forests for environmental services and using them to attain economic benefits is not abating. One key area is the role of forests in climate change mitigation efforts. Although vegetation and soil act as net carbon sinks and long-term carbon reservoirs, forests can be sources of Greenhouse gases (GHG) if poorly managed. Enhancing the mitigating role of forests and developing national legislation to support this remain challenges. One reason for this is that the Kyoto Protocol to the United Nations Framework Convention on Climate Change is not user-friendly. For example, accounting (measuring and reporting) systems on emission levels and the modalities for small-scale reforestation and afforestation projects to claim benefits from carbon trading are complex. Additional challenges are to harmonise national and supranational law and to agree on what standards to adopt.

In many instances, local people are asked to forego livelihood opportunities for conservation without being offered adequate compensation. In Uganda a carbon sequestration plantation project, in an area with high population density and high unemployment, resulted in land-based conflicts between the forest authorities and displaced communities, when the communities were removed from the land over which they had usufruct rights to make way for the plantation. The rents they received from this project were below the rents they were required to pay for the farmland they now had to lease (IUCN 2004).

The climate change debate epitomises the dilemma of policy globalisation and defining the best way to proceed. Global policy focuses primarily on reducing emissions, protecting existing forests, and developing new forests to promote carbon storage. Through international agreements the developing world has been pushed to adopt this approach. The Kyoto Protocol creates an incentive for afforestation and reforestation projects in developing countries under the Clean Development Mechanism (CDM). A market is emerging where carbon credits from these projects can be traded with industrialised countries to offset their domestic greenhouse gases emissions. However, the extent to which CDM will benefit developing countries and poor people in particular remains questionable. Will CDM result in land use patterns that marginalise forest dependent people? Is there a threat that CDM will encourage large-scale conversion of productive non-forest ecosystems to managed plantations? How can Africa's existing contribution to carbon storage through its vast tropical forests be recognised?

Plantation development, SFM (longer rotations, selective harvesting and trees providing shelter for soil), reduced deforestation, and reduced incidence of fire could make forests a more permanent carbon sink. However, forests can be susceptible to climate change, which may reduce their potential to function as carbon sinks. Finding land to expand plantations is not likely to be easy. Where forests that support wood-based activities (logging and processing) are converted into carbon sequestration projects, local people could lose livelihood opportunities. Projects that reduce access to land, resources, and jobs without offering alternatives may create incentives for illegal clearing or harvesting. New stresses may be created as people are forced to source wood supplies and land from elsewhere.

Not all CDM projects are obvious "win-win-win" for livelihoods, conservation, and climate change mitigation. Experiences from Tanzania, Uganda, and Malawi indicate that transaction costs and the complexities of CDM projects may prevent small-scale farmers from participating. In addition, a focus on large-scale projects might divert investments away from small-scale projects, resulting in an uneven distribution of benefits (Orlando et al. 2002).

Mohamed Elfadl

The relationship between poverty and environmental resources has a strong gender component. Women and girls, responsible for collecting fuelwood, fodder and water are hurt disproportionately by environmental degradation.

The Role of Private Sector in Protected Area Management

As Africa is home to 25% of the world's remaining tropical rainforests and contains 20% of the world's biodiversity hotspots thus it is of interest to conservationists. Early conservationist thinking, drawing on then dominant frameworks in ecology and motivated by wilderness preservation, focussed on creating protected areas reserved against use (Hulme and Muphree 2001). Often local people's rights and interests where not taken into account; thus this conservation model is seen as undervaluing equity. Today some international environmental organisations, with the support of many western governments, continue to focus on maintaining the sanctity of these protected areas. Several fundamental shifts are evident as the economic viability of this approach is being revisited.

First, as the incidence of poverty continues to rise and rights-concerns have come to the fore, one solution has been to focus on the flow of benefits to forest dependent people. Throughout southern Africa, community involvement in tourism and wild area management is promoted and various business initiatives are being tried. Co-management initiatives have been adopted in protected areas in Tanzania, Uganda, Gambia, Cameroon, Burkina Faso, and Guinea.

Second, as the ability to protect and manage natural forests is hampered by low government investment, a greater emphasis is now placed on the role of the private sector. Private sector investment is seen as key to creating jobs and skills development. Both CPSP and public-private sector are promoted. The area under private protection has been steadily increasing. In southern Africa, 14 million ha are estimated to be under some form of private protection (Krug 2001). Similarly in Kenya, a significant amount of land is in private protected areas. One concern about privatising national resources is that it may limit access by poor people.

Third, with global attention and scientific research focussed on the impact of habitat loss on species diversity, there has been a shift to the creation of mega transboundary parks. Many are driven by powerful private sector tourist organisations in alliance with governments or by international environmental organisations. The opportunities for local people vary considerably; however given the well established focus on community rights most initiatives at least make some rhetorical commitment to increasing community benefits.

Research and Capacity Building

Confronting challenges in forestry and the related areas of agriculture, health, environment, human security, and economic growth requires meaningful levels of investment in science and technology.

Africa cannot continue to depend solely on global research that does not always give priority to its concerns. Neither can it afford not to have the benefits of research. For example, the consequences of long-term climate change on agriculture and forestry need to be understood. Also, models for mitigating and adapting to climate change are required.

Forest research has mainly focussed on production forestry that seeks to address industry's needs. However, according to Temu and Kowero (2001), the capacity of industry to support research in many African countries, with the exception of countries like South Africa, is weak. Governments find it increasingly difficult to raise required research funds as economies of many countries have declined over the years. The on-going socio-economic reforms in Africa have not helped the lack of funding for forest research.

Africa needs to address the serious weaknesses in science by mobilising all stakeholders at the national level, such as universities and public and private research institutes, as well as regional academies of science. Coordination and consensus on what research is required will put Africa in a better position to allocate targeted funds and seek support from international donors and foundations. At the same time, African governments and international donors need to increase research and development funding that is focused on the unique challenges facing Africa. Investment in forest institutions is essential if they are to be more visionary. Research must be responsive to real world issues, including rights and equity considerations, and devise tools and methods that measure the real impact of forests on livelihoods at the household level and at larger scales. New kinds of partnerships with international research organisations, in which Africans have a greater stake in research agenda setting, advocacy, and policy development, are needed if forest research is to address the challenges of the day.

Additionally, the technology gap must be closed – Africa has an average of only one internet user for every 200 people, compared to a global average of about one in 30 (UNEP 2002b). Access to first generation communication technology remains incomplete. Without such a commitment, the opportunities presented by globalisation may not be realised.

12.6 Improving Governance of Africa's Forests

Historically, forest governance regimes have been designed to ensure exclusivity for state or private sector commercial harvesting and/or to conserve the forests for environmental services and other values. In many cases, this meant that governance frameworks controlled and restricted local use, focussed on top-down management, imposed criminal sanctions, and established poor systems for accountability and local participation. In the last ten to twenty years, several divergent factors have converged to create a focus on issues of participation, democracy, and equity. These factors include local people's demands and rights claims, global movements, multi-lateral agreements, the failure of purely preservationist management frameworks, inadequate state funding, and social conflicts, as well as a shift, nationally and globally, in the motivations for and objectives of forest management.

Democratisation and Decentralisation

There is a growing focus on democratisation and decentralisation. Many local people are demanding greater authority over local resources by, for example, more secure tenure regimes. Many link forest resource rights to historical land claims. Governments and donors are more supportive of decentralisation as they realise that policy development and management cannot be the preserve of technocrats, but must include local users.

Decentralised forest management models range from localised state management, with few opportunities for community participation, to more participatory models. Participatory mechanisms include consultative forums, multi-stakeholder co-management models, and benefit sharing schemes. In many countries, governance deficiencies continue to plague these initiatives (Mohamed-Katerere and Matose 2002; Amanor 2003).

First, the governance initiatives of the 1990s, although often the product of local rights claiming, were driven by global visions of what governance should look like in order to meet a set of predetermined criteria. Representation, participation, benefit sharing, and acknowledgement of local people's knowledge, which are at the heart of the Convention on Biological Diversity's vision for governance, were repeated in the Forest Principles and then again and again in bi- and multi-lateral conservation agreements. By focussing on these inadequately deliberated elements, the nuances that had driven the original rights claims were lost. Many of these conservation policies and programmes focussed simply on ensuring representation of previously marginalised groups – women, traditional leaders, communities – without creating mechanisms to ensure active participation in the new forums and to achieve accountability and transparency between the final decision maker and citizen (Murombedzi 1992; Katerere and Mohamed-Katerere 2002; Ribot 2002; Larson and Zeledon 2004).

Second, the definition of stakeholder and decision-maker remains problematic; it has been shaped not only by the national significance of forest resources but also by global forest policy. State agencies continue to identify themselves as stakeholders and not simply trustees of national resources.

Third, policy development and management

BOX 12.4 Progressive Law Reform but Limited Benefits: Cameroon's Community Forests

Jennifer Clare Mohamed-Katerere

In 1994, Cameroon radically overhauled its forest law. The new law allows communities to reclaim the right to manage and use 50 000 ha of their customary forest through the declaration of a community forest. Use rights were extended from NTFPs to high value timber (Brown 1999). Implementation is hindered by several factors.

First, the driving force behind the law reform was the donor community and in particular the World Bank. Unfortunately, policy development and implementation mechanisms were determined externally and local participation was discounted as not being cost effective (Brunner and Ekoko 2000). Consequently, there was little national ownership of the law and the demarcation plan that was the basis of implementation bore little resemblance to local usage (Brunner and Ekoko 2000). This undercut the effectiveness of the law. The exclusion of members of the influential forest industry from consultations lessened their support for law reform and in particular tax reforms; they have used their financial muscle to ensure that granting community rights does not undermine their interests (Fomete 2001).

Second, community forests may only be established in forests of lesser value and not in "permanent forest", which compromises 64% of forest estate, although many people live in these areas (Brown 1999). These are set-aside as commercial forestry areas or wildlife habitat. Nevertheless, the reforms are significant as most local people previously had little opportunity to "own" land. The law does not restore traditional rights; in traditional law occupation grants the occupier some degree of title.

Third, the law is vague. For local people to take advantage of the law a legal entity must be formed. However, how this is to be constituted is not stipulated in the law, and there is no requirement for it to be representative of local interests. For many local people such requirements are difficult to fulfil without external support.

Fourth, tenure is not secure. The state retains ownership of the land and the community is allocated up to 50 000 ha on a 25-year lease, which is reviewed every five years and renewable for a further 15 years.

Fifth, due to under capitalisation, communities often have little choice but to subcontract the right to harvest. Under these circumstances, there has been high-speed felling with limited community involvement. Benefits are often distributed individually, used consumptively, and not reinvested.

Nevertheless, there are demonstrated benefits. Several case studies suggest that community skills and cohesion are essential for success (Fomete and Vermaat 2001). In one case where the Ministry supported the community through training, benefits have been more substantial. Training was given in sawing planks using a precision frame; this enabled the community to get a better price. Project support in creating a market was also important. However, a drawback was that the community made short-term benefits a higher priority than long-term interests. Unfortunately, given the insufficient support to community organisations, a series of failures occurred and conflict set in. In another case, where community organisations developed goals and defined the management framework success was evident. In a third case, where there was no outside involvement and a trained forester who was a member of the community helped develop a management plan, the community opted to reinvest a percentage of earnings.

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remain firmly separated – policy continues to be predominately the preserve of global institutions, research bodies, and national governments while management responsibility has moved downwards. States have been reluctant to transfer meaningful power to local democratic institutions, preferring instead to entrust custody over natural resources to local agents that are accountable to central government. One pretext used by the state is the need to maintain standards (Ribot 2002). Consequently, forest dwellers are denied legal rights to the forests on which they depend.

Fourth, these initiatives focus on areas where the state lacks capacity rather than on local interests; they seek to improve managerial efficiency by making local people responsible for resource monitoring and law enforcement (Murombedzi 1992; Hulme and Murphree 2001; Katerere and Mohamed-Katerere 2002). They may be perceived as mechanisms for more efficient communication of centrally determined rules to local people.

Fifth, there is a failure to create adequate mechanisms to translate policy into practice. For example, in Malawi one of the purposes of the Forest Act is to empower the Village Natural Resources Committees to source financial and technical assistance from the private sector, NGOs, and other organisations but there are no mechanisms to support this. In many countries, local organisations to which some management authority has been devolved are entitled to make rules. This is, however, seriously circumscribed by ministerial or parliamentary rule making. Additionally, in many countries inadequate budgets and skills investment undermine decentralisation efforts (Porter and Young cited in Wiggins et al. 2001).

After this initial phase, two important things happened that fundamentally changed the landscape of governance. First, many governments recognised the

potential benefits of decentralised forest management and are thus now more open to creating such systems. Over 30 African countries have some form of local level forest management; this involves about 4500 communities (Alden Wily 2002). Implementation, however remains slow and is hampered by limited funding and weak capacities. Second, although many local users received some benefits, with time they have begun to re-examine these benefits and are questioning the extent to which these initiatives have fundamentally improved livelihood opportunities. Local people are increasingly aware of their lack of authority to make long-term changes that widen their livelihood opportunities or enable them to extricate themselves from poverty. These two factors need to be placed at the centre of governance debates and policy development processes, so that as new practice evolves it is better able to achieve poverty alleviation goals. To support local users to achieve livelihood objectives, management priorities and institutional design need to be specifically linked to supporting livelihoods. Experience, both positive and negative, shows that this requires clearly defined and secure tenure rights. In several countries there are conflicting tenure rights to forest resources. This may be due to multiple legal or normative systems or simply to conflicts within the general law system. More interactive governance frameworks are essential to address social conflicts.

Despite these positive trends, fundamental governance change is likely to be slow and confined to low value forests, due to the many contradictions within governments and the overlying (global) economic pressures. For economic reasons decentralisation in forest rich countries, particularly those with low population densities, will probably also be slow, as the state will continue to strive to maintain control over these resources. In Cameroon, the initiatives that support communities to enjoy the benefits of forests have had only limited success despite supportive laws (see Box 12.4).

Law Enforcement

Throughout much of Africa, law enforcement is ineffective. The reasons for this vary from country to country and locality to locality. However, understanding why this is the case is crucial to building more effective managerial regimes.

The success of policy implementation depends in part on the extent to which the policy is specifically and legally defined and partly on whether or not there is the capacity to implement and enforce it. Many countries experience difficulties; in Ghana at the local level, only about 10% of forest policy is implemented. (Wiggins et al. 2001).

Social conflict and war result in very fluid law enforcement. Over 30 African countries have been involved in wars in the last five years and many more experience local resource conflicts. In war-ravaged areas, it is difficult to monitor and enforce law. Conflicts between different users or between lawmakers and users may also exist in stable societies. Local users may ignore laws that undermine their livelihoods.

Rights Framework

Although the language of law has become more conciliatory and participatory, the reality of the law – sometimes because of careful crafting and sometimes through a lack of political will – has remained essentially unchanged. Despite forest law reform, the focus remains on controlling use, and little attention is given to the issue of rights.

Rights to forest resources, including decision making authority which can support SFM, remain poorly developed (see Box 12.4); where they do exist they are often difficult to claim Despite the decentralised approaches, law enforcement has remained the primary tool for ensuring sound management. Tenure regimes continue to emphasize the ultimate authority of governments, including the right to terminate community access to resources. In Zambia, the government extinguished local rights where it was able to earn revenue from awarding a concession to a logging company. In Cameroon, where over 100 000 completely forest dependent people live, forest law still upholds the colonial notion of land rights, which deems vast tracts of land as no man's land because of "inadequate" occupation. Only when real rights are transferred to local people will they be able to achieve the kind of balance between extraction and preservation that meets their immediate needs and long term expectations.

Similarly, procedural rights remain poorly developed. For example, Mozambique's Forest Act requires consultation prior to awarding concessions; however, this does not mean securing agreement from communities, but simply an obligation to solicit their views (Wolmer and Ashley 2003). In the absence of any obligation on the deciding authority to give reasons for its decisions, the opportunity for communities to challenge decisions remains fundamentally constrained. Throughout Africa, law is dressed in such meaningless shining finery, intended to appease communities while maintaining the status quo.

Clarifying and strengthening the legal framework is important for developing a shared understanding of the roles and responsibilities of various actors and how management will be used to achieve agreed objectives. Rights based approaches can be used to promote accountability, transparency, openness, and exclusive policy processes, and thus are an important complement to SFM. Sustainable management requires flexibility and the ability to adapt to changing circumstances. Rights need to take this into account and allow the holder sufficient discretion to make wise choices. SFM is only possible when rights hold-

ers know that they are not under threat of losing their rights and where they have sufficient legal and practical opportunity to enforce their rights.

12.6 Conclusions and Recommendations

The world and Africa are undergoing rapid changes driven by globalisation, free trade, heavy indebtedness, violent conflicts, emphasis on market mechanisms, and a decreasing role of the state. In the forest sector the trend has been towards growing deforestation due to inadequate tenure rights, conflict, agricultural expansion, and commercial logging; a rising informal sector; greater willingness to decentralise management except in high value forests; and increased privatisation. Increasing poverty and vulnerability remain major challenges. Despite the havoc being wrecked by diseases such as HIV/AIDS, tuberculosis, and malaria, Africa's population is still expected to grow and urbanisation to increase. This too will place pressure on the forests, but it will also create demand and markets for forest products.

One big question is how Africa should respond to a more globalised world and growing demand for forest products. To what extent can increased investment in plantations and forest-based enterprise development increase its share of global trade in forest products and support SFM?

Forests will continue to play a major role as safety nets for poor people who have no other option but to use forest resources. Additionally, trees outside the "forests" will remain an intrinsic part of the lives of poor people. To harness the forest's wealth for the poor, certain conditions are necessary for entrepreneurship to flourish and for successful commercialisation and profitability at the local level. First, poor people in remote areas must have access to social and financial services, markets, infrastructural development, and substantial investment in technology. Second, they require enforceable tenure rights to forest resources in their vicinity in order to counter power and legal impediments. Third, the non-poor need to assume their share of the costs of environmental protectionist policies or externally driven commercial exploitation, whether by colonialists, private sector, the state, or illegal loggers. Fourth, the focus has to be on supporting local people in making the transition from low-level primary resource management to greater value adding and economically more productive arrangements. Fifth, without market access and reliable information, communities cannot prosper. Information to support decision making at all stages but particularly for product and market identification is crucial. Sixth, capacity building to enhance local skills is essential to close the gap between the poor and the rich, and between the powerful and the marginalised. Essential skills include negotiation, conflict management, accounting, and management. Seventh, partnerships that support community trade and create equitable benefit sharing systems are vital. The private sector can play a key role in the economic revitalisation of the forest sector. Unfortunately, it remains weak in most countries. To change this requires improving the investment climate.

The lack of accurate data on the state of Africa's forests underscores the need for greater efforts at data collection to support strategic planning and to inform policy. If policy and planning are to respond to real world situations, there must be greater investment in collecting and analysing forest data and information.

Science has been a double-edged sword. It has enhanced understanding of complex problems and created a new basis for developing appropriate policies. However, too often as scientists have struggled to sell their findings, they have promoted a crisis intervention approach that has over-simplified and generalised problems and thus framed inappropriate solutions. It is evident that strictly technical or managerial solutions fail to take account of the complexities of politics and power. Finding a more positive and interactive role for science is essential. Developing SFM strategies presents numerous challenges because SFM is part of a complex nexus of biodiversity, agriculture, water, health, and environmental management that is influenced by extra-sectoral activities, such as land use planning, macro-economic policy, and power dynamics. This is further complicated by the fact that many forests are subject to competing tenure and governance claims, and multiple visions and objectives. For science to be responsive to African needs, a new culture among researchers and forest managers is needed. Many international research organisations raise money to undertake research and development in and for developing countries; however, research is often driven by the latest funding fads and the need to demonstrate impact rather than address the long-term needs of poor people (Keeley and Scoones 2003). The range of skills found in national and international forest institutions needs broadening to respond to complex issues such as land rights, democracy, resolving conflicts, and generating wealth creation.

Although forests generate multiple benefits, they are subject to numerous demands that invariably cause resource-based conflicts. Thus, viable solutions to forest related issues are often not only technical but also political. There will always be a need for laws that are not command and control but are guided by the need to conserve and recognise the rights of poor people. There will always be winners and loosers, but the gap between them needs to be narrowed; processes that create spaces for poor people to participate are essential.

Many believe that a new era is dawning for Africa. NEPAD is a bold attempt to reverse current negative trends. Whilst providing a basis for coordinated response to poverty, NEPAD remains a

contested approach in terms of how "African" it is, whether it has been sufficiently consultative, the extent to which it is new, and whether it will replace or complement many existing development initiatives. Despite numerous commitments from donors, the funds promised to move from rhetoric to action have not materialised. Whether or not NEPAD initiatives will actually result in a new and more successful chapter in Africa's story of development is subject to much debate.

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REGIONAL FORUM IV

13 Paradigm Shifts in Asian Forestry

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Abstract: During the last two decades, Asian forests have experienced dramatic paradigm shifts, such as transition from planned to market economy, shift of timber supply from natural to planted forests, increased role of wood substitutes and NTFPs, decentralization and increase in local people's participation in forest management, and advancement of ecosystem management. These paradigm shifts, and the linkages between forests, society and environment, vary greatly among different countries in Asia. The use of market-based instruments, development of payments for environmental services and community participation should be encouraged to further support sustainable forest resource management in Asia.

Keywords: Forestry; ecosystem management; paradigm shift; decentralization; property rights; trade; livelihood; Asia.

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13.1 Introduction

Asia is the most populous region in the world and home to more than 3.8 billion people, representing 60% of the global population (UN 2004). Economic growth rate in Asia is higher than the world average, especially in China and India. For example, China's annual average economic growth rate from 1978 to 2003 was 9.7% (China Statistic Bureau 2003). Asian countries have multi-cultural backgrounds and diverse needs that require different approaches to forest resources management. In the last two decades, rapid economic and population growth and the advancement of the post-industrial and ecological era have caused paradigm shifts in Asian forestry. Links between forests, societies and environment have also changed, and new approaches to sustainable forest management are required in the changing economic and ecological environment.

Based on a review of existing literature and interviews with forest professionals and experts, this chapter seeks to identify some key forest trends and paradigm shifts in Asia. The developments in the low forest cover countries in West Asia are not addressed in this chapter, even though we recognize the importance of the forest sector and the increasing needs and demands placed on it in these countries.

13.2 Forestry Sector in Asia

Forest Resources

The FAO Global Forest Resource Assessment 2000 (FAO 2003) estimates that the total forest area in Asia is 547.79 million ha, i.e. 17.8% of the land area and 0.15 ha per capita. Both indicators are lower than the world averages (29.6% and 0.65 ha of forest land per capita, respectively). Asian forests are subjected to the greatest population pressure in the world. Tropical forest accounts for 61%, subtropical forest 23%, temperate forest 14% and boreal/polar forest 2% of the forests in Asia. Forests are unevenly distributed. Countries with a forest cover of over 50% of the total land area include Brunei Darussalam (83.9%), Cambodia (52.9%), Japan (64.0%), Laos (54.4%), Malaysia (58.7%), Myanmar (52.3%) and the Republic of Korea (63.3%). The forest cover of Arabian countries is generally lower than 5%. Oman, Qatar, Kuwait, Saudi Arabia and Yemen have less than 1% of forestland. The FRA 2000 estimates total natural forest area in Asia to be 432 million hectares or 78.9% of the total forest land. China with 118.4 million hectares (27.4%) and Indonesia with 95.1 million hectares (22%) have the largest natural forest areas in Asia (FAO 2003).

Asia has the largest planted forest area in the world and it is rapidly increasing. In 2000 planted forests in Asia accounted for 115.8 million ha, or 21.1% of the total forest area. The top five countries are China (46.7 million ha), India (32.6 million ha), Japan (10.7 million ha), Indonesia (9.9 million ha) and Thailand (4.9 million ha) (FAO 2003). China, India and Japan account for 77% of the total area of planted forest in Asia. Other Asian countries with over one million hectares of planted forests include Indonesia, the Democratic People's Republic of Korea (DPRK), the Republic of Korea, Turkey and Vietnam. Indonesia has around 3 million hectares of forest plantations, comprising rubber and other industrial species plantations of *Tectona grandis*, *Acacia mangium*, and *Pinus merkusii*. The DPRK has established 2.2 million ha of *Larix leptolepis* and *Pinus koraiensis* plantations, which account for about 60% of the planted area (FAO 2003). The Republic of Korea has also planted over 2 million ha of *Larix leptolepis* and *Pinus koraiensis* and a considerable area of *Populus*. Planted forests in Turkey cover 1.9 million ha; they are mostly planted with *Pinus* species such as Calabrian pine (*Pinus brutia*) and Stone Pine (*Pinus pinea*). In Vietnam, the recent five-year plan set a target of planting 5 million ha of forest, of which 2 million ha will be planted for supplying timber, paper and mining industries.

Most of the industrial plantations in Asia are less than 15 years old. This is largely due to the rapid development of industrial short rotation plantations in China and India in recent years. In Japan, 44% of the forest area is classified as planted forests, of mostly older age classes. The most commonly planted species are sugi (*Cryptomeria japonica*), hinoki (*Chamaecyparis obtusa*), pine and Japanese larch (*Larix kaempferi* or *L. leptolepis*) (Oka 2003). A significant proportion of the planted forest is mature or close to maturity and the proportion is expected to grow in the future. The age structure is still younger than that in some European countries. Trees were planted mainly for timber production in Japan as well, but recently more emphasis has been placed on the protective functions of planted forest. More than two-thirds of forest plantations in India are non-industrial forests. Fast growing hardwoods such as Acacia and Eucalyptus dominate in planted forests. Teak (*Tectona grandis*) is the most important industrial species, covering around 1 million ha. Pakistan and Bangladesh have emphasized fuelwood plantations. Acacia, Eucalyptus and *Dalbergia sissoo* have been planted in Pakistan, as well as in India. Planted forests in Bangladesh are mostly mangroves, with an additional 70 000 hectares of teak plantations for the industry (FAO 2003).

Planted forests in Malaysia extended over 736 000 ha by 2001, with an annual increment of about 40 000 ha (Enters et al. 2004). However, industrial roundwood supply from plantations in Malaysia is still insignificant compared to that from natural forests. The Cambodian Department of Forestry and Wildlife has established 8000 ha of planted forests; about 500 hectares are planted annually.

Increasing roundwood demand in Asia will, at least partly, be met by increasing roundwood production in planted forests. This can reduce pressure on natural forests. The role of planted forests as sustainable and environmentally sound sources of industrial raw material and renewable energy must be recognized in Asia. Their economic sustainability will depend on global competition.

Deforestation

In some Asian countries, like China, India and Vietnam, deforestation rates in 1990–2000 were lower than during the previous decade. However, deforestation is still a critical problem in other countries like Indonesia and Myanmar. Indonesian lowland tropical forests are mostly at risk. They have been almost entirely cleared in Sulawesi, and are predicted to disappear in Sumatra by 2005 and in Kalimantan by 2010 if current trends continue (FWI/GFW 2002). Forest fires have destroyed significant areas and have had serious environmental, social and economic consequences. For example, the environmental effects of the 1997 forest fires in Indonesia were global.

The main causes of deforestation in Asia are forest fires, unsustainable and illegal logging, inability to effectively monitor and regulate logging operations, inadequate reforestation and afforestation, high population pressure, uncontrolled human migration and settlement on forest lands and conversion of forests to agricultural land, and conflicts over property rights to forests and forest land. Nearly 10–20% of forestlands in the DPRK have been converted to other land uses or degraded in recent decades. The main causes of deforestation in the country are fuelwood production and conversion of forestland to crop lands for food production. The consumption of fuelwood more than doubled between 1990 and 1996 (UNEP 2003). Deforestation has contributed to floods, which have severely affected agricultural production.

Illegal logging is a major cause of deforestation in Asia. Indonesian log production, derived from log consumption by industries, is much higher than that officially reported by the Ministry of Forestry, indicating that a significant portion of logs consumed by industries is harvested illegally. The amount of illegal logs consumed by forest products industries is estimated to be from 8.9 million m^3 (1985) to 42.3 million m^3, excluding smuggled logs and logs consumed by small scale sawmills, or used as other industrial roundwood (FWI/GFW 2002).

Figure 1. Consumption of forest products in Asia (FAO 2005)

Forest Products Production and Consumption

From the early 1960s to late 1990s, growth in the production of forest products in Asia was substantially higher than the world average. Asia's share of the world's industrial roundwood production increased from 13% in 1961 to 18% in 1993, and after that declined to 14% in 2002. It peaked in 1989 at 269 million m^3 and declined to 223 million m^3 in 2002.

Consumption of wood-based panels, paper and paperboard has increased rapidly (Figure 1). Production and consumption of industrial roundwood and sawnwood decreased in the late 1990s, mainly due to resource depletion in Indonesia and insular Malaysia. The gap between sawnwood supply and demand has increased the use of wood substitutes, and the increasing scarcity of large diameter logs suitable for sawnwood has encouraged a shift towards using wood-based panels. Southeast Asian people have also changed their building preferences (FAO 1998).

Trends in International Trade of Asian Forest Products

Import and export of forest products to and from Asia have been increasing much faster than world averages. From 1961 to 2002, Asia was a net importer of industrial roundwood, fiberboard and sawnwood. Since 1990, Asia has also become a net importer of wood-based panels (Table 1).

Several Asian countries, such as China, Japan and the Republic of Korea, are traditional importers of forest products. Other countries, such as Indonesia and Malaysia, are traditional exporters. Japan is a net importer of forest products. The reason for this is that the local costs of production are higher than that of its main trading partners. Domestic production of pulpwood in Japan has been rapidly decreasing. In 2000, about 80% of the forest products consumed in Japan were imported either as roundwood, woodchips or processed commodities.

Ten years ago, China was the tenth largest importer of forest products. At present, it is the second largest, surpassed only by the United States. As a

Table 1. Net import of forest products in Asia (FAO 2005)

	Chips and Particles	Fibreboard	1000 cum Industrial Roundwood	Plywood	Sawnwood	1000 t Paper and Paperboard	Wood Pulp
1961	0	31	2 546	–453	114	524	433
1970	5 353	50	17 615	–2 177	1 739	1 267	1 395
1980	15 605	71	20 774	–2 354	3 508	3 051	3 520
1990	19 799	513	29 376	–3 404	7 611	4 851	5 586
2000	25 587	3 499	33 473	–565	16 597	8 642	9 834
2003	27 608	3 500	44 039	–2 714	17 085	10 316	11 483

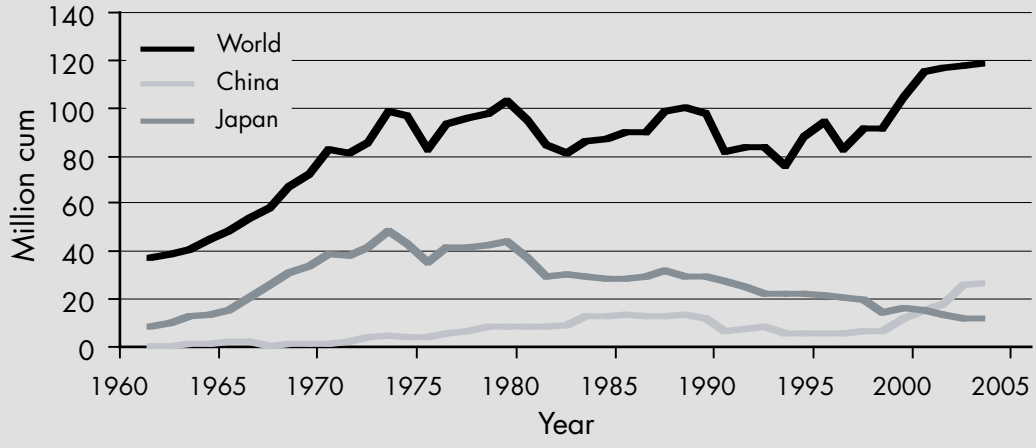

Figure 2. Industrial roundwood imports in China and Japan (FAO 2005)

result of this rapid growth, China has become the largest forest products importer in Asia, followed by Japan (Figure 2).

China provides new opportunities for exporters. Between 1993 and 2003, the value of Chinese forest product imports rose by 269%, from USD 3.78 billion to USD 13.95 billion. During the same period the value of exports rose to a lesser extent, from USD 3.76 billion to USD 11.97 billion. In 2003, China imported 26 million m^3 of roundwood, 7 million m^3 of sawnwood, 6 million m^3 of wood-based panels, 6 million tons of pulp, and 10 million tons of paper and paperboard. Chinese prefer to import raw materials for processing in China. However, while the net import of industrial roundwood rose by 529%, that of sawnwood increased by 4694%, particleboard by 642%, pulps by 808%, paper by 1223% and paper products by 144%. China's net export of furniture has increased by 1051%, and export of chips and particle boards by 2.56%. China's main trading partners in forest products are Russia (41.4%), Malaysia (10.9%), Indonesia (9.7%) and New Zealand (5.8%). (Sun et al. 2004).

Asia is leading in the world's NTFP markets. China dominates the world's NTFP trade, followed by India, Indonesia, Vietnam, Malaysia, the Philippines and Thailand. The most important traded NTFPs for China are bamboo shoots and herbs (EU-FAO 2002). In mid 2000, the Indonesian Ministry of Forestry reported that 30 million people in the country directly depended on the forestry sector for their livelihood. A particularly valuable non-timber product is rattan cane. Indonesia accounts for 80–90% of the global rattan supply (FAO 2001). According to the Indonesian Ministry of Forestry, the total export value of wildlife and plants for the 1999/2000 fiscal year was over USD 1.5 billion (FWI/GFW 2002).

Tariff and non-tariff trade barriers are the key issues that affect international trade in Asia and in the rest of the world. With GATT, WTO, APEC and ASEAN processes, tariffs have been steadily declining for the last two decades. After joining WTO in January 2002, China has reduced import tariffs on plywood from 15 to 10% and on veneer from 8 to 4%. Log and sawnwood imports have remained duty free (Sun et al. 2004).

In addition to tariff barriers, there is a wide range of non-tariff trade barriers ranging from technical and health standards to market price regulations. These measures are much more complex than tariffs and are

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Labor-intensive bamboo processing industry contributes to rural peoples incomes. In China the bamboo sector employs about 5.6 million people.

difficult to recognize and assess, especially quantitatively. They may also have a complex and ambiguous effect on different trading partners. Even when the trade barriers are not formal, they make international trade more difficult, especially for less experienced exporters from the developing countries.

Direct governmental control is one of the measures used to control international trade in forest products in Asia. For instance, the Government of Myanmar is directly engaged in timber harvesting and marketing. The Myanmar Timber Enterprise, a business arm of the Ministry of Forestry, is in charge of extraction and marketing of timber in the reserved forests. Private loggers can participate in special areas, such as forests under planned dam construction sites. They can also be hired as sub-contractors for harvesting in reserved forests. Timber export is considered important for earning foreign exchange, and is therefore under direct or indirect government control. In the case of teak the Myanmar Timber Enterprise is, in effect, the sole exporter from Myanmar, enjoying the lion's share of the market.

Forest products are not exempted from export tax, which may encourage domestic consumption. The distribution of timber among end users by the Myanmar Timber Enterprise is not based on market mechanism, e.g. distributing timber to the highest bidder. Consequently, the revenue from forest resources is not maximized (Youn 2003). An export ban on unprocessed timber is a policy option used by Malaysia in 1985 (Vincent 1990) and by Indonesia in 1980–1985 (Gillis 1988). Malaysia has later lifted the ban. The trade ban may have led to inefficiency; however, removal of the ban may stimulate illegal logging. Some authors argue that the trade ban may lead to inefficiency, higher deforestation and increasing unemployment (Gillis 1988; Repetto and Gillis 1989). Sedjo (1986) argues that export subsidies for processed forest products may result in increased deforestation.

Criteria and Indicators and Certification

Many Asian countries are involved in international initiatives for developing criteria and indicators for sustainable forest management. Eleven Asian member countries (including Cambodia, China, India, Indonesia, Japan, Malaysia, Myanmar, Nepal and the Philippines) are involved in ITTO's Criteria and Indicators initiative for the Measurement of Sustainable Management of Natural Tropical Forests. ITTO has pioneered the development of C&I since the early 1990s. After extensive review in 1998 ITTO published its revised C&I, covering both national and local level forest management (ITTO 1998). A manual on the application of ITTO's C&I was published in 1999. In 2004 ITTO adopted a revised set of C&I for the sustainable management of natural

tropical forest (ITTO 2004).

China, Japan and the Republic of Korea are involved in the Montreal Process on Criteria and Indicators for the Conservation and Sustainable Management of Temperate and Boreal Forests. Members of the Montreal Process meet on a regular basis and continue to refine and develop procedures for collecting and reporting data at the national level. Recent discussions have focused on possible components of C&I at the forest management unit level. The ASEAN Criteria and Indicators for Sustainable Forest Management were developed in line with the Montreal process. In 1999, ASEAN senior forestry officials recommended that member countries adopt standard C&I, based largely on the 1998 ITTO C&I. Representatives from 9 Asian countries (including Bangladesh, Bhutan, China, India, Myanmar, Mongolia, Sri Lanka, and Thailand) have recently launched an initiative to develop and implement C&I for the dry forests of Asia (Appanah et al. 2003). They identified 8 criteria and 49 indicators with particular relevance to the dry forests of the region. The new initiative includes several Asian countries that were not previously involved in the international C&I processes.

China has developed national and sub-national C&I systems, which are consistent with ITTO, the Montreal Process and the Regional Initiative for Dry Forests in Asia. The UNDP and FAO provide support for the effort through the "Capacity Building, Research and Extension for Sustainable Forest Management Project". Currently, these C&I are tested in three eco-zones in China. In July 2003, Japan announced the First Forest Report based on Montreal Process C&I, submitting data on 50 of 67 Montreal Process indicators. The principles of sustainable forest management recommended by the Montreal Process have been incorporated in the forest legislation the Republic of Korea (Youn 2005).

Certification schemes are market-based instruments to improve forest management. Forest managers in many Asian countries have been exploring options for certification through the FSC, the Program for the Endorsement of Forest Certification Schemes, ISO 14000, national standards authorities, etc. Malaysia's National Timber Certification Council and Indonesia's Ecolabelling Institute have taken steps towards certifying tropical forests using their own labels, supported by ITTO. In 2000, a Decree by the Indonesian Ministry of Forestry (No. 4795/Kpts-II/2002) launched C&I (4 criteria and 25 indicators) for Sustainable Natural Production Forest Management at the Management Unit. In Japan, an association for domestic forest certification, the Sustainable Green Ecosystem Council (SGEC), was established in 2003.

According to the FSC report, the total area and the number of certificates are still limited in Asia as compared to Europe and other continents. Less than 0.2% of plantations in Asia have been certified by FSC (Subak 2002). By April 2005, FSC had certified only 34 forests covering 834 375 ha of forestland in Asia. The certified forestland in China (439 630 ha), Japan (200 046 ha), Indonesia (90 240 ha) and Malaysia (77 242 ha) cover over 96% of the total area certified in Asia (FSC 2005).

Forest Resource Management and Property Rights

In many Asian countries, property rights over forest resources are often unclear, contested, overlapping, or not enforced. Much forestland in Asia is regarded as state land and is administered by governments. However, communities and households have started to play increasingly important roles in forest resources management in the last two decades (see Boxes 13.1 and 13.3 for joint forest management in India and community forestry in Nepal).

Security of land tenure seems to be lacking or vague in many countries, especially in countries in transition to a market economy. Forests traditionally have been occupied by forest communities as well as by migrant encroachers. Future forest development strategies must recognize and support the indigenous cultures and the rights of forest communities, including constructive involvement of recent encroachers. Identification of and consultation with the interest groups involved in a particular forest area should be prerequisites for developing forest management strategies.

Forests and Livelihood

About 450 million people in Asia depend on forests for their livelihood. More than 2 billion people consume three fourths of the total Asian wood harvest as fuel. Forestry and forest related industries are also important sources of employment. According to FAOSTAT, the consumption of fuelwood in Asia has increased from 665 million m^3 in 1961 to 811 million m^3 in 1997, but decreased to 789 million m^3 in 2003. In countries like Indonesia, the Philippines and Thailand, fuelwood production is expected to decrease.

While the poor in most developing countries still depend on fuelwood for their daily subsistence, the share of fuelwood in total energy supply will decline from 70% in 1980 to 55% in 2010 because of increasing supply of other energy forms (Arnold et al. 2003). Fuelwood consumption peaked in the 1990s. In India, trees surrounding villages have been cut by local people for their own fuel consumption and for sale; this has resulted in forest degradation (Pandey 2002).

Forests have an important role to play in the livelihood of the rural poor. In many rural communities in Laos for example, virtually all food except rice is derived from forests. The total value of NTFPs

BOX 13.1 Joint Forest Management in India

Can Liu

The Indian National Forest Policy of 1988 envisages people's involvement in the development and protection of degraded forests. These forests are seen as a permanent resource base to fulfill local communities' requirements for fuelwood, fodder and small timber. Forest development will also improve the environment. In order to implement the policy, the Indian Government issued guidelines in June 1990 to involve village communities in the development and protection of degraded forests. Communities were entitled to a share of usufruct from these areas. The developed mechanisms formed the concept of Joint Forest Management (JFM).

So far, 27 States have issued a resolution for JFM. By December 1 2002, 14.26 million ha of forest land in the country were managed and protected by close to 64 000 Committees. The activities under JFM programs are monitored by the JFM Cell of the Indian Government. The Ministry reviewed the program after wide consultation with all stakeholders and issued further guidelines to States for strengthening the program. The guidelines, inter-alia, include providing legal backup to the JFM Committees; extending JFM to good forest areas with sharper focus on activities concentrating on NTFP management; increasing women's participation; establishing conflict resolution mechanisms; integrating micro plans with the working plans; and contributing to regeneration of resources and to monitoring and evaluation. In order to monitor the program properly, a format for monitoring of the JFM has been prepared and circulated to all the States. JFM Nodal officers have been appointed in all States for better coordination of the JFM work.

A Committee was constituted by the Indian Government for preparing a JFM Scheme for the 10th Five-Year Plan, in order to ensure long-term success. The scheme will be implemented through Forest Development Agencies (FDAs). A JFM network is also operational under the Chairmanship of the Director General of Forests and the Special Secretary, Ministry of Environment and Forests. A stakeholder forum has been set up to include all stakeholders and to provide a channel for information exchange with the network; the forum is run by NGOs. Almost all States, which have different relevant legislation, have started to implement the JFM policy. The essence in all cases is a partnership between local users and the State Forest Department, in which both management responsibilities and benefits are shared.

a rural Lao family consumes annually is roughly USD 280, which is about 40% of the average family income (ADB 2003). Before any major forest policy is implemented, studies should be done on the impact of forest policy on livelihoods of the poor who depend on fuelwood for cooking and heating, NTFPs for foods and medicines, grasses and fodder for livestock, and wood for house building, tool making, fencing, and so on.

In the Republic of Korea the production of NTFPs is more important than timber production in providing income to rural villagers and forest owners. One of the important NTFPs is oak mushroom, or Shiitake (see Box 13.2).

13.3 Paradigm Shifts and Future Development

During the past two decades, Asian forestry experienced several major paradigm shifts in sustainable forest management, governance, livelihoods, environmental services and planted forests.

From Planned to Market-Oriented Economy

During the last twenty years China, Mongolia, Vietnam, and several other countries have started an historic shift from planned economy to market oriented economy. Shortcomings of the centrally planned economies include investment inefficiencies, distorted patterns of production and consumption, and huge deficits. Optimal combination of regulatory administrative tools and competitive markets was always an appealing alternative for the Asian developing economies. Market-based instruments have also started to play increasingly important roles in forest resource management.

Economic reform in forestry consists of a multidimensional array of changes intended to improve economic performance. Prices and markets are the central factors in the reform. Policy and legislation serve to define the scope and role of governments in the rapidly changing social systems of once centrally planned countries. Forestry does not function independently of the larger national economy, but has close links with other sectors. Public institutions need to pay attention to each other under market reform. There is a clear shift from methods of command and control to market-based incentives. Transparency and greater participation of civil society are objectives in the forestry decisions across Asia.

From Centralization to Decentralization in Forest Management

The last two decades have witnessed an important paradigm shift in forest resource management in Asia, from costly and often inefficient state control towards systems in which local people play a much more active role. These reforms increase participation of principal stakeholders in the decision making around forest management and benefits by granting essential rights to local authorities and reconstituting relations between the central government and forest communities.

Under the former colonial regimes in many Asian countries, forests were often declared public lands in order to generate revenues for the state. Postcolonial

BOX 13.2 MUSHROOM PRODUCTION IN JAPAN AND THE REPUBLIC OF KOREA

THE STATUS AND PROSPECTS OF MUSHROOM PRODUCTION IN JAPAN

Mitsuro Ishihara and Hiroyasu Oka

The value of mushroom production in Japan was USD 1.85 billion in 2002; it accounted for 41% of the annual forestry output (Forestry Agency 2004). As the importance of forestry and forest product industries continue to decline due to high costs of harvesting and processing, mushroom production has a significant role in the forestry economy. Utilization of woody materials, such as logs and sawdust, for mushroom substrates is also important for wood consumption, contributing to the rural economy by adding value while maintaining a managed semi-natural forest ecosystem.

Table A shows the quantitative changes in the production of the major cultivated mushrooms in Japan. Shii-take (*Lentinula edodes* [Berk.] Pegler) is the most important cultivated mushroom with a long history. "Shii" means chinquapin tree (*Castanopsis* sp.) and "take" means mushroom. Shii-take cultivation in Japan can be traced back to as far as Genbeh's hatchet cuts in the 17th century (Furukawa 1992). Freshly cut hardwood logs, such as oak, chestnut, chinquapin and hornbeam, were placed in the forest in wait for inoculation with windblown spores and consequent mushroom production. Cutting the bark of bed logs was found to give shii-take spores easier entrance into the wood and to increase the spreading rate of the fungus. Later, the mushroom production method was much improved by inoculating the logs with mushroom spawn (Kitajima 1937; Mori 1946).

Shii-take mushrooms that are dried before marketing are still primarily cultivated on bed logs. Dried shii-take was formerly one of Japan's main agricultural exports, with 4087 tons exported in 1985. In the 1990s spawned substrates in plastic-bags, consisting of a mixture of sawdust and nutritional supplements such as rice bran, wheat bran, corn fiber and corn cob, became the major culture medium for fresh shii-take, replacing the bed logs. The introduction of air-conditioning allowed year-round cultivation. Shii-take, the second most popular cultivated mushroom in the world, surpassed only by *Agaricus bisporus* (Lange) Imbach, has always been highly prized in Japan and China. Its commercial cultivation has now spread to other East Asian countries, Europe, America, Australia and New Zealand.

The production of other important cultivated mushrooms, such as nameko (*Pholiota nameko* [T. Ito] S. Ito et Imai in Imai), enoki-take (*Flammulina velutipes* [Curt.:Fr.] Sing.), hira-take (*Pleurotus ostreatus* [Jacq.ex Fr.] Kummer), *Pleurotus eryngii* (DC:ex Fr.) Quél., buna-shimeji (*Hypsizygus marmoreus* [Peck] Bigelow) and mai-take (*Grifola frondosa* [Dicks.:Fr.] S.F. Gray) has expanded by using plastic-bottle or -bag culture techniques in air-conditioned facilities. With the exception of hira-take, which is globally distributed in temperate and subtropical forests, these mushrooms are grown primarily in East Asian countries. Buna-shimeji and mai-take, in particular, are grown primarily in Japan. Enoki-take has been the most produced mushroom in Japan since 1990. The fruit body of commercially produced enoki-take is greatly different in color and shape from the wild enoki-take. The production of mushrooms, such as buna-shimeji, mai-take and *P. eryngii*, has increased steadily since their cultivation technology was established two decades ago. The popularity of these mushrooms is providing competition for hira-take, because they can be stored for a long time and can be used in various kinds of cooking. *P. eryngii* was first introduced from Taiwan in 1993.

Until recently, Japan's mushroom cultivation was essentially a cottage industry in the mountainous regions. Now, the mushroom industry faces a serious problem of excessive supply due to the entry of new enterprises into the market and, especially, the increase in imported dried and fresh shii-take. The resulting depression of market prices threatens the management of mushroom farms. To maintain mushroom production levels and to revitalize the economy of forested rural communities through mushroom cultivation, some strategic measures, such as formation of community-based producer-consumer networks, are needed. Customers who want good quality mushrooms will be more satisfied with local producers' products than with mass produced mushrooms from large enterprises or with low priced products from overseas.

Mushrooms are a good source of dietary fiber and chemical compounds with medicinal properties. The potential of mushroom components to lower blood pressure and decrease blood cholesterol, and to act as anti-tumor agents, is being explored. Shii-take, for instance, contains "eritadenine" (Kamiya et al. 1969), a natural chemical compound shown to lower blood cholesterol levels, and "lentinan" (Chihara 1995), a beta-glucan used as an anti-tumor drug that improves immune function for cancer patients in immuno-suppressed conditions. Eating mushrooms can contribute to a healthy lifestyle and therefore reduce medical costs. Because the content of the physiologically active compounds varies among mushroom species and strains, screening and breeding of mushrooms with respect to various functional components for health is very important. The development of cultivation technology for these medicinal species and strains holds promise to enhance the prosperity of mushroom industry.

We wish to thank Professor Jody Jellison and Dr. Andrea Ostrofsky, University of Maine, U.S.A., for reviewing the part on mushroom production in Japan.

Table A. Production of major cultivated mushrooms (tons) (Forestry Agency 2004)

Mushroom	1990	1995	2000	2001	2002	2003
Lentinula edodes (dried)	11 238	8 070	5 236	4 964	4 449	4 108
Lentinula edodes (fresh)	79 134	74 495	67 224	66 128	64 442	65 384
Pholiota nameko	22 083	22 858	24 492	23 775	24 818	25 069
Flammulina velutipes	92 255	105 752	109 510	108 444	110 444	110 244
Pleurotus ostreatus	33 475	17 166	8 546	6 796	5 800	5 219
Pleurotus eryngii	0	0	6 734	10 084	19 472	29 942
Hypsizygus marmoreus	29 957	59 760	82 414	86 550	83 790	84 394
Grifola frondosa	7 712	22 575	38 898	44 042	46 843	45 823
Total mushrooms	275 854	310 676	343 054	350 783	360 058	370 183

Production and Consumption of Mushrooms in Korea

Yeo-Chang Youn

Traditionally mountain villagers use forest products such as mushrooms as daily food sources. Forest-based mushrooms are presently a favorite food among Korean city-dwellers. About 350 kinds of edible mushrooms grow in Korea's mountain forests, among which pine mushroom (Matsutake; *Tricholoma matsutake*) and oak mushroom (Shiitake; *Lentinula edodes*) are the most popular. Pine mushrooms grow only in natural pure stands of red pine (*Pinus densiflora*), while oak mushrooms can be cultivated on small bed logs of hardwood species such as oak.

The demand for mountain mushrooms will continue to increase, as the consumption of forest mushrooms is strongly correlated with the level of household income in Korea. The consumption of pine mushrooms, by contrast, is mostly limited to the small, high-income population as the price is very high. As the mushroom markets in South Korea are open to foreign producers abiding by the free trade agreement coordinated by the World Trade Organization, the prospect for Korea's forest-based mushroom production is uncertain (Son and Youn 1994; Park and Youn 1998).

The production of forest mushrooms is important to the livelihood of forest-dependent people, especially in the case of pine mushrooms. The level of pine mushroom harvest is very sensitive to the weather, especially rainfall in the late summer and the resulting condition of the pine stands. The harvest of pine mushrooms in Korea has fluctuated over time, as demonstrated in Table B. The production of pine mushrooms is threatened by the decline of natural pine stands, due to attacks of pine gall midges and nematode. The expansion of hardwoods such as oak species in the southern part of Korea replacing the dominant species, i.e. Japanese red pine, favors production of oak mushrooms over pine mushrooms in Korea (Koo and Bilek 1998).

The production and consumption of oak mushroom in Korea has been increasing, while market conditions are rapidly changing due to the introduction of the WTO system (see Table B). Predictions suggest that demand for oak bed-logs will increase substantially as domestic consumers' incomes increase (Park and Youn 1998). Forest vegetation management is necessary for enhancing the pine mushroom cultivation environment, and thereby sustainable mushroom production. With regard to oak mushrooms, oak stand improvement should be given high priority to ensure a sustainable supply of bed logs. Korean forest owners thus face a situation that requires evaluating trade-offs between pine mushroom and oak mushroom cultivation. (Youn 2004)

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Table B. Production, consumption and trade of pine and oak mushrooms
(Korea Forest Service 1970, 1980, 1990, 2000, 2001, 2002, 2003)

Year	1970	1980	1990	2000	2001	2002	2003
PINE MUSHROOMS							
Production (ton)	191	349	945	536	250	373	306
Export (ton)	94	316	835	402	196	233	158
Import (ton)	0	0	1.3	197	228	209	300
Consumption (ton)	97	33	111.3	331	282	349	448
Per capita consumption (g)	3.1	0,9	2.6	7.2	6.0	7.3	9.4
OAK MUSHROOMS							
Production (ton)	187	1027	1648	4722	4815	5247	5261
Export (ton)	180	696	1001	228	261	291	374
Import (ton)	0	0	333	1088	821	1234	1926
Consumption (ton)	7	331	980	5582	5375	6190	6819
Per capita consumption (g)	0.2	8.7	22.6	121.4	113.5	143.2	142.5

BOX 13.3 Experiences from Community Forestry in Nepal

Pia Katila

In the 1970s, the failure of the Nepalese government to protect nationalized forest resources and to control forest encroachment and clearance led to paradigm changes in forest policy in favor of local level resource management based on community forestry. Since 1990, community forestry has been based on the formation of forest user groups (FUGs). The Forest Act (HMG 1993) and Regulations (HMG 1995) provided a clear framework for the implementation of community forest policy. It meant a total and still ongoing reorientation of the Forest Department (FD) personnel, changing their role from forest protection and policing to providing support to community forestry.

More than one million hectares have been handed over to some 12 800 FUGs, representing around 1.4 million households (Royal Danish Embassy 2002). This represents about 17% of the total forest and other wooded land area of Nepal. Most of the established FUGs are in the Middle Hills. In the Terai-region, only 1477 FUGs have been established to manage 224 136 ha (DoF 2003 cited in Springate-Baginski et al. 2003). The main reasons for slow progress in the Terai are related to high ethnic diversity, high number of forest users, recent settlement, mobility of the population, strong pressure to convert forest to agricultural land, high value forest resources, and proximity of Indian markets.

The authority to hand over national forest land for community management has been devolved to District Forest Officers (DFOs). In the first phase of the FUG formation process, the local forest users and the forest area that they have traditionally been using are identified. DFOs should also support FUGs in drawing up a constitution and an operational plan. The constitution specifies the membership of the group and the establishment of the user group committee that monitors community forest management. It also defines the rules concerning community forest and benefit sharing, as well as sanctions against breaking the rules. After being registered by DOF, FUGs are recognized as legal, autonomous, corporate bodies which may acquire, use, sell or otherwise transfer community forest products, but they cannot sell or otherwise alienate forest land.

In practice, the forest hand-over has been oriented to fulfill quantitative targets, and serious short cuts have occurred in the process. Also, the needs for post-formation support have not been adequately addressed (Springate-Baginski et al. 2002). In many FUGs, a poor hand-over process has led to unclear borders and boundary conflicts, hampering the development of community forestry activities. Boundary conflicts are also partly caused by out of date or non-existent cadastral maps (Yadav et al. 2003).

Effects on Sustainability and Livelihoods

Most of the forests handed over to FUGs have been degraded forest or planted forest established by the government. Under community management the general trend of forest degradation has been reversed in the hills, and the forests have regenerated significantly (Yadav et al. 2003).

FUGs have concentrated on the protection and improvement of community forests and on allowing regulated subsistence use of forest products. User group members are usually allowed to collect leaf litter, fallen twigs and branches and grass free of charge, but the amount of produce or the collection time have been restricted. Timber and poles are usually distributed through auctions or tender. In general, the regeneration of the forest resource has led to greater forest product flows and has opened possibilities for commercial utilization of forest products. However, sometimes restrictions on forest product extraction and the principle of distributing subsistence products equally among the FUG members have imposed difficulties on poorer households, which depend on community forests for their fodder, firewood and other needs. As well, the practice of auctioning timber discriminates against poorer households for whom the price is often too high. Some FUGs have tried to incorporate the needs of the poorest households and have, for example, allowed them a larger quota of fuelwood (Springate-Baginski and Blaikie 2003).

Some FUGs are moving towards more production oriented forest management. The majority of FUGs, however, are not utilizing their forests to the full potential. The current regulations strongly restrict FUGs' possibilities to actively manage community forests and benefit from commercial timber production. There is a general lack of consensus among policy makers and FD staff on commercial utilization of community forests, which has led to unclear directions and even contradictory orders to DFOs (Springate-Baginski and Blaikie 2003; Yadav et al. 2003). Funds generated through community forestry activities (through collection fees and, in some cases, sales of NTFPs or timber) have been used for forest development and community development activities, such as improving schools and roads or establishing credit facilities.

FUG activities have not been taxed; however, a new policy initiative (Forest Bill 2001) introduces a 40% tax on incomes from sales outside the user group in the Terai, Chure and Inner Terai regions. The Bill also states that valuable forest resources in these regions will stay under government control, and only degraded areas and patches of forests may be handed over as community forests.

While the community forestry concept entails democratic and participatory decision making, the decision making in FUGs has often been dominated by the elite and wealthier members of the community. This is largely due to the prevailing traditional social relationships, which have also been transmitted to the user groups. The poorer households, women, and low caste members have traditionally had very little say in the Nepalese society. More inclusive decision making, emphasizing participation of all members of the user group, as well as equity and gender issues, are now emphasized in donor funded projects and in training of DFO staff (Spingate-Baginski et al. 2002, 2003).

The Way Forward

Community forestry can provide a path to sustainable resource utilization and protection. It has also shown possibilities and potential in enhancing forest dependent peoples' livelihoods. Currently, it does not specifically address livelihood and poverty issues. To harness its potential requires developing community forestry to be more inclusive and participatory and to pay special attention to the needs of the poorest households. This can only be realized through continuous capacity building in all aspects of community forestry within the FD and communities.

Government policy should provide long-term, continuous support and security to FUGs. It should encourage FUGs to move towards production oriented forest management and to utilize community forests to their full potential in a sustainable fashion, as well as support commercial utilization and marketing of forest products. The benefits from the degenerating forest resource, and especially the establishment of FUGs in the Terai with high value forests, have brought up the issue of benefit sharing between FUGs and the government. An equitable solution needs to be found, which encourages FUGs to move towards sustainable forest management but also creates revenues for the government.

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BOX 13.4 DECENTRALIZATION IN WEST KUTAI DISTRICT, EAST KALIMANTAN

Tetsuya Saito, Makoto Inoue and Yasuhiro Yokota

In Indonesia, a decentralization process started after the enactment of the Forestry Law (No.41/1999) and the regional autonomy laws (Law No.22/1999 on Regional Governance and Law No.25/1999 on Fiscal Balance between the Central Government and the Regions). However, as it stands, the decentralization process is in chaos, due to lack of clear policy direction or central government consultation with the regions.

Before decentralization, forest management in Indonesia was based on a top-down approach, which allowed the government and timber concessionaires to exploit rich rainforest resources without considering the local people who lived in and managed the rainforest according to their customary practices. NGOs could only support these people in their campaigns against exploitation by the government and the timber concessionaries.

After decentralization, stakeholder roles changed significantly. More power over planning, implementation, budgeting and taxation was vested in the district government. In West Kutai District, for example, the decentralization process has so far gone relatively well because of stakeholder coordination. Coordination has been accomplished through the efforts of foreign donors, who helped to form multi-stakeholder working groups for forest management in 2000 and the Bupati (regent) and his staff who achieved good relationships with stakeholders. Local NGOs, timber concessionaries, research institutes and local peoples' associations collaborated with the government to formulate a forest management system. Consensus building through multi-stakeholder working groups resulted in the creation of a regional forest management plan in 2002, in new regional regulation on forestry in 2002, and in new regional regulation on community forestry in 2003. The working group aims to monitor the actual implementation of planned activities by the government. Management of the working group was transferred in 2002 to the local government, which has promoted a sense of ownership of the process.

Meanwhile, even in West Kutai District, relationships among the government authorities at different levels (central, province and district) are not yet harmonized and their areas of authority are not clearly defined. The case in West Kutai District suggests that decentralization and stakeholder empowerment are needed to ensure that forest management will be based on stakeholder consensus.

governments often continued to refer to the people living on public lands as "squatters". Authorities also often accused them of "illegal land use" even when indigenous rights were indisputable. Government forest departments tend to be highly centralized top-down structures focused more on timber production or forest conservation than on forest related needs of local villagers.

Since the 1970s, widely growing concerns regarding deforestation and increasing pressure for forest conservation have prompted governments to set aside large areas of forest as protected reserves and to focus additional attention on policies that have excluded local people from decision making.

Shifts in ownership and management rights from state to communities began in Latin America in the late 1970s. The shift gained momentum in Africa in the late 1990s, and more recently has spread to Asia (White and Martin 2002). Some Asian countries have developed forest concession systems for the management and particularly for the harvesting of state-owned natural forests (e.g. Cambodia, Indonesia, India, Nepal, Malaysia and Mongolia). Forest harvesting in Malaysia and Indonesia is regulated and controlled, in principle, by a well-defined concession system. The Indonesian system has undergone several modifications in recent years: a production Forest Management Unit system is being tested in Central Kalimantan and Jambi, and the Indonesian government issued a new policy that limited concession areas to a maximum of 4 million hectares (see Box 13.5).

Asian countries continuously adjust their institutions to further promote decentralization. The Philippines Supreme Court has recently upheld the constitutionality of the Indigenous Peoples Rights Act of 1997, providing legal recognition of ancestral rights pursuant to indigenous concepts of ownership. The case may affect 20% of the total national land area, including well over one third of the previously

BOX 13.5 Paradigm Shifts in Indonesian Forestry

Daniel Murdiyarso, Bintang Simangunsong and Hariadi Kartodihardjo

The history of forest resources utilization in Indonesia can be grouped in four periods. The 1970s is considered a forest extraction period, when logs from natural forests were simply extracted and exported as raw materials. The 1980s was the period when large-scale forest concession and management were introduced, followed by the forest industry period in the 1990s. The beginning of 2000 was marked by decentralization of authority to the district government.

The country's forestry sector has faced tremendous challenges since the late 1990s, when various adjustments and regulatory instruments were introduced. The intervention of the International Monetary Fund (IMF) in financial, taxation, and investment policies in the forestry sector led to the issuance of the Letter of Intent, which covers broader policies concerning good governance and the appropriate use of the Reforestation Fund. The World Bank policy on structural adjustment promoted forest policy changes towards reformist elements, away from vested interests and towards more sustainable forest management practices.

These policies have sparked a number of policy formulations and regulatory instruments in a relatively short period. In the midst of frequent change of government personnel, priority setting turned out to be uncertain. The general public was not sufficiently involved in the development of policy instruments, resulting in their ineffective implementation.

It was expected that the decentralization of authority would enhance local participation in decision-making processes, the administrative burden of the local authorities would be lessened, and they would have more opportunity to concentrate on strategic issues and capacity building. However, the unprecedented pressure did not allow local governments the opportunity to strengthen themselves; this resulted in further depletion of natural resources, including forests, on a massive scale. In addition to the technical issues related to capacity building, decentralization of forest governance is facing tremendous challenges related to many politico-economic and socio-cultural issues.

Fundamental long-term strategies are needed to re-orient the forest sector towards good forest governance, to consider society's welfare and to maintain environmental services. Forest resources should no longer be treated strictly as commercial goods. Some fundamental changes could include harmonization of central and local regulatory frameworks to support sustainable forest management, restructuring of the forest industry, erradication of illegal logging, and reduction of forest and wildland fires.

BOX 13.6 Six Forest Programs in China

Can Liu

Since 1998, the Chinese Government has initiated trans-regional shelterbelt development programs in the ecologically fragile regions. These programs aim to establish an ecological shield, improving regional ecosystem, ensuring national ecological security, enhancing sustainable forest management and contributing to local socio-economic development, production and people's livelihoods. At the turn of the century the Government made a strategic realignment of the former projects and integrated them into six key forestry programs, including (1) Natural Forest Protection Program, (2) Program for Conversion of Cropland to Forests, (3) Key Shelterbelt Development Programs for such regions as the Three North (i.e. Northwest, North and Northeast) and the Yangtze River Catchments, (4) Sand Control Program for Areas in the Vicinity of Beijing and Tianjin, (5) Wildlife Conservation and Nature Reserve Development Program, and (6) Forest Industrial Base Development Program in Key Regions with the Focus on Fast-growing and High-yield Timber Plantations. Implementation of the six key forestry programs would facilitate refocusing from timber production to ecological improvement (Liu 2002). The launching of the six forestry programs marked the advent of a new era in China's forestry development. The Chinese government's policy has shifted in recent years from encouraging maximum timber harvest to promoting protection of existing natural forests and restoration of heavily degraded ecosystems. The overall national goal is to increase the country's forest cover to 26%. China's mid-and long-term objectives are to maintain ecological stability and site productivity of planted forests and develop planting techniques for afforestation of wastelands, deserted industrial sites and decertified land in arid and semi-arid areas.

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publicly owned forests (CIEL 2001).

Decentralization and community forestry management models have been widely adopted in Asian countries, but government agencies still control the allocation and use of forest resources by means of different administrative and economic instruments. India, Nepal and Indonesia (see Boxes 13.1, 13.3 and 13.4) have granted limited rights to local communities to manage and benefit from forests, which are still officially considered in the public domain. These arrangements are known as "joint management" and "co-management", and do not alter state ownership. In India, government officers control planning, and supervise budgets and marketing of timber and valuable NTFPs and local communities' decision-making. In the Philippines, a single case of illegal forest use by a local user led to a temporary ban on all forest uses under the community-based forest management program, thereby also punishing responsible users and casting doubt on the government's commitments and intentions.

Management Strategies: Emphasis on Environmental Conservation

Asian countries are in the process of adjusting their forest management strategies from timber production to ecosystem management (see the Indonesian example in Box 13.5). Several Asian countries have imposed total or partial logging bans (or imposed restrictions on timber harvesting) in response to the rapid decline of natural forests. Ecological forest programs have been launched across Asia, such as the recently consolidated six forest programs in China (Box 13.6). These actions are mostly taken in response to natural disasters and are seen as a strategy to protect and conserve forests.

In recent years, forestry in the Republic of Korea has experienced a rapid change, a paradigm shift to emphasize sustainability of forest resources based on ecosystem management. The forest laws have been amended according to sustainable forestry principles, while the policy environment has favored decentralization and public participation in forest issues. This phenomenon has been supported by democratization and economic growth for the last few decades (Youn 2005).

Vast areas in central, northern and northeastern Asian regions are threatened by desertification. Wind and water erosion, waterlogging, salinity, flooding, loss of organic matter and biodiversity have been identified as the major contributors to desertification. Since the 1990s, the United Nations Convention to Combat Desertification has provided a useful institutional umbrella for a number of Asian initiatives in fighting land degradation. Since the late 1990s, the intensification of sandy dust storms in the Northeast Asian region has prompted the governments of Mongolia, China, the Republic of Korea and Japan to undertake closer cooperation in addressing this transboundary environmental problem. A number of international organizations, including the Asian Development Bank, have been involved in a variety of initiatives and activities to help Asian countries implement national action programs. Two trends are evident; namely, regional cooperation as in the case of dust storm mitigation in Northeast Asia, and capacity building for the establishment of early warning systems and for effective implementation of projects at the community level. In recent years, some international funding agencies such as the Global Environment Facility have intensified their efforts to incorporate forestry programs into comprehensive funding packages, for ecological rehabilitation and environmental protection.

Forest ecosystems produce wood, and a great variety of other products and services. Removing forests through clear-cutting destroys the great productive power of the forest, and the forest needs a long time to recover. Conventional industrial forest harvesting methods reduce ecological diversity of the forest, and can have social ramifications like depopulation in forest-based communities and reduction of their economic and cultural diversity. Ecosystem management is based on the recognition that sustainable communities depend on sustainable forest ecosystems. Ecological forestry should maintain and upgrade diversity in many respects – biological, social and cultural.

Biodiversity conservation and conservation area management have been emphasized in Asia. At least 28 natural World Heritage Sites containing forests had been established in 11 Asian countries by 2002, including 10 sites in China, 5 in India, 3 in Indonesia, 2 in Nepal, and 2 in Malaysia (McNeely 2002). The Convention on Wetlands of International Importance promotes conservation and wise use of wetlands through national action and international cooperation. Ramsar sites in Asia contain important forest ecosystems, such as mangroves, including Sundarbans in Bangladesh and the Olango Wildlife Sanctuary in the Philippines. Establishing natural World Heritage Sites has promoted natural forest protection all over Asia.

Payment for Environmental Services

In most Asian countries, the importance of the environmental services of forests is increasing as population increases. As the demand for these services grows, the market as well as government intervention for promoting forest environmental services may emerge in many parts of Asia. A new set of forest environmental services is entering Asian markets and changing the value and management paradigm of forest resources. Payments for environmental services can be divided into two categories, governmental

Table 2. Potential roundwood production from planted forests in Asia from 2010 to 2050 under different scenarios (1000 m³) (Brown 2000)

Scenarios	Industrial roundwood			Fuelwood		
	2010	2020	2050	2010	2020	2050
No growth	190 607	217 796	209 312	119 634	118 284	130 524
Medium growth	195 907	237 584	299 349	125 441	136 178	186 450
High growth	240 364	379 617	686 812	160 135	234 712	389 814

payments and market-based payments. There are a growing number of cases in which environmental services have created income.

Market-based payment is a transaction between supplier and buyer. Price is set through market negotiation. Payments for maintaining watersheds and water quality have created several local markets. There is a good potential for carbon markets as well. Asian countries are also involved in studies on trade models for carbon sequestration and biodiversity conservation.

A recent initiative of the Chinese Government to promote payments for environmental services was incorporated into the newly amended Forest Law (1998). The new policy was accompanied by the release of "Operational Measures on Compensation for Forest Ecological Benefits" (2001). According to the new measures, all public or private entities that benefit from forest maintenance and ecological functions are required to pay for the services, and the funds raised should be earmarked for forest environmental investments. Proceeds will be channeled through "Forest Environmental Benefit Compensation Funds". Seed funding of about USD 1.8 million was provided in 2001 to initiate the establishment of the central Fund. The Fund was increased to USD 241 million in 2003. After the "Farmland Conversion to Forests Program" was launched in 2000, the State Council issued the Decision on Converting Land to Forests and Pastures, which stipulates that the government will pay landholders to convert their degraded lands into forests or pastures. Cash and in-kind payments include 2250 kg of grain/ha in the upper reaches of the Yangtze River, 1500 kg grain/ha in the middle and upper reaches of the Yellow River, and USD 2.41 (20 yuan RMB)/year/ha. The scheme is valid for 8 years.

Planted Forests for Timber Supply

There is a tremendous shift in timber production from natural forests to forest plantations. Asian roundwood production from planted forest needs to be increased to meet, at least partly, the increase in roundwood demand. Three scenarios of potential roundwood production from forest plantations in Asia from 2010 to 2050 are presented in Table 2: no growth, medium growth, and high growth.

During the past 40 years, wood production has shifted from natural forests of the traditional Southeast Asian producing countries to Southern plantation countries. Large tracts of natural forests are likely to confer an advantage in the shorterm, but these advantages will eventually diminish owing to advantages that are offered by plantations. During the 1990s, the fast-growing plantations of the southern plantation countries began capturing the market share from Indonesia and Malaysia (Enters et al. 2004).

Some Asian countries provide incentives to encourage timber plantation establishment. The Philippine authorities provide free government technical assistance, and tax exemptions for plantation products. Forest plantation establishment is considered a pioneering industry, and it enjoys a variety of incentives: income tax holidays; tax and duty free importation of capital equipment; tax credit on domestic capital; deduction for labor expenses after the tax holiday; exemption from wharf and export duties; and exemption from contractor's tax (ITTO 2003). The government of China approved similar policies, such as income tax holiday and long-term loans, to engage different stakeholders in plantation business.

Increasing Demand of Wood Substitutes

Long-term projections show that Asian demand for forest products will rapidly increase with the continent's population and economic growth. In the foreseeable future, the most important factor affecting forest resources use in Asia will be China's growing demand for timber and timber imports. Asia has become a major net importer of wood products, while tropical plywood has become less important as a commodity. International trade, aggressive planting, and use of wooden and vegetable fiber substitutes for wood, as well as recycling, will be the major vehicles to satisfy wood hunger in Asia. Wood products will be increasingly recycled as recycled paper, fiberboard and particleboard may be partly replaced by non-wood substitutes, as well as by previously less utilized species like rubber, coconut and bamboo.

About three quarters of the world's bamboo forest is in Asia. India has over 9 million ha and China over 7 million ha of bamboo forest (see box 13.7). China's bamboo forests include 4 million ha of monospecies. Bamboo is a fast growing and environmentally friendly material. Due to impressive technological breakthroughs in the last 10–15 years, bamboo has become a valuable wood substitute. Bamboo can replace wood in its long list of uses, including housing, construction, flooring, roofing, panels, boards, furniture, paper, charcoal and composites. More recently, bamboo is being mixed with resin, glue and other fibers to produce high-tech products for very demanding European, North American and Asian markets. China has a long history of bamboo cultivation, research and development, and is hosting the International Network for Bamboo and Rattan (INBAR), which is the world's leading organization concerning bamboo and rattan. The paradigm shift towards bamboo and other non-wood substitutes for timber has emerged in Asia, and is now spreading to several other continents.

The growing demand for wood products may raise prices in Asia. Higher prices will somewhat discourage the growth of consumption and make in-

BOX 13.7 Bamboo in China: Increasing Income and Environmental Protection

Lou Yiping

At present, the total bamboo growing areas of the world add up to 22 million hectares (Jiang 2002). China has 39 genera of bamboo, with approximately 500 species distributed in 20 provinces and occupying 3% of the total forest area. (Fu et al. 2000). Throughout the world, especially in tropical and subtropical regions, forest area has been reducing dramatically due to heavy exploitation by human beings. In contrast, in some Asian countries the area of bamboo stands is rising continuously. In China, the increase of pure bamboo stands has averaged 2.45% per year over the last three decades (Fu et al. 2000).

Bamboo plays an influential role in the rural economy of China. There are millions of Chinese farmers who grow bamboo as a component of integrated farming systems. Bamboo forests and sectors in China also provide huge ecological and social benefits to the country.

Ecological Benefits of Bamboo

The fast growing and evergreen bamboo, with its vigorous propagation and regeneration capacity, well-developed root and rhizome system and selective harvesting schedule is ideal for conservation of water and soil, prevention and rehabilitation of degraded lands, biomass accumulation, and carbon sequestration. Bamboo growing in forests is also extremely important to the survival of other plant and animal species. There are many endangered wild animals, such as the giant panda, that depend on bamboo for food and habitat. Bamboo gardens are important components of Chinese public parks and tourist attractions. Indirectly, the use of processed bamboo products to substitute for timber products leads to reduced timber harvesting in forests, and subsequently lowers deforestation rates.

Socio-Economic Benefits

Bamboo is used widely in construction, transportation, furniture making, paper and pulp production, and handicrafts because of its rapid growth, easy availability, flexibility of uses and economic value. The bamboo processing industry in China has recently become very dynamic, and as a labor-intensive activity makes a key contribution to increasing the incomes of rural people and farmers, promoting local economies and generating employment.

A survey shows that about 5.6 million employers are currently working in the bamboo sector in China. Among them, about 4.52 million people are involved in natural resource and plantation management and 1.05 million people are involved in the processing sector (Jiang 2002).

Bamboo Production and Economy

Over the past few decades, the average annual consumption of bamboo in the world has been about 15–20 million tons, with about 8–9 million tons consumed in China. In 1999, the gross output of the bamboo industry in China was about USD 2.55 billion (Jiang 2002). Europe, America and Japan are the dominant consumers of bamboo products in the world accounting for approximately 60% of all bamboo products traded globally.

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vestment in plantations more attractive. Declining supply from natural forests will be at least partly offset by increased supply from forest plantations. It is likely that wood products will increasingly be imported, recycled and partly replaced by non-wood substitutes. Among various forest products, supply and demand for particleboard, fiberboard and paper are expected to increase the most; these products can be produced from recycled materials. All of these factors may substantially mitigate the scarcity of logs in Asia.

Asian Forest Industry in the Globalizing World

Globalization has greatly affected Asian forestry development. The management of natural forests changed erratically in the late 1990s in Indonesia. Multilateral financial agencies, the World Bank, the International Monetary Fund and other international donors were involved in reformulating the country's forest sector policies. In addition, the authority of the government was decentralized, increasing uncertainty as the local institutions and stakeholders lacked the resources and capacity to carry out the new tasks.

Consolidation of forest industries is another strong trend in Asia, caused by globalization forces like international investments. Only 10 companies are responsible for processing roughly 20% of the world's wood production, and the top 100 companies now process 50% of the world's industrial wood. The same shift is observed in Asia. From 1989 to mid 1993, 85% of all portfolio flows to East Asia concentrated in just four countries: China, Indonesia, the Republic of Korea, and Thailand This caused high consolidation of forest industries. The most important factor in forest use change in Asia is China's growing demand for timber and timber imports. China is expected to dominate global timber markets in the near future. Large companies, such as Asia Pulp & Paper (APP), dominate the forest products market in China. Large domestic and international companies are getting bigger. They buy or rent forestland to satisfy their growing raw material demand.

Asia will likely increase imports from other regions, especially from temperate countries, where

BOX 13.8 Change and Continuity in Mekong Forestry

Keith Barney

For most areas in the Mekong region, logging booms have come and gone. Starting with the full logging ban enacted in Thailand in 1989, bans on logging, log transport and log exports have followed in Vietnam (partial logging bans enacted in 1992 and 1997), Cambodia (repeated attempts at log export and transport bans in 1996, 1999 and 2001) and Laos (log export ban in 2000). While central governments have made overtures towards sustainable management, the implementation of improved forest governance practices in the region has been highly uneven. In the remaining natural forests in Cambodia and Laos, unsustainable logging activity is often extremely heavy. Long-term observers in these countries draw the causative link back to elite actors who appear to hold little interest in the shift towards sustainable management.

New trends towards international market-based regulatory practices involving forest certification, payments for biodiversity conservation and carbon sequestration are in initial stages in the Mekong region, although interest has outpaced implementation. Forest Stewardship Council certification of Village Forestry in Laos appears close to being achieved, although questions remain concerning the actual commitment of various actors within Laos towards the type of transparency that certified forestry represents. Thailand recently had its only FSC forest management certificate revoked, due to problems with the plantations of the state-owned Forestry Industry Organization (WRM 2003). Vietnam has also begun the certification process, while in Cambodia continued problems with the concession system, illegal logging and rural violence represents obvious obstacles towards certified forestry. Questions remain in Mekong countries regarding the potential of certification to promote broader policy level changes, or to truly address the complexity of resource tenure issues. Certification may be best considered as a second order response to these issues, which may need to be addressed primarily at the national policy level.

While forest management paradigms are changing rapidly in the Mekong, there is also continuity. The regulatory oversight of the forest sector is uneven. Reliable, quantitative information on the forest estate in Mekong countries, regarding the nature of existing forest resources, forest harvesting information, and forest trade data, remains unreliable in most cases. The fact that this situation remains prevalent in the region, even though hundreds of forestry students graduate every year from higher institutions in each country, suggests that this unreliability is best considered as instrumental to the economic interests of a range of actors within forestry in Mekong countries.

Tensions and conflicts surrounding village land and resource tenure are deeply ingrained in the region. The recognition and promotion of decentralized, community-based natural resource management systems, and the flexible implementation of national level land reforms demarcating the forest estate from village property, arguably remains the single most pressing challenge facing sustainable forestry in Southeast Asia. The Lao Village Forestry system and the passing of a 2003 Community Forestry Subdecree in Cambodia, which guarantees the rights of local communities to manage the forests, represent very important steps forward, but many challenges for promoting true community forest management remain. The issues around community resource tenure are often tied to the heated debates around swidden agriculture. Swidden and the (often upland, minority) groups which employ the practice, continue to be maligned as culturally backward and economically unproductive; this in turn justifies a range of restrictive state programs aimed at eliminating swidden agriculture. The relationship between forest clearing in the uplands and water shortages in lowland areas also becomes embroiled in these debates, although research continues to show that such a correlation is much overstated (Walker 2003). Simultaneously, a suite of industrial development projects and policies result in much more serious deforestation and water shortage effects than traditional swidden agriculture.

As with issues around harvesting and trade data, the tenacity of these notions within forestry institutions in the Mekong region suggests a certain underlying instrumentality. The case of Laos in respect to tenure reform, swidden agriculture, and ethnic minorities is instructive. In Laos, the ongoing implementation of the Land and Forest Allocation Program (LFAP) proceeds in combination with a policy aimed at "stabilizing" (eliminating) shifting cultivation, which has been identified as a new primary source for increasing poverty and food insecurity in the countryside (State Planning Committee 2001). Under the LFAP, national territory is being demarcated by the Forestry Department into village land, state forest or plantation production land, and biodiversity conservation land. Village territories are also being internally zoned into fixed forest and agricultural land use areas.

While the overall goals of the LFAP are surely commendable in terms of promoting village tenure security and enshrining community rights to territory, the implementation of the land use zoning has thus far been inflexible and implemented in a non-participatory manner by poorly trained officials. The overall

forest resources are generally increasing. The structure of forest products trade will change. Some countries in Asia will enter into free trade agreements. For example, the ASEAN countries will trade commodities and services without barriers among themselves in the near future. A common market where goods are freely traded is expected to expand.

Controlling Illegal Logging

Asian governments are taking measures to control illegal logging. In the Philippines, a multi-sector forest protection committee of the Forest Protection Program has been trying to implement some law enforcement activities like confiscation of illegal timber all over the country, and forest rangers are regularly stationed in specified checkpoints to prevent transportation of illegal timber. In 2002, 7780 m^3 of logs were confiscated in the country. Obtaining logging licenses by forgery and corruption is another type of widespread illegal activity, more difficult to detect (FAO 2003).

Governments of forest products exporting countries demand elimination of tariffs and non-tariff barriers on forest products trade. NGOs criticize countries that import tropical timber, including Japan, for importing forest products that might have been produced unsustainably or illegally. International collaborations to eliminate illegal logging by improving

effect has been to limit villagers' access to crucial swidden farmland. Simultaneously, improved rural extension programs, which were to promote higher productivity and sedentary agriculture, have been absent or poorly conceived, resulting in new food insecurity and new impoverishment for upland groups, particularly ethnic minorities. While the case of tenure reform in Laos stands out in many ways in the region, property rights to forest resources are of crucial significance in each of the Mekong countries. Indeed, in October 2004 Cambodian Prime Minister Hun Sen warned of the potential for a "peasant revolution" in the countryside if land and resource conflicts between communities and logging and plantation concession holders are not addressed (Associated Press 2004). Cambodia resumed land concession contracts in March 2005 (Hamilton 2005).

The changing structure of forest processing industries is another key issue in the Mekong countries. With the decline of natural forest logging, Mekong countries are in the process of revamping their wood processing sectors. In Thailand it has been an agricultural product – plantation rubber wood – which has supplied raw materials for a booming MDF and particleboard industry worth USD 150 million in exports per year, and for an export furniture sector worth USD 500 million. Wood processing in Vietnam, largely dependent upon imported timber, now represents an export industry worth USD 1.5 billion per year (Vietnam Economy 2005).

Lastly, the impacts of a new East Asian wood importing complex centered on the Chinese economy are being felt in the Mekong region. While full statistics on natural forest logging and trade concerning the Chinese market are difficult to detail, evidence suggests that China is now a major market for wood products exports from the region (Xiufang et al. 2004). Large eucalyptus plantation projects directly or indirectly associated with China have been proposed for Thailand, and are proceeding in Cambodia and Laos. Evidence from Cambodia suggests that a significant portion of the wood exports during the country's logging boom from the mid 1990s to 2001 was transported to China.

In spite of the rapid depletion of remaining natural forests in the Mekong, substantial areas of intact high forest still remain, particularly in Laos and Cambodia. Effective management of these forests will be crucial. With intensified economic integration seemingly inevitable, on both on a regional scale and a rural-urban scale, the paramount challenge for Mekong forestry institutions will surely be to coordinate and manage this complex transition in an integrated way, which strengthens the long-term positions of both the poorest communities and the most vulnerable landscapes. Building critical expertise and cooperative abilities of forestry institutions in Mekong countries is thus considered a key strategy. The 1990s witnessed the emergence of cutting-edge resource management institutions in places like Chiang Mai University (CMU). Growing practices of "South-South" collaborative research, and new learning networks between established Southeast Asian forestry research centers like CMU and newer institutions like the National University of Laos, speak to the potential for a brighter future for Mekong forests and forest-dependent communities.

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traceability of forest products have been launched. For example, the Announcement on the Cooperation in Combating Illegal Logging and the Trade in Illegally Logged Timber and Wood Products was made jointly by Japan and Indonesia in 2003. The Asia Forest Partnership (AFP) was launched to promote sustainable forest management in Asia by addressing issues like good governance and forest law enforcement; developing capacity for effective forest management; control of illegal logging; control of forest fires; and rehabilitation and reforestation of degraded lands. The First Meeting for the Promotion of AFP was held in 2002, and the meetings continue to be held on a regular basis. The International Tropical Timber Council proposed in November 2001 to undertake, in collaboration with others, a global study to assess the extent, nature and causes of illegal trade in timber and timber products, and to conduct studies to enhance forest law enforcement. In January 2002, the FAO organized a meeting with representatives from governments, ITTO, the World Bank, NGOs and forest industries to exchange ideas on policy options to reduce forest crime and to identify common ground for international action.

National Level Paradigm Shifts

Asian countries have different cultural and regional backgrounds, and different institutional arrangements for societies and environment. They are in different stages of economic development, and environmental concerns among countries vary. These differences have resulted in different paradigm shifts in relation to forest management. The differences in national level responses to forest sector development challenges are presented in Boxes 13.8 and 13.9.

BOX 13.9 Forests, Society and Environment in Japan

Hiroyasu Oka

Japan is one of the world's largest timber importing countries. At the same time, almost two thirds of Japan's land area is forested, including 10 million hectares of planted forests. The area of planted forests expanded rapidly during the 1950s and 1960s. The annual increment has substantially increased as a result of plantations, and the management regime has been and still is extremely labor intensive. It requires 100–250 man-days to establish one hectare of planted forest. Improvement of labor productivity has been very slow in Japanese forestry, reducing the competitiveness of local forest products.

The Basic Law of Forestry, enacted in 1964, had the principal purpose of increasing forestry income. It was replaced by the Basic Law of the Forest and Forestry in 2001, with emphasis on promotion of multiple functions of the forest. The reason for the amendment was a change in public expectations, from emphasizing timber production to valuing environmental conservation. It was increasingly difficult to justify a national forestry program for the purpose of increasing forestry income alone, as imports had dominated forest products market for more than three decades.

The consumption of forest products, especially sawnwood, is no longer increasing. Population, an important factor in determining the demand, may currently be at its historical peak, and it is expected to decrease in the coming decades. At the same time, the longevity of houses is increasing and the frequency of reconstruction is decreasing. As a result, demand for sawnwood is not expected to increase in the near future.

Government policy has encouraged domestic forestry production for the past several decades. However, forests are mostly managed by the private sector. Unexpected deterioration of competitive strength of forestry in Japan resulted in the decrease of timber harvest. The government has revised and lowered the planned level of production several times in response to changes in the economic conditions of forestry. At the same time, it has increased the area of protected forests in recognition of the increased relative importance of forest ecosystems. However, the decrease of timber harvest is not a result of the policy for local environmental protection, but rather a result of the increasing comparative disadvantage of forestry in Japan.

Policy Issues

The forest economy in Japan is now in transition. There has been a great effort to expand the area of planted forest to meet domestic demand. However, the area of planted forest may now start decreasing as a result of the changes in economic conditions. There are conflicting views on whether, how, and to what extent planted forest should be transformed into semi-natural forest. On one hand, an increasing number of people seem to consider the area of planted forest to be excessive, partly as a result of allergies caused by the pollen of a few major planted species, and partly as a result of the competitive weakness of domestic forestry. On the other hand, other people, the forest industry, and national government are concerned with the inadequacy of forest operations such as thinning and replanting. The decrease in forest investment has resulted in forests being left unmanaged. There is concern over a change of managed forest into unmanaged, neglected ecosystem, as well as decrease of economic value of the forest.

A major policy issues is how to keep forest owners managing their forests or transfer ownership to someone who is interested. The number of forest owners and their family members involved at least part-time in forestry decreased from 1 980 000 in 1970 to 600 000 in 1990, and by 2000 it had decreased a further 19% (MAFF various years).

Current forest policy focuses on thinning, corresponding to the age structure of the forest. Thinning is recognized to be desirable for long rotation management and to be an environmentally sound method of production, as well as a policy measure to increase employment opportunities in rural areas. Subsidies to thinning operations may help long rotation management, avoiding frequent clear-cutting and subsequent high-cost replanting or forest abandonment.

The forest area is almost stable; the steep terrain where the forests are located is an obstacle for land use conversion. Standing volume of forest is substantially increasing because of decreased timber harvest. The loss of natural forest areas has decreased as well. The critically threatened sustainability of local forestry and forest-based communities are the major problems identified in the forest sector of Japan. Comparative disadvantage of forestry and the resulting crisis in forest based communities in Japan is at least partly a result of the success of the manufacturing industry. Without dramatic improvement in labor productivity in the forestry sector, private forestry cannot afford to pay wages as high as those in other industrial sectors. A dramatic increase in labor productivity, unaccompanied by higher rate of increase in production, will result in decreased employment in the forest sector. A new balance is needed between forests and forest based communities, and between rural and urban populations, to improve general welfare.

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13.4 Linking Forests, Society and Environment in Asia

Sustainable forestry aims to sustain a delicate balance between ecosystems and social and economic structures. Forest management goals should fall within the intersection of three spheres: ecological, economic and social. There is a need for innovative approaches to meet the emerging and on-going paradigms in Asian forestry.

Forest Sector Employment

In Asia, forestry is one of the important sectors of employment creation, but in general employment in the sector has decreased. In Indonesia, the number of employees in the forest sector sharply increased from 113 000 in 1980 to 300 000 in 1989 as production of plywood and sawnwood increased. When an export tax on sawnwood was imposed, the number of employees decreased slightly to 285 000, and peaked with 389 000 employees in 1997 when plywood production was at the highest level. The number of employees decreased slightly again to 362 000 in 2002 (FWI/GFW 2002). The number of employees

John Parotta

Natural forests have often been converted for cash crop production, e.g. for rubber plantations as in Thrissur District, central Kerala, India. The world's largest areas of rubber tree plantations are in Indonesia (34%), Thailand (21%) and Malaysia (18%).

in the forest sector would be much higher if people who work in small-scale sawmills and other wood processing industries (furniture, particleboard, fiberboard, and veneer sheets), as well as people who are involved in forestry activities like agro-forestry, were taken into account.

The work force in the forestry sector in Japan is decreasing and aging. The number of people working in the forestry sector decreased from 519 000 in 1955 to 67 000 in 2000 (Statistics Bureau various years). From the current age distribution of forest workers, it is obvious that the majority of existing forest workers will retire in a decade or two. The contribution of forestry and wood processing to economic growth has declined in most Asian countries, and the employment in the forest sector may decrease in the future (see Box 13.9).

Inter-Linkages, External Policies and Information Needs

Forestry in Asia is at a crossroads. Forest benefits can no longer be taken for granted. Forestry cannot directly meet diverse and often opposite expectations of different stakeholders. Forestry should be a justifiable economic activity with a sound role in land use and in the national economy. Governments of Asian countries have not yet fully developed forest policies that provide medium to long-term vision for the sector. The policies should integrate poverty reduction, social development, and environmental protection. Inappropriate macro-economic policies often misallocate resources, and the willingness to invest in the forest sector is reduced. Inappropriate fiscal policies, such as selective subsidies and pricing policies, also contribute to distortions.

Establishment of effective forest products markets is not possible in the forestry sector alone. Providing the necessary market environment for forestry is highly dependent on national macro-economic policies and market institutions. Significant problems of fuelwood consumption and pricing for firewood can be fundamental market issues, but are rarely addressed as such.

Sustainable forest management requires forest inventory and other activities to compile information and data to support policy decision-making. Many Asian countries have recognized the need for regular forest inventories. Capacities for implementation vary widely among countries. Insufficient monitoring of resource and environmental changes constrain policy makers in evaluating impacts of governmental policies, strategies, programs and projects. Even in many countries where basic inventory data are available, their effective use for planning is limited (Brown and Durst 2003).

Constraints and Opportunities to Forest Environmental Services

There are several constraints to stimulating forest environmental services: (1) Difficulty in excluding "free riders" is a fundamental constraint for setting up payment systems. Unless service providers can exclude free riders, it is difficult for them to convince others to pay; (2) Pressure on governmental budgets; (3) Weak participation of suppliers; (4) Absence of a standardized formula for calculating charges. Various techniques adapted by numerous scientific studies have caused confusion and reduced credibility of the estimates; (5) High transaction costs. Various transaction costs are associated with the process of paying for forest environmental services, e.g. pricing the services, negotiating payments, setting up an institutional mechanism for payments, monitoring, and enforcement. As with any new system, these costs are in many cases higher than the potential incomes.

Forest management should include both administrative and economic levers to ensure sustainable income. The set of measures may include: educating beneficiaries regarding the importance of environmental services for their welfare, and threats associated with discontinuing these services; consultation on fair systems for raising funds to pay for the maintenance of the environmental services; and effective enforcement systems to penalize free riders.

Logging Ban, Environment and Society

Logging ban and natural forest protection programs have dramatically affected local societies and environment. Logging bans have the effect of improving the local environment and forcing reconsideration of basic purposes of forest resource management. Roundwood production has declined thanks to logging bans in several countries (Thailand, China, etc.), but rapidly increased in the neighboring countries, transferring the environmental burden to new regions. The Report of Informal Technical Workshop, which was organized by Asia-Pacific Forestry Commission in Manila, on December 13–14, 1999, pointed out that:

"*All of the case study presentations reveal the great complexity and variability of the issues related to implementing logging bans and other restrictions on timber harvesting. Most logging bans have been imposed to promote concepts of forest conservation. But most countries have conducted only a minimal degree of analysis of the social and economic impacts of logging bans prior to their imposition. Moreover, assessment of the supporting policies necessary for successful implementation has generally been inadequate. The impositions of logging bans and harvesting restrictions have, in all cases, involved substantial hardship in terms of economic costs and social dislocation or disruption.*"

And "*the case studies also highlight a complex array of approaches and methods that have been pursued to formulate and implement natural forest harvesting restrictions, with varying degrees of effectiveness. It was noted that where the goals and objectives of logging bans are poorly formulated and implementing legislation, policy and operational guidelines are inadequately elaborated, subsequent implementation is generally weak. The need for supporting changes in institutional structures, clarification of public and private roles in both forest policy and management, investment in infrastructure capacity (including human resources), and related changes was recognized and discussed in some detail (FAO 2003).*"

13.5 Concluding Remarks

During the past two decades, Asian forestry experienced a series of major paradigm shifts and smaller changes including transition from planned to market economy, urbanization, trade liberalization, decentralization, logging ban, increased role of plantation, recycling, wood substitutes, and tentative experiments with forest ecosystem management and payment for ecosystem services. Forest ecosystem monitoring with reference to Criteria and Indicators of Sustainable Forest Management, certification, and international collaboration to prevent illegal logging are all new experiences. Rapid economic development, population growth, information technologies, and the emergence of a post-industrial and ecological era accelerate and complicate the shifts. Asian societies and economies will continue to develop, and the relations between forests, society and environment will also continue to change. Inter-regional as well as inter-sector income distribution patterns form a rapidly changing socio-economic background to forestry. Asian national and local forestry institutions need to be more dynamic, flexible and responsive to address the changes in population, resource base, technology, and value systems.

Asia is one of the most diverse continents in the world, in terms of geographical conditions, stages of economic development, political systems, and cultural backgrounds. This diversity has had impact on virtually all aspects of forestry. The emerging paradigm shifts in managing forest resources to meet various human needs call for greater attention, on the part of policy makers and other stakeholders, to the roles that forests play in securing economic prosperity, social cohesion and environmental soundness.

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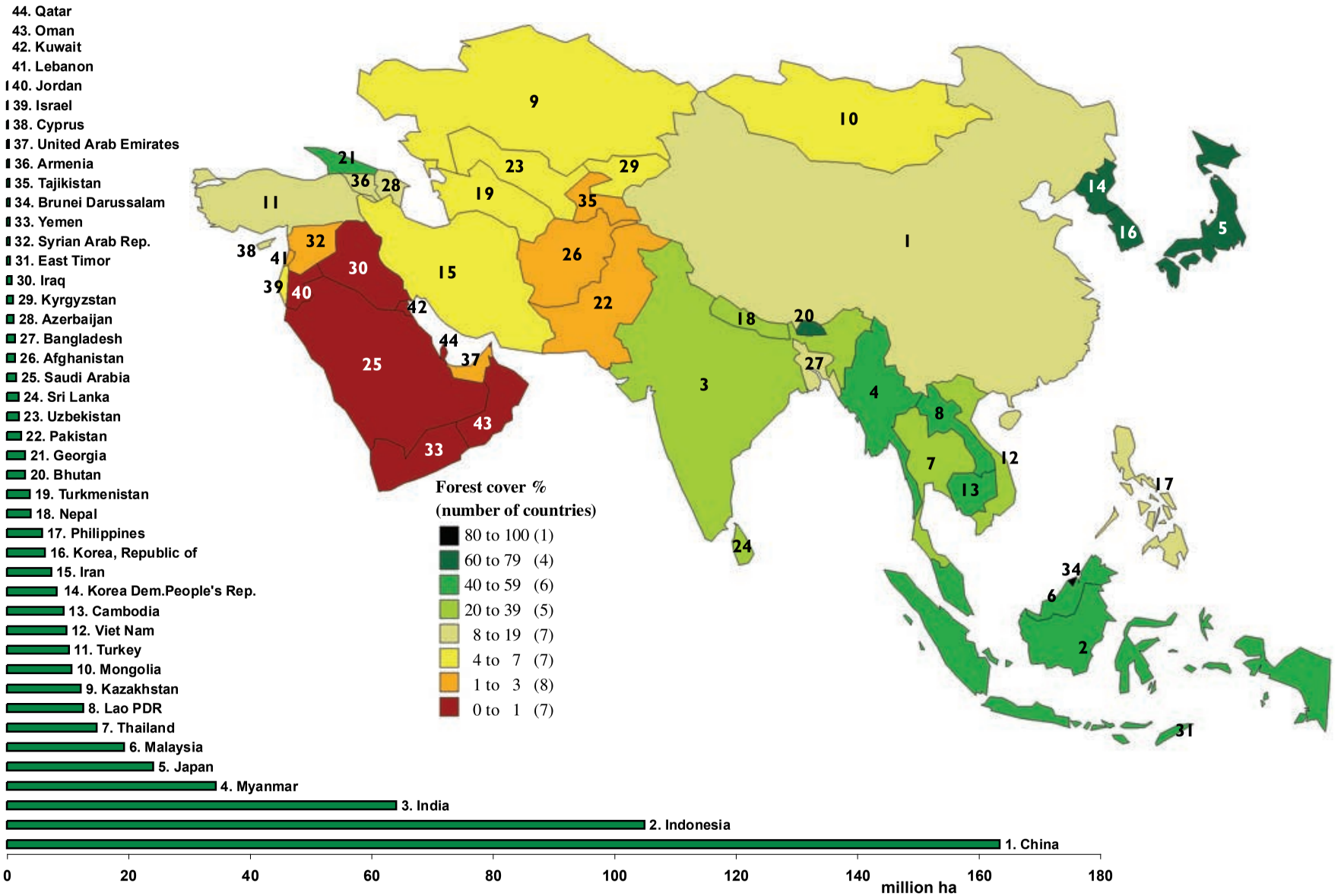

Map 13.1 Forest cover in Asia (percent of land area) and total forest area per country (countries over 500 000 ha) (Data: FAO FAOSTAT 2005; map designed by Samuel Chopo)

REGIONAL FORUM IV

14 Changes in the Forest Sector in Europe and Russia

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Contributing authors: Gerben Janse, Alexander Moiseyev, Lauma Kazuša and Max Krott

Abstract: Europe has undergone several social and political changes over the past two decades. Some of these changes are dramatic and revolutionary, such as the demise of communism in Eastern Europe and the former USSR; some are more evolutionary, such as the enlargement of the European Union; and some are more long term and general, such as the change of societies' main attitudes and values from agricultural or industrial to post-industrial and urban. The chapter describes the impacts of these changes on forests and forestry in Europe. While the major trend towards increased demand for forest products and the related increase of production and trade activities have continued unhindered, major political events, such as the complete overturn of the political system in the area of the former USSR, have had major impacts on the sector. The close link between forests and the environment is inevitably affected by environmental developments and policies. This has become evident in the context of EU policies, with the formation of large scale networks of conservation areas (e.g. NATURA 2000) and the increased future focus on renewable energies; both of these are the result of an increasing dominance of urban values in Europe. The major paradigm change which has occurred in Europe is considered to consist of the acceptance of the idea of sustainable management of forest resources as the new definition of forest sustainability; this has also found its way into the major Pan-European process of the Ministerial Conference for the Protection of Forests in Europe.

Keywords: European Forestry; forest ecosystem management; paradigm change; urbanisation; European societies; European environment; Europe; Russia.

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14.1 Introduction

Political Changes in Europe and the Former USSR

The political and social developments in Europe and Russia during the past decade have had far reaching influence on the forest sector in this region. The most dramatic changes are the demise of communism in Eastern European countries and the former USSR (The Union of Soviet Socialist Republics), and the transition of these countries from "centrally planned" to market economies. The extension of the European Union (EU), first to 5 members in 1995 and then to 25 members in 2005 (EU 25) is another important development. It has increased the EU's forest resources and the importance of forestry at the EU, as well as the role of the EU as a major player in the global forest sector.

The transition of the former USSR countries and Eastern Europe from "centrally planned" to market economies has had major social and economic ramifications in these societies, with major social, economic and market impacts on the forest sector. While the volume of production and consumption of forest products has generally increased, this has been at a rate much below the general growth of these economies, and the relative economic importance of these products has diminished. Services and communications have been the areas of predominant growth.

Increased urbanisation in most European societies has contributed to the change in values and attitudes from agricultural or industrial to post-industrial and urban. The change in values has emphasised the importance of amenity outputs from forest resources.

The Forest Sector in Europe and Russia

Forest Resource

The area of forests and other wooded land in Europe and in the countries of the Commonwealth of Independent States (CIS) amounts to some 1.1 billion ha, about one fifth of the world area. Russia accounts for 0.9 billion ha. A characteristic of this area is that it is generally stable, but with a slight tendency to increase. The harvest from these forests is less than the increment, and there is a tendency to growing stock accumulation and increasing age. The accumulation in Russia and other CIS countries increased in the past decade with the sharp reduction in harvesting since 1990.

Production and Consumption of Forest Products

Over the past four decades the volume and value of forest product production and consumption has increased substantially. This development has, however, been different for each of the three main products. The production and consumption of sawnwood was at a high level in the 1960s and peaked in the early 1970s, after which it was rather stable through the 70s and 80s. In the 90s, production and consumption in the EU grew significantly while the very high Russian and CIS production and consumption collapsed to less than one third of the earlier levels. Wood based panels production grew six-fold over the four decades and paper production grew four-fold. Growth in production and consumption was high in all regions up to 1990, but while it continued in other areas of Europe, it declined in Russia and the CIS countries after 1990. By 2002, the consumption of panels and paper in that region had recovered to about half the level of 1989. These regions are mainly net exporters of forest products, the exception being the EU, which has been a net importer of sawnwood over the past four decades. (UNECE-FAO 2000).

Trade and Trade Flows

The value of forest product exports increased fivefold in real terms over the past four decades. EU exports reached a peak in 1990 and have fluctuated around that value in real terms in more recent years. After a recession in the early 1990s, the exports of Russia and the CIS countries have expanded rapidly.

The quantity of goods traded has also increased fivefold over the past four decades; however, the increase in volume since 1990 has been much greater than the increase in real value. This has resulted in a sharp decline in the average unit value during the latter period in real terms.

The original 15 EU members (EU 15) are the dominant trading partners in these regions, accounting in 2002 for 78% of exports and 85% of imports. Around 70% of both EU imports and exports originate or are directed to other countries in the EU. The proportion of EU total imports from EU partners has increased slightly, while the proportion of EU total exports destined to EU partners has decreased slightly.

Information on trade by Russia and the CIS countries is distorted by the fact that before1990 the trade between these countries (when they were included in the USSR) was not reported. This also affects the

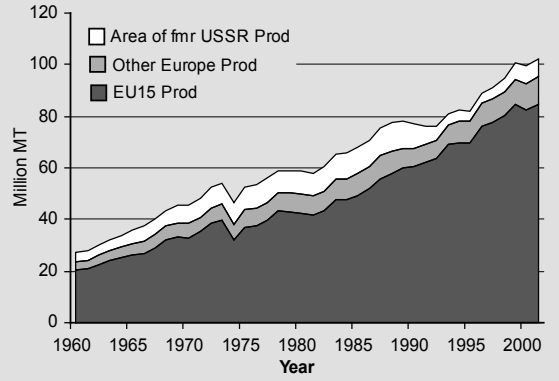

Figure 1. Paper and Paperboard production in Europe (1991–2001)

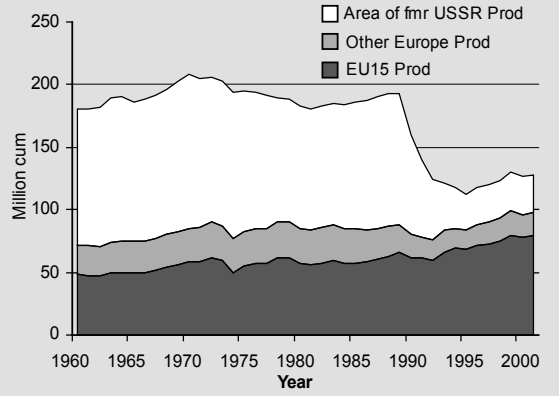

Figure 2. Sawnwood production in Europe (1991–2001)

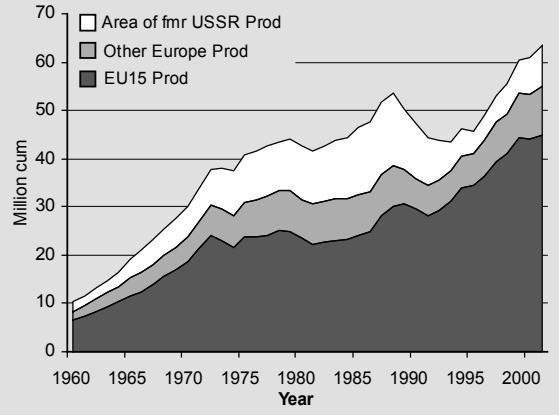

Figure 3. Production of Wood-Based Panels in Europe (1991–2001)

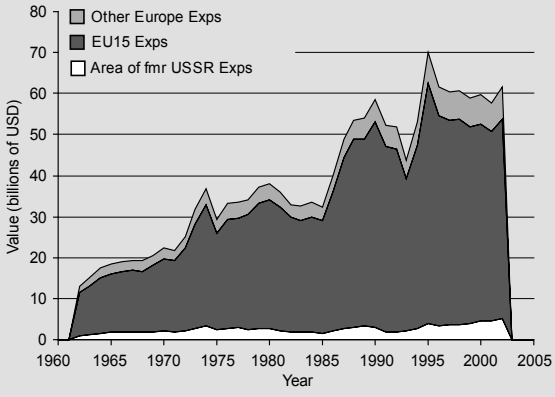

Figure 4. Exports from Europe to the rest of the World, 1962–2002 (USD, deflated)

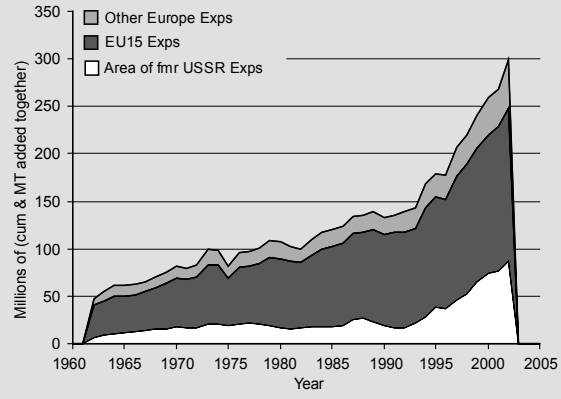

Figure 5. Exports from Europe to the rest of the World, 1962–2002, (all products, cubic metres and metric tons added together)

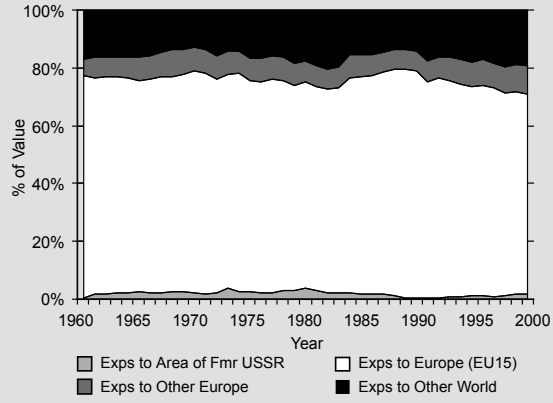

Figure 6. Export share of EU 15 to former USSR, other Europe, and the rest of the World, all products, 1962–2002, in % of value

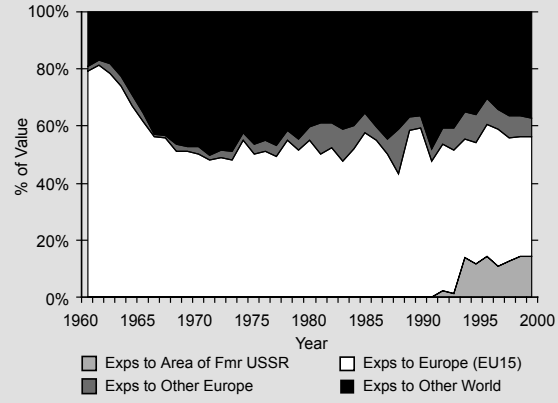

Figure 7. Exports from area of former USSR to other Europe, EU 15, rest of the World, and to area of former USSR (recorded from 1994 onwards), 1962–2002, in % of value

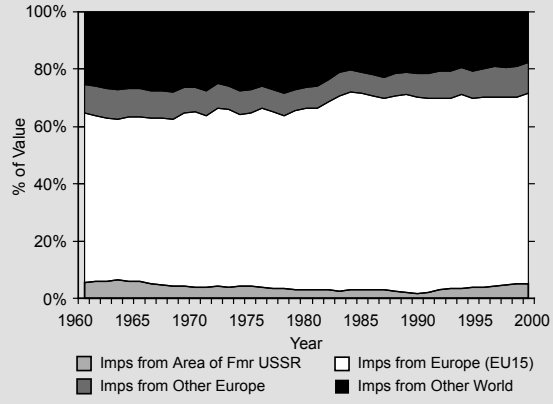

Figure 8. Import share of EU 15 from former USSR, other Europe, and the rest of the World, all products, 1962–2002, in % of value

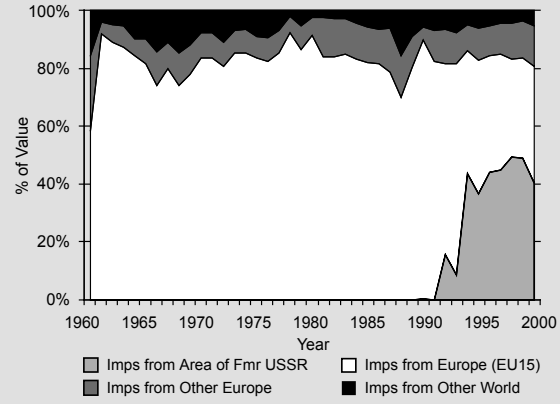

Figure 9. Imports into area of former USSR from other Europe, EU 15, rest of the World, and to area of former USSR (recorded from 1994 onwards), 1962–2002, in % of value

(Production data FAO FAOSTAT 2005; Trade data EFI/WFSE Forest Products Trade Flow Database based on UN COMTRADE data, UN Statistical Division)

record for the Baltic countries, at that time included in the USSR and the Eastern European countries, which formed part of COMICOM – the inter-trade between COMICOM members was not reported. The recorded exports of the USSR were predominantly to the EU and to the rest of the world, in about equal amounts. By 2002, though these two areas remained predominant partners for Russia and the CIS countries, trade with CIS countries now made up 15% of the total. Up to 1990, the EU accounted for 80% of the USSR's recorded imports. In 2002, trade between Russia and CIS partners was the source of 40% of their total imports, while EU and the rest of Europe accounted for most of the rest.

14.2 New EU Countries, CEECs and the Forest Sector

Amongst the newly accessed countries, there are several highly relevant for the forest sector, especially in the Central European context. It is therefore worthwhile to consider the implications that these developments might have for forestry and forest industries throughout Europe.

Implications for Forest Products Trade

In principle there will not be too many direct implications for forest products trade, as currently there are only very few limitations to timber trade globally. The trade in forest products between several of the new member states and the then EU 15 countries was already quite intensive before, but as this trade is now considered "EU-internal trade", the formalities have decreased considerably. This can also affect transport costs. Overall, this will mean a more reliable supply of raw material.

In addition, it will become easier for companies to operate in other EU member states. As a result, it may be possible and attractive for companies located in one EU country to organise their material supply from other EU countries, not only by subcontracting but also by founding subsidiary-companies. This will also ensure a higher level of "certainty about the supply", thus countering suspicions of imports' originating from dubious or illegal sources. Together with better possibilities to enforce contract-obligations within the EU, this will result in a higher amount of reliability in forest products trade throughout the EU 25. In addition, the fact that sooner or later most new member states will adopt the "Common Currency", the Euro, will remove the risks involved with exchange-rate-variations in longer-term trade-relationships.

As the developments of the last years have shown, however, one of the major objectives of forest sector policies in CEECs (Central and Eastern European Countries) is to restructure their forest sector industries towards improved value added production, and especially to lower raw or semi-processed material exports. In addition to the abundant raw material source in several CEECs, a well educated work force, competitive taxation regimes and wages, as well as incentives under EU rural development policies, have already proven to result in a combination of factors attractive to foreign investment, mostly from other EU members (Ottitsch et al. in press).

However, in some of the new accession countries, the forest sector is facing considerable problems, including allegations of illegal logging at substantial scales, which will have to be met with appropriate actions by public as well as private actors in the European forest sector. The EU-FLEGT (Forest Law Enforcement, Governance and Trade) action plan initiated in 2002, and the Europe-North-Asia (ENA)-FLEG-Ministerial Conference planned for 2005 are examples of important steps in this direction.

Implications for Forest Industries

Already today forest industries are operating throughout Europe, and some of the major companies situated in the original 15 member states have invested in production capacities in the new member states. This trend might be facilitated with the higher level of legal and economic security a "common market area" can provide and, with most new members adopting the common currency, stabilised exchange-rates. Of course, one also has to be aware that, at least for the immediate to mid-term future, one of the key-assets of new member countries will be the relatively low production costs at more or less comparable rates of productivity (i.e. low labour costs and tax-rates and a more or less equally well educated workforce). This means growing competition for operations in the current EU member states. From a longer term perspective, the mechanisms within a "common market" will mean that these differences will decrease, resulting in more even "competition conditions".

Developments in CEECs

The CEECs include not only the majority of the ten new members of the European Union, but also other countries which were part of the former Eastern Block or the Soviet Union (i.e. today's CIS-states). Also, for the new EU members the consequences of their special transformation-process are still being felt today; it is therefore worthwhile to focus on this group of countries and their issues separately.

Over the past one and a half decades, Central and Eastern European countries have undergone a period of change and transformation with considerable impacts on their national forest sectors. Due to the actual as well as potential importance of these countries for the forest sector in Europe, these impacts have consequences for the forest sector at European as well as global levels.

Some of the most important changes include:

- Transformation from communist state-planned economy to market economy.
- Structural change in trade relationships after the collapse of Soviet hegemony in Central and Eastern Europe.
- Need for new investments in processing capacities to keep pace with technological state of the art and higher quality requirements of new trading partners.
- Change in the ownership structure of forest industries and (albeit at a limited level) of forest resources.
- Involvement of international companies in the national forest sector through joint ventures, mergers, and other forms of co-operation.

- New economic environment due to EU accession:
  - Increased possibility for foreign capital investment.
  - Reduction of trade-formalities in intra-EU trade.
  - New policy framework for public financial incentives for forestry and forest industries, especially in regions considered to be "less favoured" under the EU structural funds system.
  - New conditions for the operation of state forest enterprises.
- New conditions for co-operation between state forest enterprises and forest sector industries (possible implications of stricter implementation of EU competition legislation).
- For some countries in the region:
  - Due to failures in forest law enforcement (and ill-adapted legislation), illegal logging constitutes a problem. Upcoming measures to curb the share of timber of doubtful origin on national and international markets may result in short term reduction of available raw material (but initial results of scenario-models in this context indicate that supply will be at normal levels within a reasonably short time).
  - Structural change in agriculture will result in increased forest resources in the future (but in most areas long rotation periods of 60 to 100 years mean that any such change will not have an immediate impact on resource availability).
  - Recent reforms in tax legislation (income and corporate) may increase attractiveness for foreign investments.

14.3 Developments in the Forest Sector of the Russian Federation

A series of dynamic developments have taken place in the Russian forest sector over the past years. The sector is high on the government's reform agenda, and further institutional as well as legal changes are to be implemented in the near future.

The Russian Federation's present forest policy consists of several legislative acts, target programs, strategy documents, and relevant aspects of international agreements that have not yet been completely unified into a comprehensive policy framework.

The Basics of Forest Legislation were created in 1993. The present Forest Code of the Russian Federation was adopted by the State Duma in 1997. Changes to the forest Code in 2003 allow exclusive federal authority over forests, taking away the authority from regional governments. This removes any power the regions had to establish protected territories or collect taxes on forest products. It also allows the elimination of protected forest status that prohibits industrial cutting.

In November 2002, the Government launched the World Bank-financed Sustainable Forestry Pilot Project and requested further support through non-lending advisory services. The key strategic goal of the new forest policy is to convert the huge biological resources of wood into economic values (gross domestic product, added value, and profit).

In February 2004 the new Forest Code draft that proposed privatisation of forests was released. In response, a nation-wide campaign erupted. Environmental activists became active in opposing the privatisation scheme. Environmentalists charged that the government is giving in to the timber industry, which is accused of pressuring the government to allow clear-cutting of up to 90% of Russian forests. Following this and other criticism an intensive discussion between environmental NGOs and governmental authorities ensued. Eventually the privatisation proposition was withdrawn. In August 2004, the Duma reviewed the legal changes that will establish exclusive federal authority over forests.

The latest Forest Code draft foresees two types of leasing agreements: 1) leasing agreements with responsibility only to cut a forest for a period of one to ten years, and 2) leasing agreements with responsibilities to cut and regenerate the forest, for periods from 10 to 99 years. For agreements under the first option the costs of regeneration are intended to be covered from higher license fees, whereas agreements under the second option would put the leaseholder in a position similar to that of a private owner under strict supervision of forest authorities, as is usual in many "Western" European countries.

Experts consider the main problems of the sector to be non-transparent timber flows, corruption, low income from regular forest usage due to the current tax and license systems, and significant amounts of illegal logging. These factors are all interrelated and require a comprehensive approach to forest sector policy, as well as a general change in public policies (Petrov 2003).

The move towards more centralisation in the sector is in line with current general political developments in the Russian Federation, and it constitutes a change of paradigm from earlier developments towards decentralisation. The proposed introduction of long-term lease agreements – if introduced in the spirit of free competition, private entrepreneurship, and secure contract relationships – carries potential for introducing the element of more long-term planning of private activity in the sector; this would constitute a paradigm change away from governmental planning towards more private responsibility. As can be seen, there is a certain element of tension between the tendencies towards more central control and more private activity in the sector. However, there are examples from around the world demonstrating that these seemingly contradictory developments can co-exist.

14.4 Paradigm Shifts in the Forest Sector

From Sustainable Raw Material Production to Ecosystem Management

In practically all European countries, the last one and a half decades have been a period in which the major objective in forest management has become defined as the sustainable management of forest ecosystems, rather than the sustainable production of raw materials. Thus, what was once a constraint – the preservation of the forest resource base in order to safeguard future production – has now become the main objective. This shift in orientation constitutes the major paradigm shift in the European forest sector. This has also become the accepted paradigm in forest science. In international processes – with the MCPFE (Ministerial Conference for the Protection of Forests in Europe) process being the most important one at the Pan-European level – this shift has become accepted and has already been cast into the MCPFE's resolutions.

At national levels, too, this new paradigm has become the guiding principle in the definition of new standards and practices for forestry professionals, as well as for the revision of forestry legislation. Most new forest acts and other forest relevant laws throughout Europe are now based on the commonly accepted definition of forest sustainability, consisting of the sustainable management of forest ecosystems for all social, ecological, and economic benefits.

Yet, while "sustainable ecosystem management" is basically formulated as a "win for all" concept, its actual implementation "in the field" is not possible without addressing the inherent conflicts of interest between different groups of beneficiaries of forest products and services. Consequently, modern conflict management approaches have become increasingly important tools for forestry activities, and also a challenge for forest research (Burley et al. 2001).

From National Domain to International Discussion

Forests were traditionally seen as a national strategic resource and forest policy as an object of national interest. The past decades have, however, brought upon an internationalization of forest policy processes.

The Ministerial Conference for the Protection of Forests in Europe (MCPFE) – a Pan-European effort

In Europe, the MCPFE process (Ministerial Conference for the Protection of Forests in Europe) forms a common political platform for forest policy issues for the 40 represented countries and the EU. This activity has resulted in a number of resolutions that have defined sustainable forest management in the European context. The history of these resolutions also shows how this process has become increasingly more policy relevant (MCPFE 2004).

Strasbourg 1990
The six resolutions of the Ministerial Conference in Strasbourg in 1990 focussed mainly on cross-border co-operation on technical issues, such as data exchange, joint initiatives towards data-collection, and increased scientific co-operation. Already the need to provide the best possible scientific information as a basis for policy decisions was stressed.

Helsinki 1993
The following Ministerial Conference in 1993 in Helsinki was dedicated to the implementation of the outcome of Rio 1992, as well as to the political and economic transitions going on in Eastern European countries at that time. The four resolutions focussed on "sustainable forest management", the conservation of biodiversity, climate change, and co-operation with countries with economies in transition (CET). With several of the CET countries being rich in forest resources, their importance in the context of Pan-European forest policies was thus recognised. The follow-up to the Helsinki Ministerial Conference aimed at the development of Pan-European indicators for sustainable forest management (at the operational level), as well as increased co-operation with CET countries, implementing the Helsinki resolutions, and preparing for the next Ministerial Conference in 1998 in Lisbon.

Lisbon 1998
This meeting was dedicated to the relationship between forestry and society, and the new role which forestry would assume in the wake of societal change throughout Europe. The two resolutions resulting from the Lisbon conference focussed on the enhancement of socio-economic aspects of forestry, bearing in mind the full range of benefits for societies and – as an outcome of the follow-up to the Helsinki resolution – a set of Pan-European Criteria and Indicators for Sustainable Forest Management at an operational level. The latter – essentially an adaptation of the idea of "forest ecosystem management" to the specific conditions in the European forest sector – has become an important basis for further political and legislative initiatives at national levels as well as in the EU.

The follow-up work programme to the Lisbon Conference focussed on climate change, biodiversity, rural development, a further discussion on criteria and indicators, and the needs of CEECs.

Vienna 2003
The Vienna Conference, under the title "The Living Forests Summit", was dedicated to the conservation and sustainable management of forest resources in

Europe. It also took up the "forestry-society relationship" theme in the resulting declaration, "Common Benefits – Shared Responsibilities". The relationship between forestry and other political and economic spheres in society was also the topic of most of the five resolutions, which focussed on cross-sectoral cooperation and national forest programmes (NFPs), the economic viability of sustainable forest management, social and cultural aspects, forests and biological diversity, and forestry and climate change.

In line with this general theme, a multi-stakeholder dialogue process at the pan-European level has been established, creating a forum for representatives of forest owners, forest industries, social and environmental NGOs, as well as the scientific community. The inclusion of the latter can be seen as a "return to the origins" of the MCPFE process, namely, the integration of science into sound policy decisions.

Forestry and the European Union

In the EU, the relevance of forestry has been steadily increasing over the past one and a half decades. Relevant Community policies and documents have integrated the new paradigm of sustainable management of forest ecosystem into the EU's policy framework. These have included the European Forest Strategy on a general level, as well as more concrete manifestations like the Community's policies in support of rural areas (e.g. EU-Reg. 2080/92 for the afforestation of agricultural lands or EU Reg. 1257/99 on Rural Development) and related implementation regulations. While opinions are still divided on whether there is a need for a common EU forest policy, the relevance of EU decisions for national forest policies is undisputed today. One of the most contested issues in the implementation of EU policies of relevance for forest land use has been the implementation of the EU's "NATURA 2000" network. The implementation of the EU's Birds and Habitats Directives, aimed at the establishment of a network of protected areas in which traditional land-use is not excluded but is subject to special guidelines and management plans, faced fierce criticism and resistance from private forest owners across Europe, who felt left out of the decision making process. It has also raised the awareness of national forest owner associations in Europe and increased their efforts towards representation and presence at processes in Brussels (Julien et al. 2000).

The increasing importance of EU-related policies, including the availability of additional funding opportunities, especially in remote rural regions, has led to a power shift within national policy networks. Within national ministries in charge of forestry related matters, "international departments" have gained increasing importance – amongst other reasons due to their relevance in gaining access to EU funds. On the other hand, NGOs with better access to decision makers at EU levels have actively tried to shift issues from national to EU levels, thus compensating for their weaker power in forest politics at domestic levels (Hogl 2000).

Forestry and Rural Development – Between Tradition and Innovation

Rural areas across Europe are facing more rapid emigration than ever before. Due to the diminishing prospects for financially feasible agriculture and the lack of supplementary sources of income, rural areas are characterised by high unemployment, narrow occupational base, and poor job creation. The result is a loss of attractiveness of rural regions.

The main challenge for the forest sector in supporting rural development is to find counter-measures to break the vicious circle. Higher and especially more innovative utilisation of existing wood and non-wood forest resources would contribute to rural development by increasing employment opportunities and raising the economic benefits obtained from the forests.

Low local demand and long distances to the main markets seem to be the major hindrances. The strategies aimed at increasing the forest sector's potential cannot concentrate on regional consumption alone; instead the main task lies in connecting rural producers and urban consumers. In wood processing, small and medium-scale mechanical wood industries are seen as a promising option (Hyttinen et al. 2000).

Research has also shown that in many countries "society at large" is emphasising amenity outputs from forest resources rather than raw material production. The fact that in rural areas in Europe the majority of the population is nowadays employed in "urban" professions (i.e. production and services) contributes to this general attitude. In line with the general change in population structure, the socio-demographic characteristics of private forest owners are also changing. There are an ever increasing number of urban and/or absentee forest owners, who pose an increasing challenge to traditional forest sector actors, as their needs cannot be addressed with the same arguments, policy instruments, and institutions which were designed for a predominantly rural, farm-dwelling clientele. Empirical research also shows the need for a redesign of policies to address this new socio-cultural constellation (Elands and Wiersum 2003).

Challenges Ahead – Growing Demand for New Services and Products

While the important role of environmental and recreational services has long been recognised, their real potential still needs to be realised. To some degree the traditional view of environmental services as

"functions" (e.g. recreation, protection, conservation "functions") is at the heart of the entrepreneurial view of forestry which is necessary, not only to provide these "services" to society but also to market them as products. Whether the provision of such services is to be achieved through public or private financing is a question distinct from how and by whom they are provided. Examples from other fields – such as health services – show that the state as provider of services is not necessarily the only possible solution for achieving a high level of service standard and supply.

There exist a number of interesting examples of how even those services once considered the exclusive domain of the state, such as nature conservation, can be provided in the form of private contract arrangements with forest owners, regardless of whether they are public or private. Biodiversity protection networks in Austria or Finland, to name but two of many examples, have been established by inviting private forest owners to "offer" suitable sites. This allowed the relevant authorities to choose those sites for participation in the program which were considered the best "value for money" from the point of view of conservation objectives.

Carbon sequestration, too, is a good example for how a "function" which has always been provided by forests, is becoming recognised as a service, which is increasingly in high demand by countries introducing carbon management regimes. What is currently being developed in some countries constitutes the proper transfer institutions and mechanisms to bring supply and demand together. Thus, what has once been considered an "externality" has become the management objective, with wood eventually resulting as an externality in the process.

In many if not most European countries however, the use or appropriation of some of the most important services and non-wood forest products is regulated in the form of "everyman's rights". This allows the public at large recreational access or the collection of "household quantities" of non-wood forest products (e.g. mushrooms or berries) free of charge on all forest land, regardless of the ownership situation. Research results (Janse and Ottitsch 2005) have surprisingly shown that the existence of such rights does not necessarily hinder forest owners from gaining financial profit from the increasing demand for these services and products. Rather than "charging entrance fees" it is possible to sell additional services to tourists attracted by the possibility of enjoying nature free of restrictions. The potential for such services is of course different in a rural recreation area, where longer-term stays of clients require the provision of accommodation and other services. By comparison, in an urban or peri-urban zone, visits tend to be shorter and often do not result in any local consumption, and thus the negative externalities of increased traffic may be the only tangible input into the area. The special conditions of urban areas are thus explored in depth below.

Urban Forestry – an Emerging Concept

All across Europe the role of forests and forestry is taking a different shape in and around urban areas. The past decade has seen the evolution of a specific European concept of Urban Forestry, especially in countries like the UK, the Netherlands, and Belgium; but there are also famous examples of urban forestry in the North (e.g. Sweden, Finland) and in the South (e.g. Italy). In addition, forests in rural areas are increasingly owned by absentee forest owners, who have interests and objectives other than their farm forester ancestors. These developments provide challenges to public as well as private actors in the forest sector (Krott and Ottitsch 2005).

In many cases, urban green space policy in Europe still constitutes a patchwork of segmented policies. This is mainly due to the fact that present structures originated in specific historical contexts. Today's urban green spaces originate from the representation purposes of feudal courts (parks, urban gardens, urban forests), from traditional public forest domains, and from representation-related activities of the 19th century bourgeoisie (private gardens, boulevards, alleys). They also have their roots in the concept of "peoples' gardens" from the late 19th century, partly instituted by rededication of the former categories. This development has to be regarded within the context of rising labour interests across Europe, related to industrialisation and its consequences in changing the social fabric of urban agglomerations. Moreover, green spaces and green space policy need to be seen in relation to more recent concepts of urban planning, resulting in new forms of "community forestry", and as a most current development the implementation of local Agenda 21 projects.

In those cases where urban green space management is based upon a long tradition, management institutions and organisations within municipal administration also have such a tradition. As a result, different types of urban green space within the same municipality, for example forests and parks, are administered by different organisations. The insistence on traditional spheres of influence can be seen as hindering the introduction of new, comprehensive green space concepts (such as urban forestry, for example). On the other hand this competition between different administrative units can also be used at the political decision-making level as an instrument to reach cost-efficient solutions, for example by allocating newly created areas to that institution offering the "best price" for delivering specific objectives.

Urban green space policy is mostly a policy of public property. In most cases, existing policy instruments are focussing on areas of public property. Urban green space policies can be characterised as the policies of specific branches of the public administration. Most municipal administrations prefer property strategies when it comes to selecting instruments for

Erkki Oksanen

While increased urbanisation has in most European societies contributed to the change in values and attitudes from agricultural or industrial to post-industrial and urban emphasising the amenity outputs from forests, the demand for and production of wood-based forest products have also substantially increased.

realising public objectives in the field of urban green space policies. This means that while some regulative instruments relevant for private properties may exist, municipal administrations prefer to transfer land into public property if areas are needed for realising larger scale objectives, especially in the context of urban green space strategies. This development can be seen as slightly in contradiction with general forest or green space policies at national levels. In realising public objectives on a wider scale on private lands, a trend towards the development of innovative financial policy instruments (e.g. conservation contracts, agro-environmental tools, and taxation-related instruments) can be seen.

In this context, it is also interesting to note that NGOs, which are well organised and especially active in urban regions, put relatively little pressure on private areas, which are not used for agriculture or forestry, when it comes to realising public objectives. While there is some criticism regarding freely accessible green space in urban regions, mainly in countries without everyman's rights of access regimes, this criticism does not lead to a demand for changing the legal framework. It is voiced in demands for allocation of more resources to enable municipal authorities to buy more land from private owners.

Plantations in Europe – from Tree Farming to Cultivated Forests

In the UN-ECE/FAO *Forests resources Assessment 2000*, plantations are defined as forest stands established by planting or/and seeding in the process of afforestation or reforestation. They consist of either introduced species or intensively managed stands of indigenous species which meet all the following criteria: one or two species at a plantation, even-aged, and regular spacing (UNECE-FAO 2000).

However, especially in the European context, the distinction between plantation and natural forests is not always clear. Intensively managed mono-crops of exotic eucalypts on former agricultural fields are easily identified as plantations, but enrichment planting of indigenous species on cut-over forests is more difficult to classify. In slow-growing Mediterranean, temperate, or boreal forests, a planted and a natural stand may be virtually indistinguishable after several decades (Evans 1992).

In addition, the definition of plantation forests covers different types of forests according to their main function or management strategy: forests for wood production, but also for soil protection, wind control, agro-forestry, etc. Arbez (2001) proposed the term "cultivated forest" to avoid the reduction of plantation forests to industrial forests, where the idea of cultivated forests would involve society driven management, multidimensional objectives, and a sustainable management approach (Arbez 2001).

Plantation forests' share of the forest resources is relatively small in Europe (only 3%). They amount to 17% of the global plantation area (FAO 2001). Given the rapid development in other regions of the world, especially Asia and South America, however, the relative importance of plantation or cultivated forests in an overall European context is not likely to increase dramatically. In some European regions, however, cultivated forests have gained increasing importance over the past decade, namely in the Medi-

terranean region in the South and the Atlantic region in the West. In both regions growing conditions are better than the European average.

Vast regions of Portugal and northern Spain, as well as South-Western France, where suitable edaphic and climatic conditions for cultivation forestry can be found, are undoubtedly the "El Dorado" of intensive forest plantation in Europe. This can be exemplified by the 5 million ha of fast growing species located in that part of Europe (Arbez 2001). The transition to plantation forestry has benefited from recently abandoned agricultural lands and a very dynamic wood industry sector in the region. The trend towards tree planting is expected to continue in the Mediterranean region, driven by different needs and demands in different sub-regions and within each country.

Promising economic returns on tree planting have been realized in some locations for several decades, especially in the advantageous areas of northern Portugal and Spain and the South-East of France, where biological growth rates are high (10 to 20 m^3/ha) and large areas of abandoned agricultural land have been available to plant new forests. In these areas, the general trend to high-yielding planted forests might receive additional momentum from environmental concerns, which have resulted in harvesting prohibitions in some old-growth and secondary forests and regulations that make such harvesting more expensive. As the environmental movement continues to exert pressure for the protection and setting aside of more native and natural forest areas, less of this type of forest is available for logging, and the costs of obtaining wood from these sources are rising.

14.5 Forests, Society and the Environment in the European Context

In the past decades the forests, societies, and environment of Europe have undergone considerable changes. Practically none of these changes were foreseeable when the management plans for today's existing forest resources were initially devised, or when the majority of today's forests were planted or replanted after previous harvesting.

Increasing Demand for Forest Products and Services

Societies have developed from agricultural to industrial, to today's post-industrial stages, yet examples of all three main forms can still be found across the continent. In the general political framework the values of post-industrial and urban societies are clearly dominating.

While the majority of societies have developed away from ideas of production-dominated management, the demand for traditional wood-based forest products has increased and production has followed. One of the most recent developments, the trend towards a higher share of renewable energy in Europe's energy-supply portfolio, is just an example of the trend to a more sustainable society creating even more potential demand for "traditional" forest products.

At the same time, post-industrial societies are demanding amenity services from forest resources and have also questioned the legitimacy of once traditional forest management practices and regimes in the light of the new paradigm of sustainable use of forest resources. For European societies forests are one of the most essential elements of "the Environment", with a high potential for symbolism and emotional bonds, especially for the politically dominant majority of urban minded citizens. The influence of urban values on European forestry is also increasing because a growing number of private forest owners live in urban rather than rural areas.

Demands for Participation

European societies are linked in a general trend towards more open and more democratic modes of governance in all aspects of life (see Chapter 4 for change in the governance of forest resources). In the European context, the role of environmental and social NGOs in determining forest policies is ever increasing. Even in countries currently dominated by more authoritarian trends in public policy, the power of international NGOs can be felt in the multitude of co-operative initiatives in the context of forest policy.

Major Environmental Changes Affecting Forestry

While the details of magnitude and consequences are still being discussed, global warming is one of the main accepted "paradigms" determining national and international environmental policies. In the forest sector, this has resulted in new demands for seemingly "old" products (bio-energy) as well as an upcoming demand for the new service of carbon-sequestration; both of these are intrinsically linked to policies fighting global warming. The fact that the demand for these two specific services has developed only over the past two decades (traditional use of bio-energy in the form of fuelwood is left aside in this observation), demonstrates how rapid environmental developments and the related social and economic factors can have impact on the forest sector. On the other hand, climate changes also pose formidable challenges to future forest management,

when traditional approaches to species selection and stand treatment may have to be reconsidered in the light of assumed climate change scenarios.

Changes in Forestry Affecting Societies and the Environment

While the major technological changes in the forest sector over the past decades were the consequence of general social and economic developments, they have resulted in changes in societies and their environment in many European countries. The widespread rationalisation of all phases of production, from the forest to bulk-processing mills and consumer product production, has resulted in a decreased number of employees in the forest sector, but has simultaneously increased the labour safety and quality as well as professional status of new jobs created by these technologies. The most drastic example would probably be to compare a logger of the early 20th century with a harvester-operator of the early 21st century.

Technological changes have also new approaches to forest management, resulting in different impacts on the environment. While high levels of automation allow for large scale operations in short time, they are also the prerequisite for many of the small scale approaches favoured in more "adaptive" approaches of forest management. An important factor in this context is the prerequisite of appropriate infrastructure not only for the use of modern technology, but also for the use of small scale approaches. And like technology, infrastructure, in the form of forest roads for example, may have positive as well as negative impacts on the environment. Infrastructure can function either as an access route for further forest destruction and land-use change, especially in areas suitable for agglomeration, or as a lifeline for remote rural communities, which in many areas of Europe are facing the problem of depopulation and abandonment.

Forests, Society and the Environment in Europe – Eternally Linked

As this chapter shows, it is not possible to analyse the developments of forests, society, and the environment in Europe separately; they are linked and will continue to be so. Forests are a major element of the environment in Europe, covering some 30% of its territory. Forestry as the set of society's institutions devised to deal with the conflicting interests in forest resources, their use and protection, is constantly forced to adapt to changing developments in society. The turbulent political history of 20th century Europe has resulted in several major changes. With Europe's forests being largely in temperate and boreal areas, with a comparatively long succession as well as economically determined rotation periods, the institutional framework for the management of the forest area has changed a number of times, sometimes even within one human generation. The latest change in the main paradigm of forestry in Europe towards "sustainable management of forest resources" has been more evolutionary than the more revolutionary political developments of the last two decades. However, the change is of such magnitude that it will still take considerably more time for its consequences to be read in international declarations and new legislation, and realised throughout the vast diversity of different forest ecosystems in Europe.

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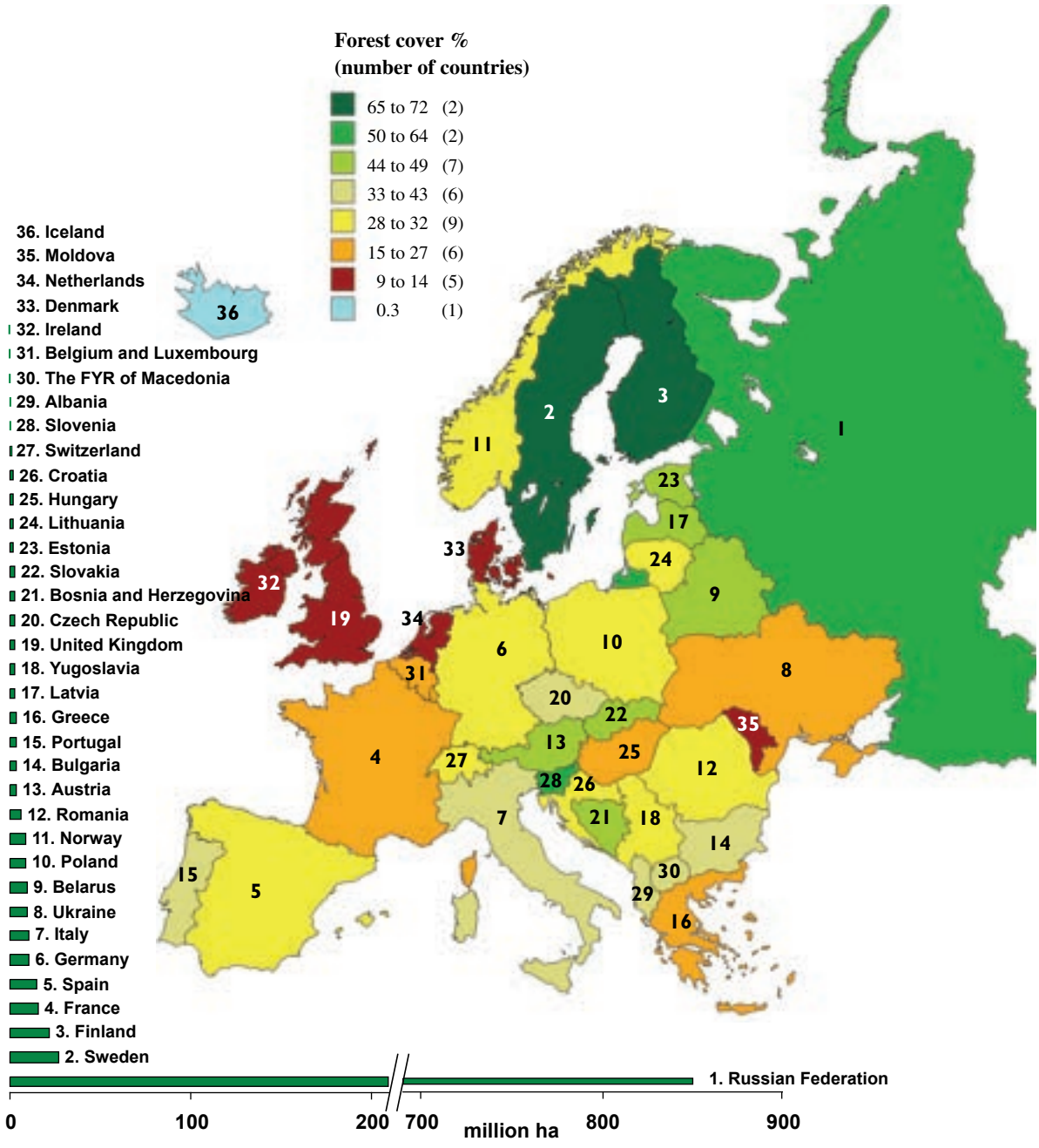
Map 14.1 Forest cover in Europe (percent of land area) and total forest area per country (countries over 50 000 ha) (Data: FAO FAOSTAT 2005; map designed by Samuel Chopo)



REGIONAL FORUM IV

15 Changing Paradigms in the Forestry Sector of Latin America

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Abstract: Changing paradigms related to *forests, society and environment* in Latin America are analyzed and discussed. A simplified overview of interrelations among different stakeholders and factors, in an ideal case of a sustainable forest sector, is presented. Utilizing this overview, a selected number of changing paradigms are suggested; they relate to forest users, the forest resource, markets and commercial aspects, the institutional settings, the political-legal framework, and social and cultural considerations. Examples of these changing paradigms are provided from throughout Latin America, and persisting problems, challenges and limitations impeding desired success are discussed. The paper concludes that sustainable forest management requires adequate progress in all dimensions and necessary conditions. The complexity of sustainable forestry management indicates the importance of multi-stakeholder platforms for strategic and operational planning, and a shared implementation of progressive initiatives. Cooperation within these platforms creates invaluable opportunities to objectively evaluate progress towards SFM in all its dimensions. Above all a true commitment to greater participation in SFM is required, reflected in an enabling environment that facilitates rather than hinders this participation.

Keywords: Empowerment; rural enterprises; monitoring; adaptive management; certification; plantations; governance; decentralization; multi-stakeholder platforms; Latin America.

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15.1 Introduction

Latin America is home to the world's largest continuous tropical forest (Amazon basin), and one of the most threatened tropical forest biomes (Central America, with a deforestation rate of 1.9% annually, FAO 2001). In both Central and South America, montane forests have suffered severe degradation and are considered one of the most endangered forest types. The establishment of plantation forests has been quite variable across the region, with a few countries standing out in terms of hectareage and industrial use of plantation wood (e.g. Brazil, Chile, Argentina). In Central America, the use of trees outside of forests has grown in importance (Kleinn and Morales 2002), and abandoned and degraded agricultural and grazing lands are often converted into secondary forests. These degraded lands are also often used in plantation programs.

As diverse as Latin American forest types are, the corresponding social, cultural, institutional, and economic settings within which forest use and protection take place are equally diverse. Much effort has been made in the last few decades to reduce forest loss and degradation. On account of the existence of diverse interests (often perceived as conflicting), approaches to promote and achieve forest conservation have varied over time among different constituents of society. Nonetheless, it has become increasingly clear that the problems that confront the region's forests are complex, involving social, economic, cultural, institutional, technical, ecological and policy dimensions. Few would deny that the fate of many of the region's forests are intrinsically tied to the widespread problems of poverty, population growth, expansion of the agricultural frontier and marginalization of sectors of society living in or near the greatest concentrations of forest. Policies that favor and often encourage the

conversion of forests to other uses have also had a major impact on the resource, as have the existence of weak, unstable institutions; these have tended to prohibit rather than stimulate forest management, and have contributed to governance problems and lack of transparency of the forest sector in many Latin American countries.

This shared awareness of the complex nature of the relationship between society, the forests and the environment, and the fact that many initiatives to date have had at best limited success, have been the major forces behind changing paradigms related to forest use and conservation. In addition, the growing expansion of areas devoid of continuous forest or undergoing processes of fragmentation has created the need to develop new approaches to conserve the functions, services and economic benefits forests can provide.

15.2 An Overview of a Sustainable Forest Sector

Before embarking on a discussion of the aforementioned changing paradigms, we present an overview of interrelations between important stakeholders and elements in an *ideal case* of a sustainable forest sector, describing stakeholder capabilities and interrelations among them necessary for sustainability to be achieved.

- Forest users or owners (peasant and indigenous groups, private companies, governments, etc.) carry out appropriate management activities, play an active role in forest protection, market goods and services from their forests, and manage their rural enterprises. These stakeholders incorporate their objectives and knowledge in participatory planning exercises and contribute to a multiplier effect of successful experiences. In this context, diverse rural livelihood strategies lead to alternative pathways to sustainable forest management.
- The natural forests or forest plantations provide a wide host of benefits and services (local, regional and global). They also generate wood and non-wood products for local use and diverse markets. Appropriate communication and exchange of information among stakeholders that participate in the forest and wood products supply chain ensure that transactions are fair and transparent.
- Public institutions, non-governmental organizations, and commercial service providers offer appropriate technical assistance, incentives, credit, and other resources to the aforementioned forest users to facilitate their participation in sustainable forest management. Public institutions also strive to promote appropriate legislation and regulations and ensure adequate control of illicit activities. Environmental groups enter into constructive debate to seek viable options to harmonize conservation and commercial interests in forests.
- Universities and technical schools develop dynamic programs that respond to evolving demands of the forestry sector. These centers of higher education seek to generate technicians and professionals with the knowledge, attitudes, and skills required to contribute to sustainable forestry development, including the ability to interact with forest-users.
- Existing and potential markets indicate which products, species and environmental services have commercial potential and thus are a source of crucial information to orient appropriate management decisions on forests and plantations. These markets generate adequate income to encourage a long-term commitment to forest conservation and management and recognize all costs and benefits derived from forest management.
- Society is the end user of the products and services, and influences both the supply chains and the institutional arrangements so that they better fulfill society's needs. Society also has a need to use other natural resources (agricultural products, minerals), but these other uses are balanced according to the society's needs and the land's potential following participatory land use planning backed by clearly defined land tenure arrangements.
- The indicated interrelations take place in an enabling political-legal framework, which facilitates and favors legal management activities and commercial transactions. Furthermore, appropriate mechanisms are created to make sustainable forestry viable in distinct social and cultural contexts. Perverse policies within and outside the forestry sector, which encourage forest destruction, are identified and eliminated over time.
- Continuous analysis and dialogue in multi-stakeholder platforms ensures the identification of constraints to sustainable forest management and agreement on strategies to overcome them.

When in an increasing number of cases the relationships among forest users, the forest resource, and other participants in the forest products supply chain are positive, greater interest in involvement in sustainable management of forests is encouraged, both within and across communities. These positive relationships also result in public institutions, non-governmental and international organizations, and centers of higher learning meeting their institutional objectives of maintaining a balance between forest conservation and poverty reduction, both essential elements of sustainable development.

From this simplified overview one can appreciate the complex nature of sustainable forest management, involving a wide host of stakeholders and elements and the interrelations among them. Forestry paradigms in Latin America change to enhance the capabilities of these stakeholders to carry out required tasks and improve the interrelations among them so that involvement in forest management becomes an attractive alternative to other land uses. Using this overview as a reference, the following changing paradigms will be examined:

Forest users

- From participation to empowerment.
- From an emphasis on sound forest management to one on the competitiveness of forest enterprises.

Forest resource

- From an emphasis on technical planning of forest management to adaptive management based on continuous monitoring.
- From management of primary forests to management of forest fragments, degraded forests and secondary forests.
- Changing paradigms related to forest plantations.

Markets

- From focusing on a few high value species for export markets to increasing sales of diverse natural forest and plantation species.
- Growing importance of payment mechanisms for forest environmental services, set up by governments, donors or local groups.
- Emergence of certification linking buyers and sellers of timber from well-managed sources.

Institutions and NGOs

- From centralized control to decentralization and greater local participation in management and control.

Political and legal framework

- Growing emphasis on governance reform.

Social and cultural context (discussed in the section on forest users)

- Increasing empowerment of indigenous groups and community organizations.

Overall context

- Increasing importance of multi-stakeholder platforms for planning and debate.

In this article, we present a sampling of some of the more important initiatives in Latin America, which illustrate these changing paradigms, aimed at increasing the contribution of forest resources to sustainable development and poverty reduction. Persisting challenges and problems will also be indicated.

Table 1. Forest resources in Central and South America. Figures are recent estimates derived principally from FAO (2001). Updated population figures are found in PRB (2004).

Country/area	Land area	Forest area 2000					Area change 1990–2000 (total forest)	
		Natural forest	Forest plantation	Total forest				
	1000 ha	1000 ha	1000 ha	1000 ha	%	ha/capita	1000 ha/ year	%
Argentina	273 669	33 722	926	34 648	12.7	0.9	–285	–0.8
Chile	74 881	13 519	2 017	15 536	20.7	1.0	–20	–0.1
Uruguay	17 481	670	622	1 292	7.4	0.4	50	5.0
Bolivia	108 438	53 022	46	53 068	48.9	6.5	–161	–0.3
Brazil	845 651	538 924	4 982	543 905	64.3	3.2	–2 309	–0.4
Colombia	103 871	49 460	141	49 601	47.8	1.2	–190	–0.4
Ecuador	27 684	10 390	167	10 557	38.1	0.9	–137	–1.2
French Guyana	8 815	7 925	1	7 926	89.9	45.6	n.s.	n.s.
Guyana	21 498	16 867	12	16 879	78.5	19.7	–49	–0.3
Paraguay	39 730	23 345	27	23 372	58.8	4.4	–123	–0.5
Peru	128 000	64 575	640	65 215	50.9	2.6	–269	–0.4
Suriname	15 600	14 100	13	14 113	90.5	34.0	n.s.	n.s.
Venezuela	88 206	48 643	863	49 506	56.1	2.1	–218	–0.4
Total S America	1 754 741	875 163	10 455	885 618	50.5	2.6	–3 711	–0.4
Belize	2 280	1 348	3	1 351	59.2	4.9	–36	–2.32
Costa Rica	5 106	1 968	178	2 146	42.0	0.5	–16	–0.77
El Salvador	2 072	121	15	136	6.6	0.02	–7	–4.60
Guatemala	10 843	2 850	132	2 982	27.5	0.2	–54	–1.71
Honduras	11 189	5 383	48	5 431	48.5	0.8	–59	–1.03
Nicaragua	12 140	3 278	46	3 324	27.4	0.6	–117	–3.01
Panama	7 443	2 876	40	2 916	39.2	0.9	–52	–1.65
Total C America	51 073	17 824	462	18 286	35.8	0.46	–341	–1.91

15.3 Sustainability in a Complex and Problematic Region

Forest Resources

The forests in Latin America cover an estimated 960 million hectares and represent 46.9% of the region's surface (Table 1). Over 11 million hectares of plantations have been established, with 260 to 370 thousand additional hectares being planted annually. At the same time, forest loss continues at an alarming rate: an estimated four million hectares are deforested annually and in most countries, little progress has been made in reducing deforestation (FAO 2001).

Forest cover in Central and South America is far from uniform across the Region. In tropical regions, Suriname, French Guyana and Guyana have the highest percentage of forest cover, with 80% or more of their total land area in forests. The Amazonian region of Brazil still boasts with 85% forest cover, and vast areas of forest are still found in the tropical lowlands of Peru and Bolivia. In Central America, the greatest concentration of natural forests is found on the more humid Caribbean side of the isthmus, especially in Honduras, Nicaragua, and the northern part of Guatemala and Belize.

Throughout the Region, ecological zones such as wetlands, coastal forest formations including mangroves, highland forests, and dry or semi-dry forests, are under enormous deforestation pressure. In some countries, the original forests in these areas have been eliminated almost entirely.

Deforestation and forest degradation are the main problems facing the forestry sector in almost all Latin America countries, resulting from conversion of forest lands to agricultural uses (policies and market incentives have often encouraged this conversion), urbanization, government-sponsored colonization (in Guatemala, Nicaragua, Ecuador and Brazil, for example), and improved access provided by the construction of new roads without the land use planning and control structures necessary to prevent widespread settlements. Structural adjustment policies, such as reduction of currency exchange rates and trade liberalization favoring agricultural exports, have contributed to the conversion of forests to agricultural use (Kaimowitz et al. 1998). In the Amazon, deforestation has long been prevalent along main river courses, and rapidly spreads along the increasing road network, and around areas of previous deforestation (Pacheco 2002). Concessions to oil companies (Ecuador) and narcotics cultivation and processing have also been extremely deleterious to tropical forests in Colombia, Peru, and Bolivia (US State Department 2004). Hydroelectric dams, mines (e.g. Carajas in Brazil), and other large infrastructure projects have claimed an additional toll on forest cover in the Brazilian Amazon (Laurance et al. 2001). Behind many of these land use changes lies the perception that the value of forest products and services is not competitive with that of other land uses.

On the fringes of natural forests, deforestation and degradation of forests have resulted in the creation of fragmented landscapes with forest remnants (Perdomo et al. 2002; Kattan 2002). These extensive areas have created unique and difficult challenges, such as how the ecological functions of these forest fragments can be conserved or enhanced at the landscape level and how these forests can be managed in an economically viable manner, especially by small landowners, without converting them to other land-uses.

Governance and Policy Considerations

One of the basic problems that affects many countries in Latin America is the limited capacity of governments to control what occurs in remote forested regions. This common deficiency, coupled with the widespread problem of corruption, has often led to unsustainable levels of illegal logging. Richards et al. (2003) reported consensus estimates of clandestine production exceeding 70% for tropical hardwoods in Honduras and Nicaragua and 35% in Costa Rica (Campos et al. 2001). Similar levels have been reported in other Latin American countries. Illegal logging results in unfair competition, reduces prices for timber, and results in the extraction of valuable species from forests that could be placed under sustainable management.

Many countries in Latin America have a dispersed and/or unclear forest policy framework, which further weakens the effectiveness of the public sector. Many countries have struggled for years to establish or update their forest policy framework (Honduras, Nicaragua and Peru, for example), often seeking to separate them from agricultural or mineral policies that received higher priorities of the governments (Ecuador for example, Pool et al. 2002). Similarly, forestry development in Brazil has been hindered by the instability of forest policy and institutions. When the incentives program for plantations ended, Brazil was left without a well-defined forest policy. Indeed, issues related to forestry became a mere appendix of environmental policy, and forestry development considerations were placed aside. This situation changed in 2000 when the government drafted the National Forest Program, which once again addressed forestry development issues. The weakness of the Brazilian forest policy framework is reflected in the estimate that only two percent of harvested timber comes from forests managed according to regulations. Another 80% is quasi-legal but harvested without management plans or technical supervision (Pool et al. 2002). Additional problems have arisen due to complex legislation, and conflicts and redundancies between federal and state legislation.

BOX 15.1 Forest Concessions in Guatemala

Fernando Carrera

In 1990, the Congress of the Republic of Guatemala approved the creation of the Mayan Biosphere Reserve (MBR), delegating its administration to the National Council of Protected Areas (CONAP). The creation of the MBR resulted in several peasant communities finding themselves within the reserve, a situation that generated a series of social conflicts once free access to natural resources was prohibited (CONAP 2002). As a consequence, illegal logging of valuable species increased by "motosierristas", and a disordered expansion of the agriculture frontier advanced unimpeded.

Because of this situation, the strategy adopted by CONAP in the Multiple Use Zone (ZUM) of the Reserve was to award long-term use rights (25 years and renewable) to management units, through concession contracts which clearly defined benefits and responsibilities. The principal benefit was the exclusive right to natural resources in the sustainably managed management unit. At the same time, concessionaires were made responsible for the integrity of the concession. To ensure good management, CONAP demanded that the concessionaires obtain certification from the Forest Stewardship Council (FSC) by the third year of the concession, and maintain it from then on (CONAP 1999).

At present, rights to 14 management units have been awarded to community groups (12 units, 400 171 ha) and to industrial concessionaires (2 units, 131 327 ha). Of this total, 488 962 are certified by the FSC or in an advanced stage of the process (Carrera et al. 2004). Initial results indicate that areas managed as concessions are better conserved than some neighboring national parks. There have been fewer problems with fires, less conversion to agricultural uses, and better control of illegal logging. The concessions have also resulted in greater social and economic benefits, and have been a catalyst for strengthening organizational and technical capacities of participating community groups (Carrera et al. 2000).

Initial success of this process has been favored by a number of factors, including:

- Existence of forestry resources of sufficient quantity and quality;
- Political decisions and support for the granting of natural resource concessions within a biosphere reserve as a strategy of conservation and development;
- Financial support from the international community to help finance the initiation of the process;
- A sound technical proposal for diversified forest management utilizing an adaptive management approach.

Even with the notable progress made, the process can still be considered young and unconsolidated. The principal bottleneck relates to the community groups' lack of business administration skills. Nevertheless, there have been important advances in this direction, reflected in the fact that many community groups have evolved from being mere producers of standing timber, to entities involved in more advanced activities of timber extraction and the transformation of wood and non-wood products.

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Where favorable policy environments have been developed – for example, in Guatemala and Bolivia – progress has been accomplished in a relatively short period of time by strengthening governmental structures to monitor and control, by establishing mechanisms to secure tenure and marketing of products and services derived from responsible forest management, and by favoring participation of indigenous groups, peasant and community organizations in natural forest management (see Boxes 15.1 and 15.3).

A rapidly growing number of protected areas are being established in Latin America to conserve forests, biodiversity, and other environmental services. Camino et al. (2002) refer to 203 million hectares of protected areas in the region, some in forests and others in savannas, coastal environments and deserts. Management of these areas is often precarious, due to insufficient personnel, low budgets, and a general lack of control of illicit activities. Forest protection in community concessions in the Mayan Biosphere appears to be more effective than that in adjacent protected areas (Pool et al. 2002; Carrera et al. 2004).

Land tenure issues and/or long-term forest use rights have figured prominently in forest development in Latin America, and continue to do so. Decades have been spent obstructing the participation of peasant and indigenous groups in natural forest management. It was not until the 1990s that these sectors of society were granted the opportunity to play a proactive role in forest management and conservation in Guatemala, Bolivia, Honduras, and Brazil through the granting of long-term concessions and/or the legalization of traditional lands. Territorial disputes and the lack of secure land tenure are still widespread in Latin America, greatly limiting the participation of potentially interested groups in forest management and reforestation.

BOX 15.2 THE CHILEAN PALM TREE: AN ENDANGERED SOURCE OF NON-TIMBER FOREST PRODUCTS

Luis González

The Chilean Palm *Jubaea chilensis* (Mol) Baillon is one of the scientifically most valuable species in the Chilean native flora. It is the only member of the *Genus Jubaea*, in the family *Aracaceae*, which is adapted to temperate climates, tolerating frost and even occasional snowfall. This palm is important because of its environmental and biodiversity values, and as a source of non-wood forest products of traditional importance to the rural population. Fruits or seeds are harvested directly from the tree or collected from the ground. They are eaten fresh or candied, and can be stored for years. The sap traditionally has been obtained from the trunk by felling the tree, although it can also be obtained in a sustainable manner (Mesa Noda 2001). The sap is then concentrated and boiled down to a syrup known as palm honey.

According to data collected around the beginning of the 19th century, the population of this palm was estimated at 5 000 000 trees. The trees were distributed throughout the dry lands between the coastal and interior mountain ranges of Central Chile (between 30 and 35 degrees of latitude South), usually growing in sandy, well-drained, moderately deep to deep granite rock-based soil, and mainly on northern exposures. Today, the palm population is less than 125 000 trees, distributed in twelve fragmented zones. About 80% of the total population is concentrated in two zones: La Campana National Park (Ocoa) and Cocalan (Quappe 1996).

The remaining populations are subject to different degrees of exploitation. The main use of the palm is for seed harvesting, which is important to rural communities as an additional source of income. However, the harvesting is completely unregulated and villagers sell the seeds in informal local markets. The seed harvest is controlled only at Cocalan, where the industrial syrup production is centred. In the other populations, including those in La Campana National Park, harvesting is not controlled and nearly the entire seed crop is harvested.

The most important syrup producer in Chile, Cocalan Alimentos SA, produces 150 000 liters annually. Production at Cocalan is well regulated, with an average of 30 to 35 individual palms harvested per year. Harvesting is regulated through harvest plans that are revised every 5 years. The average yield of concentrated syrup per tree is 85–90 kg. When diluted to commercial grade the amount is 20 times greater. The national annual syrup consumption is estimated at 187 500 liters (Poblete 1999). Thus, in spite of a high international demand for this product, the production in Cocalan can only barely meet domestic demand. Local consumption as well as world syrup consumption has remained stable during the last few years (Centro de Comercio Internacional 1986).

Due to the lack of reliable information, fruit production and potential consumption cannot be easily estimated and forecast. Informal trade and unregulated harvesting, done mostly by clandestine collectors, prevents the gathering of production statistics and makes the estimation of collected volumes difficult.

The two main reasons for the drastic reduction in palm population are the collection of seeds and the elimination of the palm's natural forest habitat. The collection of the seed crop prevents regeneration. Because of repeated harvests of nearly the entire seed crop, most remaining palm populations are composed mainly of adult and very old trees, with almost no young siblings. Regeneration occurs mainly in isolated areas with difficult access, areas which seed harvesters cannot reach (Michea 1993). Reproducing the Chilean palm requires very specific ecological conditions, including the protection of an over storey nurse layer during germination and early establishment. Massive destruction of the habitat occurred in the 1850s, when large tracts of land were cleared for growing wheat for export to California and Australia.

Until the end of the 1970s, it was generally believed that the reduction and fragmentation of palm populations were caused by exploitation of the palm trees to obtain syrup, which as noted above requires felling the trees. However, later palm population studies demonstrated that well regulated exploitation of the palm for syrup production was close to sustainable levels. This observation is supported by the fact that the remaining healthy populations are those supplying the palm tree syrup industry.

The Ocoa palm forest clearly illustrates this phenomeneon. The forest was transferred from a private syrup production enterprise to the control of the Chilean Government and added to La Campana National Park. Palm syrup production at Ocoa started at the end of the 19th century and ended in 1970, with the creation of the Park. However, palm stands within the Park are aging and have a simple, one-layer structure of adult and very old palm trees, with no regeneration. This is caused by massive illegal harvesting of practically the entire seed crop. Unfortunately, due to lack of funds, the park administration is unable to control seed harvesters within the park (Michea 1993).

This situation needs to be contrasted with conditions at the Cocalan palm tree area (Chile's second largest palm tree population), where palm syrup production started in 1878 and has continued until the present. Although some illegal seed collection also occurs at Cocalan, particularly in easy access areas, the areas dedicated to syrup production have a population structure close to that needed for a sustainable population, composed of variable age and diameter classes. Thus, the production of syrup by private industry, even though it requires tree felling, has succeeded in preserving the resource (Angulo 1985).

In many areas in Chile where impoverished rural populations' livelihood is based on degraded natural resources, the Chilean palm tree can be a source of non-wood forest products and can play an important role in poverty alleviation. This can be achieved through an active palm reforestation program in these areas.

The genetic resources of this palm need to be protected in the National Parks, where they are now threatened by illegal seed harvesting and the over-mature state of the palm population. Parks need to actively protect the palm by increasing surveillance and by planting seeds or seedlings to counteract the adverse effects of illegal seed harvesting. Otherwise, La Campana palm forest will continue to age, and will eventually disappear.

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BOX 15.3 Advancing Sustainable Forest Management through Institutional Reforms in Bolivia

Dietmar Stoian

Over the past decade, Bolivia has undergone remarkable institutional changes fostering sustainable management of the country's forests. Until the mid-1990s, timber extraction was subject to a forest concession system under the supervision of the Forest Development Center (CDF). In addition to the concessions, the CDF was in charge of supervising national parks and reserves. However budget constraints, understaffing and corruption were notorious, preventing the CDF from exerting efficient control over forest exploitation and conservation. During its first term in power from 1993 to 1997, the Sánchez de Lozada administration embarked on broad institutional reforms, including the forest sector. With the dismantling of the CDF and the promulgation of the 1996 Forest Act, a new institutional framework for forest use was established. At its core was the installation of the Superintendence of Forestry (SF), which legally succeeded the CDF. As a result, the area under forest concessions was reduced from 22 million ha to 5.7 million ha. The reasons for this reduction were the low productivity of many forests under concession, overexploitation, and overlap between concessions and indigenous territories (Fredericksen 2000). In addition, the general decentralization process was extended to the forest sector by granting more rights and resources to the municipalities. They were to establish municipal forestry units in order to identify and supervise municipal forestry areas, to which local communal groups (*Agrupaciones Sociales del Luga,* ASL) would be granted forest-use rights. These areas would be in addition to the indigenous communal territories (*Territorios Comunitarios de Origen,* TCO) recognized under the new Forest Act (Pacheco and Kaimowitz 1998).

The institutional reform process in the forest sector was accompanied by land reform under the auspices of the national land reform institute (*Instituto Nacional de Reforma Agraria*–INRA), within the framework of a law locally known as *Ley INRA*. Both the new forest and land reform acts have promoted sustainable forest management and more equitable access to the country's forest resources. By early 2004, for example, more than 1 million ha of forest have been certified according to the scheme of the Forest Stewardship Council. Several million ha, including vast forest areas, have been demarcated as TCO, granting indigenous groups access to forest resources. The case of Bolivia illustrates the positive impact of institutional reforms, not confined to forest legislation but involving the reorganization of the national forest service and embedding reforms in broader processes such as decentralization and land reform. Bolivia thus stands out among other countries in Latin America as being committed to decentralization in the forest sector (cf. Ferroukhi 2003).

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Latin America's forests are home to a wide variety of forest-dwelling people and provide a livelihood basis to millions of both rural and urban households. Extraction, processing, consumption and sale of timber and NTFPs provide employment and income along a multitude of forest and wood product supply chains (for example see Box 15.2). Forest products, in particular NTFPs, are crucial elements of livelihood strategies of rural households living in or close to forests, especially in times when alternative income, food or animal fodder is scarce (Panayotou and Ashton 1992; Ruiz Pérez and Arnold 1996).

Unfortunately, another factor that has had a great impact on rural communities and forests in Latin America relates to violence and insecurity in remote, forested regions. In Colombia the combination of political violence coupled with the related problem of the drug trade, makes progress in sustainable forestry management nearly impossible. A similar situation existed in Peru during the conflict with the Shining Path guerrilla group. Civil war in Guatemala, Nicaragua and other parts of Central and South America have all impeded social progress, without which forestry development is impossible. Sadly, the peaceful resolution of a conflict does not mean that the problem has been resolved. Violence generates violence, making true pacification a long-term healing process. Furthermore, problems of undefined land tenure and use rights, weak institutional presence, and the lack of basic services stimulate a continuation of violence and insecurity. These issues will greatly affect forestry development in many parts of Latin America for years to come (Kaimowitz 2002).

15.4 Changing Paradigms

The inclusion of changing paradigms related to sustainable forestry development in Latin America listed in this section does not imply that they have resulted in widespread changes in how forests are managed across the entire Region. They are widely expounded in current literature on sustainable forestry development and are often promoted in recent initiatives supported by local, national and international organizations. Furthermore, many of these shifts should be viewed as natural progressions from past concepts, initiatives and processes.

From Participation to Empowerment

According to Page and Czuba (1999), empowerment is a multi-dimensional social process that helps people gain control over their own lives. The recognition of the multi-dimensionality of empowerment

is important to sustainable forestry development. It includes but goes beyond traditional technical capacities strengthened in most forestry development initiatives. Empowerment implies the knowledge and authority to make and/or influence decisions in aspects critical to sustainable forest management, such as:

- use and conservation of forest and other resources,
- objectives of forest management initiatives,
- business development strategies,
- use and distribution of income and other benefits, and
- capacity to foster strategic alliances.

According to Brown et al. (2002), until recently the donor community avoided involvement in the "political" for fear of appearing neo-colonial. The word "participation" was often used to avoid notions of political empowerment. There is now widespread recognition that local stakeholders, including peasant and indigenous groups, are entitled to a voice in political debate in themes that will affect their lives. Umbrella organizations of indigenous groups in Central America, Guatemala, Bolivia, Ecuador and Peru, to name just a few, have a growing and proactive role in policy and governance issues related to sustainable forestry development. In a similar manner, the role of the forest industry associations and societies of professional foresters in Costa Rica and Bolivia have been instrumental in improving forest management regulations, while lack of involvement (empowerment) of such organizations in for example Peru is one of the constraints to further improvements.

Perhaps the most important indication of empowerment of peasant communities and indigenous groups in Latin America has been the granting or clarification of land tenure in forested areas and the provision of long-term use rights. In the past decade, such developments have occurred in a host of countries in the Region including the following: community concessions in Guatemala (Box 15.1); usufruct contracts with indigenous groups and farm communities in Honduras; territorial rights to indigenous groups in Bolivia (Box 15.3) and Peru; and Brazil, where indigenous people have rights to 82 million hectares of the Amazon (Pool et al. 2002). The gradual empowerment of community groups in the Andean region has influenced the evolution of forestry development initiatives.

Although empowerment is paramount to sustainable forestry development, it is no guarantee to improvements in forest management and the success of community-based forest enterprises. A plethora of problems and unfavorable conditions make the establishment and operation of these enterprises particularly difficult. The main problems are related to, for example:

- Weak internal organizations with little capacity for business administration;
- Inadequate infrastructure and public services including education, health care, road network, communication, electricity and water;
- High transport costs;
- High transaction costs, in part due to lengthy and unclear bureaucratic procedures;
- Inadequate availability of effective technical, business development and financial services; and
- Governance issues, which affect timber prices and the security of commercial transactions.

The following paradigm shift is a part of collective efforts to empower peasant and indigenous groups as well as other small and medium scale forest enterprises (SMFEs) to manage and consolidate their rural enterprises.

Emphasis on the Competitiveness of Forest Enterprises

Until recently, capacity development in forestry development programs has tended to concentrate on technical dimensions of tree establishment and forest management. Much has been learned from these initiatives and there are a large number of examples in Latin America of rural communities, families and indigenous groups as well as SMFEs who are successful in planting trees and applying reduced impact harvesting techniques in natural forests. Technical competence, however, is only one of the skills required to consolidate a successful rural enterprise based on forest resources.

Throughout Latin America more emphasis is now being placed on strengthening business management and marketing of forest products in community organizations and SMFEs. Different strategies have been applied to achieve this, varying with local existing capacities, access and scale of the forest resource, and targeted markets. In Costa Rica individual private forests are too small to generate a regular flow of products that can access lucrative international markets, nor can small owners develop autonomous expertise in forest management. Several organizations have been formed (for example the Fundación de Desarrollo para la Cordillera Volcánica Central, FUNDECOR, and the Corporación para el Desarrollo Forestal de San Carlos, CODEFORSA) that provide management services as well as support to facilitate market access. In the case of FUNDECOR, the assistance provided facilitated a group certification of forest management, as well as the sale of certified timber to a major (certified) door manufacturer company (PORTICO), to which FUNDECOR also provides management assistance.

In other cases, NGOs are supporting indigenous communities, with mixed results, to improve forest management, business administration and market-

ing skills to sell their products to the best bidder (for example Apoyo para el Campesino Indígena del Oriente Boliviano APCOB in Bolivia and Asociación para la Investigación y el Desarrollo Integral AIDER in Peru). In some cases companies promote forest and enterprise management skills of their providers in order to be able to comply with international standards (for example certification, where PORTICO supported a Nicaraguan company (Ubeda brothers) to achieve certification) and regulations (for example CITES recently put pressure on mahogany traders in Peru to show non-detrimental harvesting of mahogany from small forest concessions or native community reserves). In Bolivia, the Bolfor project evolved from a primarily technical and investigative phase, into a second phase with a strong orientation to the development of business and marketing skills of both companies and rural communities. In Peru, where new forest legislation calls for the implementation of forest management in small and medium scale forest concessions and in native community reserves, WWF has initiated large projects combining efforts to improve forest sector governability with technical assistance and improvement of business administration and marketing skills of the often new SMFEs and native communities.

Because this shift is relatively recent, the participation of indigenous groups, other rural communities and SMFEs is still quite limited in the global market for forest products.

From Technical Planning to Adaptive Management

Since the 1980s, experiences from Southeast Asia and studies in Latin America have shown that planning of harvesting operations helps reduce logging impacts (Hendrison 1990; Johns et al. 1996; ter Steege et al. 1996). Results from long-term trials established in the 1960s determined that silvicultural treatments sometimes contribute to productivity, as well as to the desired structure and floristic composition of the forests (de Graaf 1986; Silva et al. 1995). These pioneering efforts have led to reduced impact logging techniques and polycyclic management systems that seek to favor the recovery of the forest ecosystem as one of their planning criteria. Much of the information generated, particularly from the studies of the CELOS management system in Suriname (a method for sustainable production of high quality hardwoods in tropical forests that seeks to reduce damage to the residual stand and increase the growth of commercial species) (de Graaf 1986; Jonkers 1987; Hendrison 1990), was incorporated by policy makers in forest legislation.

In Costa Rica and Honduras, the first management plans for tropical, broadleaf forests were prepared in the late 1980s, and a model for simplified management plans was developed in 1994 (CATIE 1994). This guide built on work from Suriname, criteria and indicators developed by ITTO, and research findings from Costa Rica (ITTO 1992; Finegan et al. 1993; Hutchinson 1993). The guide proposed cutting cycles, diameter limits, and field operations. Given the limited scientific information available at that time, the response of forests to the proposed measures was largely unknown. Even so, areas under forest management plans increased from close to nil in the late 1980s (Synnott 1989) to 2.8% of forest area in the eight countries included in the Amazon Cooperation Treaty and 13% in Central America in 2000 (FAO 2001). That said, it was not until 2002 that Peru required forest concession holders to elaborate forest management plans, partially building on the Central American and Brazilian experiences.

In the early 1990s, several projects maintained permanent sample plots (PSP) in Guatemala (Louman et al. 2001), Costa Rica (Finegan and Camacho 1999), Suriname (de Graaf 1986; ter Steege et al. 2003), Guyana (ter Steege et al. 1996) and Brazil (Silva et al. 1995), to gather information on forest dynamics and the effects of logging and silvicultural treatments. The research concentrated on potential productivity and long-term changes in structure, composition and dynamics, generating invaluable information for adjusting forest management prescriptions. For example, the silvicultural refinement of the CELOS system led to increased diameter growth of commercial species, but was found to have a deleterious effect on biological diversity in less dense parts of the forest (Jonkers 1987). This finding led to an adjustment of silvicultural treatments in Surinam, while in Central America less intensive liberation treatments were adopted.

Simple yield prediction models have been developed (Alder et al. 2002) or are being proposed (ter Steege 2003), and in several countries, some forest operations have incorporated PSP as part of standard operations (Obando 2001; Pokorny et al. 2002). Data from these plots are used to compare actual forest recovery and growth with predictions from existing models, and to adjust management planning as necessary.

While sufficient knowledge is available to make good forest management technically feasible, rarely is it found in practice due to socio-economic and political constraints (Finegan et al. 1993). A commitment to sustainable forest management is reflected by a willingness to value long term-goals along with short term ones and by the implementation of protection and monitoring programs following first harvests (Amaral and Campos 2002).

Conditions and eventual impacts of forest operations are not fully known at the time of planning, and they may evolve over time. Consequently, it has become increasingly evident that in order to make informed adjustments in management prescriptions over time, apart from monitoring forest dynamics in PSP, one needs to identify and monitor critical aspects of the natural and social environment. Re-

cent research on the post-harvest performance of 24 forest management units in Costa Rica concluded that monitoring and control, as required by forest certification, and a payment for environmental services scheme (see chapter 6 of this book), were major factors leading to improved forest management (Louman et al. in press).

Innovative monitoring systems are being developed for commercial operations (Pokorny et al. 2002), for ecological monitoring of high conservation value forests (Finegan et al. 2004), and for monitoring of management within the context of the regional or national forest sector (Amaral and Campos 2002).

Widespread implementation of monitoring and control systems faces major challenges. First of all, monitoring and control implies a greater transparency of the operations. With much of the timber from natural tropical forests still coming from illegal operations, monitoring and control on a voluntary basis is unlikely, until the State improves its monitoring and control capacities and illegal harvesting is considerably reduced. Some countries have ventured into sharing responsibility for monitoring and control with the private sector. Private regents in Costa Rica and Guatemala do a reasonable job, especially those that receive institutional support from NGOs to which they may pertain (Louman et al. in press). Attempts to utilize wholly independent entities for monitoring and control – including internationally recognized organizations – has sometimes met with marked local opposition (in Ecuador, for example).

The cost of monitoring also limits its adoption, especially among smaller and/or low harvest intensity operations (Finegan et al. 2004) or where norms are inappropriate for local conditions (in the early nineties in Honduras, for example, norms for management of pine forests were applied to broadleaf forests with too few adaptations, promoting unsustainable management practices of the latter forests). In addition, the establishment and implementation of a monitoring system (Pokorny et al. 2002) and data interpretation (Finegan et al. 2004) make technical support essential. Efforts underway serve to develop monitoring systems appropriate to smaller scale and less intensive operations, where available human resources are quite limited. It is hoped that future monitoring systems will be less complex and therefore more attractive to a wide variety of organizations and companies.

Increasing Interest in Degraded and Secondary Forests

In addition to the high rate of deforestation in Latin America (1.9% in Central America and 0.4% in South America, FAO 2001), primary forests continue to be fragmented and degraded at an alarming rate. While settlers continue to enter forested lands, older agricultural areas have sometimes reverted to secondary forests, often as part of the agricultural system (Smith et al. 2002). Secondary forests are here considered to be "the woody vegetation of a successional character which develops in areas whose original vegetation has been removed as a result of human intervention" (after Finegan 1992; Smith et al. 2002). Smith et al. (2002) indicate that after several decades, about 20% of the landscape in agricultural frontier areas may be secondary and degraded forest patches. FAO estimates range from 78 to 171 million hectares of secondary forests in tropical Latin America (de las Salas 2002), largely depending on how secondary forests are defined and the quality of inventory data in a given country (Lanley 1982, cited by Sips 1993). The area under secondary, degraded and fragmented forests is rapidly expanding but the quality of these new secondary forests varies, since much of the newly forested areas are on abandoned pastures, which regenerate more slowly than abandoned agricultural land (Fearnside and Guimaraes 1996).

National policies and research and extension efforts have mainly been directed at management and conservation of primary and degraded forests (Wadsworth 1997), while secondary forests have mainly been seen as useful natural processes to recover degraded lands for agricultural purposes. Many attempts are directed at improving this potential, reducing the period during which the land is under secondary forest (Smith et al. 1999). Only in Costa Rica have secondary forests been officially recognized as such. There secondary forests cover over 400 000 hectares, almost double the area of primary production forests (Berti 2001).

Despite the general lower species diversity, more uniform structure, and smaller tree dimensions (Sips 1993; de las Salas 2002), secondary forests are considered to have good potential for the provision of goods and services (ITTO 2002; de las Salas 2002; Smith et al. 2002), some of similar or higher quality and quantity than those provided by primary forests (e.g. Chazdon and Coe 1998).

Experimental and pilot projects devoted to the management of secondary forests have shown the potential for management of fast growing timber species (Hutchinson 1993; Sips 1993; Berti 2001), non-timber forest products (Chazdon and Coe 1998), carbon fixing and storage (Ortiz et al. 1998), while studies are underway on the value of secondary forests for biodiversity conservation and restoration. Different management strategies have been suggested by Finegan (1992), ITTO (2002), de las Salas (2002) and Sips (1993), but only the Trinidad Shelterwood System has been applied on a larger scale. In this system, the full canopy cover is removed in several phases. Its success depends on the sale of all timber and the regeneration of the harvested species (Bauer 1964; Finegan 1992), a condition not met in Trinidad once the price of fuelwood could no longer compete with that of imported petrol and its deriva-

tives. From a silvicultural perspective, however, the system is well adapted to secondary forests of intermediate ages (25–30 years) that are dominated by few commercial species (Finegan 1992). In other secondary forests, polycyclic systems – based on selective harvesting followed by liberation of promising future trees – appears to be more appropriate (Hutchinson 1993; Sips 1993). In these cases, the secondary forests may over time possess structural and compositional characteristics of (intervened) primary forests.

The scarcity of good examples of secondary forest management is partly due to the same causes that limit good primary forest management – governance, poverty, forest culture, competitiveness. In addition, most secondary forests are privately owned and fragmented. The age, structure and composition of the forest patches, as well as the objectives and socioeconomic context of the owners, differ widely. These factors taken together suggest that a flexible approach to the management of secondary forests is required. Such an approach needs to draw from different management systems (Finegan 1992; Hutchinson 1993; Sips 1993; Smith et al. 2002) and involve local people, taking into account their traditional knowledge (de las Salas 2002; Smith et al. 2002).

Developments in Forest Plantations

In Latin America, the contribution of plantations to forestry sector development varies greatly across the Region. Approximately 11 million hectares have been planted in South and Central America, including both industrial and non-industrial plantations (WRI 2001). This number does not reflect the quality of the plantations established or their commercial potential. Four countries account for over 70% of this resource: Brazil (4.9 million hectares), Chile (2.0 million hectares), Venezuela (0.8 million hectares), and Argentina (0.9 million hectares). Eight of the other 13 countries in South America have more than 100 thousand hectares (Brown 2000). In Central America, approximately 300 to 400 thousand hectares have been planted: Costa Rica and Guatemala possess the greatest areas, accounting for 75% of the plantations in the Region. In this short section, a brief discussion of changing paradigms related to forest plantations in Latin America will be presented.

Plantations as a Source of Wood

The importance of plantation grown wood becomes clear when considering that while plantations account for less than 1.2% of the forested area of the Region, they supply approximately 27% of industrial roundwood produced. In Chile, with its highly advanced plantation industry, this percentage increases to 85% (Brown 2000). It is relevant to note that in 1994, Brazil and Chile accounted for 95% of all forest products exports from Latin America. Pulp and paper products accounted for 57% of this amount; most of the raw material came from forest plantations, which have been the major driving force behind forest industry development in Brazil.

The importance of non-industrial plantations is growing. In Costa Rica, where traditionally all wood has been produced in native forests, an estimated 62% of the consumed roundwood comes from plantations (Arce and Barrantes 2004). Wood produced in agroforestry systems and from trees outside contiguous forests (31%) is also important.

The conclusion of this short discussion is that plantations are producing important quantities of wood in distinctly small areas when compared to natural forests. Although it is believed that the importance of plantation grown wood will continue to increase, Brown (2000) points out that increasing production will, in most cases, only offset increasing demand and will not necessarily eliminate the pressure on natural forests. Indeed, in many cases, wood from natural forests and forest plantations supply different demands. For example, the Brazilian pulp and paper industry relies on wood from plantations. Since most forest plantations in Brazil have been established by these industries, there is no relation to pressure on natural forests.

Increased Interest in the Impacts of Plantations

Considerable debate has raged in Latin America on the impacts, both positive and negative, of tree plantations. On one side, foresters have sometimes been seen to exaggerate the potential ecological and environmental benefits of plantations, sometimes to generate support for plantation programs. Another quite vocal group perceives pure block plantations as almost universally destructive to the environment (loss of biodiversity, soil loss, water depletion in watersheds, etc.). Nevertheless, objective studies have shown that plantations are neither intrinsically good nor bad, but their impact on the environment depends on where they are planted and how they are managed (Camino and Budowski 1998).

Increased Interest in Native Species

By far, the most common species used in forest plantations in Latin America are fast growing *Pinus* and *Eucalyptus* species. This is true in both industrial and non-industrial plantations. Nevertheless, in the last two decades, there has been a growing interest in the use of native species, especially in non-industrial plantations. In highland regions of the Andes, the use of cold tolerant species that are easy to propagate vegetatively in communal nurseries has increased greatly in the 1980s and 1990s (Añazco 1996; Ocaña 1997). In the lowland humid tropics, high quality hardwoods grow well in plantations, and

much is being learned about their propagation and management (Butterfield 1995). In recent consultations with farmers throughout Central America over 1000 species were mentioned as important, including both native and exotic species, but of the 150 species deemed "most important" only 12 species were exotic (Cordero and Boshier 2003).

In many cases, native species are incorporated into agricultural landscapes – sometimes in agroforestry systems – and less so in pure block plantations. The potential of native species in pure block plantations must be researched before promoting their utilization for this purpose. Valuable, native tropical hardwoods are sensitive to the same site conditions that limit the success of exotic species: poor soil fertility, soil compaction, grass competition, etc. Thus, being a native species does not guarantee success when planted in plantations.

Recognition of the Importance of Site Conditions

Millions of hectares of plantations in Latin America have failed during establishment or have grown poorly because of inadequate site selection. It is now widely recognized that commercial plantations require adequate site conditions – soil depth, drainage and fertility. These attributes can be and often have been improved with intensive silviculture in Latin America. Nonetheless, incentive programs and private sector plantation schemes using valuable hardwoods like teak have continued on marginal sites. Again, experience has shown that long-term research is important in determining the productivity of plantations species on different quality sites. In El Salvador, for example, foresters had concluded that *Acacia mangium* was a priority species for reforestation. Nevertheless one dry year brought on by the *El Niño* phenomenon led to the almost total mortality of this species (Nascimento de Almeida 1998).

A Shift towards High Value Hardwood Species

In Central America and in parts of South America (Ecuador and Brazil, for example) there is growing interest in the production of high value hardwood species, especially teak. Through intensive silviculture, including very early thinnings, rotation lengths have been greatly reduced (Galloway et al. 2001). These stands can be thinned heavily in as early as the second year. Equally intensive regimes are being utilized in *Gmelina* stands in Costa Rica (Salazar and Pereira 1998). Again, success in these stands depends on adequate site selection and intensive plantation silviculture. These stands contrast with traditional plantations that were often never thinned after successful establishment. Studies on stand dynamics and Pipe Model Theory (Morataya et al. 1998) have provided conceptual support to the development of these intensive regimes.

Use of Incentives

When capital is available in the form of incentives, the task of promoting the establishment of plantations is a relatively easy one. The discontinuation of an incentive program, on the other hand, can lead to drastic reductions in reforestation activities, which in turn result in an unreliable supply of raw material for forestry industry. For example, in the 1980s and 1990s Costa Rica implemented an increasingly successful reforestation program with diverse incentives options. The most planted species was *Gmelina arborea*, which on adequate sites and with good silviculture has attained rapid growth. Industry and research centers like the Technological Institute of Costa Rica (ITCR) worked together to develop technologies to process *Gmelina* into solid wood products, valued on both national and international markets. Unfortunately, support for reforestation has dropped off since 1995, and a major shortage of timber is already projected for 2007, placing the fledging *Gmelina*-based industry at great risk (Arce and Barrantes 2004). Clearly incentive programs have to be planned carefully, and adequate continuity is required to consolidate industries with plantation grown wood.

In 1988 fiscal incentives for industrial forest plantations were eliminated in Brazil, as was the Brazilian Institute for Forestry Development. Although Brazil was left without a fiscal incentive policy, the more consolidated industries within the forestry sector, for example pulp and paper, continued their development and looked for alternative solutions. An innovative program integrating industry and farmers has been implemented in which the company provides seedlings and other inputs for plantation establishment and a guaranteed market for wood produced, while the farmers establish and manage the plantations. Similar schemes have been implemented in Costa Rica, Colombia, Honduras, Nicaragua and other countries in Latin America, offering an attractive alternative or complement to state financed incentive programs.

Markets

Increasing Sales of Diverse Species

Timber extraction in the extensive lowland humid tropical forests follows a similar pattern throughout Latin America, first concentrating on high-value species such as mahogany (*Swietenia macrophylla*) and tropical cedar (*Cedrela* spp.), followed by the harvesting of an increasingly diverse range of lesser known species. In Costa Rica, for example, widespread exploitation of mahogany led to an outright ban on its harvesting in 1989, and a growing number of lesser-known species have found their way into the market. In Bolivia, extraction also focused

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While plantations account for less than 1.2% of the forested area in Latin America, they supply approximately 27% of industrial roundwood produced.

on mahogany and tropical cedar until the 1990s, but similarly markets have opened up for several lesser-known species. In Brazil, Peru, Mexico and Guatemala further examples of this trend are also evident.

Tapping the commercial potential of a growing number of species requires both knowledge and effective marketing strategies. For example, the Forest Product Laboratory of IBAMA in Brazil has devoted nearly three decades to researching the wood properties of lesser-known species, but while this work is important research alone will not drive the commercial diversification of species. An aggressive marketing strategy must complement research efforts. Typically however an increasingly diverse mix of species tends to be introduced into domestic markets without major promotional efforts or market development. In the course of time some species find their way into the international market, depending on product quality, export promotion, participation in trade fairs, innovative marketing strategies and proactive identification of potential buyers. Many stakeholders of the forest and wood product supply chains throughout the region lack the skills necessary to successfully penetrate international markets. As a result, most of the potentially commercial species are extracted in insignificant volumes, with the exports of wood products continuing to rely on a limited number of species.

In the international market for tropical timber, competition is fierce among producing and importing countries. In this context broadleaved species from Latin America have few competitive advantages, as compared to those from Africa and in particular Southeast Asia. Many Dipterocarp species, for example, are well introduced into the international market, available in significant volumes, sufficiently homogenous to be graded into a few categories, and offered at competitive prices. The general trend of tropical timber imports to Europe and the United States reveals preference for wood products with increasingly higher added value. Processing capacities in Latin America though are rather limited, preventing most exporters from capitalizing on this market opportunity. On the other hand China, Korea, Japan and other relevant importing countries of tropical timber show little interest in imports of value-added products and thus provide few alternatives for Latin American exporters of wood from natural forests. These countries though exhibit growing interest in plantation products originating from Latin America.

Plantation wood from Latin America faces interesting market prospects, either as softwood or as pulp and paper. The increasing area of plantations of pine (*Pinus* spp.), eucalyptus (*Eucalyptus* spp.), gmelina (*Gmelina arborea*), teak (*Tectona grandis*) and some native species has attracted the attention of Asian importers. This holds particularly true for high-value plantation species such as teak (*Tectona grandis*). Indian importers, for example, frequently visit Central America, where most of Latin America's teak plan-

tations are located. Though many plantations have yet to reach maturity, smaller dimension teak wood originating from thinnings finds ready markets. Unless growth rates of major Asian economies decrease dramatically, the import of plantation wood from Latin America should gain further momentum.

As has been mentioned, the overall trend in Central America is to produce ever more wood outside the forest, for example in pure-block plantations, and agroforestry and silvopastoral systems. As a result, natural forests may lose their importance as a source of wood, which will pose further challenges to their conservation. Given the fragmented nature of the forest landscapes in Central America and the decreasing importance of forests as wood suppliers, new modes of protection and conservation are being explored and developed (Mesoamerican Biological Corridor, environmental service payments). In South America, on the other hand, natural forests will continue to be the main source of tropical woods, and particularly in the Amazon a vast resource of potentially commercial species waits to be tapped.

Payment for Forest Environmental Services

Perhaps one of the most profound changes over the last 10 to 15 years has been the growing recognition of the importance of forest functions as potential services for humanity. This recognition has influenced thinking on forest management and stimulated greater interest in reduced impact logging techniques. It has also facilitated forest protection by identifying specific, tangible reasons for establishing protection as a management objective, and has led to an attitudinal change favoring the promotion of protection and conservation rather than its imposition. Attention is given to results, not just to the act of forest protection. In Costa Rica, for example, 1996 forest legislation recognizes four types of services: 1) carbon fixation, storage and sequestration; 2) protection of water resources; 3) maintenance of biodiversity; and 4) maintenance of scenic beauty (Costa Rica, Presidencia de la República 1996). The explicit recognition of these services strengthens the case that the production of goods and services can be achieved simultaneously, by orienting towards a more objective evaluation of the combined production. Chapter 6 of this book discusses in more detail the many services forests may provide, and one of the main challenges to the payment for environmental services (PES): establishing who pays whom, for what service, and how much (Nasi et al. 2002).

Camino et al. (2002), using information from the World Bank, estimate that approximately 28% of Costa Rica's forests value is derived from timber production. The rest can be attributed to a host of additional services provided by forests, most of which are not negotiable; their value is not captured by the people responsible for forest management and conservation – whether they are representatives of the State, local communities or private landowners. Of these additional services, only 49% provide exclusive benefits to the country, while others benefit the global community. Nonetheless, the international community contributes a scant 5% to forest management activities and maintenance of these services.

In Latin America, only Costa Rica (see Box 6.3 in chapter 6), Guatemala and Brazil have large-scale programs to compensate the provision of environmental services, while many examples exist of more local payment schemes (Camino et al. 2002), usually related to water use for hydro-electricity (Cordero and Castro 2001) or consumption (for example, Ecuador and Nicaragua, mentioned by Camino et al. 2002). Niesten and Rice (2004) propose a similar concept to conserve forests, but rather than paying for environmental services, they propose paying for opportunities lost if the forest is closed for all uses but protection. They suggest permitting a harvesting operation prior to initiating forest protection, to reduce the opportunity cost of conservation. This controversial proposal encourages discussion on an important issue. In the neotropics, a major problem threatening the viability of forest management is the protection of forests following harvesting. In the immediate period after harvesting, forest value is at its lowest. A common practice has been to continue extracting timber periodically and over time convert previously forested areas into pasture.

In Costa Rica, the government has attempted to prevent this degradation and conversion process by requiring forest owners to leave 40% of their harvestable stock in the forest, and by extending payments for environmental services during the first five years if reduced impact logging is practiced and subsequent management activities (silviculture and protection) are carried out. Payments are calculated by determining the net value of grazing on marginal lands. Even while the PES does not meet the expectations of forest owners (Louman et al. in press), this program has helped increase the general ecological performance of protected forests as well as their monitoring and control, perhaps improving the likelihood that these areas will remain forested. However, due to pressure by environmental groups, this PES scheme has been temporarily suspended to gather evidence on its effectiveness. Currently methods are being validated to determine the amount and value of services provided in different forests and other natural and man-made vegetation types.

Emergence of Certification

When forest certification began to take shape in the early 1990s, much attention was focused on Latin America. Tropical deforestation and forest degradation had come into the limelight of international debate, spurred by alarming data on large-scale forest fires in the Brazilian Amazon. Though logging of tropical timber for export was far more prominent,

and arguably more problematic in Southeast Asia and Africa, a good part of the debate centered on the questions of how to promote sustainable forest management in Latin America and the potential role certification could play.

In 1993 the headquarters of the FSC, then the only accreditation body worldwide, were established in Oaxaca, Mexico. In the following years, the US-based Rainforest Alliance with its SmartWood Program, along with other certifying bodies (e.g. Société Générale de Surveillance SGS, Scientific Certification Systems SCS, International maritime Organization IMO, International Inspection & Certification Organisation Skal), advanced forest certification of tropical forests, particularly in Latin America. By August 2004, 5.8 million ha had been certified under the FSC scheme, as compared to 1.9 million ha in Africa and 0.5 million ha in Asia (FSC 2004). For the time being, the FSC scheme has remained the predominant certification option in Latin America, despite the emergence of alternative certification schemes, such as the Paneuropean Forest Certification (PEFC).

Though originally designed as a market-based instrument, in many cases forest certification turned out to yield non-monetary rather than monetary benefits (Viana 1996; Eba'a Atyi and Simula 2002). While access to niche markets has been facilitated by the FSC label, the anticipated price premium has materialized in only a few cases. Rather, the forest certification process promoted a dialogue between different stakeholders on how best to manage forest resources, raised public awareness on the harmful impact of ill-designed and illegal logging, and directed attention to the particular needs of forest-dwelling indigenous and peasant communities.

In recent years, the Achilles heel of forest certification has turned out to be economics. This has become particularly evident in the case of certified community-based forest management, which has largely been advanced through subsidies by NGOs and development projects. Subsidies, though, were readily available only for the first cycle of forest certification. After a period of five years small-scale operations, including community-based forest management, were expected to become self-sufficient. In view of low economic returns – because most certified wood is still commercialized via traditional distribution channels that do not demand certification – many small-scale operations face difficulties to continue the certification process. Over the next two years, a significant number of community-based operations will need to seek renewal of their certificates. Given its limited monetary benefits, certification's costs of about USD 10 000–40 000 will be prohibitive, and it is anticipated that many communities will drop out from certification unless alternative sources of subsidies can be tapped, or the SLIMF (Small and Low Intensity Managed Forests) certification proceedings recently approved by FSC prove to reduce certification costs significantly.

With the exception of Mexico and Guatemala, forest certification in Latin America has been largely confined to medium- and large-scale enterprises. The case of Bolivia is representative in this respect. Its frequently cited success story, as the country harboring the world's largest area of FSC-certified natural tropical forest (1.47 million ha in August 2004), is based on 12 industrial concessions agglutinating 1.42 million ha, as compared to a single community operation covering 51 390 ha. Most of the value added through forest certification – about USD 14 million in 2003 – therefore accrues to large-scale enterprises rather than community operations. On a worldwide scale, certification has reached less than one percent of community forests, and without changes to certification systems it is unlikely to reach more than two percent of all community forests in the next decade (Molnar 2003).

In Mexico and Guatemala, certified community forestry has been greatly facilitated through clear land tenure arrangements in the form of *ejidos* and community concessions respectively. In Mexico, certified community forests include mainly low-productive pine forests, but good market links for certified pine wood have been established with the US-based Home Depot chain. In Guatemala, access to a forest concession in the multiple use zone of the Maya Biosphere Reserve has been made contingent upon forest certification (Carrera et al. 2004). In fact, this is the only case in the world where forest certification is mandatory. Supported by a variety of NGOs and development projects, certified community concessions have been the basis for the development of community forest enterprises, adding value through wood transformation. Forest certification also brought about a diversification of intermediaries, translating into higher prices paid for wood products due to increased competition for raw material (Carrera et al. 2004).

The generally voluntary nature of forest certification, along with the relatively low returns on certification investment, prove to be major challenges to the future of the certification process in Latin America. Large enterprises will continue to take advantage of economies of scale, diluting fixed costs of certification by putting large areas under sustainable forest management. Community and other small-scale operations, however, will face difficulties in continuing the certification process once external subsidies have been suspended. To reduce the widening gap between certified industrial operations on the one hand, and certified community-based operations on the other, special efforts must be made to carve out a special niche market for certified wood originating from community-based operations. Similar to the situation in the fair trade movement in the agricultural sector, marketing campaigns will have to focus on the social benefits of purchasing "fair wood", in addition to the environmental benefits generated by forest certification.

Political and Legal Framework

Decentralization and Greater Local Participation

In many Latin American countries, traditional centralized institutions in charge of administering and regulating the forestry sector have had limited success in fulfilling their mandate. Oftentimes these institutions are faced with enormous financial limitations, are undergoing a process of downsizing, have a weak presence in the field, and are weighed down by inefficient bureaucratic and administrative procedures (Pacheco and Kaimowitz 1998). The lack of effectiveness of these institutions has given rise to a widespread effort to delegate responsibilities related to forestry sector development to municipalities and other local stakeholders.

The potential advantages of decentralization are manifold: improved efficiency, enhanced local participation in control of illicit activities and in the implementation of productive ones, greater financial benefits to local groups and governments, and greater accountability. Ferroukhi (2003) directed an in-depth study of municipal forest management in six countries of Latin America (Bolivia, Honduras, Guatemala, Nicaragua, Brazil and Costa Rica). In most countries, legal steps have been taken to delegate greater control over forest resources to local governments. Depending on the country, municipalities have been granted control over a significant portion of public forests (Bolivia and Honduras), have created offices for the environment (Guatemala, Honduras, Nicaragua), or have been assigned some resources to carry out this new mandate (Nicaragua). Although these steps and others treated in detail in Ferroukhi (2003) are significant, the overall success to date is still somewhat limited. Some of the more common constraints to progress include the following:

- Lack of experience and personnel at the state and municipal level to take on required tasks. Evidence suggests that states and municipalities sometimes lack interest in forestry matters.
- Due to budgetary constraints these governments generally seek activities that generate revenue, and forestry activities are often marginal in this respect; the management of a conservation area, for example, can imply costs rather than revenue.
- Although states and municipalities have been delegated greater responsibilities, they have not been provided with necessary financial resources and technical capabilities.
- Oftentimes, even with delegation of administrative responsibility, central control predominates in the field.
- Existence of problems of corruption and illegality.

The overall impression is that local governments will continue to take on greater responsibilities in the future, although there is nothing intrinsic in decentralization that ensures improved forest management. The challenge will be to provide them with the resources, expertise and authority to carry out this expanding mandate.

In some cases, responsibilities for the administration of forests and protected areas have been delegated directly to community groups. For example, community groups granted forest concessions in the Mayan Biosphere Reserve in Guatemala are responsible for controlling illegal logging, for preventing the conversion of forested areas to agriculture, and for the protection of cultural sites. Some community groups with forest use-rights in public forests in Honduras make considerable efforts to control illegal logging in their forests.

This type of decentralization is viable to the degree that communities perceive tangible benefits from their efforts to manage and conserve forests. In some cases, the traditional emphasis on control has given way to efforts to facilitate greater responsible participation in forest management and to create an enabling environment that favors this participation. Examples of these efforts include the following:

- Creation of the community concession process in Guatemala.
- Extension of forest use rights contracts on public lands in Honduras.
- Development and utilization of simplified management plans throughout Central America.
- Institutionalization of policies for community management of natural resources in the Andean region during the last decade.
- Formation of Forest Management Committees at a watershed level in Peru.

The international donor community and NGOs have played a major role in encouraging this type of "decentralization" and have provided considerable support to initiatives in most Latin American countries in organizational, technical and more recently commercial aspects. Even with apparent political support and assistance from international organizations and NGOs, these initiatives have had varying degrees of success. In practice, many community based operations and private attempts to carry out forest management face almost insurmountable bureaucratic hurdles and lack of institutional transparency. Communities have often missed windows of opportunity for operational activities and have failed to meet commercial deadlines because of these constraints. Frustration, generated when bureaucratic obstacles and corruption make responsible forest management almost impossible, has driven many community groups to illegality.

Finally, even when promising results have been observed in pilot communities, the scaling-up of these experiences has been a considerable challenge in most countries. Community enterprises require considerable assistance, especially initially, to carry out successful forest management, establish favorable commercial relationships and administer business concerns. This assistance is difficult to provide

to numerous small communities in remote regions with poor access and an almost total lack of basic services.

Governance Reform

As Brown et al. (2002) point out, "Achieving good governance dominates today's development agenda". Certainly this assertion is true for forestry sector development, which requires improvements in institutions and policies and the creation of a favorable enabling environment. Although an in-depth discussion of "good governance" is beyond the scope of this section, it entails among others the following concepts, principles and conditions (several taken from Brown et al. 2002):

- Subsidiarity: decisions should be taken at the most appropriate level; this is a concept closely linked to participation and a strong argument for decentralization and empowerment.
- Establishment of tenure rights over the resource, even in an intermediate form.
- Opportunities for participation in public debate and processes of conflict resolution.
- Equitable and transparent relationships among stakeholders for making and implementing management decisions and for distributing benefits. Less bureaucracy, stability of rules, legislation and institutions.
- Adequate valuation of environmental, social and financial benefits of forests, particularly forests on public lands, including timber value and harvesting rights.
- Public accountability of institutions, private sector entities and other organizations.
- Compatibility of federal, state and municipal legislation.
- Control of corruption.
- Adequate implementation of existing policies, regulations and laws.

As Brown et al. (2002) state,

"Forestry's inclusive focus, linking global to national and local; the centrality of issues of tenure and collective rights; and its importance in rural livelihoods, all reinforce the linkages between good governance, public accountability and poverty alleviation."

Attention is being given to all these concepts, principles and conditions in Latin America. Several examples of the granting of land tenure and/or use-rights have been provided. Much effort is also being made to better understand the problem of illegal logging, and its relation to corruption and institutional and policy frameworks (Richards et al. 2003). As has been pointed out, one of the potential benefits of decentralization is greater public accountability.

Throughout the Region, different types of organizations have been created which provide rural communities and indigenous groups a greater voice in public debate on aspects influencing forestry sector development, for example ACICAFOC (Asociación Coordinadora Indígena y Campesina de Agroforestería Comunitaria Centroamericana). In Honduras and Nicaragua, operational networks for horizontal cooperation have been established. These seek to augment the successful participation of rural communities in the conservation and management of tropical, broadleaf forests (community and indigenous groups participate in these networks).

Community forestry development initiatives throughout the Andean region of South America have vastly increased the incorporation of indigenous and peasant communities' perspectives into policy formulation and implementation (FAO 2003). Indeed a recent trend has been the institutionalization of policies for community management of resources in this region (Kenny-Jordan et al. 1999). Unfortunately, even with the progress to date, many of the problems that have given rise to increased interest in governance issues persist: corruption, illegal logging, lack of transparency and agility in bureaucratic procedures, the persistence of unclear land tenure and use rights, inadequate implementation of existing policies, especially on the agricultural frontier, etc.

Apart from these problems widely addressed in the literature, peasant and indigenous communities involved in forest management face a myriad of other threats to the success of their rural enterprises. These problems can be considered problems of local governance. Some examples are:

- Unscrupulous buyers underestimate wood quality and volume.
- Reduction of agreed-on prices at the moment of commercial transactions.
- Lack of transparency and adequate participation within the communities in commercial negotiations.
- Buyers exploit lack of knowledge of market opportunities.
- Payments made with checks without funds.
- Imbalances in power between buyers and sellers.
- Assault and robbery are common in rural areas, especially when large sums of money are being carried. Often a general lawlessness predominates in remote rural areas, sometimes as a sequel to political conflict.
- Poor utilization or theft of funds within community organizations.

These problems greatly reduce the benefits perceived from forest management, undermining the interest and commitment of rural communities to participate in forest development activities.

15.5 Linking Forests, Society and the Environment – Conclusions

The previous discussion has shown clearly that the advancement of sustainable forest management is a complex endeavor involving social, cultural, biophysical, technical, ecological, institutional, political and commercial dimensions. Considerable work and progress have been made at least somewhere in Latin America in each of the dimensions listed, and many notable efforts have been described in this chapter. The following list indicates some of the more important examples of progress in SFM in the region:

- A growing number of peasant and indigenous communities are now actively managing their forests with internationally accepted technical criteria.
- Considerable knowledge has been generated and published on the ecology and dynamics of natural forests throughout the region. Much of this knowledge has been used to develop silvicultural strategies for different species and forest types.
- Great strides have been made in developing technologies for plantation-based forest enterprises, including some of the most productive plantations in the world. At the same time, much progress has been made in developing propagation techniques for native and exotic species using technologies appropriate to poor farmers and communities.
- A large number of people have taken part in technical courses and higher education in forestry and forestry-related professions.
- There is a growing awareness in the region of the importance of environmental services provided by forests.
- Much progress has been made in understanding the social and cultural dimensions of SFM. For example, many forestry initiatives devote considerable effort to community organization and gender issues and apply participatory methodologies.
- A growing emphasis is being placed in the business management and commercial dimensions of small and medium forest enterprises, including those managed by peasant and indigenous groups.
- There is much greater flow of information on the state of forests, and on initiatives to foster SFM.
- It is widely recognized that the viability of SFM requires an enabling environment that facilitates responsible participation in forest management and commercial endeavors. An enabling environment implies good governance at different levels.

Even with this considerable progress, communities continue to live in poverty, forests continue to be destroyed at a rapid rate, and corruption and problems of security often limit success in SFM. A considerable number of challenges will continue to demand attention in coming years. These challenges include:

- How to achieve a better balance between production forests, protection forests and conversion forests, at the same time recognizing societal demands for diverse goods and services from them?
- How to develop effective management and conservation practices for mahogany and other high-value tree species, which have not always responded in a desirable fashion to existing silvicultural practices? Many natural tropical forests suffer from low availability of commercial species, a condition that tends to increase in areas with illegal logging.
- How to provide technical support and strengthen managerial and entrepreneurial capabilities in a large number of diverse initiatives (both community groups and small and medium enterprises)?
- How can greater progress be made in efforts to control illegal logging? What steps should be taken to improve governance in general, and what role should forest certification play?
- What can be done to slow expansion of the agricultural frontier and migration into forested areas?
- How can the benefits of forest-related activities to primary producers be increased?
- How can possible trade-offs between community-based forest enterprise development and other livelihood strategies best be addressed? Many models and paradigms advocated on forestry matters have been exogenous and have often neglected to take into account adequately the local social and cultural context.
- How can an adequate degree of inter sectoral planning, required for taking into consideration forest values in extra sectoral decisions, be achieved?

Some answers to these and many other questions can be found in past and ongoing initiatives throughout Latin America. Successful SFM, however, requires progress and acceptable conditions in all the dimensions referred to above. Technical progress alone, for example the application of reduced-impact harvesting techniques, will not lead to SFM, if a management initiative fails commercially. The strengthening of local organizations in technical aspects, business administration and commercialization will be for naught if they are unable to obtain harvesting permits on time or permission to sell products to the best available markets.

Seldom can SFM be seen as "the answer" to the economic needs of peasant and indigenous communities in Latin America. It can certainly be viewed as an invaluable option that can be an important complement to other elements of their livelihood strategies – such as farming and livestock production. The multidimensionality of SFM, and the fact the SFM should often be viewed as a complement to other productive activities, make the task of promoting SFM a complex and difficult one. Few if any organizations possess all the expertise required to consolidate SFM. By their very nature, organizations tend to possess strengths in specific aspects of SFM. While one organization may be strong in technical concerns, another may specialize in busi-

ness services and commercialization. Other entities may focus on policy issues and the strengthening of local organizations. In practice, the expertise of all these organizations is needed to achieve SFM.

Recognition of the need for complementary efforts of diverse institutions and organizations – including local organizations – has led to the recognition of the importance of multi-stakeholder platforms for strategic and operational planning and the shared implementation of progressive initiatives. Throughout the region, numerous networking examples seek to foster progress in SFM and rural development.

The aforementioned Network for the Management of Broadleaf Forests in Honduras (REMBLAH), for example, brings together entities from the public and private sector, producer cooperatives, universities, wood processing associations, projects, local NGOs and a research organization devoted to the study of lesser-known species. Network members within REMBLAH have carried out shared strategic planning and specific members co-finance and co-execute operational activities. This network has also participated in research on illegal logging and has sought to improve cooperation among peasant and indigenous groups to strengthen their bargaining power in commercial negotiations.

As mentioned, ACICAFOC in Central America plays an active role in policy debate and in furthering the empowerment of rural communities. In recent years, ACICAFOC has also devoted considerable efforts to commercial aspects and business management. Networks bringing together diverse organizations can also be found in the Andean Region. At a higher level, a global multi-stakeholder platform termed "The Forest Dialogue (TFD)" has been formed for bringing together high-level representatives from the private sector and civil society to discuss issues hindering SFM worldwide. TFD focuses on priority issues, such as forest certification, forest and biodiversity conservation, illegal logging and forest governance, intensive production forestry, forests for poverty reduction, and a "vision" for the World's forests. The creation of multi-stakeholder platforms to address the complexity of SFM is an important and necessary paradigm shift.

Cooperation within multi-stakeholder platforms creates invaluable opportunities to objectively evaluate progress towards SFM in all its dimensions. Periodic monitoring and evaluation of well defined criteria and indicators facilitate a comparison of anticipated results with those obtained in reality. If expectations are not met, adjustments can be made in the process to gradually increase success. This type of management, termed "adaptive management", is a powerful and necessary tool for SFM. The fact that much still needs to be learned clearly implies the need for well-directed research.

In closing, it is important to point out that changing paradigms are rather common in approaches to forestry development. Sometimes a new paradigm is viewed as a panacea or a blueprint for forestry development. The reality is that there is no universal solution, and the diversity that typifies forestry development initiatives in Latin America indicates the need for flexibility and creativity in responding to unique conditions. The forestry sector in Latin America finds itself in a unique position. More is known and understood about SFM than ever before, while at the same time the resource continues to suffer from rapid degradation. Meaningful progress in SFM has been shown to require a serious commitment to create an enabling environment that rewards those who practice responsible stewardship, and that facilitates forest management and commercial activities. Good intentions, reflected in progressive policies and international conventions, need to find successful expression in a growing number of initiatives in the countries of the region.

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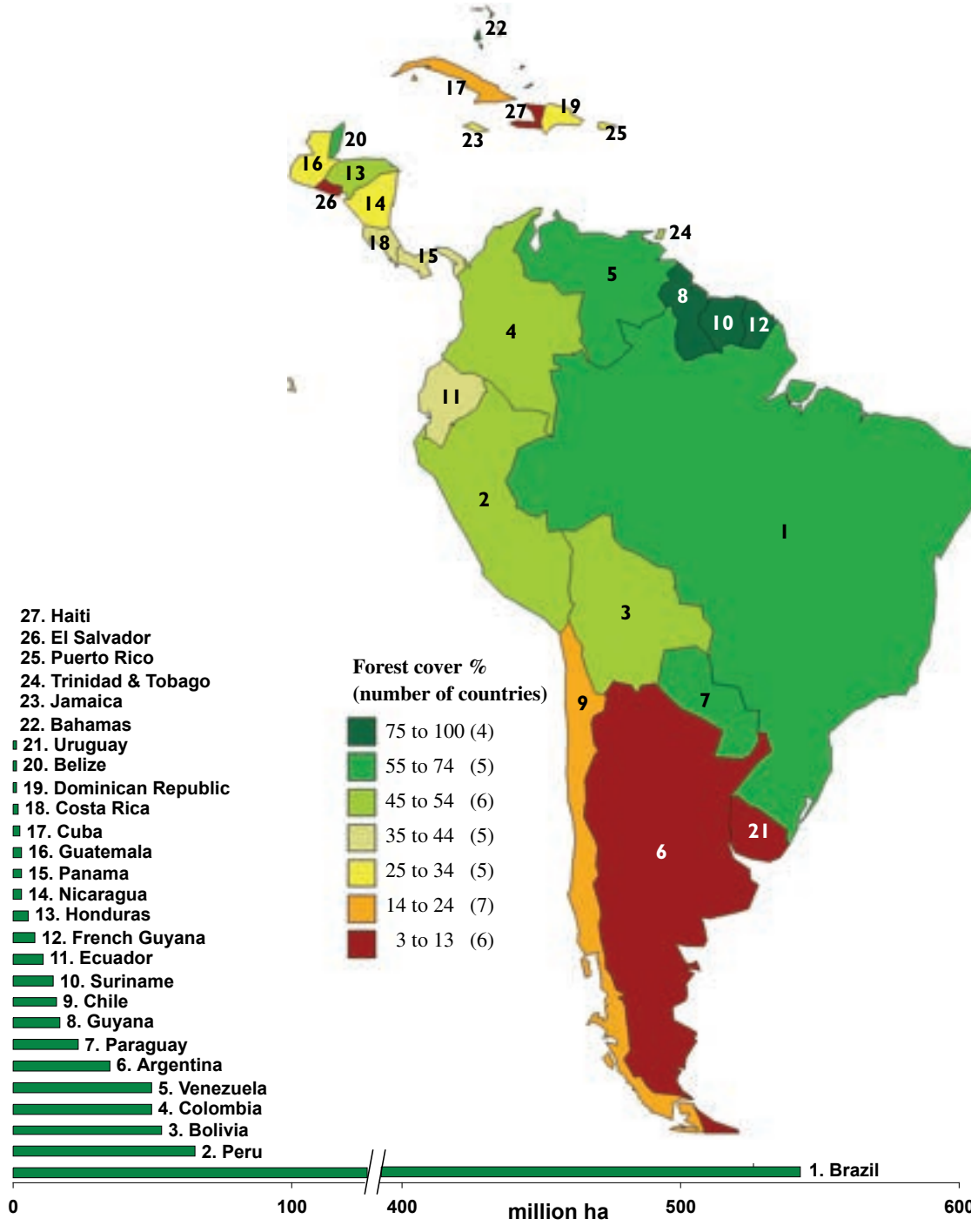
Map 15.1 Forest cover in Latin America (percent of land area) and total forest area per country (countries over 500 000 ha) (Data: FAO FAOSTAT 2005; map designed by Samuel Chopo)



REGIONAL FORUM

IV

16 Forests in North America: Responding to Social, Economic and Ecological Pressures

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Abstract: Forests are of great importance to the peoples and economies of Canada, the United States and Mexico. Over the past two decades or so, forest values and practices have evolved to encompass economic, environmental, social and cultural considerations. As a result, sustainable forest management and/or ecosystem management have emerged in North America as a new paradigm. The meaning of the paradigm shift differs somewhat among the three countries. In Mexico, sustainable forestry has led to a stronger emphasis on rural development and equitable benefit distribution. In Canada and the US, a higher level of economic development has led to a more exclusive focus on the environment; increases in wealth, education and life expectancy in these two countries have led to greater demands for a wide array of environmental services from forests. Significant changes have also taken place in forest policies and governance arrangements of the three countries. The reasons for this have been changing government priorities; the influence of forest interest groups; new knowledge about natural disturbances, climate change and dynamics at the forest landscape level; as well as the influence of global initiatives with respect to forest practices. Different management models and approaches have emerged for the purposes of diversifying livelihoods in the case of non-timber forest products, and promoting forest products trade in the case of implementing various forest certification vehicles. The chapter describes these changes and new trends, with six illustrative case studies highlighting important issues.

Keywords: Ecosystem approach; forest products trade; model forest; paradigm shift; sustainable forest management; non-timber forest products; policy; land tenure; climate change; certification; North America.

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16.1 Introduction

North American forest management and its underlying science have developed from a focus on relatively simple harvest and regeneration issues (fiber provision), through multiple use management, to the current paradigm(s) of sustainable forest management and/or ecosystem management. While these are contested and interrelated concepts, those championing ecosystem management tend to emphasize environmental problems, while those championing SFM balance environmental protection with explicitly emphasized socio-economic considerations in the approach to forest management deliberations. Drawing on the Brundtland Commission's often cited approach to sustainable development (World Commission on Environment and Development 1987), Wilson and Wang (1999) have defined sustainable forestry as encompassing "…a host of management regimes designed to maintain and enhance the long-

term health and integrity of forest ecosystems and forest-dependent communities, while providing ecological, social and cultural opportunities for the benefit of present and future generations".

We propose that changes in forestry are responses to changes in societal values and/or to serious failures in the historic fiber provision paradigm. The shift is very different among the three countries in North America, and the institutional setting is unique in each country. Tenure arrangements for forests that are dominant in Mexico are the topic of our first case study (Box 16.1). The drivers behind changes toward SFM are highlighted by the next two case studies, on shifting forest values (Box 16.2) and the problems created by a massive insect epidemic in western Canada (Box 16.3). We examine some key aspects of this paradigm shift, focusing on changes in forest management, and the impacts of these changes within the three countries. A key environmental issue, and the institutions to cope with it across North America, is climate change, the focus of the next case study (Box 16.4). The review uncovers important trends, including the increased role of privately owned plantation forests for timber supply in the US, accompanied by a greater focus on ecosystem management on US national forest lands; a growing emphasis on practicing SFM through innovative approaches, such as experimentation with "Model Forests" and forest certification (Box 16.6); and popularization of decentralized and participatory governance approaches that stress the role of forestry for enhancing rural livelihoods in Mexico. There is also an increasing recognition of the values of traditional knowledge and non-timber forest products in all three North American countries. The role of non-timber products is the subject of the case study in Box 16.5.

16.2 An Overview of Forestry in North America

Forest Ownership Patterns

Canada, the United States (US) and Mexico have different ownership arrangements and governance structures for forestlands. In Canada the forests are primarily publicly owned (Table 1), and private companies access fiber through a variety of licensing arrangements with provincial governments. Exceptions are found in the eastern provinces of Nova Scotia and New Brunswick, where private ownership of forestland is 68% and 50% respectively. Typically, Canadian tenure arrangements allow licensees either exclusive access to a defined area (area-based tenures) or a specified volume allotment within a larger management area (volume-based tenures). Stumpage fees on harvested timber are paid to provincial governments, with timber pricing methodologies varying across provinces. Such arrangements allow for public control of various aspects of forest management, typically "command and control", achieved through the use of regulations. Future access to fiber depends upon a licensee meeting a suite of defined obligations. Other important features of forestry in Canada include long rotations and generally extensive forest management regimes, especially in Canada's vast boreal forest. These factors help to explain why Canada harvests approximately 42% of the volume harvested in the US each year, despite Canada's having 20% more timberland than the US.

About 57% of US forestlands are publicly owned, including 33% under federal ownership. However, today national forestlands are not important for industrial forestry. The harvest from US Forest Service property, which accounts for the majority of federal

Table 1. Forest land base and harvest in North America

Country	Ownership				Total
	Public	Common property	Private		
			Industry	Non-Industrial	
United States (2002):					
Forestland (1000 ha)	129 158	n.a.	26 863	147 053	303 074
Timberland (1000 ha)	59 601		26 545	117 625	203 772
US harvest (mill. m^3)	36.3	n.a.	131.6	284.2	452.1
Canada (2001):					
Forestland (1000 ha)	374 844	n.a.	4 012	20 630	401 530
Timberland (1000 ha)	220 039		3 858	18 616	242 513
Canadian harvest (mill. m^3)					192.1
Mexico (2001):					
Forestland (1000 ha)	2 770	44 240	8 300		55 300
Mexican harvest (mill. m^3)					41.3[a]

[a] It should be noted that 32 million m^3 of this, or 77% is for fuelwood.
(CCFM 2004; Ghilardi et al. 2004; Smith et al. 2004)

BOX 16.1 Common Property Land Holdings in Mexican Forestry

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The Mexican Constitution (1917) defines different types of land property: a) social property, including ejidos and communities, and b) private property. Ejido is a land granted by the federal government to a group of people called "ejidatarios" who have the right to use the land. Communal property is based on the historical rights of the pre-Hispanic indigenous communities that have maintained their traditional structure.

Ejidos and communities hold about 80% of the total forestland in Mexico (Banco Mundial 1995), including an estimated 7200 indigenous ejidos and communities with 12 million people. In 50% of forest ejidos, at least 9% of the ejidatarios are indigenous (Banco Mundial 1995). The most important ethnic groups are: Tepehuanes and Tarahumaras in Northern Mexico; Tarascos and Otomies in Central Mexico; Zapotecas, Chinantecas and Zoques in Oaxaca; and Mayas in southeastern Mexico. Most of these people live in poor conditions with limited employment opportunities (Mota 2002).

Although in Mexico forest and water issues are on the national priority list, and the federal government has exhibited high confidence in rural communities, community forestry has not been a political priority. This has restricted the forest ejidos' and communities' development. However, the current new strategies in forest policy, such as the "Ley General de Desarrollo Forestal Sustentable" (General Sustainable Development Law), and the Strategic Forest Program for Mexico 2025, recognize the importance of community forestry development (SEMARNAT-CONAFOR 2001; Congreso de la Unión 2003).

The Ley Agraria of 1992 (Congreso de la Unión 1992) established the official organizational structure of forest ejidos and communities. Ejidos have three authority levels: "asamblea" (assembly) that represents the highest authority and is elected by the ejidatarios, "comisariado ejidal" (commisioner), and "consejo de vigilancia" (vigilance council). Communities have two authority levels: the "asamblea general de comuneros" (general assembly of commune) and the "comisariado de bienes comunales" (commisioner of community holdings) (Congreso de la Unión 1992). However, a wide variety of internal organization for decision-making exists, and depending on the differences in social organization and cultural circumstances, forest use patterns vary from one place to another. Usually ejidos are the lowest administrative units in the official structure (CESPEDES-CEMDA 2002).

Approximately 25% of the forest ejidos and communities sell only growing stock, 50% harvest and sell logs, and the final 25% are involved in both harvesting and processing logs into forest products (INDUFOR 2000). Although timber production has been the main objective of forest management, forest ejidos and communities have maintained multiple resource use, and are increasing their emphasis on economic diversification and forest ecosystem conservation projects related to environmental services. Community forestry development is gaining momentum and around 50% of the certified community forestland in the world is in Mexico (Bray and Merino 2004).

Most forest ejidos and communities sell their products in domestic markets. However, economic globalization has affected the commercialization process by exposing the markets for cheaper imported products (Mota 2002; Bray and Merino 2004). It is also important to mention that, in general, ejidos distribute profits among the "ejidatarios". Therefore, most of the ejidos do not reinvest their profits in forest management, or in industrial infrastructure. As a result, they do not have enough economic resources for improving the social, economic and environmental conditions.

In conclusion, forest ejidos and communities are facing important challenges in their future development because of economic globalization, industrialization, commercialization, and lack of organization for forest resource management and administration. Because of these factors, ejidos and communities need to be more efficient and effective in planning, implementation and evaluation of development plans and programs in order to become more competitive and improve their social and economic conditions. In the meantime, it is necessary to consolidate the development process by supporting production forestry and by advancing sustainable development.

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timber harvest, has fallen approximately 70% since 1987. Most of the harvest reduction on federal lands can be traced to administrative appeals (O'Laughlin 2004) and litigation over efforts to protect the Northern Spotted Owl (Yaffee 1994), which eventually culminated in the adoption of "ecosystem management" in which environmental considerations were paramount, dominating social and/or economic concerns. Commercial forestry in the US is primarily practiced on private forestland, with most of these lands owned by non-industrial landowners. Non-industrial landowners harvest 60% of the US total. Summary information on the forestland base in North America is shown in Table 1.

The forests of Mexico have two main characteristics: first, they have the most pine (72) and oak (130) species in the world; and second, 80% of the total forest area is common property land (ejidos and comunidades forestales) and only 15% is privately and 5% publicly owned (see Box 16.1 for a description of Mexican forest ownership). Pine and oak are the main harvestable species, with 79.6% and 9.7%

of the harvest respectively. High diversity of species makes biodiversity concerns important.

In the Mexican forest industry, the sawmill sector is the most important, representing 60% of the total established industry. In 2000, the sawmill industry represented 69.3% (6.5 million m^3) of the total forest production, the cellulose 18.3% (1.7 million m^3) and the plywood and charcoal, among others, 12.4% (1.2 million m^3). The largest portion of the timber harvest in Mexico is for fuelwood, which totaled 32 million m^3 for 2000 (Ghilardi et al. 2004).

Industrial Forest Production and Trade

The traditional forest industries in North America provide considerable economic benefit to the people in all three countries. Canadian forest products shipments for 2002 totaled CAD 66 billion (USD 42 billion) with 48% from wood products (including panels) and 52% from the pulp and paper sector (Industry Canada 2005). US production (2002) totaled USD 240 billion, with 37% attributable to wood products and 63% pulp and paper (US Census Bureau 2005). Forest products trade between Canada and the US is the largest in the world, with US market access the key to the continued strength of the Canadian forest sector. Canada exports 70% (of volume) of its total softwood lumber production, and 90% of that goes to the US market. Mexico's total timber production reaches only about two and five percent of the US's and Canada's production volumes respectively. Of the timber consumed in Mexico, 58% is from domestic sources (SNIF 2001), rendering Mexico, along with the US, a net-importer of timber.

Access to the US market for Canadian lumber has been impeded by a series of tariffs and quotas over the past 20 years (Cashore 1998), even though numerous recent studies show that the largest cost of such policies is borne by US consumers (Zhang 2001; van Kooten 2002; Stennes and Wilson 2004). This relationship, with the US making demands on how timber is allocated and priced in Canada, has major implications for forest management in Canada. In addition to Canada's timber pricing policies other issues, such as cut control and raw log export bans, have induced the US to launch trade measures against Canadian lumber. US market access considerations must now be included in many Canadian domestic policy decisions; otherwise they may result in additional trade actions by the US.

Employment

Although the US is the largest producer of forest products, forestry plays a relatively more important role in the economy of Canada. This is especially true in the west; in British Columbia (BC) alone, forestry directly employs 90 000 people, or 4.5% of the total workforce. In some US regions, most notably the South, forestry is also relatively more important as a source of economic activity. Many of these jobs are in rural forest dependent communities with little alternative employment. Overall, forestry in Canada directly employs 310 000 people or 1.8% of the total employment, while in the US direct forestry employment is approximately 1.2 million (less than 1% of US jobs). In addition to these direct employees, there are many more indirect and induced jobs (jobs associated with additional spending by either forest industries or workers), as well as jobs in both the consumptive and non-consumptive non-timber forest product sectors.

In Mexico, the forest sector represents only 1.1% of the gross national product (GNP) (SNIF 2001), and overall in the year 2000, forestry employed directly 216 200 or 0.64% of the total registered employment (INEGI 2004). However, as in Canada and the US, in Mexico there are many indirect (and non-registered) forest sector jobs.

16.3 Shifts in the Forest Management Paradigm

Over the past two decades or so, changes in societal values and priorities regarding natural resources and the way these resources are managed have led to significant shifts in the way that forest management decisions are made and communicated. The phrase "sustainable forest management", or SFM, is increasingly used to describe forestry that sustains economic, social and environmental benefits over the long term. SFM has emerged as a highly contested normative concept, and there is considerable debate regarding what forest practices best deserve the SFM label. To varying degrees, forest values and practices are evolving to encompass economic, environmental, social and cultural considerations. In many jurisdictions across North America, SFM is becoming an explicit forest policy goal, and similar means are used to achieve it.

While debates continue over the nature and degree of change required to achieve SFM, policy-makers across North America have developed a number of similar strategies. One of these is the promotion of adaptive management as a tool for sustaining biodiversity. The key feature of adaptive management is that managers must accept that they lack full understanding of ecosystem function, and have to adjust their management plans when the outcomes of these plans become better understood. An example of this is the Northwest Forest Plan (USDA 1997), which explicitly designates 10 Adaptive Management Areas.

Debates over the meaning of SFM differ somewhat among the three countries covered in this chapter. In Mexico, the presence of a large rural population dependent on subsistence farming and primary production, has arguably led to a stronger emphasis

on rural development and equitable benefit sharing as critical components of sustainable forestry. In fact, the largest single use of wood in Mexico is for fuelwood with approximately 25% of the Mexican population cooking with fuelwood, either alone or in combination with other fuels (Ghilardi et al. 2004).

In Canada and the US, in contrast, a higher level of economic development has perhaps led to a more exclusive focus on the environment. In fact, theorists have argued that increases in wealth, education and life expectancy (increased average age) in these countries have led to greater demands for a wide array of environmental services from forests (Adamowitcz 2002). These changing societal preferences, and the valuing of a wider range of goods and services from the forest, have been identified as important drivers of the paradigm shift toward SFM (See second case study in Box 16.2).

16.4 Changing Forest Policies

While numerous forestry interest groups have professed similar attitudes towards forest management, major disagreements remain regarding the appropriate means to promote the goal of "sustainable" forestry. These disagreements have often been accompanied, and arguably compounded, by a lack of trust between those holding conflicting views (McDermott 2003). Perhaps stemming from this lack of trust, many environmentalists in North America have pushed for more restrictive or "stringent" forestry laws that protect the environment while strictly limiting forest manager discretion. Many forest managers, on the other hand, have argued that such a "straightjacket" approach runs counter to the principles of adaptive management and sustainable forestry. The following brief review of trends in forest policy in the three North American countries illustrates some of the push and pull between different policy approaches for promoting more "sustainable" forest practices.

In the western US states and Canadian provinces, in particular, public demands have led to more of the forestland base being protected from commercial forest activity. On the US side, this has resulted in a near complete cessation of commercial timber harvests on federal lands. As the demand for timber resources remains at historic highs in the US, this has resulted in pressure to increase harvests on private lands, with the South becoming the dominant timber supplier in the US. The US is home to the largest area of commercial timber plantations in the world, with a total area of approximately 18 million ha, the vast majority in the US South (Brown 2000).

Forest policies are likewise dramatically different on US national forestlands than they are in the US Southeast. Cashore and McDermott's (2004) comparison of forest policies in twenty countries worldwide across a range of key environmental forest practice indicators, revealed stark contrasts between the mandatory and prescriptive rules governing US Forest Service lands and the voluntary Best Management Practices applied to private lands in nine top producing US Southeast states. For example, the study found that on US Forest Service lands, streams of all sizes were protected by larger mandatory no harvest buffer zones than those found in any of the US states or Canadian provinces under review. US national forestland regulations were also among the most stringent for clear-cutting, road building, reforestation, cut calculations, and the protection of endangered species (Cashore and McDermott 2004). Policies also vary significantly between state regulation of forest practices in the west coast states of Oregon, Washington, and California, where regulations regarding clear-cutting and riparian zone protection are similar to forest regulation enacted in British Columbia (BC) in the 1990s, placing these states as less stringent than federal lands regulations, but significantly more stringent than states in the US southeast.

There is considerable disagreement among US forestry interests, however, regarding the appropriateness of forest policies governing national forest lands. A number of major environmental groups have pushed for an end to all commercial harvests in US national forests. In contrast, some foresters and scientists have argued that, even given environmental protection as the sole objective of national forest management, the rigidity of existing forest management rules has served to undermine forest health.

For example, it has been argued that the very high fire risk currently facing forests in the western US can be directly attributed to the lack of removals on US federal lands (USFS), in combination with years of fire suppression and a prolonged drought. Although there has not been a move back to active forest harvests on USFS lands, the Forest Service has expressed keen interest in forest-health based thinning regimes. In response, President George W. Bush announced in August 2002 a new initiative called "Healthy Forests", which highlights the role of silviculture, with an emphasis on thinning, in wildfire management on federal forestlands. This so-called "Bush Plan" came into being, in the wake of one of the worst summer wildfire seasons in US history, during which some 2.5 million ha of forests burned. In December 2003, President Bush signed the Healthy Forest Restoration Act, billed as a means to prevent catastrophic wildfires. The Act, meanwhile, has generated considerable controversy among those opposed to logging in national forests.

While the debate over logging on US public lands continues, rules governing the ownership of the country's most productive timberlands, i.e. private forestlands in the Southeast, have remained among the least restrictive of those found in top forest product producing countries worldwide (Cashore and McDermott 2004). This stark dichotomy suggests

BOX 16.2 MULTIPLE VALUES AND FOREST MANAGEMENT IN THE US AND CANADA

David N. Bengston and Shashi Kant

Continuous interactions between human values and beliefs and the surrounding social, economic, cultural, legal, and ecological environment contribute to the dynamic nature of human values, including forest values – shared notions of what is good or desirable about forests and forest ecosystems. In recent decades, forest values have undergone a dramatic transformation in North America, shifting in relative importance and expanding in number. A growing proportion of the general population and diverse groups of people in the US and Canada view forests as a means to enhance quality of life (e.g. aesthetic, recreational, spiritual, cultural, and heritage values) and ecological services (e.g. carbon sequestration, absorption of pollutants, and soil conservation) rather than as a source of commodities. These changing perspectives are occurring across different regions, and for public and private forests.

Social scientists have developed numerous classification systems for forest values. Three common classifications are: (i) assigned values and held values; (ii) instrumental values and non-instrumental values; and (iii) bio-centric values and anthropocentric values. Assigned values provide a measure of the relative importance of forest objects, while held values specify what is considered good (or bad) related to forests. The instrumental value of a forest arises from its utility as a means to specific ends, while the non-instrumental value focuses on the worth of a forest as an end in itself. Similarly, bio-centric values emphasize the importance of protecting the environment and promoting ecological goals, and anthropocentric values emphasize human uses and benefits.

Steel et al. (1994) found that the US population is more bio-centric in orientation than anthropocentric. Bengston et al. (2004), when examining the trends (1980–2001) in forest value orientations in the US, found an increasing share of bio-centric values and a decreasing share of anthropocentric values. Manning et al. (1999) found that Vermont (US) residents rated aesthetic and ecological values as most important and economic values as least important. In a survey of thirteen southern states of the US, Tarrant et al. (2002) found: (i) for public forests, commodity value (wood production) was rated least important, ecological service (air quality) most important, and scenic beauty and cultural and natural landscape (both bio-centric values) were rated second and third most important, respectively; (ii) for private forests, air quality was ranked first, followed by scenic beauty, wood production, and cultural and natural landscape; (iii) the younger generation (age 16 to 24 years) valued scenic beauty significantly more than the oldest generation (50+ years) for both public and private forests; (iii) women valued public forests for scenic beauty significantly more than men and men valued private forests for wood production significantly more than women; and (iv) rural residents rated scenic beauty as a more important objective for public forests than did near-urban residents.

McFarlane and Boxall (2000), in a survey of the public, environmentalists, registered professional foresters (RPFs), and forest-industry public advisory groups (PAGs) in Alberta, Canada, found: (i) the public and environmentalists placed higher importance on bio-centric values (existence values, inherent worth, and spiritual values) than that of the RPF and PAG groups; (ii) the RPF and PAG groups placed higher importance on anthropocentric values than that of the public and environmentalists; and (iii) in the total sample, 25.7% of the respondents belonged to the anthropocentric group, 31.8% to the bio-centric group, and 42.4% to an intermediate, moderate group. Hunt and McFarlane (2002) found that the general public of southern as well as northern Ontario ranked bio-centric values higher than anthropocentric values. In a survey of four groups – forest industry, environmental groups, Aboriginal people, and Ministry of Natural Resources (MNR) professionals in north-western Ontario, Lee and Kant (2003) found that all the groups ranked bio-centric values (environmental, spiritual, and recreation) either first or second, and all the groups ranked most of the anthropocentric values (uses and tourism) lower than these bio-centric values. Aboriginal people ranked Aboriginal values first, while all other groups ranked Aboriginal values last. However, in Canada, Aboriginal values have gained considerable importance during the last decade (Myre 1998).

that other social values, such as conceptions of private property rights, may exert profound influences on people's views of forests and their appropriate management.

In Canada, changing societal values have led to both changing forest management and an increased interest in protected areas. This is particularly pronounced in BC, which announced the Protected Areas Strategy in 1993, with the goal of doubling the province's protected areas to 12% by the year 2000. In fact, protected areas now represent 13% of the province's total land base. In addition to expanding its protected areas, BC has also developed more restrictive regulations governing the remainder of its public forestlands. In 1995 BC enacted a new Forest Practices Code, which included extensive forest planning requirements, as well as detailed forest practice prescriptions. According to Cashore and McDermott's (2004) above-mentioned global forest policy study, BC and other top producing Canadian provinces ranked among the highest of the twenty case countries in terms of the "stringency" (i.e. prescriptiveness) of their approach to key environmental forest policy indicators.

BC forest policy, however, has more recently moved away from a purely prescriptive approach to environmental protection. Around the same time that the "Bush Plan" has granted US Forest Service managers greater discretionary authority, BC has recently introduced a "results-based" forest practices code that entails fewer planning requirements and a generally more decentralized approach to regulating forest practices. The former Forest Practices Code had been criticized as overly costly and bureaucratic, with a heavy emphasis on written documentation (Wilson et al. 1998). The new Forest Range and Practices Act (2004), in contrast, has been billed as a means to more effectively and efficiently target on-the-ground "results" of forestry practices. Similar to environmentalist reactions in the US, many BC environmentalists have opposed the imposition of more flexible forest management rules.

In Mexico, as in the US and Canada, forest policy makers consider sustainable forestry as a priority for

The shift in forest values in the US and Canada, from anthropocentric to bio-centric values, has been attributed to a post-industrial society in which higher order needs for self-development and self-actualization override subsistence needs that are satisfied through material acquisition (Steel and Lovrich 1997). However, the ecological values of forests have grown as scientific understanding of the functions and dynamics of forest ecosystems has increased. Similarly, Aboriginal values of forests have become prominent due to many court decisions in Canada, international recognition of Aboriginal and treaty rights, and consumer preferences in other countries for certified forest products.

In democratic societies, public lands are managed with the tacit consent of the citizenry, and private forestlands are also not immune to public preferences. In market-based economies, firms and private forestland managers must also be responsive to changing public values, especially values expressed through consumer preferences. Hence, all the associated sectors – governments, forest industry, and private woodlot owners – have responded to the changing forest values by developing new approaches to forest management beginning in the late 1980s and early 1990s. Some of the main new approaches include ecosystem based forest management, forest certification, forest management partnerships, and statutory requirements for public input into forest management. These new management approaches are a response to new goals for forest management that have arisen as a result of changing forest values in the US and Canada.

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national development. Mexico's Natural Resource and Environmental Secretary (SEMARNAT) was formed for the primary purposes of formulating a national forest policy for sustainable forestry development, and regulating and controlling forest harvesting and environmental conditions. SEMARNAT coordinates the National Forest Commission (CONAFOR), which is an institution of the federal public administration. CONAFOR was created in April 2001 and is responsible for developing production activities, conservation and restoration actions in forest ecosystems. CONAFOR also participates in designing plans and programs, and the application of sustainable forestry development policy. In order to achieve the objectives of CONAFOR, the development of forest policy includes the 2025 national strategic forest program, the 2001–2006 national forest plan, and sustainable forestry development law.

Mexico, like the US Forest Service and Canadian provinces, has also enacted a number of mandatory rules governing key environmental forest practices, such as the protection of riparian zones, reforestation and the establishment of annual cut limits. A number of Mexico's rules, however, are more "procedural", i.e. centered on planning requirements, than the more prescriptive rules characteristic of US and Canadian public lands (Cashore and McDermott 2004). Such procedural approaches, in fact, have accompanied a recent trend towards the decentralization of forestry decision-making. A major component of Mexico's 1992 forest law is the devolution of environmental management decisions to local forest managers via approval of management plans detailing individual forest protection strategies (Segura 2000).

16.5 Current Challenges to Sustainable Forest Management

Compliance

Forest policies are only as meaningful as their ability to affect on-the-ground forest practices. Illegal logging, defined as removal of fiber by those with no assigned property rights, is a fundamental problem undermining the efficacy of many forest policies in the developing world (Cashore and McDermott 2004). More developed countries such as Canada and the US, in contrast, suffer less from illegal forestry activities. Although high value timber theft does occur in Canada and the US, its institutions are generally more effective (Esty and Cornelius 2002) in curbing and punishing criminal activity, with the requirements of timber marks and inspections making the movement and sale of illegal logs very difficult.

In Mexico, however, illegal logging constitutes a major problem. The factors contributing to illegal forest harvest are numerous, including land tenure conflicts, local forest producers' needs, insufficient mechanisms for supervision and vigilance, opening of forest areas for land use changes without authorization, and the existence of markets for illegal wood products. It is difficult to obtain accurate and consistent data on annual volumes of illegal wood production. However, SEMARNAT (2002) estimates that, in the year 2000, the volume of illegal harvestings was approximately 1.41 million m^3. This value represents approximately 15% of the total forest production legally harvested (9.4 million m^3). Such a high rate of illegal harvesting creates barriers to the SFM principles outlined in Mexico's national forest policy.

To combat this problem, Mexico has established in its 2025 Forest Strategic Program an important strategy to prevent and control illegal logging. This strategy includes actions such as increasing the risk and cost of illegal activities, improving the structure and organization of the industrial forest sector, and increasing market transparency and reducing the market access of illegal operators. Additionally, the institutional policy promotes the participation of different social sectors to preserve the natural resources through communitarian inspection and vigilance committees.

Past Management Legacies

It has become clear that past management decisions based on the timber procurement paradigm have created ecological problems. A central crisis facing the entirety of the North American continent has been the rapid loss of species biodiversity. This species loss has been attributed to a wide range of factors, including a loss of forest cover extending into the mid 1990s, intensive forest practices involving even-aged monocultures, chemical use, and the rapid liquidation of primary forest habitats. In response to such past management legacies, more recent concepts of SFM have involved an increased emphasis on forestry that "mimics" natural forest habitats. In particular, many proponents of a more naturalistic approach to forestry have pushed for the conservation and/or restoration of old growth forests.

Not all of the environmental crises created by the legacies of past management paradigms, however, lend themselves easily to solutions with wide popular appeal. One of the largest current crises in North American forests is the Mountain Pine Beetle (MPB) epidemic in the province of BC. In this case, effective fire suppression in a fire dominated ecosystem led to an age class structure of lodgepole pine (Pinus contorta latifolia) more heavily weighted to older age classes than would naturally occur with a historic pattern of fire. As these older age classes are the susceptible host trees for MPB, the relative abundance of these trees in combination with a sustained period of favorable weather have created the conditions for the largest outbreak ever recorded in BC (see Box 16.3).

The impact of this pest on the forest industry in BC is going to be very large in terms of displacing forest workers in remote rural communities. In approximately 15 years, the harvests in the affected regions of the BC interior are anticipated to fall by 4.5 million m^3 from pre-MPB outbreak levels of 23.2 million m^3 (BC Ministry of Forests 2003). These reductions will be concentrated in areas that are highly dependent on the forest sector for employment and income, threatening the medium-term viability of some communities.

Debates abound, meanwhile, over the appropriate means of "managing" the Mountain Pine Beetle epidemic. Proposed solutions range from rapid harvest of infected stands in order to prevent further spread, to the "no action" solution of leaving nature to "take her course". Given the tremendous environmental, social, and economic matters at stake, there will clearly be no consensus or resolution of the issue for some time to come. Although the MPB outbreak is an extreme example due to its immense scale, there are a host of forest pests across North America whose levels of damage are increasing as a result of increasingly favorable climate conditions. Other examples include the recent epidemics of spruce bark beetles in the Kenai Peninsula and Canada's Yukon, and Pinyon Ips in the southwestern US, which are threatening the Pinyon Pine species in the Pinyon-Juniper ecosystem.

Climate Change

Climate change and international agreements in response to climate change have important implications on how forests are managed in both the US and Canada. Climate change is having impacts on forest ecosystems in both countries, and thus on how the forests are managed (i.e. adapting to climate change, increased drought with associated pest damage and increased fire activity). Canada, having ratified the Kyoto Protocol, is also assessing the potential contributions of forests and forestry in meeting commitments for reducing net greenhouse gas (GHG) emissions under Kyoto (see Box 16.4). The US, choosing not to ratify Kyoto, is under no such obligations. The next case study explores the relationship between climate change and forests in the Canadian context.

BOX 16.3 Consequences of Altered Disturbance Regimes in an Era of Changing Climate

Allan L. Carroll

The mountain pine beetle (MPB) is a native insect that is widely distributed in western North America, occurring from northern Mexico to central British Columbia in Canada. Throughout its range, it breeds in virtually all species of pine, but in Canada its major host is lodgepole pine. MPB preferentially attacks mature, large-diameter trees where it feeds and reproduces within the phloem. Colonization of trees is facilitated by aggregation pheromones that coordinate mass attacks and a mutual association with phytopathogenic fungi that circumvent tree defenses. Successful colonization of a tree by MPB almost always results in tree death.

Although MPB populations have reached epidemic densities in the past, the latest outbreak that began in 1992 has reached levels that are nearly an order of magnitude greater than anything previously recorded. Indeed, the area attacked in 2002 alone (detected in 2003) covered approximately 4.1 million ha of pine forests (BC Ministry of Forests 2003). For a mountain pine beetle outbreak to occur, two main conditions must be satisfied, an abundance of susceptible host trees, and a sustained period of favorable weather for beetle survival. Both of these conditions have coincided in recent years in BC. Moreover, evidence suggests that these conditions have been exacerbated by anthropogenic activities.

Lodgepole pine-dominated forests cover approximately 14 million ha of British Columbia (BC Ministry of Forests 1995). Virtually all of these forests originated from stand-replacing wildfires (e.g. Smith 1981). In fire-maintained forests the rate of disturbance will determine forest age-class structure. Where wildfires occur randomly in space at a relatively constant rate, and stands have an equal probability of burning irrespective of age and location, forest age structure will reach a steady state approximating a negative exponential distribution (e.g. van Wagner 1978). Based upon a reconstruction of forest conditions in BC during the early 1900s, Taylor and Carroll (2004) found that the age-class distribution of pine forests for the province did indeed mimic a negative exponential distribution derived from a 60-year fire return interval. Therefore, historically the majority of pine forests comprised relatively young age classes (i.e. <80 years old) due to frequent wildfires.

Forest fire suppression began approximately 100 years ago in BC and its efficacy has increased over time. By 2002, the average annual initial attack success rate (i.e. fires constrained to < 4 ha in size) was 95%. As a result, since 1910 the average yearly area burned by wildfires in BC's pine forests declined from approximately 100 000 ha to less than 10 000 ha (Taylor and Carroll 2004). This dramatic reduction in the rate of disturbance has allowed pine forests to age to the extent that nearly 70% of current stands are at least 80 years old – significantly older than that expected from the historic wildfire regime. Since MPB preferentially attacks trees that are at least 80 years old (e.g. Safranyik et al. 1975), fire suppression has significantly increased the amount of susceptible trees for the beetle. In fact, Taylor and Carroll (2004) estimated that at the start of the present outbreak there was 3.3 times as much MPB-susceptible pine in BC as in 1910.

In addition to an abundance of suitable hosts, climatic conditions have been steadily improving for MPB populations in recent years. Historically, the extent and severity of MPB epidemics have been limited by the occurrence of summer temperature regimes optimal for beetle development and/or minimum winter temperatures below a critical threshold (Safranyik et al. 1975). In fact, a large proportion of pine forests in western Canada normally experience climatic conditions insufficient for the establishment and persistence of MPB populations. By comparing the annual occurrence of MPB infestations against maps of the historic distribution of climatically suitable habitats derived from past weather records and a model of the impact of climatic conditions on MPB populations, Carroll et al. (2004) have shown that during the past three decades climatic conditions relevant to MPB have improved over large portions of BC. More importantly, as a consequence of climate change populations have expanded into formerly climatically unsuitable habitats, especially toward higher elevations and more northerly latitudes. Indeed, large parts of the current MPB outbreak occur in areas that before 1970 were climatically unavailable to the beetle (Carroll et al. 2004).

On average, past large-scale outbreaks by MPB seldom persisted longer than 10 years. Their collapse was due to localized depletion of suitable host trees in combination with the adverse effects of climate. The current epidemic is now 14 years old and shows no evidence of subsiding. The coincidence of an over-abundance of mature pine due to fire suppression, and ameliorating climatic conditions due to global warming, has served to exacerbate the extent and severity of MPB impacts in BC.

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BOX 16.4 Climate Change and Forests

G. Cornelis van Kooten

The Kyoto Protocol (KP) is the international community's policy response to the threat posed by global climate change. It requires developed countries to reduce CO_2 emissions by an average of 5.2% from the 1990 level during the commitment period 2008–2012, or by a total of some 250 megatons (106 metric tons) of carbon, denoted Mt C, per year. It comes into effect 90 days after it is ratified by 55 states, but developed countries that ratify must account for at least 55% of the CO_2 they emitted in 1990. Before Russian ratification in late 2004, over 120 countries had ratified, with developed countries' proportion of the 1990 emissions at 44.2%. With Russian ratification and in light of the United States having decided not to ratify, the proportion of 1990 emissions accounted for by developed (Annex B) countries is 61.6 percent. Russia agreed to ratify in exchange for European support of its bid to become a member of the World Trade Organization. While Russia may not have 'hot air' to sell, it likely will have forest carbon offset credits to sell to countries that are unable to meet their commitments under Kyoto.

The KP permits countries to take into account carbon fluxes due to afforestation, reforestation, and deforestation (ARD) activities in determining 2008–2012 emissions. Afforestation refers to human activities that encourage growing trees on land that has not been forested in the past 50 years, while reforestation refers to human activities that encourage growing trees on land that was forested but had been converted to non-forest use since 1990. In the first commitment period only, some countries can claim carbon credits that need not be offset against ARD debits. Canada can claim 12 Mt C (44 Mt CO_2) each year through (verified) forest management activities that enhance carbon uptake. (Russia can claim 33 Mt C per year, Japan 13 Mt C, Germany 1.24 Mt C, Ukraine 1.11 Mt C and other countries much lesser amounts.) According to its Implementation Plan (Government of Canada 2002), Canada expects to claim 5.5 Mt C (20 Mt CO_2) in this fashion, amounting to 8.3% of its required CO_2 emissions reduction (if Canada elects to include forest management in its Kyoto accounting). While more can be claimed there is fear that, by identifying a larger managed forest area, CO_2 release from natural disturbances (fire, insects, and diseases) on the managed land will negate the claimed amount. The impact of average forest fire levels on carbon was included in the 20 Mt CO_2 estimates, so it is likely that only the impact of larger than normal fires during the commitment period may negate the amounts claimed.

More important, perhaps, is that Canada can claim carbon credits for ARD activities, particularly for tree planting on agricultural lands. Canada's KP implementation plan calls for nearly one-quarter of the country's total KP target to be achieved through terrestrial carbon sinks (16–18 Mt C per year), split between actions already underway and proposed new actions (Government of Canada 2002). Research using meta-regression analysis suggests that a lower range of cost estimates for creating carbon forest credits is some USD 10–USD 35/t C (USD 2.75–USD 9.50/t CO_2) if product sinks are permitted and opportunity costs of land are ignored, but USD 62–USD130/t C (USD 17–USD 36/t CO_2) if opportunity costs of land are appropriately credited (van Kooten 2004). Based on a study region in northeastern British Columbia consisting of 1.2 million ha, with 10.5% of marginal agricultural land, Krcmar et al. (2001) found that more than 1.5 Mt C can be sequestered in the region over a period of 200 years at a cost of about USD 40/t C. This amounts to an average of about 1.3 t C per ha, or about 52 kg C per ha per year over normal carbon uptake. If this result is applied to all of Canada's productive boreal forestland and surrounding marginal farmland, some 20% of Canada's annual KP target, or some 10–15 Mt of C annually, could be achieved through afforestation at an average cost of about USD 40/t C, or USD 11/t CO_2. The time required to implement such a planting program, which could take 40 years, and associated transaction costs were neglected in this calculation (van Kooten 2000).

The problem is that terrestrial carbon offsets are temporary and it is impossible a priori to determine how credits for temporary offsets will exchange for permanent CO_2 emission reductions in carbon trading markets (Marland et al. 2001; Sedjo and Marland 2003). If the discount rate is 10%, then a temporary carbon offset will be worth only one-tenth as much as a permanent CO_2 emission reduction. This makes the sink option much less attractive from a financial perspective. Of course, this does not preclude some tree planting for biodiversity as well as carbon purposes. Also the more one uses forests for carbon credits, the more industry in other sectors can pollute. In other words, Kyoto may help conserve forest, but at expense of greater pollution elsewhere.

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Expanding Markets for Sustainably Managed Forest Products

Non-Timber Forest Products

North American forests provide a wide array of non-timber products and services including food, recreation, eco-tourism, energy, pharmaceuticals, clean air, clean water, and habitat and amenity benefits. These comprise a mix of consumptive and non-consumptive benefits, some of which have been exploited for commercial purposes. These values must be incorporated with traditional timber harvesting values to develop SFM strategies; this combination has been difficult for policy-makers. Many non-timber forest values are closely related to the historic rights of the First Nations peoples, and particular problems have arisen when management for timber production has led to the loss of these values. While there have been some successful examples of com-

BOX 16.5 Management Issues Concerning NTFPs in Canada and the US

Susan J. Alexander, Darcy Mitchell and Sinclair Tedder

Although forest management in North America has not generally focused on the production of NTFPs, they are abundant in forest ecosystems. NTFPs play important roles in North American culture and commerce. Over 200 species of NTFP are harvested from public and private lands in the US Pacific Northwest alone for commercial, personal, and traditional purposes (de Geus 1995) with dozens of other species harvested in central and eastern North America. Some of these species, such as maple syrup, wild rice, wild blueberries, and several medicinal herbs, are established in cultivated or semi-cultivated production systems. Using forest management practices to enhance NTFP production has become a focus for some forest managers (Weigand 1998; Kerns et al. 2003). However, although some NTFPs are becoming scarce in an economic sense (Pearce 1992), their value generally has not been regarded sufficient to manage them for increased production. They are usually regarded as by-products of forest management. The use of NTFP in Canada has largely been unmanaged and unregulated (Tedder et al. 2002). The primary focus of management in the US has been managing and regulating access to NTFP. Access management includes controlling the physical ability to get to a place with e.g. road closures and gates, and legal access with e.g. permits, contracts, treaties, and regulation (Alexander and Fight 2003).

In Canada, resource use on public (Crown) lands operates in most places under an open access environment, where no restrictions are placed on users, no harvesting approval is required, and no specific rights are accorded to any users. Exceptions include Special Forest Product permits in the province of Saskatchewan, prohibitions on harvesting in parks, and Community Forest Pilot Project tenures in British Columbia, which are the only forest tenures in BC that provide for the management of botanical (non-wood) forest products (Tedder et al. 2002).

Property rights in the US are fairly explicit and are based on notions of exclusivity; that is, the landowner can determine who has access to his or her land. Timber and most other forest products are private goods irrespective of management. A private good is both rival and exclusive. Rival means that one person's consumption of a resource reduces the amount available to others (Ostrom 1990). Exclusive means the owner can restrict access to the resource. Randall (1988) points out that pure non-rival goods are rare. Instead, he uses the term congestible good. As a capacity restraint is approached, congestion sets in, and the resource becomes scarce. As timber became congestible, it was realized that it could become scarce. Access to timber on all ownerships in Canada and the US is regulated through harvest contracts, sales mechanisms, and pricing structures. Most NTFPs continue to be regarded as non-exclusive and non-rival goods, particularly those growing on public lands. The transition to congestion and scarcity and the resultant efforts to allocate harvest rights to NTFPs challenge forest managers of both public and private lands (Alexander and Fight 2003).

Forest managers on public and private lands in Canada and the US face an array of choices when deciding how to allocate formal or informal access rights for NTFPs. Forest managers may be aware of and support informal access rights. In these cases, gathering takes place without explicitly written rules, laws, or policies. Informal access rights may be public, or just a personal sense of ownership. Formal access mechanisms, such as contracts or permits to harvest NTFPs, are becoming more common in the US. This increased formalization, and sometimes elimination, of access has led to concerns that long-standing customary claims to NTFPs, including claims of non-native Americans, need to be acknowledged (Goodman 2002). Goodman suggests that recognizing and embracing elements of informal legal systems may enhance the development of sustainable NTFP management. Historically, highly mobile groups of First Nations peoples had a structured set of informal rules and traditions that dictated where, when, and who harvested NTFPs, such as berries and salmon (Fisher 1997; McLain and Jones 1997; Turner and Loewen 1998; Turner and Cocksedge 2001). In Canada, particularly in BC where treaties in most parts

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mercial exploitation of these values other important services, such as the provision of carbon uptake of forests, require new and well-developed institutions. The issue of non-timber forest products and how they fit into forest management schemes is the topic of the next case study (Box 16.5).

SFM involves using forestlands and resources to satisfy a variety of human needs. The harvest, processing and marketing of non-timber forest products require appropriate institutional arrangements to address a large number of issues concerning the livelihoods of forest-dependent communities in a broad sense, employment opportunities, governance and markets. In addition to their effects on the well-being of local communities, practices in managing non-timber forest products also have significant implications for the overall health of forest habitats and the capacity of forest ecosystems to deliver a steady stream of environmental services. The experiences in North America indicate the growing importance of non-timber forest products in the transition towards SFM and the diversity of approaches that may be implemented.

Forest Certification

Increasing rates of global deforestation (Meyer et al. 2003), improved information and ready access to this information, combined with a strong re-emergence of environmental values, have raised the public profile of forest sustainability in North America. ENGOs, the forest industry, and governments have taken a range of approaches in response to this pressure for forest sustainability. The range includes intensive regulation (command and control) of forestry practices, ENGO orchestrated calls for consumer boycotts of products sourced from 'unsustainable' forests, media campaigns showcasing the impacts of select aspects of commercial forestry (typically clear-cut harvesting and habitat loss), and standards developed by producer associations. One promising approach is the certification of forests and labeling of forest products sourced from sustainably managed forests to demonstrate compliance with certain standards. The following case study provides an overview of forest management certification in North America (Box 16.6).

of the province have yet to be negotiated, Aboriginal rights and title are a significant factor in the recognition and specification of formal rights to NTFPs.

Today's managers and policymakers face an array of decisions when they formally allocate access rights to NTFPs, in jurisdictions where formal rights are recognized. Managers use mechanisms such as permits and regulation to determine who can harvest, where, and when. People harvesting for personal use may be sent somewhere different than those harvesting commercially. Groups with specific legal rights, such as those allocated through treaties, may have priority use in certain areas or for specific resources. Other decisions regarding access allocation are whether or not entry is limited, and the duration of access. Can the harvester gather whatever size or amount he wishes? Is the access right granted for a season, a year, or multiple years? The manager selling NTFPs must also decide how the prices will be set and how the payment will be made (Alexander and Fight 2003). The combination of choices in granting access rights to NTFPs can have significant long-term effects on the productivity and sustainability of non-timber forest resources. In determining an appropriate system of access rights to NTFPs, decision-makers must also consider the interactions among NTFPs, timber and other non-timber management systems. In an ideal system, values (including non-pecuniary values) of the forest resource would be optimized through the system of property rights. In actuality, however, established uses, such as harvesting trees for fiber, have been slow to give way to other claims for forest use.

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BOX 16.6 Forest Certification in North America – Drivers, Status and Outlook

Bill Wilson

Forest certification has its roots in the perceived failure of the international community to respond to rapid tropical deforestation and forest degradation during the 1980s (Vogt et al. 1999; Hansen and Fletcher 2000). However, the watershed 1992 UN Conference on the Environment and Development (the Rio Earth Summit) served to highlight the question of forest management in developed countries. The Summit subsequently led to the development of a set of principles and a suite of criteria and indicators, the key ingredients to an operational basis for SFM and an evaluation pursuant to forest certification. This case study presents the drivers pushing forest certification, provides the status of forest certification, and concludes with comments on future outlook.

Certification Drivers

In North America the public objective in forest management is mainly forest ecosystem sustainability. Certification is but one vehicle to assist in achieving this objective. However, certification does have a cadre of very strong supporters with a range of reasons for positioning and promoting certification in its various "institutional" forms. These forms include a host of international, national and regional standards. The major drivers for SFM and certification in North America (similar to those in many other jurisdictions) include wealth and education effects, reduced time and distance costs, urban economic migration, and increased globalization.

These drivers have translated into society's expecting a greater degree of non-timber and preservation values being integrated into forest use decisions. In some instances regional governments have responded to this social expectation with

Table A. Characteristics of North American forest certification vehicles

	Forest certification vehicle		
	Canadian Standard Association (CSA)	Sustainable Forestry Initiative (SFI)	Forestry Stewardship Council (FSC)
Main developer	Industry	Industry	ENGOs
Basis	Performance & systems	Performance & systems	Performance
Application	Canada[a]	US & Canada[a]	International
Verification	3rd party	1st, 2nd 3rd party	3rd party
Chain-of-custody	Yes	No	Yes
Label & logo	Logo	Logo & label	Label & logo
Upgrade provision	Yes	Yes	Yes

[a] Vehicle is available to players beyond defined region.

a regulatory package. However, a parallel process involving ENGOs, industry and landowners generated a series of forest certification options (see Table A). Basically these options seek to ensure a greater balance among timber and non-timber values. The incentives to participate are the threat of boycotts by buyer groups or consumers (i.e. loss of market share) and the potential for certified product price premiums.

Empirical evidence to date on premiums is largely related to the willingness-to-pay version, with all its inherent methodological limitations, and some temporary niche market premiums reflecting a supply/demand imbalance. Research on forest owner and industry attitudes has also typically identified market access as a greater driver than expected premiums on certification decisions (Wilson et al. 2001).

Status

At the beginning of 2004, an estimated 164 million hectares, about 4.2% of total world forests, were certified. In North America, an estimated 16.8% of forests are certified (van Kooten et al. 2004). The Canadian Standards Association (CSA) certification option is the main vehicle in Canadian forest certification. Current CSA certified forest area is 32.9 million hectares, as compared with 5.4 million in 2001. In the United States, the American Forest & Paper Association's Sustainable Forestry Initiative (SFI) is the preeminent certification vehicle. A total of 20 million hectares is SFI certified – almost double the area certified by 2001. Forest certification in Mexico has followed the Forest Stewardship Council' (FSC) option, and the total area certified, although small (about 505 000 hectares), has increased sharply in recent years. Mexico's forests are largely collectively owned and managed by farmers and indigenous communities, in contrast to the public and private ownership common in Canada and the United States. These forests are highly fragmented and have a strong human "footprint". As a consequence, forest certification in Mexico is challenged by both certification costs and institutional limitations.

In recent years the CSA has introduced a chain-of-custody (COC) process that is available for lumber, pulp and paper products. FSC has had a COC process, label and logo from its early days. COC certification is the category of forest certification that deals with the certification of forest products at each stage of the supply chain, from time of harvest until the final product reaches the end consumer (Upton and Bass 1996).

Outlook

Mutual recognition across the various certification options progressed despite strong opposition from various FSC supporters. Canadian companies have successfully achieved SFI certification (a total of nearly 26 000 hectares), a strategic consideration given the large concentration of Canadian forest product exports into the US market. Both CSA and SFI are members of the Pan-European Forest Certification (PEFC) Council and are seeking a broader consensus on recognition.

The PEFC emerged as European landowners developed their own national certification programs, after balking at the FSC response to their needs and opinions. The European process has led to a package of SFM criteria and indicators against which various national standards are vetted. PEFC mutual recognition has endorsed FSC and a collection of national standards in twelve European countries.

The European model demonstrates that mutual recognition can happen. A question to consider is whether mutual recognition is beneficial to a sound SFM objective. Institutional economic theory provides logical arguments for both sides of this question, but no definitive conclusion. The theory provides two lessons: the only desirable monopoly is your own, and substitute products will continue to challenge market share.

Certification is costly, particularly for small-scale operations. However, only rarely can market forces provide an adequate reward to offset the costs of certification. Instead, certification is becoming a cost of doing business in forestry. Certification will directly influence access to both timber and markets, and in cases where the additional costs are prohibitive, future land use change.

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In addition to certification, there are a number of other approaches to forest management that may advance our knowledge related to pursuing the goals of SFM. Specific Canadian examples include provincial initiatives to examine the possible role of community forests, best portrayed by the Community Forest Pilot Project in BC (a similar, although smaller program exists in the province of Ontario). Communities were invited to submit bids for 5-year forest licenses, and at the end of 2003, 8 license agreements had been signed and approximately 140 000 m^3 of timber had been harvested by the community forests in that year.

Another innovative approach adopted in Canada is the Model Forest Program. Launched in 1992, the Model Forest is based on the concept of testing and demonstrating best management practices in a geographically defined, forested area. At present, there are 11 Model Forests in Canada covering sites that are representative of all the major ecological zones in the country. At the 1992 UNCED, the Canadian government announced the creation of the International Model Forest Network (IMFN) program to support development of Model Forests outside of Canada. Consistent with the Canadian Model Forest Network, the IMFN supported country-led development processes that incorporate a broad range of economic, social and environmental forest issues. Today there are more than 30 international Model Forests involving some dozen, including the US and Mexico. They represent a unique global community effort with a common theme, dedicated to finding working solutions to the challenges of SFM.

At the heart of the Model Forest approach is the idea of partnership recognizing different perspectives on the social, economic and environmental dynamics in managing a forest. These perspectives are essential for making informed and fair decisions in forest management for multiple values. Today, the eleven Canadian Model forests range in size from 113 000 hectares to 7.7 million hectares, and have dozens of significant achievements to their credit. Some 500 scientists and more than 1000 forest practitioners are actively involved in the Model Forest network.

As an example, the McGregor Model Forest in the BC Interior has gained useful experience in fostering partnership among research organizations, forest product companies, First Nations, government agencies, communities, practitioners, and recreation and conservation groups to integrate their respective interests into a common goal of managing the forest in a sustainable way. The Bas St. Laurent Model Forest in Quebec is trying an innovative form of management involving tenant farmers who are allocated approximately 1000 ha, designed to ensure multi-resource management. This Model Forest is located on three private woodlots, and has been in operation since 1994.

16.6 Summary and Conclusion

It is abundantly clear that forests are of great importance to the economic and social well being of people in Mexico, Canada and the US. The preceding review and associated case study analyses provide evidence suggesting changes in forest governance and associated livelihoods, the impact of forest management in the provision of environmental services, and the shift to plantations for fiber requirements. These are all components of the shift to a new paradigm of forest management in North America, a paradigm taking into account a wide array of products, services, and functions associated with the forest.

The shift along the continuum towards SFM is not consistent across these three countries. Reflecting their differing and unique histories and priorities, the US, Canada and Mexico have pursued their commitment to SFM using different approaches. In Mexico, the shift has led to a stronger emphasis on rural development and equitable benefit distribution. Forests are communally owned, and management decisions are made closer to the local level through decentralized decision-making. The majority of harvest is for fuelwood, and is utilized by a large proportion of the Mexican population, especially in rural areas near the forest. In Canada and the US the shift has led to a more exclusive focus on the environment, and greater demands for a wide array of environmental services from forests. As managing for these additional values will certainly add costs, this will serve to reduce the relative competitiveness of the forest products sector.

Canada, with its predominantly publicly owned forests, has virtually no commercial forest plantations. Instead its vast, largely natural forests are managed by an extensive management regime. The forests in Canada provide livelihoods largely through commercial harvest and processing activities, although it is increasingly recognized that non-timber forest products play a large role as well. The US also has vast publicly owned forests, but there has been a shift to practicing commercial forestry on private lands, with the large southern US plantations becoming key suppliers of commercial timber. The paradigm shift for these private lands in the US has occurred differently from that governing public lands. There is a very wide divergence in policy related to the protection of environmental services between the publicly owned lands in the US and the private forestry lands in the US South, with the rules governing these private lands being much less restrictive.

The failure to recognize ecosystem function within forest management has led to problems such as loss of species biodiversity, and catastrophic fire and insect problems in the west. The current MPB outbreak, the topic of one of our case studies, covers over 4 million ha (2003) and will kill approximately 500 million m^3 of timber over the next few years.

This challenge will threaten the economic and social well being of communities across the northern Interior BC. The specific case of the MPB outbreak in BC illustrates the risks of ignoring ecosystem function, but there are other examples such as the buildup of hazardous fuels across much of western North America.

In addition to policy aimed at protecting other forest values, forest certification is a means by which consumers of forest products can make demands about how forests are managed. Certification is costly, particularly so for small-scale operations, and rarely does the market provide an adequate reward to offset the costs of certification. Instead, certification is becoming a cost of doing business in forestry. Certification will directly influence both access to timber and markets, and in cases where the additional costs are prohibitive, future land use change.

The emergence of a number of new paradigms within the overall SFM concept includes interrelations between forests, society and the environment. Forest practices will continue to change, in response to changing societal values, pressures from interest groups on the way forests are managed and utilized, and new knowledge and understanding about the natural, socio-economic, and cultural forces governing the forests.

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Erkki Oksanen

A growing proportion of the general population in the US and Canada view forests as a means to enhance quality of life and ecological services rather than as a source of commodities. In Mexico the importance of recreation areas is also growing in and around urban areas.

Erkki Oksanen

The US and Canada are among the world's leading producers of forest products, and forest industries provide considerable economic benefits to the people in Mexico as well.

REGIONAL FORUM IV

17 Oceania – Islands of Contrasts

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Abstract: The islands which comprise the 24 nations and territories of Oceania range from the continental scale of Australia to the smallest atolls of the Pacific. These islands, their forests, and people are diverse and geographically dispersed. They have high levels of endemic biodiversity, much of which is or may become threatened. Forests in Oceania range from mangrove to montane, and many forested landscapes reflect high levels of management under traditional land use systems. Trees and forests are of fundamental importance to Oceania's peoples and environments. Their importance in the contemporary economies of Oceanic countries varies greatly, but their non-market and environmental services values are now widely recognised. Customary land tenure and rights systems have been maintained in most countries, and are being restored in others, and present both opportunities and constraints for forest conservation and sustainable forest management. All Oceanic countries with significant areas of native forest have experienced an era of unsustainable exploitation, which continues in some richly forested countries. There have also been significant losses of trees from agricultural landscapes. Conservation and sustainable management of remaining natural forests and forested landscapes represent a shared aspiration across the region, although the means by which they are sought and the extent to which they have been realised vary widely. Plantation forests are important in the larger countries, where they and other forms of planted forest are now expected to deliver a diverse range of benefits. Decision processes about forests are increasingly recognising the diversity of values and interests in societies, and governance arrangements and delivery of services are depending more on partnerships between the public, private and non-government sectors.

Keywords: Traditional land use systems; customary tenure; customary rights; sustainable forest management; indigenous people; Oceania.

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17.1. Introduction

The Oceania region encompasses the islands of the Pacific and its neighbouring seas. These islands range in size from the continental scale of Australia and New Guinea to coral atolls of only tens of square kilometres, such as Tuvalu. Diversity – of ecosystems, economies and societies – characterises the region. The majority of islands are tropical, but New Zealand (NZ) is entirely temperate, as is around two thirds of Australia. The region is often subdivided into the sub-regions of Australasia, Melanesia, Micronesia and Polynesia (Map 17.1), reflecting the origins of its indigenous peoples. All Oceanic states have a relatively recent colonial past superimposed on their much longer-standing indigenous histories. All have forest histories in which modern forms of forest exploitation, forest management and forest conservation have been superimposed on a variety of historical and often sophisticated local-scale relationships between indigenous people and forests.

The states and territories comprising Oceania are listed in Table 1. Most of these comprise many islands with varying degrees of dispersal, although some (e.g. Niue, Nauru) are single islands. Other islands or island groups in the region – American Samoa, French Polynesia, Guam and New Caledonia – remain territories of other nations rather than independent states (Thaman 2002). All but Australia and New Zealand (jointly described as Australasia), which have advanced economies, are classified as Small Island Developing States (SIDS) (Wilkie et al.

Table 1. Key statistics about forests and people in Oceania

Sub-region & Country	Land area (sq. km)	No. of islands	Population 2002 (1000)	Population density people/sq.km	Forest area per capita (ha)	Forest area (1000 ha)	Forest area % of land area	Forest plantation area (1000 ha)
AUSTRALASIA								
Australia	7 687 000	1 mainland + 1L	19 547	2,5	8,3	164 000	21	1 600
New Zealand	268 680	2 L	3 910	15	2,1	8 200	30	1 800
MELANESIA								
Fiji	18 380	2L + 300	856	47	1	935*	51	100
New Caledonia	18 575	1 L + 11	208	11	1,8	370*	20	10
Papua New Guinea	462 243	Mainland + 7L + 593	5 172	11	6,5	36 000*	78	43
West Papua	421 981	Mainland + 12	c.2 200		–	33 000*	81	c. 30
Solomon Islands	28 370	7L + 985	495	17	5,9	2 200*	88	30
Vanuatu	12 190	80+	196	16	2,4	914*	75	3
MICRONESIA								
Federated States of Micronesia	702	607	136	702	0,1	*	–	–
Guam	541	1	161	293	–	*	–	–
Marshall Is	181	34	77	181	–	*	–	–
Nauru	21	1	12	587	–	*	–	–
Northern Mariana Is	471	17	77	162	0,2	*	–	–
Belau	488	200	19	42	1,8	35*	76	–
POLYNESIA								
American Samoa	200	5 in 2 groups	69	199	0,2	12	60	–
Samoa	2 935	8	179	61	0,6	105	37	4
Tuvalu	26	9	11	429	–	*	(77% coconuts)	–
Kiribati	810	33 in 3 groups	96	119	0,3	28*	70	*
Cook Islands	240	15 in 2 groups	20	87	1,2	*	–	1
French Polynesia	3 521	118 in 5 groups	258	62	0,5	–	–	– 1
Niue	258	1	2	8	3	6	25	–
Tokelau	12	3	1,5	125	–	*	–	2
Tonga	649	170	106	142	–	4*	6	–
Wallis & Futuna	255	3	16	57	–	–	–	–

(Carew-Reid 1989; Brown 1997; NZMAF 2001; Wilkie et al. 2002; Australian Government 2003a; Brown and Durst 2003; SPREP 2003; Alhamid 2004; Wikipedia 2004)
Note: * Forests either largely agroforestry systems (AFS) or combined AFS and natural forests; L = large island

2002). Trees and forests are of fundamental importance to traditional livelihoods in all nations and to varying degrees part of the market economy; in some, such as New Zealand or the Solomon Islands, the forestry sector is of major economic importance, but it has only modest or negligible status in others.

Consequently, relationships between forests and society in Oceania are complex and dynamic, but a number of common themes recur. Principal amongst these are:

- the importance of trees and of various forms of forests to traditional livelihoods and cultures and to ecosystem function;
- the recognition or assertion of indigenous rights over land and resources, with important consequences for both forest policy and practice;
- high levels of forest biodiversity and endemism, and thus significant conservation imperatives;
- significant environmental degradation and associated economic and social challenges, generated by unsustainable exploitation of forests;
- the emergence of social conflicts over forests, reflecting the different values associated with them, and of efforts to resolve these conflicts;
- profound emerging challenges, such as those posed by environmental degradation or climate change, or those associated with human capacity and governance.

The people of Oceania are responding to these issues in ways that reflect the diversity of their circumstances, environments and societies. This chapter outlines the contexts and issues fundamental to understanding forests, societies and environments in Oceania; it is necessarily synoptic and incomplete, but we hope it stimulates your interest in the region, and its people and forests.

17.2 Oceania – Environments, Forests and Societies

A Brief History

In general terms, the forest histories of the Oceanic countries can be described in terms of their indigenous, unsustainably exploitative, and post-exploitative foci, recognising that these elements continue to run contemporaneously to varying degrees. Each focus is characterised synoptically below.

Indigenous peoples' relationships with forests in Oceania have spiritual, cultural, economic and livelihood dimensions. All of these dimensions are captured in the phrase "land is life", used politically by contemporary Aboriginal Australians (Baker 1999), which typifies the terms in which indigenous peoples of the region explain the fundamental importance to their identity and wellbeing of their land and its resources (e.g. Siwatibau 2003). Oceania's indigenous peoples modified forests extensively, in a variety of ways – for example, by the use of fire and by hunting (e.g. Flannery 1994), and by deliberately manipulating the vegetation, as Kennedy and Clarke (2004) illustrate with extracts from earlier descriptions of the forests of the island of Tikopia in the Solomon Islands:

rather than being "... heavily wooded with small and infrequent patches of cultivation in the neighbourhood of scattered villages ... the whole of Tikopia ... is in a high state of economic utilisation, …gardens are made right up in the mountain, and …what appears to be bush is really a collection of trees and shrubs, each having its own value to the people, either for its food or in their material arts" (Firth 1936).

… the "... terrestrial environment of Tikopia is virtually its agricultural system. Its forest-like canopy, from the shorelines to the ridges and summits of the volcanic massifs of the incomplete crater rim, acts as a camouflage of the high state of economic utilization" (Kirch and Yen 1984).

Indigenous relationships with forests are dynamic as well as deeply rooted historically, and have adapted in various ways to the profound changes of the past few centuries following European contact. For example, particular trees and places retain their spiritual and cultural significance; "trees outside forests" remain at least as important, and often more so, for many livelihoods and environments than those in "natural" forests (Thaman 2002); in some countries, indigenous communities have gained significant economic benefits from engagement with modern plantation forestry (NZMAF 2001; Schirmer and Roche 2004). A wide range of non-wood forest products continues to be important for a diversity of uses (Thaman 2002; Siwatibau 2003). The interdependency of people and forests remains the common theme (Box 17.1).

All countries in the region with native forests of commercial value or standing on land deemed suitable for agriculture have experienced a phase, sometimes lengthy and in some cases still ongoing, in which these forests have been unsustainably exploited for timber production and conversion to other land uses. Australia and New Zealand have the longest history of such exploitation, and of progressively addressing it (e.g. Dargavel 1995; NZMAF 2001). Large-scale exploitation of the forests of the Pacific Island SIDS is more recent, but often dramatic, as Ward (1995) describes for the case of Western Samoa since 1978, where all accessible forests were exploited.

Forest harvesting for log export accelerated significantly in the 1990s in Papua New Guinea (PNG) and the Solomon Islands, as South East Asian timber companies exploited economic and political opportunities. Harvesting, primarily for log exports, continues to be a major source of national revenue and to have major environmental and social impacts (Hunt 1998; Dauvergne 2001). As Siwatibau (2003) notes:

"high exploitation is driven by governments' desire to maximize employment, gross domestic product, revenue and export income; and by corrupt deals between individual landowner leaders and aggressive logging companies. Landowning communities are persuaded with promises of development. Most times, they are much worse off after logging than before."

Each of the Oceanic nations has also sought to move to more sustainable forms of forest management, albeit in different ways and with varying degrees of success. These moves involve, variously, reservation of forests from harvesting, implementation of more sustainable harvesting practices in both native and planted forests, and greater consideration of the social and environmental issues associated with forestry activities. At one extreme, New Zealand ceased harvesting of public native forests and introduced greater controls over harvesting of private native forests (NZMAF 2001). Australia has established a much-expanded "comprehensive, adequate and representative" forest conservation reserve system, and introduced more rigorous controls over harvesting of the native forests that remain available for production (Australian Government 2003a).

Christian Cossalter

The combined plantation forest area in Australia and New Zealand is approaching 4 million hectares. Large areas have been planted with eucalyptus species like *Eucalyptus tereticornis* and *Eucalyptus crebra* as here in Queensland, Autralia.

For reasons discussed subsequently, the large scale reservation of forests from production and the control of forest practices have not been easy to achieve in the Oceanic SIDS; as well, harvesting levels and practices in the forest-rich nations of PNG and the Solomon Islands continue to be demonstrably unsustainable (Hunt 1998, 2001; Dauvergne 2001). However, countries in the region have committed to the implementation of the Code of Practice for Forest Harvesting in Asia-Pacific (APFC 2000). Vanuatu has resisted the scale and most of the adverse impacts of forest exploitation experienced in PNG and the Solomon Islands, principally by banning log exports, and forest production in Fiji has shifted principally to plantations (Brown 1997).

As plantation forests become more important in the region, there is growing emphasis on their sustainability in broader rather than narrower terms (e.g. Carnus et al. 2003; Kanowski 2003; Keenan et al. 2004; Salt et al. 2004). The incorporation and management of trees in farming systems and rural landscapes are now recognized as important elements of sustainability in Australia and NZ (Australian Government 2004a; NZ Landcare Trust 2004), as they have long been in other countries of the region (Thaman 2002).

Forests and People in Oceania's Sub-Regions

Australasia: Australia and New Zealand

Australia and New Zealand share comparable forest histories, albeit on different scales. Indigenous peoples – the Australian Aboriginals and Aotearoa Maori – had significant impacts on forests, through hunting wildlife and through their use of fire (e.g. Flannery 1994; Hill 2003; Whitehead et al. 2003). Maori reduced the area of forest in New Zealand by about a third prior to the arrival of Europeans, who cleared a further third (Roche 1990). In Australia, both Aboriginal and European use of fire altered the landscape pattern and structure of forests, and European settlers converted about a third of Australia's forests to other land uses (Australian Government 2003a).

In both countries, the initial reliance on native forests for wood products has been progressively supplanted by wood from plantation forests, which were first established in the late 19th century, and the area of which is now approaching 2 million ha in each country. This transition has been effected almost completely in New Zealand, where plantation forestry is among the nation's most important industries. While wood production from native forest remains significant in many Australian states, its absolute and relative magnitudes are diminishing

BOX 17.1 Key Issues for People, Forests and Environment in the Pacific Island Countries

Saisuri Bulai and Otheniel Tanganiau

Pacific islanders have always had a very close attachment to their environments, including the sea, the land and the forests and trees. With knowledge accumulated over generations, Pacific islanders were able to arrive at and implement traditional systems of use and management of their natural resources that had served them well and which had ensured their sustainable well being.

Forests and trees and associated genetic resources have always provided timber, posts, thatch, food, fuel, medicines, traditional and cultural materials, soil and water protection, and shelter from the sun and rain – all crucial to the sustainable livelihoods of the largely rural Pacific island communities. However, increased population and the demand for economic growth, often coupled with unsustainable forest and tree use and harvesting practices, have resulted in serious depletion and degradation of the forest and tree resources in the Pacific islands. This gives rise to a situation of increasing demands being placed on a decreasing and degraded resource base. Consequently, Pacific island countries urgently need to consider ways and means for using and managing their remaining forest and tree resources on a sound, sustainable basis.

While much effort has been made at the international, regional and national levels, major challenges continue to confront Pacific island countries. The fundamental challenge faced by Pacific island countries is to use and manage their forest and tree resources sustainably, while at the same time continue to respond adequately to the demands for development and the social pressures exerted by their increasing populations.

Key issues confronting Pacific island countries in responding to this challenge include:

- Need for adequate policy and legal frameworks to properly support Pacific Island countries' activities towards the sustainable use and management of their forest and other tree resources.
- Need for political will, and for adequate national capacities (including better awareness), to effectively implement activities relating to the sustainable use and management of forest and tree resources.
- Need for effective participation of resource owners in the management of their forest and tree resources.
- Lack of land use policy and proper land use planning, and continuing unsustainable forest and tree harvesting practices.
- The higher cost of implementing sustainable forest management, which make it a financially less attractive land use option.
- Loss of both traditional knowledge and forest genetic resources.

as native forests are reserved for conservation, and plantation forests and production expand. In both countries, disagreements between the forest industry and conservation movement about both native and plantation forestry have also led to forest agreements of various forms and degrees of acceptance, e.g. Australia's Regional Forest Agreements (Australian Government 2003a, 2003b,) and New Zealand Forest Accord (NZMAF 2001). In both countries, there is now considerable focus on restoring trees to agricultural landscapes through both commercial and environmental plantings (NZMAF 2001; Australian Government 2003a).

Melanesia: Fiji, New Caledonia, Papua New Guinea and West Papua, Solomon Islands and Vanuatu

In comparison to the countries of the Micronesian and Polynesian sub-regions, the Melanesian countries are large, geographically and ecologically varied, and extensively forested. They have high levels of biodiversity and endemism. The people of New Guinea's highland valleys may have been among the world's first agriculturalists (Flannery 1994), and highly developed agroforestry systems were developed and adapted throughout Melanesia (Kennedy and Clarke 2004). Agricultural cash crops – including plantation crops, initially of coconut, coffee and sugar, and more recently of oil palm – have assumed increasing importance, displacing traditional tree-crop systems.

While sandalwood has been a significant export product from Vanuatu for more than a century (Brown 1997), the forests of Melanesian countries have been heavily exploited for commercial wood production since the end of World War 2, and especially since the 1980s. The levels, scales and impacts of exploitation have been greatest in PNG and the Solomon Islands (Filer and Sekhran 1998; Dauvergne 2001). Vanuatu's forests generally have less commercial value than those of its northern neighbours, and the country curtailed the worst impacts of large-scale harvesting by progressively introducing log export bans in the mid-1980s. Impacts on native forests have been significant in Fiji, but on a smaller scale; Fiji's forestry sector is now based primarily on 100 000 ha of plantations, and there are smaller areas of plantations in other Melanesian countries (Table 1). Contemporary issues for forests and people in the island of New Guinea are outlined in Box 17.2.

Micronesia: Federated States of Micronesia, Guam, Marshall Islands, Nauru, Northern Mariana Islands and Belau

Countries of the Micronesian sub-region can be characterized as groups of small islands, often only raised atolls or low-lying islands, and usually with very large sea boundaries. Customary land tenure and land use systems (Box 17.4) prevail to varying

BOX 17.2 FORESTS, SOCIETY AND ENVIRONMENT IN THE ISLAND OF NEW GUINEA

Martin Golman, Ruth Turia and Hidayat Alhamid

Introduction

There are about 69 million hectares of forests in New Guinea (includes the Independent State of Papua New Guinea, PNG and West Papua, WP, a province of Indonesia) – 36 million ha in Papua New Guinea (PNG Forest Authority 1996) and 33 million ha in West Papua (Matthews 2002). These forests house the largest remaining block of tropical forests in the Asia Pacific region and the third largest in the world after the Amazon and Congo Basins. Divided between Papua New Guinea and West Papua, these extensive tracts of rainforest are biologically among the richest on earth containing an estimated 16 000 species of flowering plants and, among other things, the most extensive and diverse mangroves in the world (Paijmans 1976). They are home to almost all of the world's bird of paradise species and tree kangaroos and include exemplary remnants of the most ancient pines, flowering plants and animals of the super-continent of Gondwanaland. New Guinea's forests contain commercial genera including *Anisoptera, Calophylum, Instia, Flindersia, Pometia, Palaquim* and *Hopea* in the lowlands; *Araucraria, Agathis* and *Castanopsis* on the foothills and in the submontane areas; and *Nothofagus* and *Libocedrus* in the higher montane forests (Hammermaster and Saunders 1995; Johns 1997).

In addition to economic and ecological benefits from the forests, the indigenous peoples of New Guinea have their own uses of the forests, and it is seen as an asset, not so much in terms of monetary value but with high social and spiritual value (van Helden 2001), to meet their specific needs. The use of forests is based on traditional knowledge and technology passed on from one generation to the next. However, traditional use has changed and is changing due to global economic pressures where the state, logging companies, and development agencies see advantages in exploiting the forests for economic development.

Ownership of Forests

The distinguishing feature of forest and forest management in New Guinea is that rights to land and to the forest resource itself are owned by customary groups and not the State. The State has the constitutional and legal mandate to access the forest to practice forest management. In PNG, the State had to gain access through agreements with the customary owners. Agreements are made between the State and the customary owners of the land and the forest to allow the government to have access to the forest; the forest resource is then allocated to a timber developer for a particular period for utilization and some form of forest management under government supervision. (See also Box 17.4)

WP has undergone two different phases in access to forest resources. In the first phase, during the Suharto regime (1965–1999), the state claimed full access to the forest and exploited it under a system called HPH (Hak Pengusahaan Hutan / Forestry Concession Rights). In the second phase, under the present regime of "Special Autonomy" (Otsus), community cooperatives (Kopermas) formed by customary owners are allowed to negotiate directly with timber companies to log the forest on the land that they claim as theirs under *adat* (customary rights regimes).

Forestry Development

Since the 1980s, the major emphasis of the policies of both states has been to increase the volume of log exports, to boost the economy of their respective countries and, particularly for WP, to increase harvesting of NTFPs to alleviate poverty. This increase in forestry activities, combined with lack of management resources or political will on the part of the State, saw the forest industry become "out of control" in PNG (Barnett 1989) and in effect in WP (Alhamid 2004). In WP, Otsus and other administrative changes have led to a substantial increase in illegal logging. Illegal timber harvesting in WP is estimated to yield 600 000 m^3 per month, nearly three times legal production (Bisnis Indonesia 2003).

The Barnett Inquiry of 1989 prompted major reform in the forest sector in PNG in the early 1990s, both in Forest Policy (PNG 1991) and Forest Legislation (PNG 1993 and subsequent amendments). Both the policy and legislation emphasized sustainable forest management principles, effective participation and benefits to landowners, and effective monitoring of forestry

degrees. Population densities are usually relatively high, and forest and tree resources limited (Table 1). Most Micronesian countries have limited economies and some association, whether formal or not, with the United States of America, on which they are also dependent to varying degrees for financial assistance. The exception is Nauru, which has a comparable relationship with Australia.

The typically small size of islands, poor atoll soils and low rainfall on some, and population and land use pressures on most, limit the extent of subsistence gardening, and preclude commercial land use activities other than small-scale cropping. Nevertheless, sophisticated agroforestry systems have been developed; the coconut palm is ubiquitous and important in many of these systems, both in its own right and as a shelter for the development of other species such as bananas, breadfruit, nuts and pandanus (Brown 1997; Thaman 2002). Cultivation of trees near villages and in house yards, and the protection and extension of strand vegetation, are important, and there are a wide range of husbandry practices including deliberate planting of seeds and propagules, transplanting of draft and self-sown plants, and mulching and protection (Thaman 2002). Many of these trees have multiple uses, averaging 11 per species, with a maximum reported of 121, for coconut (Thaman 2002).

Polynesia: American Samoa, Cook Islands, French Polynesia, Kiribati, Niue, Tokelau, Tonga, Tuvalu, Wallis and Futuna and Western Samoa

The geography, population and forest characteristics of the countries of the Polynesian sub-region are generally similar to those of the Micronesian countries described above. Similarly, customary land tenure and use systems prevail (Box 17.3). Domestic economies are typically small, although tourism is

operations. The unstable political situation prevailing in WP has not allowed Otsus policy to become fully implemented, and Presidential Decree No. 1/2003, which divides WP Province into three new provinces, will potentially increase the pressure on natural resources.

Current Concerns

None of the three objectives of the forest sector reforms in PNG are being fully realised (Independent Forestry Review Team 2001). In WP, as a result of both the activities of the cooperatives (Kopermas) and illegal logging, more customary land is being harvested unsustainably and converted to other uses, with no regard for long-term forest management. Moreover, local welfare is being diminished rather than increased by forestry activities in West Papua, with significant social problems such as increased rates of HIV/AIDS (Aditjondro 2002), and physical confrontations associated with persistent conflict between local communities and logging companies and government agencies (Inside Indonesia 1992; Down to Earth 2002).

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significant for some islands, and there is increased dependency on imports. Significant proportions of each country's population live in diaspora, with those remaining at home dependent on regular remittances from abroad.

Traditional land use systems prevail to varying degrees, as described for Micronesia. Deforestation and the related phenomenon of "agro-deforestation" (Thaman 2002), driven mostly by the expansion of cash crops but in a few cases (e.g. Western Samoa) by logging, have severely impacted on the forests and trees of some islands, with many adverse environmental impacts (Brown 1997). Home and subsistence garden plantings of selected indigenous and exotic trees, shrubs and other plants continue to be significant for a variety of uses – e.g. coconuts, kava, fibre and bark species, perfumery and medicinal plants and ornamentals (Thaman 2002; Tilling and Holzknecht 2001).

17.3 Key Issues for Forests, People and Environment in Oceania

A number of common themes emerge as key issues for forests, people and environment across Oceania. Each of these is reviewed below.

Biodiversity, Species Extinction and Threatened Ecosystems

The Oceanic islands and the Australian continent have high levels of endemic biodiversity, reflecting their evolutionary and geographic isolation, and a rich diversity of habitats. Endemism rates of 80% are common (SPREP 2003a). Oceanic countries also have the world's highest rates of recent and predicted species extinction or endangerment, a consequence of exploitation, habitat loss, the introduction of invasive animal and plant species, and land use and land management change (NZ Ministry for the Environ-

Markku Kanninen

Melanesian countries have high levels of biodiversity and endemism, which continue to be threatened by the unsustainable harvesting levels and practices especially in PNG and the Solomon Islands.

Markku Kanninen

Coastal and mangrove forest have received belated attention as forest ecosystems of particular importance in the island environments and economies of the region.

BOX 17.3 Sustainable Management of Maori-Owned Forests

Robert Miller

Before Maori arrived in New Zealand (NZ) around 1200 AD, forest covered an estimated 75% of the country. Maori forest clearance had reduced forest cover to 50% by the time European colonization started in the late 1700s (Roche 1990). These settlers contributed to further deforestation, mainly by clearing forest for agriculture, so that New Zealand's indigenous forest cover is now 23% (6.4 million ha), with another 6% in exotic plantations (NZMAF 2001).

Maori's spiritual connections to the forests (through Tane mahuta, god of the forests and birds) is as strong as their connections to the earth (Papa tua nuku, the Earth Mother), to the sky (Ranginui, the sky father) and to the rivers, lakes and sea (Tangaroa, god of the sea). The majority (77%) of NZ's remaining indigenous forest cover is in national parks and conservation forests owned by the state. About 1.4 million ha of forest is in private ownership; Maori own 31% of this, mostly in the North Island.

Concerns with overuse and clearance of NZ's forests in the 1970s and 1980s led government to decide to end all harvesting of indigenous forests on public land by 2002, and to the introduction, under the 1993 Forests Act, of sustainable forest management regulations for all privately owned native forests. These regulations require managed harvesting of forests to ensure that forest growth is replaced, and that the forest's structure and ecosystems are disrupted as little as possible and its natural values maintained. Forest owners may apply for either an SFM Plan (registered against the land title for 50 years) or for a more limited SFM Permit.

NZ indigenous forests are dominated by softwoods such as kauri (*Agathis australis*) and rimu (*Dacrydium cupressinum*), and hardwoods such as the southern beeches (*Nothofagus* species) and tawa (*Beilschmiedia tawa*). The softwoods have long been sought for shipbuilding, house construction and furniture, so that the available volumes are now quite limited. In the future, NZ beeches will be the main source of native timbers. All the main commercial species are well represented in Maori-owned forests, and are being harvested and utilised. Maori-owned forests tend to be owned by trusts, each often representing many hundreds of families (e.g. in one clan or tribe). To date, 36 Maori owners have taken up either SFM Plans or Permits, totalling 34 000 ha. The estimated potential area of Maori forest land suitable for growing timber is around 150 000 ha.

Mechanisms for involving Maori in the sustainable management of forests include:

- Option 1: Assign cutting rights to a contractor, with the payment of stumpage or royalty to owners. This is the preferred mechanism at present; it offers the least risk but probably also the lowest returns, and may not offer employment opportunities.
- Option 2: Joint venture with a processor.
- Option 3: Full participation in forest management and downstream processing.

A significant challenge, which the Maori are seeking to address, is increasing their level of participation in forest management and processing. Although the principal focus of SFM, and the reason for its introduction into the Forest Act, has been to regulate timber harvesting, the concept goes much further than just timber. Sustainable forest management offers additional opportunities for Maori including:

- management for environmental services, such as carbon credits;
- management for a range of other products, including honey, sphagnum moss, and natural pharmaceuticals (e.g. tea tree oil);
- development of other industries based on forests (e.g. eco-tourism).

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ment 1997; United Nations 2000; NLWRA 2002; SPREP 2003a,b). The extent of many ecosystems has been severely reduced, and the integrity and persistence of others threatened.

Recognition of the magnitude of these losses and threats has prompted a much stronger focus on conservation in the past few decades, including the establishment of national parks in Australia and New Zealand, the initiation of various forms of conservation partnerships between governments or conservation NGOs and landowners, the establishment of national and regional conservation networks, specific species and habitat recovery projects, and a focus on more sustainable forms of forest management (NZ Ministry for the Environment 1997; United Nations 2000; Australian Government 2002a; SPREP 2003a,b). In some cases, these responses may arrest species and ecosystem decline; in others, the processes of land use and environmental change, population fragmentation and reduction, and the impacts of exotic organisms mean that subsequent waves of extinction or depauperation are inevitable (e.g. Australia Terrestrial Biodiversity Assessment 2002).

Conservation and Sustainable Management of Native Forests

Because of the threats to biodiversity described above, conserving representative areas of native forest from exploitation – as part of a landscape-scale approach to biodiversity conservation and maintenance of ecosystem function – has become a shared concern across the region; additionally, coastal and mangrove forests have received belated attention as forest ecosystems of particular importance in the island environments and economies of the region (Siwatibau 2003). The rise of environmental movements in both Australia and New Zealand over the past two decades has been reflected in forest policies, which progressively reserved native forests from wood pro-

duction (Dargavel 1995; Perley 2003). In the New Zealand case, all harvesting from public forests ceased in 2002 (Box 17.3; NZMAF 2001); in Australia, a "comprehensive, adequate and representative" forest conservation reserve system was established in regions with significant areas of commercial native forest (Dargavel et al. 2000; Australian Government 2003b); in some regions, state governments decided that wood production from public forests should be significantly reduced immediately or is be phased over an extended period.

The classical North American "national park" model, of establishing "protected areas" from which people are excluded other than as visitors, is not at all suited to Oceania, where landscapes reflect the outcomes of human interventions over millennia (Thaman 2002; Kennedy and Clarke 2004), and where customary land tenure systems have been retained and landowners' opportunities for economic development are limited (United Nations 2000). Even in Australia and New Zealand, which have implemented conventional "protected area" models of conservation, there is belated recognition of both the moral and practical imperatives for more collaborative management arrangements with indigenous peoples (Baker et al. 2001; NZ Ministry for Environment 2004). Consequently, conservation initiatives in Oceanic SIDS have focused on community-based approaches "which generate income from natural resources without destroying them" (United Nations 2000), and have thus sought to use mechanisms such as Integrated Conservation and Development Projects, conservation trust funds, and conservation covenants to facilitate integrated conservation and development outcomes which continue, at least in part, traditional forms of land use (e.g. Hunt 1998; Tacconi 2000; Siwatibau 2003).

Although the interpretation of sustainable forest management outside conservation forests varies between countries, and SFM remains more aspirational than operational in those with log export-dominated forest economies, the issue of SFM is strongly on the agenda in all Oceanic countries (e.g. SPC 2000, 2003). It is not only the adverse environmental impacts of unsustainable forest harvesting practices that are of concern, but also the adverse social impacts often associated with large-scale timber harvesting. These include increased levels of conflict within communities, about resource rights and the distribution and use of income from their sale, and between communities, logging companies and government agencies (Filer and Sekhran 1998; Fry 2000). These conflicts are particularly acute in the Melanesian countries, where there are strong commercial pressures for large-scale forest exploitation (Box 17.2; Siwatibau 2003). There are also serious pressures on valuable non-industrial forest species such as eaglewood (Gunn et al. 2004) and sandalwood (Channel and Thomson 1999), which similarly demonstrate the difficulties of sustaining these species in the face of strong market demand and the absence of effective conservation and management strategies.

Achieving more sustainable forest management outcomes – defined by both higher levels of community acceptance and better environmental outcomes – has proven politically, socially and operationally challenging in all Oceanic nations. It has been the focus of substantial public investment in Australia, most recently through the Regional Forest Agreement process, which sought to continue public native forest management for wood production as well as for other forest values (e.g. Dargavel et al. 2000; Australian Government 2003b). In contrast, harvesting of native forests in New Zealand is now restricted to privately and Maori owned forests (Box 17.3; NZMAF 2001). In all Oceanic countries, the focus on sustainable forest management has broadened to include all tenures and forms of forest and forestry.

Trees Outside Forests and Planted Forests

Thaman (2002) argues that: "for many of the SIDS of the Pacific, trees outside forests constitute, perhaps, the single greatest foundation for the life and health of our islands, soils, rivers, beaches, coastlines, people and the other plants and animals on which we depend".

Across Oceania, there is now a renewed emphasis on the economic role of trees outside forests, as well as on their environmental benefits (see also Tilling and Holzknecht 2001). Various agroforestry systems (summarised by Thaman 2002) are well established in Oceanic SIDS, and commercial farm forestry is now well developed in some regions of Australia and New Zealand (e.g. NZMAF 2001; Australian Government 2003c).

In Australia, where environmental degradation associated with dryland salinity already threatens agricultural production across almost 7 million ha, an area expected to nearly treble by 2050, some innovative large-scale tree crop systems, such as Western Australia's oil mallee alleys (Oil Mallee Company 2004), have been developed to address both commercial and environmental goals (e.g. CSIRO et al. 2001). However, public policy and institutional arrangements in Australia and New Zealand are only belatedly recognising the situation for the Oceanic SIDS; this is reflected in Kennedy and Clark's (2004) characterisation of Pacific islands landscapes, and described by Thaman (2002):

"In traditional Pacific Islands societies, activities such as forestry, agriculture, home economics, medicine and industry were not compartmentalised into economic sectors or 'departments' as they are in modern development. Rather, they were integral components of agroforestry systems tailored, over time, to the environmental and societal needs of each island ecosystem".

BOX 17.4 Customary Resource Tenure and Use Systems in Oceania

Hartmut Holzknecht

Many customary resource tenure and use systems continue to be entrenched and functionally active throughout Oceania. They are defined and constrained by the kinship and inheritance patterns operating in each particular Oceanic society. The most common is the patrilineal system through which permanent resource rights across a number of fields are inherited and passed down the male line. The proportion of matrilineal systems increases towards southern Oceania, where natural resource rights are passed down the female line (though males in each generation still manage the associated resources on a day-to-day basis). Some tenure systems combine elements of these two. Chiefly and strongly hierarchical systems are relatively few in the northern part of Oceania and increase towards the south of the region.

Some common characteristics of the tenure systems are:

- Tenure systems are essentially based on privatised resource ownership and use systems, which function according to established societal principles.
- A wide range of rights (inheritance, use, access, control) are vested in customary groups and individuals within them. These groups are kin-based according to local customs. Final decisions regarding land and other resources can be made at different levels of the group; for example, in Melanesia, these decisions are usually made at the clan level, but in some cases also at the sub-clan or extended lineage level.
- Membership in a customary group is inherited at birth and is confirmed by self and mutual recognition. Permanent rights holders can invite in temporary users (e.g. to make a garden together), but this does not give residual rights to temporary users.
- The right to use land for a specific purpose (e.g. new subsistence garden) is based on agreement with group elders and usually lasts for one growing season.
- Different rights may apply to the same parcel of land; for example, ownership and inheritance rights, temporary gardening rights, right to build a house, rights over economic trees, fishing rights, hunting rights, etc. The rights may also be held communally, constituting a common property. Since a range of tenure and use rules apply, resources are not under open access.
- Rights to economic trees (e.g. coconuts, nut trees, pandanus, etc.), usually planted and maintained by an individual, are held by that individual and may be transferred to any other individual (but usually a family member).
- These tenure systems are dynamic; to a large extent they have been very resilient and have coped with significant pressures and changes (e.g. high rates of population increase and planting of perennial tree crops, such as coconuts, coffee and cocoa).

Modern developments across Oceania, particularly in Melanesia, continue to place great strain on customary tenure systems, especially where logging of large areas is associated with corruption and manipulation. The active presence of emerging Melanesian elites in each country has resulted in promises of economic advancement that remain mere promises for the vast majority of customary resource rights-holders, with only a very small proportion of individuals gaining significant material benefits from exploitative activities. In addition, there are avenues by which certain individuals register areas of land in their own names, to the detriment of their fellow group members who have also held rights to those resources and have benefited from activities on those areas.

Nevertheless, Oceania's peoples have repeatedly shown that they wish to retain customary tenure systems, and as regional conservation initiatives discovered, public policy about natural resource conservation and use in Oceania needs to work with, rather than against, these customary systems (United Nations 2000).

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Thaman (2002) argues that understanding this history, and the land use systems it fostered, provide the best foundation for addressing the deforestation and agro-deforestation experienced in Oceanic SIDS as a consequence of increased population densities, and of commercial agriculture and forestry. Given the persistence of dual economies in most Oceanic nations, and the continuing reliance of many people in the region on their forest or forestland for subsistence (Siwatibau, 2003), achieving sustainable forest management across the whole landscape is both a priority and a significant challenge (Wilkie et al. 2002).

The coconut palm is the archetypal plantation tree of the Pacific, with some 121 reported uses, including biofuel (Harries 2001; Thaman 2002). In Australia and New Zealand, industrial plantation forestry has become one of the defining features of forest policy, forestry practice, and the forest-based industries over the past century (NZMAF 2001; Keenan et al. 2004). Public policy has strongly supported the expansion of plantation forests and private sector interest in them (Schirmer and Kanowski 2004; Schirmer and Roche 2004); forest plantation areas in each country are now approaching 2 million ha, and support significant processing industries, which supply the majority of domestic forest products and generate substantial export income from both processed and unprocessed products. Smaller-scale forest plantation programs have been successful in some Oceanic SIDS, notably Fiji, and to a lesser extent in PNG, the Solomon Islands, and Vanuatu (Brown 1997).

BOX 17.5 Australia's Indigenous Peoples and Forests

Sue Feary

Australia is one of the most prosperous countries in Oceania, yet its indigenous peoples are some of the most disadvantaged in the world. In 1788 the British began a legacy of dispossession and cultural denial, from which indigenous people have not fully recovered. The Australian High Court recognised native title in the landmark Mabo case in 1992; this was a significant step in the healing process (McGlade 2003). An understanding by the wider Australian population of the spiritual association that Indigenous people have with their traditional lands, and the nature of its application in contemporary society, is a critical component of the processes of self-determination and reconciliation (Young 1995; Rose 1996).

Australia was perhaps the first Oceanic country to be peopled and, from at least 40 000 years ago, indigenous communities have exploited aquatic and terrestrial ecosystems as part of a seasonal round of socio-economic activities (Mulvaney and Kamminga 1999). Sustainable use of resources was determined through an intimate knowledge of the natural world, encapsulated within complex religious and kinship systems (Berndt and Berndt 1977; Baker 1993). Apart from the desert peoples, forest resources were significant in this hunter-gatherer economy, providing plant and animal foods, medicines, and raw materials for shelter and tools (Feary 1988). " Fire stick" farming was used to increase production e.g. green pick for macropods (Jones 1969), although the impact of fire on vegetation has long been contested (Horton 1982; Hill 2003). Forested landscapes such as mountains were and still are spiritual places of immense significance, and Aboriginal people have fought hard for their protection (see Egloff 1979; Feary and Borschmann 1999).

Traditional use of forest has all but disappeared; indigenous people retain and renew their knowledge base through elders teaching younger generations about " bush tucker" and " bush medicine" (Baker 1999). Bush tucker is a growth industry, both as a tourist attraction (ATSIC and DPIE 1997) and in agroforestry (Bristow et al. 2003), and brings significant revenue to some communities, demonstrating the capacity of indigenous communities to mould traditional practices to benefit from contemporary capitalist economies.

Timber harvesting was not a traditional practice, but Aboriginal people have been involved in the timber industry in Australia since the Europeans arrived. There are few written records, but a wealth of oral history testifies to forest industries' being a significant employer of Aboriginal men (Feary 1988). Also, there was some surprise when the Aboriginal community as a whole did not side with the conservationists during the logging debates of the 1980s; many Aboriginal people felt a loyalty to the industry and were reluctant to participate in opposing it (Thompson 1985).

Indigenous involvement in forestry is currently very low in Australia (BDO 2004). Most state government forestry agencies employ some indigenous people, but there is virtually no engagement with the private sector. In an effort to redress this, the Australian government decided in 2003 to develop a National Indigenous Forestry Strategy (NIFS) (Australian Government 2004). A reduction in harvesting native forests as a result of Regional Forest Agreements, combined with the government's policy for plantation expansion, seemed to be an opportunity for indigenous people to set up joint ventures with the private sector. There are potential benefits for both parties, especially if industry could, under acceptable arrangements, access part of the 18% of Australia's landmass and 13% of forestland, now under indigenous ownership, to grow trees.

A consultation process with Aboriginal communities across Australia in connection with NIFS produced varied responses. An urgent need for initial capacity-building was identified nationally. Also universal was the desire to combine commercial tree growing with other enterprises that had more of a land nurturing quality, such as establishing nurseries and re-vegetation of degraded lands.

The outcomes of this consultation process suggest that indigenous communities' desire to be involved in timber harvesting is inversely related to the degree of retention of traditional lands and knowledge. For example, the people of the Tiwi Islands, near Darwin, have entered into a joint venture with a large company to cultivate a fast growing species of Acacia to produce woodchips (BDO 2004). At the other end of the scale, the Tasmanian Aboriginal people, who have arguably suffered the greatest loss of their culture, have expressed reluctance to be involved in any partnership that would potentially lead to further destruction of their cultural heritage in timber production forests.

For the NIFS to be successful, its implementation must recognize and take into account many powerful forces: an historical legacy leading to indigenous social and economic disadvantage; a distrust and cynicism about government programs; governance and kinship obligations in indigenous communities and, above all, a need to meet environmental, social and cultural – as well as economic – objectives.

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Oil palm plantations are expanding in PNG and the Solomon Islands, typically on sites from which natural forest has been harvested; while these estates may eventually be considered forest resources, they are currently considered their antithesis, largely because their establishment is causing the loss of natural forest.

Retention or Restoration of Customary Resource Rights

The constitutional protection of traditional ownership of land and forests throughout the Oceanic SIDS is a defining and distinctive feature of the region (Box 17.4); in Australia and New Zealand, these rights are being progressively restored to indigenous peoples after periods of denial or diminution (Boxes 17.3 and 17.5). Customary tenure has been perceived as both an asset and a liability from the perspectives of both forest-based development and forest conservation (Brown 1997). In practice, the presence of many landowners, with disparate interests and often poorly defined claims to specific resources, has provided both opportunities for and constraints to forest exploitation and conservation (Box 17.4; Brown 1997; Filer and Sekhran 1998). Given the severely disadvantaged economic circumstances of most traditional landowners in most Oceanic nations, developing institutional arrangements that provide economic opportunities without prejudicing other forest values is a regional imperative and the focus

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of considerable attention (e.g. Hunt 1998, 2001; Tacconi 2000). As is already the case in many Oceanic nations (e.g. Filer and Sekhran 1998; United Nations 2000), non-government and community-based organisations are likely to have a particularly important role in achieving this goal.

As Box 17.4 notes, land tenure in the Pacific is dynamic; de facto individual ownership is becoming more common with the expansion of cash cropping. A number of development theorists and institutions (e.g. Hughes 2004) have suggested that these customary tenure systems represent significant obstacles to development, and have advocated instead the creation of individual title as the basis for economic development in the Oceanic SIDS. However, there seems little support for, and substantial opposition to, this option within countries of the region.

In Australia and New Zealand, where ownership rights have been progressively restored to traditional owners, indigenous peoples have a strong interest in deriving economic as well as non-material benefits from their forests (Box 17.3 and Box 17.5; Hammond 2001; Whitehead et al. 2003; Australian Government 2004b; Schirmer and Roche 2004). Mechanisms for giving effect to this intent are better developed in New Zealand than in Australia, but in both countries, indigenous peoples are benefiting from products of both native and planted forests. In at least some regions of Australia, the most valuable forest products may be those supporting traditional arts and crafts rather than more industrially oriented wood production (Altman 2001; Australian Government 2004b).

Emerging Markets

The emergence of markets for the environmental services provided by forests offers some opportunities for Oceanic nations, though most have yet to be realised (see Landell-Mills and Porras 2002 for a global review; Wilkie et al. 2002 for discussion in the context of SIDS). Biodiversity conservation, catchment services, carbon sequestration and ecotourism are considered the best prospects, and there have been at least pilot scale projects seeking to develop each of these possibilities (e.g. Hunt 1998; CSIRO et al. 2001; Wilkie et al. 2002; NZ Climate Change Office 2004a). As for all market mechanisms, differences in the value ascribed to the environmental service by the resource owners and the prospective purchasers limit the extent to which owners' choices can be influenced. Hunt (1998) describes this in the particular case of some Oceanic biodiversity conservation projects, and Landell-Mills and Porras (2002) discuss these issues more generally. However, well-designed market mechanisms can be effective in helping achieve public good outcomes: examples from the region include the Australian state of Victoria's "Bush Tender" scheme, which uses a tendering process for financing biodiversity conservation priorities on private land (DSE 2004), and the conservation lease arrangements which support Vanuatu's Erramango Kauri Protected Area (Tacconi 2000).

There are a number of constraints to the establishment of environmental services markets within the region. In the Oceanic SIDS, difficulties in securing

BOX 17.6 South Pacific Regional Initiative on Forest Genetic Resources (SPRIG)

Lex Thomson

For Pacific Island peoples, forest genetic resources constitute a capital inheritance that, until recent times, was passed on relatively intact or in some cases enhanced from one generation to the next. Together with other plant and animal genetic resources, forest genetic resources are the "capital" needed for development and maintenance of rural Pacific Island communities, and upon which most cash and other forms of income are based. However, forest genetic resources, one of the essential elements for sustainable rural development in the Pacific Islands, are being steadily eroded through population pressure and land use change leading to loss of forests, poor logging practices, climate change, and invasive species.

SPRIG, an Australian Government-supported development assistance project, aims to strengthen conservation, management and utilization of forest genetic resources in the Pacific Islands, including Cook Islands, Fiji, Kiribati, Niue, Samoa, Solomon Islands, Tonga and Vanuatu. The project has:

- acted as a catalyst in raising awareness of the importance of conserving forest genetic resources and of the opportunities for their better utilization and development;
- provided training to Forestry Department counterparts in subject areas relevant to the management of forest genetic resources;
- planned for conservation and sustainable utilization of priority tree species;
- initiated research and development activities on key tree species leading to identification and production of superior tree germplasm; and
- enabled deployment of superior and more diverse forest genetic resources in rural development and tree planting programs.

SPRIG has adapted simple tree domestication processes, developed for Australian trees, to important Pacific species. Notable examples include whitewood (*Endospermum medullosum*) and sea almond (*Terminalia catappa*). Rapid growth and flowering/fruiting at a young age makes both species ideal model candidates for such work, and substantial gains are being evidenced in these and other priority tree species, such as Canarium nuts, sandalwoods (*Santalum spp.*) and mahogany (*Swietenia*).

long-term rights over trees growing on customary land and the limited areas available for tree planting in the smaller states mitigate against investment under the flexibility mechanisms of the Kyoto Protocol to the Framework Convention on Climate Change (Kanowski and Wasson 2001). Australia, which could be in a position to benefit substantially from investment in planted forests for carbon sequestration (CSIRO et al 2001; Kanowski and Wasson 2001), has yet to ratify the Kyoto Protocol, thus limiting such investments to showcase levels. While an Australian market for freshwater allocation has been established (Murray-Darling Basin Commission 2004), policy settings remain inconsistent in their treatment of forests; for example, there are proposals to tax water use by trees differently from that by other crops (Keenan et al. 2004), but no mechanism to recognise the catchment services provided by forests.

Global Climate Change

The low-lying Oceanic SIDS are amongst those nations most vulnerable to and threatened by global climate change, with both sea level rise and increased frequency and intensity of predicted extreme climatic events, and with no control over the underlying causes of these threats (Wilkie 2002). Significant changes, with considerable impacts for forest conservation and production, are also expected in the larger Oceanic nations (Australian Government 2002b; Hay et al. 2003; NZ Climate Change Office 2004b).

The implications for the people of the low-lying Oceanic SIDS are potentially drastic, and exacerbated by limited adaptation and mitigation options; as Wilkie (2002) notes, resettlement or migration of part or even entire populations may be necessary for some islands and states. The implications for forests are also profound, with likely enhanced saltwater intrusion in the coastal zones of islands, altered rainfall and storm patterns, and perhaps a greater fire frequency; impacts on biodiversity are expected to be substantial, with higher levels of disturbance likely to favour exotic invasive species (Wilkie 2002). It is for these reasons that the Oceanic SIDS in particular are so concerned about the potential consequences of global climate change.

Institutional Capacity

Institutional capacity relevant to forest conservation and sustainable forest management remains a severe constraint throughout Oceania. It is particularly acute in many Oceanic SIDS, in which limited human and financial resources constrain capacity development. Regional networks and partnerships have been fostered as means of addressing this situation (e.g. Box 17.6; Bulai 2002; SPREP 2003c). Institutional capacity for forest governance has been particularly challenged in the Melanesian states with high levels of export log harvesting. The people and forests of both PNG and the Solomon Islands have suffered significantly from the corrupted forest governance regimes (Filer and Sekhran 1998; Hunt 1998; Dauvergne 2001).

In the larger, advanced economies of Australia and New Zealand, prevailing political philosophies

since the 1980s have favoured substantial reductions in public sector expenditure in the forest sector. In general, this has led to the privatisation or corporatisation of public forestry agencies and reduced attention to non-commercial functions, such as recreational provision and research (e.g. Schirmer and Kanowski 2004; Schirmer and Roche 2004).

17.4 Paradigm Shifts Concerning Forests in Oceania

Paradigm shifts in two areas concerning forests are dominant in Oceania: sustainable forest management, and rights and interests in forests, both with a number of dimensions. There are also shifts in paradigms of governance and capacity. Seen in a wider historical context these paradigm shifts, now evident in the relationships between societies and forests in Oceania, might be better described as the progression between phases in a cycle, rather than as a linear shift. Each of these themes reflects underlying societal issues, principally the values accorded to forests, their relative importance amongst economic development opportunities, and the basis of resource rights and decision processes about natural resources.

Different countries in the region are at different stages of these paradigm shifts, which themselves interact, creating a complex policy dynamic within any one country and across the region. The principal common elements and implications are discussed below.

Sustainable Forest Management

The sustainable forest management paradigm emerging in Oceania has, as elsewhere, three principal elements: how forests are sustained on a landscape scale; how extractive uses of forests are managed; and how decisions about these issues are made and implemented. The first two of these elements are discussed in this section, and the third in the subsequent section.

Sustaining Forests on a Landscape Scale

A focus on landscape-scale forest management recognises the contributions of all forms of trees in the landscape in sustaining forest and environmental values within a wider spatial and temporal context. Landscape-scale forest management recognises the importance of forest pattern, composition and structure in the enhancement and maintenance of ecological processes, and recognises the reality of social and economic processes as embedded within functioning landscapes. Landscape-scale forest management includes and emphasizes the roles of trees outside forests, including those in planted forests, and the roles of forests managed for production as well as those managed for conservation, in the achievement of sustainable forest management goals (see Kanowski 2001; Kanowski et al. 1999). The renewed focus on this paradigm (e.g. CIFOR 2004; Dudley and Pollard in press) can be seen as a contemporary reinterpretation of roles and values of forests and trees in traditional land use systems in the Oceanic islands (Thaman 2002; Kennedy and Clarke 2004).

The renewed focus on the landscape scale redresses the narrower scope, where certain environmental, social and economic forest values were marginalised, which had been adopted by many forestry organizations during much of the 20th century. During the first part of the century, this narrower approach was limited principally to only those elements within the forested landscape of value for industrial wood production; progressively, the focus broadened to include those ecological elements valued for biodiversity conservation, and subsequently to other forms of trees and forests. This narrow utilitarian paradigm was paralleled in agriculture by a focus on intensification and increased production, which diminished the roles of trees in agricultural systems. Over the past few decades, this narrow focus within agriculture has also evolved to include a wider set of socio-ecological values with the emergence of sustainable agriculture as a critical part of sustainable land use (e.g. Vanclay and Lawrence 1995; Thaman 2002).

Increasing pressure on water resources throughout much of Oceania has also focused attention on the significance of trees and forests in catchments (e.g. Carpenter and Lawedrau 2002; Keenan et al. 2004). Consequently, throughout the region, there is a growing policy emphasis on sustaining and enhancing the roles and multiple functions of trees and forests in all parts of the landscape, for ecological values (e.g. biodiversity, dispersal and reproduction processes, etc.), social values (e.g. aesthetics and recreation) and environmental services (e.g. water purification, soil conservation, flood mitigation, etc.), as well as for commercial products.

In general, these policies are predicated on recognition and realisation of the actual or potential economic values of trees in farming and land use systems, including their value for providing ecosystem services and maintaining the environmental base upon which economic land management depends. This policy focus acknowledges that, while non-monetary motivations for maintaining or restoring trees and forests are important for particular landowners, particular values, and particular places, economic returns are a fundamental requirement for landscape-scale enhancement of the contributions of trees and forests to sustainable natural resource management. Therefore, there has been renewed emphasis on farming systems, which harness the commercial potential of both traditional and novel

forms of tree growing, and a high level of interest in the potential of environmental services markets to deliver some financial benefits to tree growers and forest owners (e.g. CSIRO et al. 2001). Similarly, both in policy and in practice, the importance of other traditional land management practices, such as the burning regimes of Aboriginal Australians, to sustainable natural resource management are beginning to be recognised (e.g. Whitehead et al. 2003). The evident unsustainability of many of the 20th century land use practices and their environmental legacies (Brown 1997; NZ Ministry for the Environment 1997; Australian Government 2002a; Thaman 2002) means that sustainable management of trees and forests in the landscape will assume greater rather than lesser significance in the future across Oceania.

Sustaining the Use of Forest Resources

While all Oceanic countries are committed to the principle of sustainable forest management (e.g. SPC 2003), the extent and means by which this intent has been realised varies, reflecting the varied circumstances and different options of countries for economic development. In the smaller island nations without forests of industrial scale or commercial value, the focus is only on the sustainable management of trees outside forests. In the more forested nations, the characteristic cycle is one which begins with unsustainable levels and forms of exploitation associated with the transformation of natural to financial capital and with the change from forested to non-forested land use; this is the paradigm of forest-based development first promulgated, and then renounced, by Westoby (1987). All countries with significant areas of forest have experienced this phase, and some – principally PNG and the Solomon Islands – have not yet progressed beyond it in other than particular cases.

The second phase is characterised by the significant reduction of harvest levels from native forests, usually in association with the maturing of plantation forests. Australia, Fiji, New Zealand and Vanuatu illustrate this, although at different scales and in different forms. This typifies the multiple-use paradigm of the last quarter of the 20th century (e.g. Kirkland 1989). The third phase is that of the increasing reservation of native forests from production, the implementation of much more conservative forest management practices in native forests, and the recognition of goals other than wood production in the management of plantation forests. Australia and New Zealand exemplify different interpretations and forms of this phase; the latter has chosen to forego wood production from remnant native forests almost entirely, embodying the post-productivist paradigm (Mather 2001), and many Australian conservation organizations advocate a similar path for Australia (Australian Conservation Foundation 1995). In the countries with large plantation forest estates, the management of these forests is progressively recognising and accommodating values other than wood production (e.g. Carnus et al. 2003; Keenan et al. 2004).

In most countries of the region in which forests are important, there is strong debate at both community and political levels about the issues associated with each of these paradigms and the shifts between them. In forest-rich but economically-poor countries with few alternative economic development pathways, typified by PNG and the Solomon Islands, the debate and operational practice focus less on whether the forest should be harvested, and more on how it should be harvested to minimise adverse environmental and social impacts (e.g. Hunt 1998, 2001). Reduced-impact industrial-scale logging (APFC 2000) and small-scale "eco-forestry", characterised by the use of portable sawmills (Groves 2001; Hunt, 2001; Tilling and Holzknecht, 2001), are two common elements of the paradigm shift; greater capture of the profits flowing from forest harvesting, by both government, customary landowners and the communities they represent, are another (Hunt 2001; Siwatibau 2003). Many communities see eco-forestry as a preferable alternative to industrial logging because they can exercise much greater control over it, and may derive a broader set of benefits from it.

Hunt's (2001) comparison of the economic and non-monetary outcomes of industrial-scale logging, eco-forestry, and direct subsidisation of conservation management helps illustrate why the latter two options remain less, rather than more, common. The analysis suggests that eco-forestry and logging generate different suites of costs and benefits – for example, the income stream from eco-forestry is modest and extended over time, whereas that from industrial logging is greater initially, but likely to be a one-off lump sum; eco-forestry requires the community to raise start-up costs, although these are often met by donors, and industrial logging is likely to generate higher levels of foreign exchange and tax revenue, at least in the short term; the environmental effects of eco-forestry are generally minor, but industrial logging facilitates conversion to agriculture, which landowners may find attractive. Hunt's (2001) analysis found that the income streams generated by eco-forestry and direct subsidisation for conservation were likely to be comparable, but both were substantially less than the more common model of industrial logging, particularly where it is followed by conversion to agriculture. These results illustrate both the many dimensions of, and the challenges in, moving to more sustainable forest management.

In the economically developed countries of Oceania, the debate has been principally between productivist and post-productivist (Mather 2001), or resourcism and preservationist (Perley 2003), paradigms. The land allocation and use outcomes of this debate have been discussed in preceding sections; the associated paradigm shift has also enabled the

historically strong distinction between attitudes to the management of public and private land in Australia and New Zealand to be progressively overcome, leading to the more consistent regulation of forest practices on all land tenures (NZMAF 2001; Australian Government 2003a). The other dominant features of this debate are the recognition of a diversity of interests in forest policy and forest management, and the exploration of the means by which this diversity is accommodated; these issues are discussed further below.

Rights and Interests in Forests

The paradigm cycle associated with rights and interests in forests in Oceania is characterised by two parallel elements: the progressive restoration of indigenous rights where they have been denied in the past, and the increased recognition in policy and management of the plurality of interests in forests. Indigenous rights over forests were never denied in the Oceanic SIDS; while they were recognised in New Zealand through the 1840 Treaty of Waitangi, they had little effect until the 1975 Treaty of Waitangi Act (Matunga 2000; NZMAF 2001); prior indigenous rights over resources were not recognised in Australia until a 1992 High Court decision (Box 17.5; McGlade 2003).

Indigenous Rights and Interests

In the Oceanic SIDS, the focus of discussion between customary landowners and others with interests in forests is now on the most appropriate forms of partnership arrangements for achieving forest management goals. The history of forest exploitation in the richly forested nations of PNG and the Solomon Islands illustrates many of the unsatisfactory elements of such partnerships, in environmental, economic and social terms (e.g. Filer and Sekhran 1998; Hunt 1998, 2001; Dauvergne 2001). Conversely, a number of forest-based development and conservation projects illustrate that, while it may be challenging, it is not impossible to develop partnerships which protect the environment as well as enhance peoples' livelihoods (e.g. Hunt, 1998, 2001; Tacconi 2000).

One of the challenges common to forest-based development throughout the Oceanic SIDS is the difficulty of securing investment in local value-added processing, and thus delivering higher levels of livelihood benefits than through the export of unprocessed product. Such investment is constrained by the limitations of forest resource access, poor infrastructure and the local skill base, as well as by the more general factors determining investment, such as the extent of comparative advantage (Brown 1997). While there are various economic opportunities associated with non-timber forest products (Box 17.6; United Nations 2000; Thaman 2002), the potential value of wood products has generally been the focus of external investor interest. Successful wood processing enterprises have been established in Fiji, based on plantation forests, and in Vanuatu, based on both native and planted forests. As discussed above, "ecoforestry" – based on processing by small-scale portable sawmills – has been promoted in Oceania as a means by which landowners can engage in economic activity and exercise a higher degree of control over forest harvesting, enhance product value recovery and maximise the value of the retained forest, provided various constraints are addressed (Hunt 2001; Tilling and Holzknecht 2001). The emergence of alternatives to industrial-scale forest harvesting, which also empower landowners, represents an important paradigm shift in Melanesia, and is also relevant elsewhere in Oceania, for example to Maori and Aboriginal communities. Indigenous communities all over Oceania are increasingly expressing their concerns about logging and value-adding activities which are seen as "too large" and in which they do not have direct participation.

In the cases of New Zealand and Australia, where Maori and Aboriginal rights were denied to varying degrees and for varying periods, the restitution of those rights defines a fundamental paradigm shift. This restitution has progressed furthest in New Zealand, where Maori are now significant landowners and stakeholders in both indigenous and plantation forestry (Box 17.3; Schirmer and Roche 2004). Aboriginal Australians now manage 18% of Australia's land; although much of this is only sparsely forested, its management nevertheless offers opportunities to address both economic and social needs, as well as deliver environmental benefits associated with more sustainable management (Altman 2001; Baker et al. 2001, Whitehead et al. 2003). While the rights and interests of Aboriginal people are also increasingly recognised by those who manage other public and private forests (Australian Government 2003a), the mechanisms to institutionalise those rights and interests remain at an early stage of development (Australian Government 2004b).

Recognising the Plurality of Interests in Forests

In contrast to the forests of the Oceanic SIDS, for which customary ownership is the starting point for decisions about how forests will be managed, the native forests of Australia and New Zealand have been largely under either public or individual private ownership. In both countries, plantation forestry started as a state enterprise, but has become completely privatised in New Zealand and either privatised or corporatised in Australia (Schirmer and Kanowski 2004; Schirmer and Roche 2004). The rise of the environmental movement over the past 30 years has profoundly altered the emphasis and conduct of forest policy and management in both Australia

and New Zealand and, to a lesser but nevertheless significant extent, in Oceanic SIDS (Dargavel et al. 2000; Roche 1990; Hunt 1998). One important dimension of these changes has been the recognition of the plurality of interests in forests, and the initiation of processes to facilitate greater community input into decision processes about public forests.

These processes take three general forms. The first comprises various consultative and participatory mechanisms established and managed by governments, primarily about public forest policy and management in Australia and New Zealand – where there has also been an increased focus on private forest policy – and about customary forests in Oceanic SIDS. The second comprises forest certification processes and their mechanisms for stakeholder involvement (e.g. Australian Forestry Standard 2004; Forest Stewardship Council 2004). The third, currently less common than the two preceding, is the establishment of collaborative forest management arrangements in the sense generally understood internationally (e.g. Petheram et al. 2003).

At the highest level of public policy formulation, Vanuatu has the distinction, uniquely, of having developed its national forest policy through a highly consultative public process (Wyatt et al. 1999). At the level of forestland allocation and use, the greatest number of consultative and participatory processes about public forests in the region has been in Australia, reflecting in part its extensive areas of native forest and the long history of community debate about their appropriate management. The national Regional Forest Agreement process (Dargavel et al. 2000; Australian Government 2004b), and related state-based processes which preceded and followed it, engaged stakeholders in decisions concerning forest allocation and use to a much greater extent than previously, although not to all parties' satisfaction. In both Australia and New Zealand, private forest owners have become subject to a higher level of regulation, under the provisions of various Australian state arrangements, e.g. Tasmania's Forest Practices Code (Forest Practices Board 2004) or New Zealand's Resource Management Act (NZMAF 2001), or forest certification requirements. At the forest management unit level, a variety of stakeholder consultative and negotiating processes are employed throughout the region (e.g. Buchy et al. 1999 for Australia; Filer and Sekhran 1998 for PNG; Brown 1997 for the region).

To date, forest certification has been pursued principally for some plantation forests in Australia and New Zealand, and for some small-scale native forest management projects in Oceanic SIDS (Tolfts 2000; Kanowski 2001; NZMAF 2001). Consequently, certification has not yet impacted significantly on stakeholder involvement in forest management other than for those relatively few forests and forest operations that have been certified (e.g. Forest Stewardship Council certification now covers 34% of New Zealand's plantation forests, mainly small and medium forests). Certification's impact is likely to increase as forest owners and processors in the region pursue certification with either Forest Stewardship Council or Pan-European Forest Certification accreditation.

Because of the prevalence of customary land ownership in the region, collaborative forest management in the sense of "community forestry" (e.g. Arnold 2001) is not directly applicable in the Oceanic SIDS. However, joint action by landowners, and their collaboration with government, to achieve a common purpose – whether conservation or development related – is common (e.g. Filer and Sekhran 1998; Hunt 1998; Tacconi 2000), and collaborative partnerships for forest management are recognised as the basis for sustainable development in the Oceanic SIDS (United Nations 2000). Collaborative forest management has unrealised potential in Australia and New Zealand, where small-scale pilot initiatives, or research to support them, are underway (e.g. Petherham et al. 2003; Langer and Tomlinson 2003). It is likely that forms of collaborative forest management will expand in Oceania as policy and practice evolve, and will complement other mechanisms for recognising the plurality of interests in the region's forests. This will be facilitated by a growing acknowledgement of the value of traditional knowledge of forests, and the potential for integrating traditional and modern knowledge in contemporary forest management (e.g. Boxes 17.3, 17.5 and 17.6; United Nations 2000; Whitehead et al. 2003).

Governance and Capacity

The dominant paradigm shifts underway in Oceania in relation to governance and capacity are from a public forestry agency to other government agencies and to "new generation" regulatory instruments, and from the public sector to private and community organisations. New Zealand led this shift, with changes in its forestry agency associated with privatisation, and with the 1991 Resource Management Act focusing on effect-based, rather than prescriptive, approaches (NZMAF 2001). The Australian states have followed to varying degrees (Kanowski 2001), with the state of Tasmania exemplifying many aspects of "new generation" environmental instruments (Gunningham and Sinclair 2003) in its forest practices system (Forest Practices Board 2004). PNG outsourced key elements of log export monitoring to a private company, SGS Pty, Ltd., and is considering further outsourcing of forest administration and management (Stocker 2001).

These changes are consistent with contemporary thinking about good governance in the forestry sector (e.g. Mayers and Bass 1999; RECOFTC 2002), and – to the extent that they enhance and diversify overall capacity, empower civil society, and thus add resilience – they are to be welcomed. For example,

community-based organizations in Australia and PNG, such as Greening Australia (Greening Australia 2004) or the Village Development Trust (Hunt 2001; Holzknecht et al. 2002) respectively, have become important agents for engaging with the community, promoting sustainable forest management and delivering services on behalf of government.

However, these changes also reflect a diminishing public sector capacity to levels that are of concern in many Oceanic nations. This is particularly the case in the Oceanic SIDS, where the capacity of relevant agencies has always been limited, but it is also becoming an issue in Australia and New Zealand as the public sector downsizes and the funding necessary to maintain alternative capacity is seldom committed over the long term (Dovers 2003). This loss of capacity is also reflected, to varying degrees, in forest-related research, which is characterised by an increasingly commercial focus, and in tertiary education relevant to forests. While there has been an encouraging diversification in the institutions and individuals engaged in forest-related research and education, it has generally been at the expense of critical mass and breadth of coverage, and therefore of the capacity underpinning research and education. One of the responses to these challenges has been the initiation of joint endeavours between previously distinct organizations, such as the joint venture between Australia's CSIRO (Commonwealth Scientific & Industrial Research Organisation) Division of Forestry and Forest Products and New Zealand's Forest Research Institute (CSIRO and NZFRI 2004), and the fostering of regional research networks such as that represented by the South Pacific Regional Initiative on Forest Genetic Resources (SPRIG) Project described in Box 17.6.

Consequently, throughout Oceania, governments are now likely to invest in public sector activities related to forests only in partnership with either or both the private sector and community-based or non-government organisations. This shift from the public sector paradigm of much of the 20th century reflects both the more general global shift in political ideology, and the related set of choices about the use of scarce public funds. While partnership approaches have much to recommend them, they do need to be adequately resourced if they are to meet societal needs. Given that they are often associated with diminished resource provision, there is increasing concern amongst environment and resource management professionals and communities about the adverse consequences of this shift for sustainable forest management across the landscape, and thus its longer-term environmental and social impacts. However, these concerns have yet to impact significantly on prevailing political paradigms in the region.

17.5 Conclusions

Relationships between societies and forests in Oceania illustrate many common themes. The principal of these are:

- the rich histories of indigenous use and management of trees and forests, and their livelihood and cultural values;
- the high levels of forest biodiversity and endemism, some of it sustained by traditional practices, and much of it vulnerable because of land use and global change;
- the more recent substantial loss and degradation of trees and forests associated with exploitative forest practices and agricultural conversion, and the consequent environmental and social implications;
- the challenges of progressing towards more socially inclusive and ecologically sustainable forest management, and of accommodating the diversity of values and interests in forests;
- the emerging and profound challenges posed by global change.

The challenges of managing the increased complexity manifested by these relationships are occurring at a time when some key forest sector capacities, such as those for forest research, education and policy development, are facing increasing resource and human capacity constraints across the countries of Oceania.

These relationships also exemplify many contrasts. The more striking contrasts are between those large areas of forests which remain under traditional and conservation-oriented management, and others which are subject to intense exploitation or management; between societies that value forests for services rather than products, and those that seek principally to realise the value of forest products; between recognition and denial of traditional rights over forests; between some of the world's best forest practices and some of the worst; between traditional heterogenous polycultural land use systems and modern industrial plantation forestry; between sustainable value-adding forest industries and those which remain largely exploitative; and between nations which are large exporters of forest products and those that depend almost entirely on imports.

The common themes and interests across the region facilitate cooperation, and a number of mechanisms exist to foster this. Conversely, the great differences in levels of economic development, and thus in access to basic services, across the region mean that there are quite different priorities for forests between wealthy and less wealthy nations. Reconciling these differences through consensus processes can be challenging. It is apparent that the Oceanic countries with advanced economies have much to learn from the other nations of the region about many aspects of the relationships between people and forests; it is also apparent that the experiences of the advanced economies with their forests can and should inform

the forest-related choices which other countries make on their paths to economic development.

The paradigm shifts associated with forests in Oceania – towards more sustainable forest management at both landscape and stand scales, towards more meaningful engagement of the plurality of interests in forest policy and management, and towards more contemporary models of governance and capacity – reflect the efforts of societies in the region to find balance among the diverse values and benefits of forests, and the costs associated with particular choices. Both traditional and modern knowledge and practice can and should contribute to this dynamic and ongoing process of reconciling the benefits forests and trees can offer, with the demands which the people of Oceania make of them.

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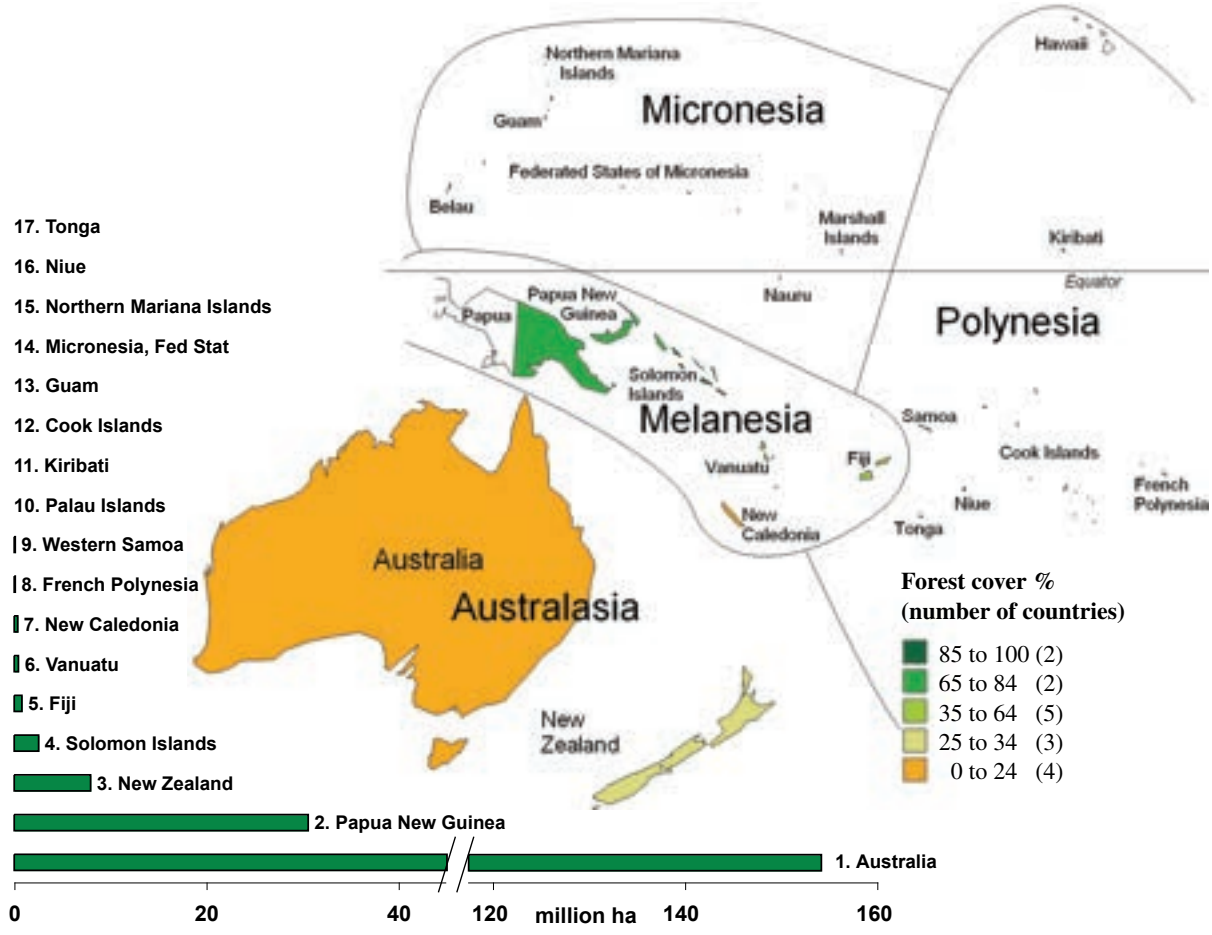
Map 17.1 Forest cover in Oceania (percent of land area) and total forest area per country
(Data: FAO FAOSTAT 2005; map designed by Samuel Chopo)



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