

World Forests, Society and Environment - Executive Summary

Chief Editor: Philip Wardle

Co-editors: Libor Jansky, Gerardo Mery, Matti Palo,
Jussi Uusivuori and Heidi Vanhanen

About the United Nations University (UNU)

The United Nations University is an organ of the United Nations established by the General Assembly in 1972 to be an international community of scholars engaged in research, advanced training and the dissemination of knowledge related to the pressing global problems of human survival, development and welfare. Its activities focus mainly on peace and conflict resolutions, development in a changing world, and science and technology in relation to human welfare. The University operates a worldwide network of research and post-graduate training centres, with its planning and coordinating headquarters in Tokyo.

©The United Nations University, 2003

Edited by: Philip Wardle (Chief Editor)

Libor Jansky

Gerardo Mery

Matti Palo

Jussi Uusivuori

Heidi Vanhanen

The views expressed in this publication are those of the authors and do not necessarily reflect the views of the United Nations University.

First edition published: August 2003

Environment and Sustainable Development Programme

The United Nations University

53-70, Jingumae 5-chome

Shibuya-ku, Tokyo 150-8925, Japan

Tel: +81-3-3499-2811

Fax: +81-3-3499-2828

E-mail: mbox@hq.unu.edu

Website: <http://www.unu.edu>

Designed and printed by: Orange Corp., Tokyo, Japan

ISBN 92-808-8016-0

World Forests, Society and Environment –Executive Summary

Chief Editor:

Philip Wardle

Co-editors:

Libor Jansky,

Gerardo Mery,

Matti Palo,

Jussi Uusivuori,

Heidi Vanhanen

World Forests, Society and Environment

Edited by Matti Palo and Jussi Uusivuori

WORLD FORESTS VOLUME I 1999

ISBN 0-7923-5594-6 (HB)

ISBN 0-7923-5595-4 (PB)

ISSN 0785-8388

Published by Kluwer Academic Publishers,
P. O. Box 17, 3300 AA Dordrecht, The Netherlands.

World Forests from Deforestation to Transition?

Edited by Matti Palo and Heidi Vanhanen

WORLD FORESTS VOLUME II 2000

ISBN 0-7923-6683-2 (HB)

ISBN 0-7923-6684-0 (PB)

ISSN 0785-8388

Published by Kluwer Academic Publishers,
P. O. Box 17, 3300 AA Dordrecht, The Netherlands.

World Forests, Markets and Policies

Edited by Matti Palo, Jussi Uusivuori and Gerardo Mery

WORLD FORESTS VOLUME III 2001

ISBN 0-7923-7170-4 (HB)

ISBN 0-7923-7171-2 (PB)

ISSN 0785-8388

Published by Kluwer Academic Publishers,
P. O. Box 17, 3300 AA Dordrecht, The Netherlands.

(See p. 52 for a listing of the authors of these WFSE publications).

Foreword

The last decades of the twentieth century witnessed an increasing awareness by people and institutions around the world of important issues related to forests and forestry. Tropical deforestation, desertification, decreasing biodiversity, climate change and the scarcity of fresh water are issues of recent and ongoing global conflict and debate. The 1990s saw a rapid globalization of forest politics, forest industries, NGOs and consumers of forest products and services. A historical turning point was reached when forestry issues appeared on the global political agendas of both the United Nations and the G8 Summits. The globalization of the forest sector calls for global research.

The World Forests, Society and Environment (WFSE) research project was created as a response to this global concern. The project was initiated in May 1996 by three partners: the Finnish Forest Research Institute (METLA), the United Nations University/Institute of Advanced Studies (UNU/IAS) and the European Forest Institute (EFI). Later on, UNU Centre, through its Environment and Sustainable Development Programme, and five new institutions engaged in international forest research joined WFSE. The partners constitute an important alliance with a mission for globally relevant research, effective dissemination and human capacity building on the interrelationships between forests, society and environment in support of sustainable development and the well-being of people. In its work, the WFSE maintains an independent and non-governmental point of view.

The project was planned and conducted by Professor Matti Palo until 2001. Dr. Jussi Uusivuori also played an important role in the work of WFSE. Research, coordination and editing were performed at METLA and EFI in Finland by an international team of researchers from seven countries. The team assembled a collaborative network with 149 scientists from all continents. WFSE has also been able to disseminate its research results in Africa, the Americas, Asia and Europe at numerous conferences, workshops, seminars and lectures.

Kluwer Academic Publishers established for WFSE a "World Forests" series with academics, students and

experts as target audiences. Policy makers and policy advisors constitute another important target group whose special requirements are being covered by the present executive summary that highlights the research results from three volumes that were published by WFSE in 1999-2001:

- ***World Forests, Society and Environment*** (edited by M. Palo and J. Uusivuori 1999) was Volume I in the "World Forests" series. It contained 40 articles and 19 boxes by 70 authors, more than half of whom came from non-OECD countries.
- ***World Forests from Deforestation to Transition?*** (edited by M. Palo and H. Vanhanen 2000) was Volume II. It contained articles of 15 authors from 9 countries on four continents.
- ***World Forests, Markets and Policies*** (edited by M. Palo, J. Uusivuori and G. Mery 2001) was Volume III. It contained 33 articles and 24 boxes by 98 authors from five continents.

In addition, WFSE in collaboration with EFI has created a Forest Products Trade Flow Database. Some of the results obtained in this research activity were presented in the book *A Global Study of Regional Trade Flow of Five Groups of Forest Products* (B. Michie and S. Kin 1999) published independently by WFSE.

As partners, we are very satisfied with the scientific productivity, relevance and quality of the results achieved by the researchers of the METLA/UNU/EFI project. We appreciate the special collaboration and quality input of the international forest research community for this initiative. With its renewed, ten-partner structure within the International Union of Forestry Research Organizations (IUFRO), we are optimistic that IUFRO-WFSE will continue to make important scientific contributions in this crucial area.

Eljas Pöytäla, Hans van Ginkel, Risto Päävinen,
METLA, Helsinki UNU, Tokyo EFI, Joensuu

IUFRO-WFSE Preface

The World Forests, Society and Environment (WFSE) research project leading to the three published volumes in the "World Forests" series during 1999-2001 was a response to the increasing demand for research information concerning the world's forest issues.

Although the demand regarding many specific issues related to the world's forests is still growing, there is simultaneously an urgent need to present existing scientific results on global issues addressing the interrelations between forests, societies and environments in a more accessible form for scientists, policy makers and practitioners. This is precisely the main aim of the Special Project of the International Union of Forest Research Organizations (IUFRO) on World Forests, Society and Environment, IUFRO-WFSE, in 2002-2005.

To the international scientific community, the project provides an innovative forum for critically reviewing and synthesizing relevant existing knowledge on key issues of forestry and related disciplines. In addition, it provides a unique scientific debate for challenging and testing new ideas through a scientific approach. IUFRO-WFSE builds on the worldwide partnership of ten research institutions and benefits from IUFRO connections in working towards strengthening a global collaborative network. The project is based on high-quality output, objectivity and scientific independence.

IUFRO-WFSE aims to achieve the following specific results:

- to create an active scientific network for critically analysing and synthesizing research findings on specific relevant global forest issues;
- to produce a new book, to be printed and widely distributed in 2005, mainly addressed towards the academic community;

- to edit and distribute two executive summaries, one published in 2003 (the current one) and one in 2005, for policy makers, practitioners and interested individuals; and
- to generate dissemination materials for training and capacity building purposes.

The results of IUFRO-WFSE will assist and enhance the dialogue of policy makers and opinion formers with scientists who deal with key issues in global forests, society and environment, and with people who are involved in international cooperation processes.

World Forests, Society and Environment was an ambitious initiative that brought together the research of numerous scientists from many countries in the three volumes published during 1999-2001. IUFRO has established its special project to build on this initiative. We would like to extend our appreciation to the chief editor Philip Wardle, who has succeeded in summarizing the information in an easily accessible manner for a wide variety of readers, and to the co-editors for their valuable contributions. Our acknowledgement also goes to Libor Jansky and the United Nation University for pioneering the publication of this executive summary and for generous financial support - a collaboration which will be valuable for future work of the IUFRO-WFSE Special Project.

Risto Seppälä
President of IUFRO

Gerardo Mery
Coordinator of IUFRO-WFSE

WFSE Volumes I-III Editors' Preface

This executive summary is an ambitious undertaking. It reviews research findings based on work by 149 scientists published in three volumes of the "World Forests" book series established by Kluwer Academic Publishers. A multitude of scientific approaches and research philosophies underlie the original reports.

Undoubtedly, the world's forests, societies and the environments are integral parts of the ongoing globalization process. The research project leading to the three published volumes was a response to the actual transition from earlier focuses on local and national issues to global actions and perspectives concerning world's forests.

Globalization, however, is a demanding process - and likely to treat people and nations inequitably. The poorest people and the poorest nations have the highest likelihood of being on the losing side in this process. To cope with the challenges of today, policymakers, advisers and opinion formers need research findings on the critical interactions between forests, society and the environment. However, research findings alone are not sufficient. As the ancient Greek philosophers regarded truth, goodness and beauty as their greatest ideals, similarly today public policy and corporation planners, industrialists, politicians and other stakeholders need cognitive, ethical, and aesthetic knowledge and values to be able to work together and face their common global challenges.

We believe that, indeed, understanding how to integrate and balance facts and values will help us to create a clearer vision of world forests, society and the

environment to support the sustainable forest management and well-being of people.

While it is true that demand still continues to grow as regards many of the specific research issues related to world's forests, there is perhaps even more immediate need for effective dissemination of existing scientific information. It is time to realize that an impressive body of research outcomes and results already exists, and that it is imperative to improve the use of these outcomes. This executive summary aims at strengthening the linkages between scientific information and the various uses of this information.

As editors of the three volumes of "World Forests," we wish to express our sincere gratitude to Philip Wardle for his work in planning and compiling this executive summary. We also wish to acknowledge the United Nations University for its financial support and for publishing this executive summary. Special thanks go to the authors of the original research articles (see p. 52), to the reviewers and to the members of the WFSE Scientific Editorial Board who guided the planning process of the project.

Helsinki, June 2003

Matti Palo
Jussi Usivuori
Gerardo Mery
Heidi Vanhanen

Acknowledgement

My warm thanks to the editors of the three volumes and the UNU editorial manager for their help and advice in preparing *World Forests, Society and Environment - Executive Summary*. Responsibility for errors of selection, of fact or of interpretation remain those of this chief editor alone. My special thanks go to Janet, my wife, for her great support.

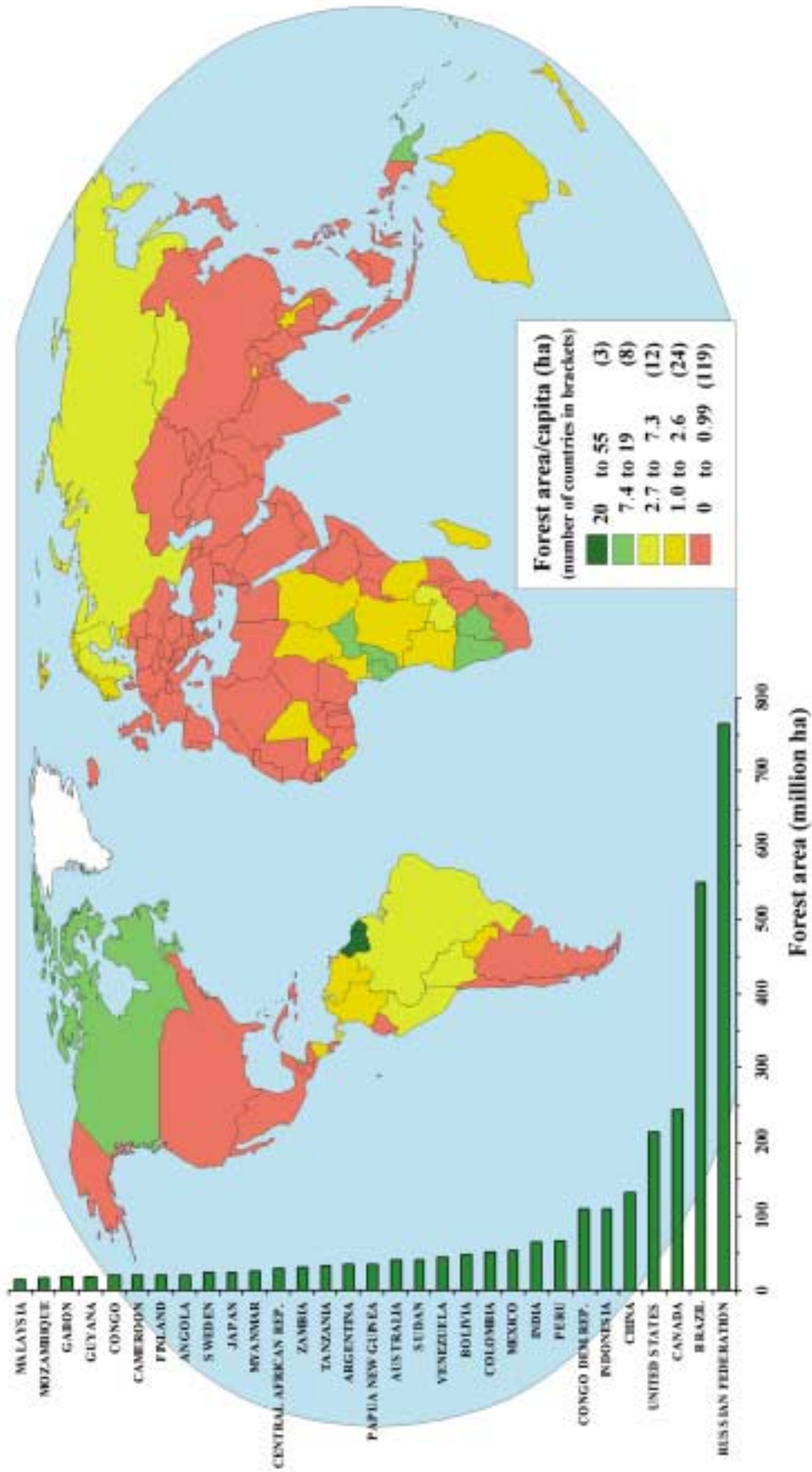
Philip Wardle, Chief Editor

C o n t e n t s

I. Conclusions and Recommendations	9
II. Forests in the Global Context	12
Social and economic trends	12
Globalization and forests	13
III. The Importance of Forests	16
Value	16
Equity	17
Forestry in G8 Summits	17
IV. From Deforestation to Transition	19
The role of open access and corruption	19
Deforestation: the final cause	19
Forest transitions	21
Forest resource assessment	22
V. Forests and Environment	23
Water	23
Forests and climate change	24
Forests as a renewable energy source	24
Wood energy in Africa	25
Substituting biomass for oil	25
Biodiversity conservation - the Spotted Owl	26
Environmental forestry conflicts	26
VI. Production of Goods and Services	28
International trade	28
Production technology	29
Paper consumption and information technology	30
Internationalization of the forest industry	30
Urban forestry	31
Outdoor recreation	32

VII. Community Forestry and the Agricultural Frontier	33
Community forestry in India	33
Agroforestry and farm forestry in Africa	33
Dry forests and livestock in Africa	35
Land tenure in Namibia	35
Forest and small farmers in Cameroon and Indonesia	35
Colonist swidden agriculture in Peru, Brazil and Nicaragua	36
From agarradas and wood smuggling to conservation	37
The giant snail	37
VIII. Policies and Development	38
African forests, societies and environments	38
Asia-Pacific forests	39
Latin American forests, societies and environments	42
Forestry in Canada, Australia and New Zealand	44
IX. Russian and Chinese Forestry in Transition	46
The Russian forestry transition	46
China's forest sector in transition	48
X. Forest-based Development in Finland - a Model?	50
List of Authors of the WFSE Publications, Volumes I, II and III	52

Note: The main sources in the WFSE Volumes I, II and III used in compiling this Executive Summary are listed at the end of each section (II through X), indicating the source volume and chapter or box (e.g., *[SOURCES] Volume I, Chapters 12 & 14; Volume III, Chapter 15 and Box 5.4*).



Forest area and forest area per capita (Data source: FAO 1999)

I. Conclusions and Recommendations

This executive summary presents, in brief, the spectrum of ideas about World Forests, Society and Environment (WFSE) collected in the three volumes of the World Forests series published from 1999 to 2001. The purpose of the series was to disseminate research-based reviews of globally relevant issues, as seen from an independent and non-governmental point of view. This chapter presents a synopsis of the issues covered in the three volumes, followed by conclusions and the principal recommendations.

Forestry issues are placed in the context of universal social, economic and policy development. Population pressures remain a major factor contributing to deforestation, but the linkage between income and deforestation may prove to be more important. Utilization of energy, resources and technology is at the heart of the relationship between economic and environmental policy. The world's forests, societies and the environment are all integral parts of the ongoing process of globalization, making cooperation on a global scale not just commendable, but essential, if we are to find solutions to the problems facing the world's forests.

The importance of forests derives not only from the products and services they supply, but also from the value of their present and future existence. Wood and non-wood forestry products make a considerable contribution to the world economy as well as to rural and subsistence communities. Forest service functions range from the conservation of soil, water and biological diversity to modulation of the carbon cycle. Forests are also a vital part of our human heritage. With the complexity of society's demands leading to competition and conflict in the delivery of these forest products and services, social equity requires that the costs and benefits are fairly distributed so that no one is made worse off.

Deforestation in the North, common until the beginning of the twentieth century, has been transformed into sustained-yield forestry. In the South, however, degradation and deforestation still appear difficult to stop. Will the late twentieth century be seen in the future as a major turning point? With transitions from natural forests to managed forests and plantations, from declining to expanding forests, the perception of the role of forests has changed increasingly to their being valued as an environment rather than simply as a source of wood. Public interest in forests is not confined to their ownership or bounded by national borders.

All sectors - whether forestry, agriculture, urban or industrial - must have a clear strategy for water. Tree planting needs to be assessed in relation to its possible dis-benefits as well as its benefits, particularly where water resources are scarce or when salinity is an issue. If forest and land-use management are to address global climate change, forests must be given their due attention at all levels. Forest biomass can become an attractive source of energy, but how to efficiently convert biomass into energy with minimal loss is crucial for both developing and developed countries. Striving for economic growth has led to deterioration of the environment; policy makers need to understand the potentially positive role of conflicts as an "engine" of change and social development.

Society has evolved a growing dependence on technology to sustain its demands. Information technology has already had a declining impact on the demand for newsprint in the United States. Trade concentrates on higher value products and, with fewer restrictions on capital transfers, companies have realized the need to expand through global investment.

Forestry development paradigms (other than community-based ones) have become anachronistic, and should be rejected and replaced by a concept of people's management. Involving communities - giving them responsibility and accountability, encouraging their participation, and using their local knowledge - will improve the success of management.

The main question about the allocation of scarce financial resources for forestry development has been whether to concentrate on intensively managed plantation forests or on the sustainable management of natural forests. Political will is an essential condition for achieving balanced sustainable development of forest resources.

The Russian Federation and China are two countries with "transition economies" that are important in terms of forest areas, forest products and environmental values. Reforms have involved transition away from state ownership, decentralization and establishment of enterprises with mixed capital structures, property rights transformation, timber market and price liberalization, as well as afforestation and protection of natural forest resources. Russia, however, has firmly maintained state ownership of forests, while China has largely privatized the use rights or user rights of plantation forests. Only a sound economy can bring about a healthy growth in demand for forest products, but the transition continues

to be painful, with often inconsistent and volatile policy changes.

The experience of Finland suggests that well-functioning timber markets underpinning the growth in the value of forests, together with prevailing private (traditionally farmer) ownership of forests, innovation, research and development, training and extension, and guaranteeing environmentally sustainable forest management, are key elements in successful forest-based development.



"Forest resources and forest lands shall be managed and used sustainably to fulfill social, economic, ecological, cultural and spiritual needs of present and future generations." This declaration is the most striking of the Non-Legally Binding Forest Principles agreed to at the United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro in 1992. It can be considered a revolutionary turning point in the history of international forest politics. With the various environmental and social global conventions, it brought forest issues onto the agendas of global politics.

The articles in the WFSE books explored many of the social, environmental and economic issues that confront world forestry, from global as well as regional perspectives, and offered many conclusions and recommendations that support the pursuit of this great aspiration. These converge into the following major conclusions and recommendations.

Conclusion 1:

Globalization continues to influence forest sectors worldwide; it affects national and international forest policies, internationalization of forest industries, forest owners, consumers, and the work of environmental non-governmental organizations. Forest and environmental policy actions have focused primarily on negative environmental externalities, such as declining biodiversity, climate change, tropical deforestation and global degradation of forests. On the other hand, advances in information and communication technologies, liberalization of capital movements, and decentralization and democratization in policy making have a positive potential.

Recommendations

- Support the opportunities offered by globalization - of speeding up the diffusion of innovations, know-how and new technology that contribute to economic growth - and secure the development of the necessary pre-conditions for their adoption (stable governments, the rule of law, educational and physical infrastructures, and competitive markets). Counter the marginalization of the poor and less privileged by promoting the participation of key stakeholders in forest sector policy.
- Utilize the contributions of objective scientific information in decision-making, and mobilize qualified human resources and adequate financial resources for implementation.
- Acknowledge that coordination of multi-sector policies - in fiscal issues, land use, agriculture, and trade and energy, in particular - is a key issue for the future of global forests. Forest policy measures alone will remain too weak to conserve the forests and their contribution to rural livelihoods and well-being.

Conclusion 2:

Deforestation and forest degradation continue globally. To establish economically and ecologically sustainable forest management, both deforestation and degradation must be controlled. Deforestation is less about "forestry" than it is about economic policy in general, and land-use policy in particular; forests are, from a national point of view, essential resources to be exploited. To a limited extent, deforestation can be socially beneficial, but in most cases socially excessive deforestation is continuing because of various market and government failures.

Recommendations

- Combat land-use sector corruption worldwide, and especially in developing countries and economies in transition; corruption perpetuates government failures, market failures and under-valuation of remaining forests.
- Develop property rights to reduce open access to forest land and to establish competitive markets. National governments and official development aid institutions should increase efforts to overcome transaction costs and implement closing of open access to forests, particularly through land reform and decentralization projects.

Conclusion 3:

The Food and Agriculture Organization of the United Nation (FAO) has the mandate to coordinate and compile global forest resource assessments. While methodological advances have taken place in this work, the validity and reliability of the stock and change data on world forests are still inadequate. Only a handful of countries worldwide have established continuous scientifically based monitoring systems to measure changes in stocks of standing timber, biodiversity and carbon stocks.

Recommendations

- National governments and the intergovernmental organizations should agree on and support expanding and improving global forest monitoring systems. This work should be integrated with increased scientific research and extension work on sustainable forest management.
- Non-governmental organizations and media should pressure the national governments and intergovernmental organizations to allocate adequate resources and skills to implement the above recommendations. This work should be integrated with increased scientific research and extension work on sustainable forest management.
- Environmental Non-governmental Organizations (NGOs) and media should promote the development and dissemination of this essential information.

Conclusion 4:

The G8 economic powers established their Action Programme on Forests in 1998-2002. This compact programme addresses monitoring and assessment, national forest programmes, protected areas, and private sector and illegal logging. The programme concerns the member countries (Canada, France, Germany, Italy, Japan, Russian Federation, the United Kingdom and the United States of America) as well as their partner countries. Three of these countries (Canada, Russia and the United States) plus seven developing countries (Brazil, China, Congo, Indonesia, Peru, India and Mexico) contain 70 per cent of the global forest area.

Recommendations

- G8 should adopt an alliance with the developing countries having the largest forest areas to seriously implement the programme for 70 per cent of the world's forests.
- Environmental NGOs should closely monitor this work.

II. Forests in the Global Context

When the United Nations Conference on the Human Environment was held in Stockholm in 1972, there were sharp, often acrimonious conflicts. Industrialized countries were focused on the environmental threat posed by economic growth and industrial pollution, while developing countries viewed poverty or the absence of economic growth as the bigger threat to their societal welfare. Natural resources, including forests, became the focus of this great divide.

The term "sustainable development," which grew out of the 1987 report *Our Common Future* by the World Commission on Environment and Development, was popularized after the 1992 United Nations Conference on Environment and Development. The concept of sustainable development represents a major shift in our understanding of human development by treating economic development as a complement to environmental protection. It encompasses the interplay of global trends (such as population growth, urbanization and private capital flows to developing countries) that are driving major changes in the ecological and economic landscapes of forests, and underscores the threats and opportunities that are associated with these trends.

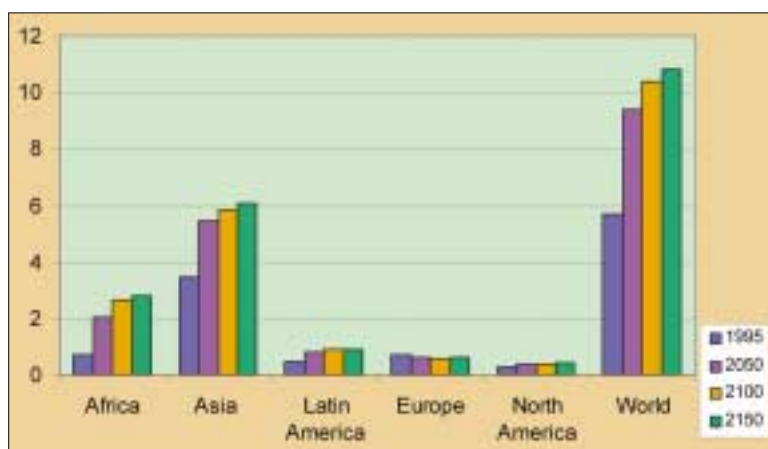
Social and economic trends

World population

Due in part to a general increase in the standard of living and public health, the world population rose from about 1.6 billion persons in 1900 to 5.7 billion in 1995. (The rate of population growth in the 1950s and 1960s was the most rapid in human history.) Based on a medium-fertility scenario, world population will grow to 9.4 billion in 2050, and finally stabilize at slightly under 11 billion around 2200.

Controversy concerning the environmental threat posed by the growing world population is ongoing. While population pressures remain an important factor contributing to deforestation, the linkage between income and deforestation, however, may prove to be more important.

Urbanization and changing age distribution patterns



World population scenario (in billions; Data source: UN 1998)

are two demographic factors likely to have an important impact on the world's forests, through changes in demand for agricultural and forest products and services. An unprecedented urban transition - more than half of the world's population is expected to live in urban areas by 2010 - may lead to increased opportunities for sustainable forest management practices, or may merely shift the focus from rural to urban areas. The increase in the elderly population, necessitating greater government spending on geriatric-related expenditures, also makes it even harder to set aside adequate public resources for forest conservation.

Energy, resources and technology

The utilization of energy, resources and technology is at the heart of the relationship between economic and environmental policies for virtually every ecological problem. One of the most important energy-environmental dilemmas in the industrialized world is the development of an effective policy response to the problem of global climate change.

To address environmental deterioration on the global level, the unsustainable use of resources must be placed at the centre of any effective policy response. Agriculture, food supply and water management all have great significance for forests. While the increasing demand for food can lead to forests and rangeland being converted to farmland, increased global food production could be realized instead through intensification and improvement

of technology. The growing demand for water will also have a profound impact on sustainable management of the world's forests.

Private capital and environment

Deregulation in the international financial sector, in both industrialized and emerging economies, has brought a high degree of change to the global financial market; the increase in private capital flows to emerging economies has been dramatic compared with the stagnating level of official development assistance (ODA). In a complete reversal, private capital flows now constitute more than 80 per cent of the total flows to non-OECD economies, displacing ODA as the main source. These flows represent an important sustainable development issue, because only a small fraction is going to the countries in sub-Saharan Africa that desperately need external development financing.

For years, the business and environmental communities seemed hopelessly bogged down in conflict and litigation. In the 1970s, companies complied with environmental regulations only when absolutely necessary. Then, when regulations moved towards emphasizing environmental results, companies adopted environmental management programmes, yielding cost savings and reductions in waste emissions. In the late 1980s, companies began to give even more active attention to global environmental issues. Yet, despite vast improvement, many firms still perceive sustainable development more as an unknown threat than as a strategic opportunity. What makes this so important is that corporations may ultimately be the only organizations with the financial resources and the technological capability to promote sustainability on the global level.

Globalization and forests

Globalization is a term that is frequently invoked, yet there is no firm consensus on what it is and whether it poses an economic or political threat (an attack on national sovereignty and citizenship or, rather, a reconfiguration of the traditional definition of sovereignty).

From the standpoint of the world's forests, the impact of globalization can manifest itself in a number of different ways, including the growing influence of corporate environmental management, market transition,

trade liberalization and private capital flows to emerging economies. A shift in global politics is particularly noticeable in the international environmental and forest policy arena, and there has been a reassessment of how power can be exercised to improve the management of a public good, such as forests.

Forest industry in the globalization process

The globalization of market forces has been assisted by four events: (i) the market transition of Central and Eastern Europe, states of the former Soviet Union, Viet Nam and China; (ii) economic integration and trade liberalization; (iii) the rapid increase in private capital flows to emerging economies, in addition to the general trend towards deregulation and privatization; and (iv) development of information technologies. In the corporate world, however, forest products industries have been latecomers in participating in the globalization processes, even though the share of international trade in forest product output has been larger than that in many other industrial sectors.

The expansion strategies of forest industries have involved international mergers, acquisitions and corporate alliances. Markets and policies have been central in increasing foreign investments in forest industries and plantation forestry; future investments may include acquisition of carbon stocks. The development of foreign direct investment is dependent on the liberalization of international capital flows and the repatriation of profits.

In the past, policies have been used to improve and control technological advances while markets have been used to disseminate the results of research and technology and to reward capital and management. In the future, however, with the evolution of biological technology, in particular, this global "technolution" may become less and less controllable by national governments.

Unless the liberalization of forest products trade is complemented with improved forest protection policies and efforts to prevent the negative social impacts of forest operations, efforts towards sustainable management of forest resources may be seriously compromised. Some forest industry companies, for example, have tried to anticipate national forest conservation measures by shifting their roundwood purchasing to other countries,

thus causing concern that conservation policies may actually have global "leakages."

Global politics and international forest policy

The autonomous power once enjoyed exclusively by national governments now has to be shared by an ever-increasing number of global actors, including multinational enterprises, regional economic groups and international NGOs. Ecological concerns are increasingly serving as the policy platform for "epistemic communities" of transnational scientists and policy experts who can mobilize enough political support to pass environmental protection measures at the national and the global levels.

Almost since its inception in 1945, FAO has been publishing a periodical called *Unasylva*. This name is well chosen (the Latin root means "one forest," carrying the connotation of "one forest for one world"), lending itself to an image of the earth's forests as one great biophysical system (connecting boreal, temperate and tropical; wet and dry; fertile and infertile; highland and lowland) and an implicit philosophy that aims at a world scope and global mission. It is a name which calls attention to the unity of forests, inspires grand achievements, and reminds us of present shortcomings.

FAO's 1980 assessment of tropical forest resources estimated annual average tropical deforestation for the 1970s to be 11 million hectares. This alarming estimate raised widespread environmental and political concern, causing deforestation's place on the international agendas to jump upwards. This triggered a series of responses by the international community - from the Tropical Forest Action Plan, mobilized in 1985, through the Forestry Principles and Agenda 21 of UNCED in Rio in 1992, to the recent formation of the United Nations Forum on Forests (UNFF).

In spite of these actions by FAO, the World Bank, International Tropical Timber Organization (ITTO), and other actors, tropical deforestation is continuing at a nondecreasing pace. FAO's 2000 assessment estimated tropical deforestation for the 1990s to be 14 million hectares as an annual average.

Global governance

Cooperation on a global scale is not only commendable -

it is essential if solutions are to be found to the problems facing the world's forests. Concomitant with such cooperation, modern science needs to produce an ever clearer (and, increasingly, global) picture of the relationship between human activity and the environment, and of the consequences of environmental change for the ability of societies to survive. Thanks to modern communications technologies, people around the world have a wider awareness of global events, even as more and more aspects of human life are becoming exposed to worldwide influences.

Global governance does not imply a surrender of power to the UN. What it does imply is a reassessment of how power can be exercised to improve the management of a public good, such as forests. One reason underlying the growing interest in global governance is the rising influence of environmental NGOs. A critical shift in roles took place during the 1992 Rio negotiations, when NGO representatives provided critical support to a number of national government delegations.

Consumers of forest products have profoundly changed their attitudes in recent years, and NGOs have been a driving force for this change - first reacting against tropical deforestation in the 1980s, then shifting their campaigning in the 1990s more against degradation of boreal and temperate natural forests by plantation forest monocultures. By influencing the behaviour of forest product customers and the media, NGOs have conveyed the message to forest product companies that they must change their logging practices and make forest management more environmentally friendly. NGOs were a key factor in forest and timber certification developments.

In the past two or three decades, the environmental goods and benefits provided by forests have received increasing attention. It is now commonly recognized that the biodiversity of tropical forests, or carbon sequestration by boreal forests, does not benefit just people living in or close to these forests. Rather, there is a broad awareness of mankind's shared dependency on the well-being of these forests. Along with regional and spatial interdependencies, there is an invigorated awareness of the need for intergenerational solidarity with regard to natural environments. Yet, despite these efforts, no global criteria or indicators for monitoring of sustainable forest management have been developed.

Globalization's threats and opportunities

Most of the world as we know it was discovered in the past millennium. Today, we know more about the world's geography, natural resources and human cultures than ever before. The world has been going global, and its forests, societies and environment are integral parts of this globalization process.

The process of globalization, however, is demanding - and likely to treat people and nations inequitably. To cope with these challenges, knowledge and information are essential, but these alone are not sufficient. Just as the ancient Greek philosophers held truth, goodness and beauty as their greatest ideals, today's people and societies need a foundation of cognitive, ethical and aesthetic values to work together and face their common challenges. Indeed, understanding how to combine and balance facts and values will help us create a clearer vision of *unasyva*.

Globalization remains, if not an undefined concept, at least one that carries multiple and varying connotations for different people. The key question is whether globalization will be destructive of forests, or helpful in achieving more sustainable ways to manage them.

Globalization may be a "reality" for about one billion people in the industrialized world, but in the lives of three to four billion people living in the developing world - who are subsistence-oriented and meet their basic needs from their immediate natural surroundings - it plays a limited role at best. Innovations in the utilization of energy, resources and technology will represent a global opportunity in promoting sustainable development *only* if these innovations are able to diffuse sufficiently quickly to newly industrializing and developing countries.

Perhaps the biggest threat is the potential marginalization of local and national institutions, especially in the developing countries. Governments worldwide could work against this possibility by supporting local structures that help less well equipped nations and forest people to reap the benefits of the globalization process rather than suffer its damage. Corruption and government failures must be reduced through increased transparency, publicity and capacity building. Also market failures have to be removed. The aim should be an optimum mix of markets and policies at the local, national, regional and global levels.

SOURCES | Volume I, Chapters 1 & 2; Vol. III, Chapters 1, 2 & 3.

III. The Importance of Forests

Forests are important for the products and services they supply. Wood-based products make a considerable contribution to the world economy, amounting to some 2 per cent of global gross domestic product (GDP) and meeting basic needs for energy and materials of modern living (construction, furniture, packaging, etc.). Some non-wood forest products are also of commercial importance, but many more are non-market goods essential to the economies of rural and subsistence communities. Forest services range from the conservation of soil, water and biological diversity to modulation of the carbon cycle and amelioration of microclimate. Forests are also a part of human heritage, providing landscapes to meet our aesthetic as well as spiritual needs.

The importance of forests in providing these production and service functions lies in their great extent; forests cover somewhat more than one-fourth of the world's land area. Natural forests have traditionally been regarded as a free resource and a residual land use, while forestry has been seen as the means of delivering forest-based goods and services at minimum cost. Society has perceived forest products and services as "free benefits" with virtually infinite replaceability, and forested land as areas readily available for conversion to other uses.

Increases in both population and wealth have led to an increase in demand for the products and services of the forest, and for the very land on which it grows. Society has, consequently, come to the realization that this land - these resources, and their products and services - are no longer "free" or infinitely available. The complexity of society's demands for the wide range of goods and services that the forest can deliver places the production of these goods and services into direct competition, even though multiple uses of forests can be partially complementary.

Value

Many wood products are market or tradable goods and have a recognized market value. Many non-wood products, and the social and environmental services of the forest, are largely non-market or non-tradable goods and services with no established market value. This separation of market and non-market products results in the undervaluation of forests, thereby making them more liable to degradation and deforestation.

It has been realized, however, that non-market or

non-tradable products and services can have high social and environmental values, whether measured by scarcity or social preference. So, it has become necessary to define the full range of values which accrue from the forests to ensure recognition of the economic importance of forests and the need for their sustainable management.

Valuation methods have been developed to estimate the total economic value of forest resources, with the aim of integrating environmental effects into the decision-making process. The economic theories behind these valuation methods are based on neo-classical and humanistic paradigms; in particular, welfare theory is widely applied, and the so-called *Pareto efficiency* criterion is employed to determine social desirability.

The values derived from forests are social, economic, ecological and cultural; all these are dimensions which must be recognized in forest resource management. Even though most goals of forest management state that forests confer values to mankind and contribute to social welfare, the subjective position and time preference of different forestry stakeholders have, nevertheless, tended to influence the definition of forest values. Three broad categories of values can be recognized: use, non-use and total economic values.

Valuation of forests is useful if it helps society to make better decisions about proper stewardship. It may be of interest to know the value of preserving a forest, but only insofar as we are able to compare this preservation of a forest to another use. Valuation studies that purport to measure the global value of forests are of limited interest, therefore, since valuation is only one of many important inputs to the decision process.

It is difficult for developing countries, struggling to meet their basic needs today, to take a long-term perspective. What is the opportunity cost of keeping an area preserved, perhaps waiting for the discovery of a medicinal plant, and who will pay them for not using the forest in the meantime? Although the estimated value of a potential drug discovery could be high, what is the meaning and utility of such a value: who is going to use it and who is going to capture it? Excellent studies have assigned monetary values to different goods and services provided by forests, but evidence suggests that deforestation and forest degradation will continue to take place; estimating value is not the same as capturing it.

Equity

Management strategies, to be effective, should design efficient ways of assuring fair and equitable distribution of forest values and benefits. The three basic dimensions of distributional equity are *spatial* (local, regional, national and global distribution), *temporal* (distribution between various generations) and *social* (distribution between rich and poor within societies). Social equity requires that forest costs and benefits be fairly distributed, such that no one is made worse off.

There are three categories of costs for forest conservation: *direct* (costs for management and silviculture), *indirect* (such as increased travel costs and costs of seeking new employment that are borne by those living in or adjacent to the forest) and *opportunity costs* (the benefits foregone, including lost use of the forest for hunting and livestock grazing by local people). The cost of forest conservation is largely borne by the local poor populace, especially in terms of foregone benefits.

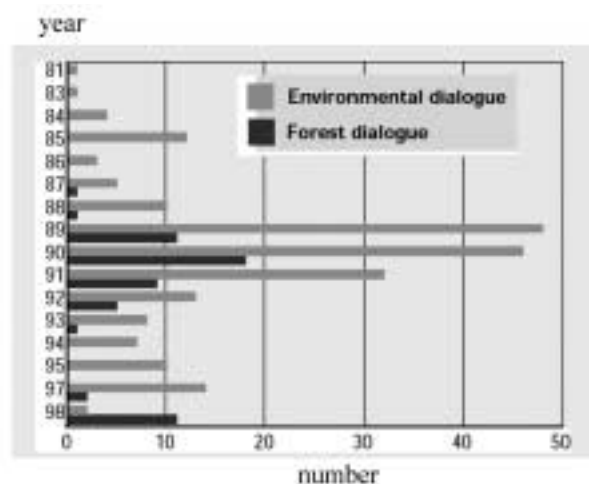
In terms of distributional equity, there is likely to be an increasing disparity between the income of the rich and the poor. In short, the benefits of conserving forests (such as the mitigation of global warming) are enjoyed globally while the costs are borne locally, thus adding to "global inequity."

Perceptions, concepts and the state-of-the-art with respect to recording, accounting and estimating the future are necessary components of an accurate assessment of the importance of forests. Society can do better if it assembles the necessary information, works out the real value attached to the various functions of forest and the land on which it stands, and then draws fully informed conclusions and makes sound decisions about the balance of functions that best benefits the whole community.

Forestry in G8 Summits

Since 1975, the heads of state of the seven richest nations have held regular meetings. The so-called G7 Summits were organized to combat chaos and create order in the world's economic and political affairs. The meetings were held annually, hosted in one of the G7 countries: Canada, France, Germany, Italy, Japan, the United Kingdom and the United States. These were recently joined by the Russian Federation, becoming the G8.

That the G7/8 summits have, since 1987, incorporated forest policy issues in their summit resolutions is another indication of the key role of forestry in contemporary global political agendas. In 1998, the G8 approved the Action Programme on Forests (APF). Yet while the arrival of forestry issues on the world political agenda is an achievement in itself, implementation of the G8 programme has not been taken seriously.



G8 Resolutions on forests and environment

What are the purposes, expected results and corresponding activities of the APF? What quantitative and qualitative indicators of achievement are to be used for monitoring? Are the supported activities indeed the most urgent issues? The last year of the APF implementation was 2002.

In fact, the activities reported are merely on-going actions, and there is limited evidence of joint, coordinated measures. (The single example involving all G8 members is "initiating a collaborative effort to assess the enhanced use of remote sensing.") The APF makes no reference to implementation procedures, the responsibilities of the people and bodies involved, nor the financial resources to be committed. Putting their faith in the regional and international processes, G8 members were seemingly hesitant to develop a comprehensive programme, fearing that a unique top-down G8 initiative on world forests would not provide the intended results.

SOURCES | Volume I, Chapters 4 & 10 and Box 4.1; Volume III, Chapters 11, 12 & 13 and Box 5.2.

Forest-related issues in the G7/8 Summits

Place and year	Declarations on Forests and Environment
London 1984	<ul style="list-style-type: none"> • Recognized environmental problems and their role in economic development
Venice 1987	<ul style="list-style-type: none"> • Recognized need to tackle the destruction of tropical rain forests
Toronto 1988	<ul style="list-style-type: none"> • Recognized that deforestation requires priority attention
Paris 1989	<ul style="list-style-type: none"> • Called for better conservation and sustainable forest management • Supported Tropical Forest Action Plan • Indicated readiness to assist tropical forest nations financially and technically • Stated that temperate forests must be protected from acid pollutants
Houston 1990	<ul style="list-style-type: none"> • Declared that combating deforestation requires effective international cooperation and concrete action while recognizing sovereign rights • Recognized the destruction of tropical rain forests as alarming • Favoured new dialogue with developing countries on ways to support their efforts • Supported cooperation with Brazil on pilot programme to counteract threats to forests • Stated that the Tropical Forest Action Plan must be reformed to emphasize forest conservation and protection of biodiversity • Stated ITTO Action Plan must emphasize sustainable forest management and improve market operations • Stated readiness to begin negotiations on global forest convention to curb deforestation • Declared readiness to protect biodiversity
London 1991	<ul style="list-style-type: none"> • Agreed to financial support for pilot programme of conservation of Brazilian tropical forests • Welcomed debt-for-nature exchanges, with emphasis on forests
Munich 1992	<ul style="list-style-type: none"> • Recognized that rapid and concrete action is required to protect forests
Tokyo 1993	<ul style="list-style-type: none"> • Sought international arrangements on management, conservation and sustainable development of forests
Denver 1997	<ul style="list-style-type: none"> • Called for long-term political commitment to achieve sustainable forest management practices worldwide • Agreed on building consensus for implementing proposals of UNCSD Intergovernmental Panel on Forests
Birmingham 1998	<p>The G 8 Action Programme on Forests</p> <ul style="list-style-type: none"> • Recognized continuing pressure on world's forests and importance of sustainable forest management • Participated in international processes for defining criteria and indicators for sustainable forest management • Agreed on using national-level criteria and indicators by monitoring and assessment of state members' own forests • Shared experiences in developing and implementing national programmes • Stated need to maintain and establish protected forest areas • Encouraged private sector, particularly forest-related industries, to develop and apply voluntary codes of conduct that support sustainable forest management, both domestically and internationally • Encouraged development of practical and effective measures to counter international trade in illegally harvested timber

IV. From Deforestation to Transition

The world's forests extend over 34 million km², or 27 per cent of the global land area. In the North, the total forest area is now slowly increasing, by nearly 2 million hectares annually; but in the South, the deforestation of natural forests continues to advance at an annual rate of about 14 million hectares.

Deforestation - the change from forest cover into some other land cover formation without the planned revival of forests by natural or artificial reforestation - results mostly from intentional human actions, but also from unintentional action and natural causes. In addition, degradation - the deterioration of a forest due to decreasing biomass - lowers the biological diversity and productivity.

While tropical forests are perceived (by public opinion) in developed countries as goods to be preserved, in developing countries they are (from a national economic development point of view) essential resources to be exploited. Deforestation actually can be socially beneficial, up to a theoretical threshold where marginal social costs due to the loss of forest land equal the marginal social benefits from its replacement. But if deforestation continues beyond this point - as has often been the case - it can be called socially excessive deforestation.

Neomalthusians have reminded us about the doomsday effects of population growth on human welfare and mankind's future. On the other hand, a number of development economists have regarded population as either neutral or beneficial to economic development. Some observers have identified a vicious circle involving population growth, weak property rights, poverty and deteriorated environment in sub-Saharan Africa and the Indian subcontinent, where, as the communities' natural resources are depleted, more hands are needed to gather fuel and water for daily use.

Both population growth and economic growth have been identified as underlying causes of deforestation - although the role of economic growth may, at a certain point, turn to one of slowing down deforestation. There is a weak indication of the existence of the so-called Kuznets hypothesis among the countries of the world: measured as total forest area (natural plus plantation forests), declining forest area starts to change into an increasing forest area as income per capita reaches a certain level.

The role of open access and corruption

Four-fifths of the world's forests are under public ownership - many with open access, which hinders the emergence of competitive stumpage markets. Where state ownership of forests is prevailing, sales of standing timber, or stumpage sales, are mostly administratively priced lower than the competitive price level in most countries of the world. The resulting under-pricing of stumpage creates incentives for continued deforestation and forest degradation, and thus undermines the profitability of forest management. Socialistic forestry in countries like Russia, Brazil, Canada, Indonesia and Malaysia has not been able to facilitate economically, ecologically and socially sustainable forest management.

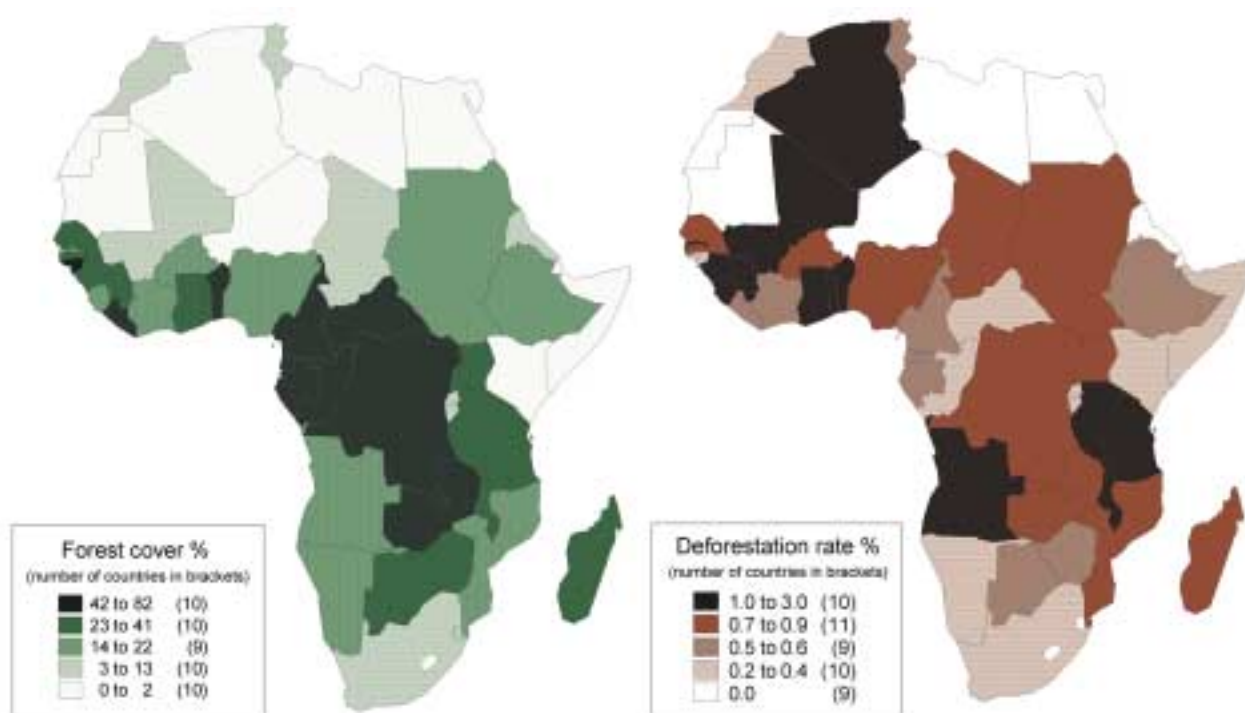
Rational decentralization and privatization of socialistic forestry is a major challenge. Private ownership of forests in conjunction with competitive stumpage markets and sufficient public regulation seems to be an important combination in the transition from declining to expanding forest resources. Increasing privatization of forests is not, however, a sufficient measure to facilitate transition.

To close open access to forests requires strong political will to overcome transaction costs; it is only possible at a certain stage of economic development, with sufficient juridical infrastructure and clear property or user rights. Political will of national governments plays a key role, as reducing deforestation and degradation calls for a balanced use of both markets and policies by a stable, strong-willed government.

Corruption in the context of commercial logging in the forest-rich countries where state tenure is prevailing seems to be a widespread problem. Political instabilities and armed conflicts (both internal and international) increase risks, shorten planning horizons in natural resources utilization, and aggravate deforestation and forest degradation.

Deforestation: the final cause

Many "explanations" of the cause(s) of deforestation focus on population growth, the building of roads, incompetent government policies, or the political power of timber concessionaires. Such analyses, however, tend to



Forest cover and deforestation – Africa (Data source: FAO 1997)

focus on the obvious precursors to deforestation rather than seeking other possible underlying causes. Deforestation does not happen by accident or through neglect; it happens because there are purposes to be served by deforestation.

Two possible explanations for deforestation can satisfy the conditions of "final cause": (1) to earn resource rents (revenues) from harvesting trees, and (2) to provide land for other uses. Indeed, these two "causes" really collapse into one: the high social opportunity cost of forested land.

As long as a particular nation-state is driven by a desire to earn rents from harvesting trees, and as long as land-hunger drives governments to open up remote areas, then very little is to be gained by suggesting that it stop building roads, or that property rights be made more secure, or that population control be implemented, or that government corruption be rectified, or that the powerful logging interests be reigned in. The only way to confront deforestation is to focus on its final cause; deforestation is less about "forestry" than it is about economic policy in general, and land-use policy in particular. It is not useful to ask governments to save forests while failing to address

the very real problem of land-hunger.

If we assume that some governments genuinely seek to reverse decades of deforestation, then it will be necessary to insist that these new intentions must be accompanied by a serious change in both *de facto* and *de jure* circumstances. In simple terms, a necessary condition is introduction of the rule of law. However, this is not always a sufficient condition. Competitive stumpage markets and relevant pricing of other forest goods and services are also needed.

The majority of the world's forested areas are on common-property land or government land. When enforcement (the rule of law) is present, national parks and forest preserves can ensure that natural resources will be conserved for future generations. But to be successful, this requires governmental structures that match policy pronouncements with administrative capacity. The more frequent situation, unfortunately, tends to be that of grand policy pronouncements about protecting forests but a lack of serious enforcement efforts (either because of an absence of knowledge about proper use, or because of inadequate funding).

Forest transitions

The late twentieth century will probably be seen as a major turning point in the history of global forestry, with several changes occurring concurrently: forest-management transition and forest-area transition, as well as shifts in forest perceptions and forestry paradigms. A trend towards internationalization is also evident. Within these changes lie several challenges that have important South-North dimensions. How these challenges are met will be of the utmost significance for global forestry.

The transitions can be summarized as follows:

- **forest-management transition:** from natural forests to managed forests and plantations;
- **forest-area transition:** transition from declining to expanding forest extents;
- **shifts in forest paradigms:** from pre-industrial, to industrial and post-industrial; and
- **global integration:** a global forest resource system and a North-South shift.

Forest-management transition

While natural forest resources were plentiful and extensive, there was little perceived need to practice management. Only when scarcity began to be felt did active management begin. The unpalatable conclusion is that perceived scarcity has, up to now, been a prerequisite for the application of management and sustainable use.

It remains to be seen whether such general concerns as the effects of deforestation on climatic change and loss of biodiversity are sufficiently sharp to give rise to global transitions in forest management. The historical evidence is not encouraging. On the other hand, fears of a timber shortage have historically been a driving force to extend the area of search. Today, when few new areas of exploitable forest remain, *extensification* is giving way to *intensification*, and especially to the establishment of plantations.

Forest-area transition

Deforestation is still occurring on a non-decreasing scale in much of the South. In parts of the North, however, forests have been expanding for much of the twentieth century, even though their history prior to the last 100-200 years

was characterized by deforestation, forest degradation, scarcity of forest resources and the side effects of deforestation (such as floods and erosion). Time will tell whether similar transitions be expected to occur in the South and, eventually, on a global scale.

Shifts in forest paradigms

The perception of the role and purpose of forests in some parts of the world has undergone significant change in recent decades. The forest is increasingly valued as an *environment*, rather than simply as a source of wood.

This paradigm shift can be located within a three-stage descriptive model of forest use. In the *pre-industrial* forest, forest products are diverse and the forest is a common-property resource. The *industrial* paradigm is characterized by the primacy of wood production as a management objective. In the *post-industrial* paradigm, the primacy of wood production weakens as environmental benefits, such as nature conservation and recreation, are increasingly sought. The notion that there is a public interest in forests - one not necessarily reflected in ownership - is expressed through a combination of regulation and incentive.

Global integration

Most wood and forest products are consumed in their country of production. A growing proportion of value-added forest products, however, enters international trade. The geographical scale and complexity of that trade have clearly increased in recent decades.

The trend towards global integration both offers opportunities and poses threats to the South. It presents opportunities through the comparative advantage that many Southern areas enjoy in terms of rapid timber growth potential. But it is also a threat to the extent that activities which, for environmental reasons, are not welcome in the North may be displaced to the South.

Internationalizing trends present challenges for the North, but the forest-products industry can adapt - by maintaining comparative advantage through research and development; by gaining access to external supplies through investment in overseas plantations; and by internationalizing manufacturing operations. At the same time, however, the North must seek to ensure that its shift to the post-industrial forest paradigm is not at the expense

of imposing the industrial paradigm on the South.

Various challenges face the South as well. Can a direct jump be made from the pre-industrial to post-industrial paradigm, without passing through the industrial stage (and thus avoiding undesirable socio-economic and ecological features of forestry)? Another challenge involves policies towards plantations. While some welcome them as a means of reducing pressures on natural forests, concern about both the socio-economic and environmental impacts of such forestry have been widespread. Too often, plantations have had a colonial flavour, with capital, control and management coming from outside the locality, where the profits also have usually accrued.

Forest resources assessment

Reliable and up-to-date information on forest resources is a prerequisite for controlling forest degradation and deforestation, planning and implementing forest policy, programmes and projects, and carrying out forest operations. The United Nations Conference on Environment and Development (UNCED) and its follow-up meetings has revealed the necessity for reliable forest resources assessments at global, regional and national levels. UNCED led to an increase of information requirements at the global level and the commitment to strengthen information, gather multi-sectoral information (about forest, wildlife, soils, water, etc.), involve the local population in the data collection process, and improve public access to information.

FAO and the United Nations Economic Commission

for Europe (ECE) have made progress in setting the framework for regional and global assessment relating to the various forestry protocols. But while considerable funds have been used both in national inventories and in global assessments, very limited funding and time have been devoted to combining these two efforts, even though integration of national forest resources information into a global database has been recognized as the aim.

Improved data quality and quantity would greatly advance in-depth studies on the underlying causes of deforestation. Enhanced monitoring of changes in the forests, too, is essential for follow-up of the progress in sustainable forest management. There is a wealth of technology available to assist with data collection and interpretation. All the data needed could be gathered periodically, for example, through remote sensing, ancillary information collection and a network of field plots. While forest inventory requires expensive field measurements to provide reliable results, change detection based on sampling can be utilized to update existing information and provide the essential basis for regional resource monitoring at much lower cost.

Smooth progress of forest assessments derives from agreement on forest concepts and definitions. Establishing a common set of definitions and standards is problematical, however, as the "forest" and "tree" concepts are politically sensitive.

SOURCES | Volume I, Chapters 5, 6 & 9; Volume II, all;
Volume III, Chapter 1 and Boxes 1.2, 3.3 & 5.3.

V. Forests and Environment

Water

Freshwater is essential for virtually all human endeavours, and it is a critical resource for ecosystem health. Access to water (of a sufficiently high quality) may be a determining factor in the peace and prosperity of the twenty-first century. In terms of costs to human health and the economy, problems related to freshwater rank at the top of all our environment and development problems. Freshwater will be the critical resource for future development in many parts of the world.

Reducing water pollution and, equally important, reducing per capita demand for limited water resources are essential. Providing access to safe drinking water and sanitation for all by the year 2025 will require adding services to accommodate an additional five billion people, or some 450,000 per day - a daunting task. The required actions will include new and improved technologies, institutional development, research, education and capacity building.

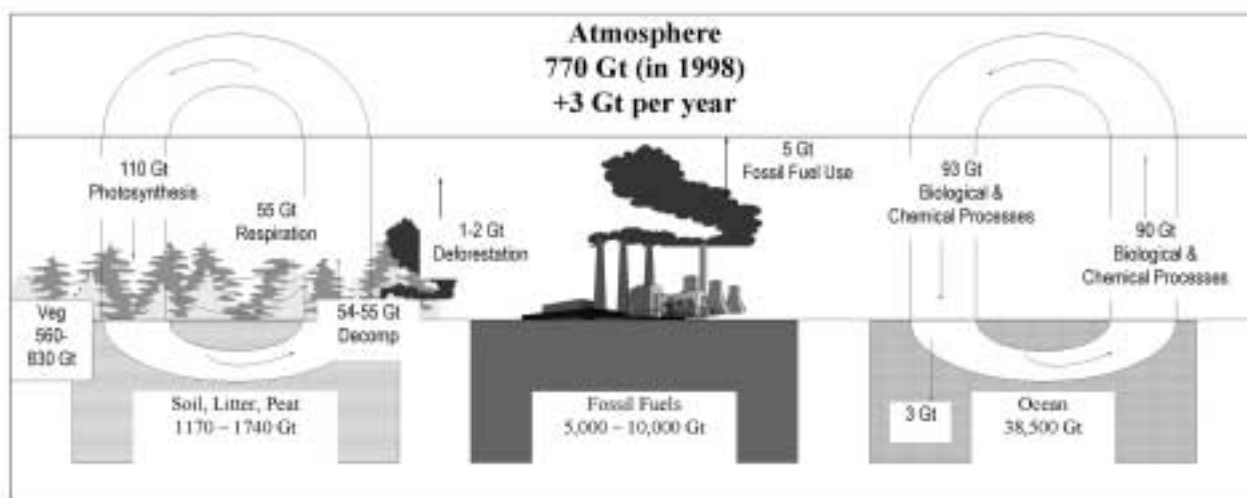
As the possibilities of new sources of freshwater are very limited, demand management must be a central goal. Market-based approaches can be effective in managing demand, paying attention to the social costs (especially so that poor people are not adversely affected by water prices). Responding to the challenge will require significant financial resources, and involvement of governments and the public sector. It will be essential to mobilize private sector investment as well.

The linkages between water resources, land degradation, soil erosion and deforestation clearly highlight the need for comprehensive management of watersheds. This makes having an integrated ecosystem approach to managing freshwater resources of great importance. All sectors - whether forestry, agriculture, urban or industrial - must have a clear strategy for water.

The interaction between forested landscapes and water quantity is well known. It is conventional wisdom that forests are beneficial in attracting rainfall, increasing infiltration, regulating flows and reducing flooding. The magnitude of these effects, however, may be less than has been imagined. Trees generally intercept more rainfall than other land uses and often transpire for longer, thus using more water. Such considerations are important in water-scarce areas.

However, the high transpiration of forests can be used, in certain conditions, to control salinization of agricultural land. Slope stability is also generally enhanced by forests, particularly natural forests, keeping soil loss low (while plantations, on the other hand, can accelerate soil loss by concentrating leaf drip). Forest operations, especially logging and road construction, may cause severe soil loss. And while there is generally less leaching of nutrients from forests, the deposition of atmospheric pollutants is increased, and the resultant stream acidification can have adverse effects on fisheries.

Considering the particular example of hydrological responses to afforestation in the context of managing river salinity, a complex and (potentially) antithetical response



The global carbon cycle

can arise from the conjunction of the phenomena of rainfall gradient, scale and system hysteresis. This gives emphasis to the cautionary note that the net value of tree planting needs to be assessed in relation to its possible dis-benefits as well as its benefits, particularly where water resources are scarce and salinity is an issue.

Forests and climate change

The accumulation of greenhouse gases in the Earth's atmosphere, and the resulting influence on climate, is of increasing worldwide concern. The most important of these gases is carbon dioxide (CO₂). Globally, greenhouse gas emissions (CO₂ and methane) exceed 6 petagrams (10¹⁵ grams) annually. A significant proportion originates from deforestation. Estimates of unrealized global forest conservation and carbon sequestration potential suggest a biologic capability of 1-3 pg carbon annually for as much as a century. What are the effects of global climate change on forests, and the effects of forestry on the carbon balance?

Effects of global climate change on forests

A 1°C change in annual average temperature can affect the growth rate and regeneration capacity of trees. Slow-growing species are more vulnerable than fast-growing species, and stands in extreme conditions of water availability (i.e., prone to drought or water-logging) are particularly susceptible. The greatest impacts of a possible greenhouse warming on forests are likely to occur in the boreal region.

There is also a "direct fertilization effect" - the water-use efficiency for individual plants is almost directly proportional to the level of CO₂. Forests of today have a greater potential to grow in arid areas than did forests in the nineteenth century, when the CO₂ concentration was lower by 50 to 70 ppm. Stands suffering from drought are assessed to be particularly sensitive to warming because evaporation will rise (although an increase of water-use efficiency can counteract the responses).

Effects of forestry measures on the carbon balance

Three categories of policies can have a positive effect on

the carbon budget of forests: *conservation management* (safeguarding of existing carbon reservoirs), *storage management* (increasing of carbon reservoirs) and *substitution management* (compensating for fossil fuel use with increasing uses of wood-based materials). Increased use of energy based on forest biomass is seen as probably the most promising climate mitigation option for forestry.

A dynamic optimization model of shadow price estimates of the potential losses or gains related to carbon sequestration and timber supply over time showed that a carbon tax at 3 per cent p.a. (real term) interest rate gives a net economic value of carbon sequestration in forest biomass that is about five times higher than the net stumpage value of timber as a raw material. Forestry options exist which can sequester large quantities of carbon; the question is, how efficient are these measures relative to possible activities in other sectors? To include the substitution impacts, a suitable global general economic equilibrium model is required.

The Kyoto Protocol includes forestry, but only in terms of planting. Deforestation is included as a source of CO₂ emissions, but stopping deforestation is not included. The end-use of the timber felled is not considered. Flexible economic instruments of the Kyoto Protocol - such as joint implementation, the Clean Development Mechanism and emissions trading - offer a concomitant means to facilitate economic, energy and environmental security, but socio-economic repercussions need to be equally considered. If forest and land-use management is to address global climate change, forests must be given due attention at all levels.

Forests as a renewable energy source

More than half of the global harvest of wood is used for fuel, primarily in the developing countries. In the developed countries, wood is used mainly for the production of lumber, boards, pulp and paper - although a large proportion of the raw material of forest industries actually ends up as process residue used for the production of heat, steam and electricity. In addition to the present use of wood-based fuels, forests represent a vast untapped source of energy.

Woody biomass, used as fuel, produces more carbon dioxide than fossil fuels, but in the case of sustainable forestry the carbon cycle is closed and does not add to the

carbon dioxide content of the atmosphere. Thus, for countries rich in forests, substituting wood for fossil fuels is an attractive means to meet the obligations of the Kyoto protocol.

Currently, biomass accounts for 3 per cent of energy consumption of the European Union. There is significant potential to contribute to further reduction of CO₂ emissions from power production through the recovery of residual biomass from forest operations, and use of part of the net biomass increment that has no demand as industrial raw material. When the use of wood fuels is promoted through tax reductions and investment subsidies, residual forest biomass can become an attractive source of energy for large-scale use.

Wood energy in Africa

In Africa, in spite of its importance and political significance, wood-based energy supply has continued to dwindle, and has been accorded low priority in efforts to redress the declining raw material base. Efforts have focused more on alternative commercial energy sources, such as hydro-electric power, fossil fuels and petroleum-based sources of energy.

Some of the welfare problems associated with wood-based energy scarcity are health hazards, problems for women and children, and the decline of agricultural production. Where there is fuelwood scarcity, for example, women and children must walk further to collect it, cook less, or use inferior substitutes such as dung and agricultural residues (thus depriving agriculture of manure, which could increase maize production by up to six times and groundnut by up to three times).

Natural forests and other wooded land that provide the fuelwood are usually open access areas where the wood is collected for free. As fuelwood is still regarded as a free commodity, wood prices do not reflect the cost of its production; hence, no allowance is made for regeneration of the resource. In rural areas, lower incomes raise the demand for an inferior good, while fuelwood demand in urban areas is higher than it should be (because low rural wages lower the supply cost). Low per capita income has prohibited the use of alternative energy sources.

Fuelwood consumption has been blamed for forest degradation; certainly, sustainable forestry is far from becoming a reality and, in consequence, the carbon cycle

remains unclosed. The annual rate of consumption of wood exceeds the mean annual increment of local forests. Fuelwood supply is dwindling, and in many areas the situation is at crisis level. There is, thereby, an urgent need for both policy reforms and technical innovations to promote the efficient use of available fuelwood (such as through introduction of improved cooking stoves); to increase tree stocks by planting; and to give high priority to sustainability of the fuelwood supply.

Necessary political and economic conditions include:

- stability in the political and economic environments;
- privatization of fuelwood production;
- risk reduction in order to promote investment;
- solving of land ownership issues in forestry; and
- management of forest resources by devolution of power, with benefits accruing to the local people.

Substituting biomass for oil

The world's industries are dependent upon fossil fuels - particularly on oil - which increase CO₂ emissions and production of other wastes. Current technology based on linear production models produces wastes in all three phases: in exploiting resources, in processing, and in the product phase. The limited nature of oil resources, and the environmental pollution resulting from their use, creates a demand for alternative sources.

Accordingly, production systems should be organized so as to inflict zero or minimal damage on natural systems and cycles. New biomass-integrated technologies could increase resource productivity and conserve nature's capital in harmony with the planet's limits. Because the density of biomass resource distribution is low in comparison with existing fossil fuel resources, the economic value of biomass per unit weight and the added value are also low. Consequently, development of bio-refinery technologies should be aimed at making units compact and mobile, for application in rural areas.

Genetically engineered trees might make paper and some biofuels easier and less costly to produce by lowering energy costs and reducing the amount of chemicals required. The effects of genetic engineering are still uncertain, however, and raise ethical as well as practical issues (particularly related to foreign proteins and threats to biodiversity).

Thus:

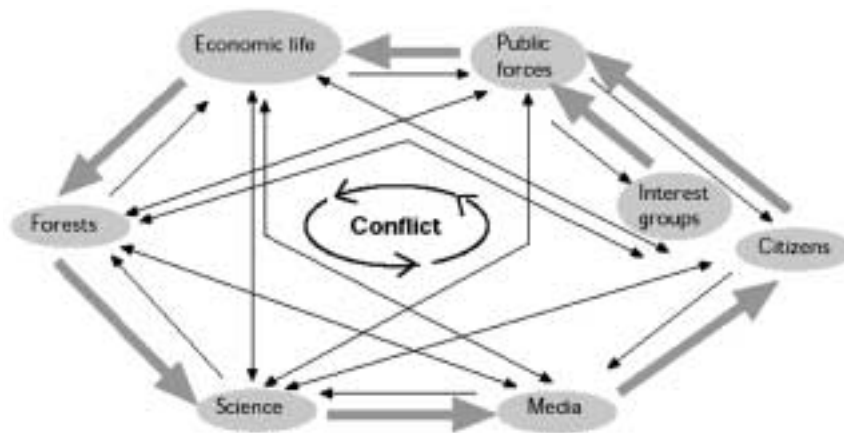
- With respect to global climate change, new technological developments to reach zero emissions standards in forest industries are especially important.
- High-energy and CO₂-polluting industries based on the use of fossil fuels should be abandoned in favour of new biomass-integrated technologies that increase resource productivity and conserve nature's capital.
- Research must be multi- and inter-disciplinary, removed from universities' traditional specialized departmental constraints.
- In contacts with society, transparency in the dissemination of research results is an important factor.
- The owners of knowledge should be ordinary people, communities and the society, not companies with distinct business interests.

Biodiversity conservation - the Spotted Owl

The complexity of society's demands often leads to competition and conflicts in the delivery of the various forest products and services. In the early 1990s, court-mandated requirements to protect the habitat of the endangered Northern Spotted Owl in the US Pacific Northwest led federal agencies to change their management rules and practices based on proposals of an Inter-Agency Scientific Committee (ISC). This, in turn, brought about a major conflict between environmental groups, timber industries and federal agencies. A core issue in the debate has been the impact of these changes on timber supply in the region, and the implications for the regional economy. Concern has also been expressed regarding the national and international consequences of these changes.

Using the Timber Assessment Market Model, the opportunity cost of protecting owl habitats on federal land (the present value of changes in the surpluses in wood products markets in the United States over a 50-year time horizon) was estimated at US\$33 billion for a 92 per cent likelihood of owl survival.

The benefits of the ISC level of owl protection were estimated using a contingent valuation survey of households. The estimates of aggregate willingness-to-pay



The cycle of forest policy

fell in a range of 3 to 40 times the opportunity cost estimates. Other estimates, though more modest, still found benefits to outweigh costs.

However, the people who benefit are rarely the same people who bear the cost. Estimates of gains and losses from federal timber harvest reductions found that private timber landowners benefited from higher stumpage prices, and wood products industries outside the owl region also benefited. The bulk of the cost, meanwhile, fell on wood manufacturers, their employees and loggers in the owl region, while all consumers of wood products faced higher prices for wood-using goods.

Studies of the impacts on global wood products markets predicted price-induced increases in timber production in the southern United States, eastern Canada, Scandinavia, eastern Russia, and the radiata pine plantations of New Zealand, Chile and South Africa.

If the rest of the world followed US federal forest policy and shut down their forests for timber production, we would probably experience increasing marginal costs for conservation (and associated economic disruptions). An alternative - one which requires a sense of common cause and strength of political will that is too often lacking - is to accompany supply reductions with measures to control the pressure of demand.

Environmental forestry conflicts

In the 1960s and 1970s, criticism of forestry arose mainly at the national level. They originated from a clash of three

simultaneous developments related to economic growth:

- the striving for economic growth, which led to intensified forest management,
- the raised standard of living, which increased recreational pressure upon forests, and
- economic growth, which led to deterioration of the environment and fear about the exhaustion of natural resources.

Most often, policy decisions are made in a setting where different values and interests clash and, thus, involve conflict management. Conflicts, which may vary from mild differences of opinion and disagreements to disputes, campaigns, litigation and even physical confrontation, are sometimes even the "engine" of policy change and social development.

Forest-related conflicts in many Western countries often appear to be similar at first sight. Yet there are significant variations in the themes discussed, the protagonists involved, the geographical scales and the type of conflict.

Scientific arguments have formed a part of the rhetoric; however, science can only guide conflict

management, not impose solutions. The attention of the media on conflicts affects the values and attitudes of the public by means of the images created. It is often these created subjective values rather than objective facts that have an impact on political and economic decision-making. Citizens have been involved, and the support and resource base of many environmental organizations has tended to facilitate the integration of these groups into the planning processes.

Forest-related conflicts have had an impact on the economic environment of the forest sector. The debate over timber certification has been strongest in countries which are most dependent upon environmentally sensitive markets.

The cycle of forest policy model may encourage public and industry policy makers to better understand the potentially positive role of conflicts and their constructive management for policy development.

SOURCES | Volume I, Chapters 11, 15, 21, 29 & 30; Volume III, Chapters 2, 3, 8, 9, 10, 26 & 27.

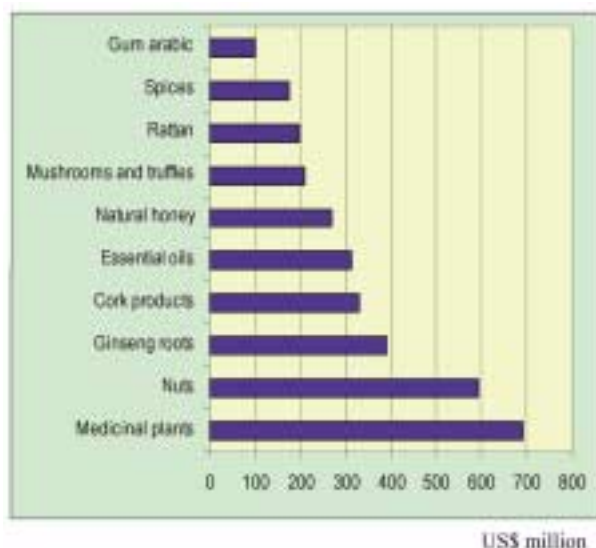
VI. Production of Goods and Services

Approximately 2 per cent of global production and 3 per cent of trade in merchandise derive from goods based on the raw materials that forests supply. More than half of the world's roundwood harvest is consumed as fuelwood, with forest industries using most of the rest.

Forest industries are not, however, a pervasive user of the world's forests. It has been estimated that two-thirds of the current world supply of industrial wood comes from an area of intensively managed forests and plantations of about 500 million hectares, or just 15 per cent of the total area of forests.

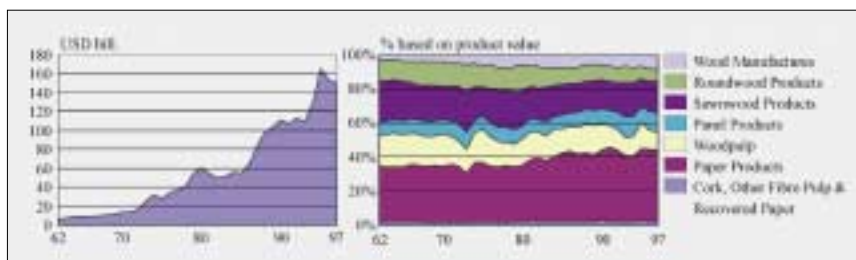
Growth of the economic contribution of the sector has been positive, but it is less than the growth of economies as a whole. A similar trend may prevail in the future - positive growth, but a gradual diminution in the percentage contribution of the sector's production activities, as services increasingly dominate the global economy.

Non-wood forest products are a heterogeneous group of products, ranging from live plants, biological research materials, forest food, wild fruits, pelts and plumes to aroma chemicals and phyto-pharmaceuticals. They are consumed by people of varying economic levels: rural households, subsistence farmers, shifting cultivators and affluent urban populations. Millions of people living in the vicinity of forests in developing countries are highly dependent on them. Non-wood forest products rank



World trade in selected non-wood forest products

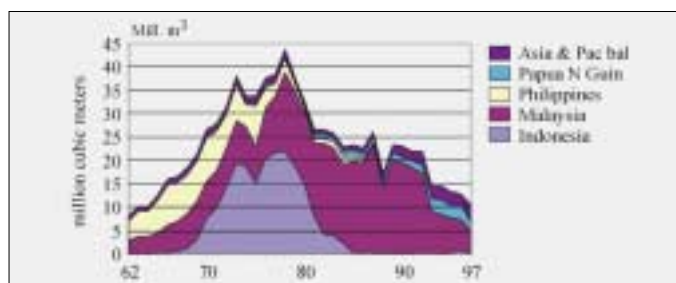
among the oldest traded commodities, and today at least 150 are of significance in international trade.



World export of forest products

International trade

Some 30 per cent (by value) of world production of industrial wood products enters into international trade. The value of world forest products trade increased fivefold in real terms over the past 40 years. The traded volume of all major forest products has expanded substantially; the greatest increases were for panels and paper. Roundwood plays a diminishing role, particularly in the exports of tropical countries. The trend has been toward concentration on higher value products and the growing dominance of nearest regions in trade relations.



Asia and Pacific industrial roundwood exports

Importing forest products worth nearly US\$20 billion, Japan ranks second only to the United States in the total value of imports. Over the past 40 years, the value has increased 10-fold in real terms - a dramatic increase that is related to substantial increases in the volume of all forest products as well as to transformation of the composition. At the beginning of the period, roundwood accounted for 80 per cent, but this proportion fell to 35 per cent in recent years. The regions predominant in supplying Japan

Production technology

Technological flexibility in the North American forest sector exemplifies significant changes in wood manufacturing during recent decades. These changes include intensified timber management; mechanized timber harvesting systems; improvements in sawmill technology, wood panel technology, construction engineering and materials; and adjustments in papermaking and recycling.

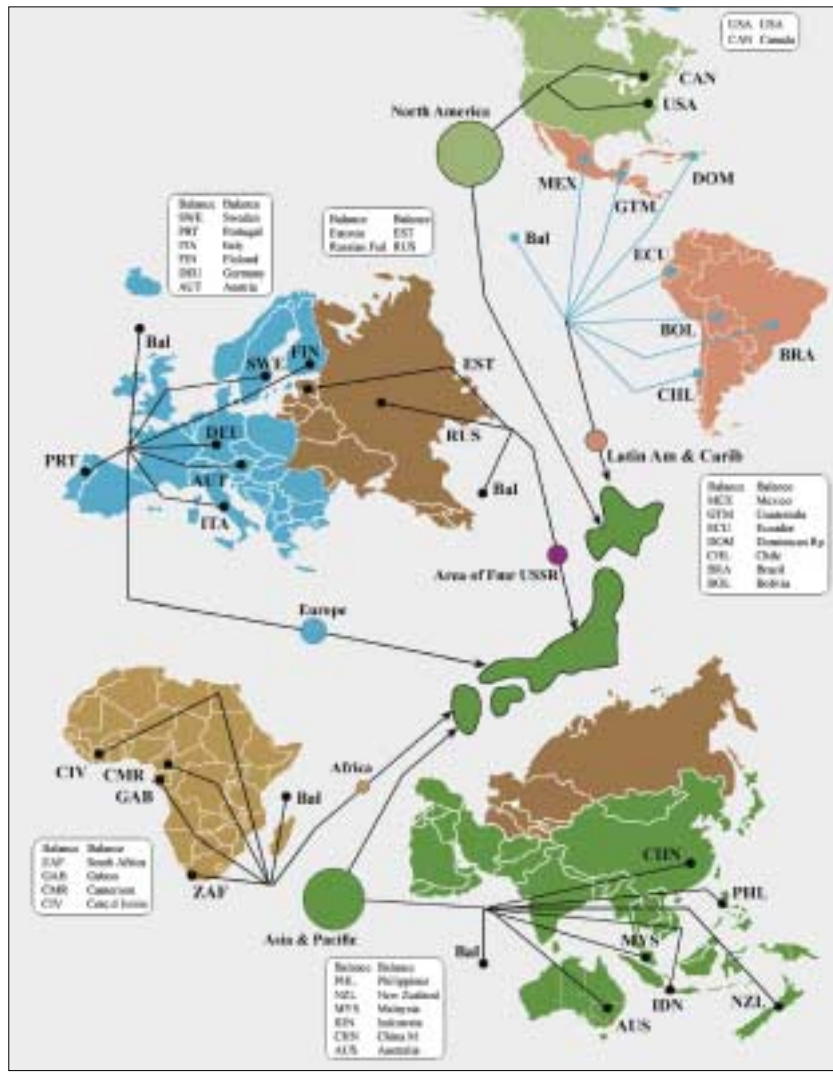
Throughout the latter half of the twentieth century, the North American forest sector experienced largely unabated growth in demand and production of forest products. This drove a long-term escalation of real prices for sawlogs and veneer logs. The market fostered expansion in composite wood panel output with the opportunity to exploit relatively abundant pulpwood and wood residue supplies. Expanded consumption of paper contributed to increased waste disposal costs, which fostered expansion in collection of paper for recycling, thus flooding the market with low-cost recovered fibre and leading, in turn, to expansion of recycling capacity within the paper industry.

Modern mechanized harvesting systems, developed largely as an economic response to rising labour costs, started with the advent of portable gasoline-powered chain saws, diesel-powered tractors, and trucks for hauling wood to mills. More stable and precise

sawing equipment, laser-guided sawing, computerized log breakdown systems, and improved drying systems enabled sawmills to steadily increase recovery of sawnwood from logs.

Wood panel production capacity growth in recent decades has shifted toward expansion in the composite wood panel industry. Factors favouring the rapid expansion of oriented strand-board (OSB) production include generally low mill labour costs (relative to plywood) and the use of cheap, small-diameter pulpwood.

These changes effectively create a larger, more sustainable, and more economical resource base. The



Japan's imports of forest products, 1962-97

were Asia and the Pacific, and North America, with each supplying 40 per cent or more (and together accounting for about 90 per cent).

Initially, the supply from Asia and the Pacific was practically 100 per cent roundwood, but by the end of the period roundwood made up less than 30 per cent, with panels accounting for nearly 40 per cent, sawnwood for 20 per cent and wood manufactures for 10 per cent. North American exports to Japan initially comprised 50 per cent roundwood, declining to 35 per cent, with sawnwood, pulp and paper making up the balance.

current level of demand for wood products simply could not be met economically without technological advances in production. Society has evolved a growing dependence on technology to sustain its demands.

Biotechnology in pulp and paper production

Demand for pulp and paper industry products is the one item that may be the best correlated with the different national living standards.

The main actions of the papermaking process involve separating the wood fibres at the pulp mill, rearranging them in a paper machine, pressing and drying the resultant paper web. (Recycled fibre from waste paper is a valid alternative for virgin fibre.) As a rule, energy consumption is higher for the high-yield processes. Chemicals are used abundantly in the processes of pulping and bleaching, and can pollute large quantities of water and air. The 1999 convention on the emission of wastes into the atmosphere and water, called the Best Available Techniques of Reference (BREF), requires the paper industry to control emissions and achieve the norms laid down by the year 2006.

In a new biotechnology-based kraft process, wood is first treated with delignification fungi that cause loss of lignin in the wood. Compared to traditional processes, this modification makes the defibration process friendlier to the environment and improves the quality of the paper; the yield of kraft pulp is thus increased, energy consumption in refining is lowered, and the paper properties are better.

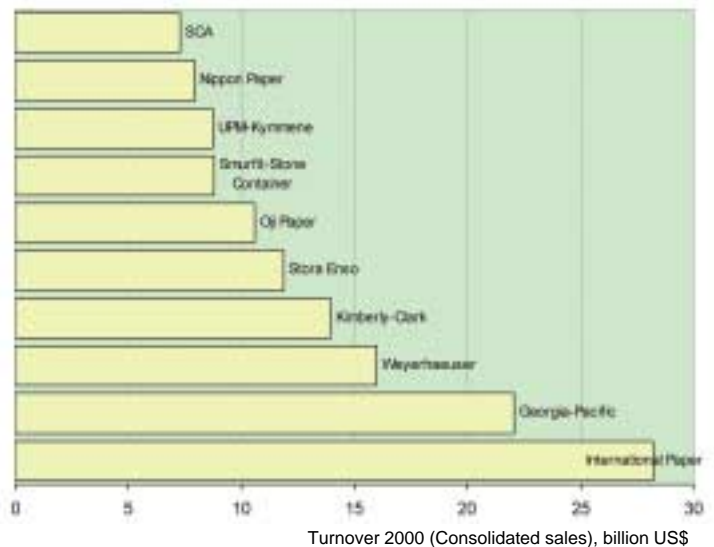
Paper consumption and information technology

A debate on whether electronic information technology (IT) will make paper products obsolete has continued for decades. Early predictions of the "paperless office" have turned out to be premature, but since the end of the 1980s the consumption of newsprint in the United States has stagnated. Computer and communication industries currently make up more than 8 per cent of the US economy and are growing twice as fast as the economy as a whole. The rapid spread of new IT is partly a result of the economies of information as IT reduces production and consumer costs while exponentially increasing the

information available.

For most consumers, paper is a means for information distribution. Digital technology will not necessarily change the way books and newspapers are written and read, but the "old" media may cease to be the preferred form of information and entertainment due to the *generation factor*. Generations born after 1985 have always used computers as their primary source of information and entertainment; after 2010, these young adults will comprise an important segment of consumers.

Expanding IT will increase the demand for paper for digital printing purposes, but the growth of demand for present communication paper types will decrease. Considering its potentially dramatic effect on the paper industry and the use of world forests, this is a prime topic for academic research.



Top ten forest industry companies

Internationalization of the forest industry

Internationalization is the general process whereby firms activate their transnational operations, be they acquisitions from abroad, buyouts, mergers, or foreign direct investment. Forest industry companies worldwide have been latecomers in this process, in part due to relatively low tariffs in international trade on forest products. Forest industry companies have been expanding mainly through

foreign direct investment and by forming transnational corporations or multinational enterprises. As there are fewer restrictions to capital transfers across national borders and to international investments, companies have realized the need to expand through global investments. To grow bigger is as important as the need to become global.

There are several advantages for a firm that crosses national borders:

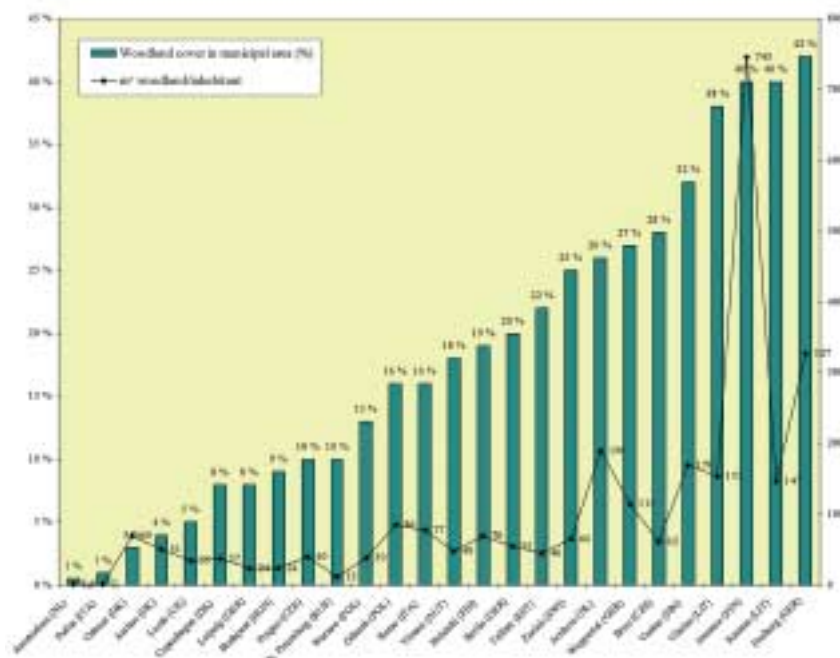
- The company gains flexibility in reacting to demand cycles and can reduce risk;
- It can disseminate information at low cost between its production plants;
- It gains comparative advantages of size and alliances between companies of different nations;
- Access to capital from international markets is improved;
- Marketing benefits from better links to international markets (sales offices, warehousing, transportation);
- Trade barriers, duties, levies and patents can be circumvented by global production;
- Spreading the operational base between different currency zones may avoid exchange rate risk; and
- Globalization offers improved access to emerging markets.

Competition policy (European Union) or antitrust laws (North America) are required to prevent a single unit from becoming too large a player and gaining a dominant market share. In Europe, competition policies have relied on the concept of substitutability between products, while in North America approaches such as the hypothesized monopolist's ability to raise prices have been deployed.

As mentioned, forest industry firms are latecomers to internationalization and globalization. This is especially true in North America, where in 1997 the top five forest industry companies accounted for only 13 per cent of the total production. It is predicted, however, that the concentration process will continue, and by 2005 this figure is expected to rise to 30 per cent.

Urban forestry

Many European countries currently have over 75 per cent



Woodland in urban areas

of their population living in urban areas. Urban forestry aims at managing trees not as isolated entities, but as part of an overall resource. Urban forestry is seen as a multi-disciplinary activity, involving horticulture, landscape architecture, urban planning, ecology and social sciences as well as forestry. Research in nine countries has produced a historical overview, reviewed planning, and defined needs of European urban forestry.

In medieval times, there were cities that owned forests and used them for provision of timber, food and grazing. In the sixteenth century, estates began to be established near cities as places of retreat. During the Industrial Revolution, when cities exploded as centres of industrial activity and labour, the need for large areas close to the city for recreation and other services was recognized. Characteristically since then, local authorities and citizens have fiercely protected woodlands from immense pressures of urban development.

The location of woodland in and near dynamic urban areas presents certain challenges to their planning and management. Fragmentation results in a large interface between woodlands and surrounding urban areas, and there are peculiar problems associated with wildlife taking to the town (such as wandering deer or wild boar).

Woodlands can also host diseases dangerous to humans. Another challenge is dealing with forest fires. Ever present is the intensive use of urban woodlands with issues of access and safety, and problems of litter, waste dumping, vandalism, motor vehicles and crime.

There was a lack - in a sample of 16 European cities - of formally accepted policies specifically for urban woodlands and of integration with overall town planning. Woodland management plans were focused on recreation and environmental services. Wood production was secondary, while important functions included cultural, historical and educational ones.

The cutting of trees was seldom popular, and woodland managers have had to make an increasing public information effort to legitimize their actions. The pressing need to deal with a wide range of users and uses has resulted in the development of innovative, participatory planning and management, sometimes with a close link to community and social forestry experiences from developing countries.

Urban population in Latin America in 1995 was 73 per cent. Curitiba (Brazil) was one of the first cities in the region to implement an integrated urban development plan that gave due importance to environmental issues.

The principal benefit of urban forestry comes from the creation of a healthier and more agreeable environment. In Trinidad, for example, pink and yellow poui trees (*Tabebuia* spp.) are planted by squatters around their homes. The metropolitan park in Quito (Ecuador) has native vegetation, and people visit to observe the flora and fauna. In Sao Paulo (Brazil) and Vina del Mar (Chile), municipal governments give plants to schoolchildren to plant in their homes. Recognizing that trees and bushes can be useful for reducing noise levels and creating a living barrier, Santiago (Chile) and Quito have designated large areas of peri-urban land surrounding the city as greenbelts.

There are notorious differences in the provision of recreation areas. In Quito, 75 per cent of green areas are situated in the middle and upper class residential zones. Urban forestry can offer material benefits to the poorer

population by providing fuelwood and fruits. The Fundacion Natura, at the request of local residents, planted medicinal plants, fruit trees and hedges in a poor neighbourhood.

Outdoor recreation

Urban forestry may very well be one of the most promising answers to the question of how to keep society in touch with natural and rural values and processes. Forest as the venue for outdoor recreation offers substantial benefits for society, and demand is growing faster than at any time in five decades. How can this rapidly growing demand for recreational access to forests be accommodated without compromising our ability to sustain the health and overall productivity of forest ecosystems?

In the United States, activities traditionally referred to as "forest recreation" - walking, picnicking, sightseeing, swimming in natural waters, hiking, bicycling and fishing - have retained their position as being the most popular. Among the fastest growing recreational activities are backpacking, horseback riding, snowmobiling, cross-country skiing and off-road driving. There is continued growth of interest in viewing and learning activities, and in participation in new and risky recreational activities.

Access has been limited to areas having roads and trails. Recent technology advances, however, have begun to change what is or is not accessible. For example, jet boats, helicopters and all-terrain motor vehicles have made access easier to much larger areas. Conversely, access to private lands for recreation has been declining since the 1970s.

Business activity is generated by the pursuit of forest recreation, often important to local economies in forested parts of the country. While demand growth offers profitable opportunities to the private sector, it also ushers in daunting challenges for public land managers, fuelling pressures to convert forest lands to other uses.

SOURCES | Volume I, Chapters 3, 7, 10, 25 & 31; Volume III, Box 2.1 and Chapters 6, 7, 12, 14, 20, 28 & 29.

VII. Community Forestry and the Agricultural Frontier

Community forestry in India

In India, forestry development paradigms, other than community-based ones, have become anachronistic and should be rejected in order to make further headway.

The forest department was entrusted with custodianship of 90 per cent of the forest area of 64 million hectares - 20 per cent of the land area of the country. The present method of forestry development, referred to as a "scientific management system," has been practiced for the last 130 years. However, this system is unable to sustain the quantity and quality of India's forests, and it is failing to meet the demands of the rising local population for industrial wood, fuelwood, non-forest products and recreation. The most glaring deficiency in the "scientific" management has been its concern to satisfy local needs in theory while being oblivious to them in practice.

Community-based forestry, which is a substantial departure from the presently practiced scientific forestry, is now considered to be the only possible paradigm for forestry development in India. While traditional community forestry is on the wane, it still accounts for 6 million hectares. Of the new forms of community forestry, village woodlots are estimated to cover about 0.5 million hectares, joint forest management controls 2.15 million hectares, and eco-development is practiced on a few thousand hectares.

The policies and laws introduced by the British colonialists were oriented towards government forest ownership. Traditional forest use rights of the local and indigenous people were rigidly controlled or abolished. "Common property" forest area, available to villagers for swidden cultivation, gathering and grazing, was dramatically reduced.

Arunachal Pradesh witnessed, in that time, a unique community and government joint effort in forestry. In the Tirap district, agreement was reached whereby the rights of the Nocte villagers and the tribal chiefs of Borduma and Namsang were fully recognized, and annual revenues from the forest operations were divided between the community and the government. In other regions of India, local communities introduced successful indigenous systems of management - for example, the *Kans* of Uttarakhand, the *Orans* of Rajasthan and the *Shamilats* of Punjab. But village forests generally became open-access

forests exposed to indiscriminate cutting and degradation.

Village woodlots, which were a part of social forestry, consisted of two sub-components: (i) self-help, in which villagers were expected to provide labour for voluntary planting and protection while the authorities were to supply the required seedling stock, and (ii) finance from sources outside the village. The externally financed plantations had better success, with plantation costs borne by the project while the benefits would go to the village people.

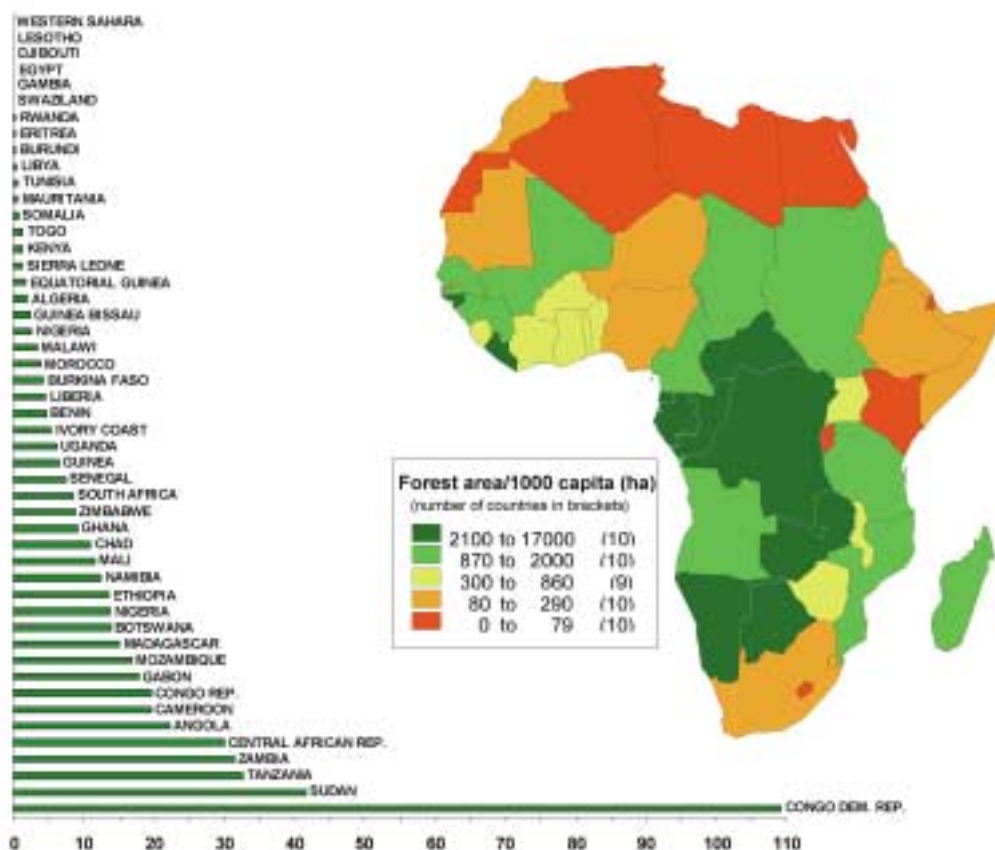
In the 1970s, government encouragement of public participation in public forest management first made its appearance with the initiation of the Arabari "socio-economic experiment" in West Bengal. In the 1990s, the concept was accepted by governments in eighteen states. Thus began the joint forest management of forests by the local people and the forest department. A forest is linked to a village, and all households become members of a forest protection committee (in Haryana state, for example, each household has one male and one female representative). The incentives for participation include collection rights concerning non-wood forest products, a 100 per cent share of the intermediate fellings and at least a 25 per cent share of the final cut.

Eco-development is a strategy to protect conservation areas from the local people who traditionally collect for their subsistence needs from these areas. Village committees, in association with the forest department, decide on the nature of government or foreign-financed village development programmes that they would like to undertake, which generate employment and improve the village economy. In this way, they improve their economic status by becoming less and less dependent on the forests.

Amongst all the recent trends in community forestry, the most promising is joint forest management, though it has deficiencies. The major problem is the strong hold the forestry department maintains on joint forest management, so that the people's committees cannot take any initiatives of their own. The concept of joint management should be abandoned, to be replaced by the concept of *people's management*.

Agroforestry and farm forestry in Africa

Natural resources, particularly forests and soil, in African countries have been under enormous pressure from



Forest area in Africa (Data source: FAO SOFO, 1999; United Nations, 1998)

different users, attributable to the increase in population and subsequent intensification of land uses. Soil productivity has been decreasing in low-input farming systems, which implies that farmers have to cultivate larger areas to meet their food requirements. Arable land per capita has also been decreasing.

Agroforestry systems are land use systems in which woody perennials are introduced into the same management unit with agricultural crops and animals. It is an ecologically based dynamic resource management system that diversifies and sustains production for increased social, economic and environmental benefits to land users. Agroforestry, as a field of study, combines a range of disciplines, including anthropology, economics, soil science and tree genetics as well as agronomy and forestry. It is a multidisciplinary approach for solving production and environmental problems for the benefit of the local people.

Interest in long-term investments is demonstrated by

the Chagga home gardens in Tanzania, the Nyabisindu system of Rwanda or the shamba system in which trees and farm crops are mixed in a defined proportion. There are successful traditional agroforestry practices, such as intercropping *Acacia albida* with millet and sorghum in West Sahel, and silvopastoral systems based on the management of fodder in savanna land and Chitemene and Fundikila in Zambia.

Efficient utilization of the subsoil by deep-rooted tree species will result in a translocation of nutrients and humidity to the upper layers of the soil, from where agricultural crops can access them and potentially increase yields. The interception of solar radiation by trees, meanwhile, helps sustain microclimate conditions, which enhance the

performance of the annual crops. The animal component of the system uses crop/tree products and plays an important role in the nutrient recycling process.

In southern Africa, only labour is assumed to be a constraint, since land is abundant; but land may become a constraint because of declining land per capita. Land-use conflicts between smallholders, private owners and governments are more frequent in countries such as Zimbabwe, South Africa and Mozambique. Because agroforestry concerns smallholders who, through customary rights, generally use the land without a title, an element of uncertainty is introduced, which limits permanent investments in land.

Essential conditions for the successful adoption of farm forestry and agroforestry in Africa include land tenure, integration of agroforestry systems in a wider land use planning framework and a research network that includes policymakers, research institutions and researchers.

Dry forests and livestock in Africa

Drylands, arid, semi-arid and dry sub-humid areas cover one-third of the earth's surface. Semi-arid lands in sub-Saharan Africa cover 1.2 billion hectares, or more than half of the semi-arid areas in the tropics. Dry forests are located in the Sahel and in Eastern and southern Africa. They contain species of various vegetation types that are incredibly resilient and well adapted to the extreme environmental conditions, such as miombo woodlands, mopane woodland, *Acacia* savanna, *Acacia-Commiphora*, *Combretum* woodlands and many bushlands and thickets.

Most of these areas are owned by governments as game or forest reserves, or simply as state lands. They support two-thirds of Africa's population, providing important sources of products needed for survival, income and economic growth: fuelwood, construction materials, artisan wood, medicines, soap, gums, tannin, dye, biocide, water purifier, fibre, fruits, vegetables, mushrooms, honey, insects, etc. The wildlife is cropped for meat and skins, and supports tourism. Dry forests are also critical sources of dry season browse for livestock; about 200 tree species are used as browse. Leaf litter is collected and spread on fields as fertilizer.

Livestock is generally kept on an extensive basis and herded on communal grazing areas, either transhumant (which involves migration between regular seasonal areas) or agropastoral (which involves subsistence crop cultivation in addition to livestock production). During the dry season, forests and woodlands are used for browsing except in areas with tsetse fly (*Glossina* spp. which transmit *trypanosomiasis* in humans and in domestic livestock). The Turkana herders make optimal use of the sparse vegetation by moving livestock between wet and dry season grazing. The Sukumas in Tanzania designate family or communal land as dry season grazing reserves.

Overstocking is cultural: cattle are symbols of wealth and prestige, while herders maximize the size of the herd to spread risk and maintain long-term reproductive capacity. But expansion of sedentary agriculture has created conflicts. The development of national parks and game reserves is also depriving herders of grazing land. Tenure flexibility, access and sharing, which are central to pastoral communities, are being undervalued.

The closer the management is to the ecosystem, the more there is responsibility, accountability, participation

and use of local knowledge. Involving communities will therefore improve the success of management. The growth of both livestock and human population, and the growth of poverty, should be addressed because they are the major forces driving land and forest degradation in Africa.

Land tenure in Namibia

There is a dualistic land ownership system in Namibia, with freehold areas of commercial farmland owned by white farmers, and state-owned communal lands occupied by black farmers. Some of the most valuable forests and woodlands in southern Africa are found in northern Namibia's communal lands. These include kiaat (*Pterocarpus angolensis*), Rhodesian teak (*Baikiaea plurijuga*) and mopane (*Colophospermum mopane*) forests.

Privately owned commercial farmland is used mainly for extensive livestock production. Biomes are increasing due to bush encroachment, but the value of the land is decreasing due to overgrazing, under-browsing and fire exclusion. No economically viable way has been found to destroy existing bush, but its use for charcoal has shown a lot of potential.

Communal land is formally owned by the state, but the power of allocating it - still with the traditional authorities - has weakened, leading to insecurity in land tenure. The forests and woodlands provide key grazing and browsing habitat for domestic livestock and wildlife, but are treated as open access, and illegal cuttings have become a severe problem.

The government of Namibia has recognized that the current resource use is not sustainable. A new Communal Land Reform Bill introduces the possibility of acquiring individual leasehold rights to communal land, leading to more sustainable land use. A new Forest Act allows the rights to use and control of the forest resources to be given to the communities; as a prerequisite, the community has to sign management agreements and a management plan.

Forest and small farmers in Cameroon and Indonesia

In both Cameroon and Indonesia, economic crises led to changes in farming systems and to a significant increase in

the rate of forest clearing - yet the circumstances leading to this outcome are strikingly different. In Cameroon, a collapse of the prices of leading agro-export commodities (cocoa and coffee), withdrawal of government subsidies for these commodities, and restrictions on food imports made farmers clear land to produce food crops for domestic consumption. In Indonesia, a drastic depreciation of the national currency against the US dollar made certain agro-export commodities profitable, with the consequence that many farmers cleared land to produce these crops.

The vast majority of Cameroon's rural inhabitants are small farmers producing cocoa and coffee (the main export crops), and plantain, cassava, maize, groundnuts, and cocoyam. An economic crisis began in 1986, resulting from a dramatic decrease in the international prices of oil, cocoa and coffee; a decline in Cameroon's oil reserves; and appreciation of the value of the CFA franc. Among the consequences of the crisis were a severe decline in Cameroon's terms of trade, public sector pay cuts, increased urban unemployment and urban-to-rural migration, a drastic reduction in subsidies and the government purchase price of cocoa and coffee, and greatly decreased incomes to small farmers.

In Indonesia, people residing in the forested areas produce a wide variety of export crops (for example, rubber in Sumatra and West Kalimantan, and cocoa in Sulawesi and parts of East Kalimantan). Small farmers throughout the outer islands produce subsistence food crops (such as rice and cassava). Indonesia's principal foreign exchange earners are oil, textiles and timber products. In the regional Asian economic crisis from 1997, Indonesia's currency depreciation was dramatic, losing on average 70 per cent of its value against the US dollar. Consequences included an increase of poverty, massive private sector layoffs in urban areas, high rates of inflation and a severe decline in consumer purchasing power. Strong economic reform measures were imposed, which greatly enhanced the value of exports.

An analysis of time series satellite imagery in Cameroon showed that there had been a substantial increase in forest clearing by small farmers in the decade after the onset of the crisis. Stagnation of the growth of cocoa and coffee lands, and the expansion of plantain and non-plantain food crops, was generally confirmed.

The data on forest clearing in Indonesia showed a gradual increase in the number of clearings in the first year of the crisis, and a considerable increase in the second

year. The main purpose of the increased clearing was for the production of tree crops, such as rubber, coffee, cocoa, and pepper. Land clearing for swidden cultivation, for food crops such as upland rice, declined.

In both Cameroon and Indonesia, the economic crisis led to a higher rate of forest clearing by small farmers and a modification of crop preferences. In Cameroon, this forest clearing can be characterized as "survival oriented" to diversify and expand the cultivation of food crops. In Indonesia, higher costs forced a search for additional farm income by establishing tree crops - to face the crisis, but also to invest in future income-earning possibilities.

Increased rates of forest clearing have more to do with destabilization than a decrease or increase in agro-export prices. Clearly, macroeconomic adjustment policies can lead to unexpected (and, in some cases, undesirable) social and environmental consequences.

Colonist swidden agriculture in Peru, Brazil and Nicaragua

Swidden agriculture is responsible for about a third of tropical deforestation in Latin America. Swidden farmers also regenerate significant areas of secondary forests on their farms as part of the fallowing process, so that 25 per cent of farm area remains under secondary forest even after a century of settlement. These are the only significant forest resource available to the rural poor in older settlement areas. At the landscape level, there is a shifting mosaic of secondary forest fallows, crop and pasture, small areas of permanent secondary forests and declining areas of residual forest.

A conceptual framework of the phases of development in colonist agriculture has four stages: The "Early Pioneer" stage, when the first settlers arrive in a forested area, is characterized by minimal infrastructure. In the "Emerging Market Economy" stage, infrastructure and market access improve, more colonists arrive, and land tenure becomes more formalized. In the "Closing Frontier" stage, there is little forested land available for colonization, and market integration shows further improvement. In the fourth stage, "Old Frontier," colonization has ceased and no further unclaimed forested land is available.

Slowing down the conversion of residual forest to agriculture and secondary forest would result in more biodiversity conservation and less, but more productive,

secondary forest. Residual forest disappears from farms over time because it is mined for commercial forest products at early stages of frontier development, and is then converted to agriculture. Forest fallow expands because it is highly complementary with agriculture, alleviating weed and nutrient problems that build up.

The main justification for increasing secondary forest rests in the commercial value of its goods and services, relative to alternative land uses. In Nicaragua, it was being maintained mainly for the production of a medicinal plant, known locally as raicilla (*Cephaelis ipecacuana*), for supplying firewood, for protecting watercourses and for providing fencing materials for pastures.

From *agarradas* and wood smuggling to conservation

Until recently, migrants from the highlands claimed parcels of tropical forest in the lowlands of Peten (Guatemala) and converted them into agricultural land or pastures. Due to these *agarradas* (literally: "grab what you can"), the agricultural frontier kept moving, threatening to eliminate the remaining tropical forests of Guatemala. Wood smuggling and frequent forest fires added to the threat.

In the 1950s, the boom of chicle exportation boosted the colonization of Peten. In the 1960s, the government of Guatemala promoted land settlement and cattle raising. Timber companies were assisted by roads, constructed for the exploitation of timber and gasoline. In the view of the migrants, forest was abundant, so they had no incentive to care about sustainable use.

In 1989, the upper part of Peten was declared a protected area, Biosphere Maya, for preservation of biodiversity and the historical Maya monuments. The National Commission for Protected Areas put emphasis on protection and prohibition, which created strong opposition among the local population.

A new policy has recently been put into practice to combine conservation with development, and to give communities a stake in the sustainable use of forests. The communities' priority was access to social services, roads, drinking water, schools and health care. Their interest in forest management was dampened by the lack of security of land tenure. A deal was made with communities in the protected zone allowing them to stay, on the condition that they collaborate in preventing major migrations and limit their agricultural activity. A concession was created

giving a community of families the right to use an area for 25 years.

The gain is the improved control of fires, smuggling and *agarradas*, and cautious hope that these changes will be sustainable.

The giant snail

The giant snail, *Strophocheilus popelarianus*, is one species in the mega-diversity of the humid tropical forest that has the potential to become an important non-wood product if exploited rationally. Research on this species in Ecuador resulted in new data on the biology, etology, environmental significance and usability of this species, as well as on its potential production in captivity.

This terrestrial snail is found in tropical and subtropical primary forests. Its most distinctive characteristics are its weight (544 g), the size of its shell (which may reach about 15 cm in length) and its foot (which can be as long as 25 cm).

The Amazon Indians consider the meat to be very tasty (and it is a popular aphrodisiac). The giant snail also has a variety of medicinal functions: its blood is used against diseases caused by nematodes (trichinosis), and its mucus as a relief for varicose veins. The shell can be used for artistic purposes, or as a natural fertilizer.

Quichua women usually collect and sell the live animals. Depending on demand, a maximum of 30 snails per week are sold at the market, each fetching a price of US\$0.43 (1999). This money is significant, as the families engaged in snail trade usually have no other source of income. Cultivation of the animal can be feasible; it does not require significant funds, and guidance and instruction are easy.

Logging, which usually causes conflicts with the local people's traditional way of living, is not the only profitable use of forests. The traditional knowledge of the locals, as in the case of the giant snail, can turn out to be a key factor in alternative sustainable exploitation.

SOURCES | Volume I, Chapters 14, 16 & 20; Volume III, Chapters 15, 16, & 18 and Boxes 5.6, 5.8 & 5.9.

VIII. Policies and Development

African forests, societies and environments

Africa possesses a wide range of climatic and soil conditions, tropical (76 per cent) and non-tropical (24 per cent). Forests covering a total area of 520 million hectares produce goods and services for both local and global communities.

Roundwood production is nearly 90 per cent fuelwood and charcoal. Sawnwood, wood-based panels, wood pulp and paper account for just over 10 per cent. Eight countries are producers of pulp and paper, and only a very few countries are significant importers of wood products. Forests in Africa also produce a wide range of non-wood products and play an important role in food security.

No significant slowing down of population growth in Africa is expected. The challenge, if poverty is to be reduced significantly, is to achieve a sustainable and broad-based economic growth. The pressure of external financial institutions, weak economic policies and a poor business environment imply that it will take time for the economies of Africa to grow at a rate that will lift the majority of their people above the poverty line.

South Africa is an exception, in that it has gained international status in the areas of forest-related research, silvicultural practices of plantation forestry and trade in forest products. There, the forest sector makes a substantial contribution to the economy, employment and welfare services of society.

Forest policies in Malawi, Mozambique, Tanzania and Zimbabwe

Broad policy statements about involving local communities in forestry have existed in some countries for several decades, but adequate resources have not been committed for their effective operationalization. Generally, the forestry sector in southern Africa has lagged behind, although current forest policies are more comprehensive in terms of stakeholders considered and issues addressed.

Forest policy is concerned with the manner in which forests and tree resources should be managed to serve the needs of people and meet society's demand for goods and services, as well as with regard for the non-material values. The forestry policy-making process has moved away from

the top-down approach, in which policies were dictated to the people by their governments, back to a more consultative approach encompassing many stakeholders.

The pre-colonial period was characterized by land use systems that were sustainable, such as shifting cultivation and nomadic livestock rotation; the long fallow period allowed the land to recover fully before the next rotation, and low livestock densities minimized over-grazing. Authority over forest resources was vested in traditional leaders who had a sense of direction in forestry matters of relevance to the local communities. There were fewer stakeholders with fewer demands on forests, which were abundant in many communities.

One characteristic of the colonial period was how the administrations and their commercial agriculture activities introduced drastic changes to local peoples' access to forests and land. The general thrust of colonial land law was to appropriate all land and to facilitate access by the settler community, thereby disrupting common property regimes. The major players in formal forestry in all the countries were the government and the private sector.

A significant development during this era was the introduction of the concept of a "state" or "nation," with formal national policies and legislation, and the creation of centralized administration of the national forest estate. Forestry matters that had always been in the domain of local leaders were now being governed in the context of a district, province and nation.

The Malawi 1926 forest ordinance is outstanding in that it provided for the creation of community forests, known as village forest areas. This marked the beginnings of central government encouragement of community forestry, and the decentralization of forestry resources management to local communities in the southern African region.

The post-independence period saw the emergence of differences in both political and economic orientations. Malawi, Mozambique, Tanzania and Zimbabwe all had strongly centralized governments, with different degrees of private sector involvement in production. Private sector growth was stifled in both Tanzania and Mozambique through nationalization policies, while Zimbabwe left its private sector intact.

Initially, economies were centrally planned, with state ownership and control of most means of production and distribution; the role of the market was very constrained. Forestry prices were set administratively. Although

secondary forestry production was more market oriented, with governments in charge there were gross inefficiencies.

Then followed a period when these countries came under intense pressure from international financial institutions, like the World Bank, to make significant economic reforms known as structural adjustment programmes. Emphasis was on private sector involvement, trade liberalization and reduction in fiscal deficit. On the political front, democratization precipitated some diversion of resources from economic development into servicing the political machinery.

For forestry, structural adjustment discouraged government monopoly and promoted private sector development. Democratization encouraged local people to effectively participate in decisions about these resources. However, earlier forestry policies and legislation continued to operate, and their eventual revision appears to reflect developments in forestry worldwide rather than structural adjustment policies.

Governments were decentralizing the administration of forest resources ownership and management to sectors outside government, encouraging partnerships with other stakeholders in natural forest management to include local communities, women's involvement, the private sector, NGOs and the international community. They demonstrate a very clear shift in emphasis:

- from plantations of exotic tree species to better management of natural forests;
- from centralized forest ownership and management to decentralized, devolved and joint management and ownership; and
- from forestry practice revolving around tree and forest management to forestry as rural development.

At the same time, forestry sectors accommodated various international agreements and conventions. This created a state of confusion, characterized by conflicting sector policies and poor coordination, and has precipitated a continual state of planning to accommodate the emerging trends. This has strained institutional capacities and financial resources as well as undermined long-term planning.

The successful implementation of these conventions requires development of:

- harmonization of relevant policies and legislation;
- an institutional framework defining responsibilities,

procedures and accountability;

- qualified human resources and financial resources;
- mechanisms for consultation and stakeholder participation; and
- systems for information generation and dissemination.

Forest plantations in Ethiopia

The relatively early and extensive deforestation in Ethiopia, coupled with the cultivation of steep marginal lands, overgrazing and socio-political instability, has resulted in severe land degradation in large areas. This is the most pressing environmental problem facing the country.

Ethiopia's forest plantation history is one of the longest in Africa. Eucalyptus species were imported from Australia around 1894, and they have since been successfully established throughout the country. By 1995, plantations in Ethiopia covered about 140,000 hectares, with industrial and peri-urban fuelwood plantations accounting for about 70 per cent. While facilitating the long-term rehabilitation of degraded lands and forest ecosystems, they also provide economically and socially valued forest products and services.

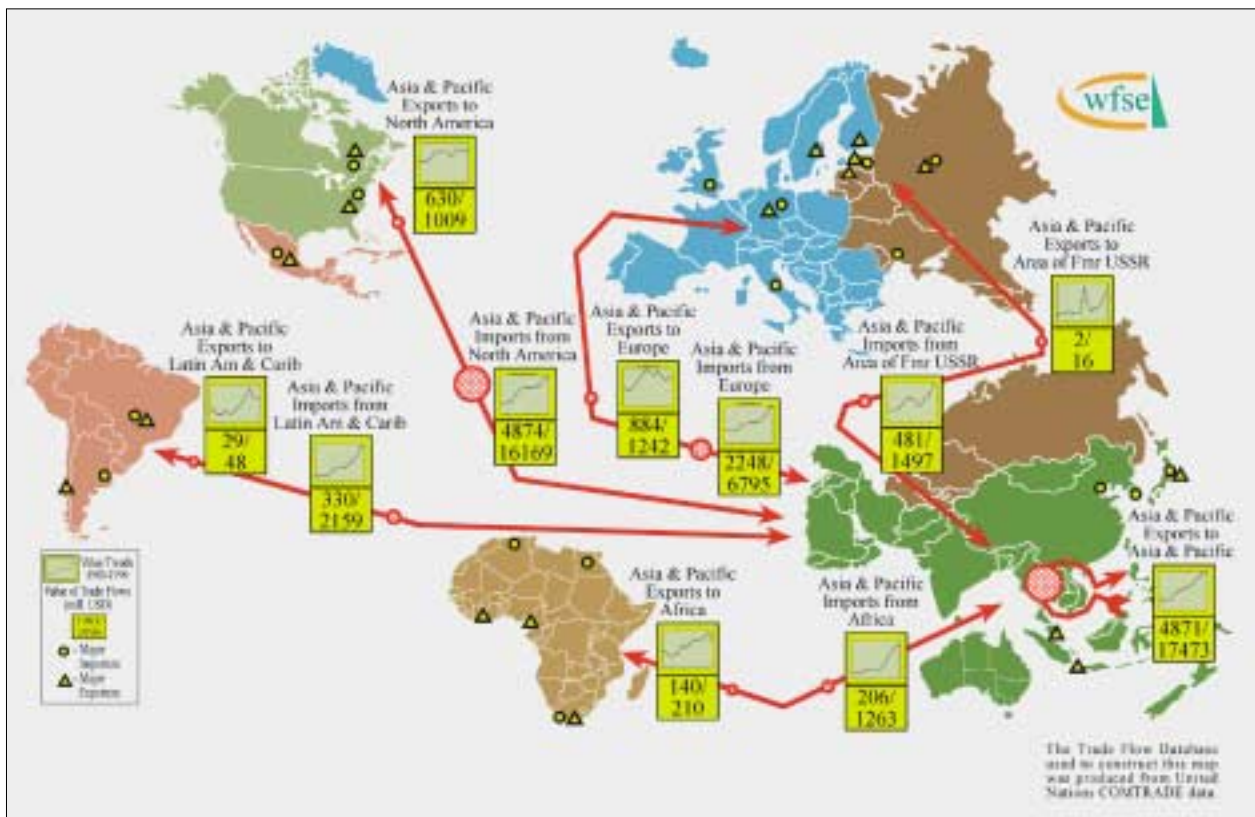
Recent research results indicate that species richness under plantations increases over time. Inventories in Ethiopia showed a total of 53 naturally regenerated tree and shrub species at one forest plantation site.

Asia-Pacific forests

The population of the Asia-Pacific region is high compared to other regions of the world. The region has been economically the most dynamic in the world over the past three decades. The most striking and significant trend from the 1970s has been the very rapid spread of the market economy.

The forests of Asia-Pacific are very rich in biodiversity and have high potential for mitigating the impact of global warming. Long-term prospects are, however, gloomy, with major threats of deforestation and degradation of forest resources.

The forest industry in the Asia-Pacific region has expanded greatly in the last three decades. The region has been the world's largest exporter of processed tropical hardwoods. Over the last two decades, the consumption of industrial roundwood in the Asia-Pacific region has shown sustained increases.



Trade flows between Asia-Pacific and partner regions, 1983-1996

The forecasts obtained using a market equilibrium model indicate that Asia-Pacific demand for forest products will continue to rise, as a number of rapidly growing economies are concentrated in the region. The real prices of industrial roundwood and sawnwood are projected to increase slowly until the year 2010, while the real prices of wood-based panels, paper and paperboard would change little. China is expected to become the world's largest economy, and a major source and destination of forest products.

However, the forest products sector in the Asia-Pacific region will not grow without setbacks; growth depends on the performance of the economies in the region. The provision of sufficient wood supplies will call for active forest policies in which both market incentives and old-fashioned planning play a role.

The evolution of forest regimes in India

In India, forest regimes have come full cycle, starting with

community forest in the pre-British period, through state regimes during the colonial period, and finally back to community-based forests in the 1990s.

Long-term institutional changes are evolving, path-dependent phenomena. The evolutionary theory of institutional change developed the idea of adaptive efficiency, which includes the willingness of a society to acquire knowledge and learning, to induce innovations and to undertake risk and creative activities.

In ancient India, forest dependence of people was institutionalized through a variety of cultural and religious mechanisms, such as sacred groves, temple gardens and worship of select trees. Local communities developed indigenous systems of forest management to achieve a continuous flow of benefits from forests in which public welfare had a considerable weight.

The British came to India saddled with an attitude that often predisposed them to view forests in a negative light. They extended the land under cultivation as a means of consolidating their control. Forest regimes were aimed

at securing economic, political and strategic advantages for the Empire. The Forest Act of 1865 empowered the state to declare any land covered with trees or brushwood as government forest. The 1878 Indian Forest Act put restrictions on the public's access to forest, and in practice it abolished local people's well-defined rights. This evoked sharp reactions from some forest communities, and the response to some of the stronger demands was a community-based forest management system.

The first forest policy of independent India (1952) retained the fundamental idea of the earlier policy - that the state should administer the forests. Emphasis was on industrial development. Changes in policy in 1976 emphasized that production of industrial wood should be economically defensible in terms of cost and returns. This led to large-scale plantations of fast growing tree species focused only on technical efficiency; price efficiency was never a criterion.

In the late seventies, social forestry programmes were started in many states, and there was a sudden emergence of forest protection initiatives by thousands of villages all over the country. Local communities were challenging the authority of forest officials and their management systems. Some innovative and risk-loving forest officers also supported the cause of local people by involving them in forest management. By the 1988 Forest Policy, the government issued detailed directions for forest management programmes in collaboration with local peoples – now known as Joint Forest Management.

The willingness of forestry personnel and communities to acquire knowledge and learning, to induce innovations, and to undertake risks and creative activities are observed in the present forest regimes, whose apparent origin is in the risky innovations adopted by some forest officers in the state of West Bengal. Thus, the history of the forest regimes in India conforms well to the theory of path dependence of institutional dynamics. However, despite this trend back towards community-based forest regimes, state regimes remain important and still account for the majority of the forest area.

Political power and concessionaires in Indonesia

Indonesian forest concessionaires came under international scrutiny in the late 1980s when, as a result of global concern over the world's remaining tropical moist

forests, Indonesia attracted attention as the second-largest area of these forests. The response was a proliferation of Indonesian government rhetoric and proclamations, while government agencies and companies followed business-as-usual routines of giving high priority to rapid profits at the expense of the long-term regenerative capacity of the forest.

The 1967 Foreign Investment Law favoured foreign investors through tax exemptions and profit repatriation. Unclaimed forest was decreed property of the state, and the government was responsible for regulating the exploitation of timber, with the private sector operating renewable concessions. The logging boom led to a rapid extension of concessions. Under-pricing of logs, negligence in the use of wood residues and high-grading in logging operations led to enormous waste and destruction of vast areas.

The 1970's regulations to stimulate domestic wood processing resulted in a massive upsurge in investments. Taxes introduced in 1989 as an incentive to higher value-added products halted sawnwood exports and led to a drop in domestic prices; plywood became the most favoured wood industry branch. A further strong incentive to expand was the log export ban.

From the onset of the logging boom, several laws and regulations were introduced which were aimed at preservation of the local and global environmental functions of forests. Concessionaires ignored these regulations, however. There was clearly a much stronger government interest in the short-term production potentials of the forests than in their long-run regenerative capacity. Although legal options and monitoring and enforcement instruments existed, enforcement and compliance was nearly absent.

Financial and economic barriers are poor candidates for explaining the dismal environmental performance of Indonesia's forest concessionaires. The political power and influence wielded by forest concessionaires and wood industrialists is the key to understanding the problems of forest concession reform. Wood industries have been the most ardent anti-environmental lobbyists. The most important of these was the plywood producers' association, APKINDO. The principal groups in forestry shared the characteristic that almost all of them had strong connections to former President Suharto's family and the military establishment.

Political systems in which partnerships like those

found in Indonesian forestry occur are usually described as *neopatrimonial*, involving the award by public officials of personal favours (jobs, licenses, contracts). In return for material rewards, clients mobilize political support. This system provides concessionaires and plywood groups with extraordinary access to government, and a corresponding incentive to the government to neglect law enforcement. As the system is insecure, there are few incentives for investment or rational forestry practices.

The absence of a framework for long-term environmental strategies in the forestry sector and inadequately designed and poorly implemented government regulations create risks for society:

- forest concessions may function as political rewards to amass electoral support;
- forests could be valuable sources of income for regional strongmen; and

- through privileged access to government policy-making, forest concessionaires may become so powerful that they operate above the law and control the regulatory agencies responsible for controlling concessionaire behaviour.

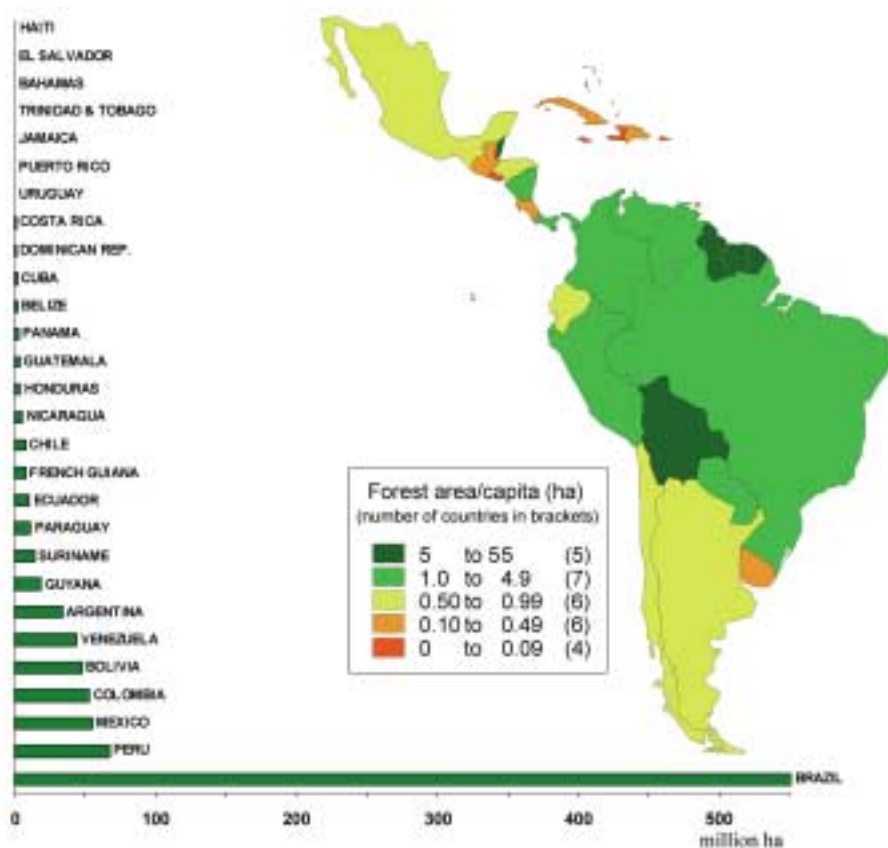
Latin American forests, societies and environments

Latin America holds almost half of the total forest area, and more than half of the growing stock and biomass, of forests in the developing countries. The Amazon region is particularly important because it contains one of the world's most diverse ecosystems and the largest area of pristine tropical forest in the world.

It is a paradox that many of the countries of South and Central America are rich in forest resources, but are unable to satisfy their own needs for forest products. Only Brazil and Chile are significant net exporters of forest products. Most of the consumption of roundwood (66 per cent) is used for fuel, and there is no sign of a rapid substitution of fuelwood by other sorts of energy. The contributions of non-wood forest products to the regional economy are significant, particularly for the rural population and indigenous communities, but these are not well identified and there is little knowledge of their quantities, value and potential.

Deforestation is one of the worst environmental problems in Latin America, and is especially acute in the southern and eastern areas of Amazonia, in Central America and in the Caribbean region. Many countries of the region have supported the establishment of forest plantations for producing industrial roundwood.

In Latin American



countries, the main question about the allocation of scarce financial resources for forestry development has been whether to concentrate on intensively managed plantation forests or on the sustainable management of natural forests. The forest industry favours plantation forests, while the environmental community encourages the management and conservation of natural forests. A balanced policy would include both.

Arguments in favour of planted forests are mainly economic: high investment returns, rapid growth rates, growth improvements through genetic selection, simplicity of silviculture practices and management regimes, easy access to planted sites, and consistency in species selection. Though they also provide environmental benefits, plantations have been established mainly for industrial purposes, not for halting deforestation.

Arguments in favour of the conservation and management of natural forests are mainly ecological, although they also provide high-quality wood and non-wood forest products. Natural forests have not been valued sufficiently as an economic resource for communities, farmers and private companies. Consequently, no real effort has been made to promote their management, while forestry and agriculture incentives have often worked against the sustainable management of natural forests.

Political will is an essential condition for achieving balanced sustainable development of forest resources:

- Policy for balanced and sustainable forestry must be integrated into sustainable development policy, with management and utilization that is ecologically appropriate, economically profitable and acceptable to society, and must consider all stakeholders.
- Policy for plantation forestry must seek to improve the technical and environmental quality of plantation forestry, target plantation programmes mainly at degraded land, and urgently promote fuelwood and charcoal production.
- National policies on protected areas must provide financial and human resources sufficient to exert real control, grant fee-based concessions for environmental services, tourism and recreation, and ensure that the environmental services produced by forests are paid for.

Plantations and forest policies in Brazil

Brazil's search for economic progress and the utilization of

its forest resources has been characterized by the dilemma between utilization practices and attempts to conserve.

Because of the diversity of climates and soils, Brazilian forests are very diverse, ranging from tropical rain forests to sub-tropical forests and Araucaria forests. The tropical rain forest is the largest type, mostly concentrated in the Amazon basin. More than 30 per cent of Brazil has been deforested, but native vegetation still covers 66 per cent of the area. Reforestation has taken place on 0.7 per cent of the total area (6.3 million hectares). Deforestation still continues in the Amazon basin, mostly associated with itinerant agriculture.

Much of the raw material demanded by Brazilian forest industries is supplied by harvesting the plantation forests, mainly established during the last forty years. Approximately 40 per cent of plantation forests provide raw material for the pulp and paper industry, 25 per cent provide wood-based boards and 35 per cent contribute to charcoal production for the iron and steel industry.

In 1966, the government launched a scheme that offered tax incentives to stimulate individuals and corporations to invest in large-scale industrial plantation forests. This resulted in the establishment of about 6 million hectares up to 1988. In that year, the new constitution gave states and municipalities the right to pass legislation dealing with forestry, so initiatives then became dispersed and local.

A firewood and charcoal-based energy framework was economically viable while subsidies existed. Without them, important metallurgical companies are substituting imported coal for charcoal and selling their plantation forests to pulp and paper companies. Companies that still use charcoal are making technological adjustments to convert wood into charcoal more efficiently. In the 1990s, only few new-planted forests have been established at a rate of 50,000 hectares per year, and reforestation of previously planted forests has been reduced to an average of 100,000 hectares per year.

Governmental institutions had given priority to conservation at the expense of production. Substantial areas were designated as national forests, ecological and biological reserves, and areas of environmental protection. Strong and effective environmental legislation was compromised, however, by poor leadership and strategies which permit abuse.

Brazil lacks a forest policy, despite being responsible for the world's major tropical forest area. The main issue

seems to be a tug-of-war between the political forces supporting environmental policies and those favouring corporate interests. While this confrontation continues, the forest policy vacuum will harm the Brazilian economy.

Forestry in Canada, Australia and New Zealand

Harvesting fees for public timber in Canada

Ninety-four per cent of Canada's forests are publicly owned (71 per cent provincial, 23 per cent federal). The Canadian Constitution grants ownership and control to the provinces, which are responsible for forest policy and management and have the sole authority to levy fees for the use of timber.

In all provinces, management responsibilities for public forest resources are delegated to the private sector through licensing arrangements. This may include reforestation, preparation of forest inventories, planning, forest protection and enhancement of non-timber forest values. Licensees are typically forest products or pulp and paper companies.

Markets are restricted; exporting logs is prohibited, and tenure holders are required to direct the timber they harvest to mills that they own and operate. This significantly reduces opportunities to establish competitive markets for standing timber. Stumpage values are determined administratively, with stumpage prices adjusted in accordance with changes in end product prices. Stumpage prices can be varied to encourage desirable forest practices, protect the health of forests or advance economic objectives.

Underpricing of standing timber (stumpage) in Canada is a major issue in the ongoing softwood lumber trade disputes with the United States.

Australia's expanding plantation estates

There are now 1.34 million hectares of plantations in Australia, of which 71 per cent are softwood and 29 per cent are hardwood. While the total current ownership of plantations is roughly equally distributed between the private and public sectors, 90 per cent of the new plantings established in 1999 were by private owners.

Australian federal and state governments have

developed tax reliefs, subsidies and other policies over the last four decades to promote plantation development and enhance industry growth. Most recent among these initiatives is "Plantations for Australia: the 2020 Vision," launched in 1997, aiming at three million hectares by 2020.

Low commodity prices, land degradation and regional unemployment have provided the opportunity for plantation expansion. Traditional grazing and cropping landholders are diversifying production and seeking new income sources.

Almost all states now share the policy, consistent with ecologically sustainable management, of not clearing public land for plantations where this would compromise conservation and catchment objectives.

Participants in plantation expansion in Australia include:

- pulp and paper producers (typically foreign investors growing pulp for offshore mills);
- long-term corporate investors (including privatization of government plantations);
- investment companies seeking tax incentives;
- solid wood industries;
- environmental plantings for carbon credits, soil erosion, and salinity; and
- rural landholders.

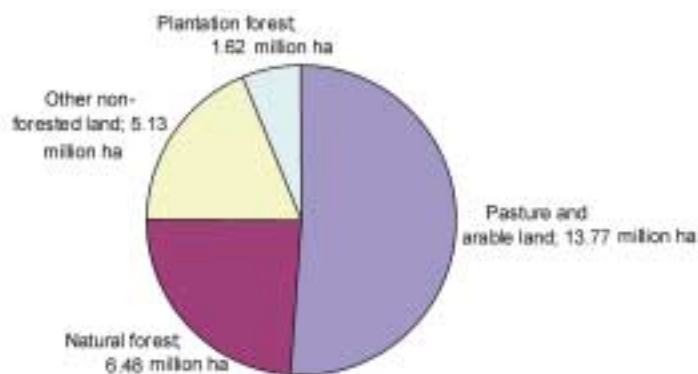
It is expected there will be an increase in planting by the private sector, leading to a trend with tree ownership shifting from public to private.

Forestry in New Zealand

Forestry is one of New Zealand's major export earners, second only to dairy farming. Plantation forests are grown for wood production; they consist mainly of a single species (*Pinus radiata*) and demonstrate high levels of productivity and profitability. Indigenous forests (one-quarter of the country's area) contribute only 0.7 per cent of the national wood harvest; their role is almost entirely for water and soil conservation, wildlife habitat and recreation. This example of extreme land-use zoning contrasts greatly with northern hemisphere ideals of multiple use.

The first human arrivals encountered a unique ecosystem that had evolved independently since parting from Gondwana some 80 million years previously: 85 per

cent of the country was densely forested and (with the exception of two species of bat) mammals were not part of the local ecology. Instead, birds and insects evolved to fill the niches that mammals occupied elsewhere. In the absence of co-evolution, native flora and fauna can rarely compete with introductions. It is difficult to manage forests when rotation cycles can exceed 700 years (Westland rimu), or where even after 100 years almost no valuable heartwood is present (kauri). The indigenous forests are being managed under a regime of "benign neglect."



Land use in New Zealand

In contrast, plantation forestry with exotics is commercially competitive. One unusual feature is intensive management with at least one thinning and two-thirds of stands pruned (the consequence of integrated computer models generated from sample plot data). New-land planting has held steady at a rate of 70,000 hectares per year. There is perhaps another 5 million hectares of suitable pasture that could be planted.

A major event in 1985 radically changed forestry in New Zealand. Environmentalists and economists successfully lobbied to introduce legislation that placed nearly all the state-owned indigenous forest in the hands of the new Department of Conservation. The state-owned exotic plantation forest was corporatized and, finally, privatized.

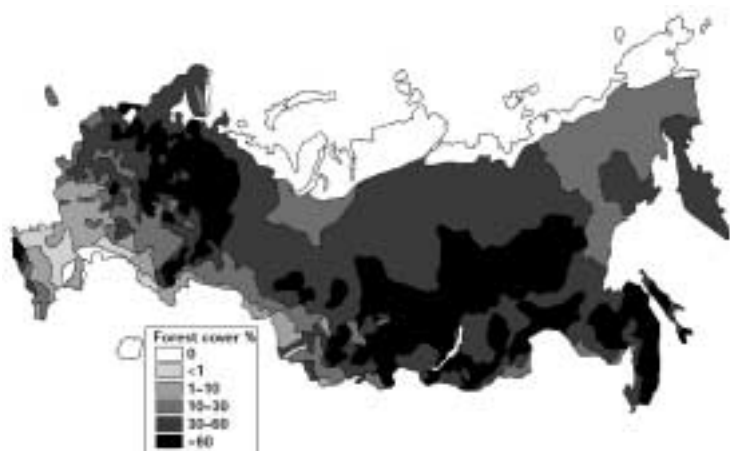
Taking the country as a whole, all expectations of forestry have been met: biodiversity and recreation in the indigenous estates, employment and profit in the exotic estates, and soil and water conservation in both.

SOURCES | Volume I, Chapters 13, 17, 18, 19, 23, 24, 26 & 27; Volume III, Chapters 17, 20, 21, 23 & 25 and Boxes 5.10, 5.11 & 5.12.

IX. Russian and Chinese Forestry in Transition

The term "countries with economies in transition" refers to the change from a centrally planned economy to a market-based system. The Russian Federation and China are two of the most important countries with "transition economies," and they are important in terms of their forest areas, growing stock, forest products and environmental values as well.

Russia has rich forest resources, with 6 hectares of forest area and 500 m³ of growing stock per capita. In contrast, China is deficient in forest resources, with just 0.1 hectare of forest area and less than 10 m³ of growing stock per capita.



Forest cover in the Russian Federation
(Data source: Federal Forest Service of Russia)

For many years, the annual allowable cut has not been reached in any of the regions of the Russian Federation; recently, only one-quarter of the potential cut has been utilized. The location of forests, necessitating long-distance transportation, places constraints on roundwood exports. Unless demand increases, Russia's forest sector cannot develop.

In China, the forest problem is mostly a supply issue. Demand for wood products compels China to import. Economic reforms in the forest sector have advanced, and China has begun to decentralize land tenure arrangements and legalized private forest management. Stumpage prices, previously zero, have been in force since 1990 with the income to be used for silviculture, infrastructure investment and administration. The market was opened gradually; a free timber market has already been established, and the wood products markets are competitive. However, political reforms lag far behind,

which may cause serious problems in the future.

A few general lessons have been learned on how to successfully progress from a planned economy to a market:

- Good reform packages should take into account socio-economic circumstances and constraints.
- Macroeconomic stabilization is a priority.
- Fiscal constraint is required.
- Democracy nurtures liberalization.
- The legal system and property rights are essential components of the change.
- In the long run, stability of the political system is the most effective means for promoting economic growth.
- Gradual transition from plan to market in China has been superior to "overnight" shock transition in Russia.

The Russian forestry transition

Development of forest management in Russia has a long history. The first edicts, issued in 1721-25 (during the reign of Peter the Great), addressed conservation of the admiralty forests, with their strategic importance for ship building. Centralized forest management was then initiated. Between 1782 and 1917, two forms of forest ownership existed: treasury (state) forests and private forests. After 1917, forest management and utilization were based on state ownership.

In the period to 1990, the social aspects of forestry were weak, and environmental and ecological sustainability principles were often ignored at the expense of "timber mining." The lack of coordination of resources and production derives from the fact that Russia is a Federal State, with 89 "subjects" each possessing powers of jurisdiction over forests and their utilization. Physical diversity, combined with the large number of political boundaries, creates problems for the integration of forest management, plans and policies.

Economic reforms started in Russia during the early 1990s. Their main features were a transition away from the state ownership and towards private ownership (though no forests were privatized), decentralization of management, and the establishment of enterprises and companies with mixed capital structures.

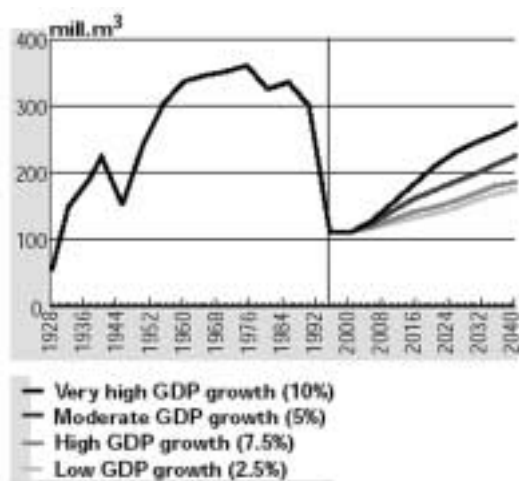
Sales on the stump by auction are considered to be key to the successful transition to a market economy, but the auctions still take place only on a small scale. Stumpage prices are mostly administratively set, at levels

which are only fractions of the competitive price levels.

Forest industries in Russia

The forest sector in Russia is significant for the economy of the country, accounting for 4 per cent of the GDP and over 7 per cent of the total industrial labour force.

A steep decline in production followed the collapse of demand for forest products due to price liberalization and decreased income levels in Russia and other countries of the former USSR after 1990. By 1997, Russian roundwood and sawnwood production had decreased to less than one quarter of its 1990 level. Pulp and paper production levels corresponded to the levels in 1965, while sawnwood production was at the 1930 level.



Roundwood production in Russia (with estimates to 2040)

Labour productivity decreased in all of the branches of forest industries. The increase in unemployment in logging succeeded in maintaining labour productivity in that sector. In the pulp and paper industry, increased price levels for paper products secured employment and income levels in that sub-sector.

Future prospects for forest industries largely depend on the recovery of the Russian economy. According to alternative projections, even in the case of very high growth, roundwood production in 2040 will not exceed the 1989 level.

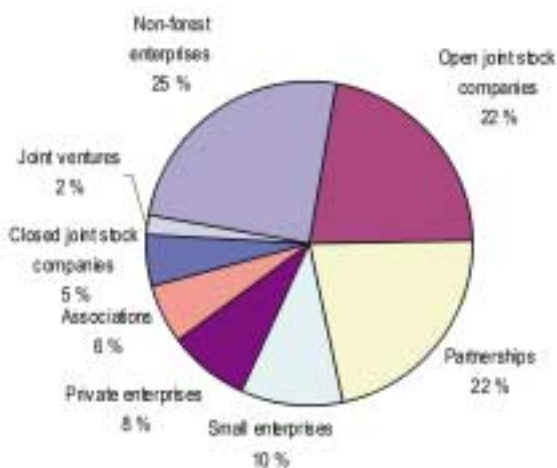
Globalization and forests - the Russian Far East

When the Russian Federation introduced policies of economic liberalization and administrative decentralization, regional governments in the Russian Far East opened the forest sector to expanded economic and environmental collaboration with foreign firms and international organizations. Domestic and foreign forest industry enterprises turned to the Pacific Rim export markets of Japan, China and the Republic of Korea for selling the region's wood products.

The Russian Far East, from Yakutia to Chukotka, covers about one-third of Russian territory. The region hosts tremendous stores of natural resources - oil, natural gas, coal, diamonds, minerals, timber and fisheries - and has been involved in international trade since the beginning of the region's economic development.

However, reforms have provoked management deregulation and loss of control over the use of the forest resources. This, in turn, has aggravated the social, ecological and economic problems of forest use.

In the early 1990s, almost all the former state forest industrial enterprises were converted into privatized joint-stock companies (with the state retaining partial ownership of the enterprise shares). The former regional industrial monopolies, such as "Dallesprom" (Far East Forest Industrial Enterprise), reorganized into holding companies coordinating forest industrial enterprises. So,



Types of forest industry enterprises in Khabarovskiy Krai (Russian Far East), 1977

the sector now consists of privatized former state industrial enterprises and new private enterprises, although forest ownership has remained in the hands of the state. The stockholding companies in the forest sector redistributed controlling interest in the enterprises, and provincial authorities began taking enterprise shares in exchange for forgiveness of enterprise debt to the provincial budget. The result has been an increase in provincial property, and a return to centralized administrative control over the forest industry and forest resources.

China's forest sector in transition

China initiated economic reforms in 1978. Progress has occurred in three phases:

- 1978-1984: During this period (following the end of the decade-long Cultural Revolution), the people's commune system was steadily replaced by a household responsibility system; prices of agricultural products were raised considerably in order to stimulate agricultural production.
- 1985-1991: China debated whether to go towards a market economy or a planned economy. The *planned market economy* was the official solution, and *market mechanisms* were introduced. The emphasis of reform shifted from rural areas to urban areas, and more authority was delegated to enterprises.
- 1992-1998: The 14th Congress of the Party came up with the concept of a *socialistic market economy*. Most provinces removed all controls on food prices, with the market economy playing a predominant role in resource allocation and price formation.

Market liberalization, decentralization and privatization, as well as technology transfer and extension, are key elements contributing to China's economic growth over the past two decades. Challenges include the losses and low efficiency of most state-owned enterprises, growing unemployment, disparity of income, serious environmental problems and widespread corruption.

Data on China's forest resources, first published in 1943, stated that forest cover ranged from 5 to 9 per cent. These figures, repeated up to 1973, were erroneous; the 1949 forest cover rate can be reasonably estimated at 13 to 15 per cent based on today's definition. Currently, forest land covers 14 per cent of the total territory. China

has the world's largest area of plantation forest (41 million hectares in the early 1990s, with a 1 million hectare annual planting rate). There are an additional 2.5 billion trees beyond the forests, located near houses, in villages, and beside roads and water bodies.



Forest cover in China
(Data source: Ministry of Forestry, 1993)

The forest sector is important for China's socio-economic development, accounting for about 5.3 per cent of the value of agricultural output. The forest industries accounted for about 1.0 percent of industrial output by value. The forest sector employs over 2.5 million workers, engaged in silviculture, logging, wood processing and non-wood forest products processing. Forest ecotourism is becoming an important industry, and forest energy remains a traditional energy source, accounting for 30 per cent of total consumption of forest resources.

There are 80 million people in China's 592 poorest counties, with about 80 per cent living in mountain areas. Ambitious plans have been made by the Ministry of Forestry to eliminate poverty through forest-based development in poor mountain areas.

Deforestation is an important environmental issue in China. Deserts and semi-desert areas are currently expanding, mainly due to human activities such as

deforestation and overgrazing. Water shortages, particularly in rural areas, are partly caused by deforestation. Generally, it is difficult to combat environmental problems without the support of afforestation; ten of the eleven recently implemented massive afforestation programmes were initiated specifically for this purpose.

Particularly in the forest sector, it was believed that public ownership was superior to private ownership. However, it is obvious that inconsistent and over-centralized property rights have been very harmful to both forest protection and investments.

"The Decisions on the Issues of Forest Conservation and Forestry Development," issued by the central government in 1981, was a landmark in forestry reforms. This document was intended to *stabilize* forest and forest land ownership, to *specify* private forest land, and to *set up* a system of management responsibility (the so-called "3-S" plan). Government would issue a property certificate to owners to recognize property rights and thus guarantee stability; in accordance with needs of local forest farmers, the government would specify allocation of plots of forest land, including waste hills, to the farmers for long-term planting of trees; and it would set up a system of management responsibility by allowing the trees planted by the farmers to become inheritable property.

There are about 4,500 state-owned forestry enterprises in China, and several kinds of collectively owned forestry properties, including township or village forest farms, joint-forest farms, and the share-holding system. By 1992, there were about 130,000 township or village forest farms (managing about 12 million hectares) and over 4 million specialized forest households.

Several measures have been applied to protect forest resources, including an annual logging quota, logging licenses, timber transportation licenses, and controls on the number and scale of wood processing enterprises.

Enhanced forest fire control has considerably decreased the number and seriousness of forest fires. The guiding principle of forest disease and pest control emphasizes the importance of prevention combined with integrated control.

China's forestry reforms since the late 1970s have generally been successful when measured by the growth of forest resources and timber production. China's experiences include decentralization, property rights transformation and stabilization, management reforms (separating ownership from management and establishing contract responsibility systems and share-holding systems), and timber market and price liberalization, as well as the promotion of afforestation and protection of natural forest resources.

The transition continues to be painful, however, as the accessible forest resources are being exhausted even as large and still-growing populations have to rely on them. Property rights issues remain problematic, as the farmers continue to be uncomfortable with the often-inconsistent and volatile policy changes. Heavy taxes and fees charged on timber production discourage long-term forest investments, but maintaining lower taxes seems very difficult in practice since forestry plays a key role in supporting local governments in rural areas. Meanwhile, the bureaucratic administration system, the poor market mechanism, and corruption all hinder the economy's progression towards a market economy.

Economic development will increase the relative scarcity of forests and lead to the higher level of demand for and supply of necessary institutional infrastructure. If we are optimistic about China's economy, we have no reason to be pessimistic about China's forestry in the long term.

SOURCES | Volume I, Chapters 33, 34, 36 & 40; Volume III, Chapters 24, 32 & 33.

X. Forest-based Development in Finland - a Model?

In 1962, Jack Westoby presented a hypothesis that forest industries have stronger linkages - above national average - with economic development than other economic sectors. Therefore, an investment in forest industries will result in faster than average economic growth. This framework of forest-based development was adopted by FAO and several international aid agencies in combating economic underdevelopment. However, only a few empirical cases supported the hypothesis, and even Westoby himself later lost the confidence in it. Skilful economic and industrial policies are required to maximize national benefits of using forest resources within the framework of economic efficiency.

Finland is one of few industrialized countries to have established economically sustainable forest management at a high level of forest cover (75 per cent of the land area). Forestry and forest industries have contributed to Finland's economic and social development, both directly through their own production and indirectly through the forest industries' material, energy and information links to other industrial sectors (and to the rest of the society). The share of the forest sector is about 8 per cent of GDP, and forest product exports account for about 27 per cent of the nation's total exports. Nearly 80 per cent of the value of forest industry production is due to exports, and studies show that Finland has enjoyed comparative advantage in forest product exports.

Despite low population densities during the nineteenth century, human pressure on forests in Finland was strong. Low levels of income, technology, industrialization and urbanization meant that shifting cultivation (slash and burn practices) was widely used. Along with forest clearing, forest degradation was typical in open access forests.

State forestry administration and forestry education were created in the middle of the nineteenth century. The Great Land Reform - nearly completed by 1900 - provided the basis for private ownership and the demarcation of public and private forests, thereby enhancing the value of forests. By increasing farm-forest owners' income levels, agricultural productivity was enhanced. Additionally, diminishing population growth, higher GNP per capita and urbanization, meanwhile, jointly led to the end of shifting cultivation. This represented a market-led process.

The Forestry Act of 1886 criminalized deforestation, but without effective implementation this remained a "paper law." A new forest act launched in 1917 again

criminalized deforestation with, for first time, effective enforcement. When this act was renewed in 1928, it was complemented by a forest improvement act that introduced a cost-sharing investment scheme to intensify forest management. The Forest Research Institute METLA, also established in 1917, has played a major role in monitoring changes in forest resources and providing other inputs for forest policies. The expansion of forest education, both at the university and lower levels, supported the positive development. Gradually, Finland was steered towards sustained yield forestry, both through markets and policies.

Since the 1960s, development of forest policy in Finland has been based on 12 national forestry programmes. These programmes, which have had the support of forest industries unions and farm-forest owners, have been aimed at increasing long-run roundwood production through increased public and private funding for drainage of peatlands for timber growth, logging road construction, tending of young plantations, and fertilization and pruning of trees. The Ministry of Agriculture and Forestry and the Ministry of the Environment collaborated in formulating a joint environmental forest policy programme in 1994, and later the National Forest Programme 2010 was designed on a participatory basis.

Increasing foreign and domestic demand for forest products promoted investments in forest industries in Finland, while changes in technology diversified that demand and increased demand for all assortments of roundwood. Higher wood prices resulted in increasing profitability and value of forests. The replacement of fuelwood by other energy sources facilitated greater wood supply to forest industries, and a new source for wood supply was discovered in wood residues produced by sawmills, plywood mills and pulpmills.

Gradual liberalizing of international trade contributed to a continuous increase in wood imports from the end of the 1950s. Simultaneously, duties and quotas were abolished on exports. Finland had exported 7 million m³ of roundwood in 1961, but became a net importer only a few years later - a market-based end to large-scale roundwood exports.

Both markets and policies have played instrumental roles in initiating forest-based development in Finland. Linkages within the forest cluster (consisting of forestry and the forest industry, machinery and equipment

manufacturing, chemicals production, printing and publishing, engineering and biotechnology, research, consulting and education activities) have been stronger than those within the other manufacturing sectors. For example, Finland has become the world's largest exporter of logging machines, and one of the largest exporters in paper machines and in forest sector consulting.

Competitive stumpage markets in Finland have been created by the politically powerful farmers' trade unions and the cooperative forestry company Metsaliitto; they were able to countervail the market power of the forest industries on the roundwood markets. Farm-forest owners and the forest industries have also lobbied the political decision-makers on forest sector issues and on economic policies.

The forest sector has contributed to regional equity in that its value-added has been regionally more evenly distributed, on average, than the national GDP. The right of access of all citizens to all forests in Finland can also be seen as increasing the social equity through the recreational values of forests. Institutions (research, education, training and forestry extension) act both as sources of innovation and as a part of social sustainability. However, labour productivity has increased in the forest sector more rapidly than on average in the economy, and the mechanization of forestry operations has reduced rural employment opportunities.

The pulp industry has achieved dramatic declines in water pollutant discharges and air pollutant emissions. Today the ecological value of Finland's forests for carbon storage is greater than ever before, with forests fixing more than half of the carbon emissions from the combustion of fossil fuels and peat. On the other hand,

the biological diversity of forests has been reduced by the intensive forest management practices. About fifty mammal, bird and vascular plant species are threatened (or some 700 species, if invertebrates, lichens and mosses are included) - half of these living in the most fertile forest sites where forest clearing for agriculture has been a factor in species endangerment.

Finland's 1997 Forestry Law extended the objectives of forest policy from sustained and progressive timber yield to economically, ecologically and socially sustainable forest management. The law also introduced a compensation scheme for private forest owners to increase conservation of nine specified biotypes, and is promoting ecologically sustainable forestry. A market-based Pan-European Forest Certification system now covers all forests in Finland, where the share of legally protected forests is 6.5 per cent of total forest area (among the highest shares in Europe).

Among the conditions to ensure that forest-based industrialization promotes long-term sustainable development are stabilization of macropolicies, establishment of competitive stumpage prices, maintenance of free trade, performance of sector-level analysis and introduction of environmental protection measures. Focusing on competition policy, innovation (including research and development, training and extension) and environmentally sustainable forest management should be key elements in drafting future forest policies in Finland - and elsewhere.

SOURCES | Volume I, Chapter 32; Volume III, Box 5.1.3

List of Authors of the WFSE Publications, Volumes I, II and III

(Name and country of residence as identified in the original publication)

Volume I: World Forests, Society and Environment

Tania Ammour, COSTA RICA
Ajit Banerjee, INDIA
Edward Barbier, UK
Daniel W. Bromley, USA
Katrina Brown, UK
Joseph Buongiorno, USA
Nikolai A. Burdin, RUSSIA
Ronnie de Camino, COSTA RICA
Cherukat Chandrasekharan, INDIA
Wania Cobo, ECUADOR
Guangcui Dai, CHINA
Tarcisio Della Senta, JAPAN
Vladimir Dimitriev, RUSSIA
Raija-Riitta Enroth, FINLAND
Andrey N. Filipchuk, RUSSIA
Mikhail D. Giryayev, RUSSIA
Luis Graca, BRAZIL
Alexey Grigorjev, RUSSIA
Eeva Hellstrom, FINLAND
Lauri Hetemaki, FINLAND
Heyu Huang, CHINA
Peter Ince, USA
Denise Ingram, USA
Susan Iremonger, UK
David Kaimowitz, INDONESIA
Abdallah R.S. Kaoneka, TANZANIA
Sjur Kasa, NORWAY
Pekka Kauppi, FINLAND
Sebuega Kelatwang, SOUTH AFRICA
Sebastiao Kengen, BRAZIL
Vincent Kihyo, TANZANIA
Fanwen Kong, CHINA
Elena Kopylova, RUSSIA
Susanna Laaksonen-Craig, FINLAND
Erkki Lehto, FINLAND
Maxim Lobovikov, RUSSIA
Gyde Lund, USA
Alexander Mather, UK
Gerardo Mery, FINLAND
Bruce Michie, FINLAND
Alexander Moiseyev, FINLAND
Gerald C. Monela, TANZANIA
Marcia Muchagata, UK
Isilda Nhantumbo, MOZAMBIQUE
Anja Nygren, FINLAND
Matti Palo, FINLAND
Jakob Park, JAPAN

Joanne Parkinson, UK
Julio Paupitz, PANAMA
Eustaquio J. Reis, BRAZIL
Reginaldo Reyes, COSTA RICA
Jukka Salo, FINLAND
Jeffrey Sayer, INDONESIA
Roger Sedjo, USA
Andrey Selikhovkin, RUSSIA
Adelaida Semesi, NORWAY
Graham Sheppard, UK
Pavel Sokolov, RUSSIA
Birger Solberg, NORWAY
Viktor K. Strakhov, RUSSIA
William Sunderlin, INDONESIA
Viktor K. Teplyakov, RUSSIA
Zhiwei Tian, CHINA
Jussi Uusivuori, FINLAND
Jeffery Vincent, USA
Xuan Wang, CHINA
Philip Wardle, UK
Dali Zhang, CHINA
Lei Zhang, CHINA
Yaoqi Zhang, FINLAND

Volume II: World Forests from Deforestation to Transition?

Fernando A. Blanco Cossio, BRAZIL
Erkki Lehto, FINLAND
Alexander S. Mather, SCOTLAND
Gerald Claudius Monela, TANZANIA
B.D. Nasendi, INDONESIA
Anssi Niskanen, FINLAND
Matti Palo, FINLAND
Alexander S.P. Pfaff, USA
Eustaquio J. Reis, BRAZIL
Roberto Scotti, ITALY
Ari Siiriäinen, FINLAND
Birger Solberg, NORWAY
Jussi Uusivuori, FINLAND
Heidi Vanhanen, FINLAND
Yaoqi Zhang, FINLAND

Volume III: World Forests, Markets and Policies

Darius Adams, USA
Janaki Alavalapati, USA

José Alvarado Alegria, SPAIN
Arild Angelsen, NORWAY
Camille Antinori, USA
Natalia Antonova, RUSSIA
Tupac Barahona, SPAIN
David Barkin, MEXICO
Mattias Boman, SWEDEN
Joseph Buongiorno, USA
Nadia Bystriakova, FINLAND
Ian R. Calder, UK
Ken Cordell, USA
Tarcisio Della Senta, JAPAN
Armando Díaz Barba, PERU
Robert K. Dixon, USA
Maria do Socorro Goncalves Ferreira, BRAZIL
Bryan Finegan, COSTA RICA
James Finley, USA
Richard E. Fletcher, USA
P. Gondo, ZIMBABWE
Javier Gonzalez Molina, CHILE
Janis Gravitis, LATVIA
Gary Green, USA
Pentti Hakkila, FINLAND
David Haley, CANADA
Tom Hatton, AUSTRALIA
Riitta Hjerpe, FINLAND
Alexander Horst, GERMANY
Claire Howell, AUSTRALIA
David Humphreys, UK
Ian Hunter, CHINA
C. Jumbe, MALAWI
David Kaimowitz, INDONESIA
Markku Kanninen, COSTA RICA
Shashi Kant, CANADA
Kari Keipi, USA
Sebastião Kengen, BRAZIL
Jean-Pierre Kiekens, CANADA
Cecil C. Konijnendijk, DENMARK
Alexander Korotkov, SWITZERLAND
Godwin Kowero, ZIMBABWE
Bengt Kristrom, SWEDEN
Susanna Laaksonen-Craig, USA
Erkki Lehto, FINLAND
Maxim Lobovikov, CHINA
Concepción Luján Alvarez, MEXICO
Marian Mabel, USA
Piers Maclaren, NEW ZEALAND
Rene Mendoza, NICARAGUA
Gerardo Mery, FINLAND
Bruce Michie, FINLAND
Gerald C. Monela, TANZANIA

Claire Montgomery, USA
Isilda Nahantumbo, MOZAMBIQUE
P.K.R. Nair, USA
Ousseynou Ndoye, CAMEROON
Anja Nygren, USA
Pekka Ollonqvist, FINLAND
Andreas Ottitsch, FINLAND
Pablo Pacheco, USA
Marc Palahi, FINLAND
Matti Palo, FINLAND
Pia Parolin, GERMANY
Anatoly Petrov, RUSSIA
Cornelis Prins, COSTA RICA
Gordon Rausser, USA
Ida Aju Pradnja Resosudarmo, INDONESIA
Cesar Sabogal, BRAZIL
Andreas Schuck, FINLAND
Roger Sedjo, USA
Marjatta Selanniemi, FINLAND
Alexander Sheingauz, RUSSIA
Gustavo Siles Gonzalez, NICARAGUA
Joyotee Smith, INDONESIA
Brent Sohngen, USA
Heinrich Spiecker, GERMANY
William Sunderlin, INDONESIA
David Tomberlin, USA
Anne Toppinen, FINLAND
Juha Uitto, USA
Jussi Uusivuori, FINLAND
Petra van de Kop, ITALY
Jari Varjo, FINLAND
Philip Wardle, UK
Michael Washburn, USA
Mellissa Wood, AUSTRALIA
Eshetu Yirdaw, FINLAND
Carlos Eduardo Frickmann Young, BRAZIL
Yaoqi Zhang, CANADA