

PART I

INTRODUCTION



Gerardo Mery



# I Forests in a Changing World

*Gerardo Mery and René I. Alfaro*

## I.1 The Rationale of the Book

This new book produced by the International Union of Forest Research Organizations (IUFRO) Special Project on World Forests, Society and Environment (WFSE) is the result of a collaborative effort involving researchers in multiple disciplines from throughout the world. The publication was conceived as a forum to analyse the challenges, threats, and opportunities facing the forest sector due to the profound changes that our planet and contemporary society are experiencing. The unprecedented pressures produced by these changes – many of which are global in nature, such as climate change, the growing demands of human society on natural resources, and increasing deforestation – often place the very survival of numerous ecosystems at risk, threatening their resilience, and seriously affecting the biodiversity of the planet and the well-being of society.

This book follows our previous publication, *Forests in the Global Balance: Changing Paradigms* (Mery et al. 2005), and uses a similar research approach in which the analyses evolve in broad global or regional levels, and the phenomena studied are intended to describe problems and challenges in a comprehensive manner. Our aim has been to avoid an analysis of the forest sector in isolation. We wanted to consider the pressures and synergies on forests presented by other socio-economic sectors, particularly those that have a clear impact on forests and forestry, such as wood-based industries, agriculture, energy, infrastructure, and the complex array of pressures from a growing human population and the resultant high demands for forest products and services. We wanted to apply an interdisciplinary approach to the topics studied.

Our primary interest was to identify the main drivers of change and their direct or indirect repercussions on forests and forestry, to propose ways to reduce the adverse effects posed by these drivers, and to identify the benefits or opportunities these drivers of change may bring. We have included a number of case studies that serve to illustrate how society and institutions are striving to respond to the aforementioned drivers of change, at different scales, and in diverse parts of the world.

A key aspect in this publication was to investigate whether the foremost paradigm that has governed forestry during the last two decades, namely sustainable forest management (SFM), is really working in practice for people and nature. We acknowledge the strategic impetus provided by SFM in the sustained production of goods and services, and in the maintenance of future options related to forests, without damaging other ecosystems. However, the rampant rate of deforestation and forest degradation that still exists, the continuity of the serious problems affecting our planet's biodiversity, and the persistence of poverty in areas where forest resources play an important role in socio-economic development, has led us to think that the ultimate solution to these problems must be found not only by considering forests and forestry activities, but also in looking beyond the forest sector.

Therefore, our *a priori* consideration was the urgent need to broaden the concept of SFM through a more integrated notion of social and natural resource management, including the management of land, water, and other natural resources along with the forests. On that basis, we may find a proper balance – at the broadest landscape level – that enables us not only to use these natural resources, but also to effectively conserve them for the benefit of future generations.

Special emphasis was placed on analysing policies and institutional arrangements being pursued to address new challenges, and how global and regional policy goals translate into tangible progress in sustainable forest management at the local level. Drawing on experience to date, and on the perceived growing complexity of the forestry sector, policy and institutional arrangements are proposed, as well as conclusions about the profile of new professionals needed to meet crucial challenges affecting forests, society, and the environment.

Consistent with the analysis and assumptions outlined above, this book, *Forests and Society – Responding to Global Drivers of Change*, offers readers 24 chapters grouped into six parts. This first part is introductory, explains the purpose of the book, and describes a brief introduction for each chapter. The second part, in six chapters, analyses the



**Photo 1.** This book was developed by 160 authors from all around the world through a collaborative and open process. The photo shows the participants to the Editorial Workshop organised on the premises of von Thünen Institut in Hamburg, Germany, in June 2009.

global environmental changes affecting the world's forests. The third part, also with six chapters, deals with issues relating to global socio-economic changes affecting forests. The fourth part presents eight regional or local examples of forest-related challenges and opportunities in the changing world. The fifth part, in two chapters, deals with forest management options, policies, and institutional arrangements the authors believe are needed to address new challenges, and present the main findings, highlighting the challenges and opportunities found within the book, and propose strategies to promote a better future for people and forests. In the sixth part, the final chapter of the book, the reader will find in-depth analyses of the challenges and opportunities faced by forests and forestry in a changing world. Beginning with Part 2, Chapter 2, the individual chapters are briefly described below.

## 1.2 Brief Introduction to the Chapters

**Chapter 2** is *Forests and Adaptation to Climate Change: Challenges and Opportunities*. In this chapter, the authors explain why and how forests and forest-dependent societies are likely to be affected by climate change and its associated environmental and socio-economic disturbances. The chapter provides an overview of climate change as a driver of change in forests, the challenges and opportunities of adapting forests and forest-dependent people to

climate change, and the use of forests in adaptation practices, as well as associated policy issues.

In **Chapter 3**, *Harnessing Forests for Climate Change Mitigation through REDD+*, the authors point out that deforestation, forest degradation, and land-use changes are major sources of carbon emissions. The urgent need to reduce carbon emissions has led to the development of mechanisms, such as REDD+, that may provide an attractive option to enable developed countries to partially achieve their reduction targets through investment in developing countries. Such mechanisms may also provide less developed countries with a source of financing for sustainable forest management to support rural development plans and poverty reduction strategies. The implementation of these new mechanisms will demand the active participation of local communities, enabling them to benefit from emerging carbon markets and opportunities generated by the renewal of governmental institutions, and the formulation and application of new policies and regulations.

**Chapter 4**, *Air Pollution Impacts on Forests in a Changing Climate*, is also concerned with climate change issues. The authors point out that awareness of air pollution effects on forests from the early 1980s led to intensive research, monitoring, and public awareness, particularly in developed countries. The first indications of a recovery of forest soil and tree conditions – which may be attributed to improved air quality – have been identified. However, the integrative effects of air pollution and climatic change (particularly elevated O<sub>3</sub>) altered nutrient cycling and availability, temperature, water availability, and el-



evated CO<sub>2</sub>, will be key issues for research, including into interactions of these effects and the development of ecosystem models integrating multiple effects.

In **Chapter 5, *Forest Cover in Global Water Governance***, the authors stress the importance of water as a key resource for growing human populations and for sustaining increased production of food and energy under threat from climate change. The central role of forests in water cycling and for protecting water quality is also emphasised. The development of a common understanding of the role of forest management in water governance, and a readiness for diverse future scenarios in a global change perspective are key objectives. Major conclusions include emphasis on preparedness for solutions where forest management is part of water governance to meet the needs of different land users. The importance of transparency and local involvement of stakeholders is also discussed.

**Chapter 6, *Forest Biodiversity and Ecosystem Services: Drivers of Change, Responses, and Challenges***, describes four relevant anthropogenic drivers of change in biodiversity, namely conversion of forests into agricultural lands, over-exploitation of forests, air pollution leading to climate change and acid rain, and invasive species. The authors recommend a proactive approach to forest conservation, combining aspects of willingness to conserve with willingness to pay for further conservation; removal of administrative barriers to sustainable forest management and protection; landscape management; inter-sectoral coordination between international, national, and local policies; increased communication among stakeholders; and more research on the interactions between biodiversity and ecosystem services.

In **Chapter 7, *Forest Health in a Changing Environment***, the authors emphasise that climate change will have profound effects on future forest distribution and composition, as well as on the organisms living in forests. It describes how climate change models anticipate that trees will become more susceptible to insects and diseases as these organisms sustain alterations in their lifecycles, increase their host ranges and virulence, and become important drivers of change in forest ecosystems. Accelerated global trade will foster the likelihood of introduction of new pathogens as well as plants and animals alien to native ecosystems. Measures for increasing forest resistance to climate-induced forest health decline and the role of pest management as a mitigating tool for climate change on forests are presented.

**Chapter 8, *Changes in Global Markets for Forest Products and Timberlands***, presents a brief review of the major global trends in the trade of forest products, followed by an analysis of foreign direct investment in forest industries, and the growth of timberland investments. The driving forces of changes are identi-

fied and investigated. The reallocation of the forest industry's production capacity in developing countries is analysed. The authors also discuss the changing face of forestry and the global markets for wood products, coupled with timberland investment as a form of joint response to changing economies, markets, land values, technologies, and public policies. The greater environmental awareness of consumers is also considered.

**Chapter 9, *Implications of Technological Development (TD) to Forestry***, observes that TD often creates new opportunities and structures that make obsolete and commonly destroy the old technologies. Technological development has rarely been the focus of forest research, despite its large impact on different fields of forest sciences and forestry. The impacts of technological change on the forest sector are analysed by focusing on three technologies: information and communication technologies, biotechnology applications in forestry, and laser technology applications to forest inventories and monitoring. The implications and opportunities created by these three technologies are analysed, as well as the challenges that they represent.

**Chapter 10, *Forests and Bioenergy Production***, refers to the growing global role of forests as a renewable energy source. The authors explain how woody biomass is increasingly being used for power, heat, and in the derivation of transportation fuels. Forest-based energy production can reduce the use of fossil fuels and the emission of greenhouse gases. However, the over-utilisation of forest ecosystems can jeopardise the sustainable development of forests and have negative effects on the people who are dependent on them. Therefore, forest energy policies have to be based on the principle of sustainable development, ensuring both socio-economic and environmental viability of this use of the resource.

**Chapter 11, *Forestry in Changing Social Landscapes***, describes how current rapid changes tend to push social and ecological systems toward unsustainable conditions. The challenge is to maintain the balance between these systems and, simultaneously, secure ecological resilience while avoiding social disruption and insecurity. Global population growth, its concentration in urban centres, as well as changing consumption habits, will impact global land use, including forests. Perceptions and attitudes, and inherent cultures of societies, determine the level of public support and success of forestry, the implementation of sustainable management, and effective conservation measures.

**Chapter 12, *Forests, Human Health and Well-being in Light of Climate Change and Urbanisation***, begins with the recognition that forests provide a wide range of ecosystem goods and services beneficial (and in many cases, absolutely required) for human life in both urban and rural areas. In addition,

forests are important arenas for recreation, aesthetic appreciation, and stress relief, and for some cultures, even spiritual renewal. However, many of these positive effects of forests on human health and well-being may be threatened as a result of climate change. Increased pressure on urban forests and their capacity to provide ecosystem services, reduced availability and quality of recreational areas, and higher risk of exposure to vector-borne diseases are some of the adverse effects discussed.

**Chapter 13, *Extra-Sectoral Drivers of Forest Change***, discusses the importance of drivers that are external to the forest sector in shaping forests and forestry. These driving forces originate beyond forestry, and often affect forests and their social, economic, and ecological functions. The authors explain that these drivers of change have frequently contributed to extra-sectoral influences that eclipse sectoral developments as key drivers of forest landscape transformation. A brief overview of extra-sectoral pressures on forests, and the effects these have had on forest-dependent communities, is given.

**Chapter 14, *Sustainability of Boreal Forests and Forestry in a Changing Environment***, explains that this extensive biome, which is undergoing changes such as thawing of permafrost and increased levels of natural and anthropogenic disturbance, may produce net releases of CO<sub>2</sub> and methane, while forest cover with greater biomass can be expected to expand onto the arctic tundra. Human use in some parts of northern forests is becoming more centralised and industrialised. The ecosystems and people of the world's boreal forests are vulnerable to impending climatic and socio-economic changes. Despite these changes, the boreal zone will continue to present opportunities to undertake landscape management over large areas dominated by natural forests to conserve biodiversity, establish and sustain economically viable enterprises and enhance development opportunities for northern communities.

**Chapter 15, *Amazon Forests at the Crossroads: Pressures, Responses, and Challenges***, describes some of the current key social, occupational, and political dynamics in the region, and reviews the prime threats affecting Amazonian forests and rural livelihoods. Among these are cattle-ranching, soybeans production, logging, infrastructure expansion, and the oil and gas industry. Also, a review of several recent responses to these threats is discussed, including progress in retooling institutions: for example, land tenure reform, decentralised government and deregulation, and incentives to support sustainable forest use and the newly emerging REDD initiatives.

**Chapter 16, *Opportunities and Challenges for Community Forestry: Lessons from Tropical America***, focuses on the actual contribution of forests and trees to rural livelihoods concentrating on evidence

that provides a more precise identification of the real potential of communal forestry to contribute to rural development. The authors review some of the challenges faced by community forestry development initiatives, and critically reflect on the need for actions to favour community forestry enterprise development and their integration into forest products value chains. These measures are seen necessary to enhance the generation of profits and to better prepare community-based enterprises to deal with complex policies and regulations. Finally, the potentials, limitations, and challenges of community and smallholder forestry are discussed.

*Emerging Local Economic and Social Dynamics Shaping East African Forest Landscapes* is the subject of **Chapter 17**. It focuses on three East African countries: Kenya, Tanzania, and Uganda. Climate change is a future threat in the region, accentuated by the heavy dependency of local communities on forest resources for income and fuelwood. Conversion of forest land to agriculture is another key challenge. Among the major drivers of deforestation is the failure to implement policies and regulations meant to control the use of forest resources. New initiatives have been undertaken to help resolve these challenges, including decentralisation, increasing participation of communities in the management of forests, expanding the role of the private sector, and local communities in forest plantation development.

In **Chapter 18, *Secondary Forests in West Africa: A Challenge and Opportunity for Management***, the authors point out that secondary forests constitute about 90% of West African forests. These forests are often degraded and continue to suffer diverse pressures and disturbances. Viable options for the sustainable use of these forests must be developed. A broad dissemination and application of rehabilitation concepts based on ecological processes – such as succession – must be undertaken. Applicable silvicultural management systems, including enrichment planting, refining, and liberation to gradually re-convert degraded forests into valuable timber resources, must be explored and applied with local participation. Agroforestry and utilisation of non-wood forest products also offer good possibilities for management, economic improvement of impoverished resources and food security, contributing to the stabilisation of livelihood strategies of rural populations.

**Chapter 19, *Promoting Sustainable Forest Management Through Community Forestry in the Philippines***, explains that participation and equity are core values of “community forestry or participatory forestry.” The Philippines is one of the pioneers in Asia in the adoption of community-based forest management strategies, having three decades of experience in promoting sustainable forest management (SFM) through the participation of local

communities. The potential and current limitations of this national strategy are explored, and the rationale, history, objectives, and analyses of the factors behind its development are explained. Different approaches to community forestry, accomplishments, and outcomes are discussed; the enabling and reinforcing mechanisms are analysed, along with the issues and challenges facing the implementation of SFM. Finally, a synopsis of conclusions and lessons learned is presented.

**Chapter 20, *Genetic Resources and Conservation of Mahogany in Mesoamerica***, reviews the current knowledge on the genetic variation of mahogany (*Swietenia* spp.) and discusses the importance of provenance variability, seed transfer and sourcing recommendations. Further, the authors explore management strategies for mahogany, and provide guidelines for conserving genetic diversity in different forest landscapes. They conclude that conservation and sustainable management of mahogany genetic resources are not simple tasks, requiring local community involvement to prevent illegal logging. Community efforts must be compensated to ensure mutual benefit. Landscape level strategies for the effective management of mahogany trees outside of forests, for example in agroforestry practices, are urgently needed. An international consensus is needed for phytosanitary procedures.

**Chapter 21, *Sustainability of Wood Supply: Risk Analysis for a Pulp Mill in Guangxi, China***, focuses on the experiences of Stora Enso Corporation in establishing eucalypt plantations for supplying a large pulp mill in southern China with an annual production capacity of 1 million tonnes. The evaluation of the project concluded that it would be profitable, and environmentally and socially sustainable. Wood supply was assessed to be sufficient for the plant, a conclusion based on simple estimates of mean annual increment and areas of plantation available without fully taking into account many high-risk factors. The paper illustrates the need for many new fast-growing eucalypt plantations to ensure long-term sustainability of wood supply. National macro-economic planning; a consistent policy and management framework; and systematic and focused approaches emanating from the government and the private sector are needed, including clear policies of corporate responsibility.

**Chapter 22, *Managing Forested Landscapes for Socio-Ecological Resilience***, puts forward new approaches for managing forests for wood and other ecosystem goods and services. Case studies are used to illustrate recent advances in forest management in response to local impacts brought on by global change that address current challenges and elements of an emerging management paradigm based on ecological and socio-economic systems. Such a framework recognises the complexity of systems, their hierarchical structures, their interactions, and their capacity for self-organisation. Learning how to facilitate the ability of natural forest systems to self-organise, adapt and evolve, and to guide them towards a desired appropriate state is one of the challenges. The increasing importance of engagement, capacity building, and participation in landscape management is recognised as a first step toward maintaining the provision of ecosystem goods and services.

**Chapter 23, *Ability of Institutions to Address New Challenges***, presents an analytical framework for reviewing research findings and analysing the most promising institutional settings with which to address the drivers of change, to ameliorate problems, and to encourage responsible and sustainable forest management. Attention is focused on the shift from government to governance, political authority, disentangling abstract policy for specific requirements, and capacity enhancing knowledge-generating and administrative institutions. It reveals that the global nature of economic, social, and environmental demands on the world's forests, and complex commercial trade relationships, require an integrative analyses of domestic and local responses to assess the role of innovative regional and global institutions designed to address "good governance." The authors conclude by calling for much greater attention to the potential of synergistic institutional intersection to respond to new and enduring challenges in ways that single institutions are incapable of doing.

**Chapter 24**, the concluding chapter, is titled *The Need for New Strategies and Approaches*. This chapter summarises the main findings of the book, highlights challenges and opportunities, and analyses and proposes strategies required to promote a more promising future for people and forests. A brief allusion is made to the profile of new professionals required to meet current challenges affecting forests, society, and the environment. The key messages of the book are presented in a concise fashion in the last section of this chapter.