

ASIA-PACIFIC FORESTS AND FORESTRY TO 2020

Asia-Pacific Forestry Sector Outlook Study II





RAP PUBLICATION 2010/06

ASIA-PACIFIC FORESTRY COMMISSION

ASIA-PACIFIC FORESTS AND FORESTRY TO 2020

REPORT OF THE SECOND ASIA-PACIFIC FORESTRY SECTOR OUTLOOK STUDY

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS Bangkok, 2010 The designations employed and the presentation of material in this publication do not imply the expression of any opinion whatsoever on the part of the Food and Agriculture Organization of the United Nations concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. The mention of specific companies or products of manufacturers, whether or not these have been patented, does not imply that that these have been endorsed or recommended by FAO in preference to others of a similar nature that are not mentioned.

All rights reserved. Reproduction and dissemination of material in this information product for educational or other non-commercial purposes are authorized without any prior written permission from the copyright holders provided the source is fully acknowledged. Reproduction of material in this information product for resale or other commercial purposes is prohibited without written permission of the copyright holders. Applications for such permission should be addressed to: Chief, Electronic Publishing Policy and Support Branch, Communication Division, FAO, Viale delle Terme di Caracalla, 00153 Rome, Italy, or by e-mail to: copyright@fao.org

Cover design: Chanida Chavanich

For copies, write to:

Patrick B. Durst Senior Forestry Officer FAO Regional Office for Asia and the Pacific 39 Phra Atit Road Bangkok 10200 Thailand Tel: (66-2) 697 4000 Fax: (66-2) 697 4445

E-mail: patrick.durst@fao.org

The cutoff date for the data and information used in this report was 18 May 2010. Printed and published in Bangkok, Thailand.

Food and Agriculture Organization of the United Nations Regional Office for Asia and the Pacific Bangkok, Thailand

2010 © FAO

ISBN 978-92-5-106566-2

FOREWORD

Twelve years after the publication of the first Asia-Pacific Forestry Sector Outlook Study in 1998, FAO welcomes this opportunity to once again contribute, at the behest of the Asia-Pacific Forestry Commission, to the regional forestry dialogue. Countries and their forestry sectors are becoming ever more closely linked as economic liberalization and regional integration accelerate. Since the first outlook study, it has become increasingly clear that a regional perspective is essential in negotiating a better position for forestry and the values with which it is associated. With the advancement of globalization some of the most important effects on forests and forestry in many countries in the region are the result of international and regional developments.

Heightened awareness of the values of forests and their greater inclusion in international climate change agreements has increased the importance of linking spatial levels and broadening understanding of issues and opportunities likely to affect forestry in the coming years. Identification of key trends in forestry – both physical and political – and construction of scenarios for the future adds a valuable dimension to regional forestry discussions. Building responsiveness into institutional mechanisms and adapting to change constitutes one of the most important steps in creating a robust sector in a fast-evolving world.

Great changes have occurred and major advances have been made in Asia-Pacific forestry since the first outlook study was published. Significant challenges remain in many parts of the region and it is increasingly evident that countries cannot develop forestry policies in isolation – rights and responsibilities are increasingly spilling across borders and across sectors as populations increase, demands on resources heighten and economies integrate. The collegial nature of the process through which this outlook study was developed gives credence to the success of collaborative regional action and sharing in a common future. By openly contributing information, the countries and organizations involved in the outlook study have demonstrated their commitment to the future of forests and forestry and their desire to improve upon the benefits from forests that the current generation has received.

Many organizations and individuals have put huge effort into this study and have gone to considerable lengths to share the fruits of their experiences. In bringing together this regional report, nearly 50 country reports, thematic studies and subregional papers have been prepared. The first Asia-Pacific Forestry Sector Outlook Study provided a benchmark in regional and global forestry and was followed by a series of regional outlook studies around the world. We hope that this study will be as well received as the first and that this contribution to the region's forestry sector is both timely and appropriate and will challenge countries to build forests that future generations will value.

Hiroyuki Konuma Assistant Director-General and Regional Representative for Asia and the Pacific Food and Agriculture Organization of the United Nations

CONTENTS

FOREWORD CONTENTS BOXES ACRONYMS AND ABBREN ACKNOWLEDGEMENTS EXECUTIVE SUMMARY	/IATIONS	iii v ix xi xiii xv
1. INTRODUCTION		1
BACKGROUND		1
OBJECTIVES AND KEY QUI	ESTIONS ADDRESSED	1
SCOPE OF THE STUDY		2
THE STUDY PROCESS		3
STRUCTURE OF THE REPO)RT	3
2. FORESTS AND FOREST	RY IN THE ASIA-PACIFIC REGION	5
INTRODUCTION		5
FOREST AND TREE RESOL Forest area Forest degradation and de	IRCES	5 6 13
Trees outside forests FOREST MANAGEMENT Management of natural fo Planted forests Management of forests fo	rests for wood production r environmental protection	14 17 17 24 28 31
Forest policies Legislation Forestry institutions		31 34 37
AN OVERVIEW OF RESOUP	CES, POLICIES AND INSTITUTIONS	43
3. ECONOMIC, SOCIAL AN	D ENVIRONMENTAL FUNCTIONS OF FORESTS	45
WOOD AND WOOD PRODU Industrial roundwood Sawnwood Wood-based panels Paper and paper board Forest product trade	ICTS	45 46 47 48 50 51
WOOD AS A SOURCE OF E General trends in the use Wood energy systems Economies of scale versu Wood energy overview	NERGY of wood energy s economics of location	59 60 62 63 64

	NON-WOOD FOREST PRODUCTS Development of new processes and products	64 68
	New institutional arrangements	69
	ECOSYSTEM SERVICES	71
	Biodiversity conservation	71
	Combating desertification	74
	Forests and climate change	76
	Amenity values – ecotourism and urban forestry	۱۵ ۸۹
	Payments for ecosystem services	86
	FORESTRY AND POVERTY REDUCTION	88
	CONTRIBUTION OF FORESTRY TO INCOME AND EMPLOYMENT	90
	Gross value added	90
	Employment in the forest sector	93
	OVERVIEW OF ECONOMIC, ENVIRONMENTAL AND SOCIAL BENEFITS FROM FORESTS	96
4	DRIVERS IMPACTING THE FOREST SECTOR	
	INTRODUCTION	97
	DEMOGRAPHIC CHANGES	97
	Population growth	97
	Changing age structures	100
	Urbanization	102
	International migration	103
	Demographic changes: An overview	104
	ECONOMIC CHANGES	105
	Growth in incomes	105
	Income distribution, inequality and poverty	108
	Structural changes and dependence on land	111
	Investments in industries and infrastructure	114
	Globalization and its impacts	114
	POLITICS POLICIES AND INSTITUTIONS	117
	Politics and governance.	117
	Policy changes	118
	Institutional changes	120
	Forest governance issues	120
	ENVIRONMENTAL DRIVERS	123
	Local environmental issues	123
	National environmental issues	123
	Regional and global environmental issues	124
		123
	IECHNOLOGICAL CHANGES	127
	Productivity-ennancing technologies	128

	Harvesting and processing technologies Energy technologies Technologies from outside the forest sector	. 120 . 130 . 130
	OVERVIEW OF DRIVERS AND CHANGES	. 132
5.	SCENARIOS FOR THE ASIA-PACIFIC REGION	. 135
	RATIONALE FOR DEFINING SCENARIOS	. 135
	THE ASIA-PACIFIC REGION: DIFFERING INITIAL CONDITIONS Low-income countries Middle-income and emerging economies Developed economies Small island countries	. 136 . 136 . 138 . 139 . 139
	FOUNDATIONS FOR SCENARIOS Income growth Ecological and social sustainability	. 140 . 140 . 141
	POSSIBLE SCENARIOS Three broad paths The high growth 'boom' scenario The low growth and stagnation 'bust' scenario Social and ecological stability: the 'green economy' scenario	. 142 . 142 . 143 . 145 . 148
	THE LIKELY SITUATION	. 151
6.	THE ASIA-PACIFIC FOREST SECTOR IN 2020	. 153
	FOREST AREA CHANGE Forest area change under the high growth 'boom' scenario Forest area change under the low growth and stagnation 'bust' scenario Forest area change under the 'green economy' scenario	. 154 . 154 . 156 . 157
	IMPLEMENTATION OF SUSTAINABLE FOREST MANAGEMENT Sustainable forest management under the high growth 'boom' scenario Sustainable forest management under alternative scenarios	. 157 . 157 . 159
	DEMAND AND SUPPLY FOR WOOD AND WOOD PRODUCTS Demand for wood and wood products under the high growth 'boom' scenario Demand for wood and wood products under the low growth and stagnation 'bus scenario	. 159 . 160 t' . 165
	Demand for wood and wood products under the 'green economy' scenario Industrial wood supply situation under the high growth 'boom' scenario Industrial wood supply situation under alternative scenarios	. 167 . 168 . 170
	WOOD ENERGY Wood energy implications under the high growth 'boom' scenario Wood energy implications under the low growth and stagnation 'bust' scenario Wood energy implications under the 'green economy' scenario	. 170 . 170 . 171 . 171
	NON-WOOD FOREST PRODUCTS NWFPs: implications under the high growth 'boom' scenario scenario NWFPs: implications under the low growth and stagnation 'bust' scenario	. 172 . 172 . 172

NWFPs: implications under the 'green economy' scenario	173
ECOSYSTEM SERVICES	173
Ecosystem services: implications under the high growth 'boom' scenario Ecosystem services: implications under the low growth and stagnation 'bust'	173
scenario	176
Ecosystem services: implications under the "green economy" scenario	177
FOREST SITUATION IN 2020: A SUMMARY	181
Deforestation and forest degradation will remain a major challenge	181
Sustainable forest management will remain elusive in practice	182
Trade patterns will encompass new values	183
Providing ecosystem services will be challenging	183
Where climate change goes, forestry will follow	184
The policy focus will shift from formulation to implementation and enforcement	nt 184
New roles and opportunities will emerge for all sector participants	184
SPECIFIC DEVELOPMENTS IN COUNTRY CLUSTERS	185
Developed economies	185
Emerging economies	185
Low-income, forest-rich countries	185
Low-income, forest-rich countries Low-income, resource-poor countries	185 186
Low-income, forest-rich countries Low-income, resource-poor countries Small island countries	185 186 186
 Low-income, forest-rich countries Low-income, resource-poor countries Small island countries 7. PRIORITIES AND STRATEGIES 	185 186 186 187
Low-income, forest-rich countries Low-income, resource-poor countries Small island countries 7. PRIORITIES AND STRATEGIES OVERALL PRIORITIES.	185 186 186 187 187
 Low-income, forest-rich countries Low-income, resource-poor countries	185 186 186 186 187 187 188
 Low-income, forest-rich countries	185 186 186 186 187 187 188 188
 Low-income, forest-rich countries Low-income, resource-poor countries Small island countries 7. PRIORITIES AND STRATEGIES. OVERALL PRIORITIES Rebuilding natural resource bases and conservation of existing resources Rural development, employment generation and poverty alleviation Enhancing efficiency of raw material/energy use	185 186 186 186 187 187 188 188 189 190
Low-income, forest-rich countries Low-income, resource-poor countries Small island countries 7. PRIORITIES AND STRATEGIES OVERALL PRIORITIES. Rebuilding natural resource bases and conservation of existing resources Rural development, employment generation and poverty alleviation Enhancing efficiency of raw material/energy use.	185 186 186 186 187 187 188 188 189 190
Low-income, forest-rich countries Low-income, resource-poor countries Small island countries 7. PRIORITIES AND STRATEGIES OVERALL PRIORITIES. Rebuilding natural resource bases and conservation of existing resources Rural development, employment generation and poverty alleviation Enhancing efficiency of raw material/energy use. Governance. STRATEGIES.	185 186 186 187 187 188 188 189 190 191
Low-income, forest-rich countries Low-income, resource-poor countries Small island countries 7. PRIORITIES AND STRATEGIES OVERALL PRIORITIES. Rebuilding natural resource bases and conservation of existing resources Rural development, employment generation and poverty alleviation Enhancing efficiency of raw material/energy use. Governance. STRATEGIES Policies and institutional improvements. Grassroots forestry	185 186 186 187 187 187 188 188 189 190 191 191 191
Low-income, forest-rich countries Low-income, resource-poor countries Small island countries 7. PRIORITIES AND STRATEGIES OVERALL PRIORITIES Rebuilding natural resource bases and conservation of existing resources Rural development, employment generation and poverty alleviation Enhancing efficiency of raw material/energy use Governance STRATEGIES Policies and institutional improvements Grassroots forestry Investments to improve science and technology.	185 186 186 186 187 187 188 188 189 190 191 191 192 192
Low-income, forest-rich countries Low-income, resource-poor countries Small island countries 7. PRIORITIES AND STRATEGIES OVERALL PRIORITIES Rebuilding natural resource bases and conservation of existing resources Rural development, employment generation and poverty alleviation Enhancing efficiency of raw material/energy use Governance STRATEGIES Policies and institutional improvements Grassroots forestry Investments to improve science and technology Investments in human resources	185 186 186 187 187 187 188 188 189 190 191 191 192 192 193
Low-income, forest-rich countries Low-income, resource-poor countries Small island countries 7. PRIORITIES AND STRATEGIES OVERALL PRIORITIES Rebuilding natural resource bases and conservation of existing resources Rural development, employment generation and poverty alleviation Enhancing efficiency of raw material/energy use Governance STRATEGIES Policies and institutional improvements Grassroots forestry Investments to improve science and technology Investments in human resources Societal consensus	185 186 186 187 187 187 188 188 189 190 191 191 192 192 193 193
Low-income, forest-rich countries Low-income, resource-poor countries Small island countries 7. PRIORITIES AND STRATEGIES OVERALL PRIORITIES. Rebuilding natural resource bases and conservation of existing resources Rural development, employment generation and poverty alleviation Enhancing efficiency of raw material/energy use Governance STRATEGIES. Policies and institutional improvements Grassroots forestry Investments to improve science and technology Investments in human resources Societal consensus Leadership and communication	185 186 186 187 187 187 188 188 189 190 191 191 192 192 193 193 194
Low-income, forest-rich countries Low-income, resource-poor countries Small island countries 7. PRIORITIES AND STRATEGIES OVERALL PRIORITIES Rebuilding natural resource bases and conservation of existing resources Rural development, employment generation and poverty alleviation Enhancing efficiency of raw material/energy use. Governance STRATEGIES Policies and institutional improvements Grassroots forestry Investments to improve science and technology Investments in human resources Societal consensus Leadership and communication SELECTED REFERENCES.	185 186 186 187 187 187 188 188 189 190 191 191 191 192 192 193 193 194 197

BOXES

Box 1.1. Key questions on the future of forests and forestry in Asia and the Pacific	1
Box 2.1. Definition of forests	7
Box 2.2. Russian forest resources	9
Box 2.3. Some examples of forest area changes during 1990 to 2010	11
Box 2.4. Forest area change in Australia	11
Box 2.5. Asia-Pacific Forest Invasive Species Network	14
Box 2.6. Farm forestry in Haryana, India	15
Box 2.7. Contract tree farming in Thailand	15
Box 2.8. Coconut plantations in Asia and the Pacific	16
Box 2.9. State of forest management in ITTO producer member countries in Asia and the	
Pacific	18
Box 2.10. Logging in the Solomon Islands	19
Box 2.11. Reduced impact logging	21
Box 2.12. National certification systems in Asia and the Pacific	22
Box 2.13. Effectiveness of logging bans in natural forests in the Asia-Pacific region	23
Box 2.14. Definition of planted forests	24
Box 2.15. China's afforestation programmes	25
Box 2.16. Main species planted	25
Box 2.17. Rehabilitation of Imperata grasslands in Indonesia	27
Box 2.18. Protected areas and investment in the lower Mekong countries	29
Box 2.19. Sunderbans: people and tiger conflicts	30
Box 2.20. Asian demand driving illegal trade in endangered animals	31
Box 2.21. Ownership of plantations in Australia and New Zealand	34
Box 2.22. Forest ownership in South and Southeast Asia	35
Box 2.23. Restoration of rights to indigenous communities	36
Box 2.24. The contribution of forest land allocation in Viet Nam to SFM and livelihoods	37
Box 2.25. Reinventing forestry agencies	38
Box 2.26. Fiji Pine Ltd	38
Box 2.27. Public sector institutions involved in forestry	39
Box 2.28. Mobility of institutional investments and stability of wood supply	40
Box 2.29. Community forestry in Nepal	41
Box 3.1. Republic of Korea (ROK): changes in the wood-based panel industry	48
Box 3.2. Tariff reforms in India	59
Box 3.3. Woodfuel consumption in Japan	61
Box 3.4. Adoption of energy efficient cook-stoves in Asia and the Pacific	62
Box 3.5. Wood pellet markets in Asia and the Pacific	63
Box 3.6. Edible forest insects	67
Box 3.7. Price volatility of safed musli in India	68
Box 3.8. Grama Mooligai Company Limited: scaling up through collective action in India	70
Box 3.9. NWFP certification in Nepal	70
Box 3.10. Biodiversity hotspots in Asia and the Pacific	72
Box 3.11. Bioprospecting in the Asia-Pacific region	73
Box 3.12. Desertification in Mongolia	76
Box 3.13. Local level efforts to combat desertification in Pakistan	76
Box 3.14. CDM afforestation and reforestation projects in the Asia-Pacific region*	78
Box 3.15. The New Zealand Emissions Trading Scheme (ETS) and forestry	80
Box 3.16. 'Green dams' for water conservation in Republic of Korea (ROK)	83

Box 3.17. Some examples of urban greening in the Asia-Pacific region	84
Box 3.18. Some examples of pro-poor community-based tourism	85
Box 3.19. Ecotourism development in Asia and the Pacific	86
Box 3.20. Definition of payments for ecosystem services	86
Box 3.21. Lessons from Viet Nam's experiences with creating successful PES schemes	87
Box 3.22. Why devolution has not reduced poverty	89
Box 3.23. Contribution of forestry to gross domestic product (GDP)	91
Box 3.24. Changing employment situation in Japanese forestry	95
Box 4.1. Population ageing in Japan	101
Box 4.2. Population ageing and skills shortages in Australia	102
Box 4.3. Impact of the global economic crisis	108
Box 4.4. Economic crisis, unemployment and poverty	110
Box 4.5. The surging middle class in China and India	111
Box 4.6. Index of globalization for selected Asia-Pacific economies	115
Box 4.7. Agricultural land acquisitions in Asia	116
Box 4.8. Democracy Index 2008	117
Box 4.9. Politics, governance and forest conflicts	118
Box 4.10. Forest tenure reform in China	119
Box 4.11. Forest law enforcement and governance in Asia	121
Box 4.12. New trade and procurement policies impacting timber trade and illegal harvesting	122
Box 4.13. 'Green courts' in Asia-Pacific countries	124
Box 4.14. Forestry provisions in the Copenhagen Accord 2009	126
Box 4.15. Tree genome technologies to fight illegal logging	128
Box 4.16. New generation biomaterials	129
Box 4.17. Nanotechnology	132
Box 5.1. Scenario analysis	136
Box 5.2. Decline of industrial forestry in Samoa	141
Box 5.3. Recession in 2008/09: Impacts on housing construction in New Zealand	146
Box 5.4. Green economy initiatives in the Asia-Pacific region	150
Box 6.1. World Bank "Global Economic Prospects 2010"	153
Box 6.2. Implications of REDD and REDD plus on forest area changes	157
Box 6.3. Economic viability of forest plantations in New Zealand	158
Box 6.4. Inconsistencies in demand projections for wood-based panels for India	163
Box 6.5. Green building in Asia and the Pacific	168
Box 6.6. Incidence of logging bans	182
Box 7.1. Towards a model of good forest management	194
Box 7.2. Forestry administration in China	195

ACRONYMS AND ABBREVIATIONS

AKF	Aga Khan Foundation
ANZCERTA	Australia and New Zealand Closer Economic Relations Trade Agreement
APFC	Asia-Pacific Forestry Commission
APFISN	Asia-Pacific Forest Invasive Species Network
APFSOS	Asia-Pacific Forestry Sector Outlook Study
ASEAN	Association of Southeast Asian Nations
ATL	Advanced Tariff Liberalization (of the WTO)
CBD	Convention on Biological Diversity
CBFM	Community Based Forest Management
CCTF	Conversion of Cropland to Forest and Grass Programme
CDM	Clean Development Mechanism
CIEOR	Center for International Forestry Research
CITES	Convention on International Trade in Endangered Species of Wild Fauna and
ONLO	Flora
COP	Conference of the Parties
CPRS	Carbon Pollution Beductions Scheme
CSPART	Compating Sandification around Beijing and Tianiin Programme
	Democratic People's Republic of Korea
	Environmental Investigation Agency
	Environmental investigation Agency Emission Trading Schomo
	Early and Agriculture Organization of the United Nations
	Food and Agriculture Organization of the Onited Nations
	Foreign Direct investment
	Prederation of Community Forestry Users, Nepal
	Programme for Fast-Growing and High-Yielding Forest in Key Areas
FLEG	Forest Law Enforcement and Governance
FLEGI	Forest Law Enforcement, Governance and Trade
	Global Forest Resources Assessment
FRLHI	Foundation for Revitalization of Local Health Traditions
FSC	Forest Stewardship Council
FUGS	Forest User Groups
GALL	General Agreement on Tariffs and Trade
GDP	Gross Domestic Product
GLASOD	Global Assessment of Soil Degradation
	Information and Communication Technology
IIFM	Indian Institute of Forest Management
ILO	International Labour Organization
	International Tropical Timber Organization
JFM	Joint Forest Management
KFP	Key Forestry Programme
LEI	Lembaga Ekolabel Indonesia
MDF	Medium Density Fibreboard
MESCOT	Model Ecologically Sustainable Community Tourism
MRC	Mekong River Commission
MTCC	Malaysian Timber Certification Council
NFPP	National Forest Protection Programme
NGO	Non-governmental Organization
NTM	Non-tariff Measure
NWFP	Non-wood Forest Product
OECD	Organisation for Economic Co-operation and Development

PEFC PES PNG PPP PV REDD RIL ROK	Programme for Endorsement of Forest Certification Payments for Ecosystem Services Papua New Guinea Purchasing Power Parity Photovoltaic Reducing Emissions from Deforestation and Degradation Reduced Impact Logging Republic of Korea
SAARC	South Asian Association for Regional Cooperation
SFAKK	Sheller Forest along the Yangize and other Key Rivers
SFP	Shelter Forest Programme
SKFP	Six Key Forestry Programmes
SPARTECA	South Pacific Regional Trade and Economic Cooperation Agreement
TFF	Tropical Forest Foundation
TIMO	Timber Investment Management Organization
TNSF	Three North Shelter Forests
UNCCD	United Nations Convention to Combat Desertification
UNCED	United Nations Commission on Environment and Development
UNEP	United Nations Environment Programme
UNFCCC	UN Framework Convention on Climate Change
USDA	United States Department of Agriculture
WPNRP	Wildlife Protection and Nature Reserves Programme
WTO	World Trade Organization

ACKNOWLEDGEMENTS

FAO expresses sincere appreciation and gratitude to all who contributed to the Second Asia-Pacific Forestry Sector Outlook Study (APFSOS II). In doing so, FAO recognizes that contributions have been far wider than the list provided here. Hundreds of unidentified contributors provided information, advice and opinions during seminars and workshops, the preparation of working papers and the final study report. Grateful thanks are offered to all these people and agencies.

The strong support given by member countries toward the completion of the APFSOS II is reflected by the nearly universal preparation of country outlook studies by member countries of the Asia-Pacific Forestry Commission. Many countries also provided comprehensive reports and recent documentation on national policies, strategies and actions and shared relevant data with the outlook team. Governments in the region nominated national focal points who met early in the process to discuss their roles and to agree upon a common national report structure. The national focal points were instrumental in running national level outlook consultation processes, collecting country level data and information, clarifying issues and verifying statistics and coordinating submission of country outlook papers.

Valuable support for the APFSOS II was also provided by partner agencies within and outside the region. These include the Asian Development Bank (ADB), the Department for International Development of the United Kingdom (DfID), International Tropical Timber Organization (ITTO), The Center for Forests and People (RECOFTC), Asia Pacific Association of Forestry Research Institutions (APAFRI), Asia Forest Network (AFN), Secretariat of the Pacific Community (SPC), The Nature Conservancy (TNC), The New Zealand Ministry of Agriculture and Forestry and the Swedish International Development Cooperation Agency (Sida).

The implementation of the Study was endorsed by the Twenty-first session of the Asia-Pacific Forestry Commission, which was chaired by Shri J.C. Kala (Director-General of Forests and Special Secretary, Ministry of Environment and Forests, Government of India); and reviewed at the Twenty-second session chaired by Mr Nguyen Ngoc Binh (Director-General, Forest Department, Ministry of Agriculture and Rural Development, Government of Viet Nam).

Implementation of the study was coordinated by CTS Nair and Patrick Durst, and assisted by Desk Officers Chris Brown and Jeremy Broadhead under the supervision of He Changchui, Michael Martin and Hiroyuki Konuma. Implementation was overseen by a Scientific Committee comprising Sairusi Bulai (Secretariat of the Pacific Community); Neil Byron (Australia Productivity Commission, Government of Australia); Barney Chan (eSFM Tropics, Malaysia); Lu De, Bai Weigao and Zhang Zhontian (State Forestry Administration, Government of China); Steve Elliott (Forest Restoration Research Unit, Chiang Mai University), Steven Johnson (International Tropical Timber Organization); Togu Manurong (Bogor Agricultural University, Indonesia); Kaosa-ard Mingsarn (Chiang Mai University, Thailand); Javed Mir (Asian Development Bank); Ram Prasad (International Forestry Consultant, India); Victor Ramos (Secretary of Environment and Natural Resources [retired], Philippines); Tonny Soehartono (Ministry of Forestry, Indonesia), Rowena Soreiga (Asia Forest Network); Takako Teranishi and Hiro Miyazono (International Forestry Cooperation Office, Japan); James Turner (Scion Research) and CTS Nair, Patrick Durst, Purushottam Mudbhary, Aru Mathias, Jeremy Broadhead, Chris Brown, Rebecca Rutt and Akiko Inoguchi (FAO). Arvydas Lebedys and Mette Løyche-Wilkie of FAO Rome are also thanked for their generous provision of data and information in support of the overall study.

National reports were submitted by government forestry agencies from nearly all countries in the region, staff, consultants and other contributors to these reports are attributed in those documents and thanked for their efforts. Additional thematic working papers were contributed by: Romulo Arancon, Bijendra Bisnayat, Michael Canares, Moushumi Chaudhury, Tini Gumartini, Regina Hansda, Meng Linlin, Andrew MacGregor, Chris Perley, Mark Sandiford, Yurdi Yasmi, Thomas Enters, Daisuke Sasatani, Sim Heok-Choh, Akiko Inoguchi, Ragnar Jonsson and Adrian Whiteman. Inputs were also received from David Cassells, Cole Genge, Francis Hurahura, Yudi Iskandarsyah, Tint Thaung, Gunawan Wicaksono, Chen Xiaoqian, Coi Lekhac, Gem Castillo, Ben Hodgdon, Serey Rotha Ken, Top Khatri, Rao Matta, Preecha Ongprasert, Sithong Thongmanivong and Pei Sin Tong.

The following individuals served as National Focal Points or participated in National Focal Points' meetings: Neil Hughes (Australia); Adam Gerrand (Australia); A.K.M. Shamsuddin (Bangladesh); Dhan Bahadur Dhital (Bhutan); Khorn Saret (Cambodia); Sophal Chann (Cambodia); Lu De (China); Yong Qing Meng (China); Zhang Zhongtian (China); Osea Tuinivanua (Fiji); Susana Tuisese (Fiji); Samuela Lagataki (Fiji); Jitendra Vir Sharma (India); Basoeki Karyaatmadja (Indonesia); Hermawan Indrabudi (Indonesia); Togo Manurong (Indonesia), Bintang Simangunsong (Indonesia); Takako Teranishi (Japan); Rikiya Konishi (Japan); Betarim Rimon (Kiribati); Thongphath Vongmany (Lao PDR); Somchay Sanontry (Lao PDR); Azmi bin Nordin (Malaysia); Hizamri Yasin (Malaysia); Hussain Faisal (Maldives); Hijaba Ykhanbai (Mongolia); U Sann Lwin (Myanmar); Maung Maung Than (Myanmar); Pem Narayan Kandel (Nepal); Meredith Stokdijk (New Zealand); Alan Reid (New Zealand); Bashir Ahmed Wani (Pakistan), Shahzad Jehangir (Pakistan); Vitus Ambia (Papua New Guinea); Ruth Turia (Papua New Guinea); Neria Andin (Philippines); Romy Acosta (Philippines); Domingo Bacalla (Philippines), Gwendolyn Bambalan (Philippines); Rin Won Joo (Rep. Korea); Alexander Alekseenko (Russian Federation); Aukuso Leavasa (Samoa); Nani Toni Leutele (Samoa); Gordon Konairamo (Solomon Islands); Terrence Titiulu (Solomon Islands); A.U. Sarath Fernando (Sri Lanka); K.P. Ariyadasa (Sri Lanka); Prapun Tanakitrungruang (Thailand); Pichart Watnaprateep (Thailand); Chudchawan Sutthisrisilapa (Thailand); Jerdpong Makaramani (Thailand); Americo Da Silva (Timor-Leste); Tevita Faka'osi (Tonga); Taniela Hoponoa (Tonga); Leody Vainikolo (Tonga); Uatea Vave (Tuvalu); Livo Mele (Vanuatu); Rexon Viranamangga (Vanuatu); Nguyen Hoang Nghia (Viet Nam) Pham Duc Chien (Viet Nam); Vo Dai Hai (Viet Nam).

The core drafting team for the main report comprised: CTS Nair, Chris Brown, Jeremy Broadhead, Patrick Durst and Rebecca Rutt. The report was edited by Robin Leslie and formatted by Chanida 'Tammy' Chavanich.

Thanks are due to the Forestry Staff of the FAO Regional Office for Asia and the Pacific and the Forestry Department, FAO, Rome many of whom contributed to the study.

Finally, special thanks go to those who worked long and late to provide essential secretarial support: Kallaya Meechantra and Sansiri Visarutwongse (FAO, Bangkok) and to Janice Naewboonien for proofreading.

EXECUTIVE SUMMARY

THE SECOND ASIA-PACIFIC FORESTRY SECTOR OUTLOOK STUDY

Since the completion of the first outlook study in 1998, the Asia-Pacific forestry sector has undergone major changes in response to larger societal transformation within and outside the region. A better understanding of what is likely to happen in the context of such changes is essential in choosing options and developing plans and policies to create a robust forestry sector. It is in this context that the 21st Session of the Asia-Pacific Forestry Commission (APFC) recommended conducting this second outlook study to assess the likely changes to the year 2020, focusing on policy options and implications.

STATE OF FORESTS AND FORESTRY: A MIX OF POSITIVE AND NEGATIVE

Asia and the Pacific: the least forested region in the world

With only 0.2 hectares of forest per person, the Asia-Pacific region is, per capita, the least forested region in the world. Uneven forest distribution means there are a number of countries and subregions where per capita forest area is far lower than the regional average. For example, South Asia, with 23 percent of the world's population, has only 2 percent of the world's forests; these amount to only 0.05 hectares per person and signify the enormous pressure these forests must bear.

Deforestation continues in many countries

Deforestation is a major issue faced by many countries in the region. At the aggregate level, there has been a positive trend, from an annual regional loss of over 0.7 million hectares of forests during 1990 to 2000 to an annual increase of 2.3 million hectares during 2000 to 2005. Recently – between 2005 and 2010 – the rate of increase in forest area has declined to just under 0.5 million hectares per year. The increase over the last decade is primarily due to large-scale afforestation in the People's Republic of China. In addition to China, forest area has increased in Bhutan, Fiji, India, the Philippines, Sri Lanka, Thailand and Viet Nam. If gains in these countries are excluded, deforestation elsewhere remains high. Major areas of forest loss are evident in Southeast Asia – particularly in Indonesia and Myanmar – and large reductions have also been reported in Australia.

Forest degradation – the hidden problem

Forest degradation and declining health and vitality remain major problems confronting Asia-Pacific forests. The definition of forests as areas with at least 10 percent canopy cover fails to capture the extent and severity of degradation. Growing stock per hectare continues to decline in several countries. Fire – most of which is human-induced – and uncontrolled logging remain major factors contributing to degradation in most countries.

Trees outside forests - the silver lining

An important positive trend is the expansion of trees growing outside forests under a wide array of farming systems. Home gardens and tree planting under agroforestry have become important sources for industrial roundwood and woodfuel supplies. In several countries, forest industries have entered into contractual arrangements with farmers to supply pulpwood. A substantial quantity of wood is also produced in cash crop plantations, notably rubberwood and coconutwood.

Implementation of sustainable forest management remains challenging

Despite a wide range of supporting initiatives and much discussion, implementation of sustainable forest management continues to be a challenge. Undefined or overlapping property rights, weak governance and high demand for wood and wood products have led to high levels of unsustainable logging. Agricultural, industrial and urban encroachment remain problems in many areas and excessive pressures on forest resources are causing extensive degradation. There are very few instances of balanced approaches where various forest management objectives are integrated and clear trade-offs established between divergent goals. At the same time, more wood is produced from plantations and trees outside forests and dependence on natural forests as a source of wood supply is on the decline.

Catastrophic environmental problems – especially floods and landslides – have often led to radical responses, logging bans in particular. Although generally reducing deforestation rates in the country of origin, logging bans have often had perverse effects, including the 'exporting' of deforestation to other countries. Without sound accompanying measures to satiate wood demand and effective enforcement measures, logging bans have generally been ineffective in stemming deforestation and degradation.

Potential of planted forests remains unrealized

The Asia-Pacific region accounts for about 45 percent of the world's planted forests. With the exception of a few countries, plantation productivity remains far below its potential. Public sector forest plantations are particularly prone to low productivity, largely on account of inadequate management. The potential wood production from planted forests in 2005 was estimated at 542 million m³ but total industrial roundwood production (including production from natural forests) in 2005 was only about 273 million m³.

Many challenges plague management of protected areas

The provision of ecosystem services is gaining importance and increasingly large tracts of natural forests are being withdrawn from production and set aside as protected areas. Since 2002 the extent of protected areas has remained stable, as potential limits to their expansion are neared. Management of protected areas remains problematic on account of encroachment and poaching of animals and plants; human-wildlife conflicts remain a major problem in many countries. Mining and infrastructure development pose significant threats to protected areas across much of the region. Nonetheless, protected areas remain the mainstay of biodiversity conservation and continued support is essential.

Forest policies revised, but implementation lagging

Most countries in the Asia-Pacific region have revised their forest policies to incorporate sustainable forest management. The provision of ecosystem services has become a primary goal in most policies, with a lessening of the dominant focus applied to wood production. There has also been

increased emphasis on the involvement of stakeholders in policy formulation and implementation. However, the wide gap between what is visualized in policies and what is actually practiced persists. With a host of forest-related initiatives – poverty reduction, biodiversity conservation and climate change mitigation in particular – traditional sectoral boundaries have become less relevant and forestry institutional arrangements have become increasingly fragmented.

Forest ownership remains contested

While there is a preponderance of private ownership in the developed economies, in others (with the exception of the Pacific Island Countries) public ownership dominates. Forest ownership has been a contentious issue in several countries, especially in the context of appropriation of forests by governments from traditional owners. Efforts are underway in several countries to restore the traditional rights of indigenous and other forest-dependent communities and to allocate forest land to families and individuals. The region has also been a pioneer in a number of initiatives to enhance the involvement of local communities, for example through Forest User Groups in Nepal and Joint Forest Management arrangements in India. These efforts, however, face a number of challenges, including economic viability, equitable distribution of benefits and sustainability.

Changing patterns of production and consumption of wood and wood products

Industrial roundwood production has remained stable

Officially reported industrial roundwood production has remained relatively stable since 1980, increasing from about 248 million m³ to 274 million m³ in 2007. In several countries there has been a significant decline in wood production either because of exhaustion of forest resources or due to increasing concern about environmental protection. One of the steepest declines in production has been in Japan where cheaper imports have made domestic production uneconomical. Oceania is the only subregion that has registered a significant increase in industrial roundwood production, largely accounted for by Australia and New Zealand.

Unclear trends in sawnwood production

Production and consumption of sawnwood in the Asia-Pacific region have fluctuated erratically since 1980 and the available statistics indicate a production decline from about 95 million m³ in 1980 to 91 million m³ in 2008. As in the case of industrial roundwood, sawnwood production statistics fail to capture a significant part of the real situation in view of the preponderance of small- and medium-sized sawmills, many of which operate in the informal sector.

Spurred by production growth in China, Asia and the Pacific has become the top producer of wood-based panels

In contrast to declining sawnwood production, wood-based panel production has increased significantly, from about 19 million m³ in 1980 to over 114 million m³ in 2008 with China accounting for most of this increase. China's share in the region's production increased from 12 percent in 1980 to about 70 percent in 2008, making it the top global producer of wood-based panels. This has also enabled China to become a major exporter of wood-based panels.

Rapid growth in paper and paper board production

Production of paper and paper board has increased rapidly during the last two decades, increasing from about 31 million tonnes in 1980 to 147 million tonnes in 2008. Investments in new capacity have continued until recently, suggesting continued growth in production. Although consumption

is likely to increase with increases in population, incomes and levels of education, much depends on the future state of the economy and trends toward increased use of electronic media; while increased use of recycled fibre could affect volumes of wood used in paper manufacture.

Domination of the world's furniture market

During the last two decades, the Asia-Pacific region, led by China and Viet Nam, has emerged as a major producer and exporter of wooden furniture. The surge in production is evident from the rapid increase in the value of furniture exported from the region, which increased from US\$1.56 billion in 1990 to about US\$17.7 billion in 2007 with the region's share in global exports increasing from 9 percent to 33 percent in the same period. Much of this is accounted for by China, whose exports increased from US\$111 million in 1990 to US\$10.7 billion in 2007, making it the world's largest exporter.

Exports shift to higher value-added products

One of the major changes in the forest products sector in the region is a shift from being a regionally focused exporter of industrial roundwood and other less-processed items to being an internationally focused exporter of more value-added items, especially wood-based panels, paper and paper board and furniture. China is also the main driver of this trend, clearly indicating that even in the absence of a domestic wood surplus a competitive industry can develop if other competitiveness conditions are satisfied.

Sources of industrial roundwood imports are changing

During the last decade there has been an important shift in the sources of industrial roundwood supplying the major importing countries; China, Japan and India. The Russian Federation, Australia, New Zealand and South Africa have become prominent as supplies from tropical countries have fallen and capability to mobilize wood on a large scale in countries like Russia has grown.

Wood: from an inferior fuel to a modern environmentally friendly fuel

More than three-quarters of all wood production in the Asia-Pacific region is used as fuel, and wood continues to be the main source of energy in many developing countries. Available data suggest that production has remained relatively stable during the last 15 years, at slightly less than 800 million m³. Increases in income and improved availability of more convenient fuels have led to a reduction in the proportion of people using wood as a primary source of energy. However, there are signs of change in this trend as the virtues of woodfuel are being rediscovered in the context of climate change and energy policies while improved technologies are enhancing efficiency and convenience of use.

Many non-wood forest products will no longer be forest-derived

Non-wood forest products (NWFPs) continue to play an important role in the economic and social well-being of many people in the Asia-Pacific region. Many NWFPs cater to subsistence needs of forest-dependent communities and contribute significantly to poverty alleviation. Management of forests for the production of NWFPs continues to pose major challenges. Increased demand has led to overexploitation, especially in the context of ill-defined tenure and weak institutional arrangements, while potential income opportunities have led to domestication of a number of products. There have also been significant improvements in processing technologies, resulting in a wide array of new products.

Increased interest in forest-derived ecosystem services not yet matched by willingness to pay

Conservation of biological diversity, maintenance and improvement of watershed values, combating desertification and land degradation, and climate change mitigation and adaptation are key ecosystem services provided by forests. With climate change becoming a critical global issue, the role of forests in climate change mitigation and adaptation has become one of the most discussed topics in recent times. Continued deforestation and degradation for timber and land has resulted in significant environmental degradation. However, slow declines in ecosystem services often go unnoticed, delaying appropriate responses. Meanwhile systems of payments for ecosystem services (PES) remain in their infancy.

REDD to the rescue?

With climate change becoming one of the most critical environmental issues, forests and forestry are gaining increasing attention in mitigation strategies, especially as deforestation and forest degradation accounted for about 17 percent of global carbon emissions in 2004. Forestry's role in climate change mitigation largely depends on progress in arresting deforestation and degradation to reduce carbon emissions and stepping up of afforestation and reforestation to enhance carbon stocks.

The proposed programme for Reducing Emissions from Deforestation and Degradation (REDD) envisages payment of compensation to forest owners in developing countries for conserving forests. However, there are considerable uncertainties as to how REDD will evolve and to what extent it will become an important component of climate change mitigation strategies.

LARGER SOCIETAL CHANGES WILL HAVE PROFOUND IMPACTS ON FORESTS

A host of factors outside the forestry sector – demography, economy, political and institutional conditions and technological progress – collectively affect forests and forestry. Growing concern about the provision of ecosystem services, especially in the context of climate change mitigation and adaptation, has added a new dimension. At the same time, changes in society's behaviours alter patterns of goods and services demanded and how these are produced and consumed. These societal changes also affect policies and programmes in other sectors, impacting forests and forestry through backward and forward linkages.

Demography will have a critical impact on forests and forestry

By 2020 the population in Asia and the Pacific will be 4.2 billion (an increase of 600 million from 2005), accounting for about 60 percent of the world's population. While population growth is slowing and some developed countries will see population reductions, many developing countries are on high population growth paths and much of the growth is in countries where population densities are is already very high. South Asia remains the most densely populated subregion, almost three-times higher than the regional average.

Multiple impacts of economic changes

High economic growth rates will continue, increasing demand for food, fibre and fuel

Rapid growth in countries such as China and India is bringing about fundamental changes in production, consumption and trade of all forest products and services. The GDP of the region is expected to increase from about US\$10.7 trillion in 2006 to US\$22 trillion by 2020. Continued growth implies a surge in demand for all products, including wood and wood products.

Poverty to decline, but the number of poor will remain high

Rapid economic growth in the past has led to significant reductions in poverty, but in many countries, especially in South Asia, high levels of poverty are likely to persist despite high economic growth rates. In many countries, rapid growth has exacerbated disparities, especially between rural and urban areas. The trickling down of benefits has been extremely slow, ensuring that dependence on natural resources will persist. However, international migration and associated flow of remittances are having an impact on land use in the region. Remittances have been a major source of income to many families, reducing the pressure and dependency on natural resources.

Structural changes in economies and a growing middle class

Rapid growth of the manufacturing and services sectors has reduced the share of agriculture in national incomes and employment. Between 1990 and 2007, agriculture's share in Asia-Pacific's GDP declined from about 25 percent to 12 percent; however, agriculture remains the most important sector for rural employment. The Asia-Pacific region will witness a major surge in numbers of middle-income households with attendant changes in values, perceptions and demands for goods and services. In particular, pressures to focus resources on environmental conservation are likely to increase.

Globalization will alter the opportunities and challenges for forests

The rapid growth in Asia-Pacific economies has been primarily due to globalization, involving increased flows of investments, trade, technology and management practices across national borders. The forest sector will continue to be influenced by globalization as it changes the nature of forest product value chains and the nature of trade and cooperation relationships, while investments shift among countries in response to shifting competitiveness.

Continuing political and institutional changes

Shifts in the political and institutional environment

Asia-Pacific countries are witnessing major shifts in the overall policy and institutional environment, reflecting larger political and social changes. Notable trends include greater demands for social justice and participation in governance and in public policy decision-making, increased plurality and wider involvement of civil society and private sector organizations. Devolution of resource management responsibilities to local levels and to families and individuals in particular has become another growing trend.

Forest governance under increased public scrutiny

Poor governance and inabilities to resolve resource-use conflicts are major problems in some countries. Forest governance continues to be a major challenge where overall political and institutional frameworks remain undeveloped. New international initiatives in the European Union and the United States aimed at supporting sustainable forest management by preventing entry of illegal forest products into markets are likely to redefine aspects of international trade.

Growing environmental concern a major driver of change

Increasing awareness about the environmental roles of forests has brought forestry and other related land uses under greater scrutiny. Already a number of local, national and global environmental issues have changed the course of forestry in unprecedented ways. With climate change becoming a critical environmental issue, forests and forestry are at centre stage of global political discussions with considerable potential for reshaping the future of the sector.

Emerging technological changes

Notwithstanding the various uncertainties, developments in science and technology could significantly impact the forest sector. These include technologies for improved management, productivity-enhancing technologies (for example tree improvement) and the development of new products and processes. Remote sensing technologies are revolutionizing abilities to monitor resources, helping to track changes on a real time basis. Ongoing efforts to develop commercially viable cellulosic biofuel and 'biorefinery' technologies could have major impacts on the use of wood by 2020.

SCENARIOS AND THEIR IMPLICATIONS

Three probable scenarios based on future economic growth and social and ecological sustainability

During the next one to two decades, the major uncertainties relating to overall social and economic development of the Asia-Pacific region will be determined by: (a) economic growth; and (b) social and ecological sustainability. Most Asia-Pacific countries will likely move along one of three broad paths of development:

The high economic growth 'boom' scenario is one under which countries pursue rapid economic growth rates, overlooking critical social and ecological problems. 'Growth first and trickle down later' remains the guiding philosophy.

Most middle-income and emerging economies are likely to pursue the high growth scenario. Political and institutional conditions will encourage this path, except in the context of catastrophic problems (including a prolonged global recession or climate change-related events). Resource-rich low income countries are also likely to grow rapidly, taking advantage of demand for raw materials from emerging economies.

The low growth and stagnation 'bust' scenario presents a future restrained by weak economic performance with low priority given to social and ecological sustainability in many countries.

The low growth scenario envisages slow and weak recovery from the current economic crisis, with a protracted recession extending well into the current decade. Demand for forest products would be dampened, and investments in most aspects of forestry would be sluggish. Forest management would stagnate and forest degradation would likely accelerate, especially in developing countries where livelihood pressures would drive people to greater exploitation of forests. Even in the event of global economic recovery, some low-income resource-poor countries (and regions within countries) may remain vulnerable to a low growth scenario, as may some developed countries where economic fundamentals constrain growth.

The 'green economy' scenario envisages changes leading to balance between growth with social and ecological sustainability. This is increasingly becoming the vision for a number of countries, especially in the context of the economic and climate change crises.

Most of the middle-income and emerging economies will apply some effort towards developing green energy, in the context of increasing costs of fossil fuels and concerns over energy security. Developed countries – with relatively well-developed policies and institutional frameworks, and greater ability to invest in science and technology – have greater potential to shift towards a 'green economy' scenario. Several emerging economies will also have good prospects to leap-frog into 'green economy' positions, especially if inspired by visionary leadership and empowering policies. Sustainability is, however, unlikely to receive great attention, especially in resource-rich low-income countries with weaker policies and institutions and enormous imperatives to maintain economic growth and development.

FORESTS AND FORESTRY IN 2020

Forest area to stabilize regionally, but losses in Southeast Asia, South Asia and Oceania to persist

At the aggregate level, forest area in the Asia-Pacific region will increase or stabilize largely on account of the significant increase in afforestation and reforestation in China, India and Viet Nam. Rapid economic growth and increases in income will help to bring about forest transition in a number of countries. However, the loss of natural forests through clearance to meet growing demand for food and fuel will continue, especially across Southeast Asia, South Asia and some of the Melanesian countries.

Forest degradation will persist in most of the densely populated low-income countries

Forest degradation is expected to remain a major problem in more densely populated low-income countries, especially in South Asia where dependence on land and forests is high. Considering the high rates of population growth in many countries, a scenario of low economic growth could aggravate degradation. Uncontrolled logging in resource-rich countries to supply export markets will also continue to damage forest health and vitality.

Policy and institutional constraints will continue to hinder sustainable management of natural forests

While adequate technical knowledge exists on approaches to sustainable forest management – including, for example, reduced impact logging – implementation of such measures will be constrained in many countries by weak policies and institutional arrangements. Throughout the region most easily accessible natural forests have already been logged. In the future, managing natural forests for wood production may be increasingly seen as too complicated, too controversial and too costly – resulting in many areas being withdrawn from production and often any formal management.

Planted forests and trees outside forests are increasingly important sources of wood

Forest plantations in countries such as Australia, China, India, Indonesia, Malaysia, Thailand, New Zealand and Viet Nam increasingly dominate wood supplies along with farm level plantings in China and India. Even slight increases in productivity of the current area of planted forests could significantly increase wood supplies. However, in many countries this will depend on improving enabling incentives for planted forest management and the creation of favourable policy and institutional environments.

Demand for industrial roundwood to increase

Considering population and income growth in the region, demand for wood products, especially panel products and paper and paper board, will increase significantly from the current relatively low levels. Demand for industrial roundwood will increase from 317 million m³ in 2005 to 550 million m³ in 2020. Under the low growth scenario, the consumption of industrial roundwood will increase to only 462 million m³. Some of the key features of the consumption forecasts are:

- East Asia, especially China, will account for most of the surge in consumption, in particular panel products and paper and paper board as well as industrial roundwood.
- East Asia (mainly China) and South Asia (mainly India) will rely very heavily on imports. Oceania and Southeast Asia will remain surplus producers.
- In general wood supplies will be adequate to meet demand, although there could be supply shortages in some localities.

No major constraints are expected in mobilizing wood supplies. Production in existing plantations can be increased significantly through improved management. Wood resources outside forests are also increasing as secure tenure and assured markets are encouraging the expansion of farm-based tree planting. The overall global wood supply situation is improving especially as removals are far less than growth increments in key producing regions in the Russian Federation, Europe, North America and Latin America. Demand for wood in these regions has slumped as a result of the economic recession.

Major changes likely in the use of wood as a source of energy

While wood will remain an important source of energy, its consumption is estimated to decline from 790 million m³ in 2005 to 699 million m³ in 2020 with most of the decline taking place in East Asia and Southeast Asia. However, energy and environmental policies could bring about important changes in the extent of wood use. For example, wood pellet markets are emerging in the Asia-Pacific region as many countries attempt to reduce dependence on fossil energy

sources. New technologies, such as cellulosic conversion processes for biofuel production and efficient small-scale wood gasification technologies could have significant impacts on wood use.

Major changes in the use of non-wood forest products

With some exceptions, subsistence production, processing and utilization of NWFPs are expected to decline. A number of products will be cultivated on a commercial scale and will cease to be 'forest-derived' products. Improved processing and marketing technologies will bring about significant changes to the NWFP sector, especially as the market reach of traditional producers expands.

Mixed situation vis-à-vis forest-derived ecosystem services

The provision of ecosystem services – including conservation of biological diversity, watershed protection, land degradation and desertification, and climate change mitigation – will vary markedly (in terms of efficiency, quality and magnitude) across the region in view of differing resource situations and policy and institutional environments.

• Developed economies able to improve the provision of ecosystem services

In view of high incomes and greater willingness to pay, developed countries will give greater attention to the provision of ecosystem services. This will be facilitated by better-developed policy and institutional frameworks and stronger technological capacities.

• Emerging and middle-income economies will face a mixed situation

With most emerging and middle-income countries putting high priority on economic growth, environmental issues could receive secondary attention. Nevertheless, many are moving or have moved towards improving the flow of ecosystem services, especially through afforestation and reforestation.

• Low-income countries will face the biggest challenges

Forest-related environmental problems will be acute in all low-income countries, both forestrich and forest-poor. The forest-rich countries will be under pressure to clear forests to raise incomes and to clear land for alternative uses. In forest-poor countries degradation and impoverishment of forest resources will be a major problem. All of these countries face severe policy and institutional constraints in managing forests sustainably.

• Small island countries

Small island countries are extremely vulnerable to changes in their economic and ecological conditions. Many of the changes are largely exogenous and domestic capacities to handle them are limited. Improved management of uplands (where they exist), especially to provide high-value watershed services, and coastal vegetation management (to minimize the impacts of storm surges) will be major priorities. Dependence on remittances, external assistance and tourism will persist. Several countries have unique opportunities to shift to a 'green economy' through green tourism initiatives and development assistance interest in mitigating climate change impacts.

PRIORITIES AND STRATEGIES

Focus on social and ecological sustainability

Priorities and strategies for the forest sector will have to be country- and scenario-specific. Countries are passing through divergent development paths with high and low economic growth rates and varying levels of social and ecological sustainability. For most countries, accomplishing high growth rates remains the priority. However, increasing social and ecological vulnerability is encouraging countries to shift to green pathways.

Overall priorities

The focus of international discussions on forestry reflect only a small portion of overall forestry activity but often consumes a disproportionate amount of attention and energy, especially of government forestry officials. The vast majority of on-the-ground forestry-related activities are often seemingly overlooked and although the international focus can eventually have major positive implications for forestry, practical management aspects should not give way completely to more distant goals.

Rebuilding the natural resource base and conserving of existing resources

Although the Asia-Pacific region is unlikely to face any critical wood shortages in the near future, rebuilding the natural resource base and conservation of existing resources will remain a high priority. As countries develop, the demand for wood and wood products is expected to increase considerably. More importantly, there will be a rapid increase in demand for ecosystem services. Considering that populations will continue to grow and levels of consumption will surge, it is imperative that the Asia-Pacific region invests in conserving and enhancing the natural asset base.

Rural development and poverty alleviation

Although the Asia-Pacific region is urbanizing rapidly, it will still remain largely rural and rapid economic growth in urban areas is widening the rural-urban divide. With low incomes from agriculture, poverty will remain a major issue, especially in South Asia. Although forestry itself may not be able to lift people out of poverty, it will be important for providing basic needs, especially for forest-dependent communities.

Enhancing raw material and energy-use efficiency

With burgeoning demand for various products, it is imperative that the Asia-Pacific region pays greater attention to enhancing efficiency in the use of raw materials and energy. Efficiency in wood energy use particularly requires improvement. A wide array of technologies is already available and, with greater attention to policies and other incentives, it is possible to significantly improve the output of products and energy. Enhanced use of wood residues for local processing and energy generation also warrants more attention. Expanded recycling of fibre would help satisfy the growing demand for paper and paper products while reducing the need for more forest plantations and fibre production from natural forests.

Governance

There is an overarching need to strengthen governance; generally and within the forestry sector. Attention to reducing or eradicating corruption including endemic bribery and extortion will be important in improving investor confidence and creating efficient industries. Better governance will also be a prerequisite to continuing to export to some developed country markets and in attracting carbon-financing. Countries with poor governance will be severely disadvantaged in competing for carbon funds, with money gravitating to where investors have confidence.

Strategies

Several broad areas require renewed attention in the coming decade: (a) improvements in policy, legal and institutional frameworks; (b) building capacities for grassroots forestry; (c) strengthening science and technology capacities; (d) improving education and awareness related to forests and forestry; (e) developing societal consensus; and (f) strengthening leadership and communication.

Policies and institutional changes essential

Policies, legislation and institutional arrangements should empower people to undertake individual and collective actions, helping to resolve conflicts and establish acceptable trade-offs among competing and conflicting objectives. Issues that will require immediate attention include:

- Tenure reform. Secure tenure will remain one of the core issues in empowering local communities and in motivating them to undertake activities that could help address natural resource degradation and poverty.
- Reform of public sector agencies with emphasis on facilitation and regulatory functions and shifting managerial functions to the private sector, including farmers and communities.
- Improved land-use planning and careful management of land conversion programmes. Enforcement of decisions will also need to accompany improved planning, such that institutional frameworks effectively correspond to ground-level jurisdictions.
- Creating enabling environments. Policies and legislation need to be structured to ensure they create enabling environments in which incentives reward 'good' behaviours and penalize the 'bad'.

Grassroots forestry

While theory, science and policy may advance; at grassroots levels, lack of capacity and knowledge are often highly constraining. International agreements and policy development need to be accompanied by practical steps towards improvements in forest management. Forestry extension and major attention to training, capacity development and enforcement of regulations are sorely needed if hopes are to become realities.

Investments to improve science and technology

Enhancing social and ecological sustainability requires major improvements in science and technology capacities. To change the current pattern of resource use, stronger inputs from science are necessary. The focus is, however, not so much towards research, but in translating existing knowledge into technologies that are more energy and material efficient.

Investment in human resources

The region's growing population and increased desire of diverse segments of society to be involved in forest-related decision-making places greater emphasis on the need for improved education and awareness related to forests and forestry. An 'environmentally smarter' population of consumers and decision-makers will be essential to reverse trends of forest loss and degradation and move toward truly sustainable resource management in the future.

Societal consensus

Continuation and acceleration of efforts towards achieving societal consensus in how forests should be managed, and for which purposes, will be a key element in effective forest management in the coming decade. Greater efforts are required to integrate public opinion into decision-making and build levels of awareness in relation to forests and forestry so that policies are appropriate, widely supported and can be easily implemented with broad community support. Increased attention to national forest programmes can contribute to these aspects.

Leadership and communication

A major challenge for forestry is to strengthen its sectoral profile and to develop more powerful champions, advocates and leaders. Provision of specialized training opportunities, greater encouragement and empowerment of staff, and significant institutional culture changes could assist this development. The emergence of stronger leaders and advocates could be a major driving force to shift forestry onto better and more sustainable pathways.

INTRODUCTION

BACKGROUND

The Asia-Pacific forest sector is undergoing unprecedented changes as economies grow rapidly and demands on forests for goods and services accelerate. Already the **impacts of these** changes are being felt within and outside the region and in some cases the increasing demands and the absence of concomitant investments have undermined long-term sustainability. A better understanding of what is likely to happen in the context of larger societal changes is imperative to identify the options available. The decisions and compromises made during the next decade will determine the course of forestry in the coming century.

The Food and Agriculture Organization of the United Nations (FAO) has been undertaking a series of global and regional outlook studies in response to requests from its Committee on Forestry and Regional Forestry Commissions. The first in this series was the inaugural Asia-Pacific Forestry Sector Outlook Study (APFSOS). Since its completion in 1998, the overall social, economic, political and institutional environment within and outside the region has undergone unprecedented changes and the pace of change is accelerating. The demands placed on forests have increased and intensified, forest areas have dwindled and been degraded, and people are demanding greater voice in how forests are managed and for what purposes. As countries become more integrated through globalization and the impacts of what happens in one country are felt far and wide, national forest programmes will be required to adapt to the new opportunities and challenges. The long-term horizons of forestry investments reinforce the imperative to understand future changes in society-forest relationships.

It is in this context that the 21st Session of the Asia-Pacific Forestry Commission (APFC), held in Dehradun, India, in April 2006, recommended revisiting APFSOS I to assess the likely changes to 2020, focusing on what may be done to enhance the forest sector's contribution to society's well being.

OBJECTIVES AND KEY QUESTIONS ADDRESSED

The key question addressed by the study is how to steer the forest sector along a path that is relevant and appropriate to society's emerging needs? As social, economic and technological changes accelerate, forests and forestry will confront a complex array of opportunities and challenges, some familiar, while others very new. The Asia-Pacific Forestry Sector Outlook Study II aims to articulate this larger picture of change, enabling more informed decision-making at various levels. The specific objectives of APFSOS II are to:

- Identify emerging socio-economic changes impacting forests and forestry;
- Analyse probable scenarios for developments in the forestry sector to 2020;
- Outline priorities and strategies to address emerging opportunities and challenges.

Specifically, the study will address a number of questions relating to the changing roles of forests and forestry in the larger context of social and economic changes (**Box 1.1**).

Box	1.1	Key questions on the future of forests and forestry in Asia and the Pacific	
•	 How will developments outside the forest sector impact forests and forestry, especially in the context of the accelerating pace of globalization? 		
•	Wha	at will be the future role of forests and forestry in the rapidly changing Asia-Pacific region?	
•	 What will be the progress towards accomplishing sustainable forest management? 		
•	Hov	v will future demands for wood and wood products be met?	
•	 Considering the underdevelopment of certain areas, what will be the role of forests and forests in improving social and economic conditions, especially in alleviating poverty? 		
•	 What will be the future of the forest industry in the region in view of the changing investmen climate and increasing trade of wood and wood products? 		
•	 How can forestry respond effectively to emerging environmental crises, in particular clima change? How will forestry be affected by increasing concern for the protection of the environme and how will it address potential conflicts in dealing with multiple objectives? 		
•	What soc	at are the lessons learned from the experiences of countries in dealing with the changing ietal demands on forests and how could these be used in addressing future challenges?	

SCOPE OF THE STUDY

This study covers 33 countries (**Table 1.1**) including all the member countries of the APFC that are physically located in the region, in their entirety. These have been grouped into four subregions (**Figure 1.1, Table 1.1**). A large part of the Russian Federation is also considered to be within the Asia-Pacific region; however, considering that the Russian Federation straddles Asia and Europe and has already been included in the European Forestry Sector Outlook Study (UNECE and FAO 2005), this study does not provide in-depth analysis of the situation in the Russian



Figure 1.1. Asia-Pacific subregions

Federation. Rather, it limits its focus to the changing role of wood supplies from Russia (especially from the Russian Far East) to the rest of the Asia-Pacific region. A number of Pacific Island Countries and territories that have not formally participated in the study process have not been specifically included in the analysis, but many of the findings and conclusions of the study will also be relevant for them. The primary focus of the study is APFC member countries, which have been heavily involved in a three-year APFSOS development process. However, the study does take into account information from non-APFC member countries, although they have not been formally involved through a national process.

Subregion	Countries
East Asia	Democratic People's Republic of Korea (DPRK), Japan, Mongolia, People's Republic of China, Republic of Korea (ROK)
South Asia	Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan, Sri Lanka
Southeast Asia	Brunei, Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, Philippines, Singapore, Thailand, Timor-Leste, Viet Nam
Oceania	Australia, Fiji, Kiribati, New Zealand, Papua New Guinea (PNG), Samoa, Solomon Islands, Tonga, Tuvalu, Vanuatu

THE STUDY PROCESS

The outlook study was implemented adopting a highly participative approach involving APFC member countries and other stakeholders, including bilateral and multilateral development agencies, international organizations, civil society organizations, industry and academic and research institutions. APFC member countries nominated national focal points who coordinated the preparation of country outlook papers. In addition, a number of thematic studies addressing cross-cutting topical issues were undertaken. Workshops were organized to facilitate exchange of information and to develop coherent scenarios relating to forestry development. The country outlook papers, thematic studies, as well as discussions during national, subregional and regional meetings and information from the wealth of current literature, formed the basis for preparing draft subregional and regional reports. An international conference organized in October 2007 provided a unique opportunity to discuss a wide array of issues relating to the future development of the forest sector in the region.

A Scientific Committee consisting of experts from the region and collaborating organizations provided guidance and technical oversight. Draft subregional and regional reports were discussed during a meeting of the Scientific Committee held in June 2009 and the revised reports were subjected to further review and revision by the Scientific Committee.

STRUCTURE OF THE REPORT

Chapter 2 provides an overview of the current state of forests and forestry in the region, outlining the state of forests and recent trends in their management including developments in policies, legislation and institutions. An overview of the economic, social and environmental significance of forests is provided in Chapter 3. The main drivers of change impacting the sector are described in Chapter 4. Drawing upon the major drivers of change and the key uncertainties, Chapter 5 describes the probable scenarios that may develop to 2020 and the implications for the forest sector. Chapter 6 outlines how the forest sector may have evolved by 2020. Possible options – especially priorities and strategies – for moving to a more desirable path of development are outlined in Chapter 7.

2 FORESTS AND FORESTRY IN THE ASIA-PACIFIC REGION

INTRODUCTION

Forests and trees play an important role in Asia-Pacific economies on account of their diverse economic, social, environmental and cultural values. Over time, the relationship between society and forests has undergone important changes, altering the nature of demands placed on forests. Among the region's countries there is considerable diversity as regards the extent of forests and tree cover, overall conditions of growth and productivity and the level of investments required to sustainably manage the resources. While climatic factors play an important role in the overall state of forests – especially as regards productivity of wood and non-wood products and the various ecosystem services – the national and local situations confronting forests are also products of differing policies and institutional capacities to manage the resources. This chapter provides an overview of the state of resources and the policy, legal and institutional frameworks that guide their management.

FOREST AND TREE RESOURCES



Figure 2.1. Asia and the Pacific: distribution of forests and woodlands Source: FAO (2006a).

Arable and permanent croplands account for about 18 percent of the land area in the Asia-Pacific region, while the share of forests is about 26 percent (**Figure 2.1**). However, there are considerable differences among subregions and among countries within each subregion, largely reflecting

ecological conditions and, often more importantly, demographic and socio-economic conditions. For example, in South Asia, arable land and land under permanent crops accounts for almost 50 percent of the total land area; correspondingly, the extent of land under other uses, especially forests and permanent pastures, is very low. In contrast, the share of permanent pastures in East Asia and Oceania is considerably higher. In the case of Southeast Asia, forests form the major land use and, correspondingly, the share of pasture and arable land is relatively low (**Figure 2.2**).



Figure 2.2. Land use in the Asia-Pacific region, 2007 Source: FAO (2010b).

The share of various land uses in the region has been changing, with agriculture expanding into forest areas and permanent pastures and meadows in most subregions. Between 1995 and 2005, the extent of agricultural land increased by about 38.7 million hectares, with East Asia, mainly China, accounting for about 53 percent of the increase. Interestingly, during this period there has been a significant expansion of forest area, especially through large-scale afforestation, suggesting that most of the agricultural expansion has been into areas classified as permanent pastures. Among the subregions, South Asia registered the least expansion of agricultural land, perhaps not surprisingly, given that agriculture already accounts for 50 percent of the total land area in that subregion.

The balance of overall land use, in particular, changes in the extent of land under agriculture, will have a major impact on forests in the region.

Forest area

The total forest area (**Box 2.1**) in the Asia-Pacific region is estimated at 740 million hectares (FAO 2010b), accounting for about 18.3 percent of the global forest area (**Figure 2.3**). However, the distribution of Asia-Pacific forests is uneven. For example, South Asia accounts for 23 percent of the global population, but has only about 2 percent of the world's forests. Conversely, Oceania and Southeast Asia have greater proportions of forests in relation to their populations (**Table 2.1**).

Box 2.1	Definition of forests
There is a wide array of definitions of forest and in some countries more than one definition is in use depending upon who is using the definition and for what purpose. Definitions that are suitable at aggregated regional and global levels are unlikely to satisfy more detailed national level requirements. Conversely, definitions developed to suit the needs of any given country are unlikely to be applicable at a global level (UNEP, FAO, and UNFF 2009).	
For the purpose of consistency, especially for intercountry comparisons, this report adheres to the definition of forests adopted by FAO for the Global Forest Resources Assessment (FRA) 2005.	
Forest is defi cover of more	ned as: land spanning more than 0.5 hectares, with trees higher than 5 metres and a canopy e than 10 percent or trees able to reach these thresholds <i>in situ</i> . It does not include land that intly agricultural or under urban use.

Other wooded land is defined as: land not classified as forest, spanning more than 0.5 hectares, with trees higher than 5 metres and a canopy cover of 5 to 10 percent, or trees able to reach these thresholds *in situ* or with a combined cover of shrubs, bushes and trees above 10 percent. Urban parks, orchards and other agricultural crops are excluded from this definition – as are various agroforestry systems.

Source FAO (2010b).

Subregion	Area (million ha)				Annual change (1 000 ha)			Share of	Share of
	1990	2000	2005	2010	1990- 2000	2000- 2005	2005- 2010	global popula- tion in 2010 (%)	global forests in 2010 (%)
East Asia	209.2	226.8	241.8	254.6	1761.7	3005.3	2556.9	22.6	6.3
South Asia	78.2	78.1	79.8	80.3	-6.5	346.6	95.6	23.4	2.0
Southeast Asia	247.3	223.0	219.5	214.1	-2421.5	-709.8	-1086.4	8.5	5.3
Oceania	198.7	198.4	196.7	191.4	-36.2	-327.4	-1072.1	0.5	4.7
Asia-Pacific	733.4	726.3	737.9	740.4	-702.5	2314.7	494.0	55.1	18.4
World	4168.4	4085.2	4061.0	4033.1	-8323.0	-4840.8	-5580.9	100	100

Table 2.1. Forest area change in the Asia-Pacific region

Source: FAO (2010b).

The four largest countries, namely China, Australia, Indonesia and India, account for about 71 percent of the forest area. Myanmar, Papua New Guinea (PNG), Japan, Malaysia, Lao PDR and Thailand collectively account for another 18 percent, with the final 11 percent located in the remaining 23 countries and territories (**Figure 2.3**).


Figure 2.3. Distribution of forest area by country Source: FAO (2010b).

The region also has about 312 million hectares of other wooded land with Australia and China accounting for about 76 percent of the other wooded land in the Asia-Pacific region. Some key features relating to forest area are summarized below:

- On a per capita basis, the Asia-Pacific region is one of the least forested regions (with about 0.2 hectares per person) in comparison with the global per capita area of about 0.6 hectares. Further, within the region, South Asia is the least forested subregion with about 0.05 hectares per person, indicating the pressures on these forests for competing uses.
- The diversity of forest distribution is emphasized in a comparison of forest areas in the Asian
 part of the region, where forests total 0.15 hectares per capita, compared with the Pacific
 subregion, which has 6.3 hectares of forests per capita. The population pressure on Asian
 forests is heavier than any other global region, while forests in the Pacific are subject to the
 least pressure, globally. However, the forest situation varies markedly among countries in
 Asia and in the Pacific (Table 2.2).
- In some of the small island countries, the extent of forests is negligible and much of their forest management is in fact management of trees outside forests, including for example coconut trees.
- If forests in the Russian Far East were included in this analysis, many regional forest resource statistics and ratios would be significantly altered (**Box 2.2**).

	More than 10 million h	a of forest in total	Less than 10 million ha of forest in total			
	More than 40% forest cover	Less than 40% forest cover	More than 40% for- est cover	Less than 40% forest cover		
More than 0.6 hectares of forest per person	Cambodia Indonesia Lao PDR Malaysia Myanmar PNG	Australia Mongolia	Bhutan Brunei Fiji Solomon Islands. Timor-Leste	New Zealand Vanuatu Samoa		
Less than 0.6 hectares of forest per person	Japan	China India Thailand Viet Nam	Korea DPR Republic of Korea	Bangladesh Kiribati Maldives Nepal Pakistan Philippines Singapore Sri Lanka Tonga Tuvalu		

Table 2.2. Current importance of forest resources in countries of Asia and the Pacific

Source: FAO (2006a).

Box 2.2 Russian forest resources

With about 850 million hectares of forests accounting for 22 percent of the global forest area, the Russian Federation has the world's largest forest area. About 78 percent of the country's forest lands are located in Asiatic Russia, with the remaining 22 percent in the European part of Russia. Forests account for 50 percent of the total area of Russia. The growing stock of 82 billion m³ accounts for a quarter of the total volume of the world's forests. Coniferous species (i.e. spruce, pine, fir and larch) predominate, accounting for 71 percent of the forest area; in terms of growing stock, conifers account for 80 percent of the volume. Siberian pine (*Pinus sibirica*), larch and fir forests are predominant in the Asian part of Russia.

The annual estimated wood increment in Russian forests is about 943 million m³ and the annual prescribed cut is 635 million m³. Of this, 367 million m³ are assigned for harvesting from areas which are currently accessible economically, while the remaining 268 million m³ are in areas that are currently inaccessible economically. In 1990, prior to the collapse of the Soviet Union, the annual harvest was about 300 million m³. Since then, harvests have declined drastically, reaching a nadir of about 140 million m³ in 1994, but gradually increasing since, to 187 million m³ in 2007. This is about 62 percent of the 1990 harvest level. Of the 2007 harvest, about 50 million m³ were exported as roundwood, 33.5 million m³ were allocated for use by local communities (social needs) and 104 million m³ for domestic production of various products.

With its vast resources, Russia has become a major source of wood supplies to a number of countries in the Asia-Pacific region. A shrinking domestic market implies increased dependency on exporting logs and wood products for the Russian forest industry. Many countries in the Asia-Pacific region will continue to rely on Russian forests to meet demands for wood and wood products.

A new forest code was adopted in 2006, including the announcement of major increases in export taxes on wood products, especially logs. This was aimed at increasing domestic value addition. However, a decline in global demand for wood and wood products on account of the global economic downturn has led to the deferment of tax increases till 2011.

Forest area changes

Deforestation is a major issue facing a number of countries in the region. At the aggregate level, there has been a positive trend in deforestation in the region; from an annual loss of more than 0.7 million hectares of forests during 1990 to 2000 to an annual increase in forest area of 0.5 million hectares during 2005 to 2010. However, this change is uneven among countries and over time. In fact, since 2005 there has been a significant drop in net annual increase in forest area, from over 2.3 million hectares during 2000 to 2005 to about 0.5 million hectares between 2005 and 2010. This is largely due to a decline in the pace of afforestation and reforestation in China and increased deforestation in Australia and Indonesia. If China's forest area increase is excluded, the rate of deforestation has increased the extent of forest area in East Asia and kept forest area in South Asia relatively stable. However, Southeast Asia has registered a substantial reduction in forest area (Figure 2.4). In addition to China, the most significant increases in forest area have been in India and Viet Nam. In most other countries there has been a decline in the forest area, with substantial losses recorded in Cambodia, Democratic People's Republic of Korea (DPRK), Indonesia, Myanmar and PNG.



Figure 2.4. Forest area changes in the Asia-Pacific region Source: FAO (2010b).

Absence of regular monitoring, assessment and reporting of area changes remains a major challenge in several countries. With the exception of a few countries, overall national capacities for assessing forest conditions remain unsatisfactory. There are several countries where forest area change has been constant during 1990 and 2010 (**Box 2.3**). In at least some cases – especially the larger countries – this may reflect the absence of reliable data rather than the actual ground situation.

Box 2.3	Some examples of forest area changes during 1990 to 2010
 In Eas during 	t Asia, the annual rate of forest area decline in DPRK and Mongolia has been constant the entire period of 1990 to 2010, at 127 000 hectares and 87 000 hectares respectively.
 In sev 1990 t Micror Iow that stabilit 	eral countries and territories in Oceania, forest area has remained unchanged during o 2010. These include American Samoa, Cook Islands, Guam, Kiribati, Marshall Islands, nesia, New Caledonia, Vanuatu, Tonga and Tuvalu. On some islands, forest area is so at further conversion is almost impossible, without undermining economic and ecological y.
Within consta annum to 201 to 201	South Asia, the annual rate of forest area change in Bangladesh and Bhutan has been int. Bangladesh has recorded a constant annual decline of 3 000 hectares of forests per n, while Bhutan registered an annual increase of 11 000 hectares during the period of 1990 0. Forest area in Maldives is reported as unchanged at 1 000 hectares throughout 1990 0.
 In Sou period area o defore 	utheast Asia, Lao PDR reported a rate of annual forest loss of 78 000 hectares during the 1990 to 2010. On the other hand, the Philippines reported an annual increase in forest f 55 000 hectares throughout this period, dispelling earlier perceptions of a high rate of station in the country.

Sources: FAO (2010b)

Australia represents an unusual situation in that it has a high level of deforestation, despite being a developed economy with robust policy and institutional frameworks. In fact, for the period 2005 to 2010, Australia has reported the highest level of annual deforestation in the Asia-Pacific region – about 0.9 million hectares per year. (**Box 2.4**).

Box 2.4

The Global Forest Resources Assessment 2010 reports an annual reduction in forest area in Australia of 200 000 hectares during the period 2000 to 2005. This reduced the country's forest area from 154.9 million hectares to 153.9 million hectares.

However, between 2005 and 2010 there has been a significant acceleration in forest loss, to an annual average of 900 000 hectares, further reducing Australia's total forest area to 149.3 million hectares. Consequently, Australia has the highest gross deforestation rate in the Asia-Pacific region, ahead of Indonesia. Several factors, including some associated with natural causes, have contributed to the high deforestation rate.

Australia's country report to the Global Forest Resources Assessment 2010 notes that:

"the most likely reason for the detected decline in forest extent is the extended drought across much of Australia since 2000, which has resulted in a double loss: a decline in forest regrowth along with a decline in tree foliage from water stress. It is unclear at this stage whether the climatic-induced reduction is a temporary or permanent loss of forest. Since 2000 there have been a number of highintensity mega fires, especially in Australia's open forests – the long term effect on Australia's forest extent as a result of these fires is, as yet, unclear."

However, the report also notes that land clearing in 2006 totalled 378 300 hectares. A significant proportion of this forest loss results from conversion of dry woodlands on private lands in Southwest Queensland. These areas were previously uneconomic to farm; but new technologies, new varieties of grasses and cattle, and new export markets suddenly made it commercially attractive to convert these lands to pasture.

Sources: FAO (2010b) and FAO (2010c).

An important issue in assessing overall changes in forest area relates to the definition of forest plantations. A broad definition in some countries has led to the inclusion of rubber and coconut as forest plantations. Consequently, conversion of natural forests to these crops is not accounted as a reduction in total national forest area; although, obviously, functions fulfilled by these plantations are different from the natural forests they have replaced.

Forest clearance for agriculture remains the most important cause of deforestation in most of the Asia-Pacific region (**Figure 2.5**). However, there has been a change in the nature of agricultural expansion. In the past smallholder cultivation, especially swidden, has been an important cause of deforestation; however, economic and demographic changes have led to a decline in such cultivation. On the other hand, expansion of industrial agricultural crops – for example, rubber and oil-palm – has become a major cause of forest clearance, especially in some of the Southeast Asian and South Pacific countries including Cambodia, Indonesia, Lao PDR, Myanmar and PNG. Most often large-scale investments in industrial crops are driven by demand from external markets, in particular emerging economies.

In Southeast Asia the primary reason for forest conversion is the establishment of cash crop plantations and agriculture, which in recent years has had a stronger impact on forest cover than logging. Forests in countries adjoining rapidly expanding economies are particularly vulnerable to deforestation, as is the case in Cambodia and Lao PDR. The rapid expansion of infrastructure, especially roads in the Greater Mekong subregion under various economic development corridor initiatives, will increase the value of land, potentially triggering forest clearance for more remunerative uses. Recent trends of large-scale cultivation of land for agriculture and biofuel crops (including through overseas acquisitions as in the case of a number of countries for example, Cambodia, Philippines and Lao PDR) could also have significant negative impacts on forests. As the demand for food, fibre and fuel increases in the region, forests in some Southeast Asian and Pacific countries will become more vulnerable to change. Strengthening environmental regulations and their effective implementation will remain a major challenge.



Figure 2.5. Direct causes of forest area changes (Asia only), 1990-2000 Source: FAO (2001a).

Forest degradation and declining health and vitality

Forest degradation remains a major, but less visible (than deforestation) problem, especially in densely populated countries. The definition of forests, primarily based on canopy cover and tree height, fails to capture data on the gradual process of degradation. Currently there is no globally agreed operational definition for forest degradation (RECOFTC 2009b). The adoption of a definition of forests based on canopy cover in excess of 10 percent often includes severely degraded open woodlands. Changes in forest condition and quality – down to this cut off point – remain unidentifiable in national forest statistics (**Figure 2.6**). Changes in the growing stock per hectare may provide some indication of forest degradation, provided forest inventories are undertaken periodically. However, forest inventories are sporadic, incomplete, or extremely dated in many countries. The Global Forest Resources Assessment 2005 suggests a decline in the per hectare growing stock in a number of countries in the region (**Table 2.3**). However, since estimation of growing stock is based on commercial timber volume, this provides at best a partial picture of degradation.



Figure 2.6. Changes in crown cover and forest degradation (representations of 70, 40, 20 and 10 percent canopy cover – all are 'forest' under the FAO definition) Source: FAO (2010c).

|--|

Change in growing stock/hectare/year	Countries	Remarks
Significant increase (more than +1.0 m ³)	Bhutan, Japan, Republic of Korea (ROK), Malaysia	Japan and ROK registered annual increases in growing stock at rates of 3.19 m ³ and 3.10 m ³ respectively
Stable or slight increase (0 to +1.0 m ³)	India, Myanmar, DPRK, Philippines	
Decline (-1.0 m ³ to 0)	Bangladesh, Cambodia, Mongolia, Pakistan, Sri Lanka, Viet Nam, PNG	
Severe decline (more than -1.0 m ³)	Indonesia	Some of the decline of per hectare growing stock could be due to methodological problems in growing stock assessment especially inconsistent approaches

Source: FAO (2006a).

Several human and natural factors are contributing to declines in health and vitality and the degradation of forests in the region. Fire has been a major factor contributing to forest loss and degradation. Most fires are human-induced and fire is a major tool for forest clearance in many countries. The increasing frequency of El Niño events over recent decades, along with prolonged dry periods, compound the problem and enhance the severity of forest fires. Since 1997/1998, when fires swept across large areas of Australia, China, Indonesia, Malaysia and PNG, responses to the threat of fire have been limited and the sources of problems have, in many cases, remained untackled. As such, the ability to manage fires has not improved significantly in most countries.

Logging has also had significant impacts on forest health and vitality in the region in view of the generally low quality of harvesting operations. Associated degradation has in many cases reduced the present and future value of forests and along with other influences may negatively affect the future economic and ecological viability of the region's forests. In general, reduced impact logging is not widely practiced in the region despite efforts to introduce better practices.

Incidence of pests and diseases, some of them highly invasive, has been another factor contributing to forest degradation and loss of productivity. Despite significant improvements in the science of pest and disease management, the application of knowledge lags far behind, although a variety of initiatives are seeking to address this (**Box 2.5**). In addition, new problems are cropping up. Especially in the context of climate change, the potential for the emergence of invasive pests is substantial. Pests and diseases will remain a major concern in managing planted forests.

Box 2.5 Asia-Pacific Forest Invasive Species Network

The Asia-Pacific Forest Invasive Species Network (APFISN) was established in 2004 as a response to the immense costs and dangers posed by invasive species to the sustainable management of forests in the Asia-Pacific region. APFISN is a cooperative alliance of the 33 member countries of the Asia-Pacific Forestry Commission. The network focuses on intercountry cooperation to help detect, prevent, monitor, eradicate and control forest invasive species in the Asia-Pacific region. Specific objectives of the network include:

- Raising awareness of FIS throughout the Asia-Pacific region;
- Defining and developing organizational structures;
- Building capacity within member countries;
- Developing and sharing databases and information.

Trees outside forests

A wide array of farming systems exists in Asia and the Pacific; in several of these annual and seasonal crops are well-integrated with tree crops. Traditional home gardens and tree planting under agroforestry systems form an important source of industrial roundwood and woodfuel. In addition, cash crop plantations, notably coconut and rubber, produce substantial quantities of wood. Examples of trees outside forests becoming important sources of wood supply include:

 Traditional home gardens. Home gardens consisting of a mixture of trees and annual and seasonal crops are widespread in several countries, especially in the moist tropical belt. High species diversity is a general feature of many home gardens. Home garden management is extremely flexible and largely depends on the social and economic conditions of a household, in particular, the degree of dependence on land as a means of livelihood. Intensively managed home gardens often incorporate only a limited number of tree species. As dependence on land as a source of income declines, many landowners reduce cropping intensities, allowing more space for tree growth. In several countries – for example, Bangladesh, Indonesia, parts of India, Malaysia and Sri Lanka – home gardens form an important source of wood supply. In many cases, the numbers of home gardens and the stocks of timber therein are increasing.

• Farm tree planting. During the past three decades, there has been a significant expansion in systematic tree growing on farms in several countries in the Asia-Pacific region. Some of the early social forestry initiatives (for example in India) involved provision of technical support to farmers to grow trees in strips or blocks on farms and this practice has expanded in recent years, significantly increasing wood supplies. Realizing the potential of farm plantings, wood industries in a number of countries (for example India and Thailand) are sourcing supplies from farmers under outgrower schemes (Box 2.6 and Box 2.7).

Box 2.6 Farm forestry in Haryana, India

The Indian state of Haryana is primarily an agricultural region focused on irrigated cultivation of wheat and rice. With low forest cover (3.5 percent of the land area), the state relied heavily on wood imports from adjoining states, especially the forested state of Himachal Pradesh. In the 1970s, the Haryana Forest Department commenced introduction of eucalyptus and poplar-based agroforestry models that have been widely adopted by farmers on account of their profitability. Farms in Haryana now supply wood to 600 veneer mills in Haryana and adjoining states, with 300 mills in the town of Yamunanagar alone. Tree growing on farms has led to an increase in forested area – 8 percent of the land in Haryana is now forested – and has significantly reduced pressure on natural forests.

Source: Bhojvaid (2009).

Box 2.7 Contract tree farming in Thailand

Contract tree farming has become critical for major pulp companies in Thailand to ensure secure supplies of raw material. The three largest firms, Advance Agro, Phoenix Pulp and Paper and Siam Forestry, collectively have more than 230 000 hectares of eucalypt plantations under contract farming. Contracts for tree farming specify what is to be produced, how trees are to be grown and outline commitments for future sale, including prices. The company often provides improved planting materials and technical advice on management practices and agrees to buy wood at the end of the rotation. Farmers take full responsibility for management, including protection from fire, pests and diseases. Contract tree farming is partly an outcome of declining profitability of agriculture, especially on marginal lands.

Source: Boulay (2010).

 Plantation crops such as rubber and coconut have become important sources of wood supplies. While latex production remains the primary objective of rubber plantations, developments in rubberwood utilization technologies have created new end uses – for example, furniture and medium density fibreboard – significantly enhancing incomes for growers. Similarly, coconutwood is an important construction material in a number of Asia-Pacific countries (**Box 2.8**).

Box 2.8 Coconut plan

Coconut plantations in Asia and the Pacific

The total extent of coconut plantations in the Asia-Pacific region is estimated at approximately 10.3 million hectares, accounting for about 87 percent of the global area of coconut plantations. India, Indonesia and the Philippines have the largest areas of coconut, collectively accounting for about 9 million hectares. Coconut is a multipurpose species, with uses for virtually every part of the palm. The stem (trunk) is used in construction, substituting for wooden poles and beams, with fronds used as a roofing material. In addition to furniture and handicrafts, the husk is used for making ropes, mats and mattresses. A recent product innovation is coconut-fibre cement board using coconut coir, leaf fronds, spathes and shredded coconut wood. Coconutwood and shells are also an important source of domestic energy.

Source: Arancon (2009).

A number of factors have contributed to the increase in tree growing on farms:

- In several countries, the profitability of agriculture is declining on account of increases in input costs (for example, wages) and competition from higher productivity countries. This is encouraging a shift to less labour-intensive tree crops; especially on low productivity marginal lands. Financial and technical support from wood industries (for example, in China, India, Lao PDR, the Philippines and Thailand) or from government-funded agroforestry and social forestry programmes (India, Philippines) has provided further impetus to tree cultivation.
- Favourable policy and legal environments, especially increased security of land tenure and amendments to rules and regulations that earlier discouraged farm tree planting.
- A number of farmers have taken up tree planting as a risk-minimization strategy.
- Increases in the demand for wood, declining supplies and consequent higher prices.

Expansion of trees outside forests has important implications on policies and legislation and for the support systems that tree growers may require. Invariably, removal of various constraints, especially active disincentives, will be critical in encouraging tree farm cultivation, although provision of direct and indirect incentives is still utilized in some cases.

FOREST MANAGEMENT

Primary forests account for 19 percent of the forest area in the Asia-Pacific region, while modified natural forests account for about 65 percent of forests (**Figure 2.7**), reflecting the intense human pressure. Since 1990, the extent of primary forests has declined significantly (**Figure 2.8**).

Planted forests account for 16 percent of the forest area and focus primarily on production of wood and non-wood products. The proportion of forests managed intensively in Asia and the Pacific is more than double the world average, reflecting a long tradition of forest management and afforestation in the region.



Figure 2.7. Characteristics of Asia-Pacific forests (degree of human intervention) Source: FAO (2010b).



Figure 2.8. Trends in forest characteristics, 1990-2010 Source: FAO (2010b).

Despite a thrust on multiple-use management, problems in determining the trade-offs between competing uses persist – especially between wood production and provision of ecosystem services. Thirty-two percent of the forest area of the region is managed primarily for production of wood and non-wood products. Multiple-use management is adopted in a further 20 percent of the forest area (FAO 2010b).

Management of natural forests for wood production

Natural forests in the region differ considerably in species composition, growing stock, regeneration status and accessibility. Broadly they can be grouped as protection forests or production forests, primarily based on legislative protection and the feasibility of commercial logging. Relatively easily accessible areas with a high proportion of marketable species are more likely to be managed for wood production. Although the dependence on natural forests as a source of wood supply is declining, they remain important for several countries for revenue generation. Notwithstanding a long history of sustained yield forest management, the extent of natural forests managed sustainably remains very low (**Box 2.9**).

Box 2.9 State of forest management in ITTO producer member countries in Asia and the Pacific

The International Tropical Timber Organization's (ITTO) ten largest producer countries in Asia and the Pacific collectively have a total forest area of 204 million hectares. Of this, 97 million hectares are productive natural forests. Although 69 million hectares have been allocated for concessions, only 55 million hectares have any formal management plan. The extent of sustainably managed forests is estimated to be about 14.4 million hectares, most of which are in India, Indonesia and Malaysia. In the ITTO estimate, forests are assessed to be sustainably managed if they:

- Have been independently certified or progress towards certification is being made.
- Have fully developed long-term (ten years or more) forest management plans with firm information that these plans are being implemented effectively.
- Are considered as model forest units in the country and information is available on the quality of management. And/or
- Are community-based units with secure tenure for which the quality of management is known to be of a high standard.

The extent of forest area certified as sustainably managed in the ITTO Asia-Pacific producer countries is about 5 million hectares, most of which are in Malaysia.

Source: ITTO (2006).

In general, three approaches are observed in utilization of natural forests, each with differing impacts on production of wood and provision of ecosystem services:

- Intensive logging, giving very little attention to the long-term sustainability of wood production and provision of ecosystem services.
- Sustained yield management, adopting a selective felling system (or variants) aiming to balance production and protection objectives.
- Outright bans on logging in response to growing demand for ecosystem services.

Additionally, forest areas that are remote and cannot be logged economically are often left without management for any purpose.

Logging is seen as an important source of income for some low-income forest-rich countries. However, severe policy and institutional constraints facing some of these countries result in substantial leakages of income through illegal logging and corruption. Undefined or overlapping property rights, weak governance (largely due to weak policies and institutions) and high demand for wood and wood products have contributed to unsustainable logging and several countries are facing, or have already suffered, sharp declines in wood production (**Box 2.10**).

Box 2.10 Logging in the Solomon Islands

Forest harvesting in the Solomon Islands remains highly controversial. Logging practices have been criticized as being wantonly destructive with 'high grading' and with little regard for the residual forest and wider environmental implications. Log harvests have far exceeded the sustainable capacity. For example, while the annual allowable cut is estimated as about 220 000 m³, the actual harvest exceeded 1 million m³ in 2004. In 2007, log exports were 1 446 000 m³. Most projections suggest that the merchantable forests in the Solomon Islands will be gone in less than a decade. In recent times the forest industry has generated around 20 percent of government revenue and often more than half of export revenues. Thus, there are enormous economic pressures to continue logging, regardless of the long-term implications.

Source: Pauku (2009).

The Philippines was a classic case of large-scale logging which, in the 1960s and 1970s, led to a near total depletion of timber, transforming the country from a major wood exporter to an importer. Cambodia, Indonesia and Myanmar appear to be following a similar pattern. In 2002, in response to uncontrolled felling, Cambodia suspended all logging concessions and required concession holders to prepare strategic forest management plans as a prerequisite to resumption of logging. However, hitherto no such plans have been prepared. To some extent, suspension of concessions has increased illegal logging (ITTO 2006). In Indonesia, decentralization of forest management in 1999 is reported to have accentuated unsustainable logging as local bodies with limited institutional capacity focused on increasing incomes. This was the justification for a reversal of decentralization in 2002 (Barr *et al.* 2006).

Criteria and indicators for sustainable forest management

There have been several initiatives to develop criteria and indicators for sustainable forest management, broadening the traditional concept of sustained yield management:

- Development of criteria and indicators for groups of countries. Within the Asia-Pacific region, two processes are well established. ITTO pioneered the development of criteria for sustainable forest management, with its member countries endorsing ITTO Criteria for Sustainable Tropical Forest Management in 1992. Also in the region, a number of countries are participants in the Montreal Process Working Group on Criteria and Indicators for the Conservation and Sustainable Management of Temperate and Boreal Forests. Additionally, in 2000, ASEAN published Regional criteria and indicators for sustainable management of natural tropical forests for its member countries.
- National initiatives. Several tropical countries are utilizing ITTO criteria and guidelines as a framework to develop national criteria and indicators. For example, Malaysia has developed its own set of criteria and indicators. Similarly, Australia has developed and is implementing a nationally agreed framework of regional (subnational) criteria and indicators based on the Montreal Process structure. The framework provides a coordinated approach for collecting data on forests that facilitates consistent reporting and minimizes duplication.
- Criteria and indicators for specific forest types. There have also been efforts to develop criteria and indicators for forest ecosystems outside the moist tropical, and temperate and boreal classifications, for example, in dry forests. A process culminating in a 1999 meeting in Bhopal, India, involved FAO, UNEP, ITTO, the USDA Forest Service and the Indian Institute of Forest Management (IIFM) and resulted in the identification of eight criteria and 49 indicators with particular relevance for dry forests. Guidelines have been drafted for monitoring criteria and indicators in dry forests of Asia.

A number of countries have also developed and adopted codes of practice for forest harvesting, largely drawing upon the regional Code of Practice for Forest Harvesting in Asia-Pacific developed by the Asia-Pacific Forestry Commission (**Table 2.4**). The Association of Southeast Asian Nations (ASEAN) Senior Officials on Forestry endorsed this code in 2001 as a guide to developing specific national codes and guidelines.

However, notwithstanding a multitude of initiatives, the extent of forests managed sustainably remains low; largely on account of policy, institutional and financial constraints. Implementation of national codes continues to face a number of constraints, which include:

- Some national codes are not accepted or implemented by all stakeholders, especially forest concessionaires.
- Inflexibility in some codes and difficulties in adapting them to local conditions.
- Political instability, weak law enforcement, illegal logging and trade and increased demand for wood by industries (FAO and ASEAN 2006).

StatusCountriesCode of Practice establishedAustralia, Fiji, New Zealand, PNG, Samoa, Solomon Islands (revised
in 2002), Vanuatu, Cambodia, Indonesia, Lao PDR (2005), Malaysia
(guidelines), Mongolia, Myanmar, (2000), JapanCode of Practice under
developmentBhutan, Sri Lanka, China, Viet Nam (nearly complete)Code of Practice plannedBangladesh, India, Nepal, Pakistan, ROK

Philippines, Thailand

Table 2.4. National codes of practice: development status

Sources: APFC (2000); FAO and ASEAN (2006).

Reduced impact logging

Logging minimal or suspended

During the last two decades there have been a number of national and international initiatives to promote reduced impact logging (RIL) (**Box 2.11**). Although RIL is economically viable in the long term, its adoption is very limited. Conventional logging is easier and commercially more profitable in the short term; hence, most concession holders and logging crews are less willing to adopt RIL. It requires substantial investments in planning, including training of logging crews. In particular subcontracting various tasks, with maximizing short-term profits as the main consideration, usually discourages the adoption of RIL.

Box 2.11 Reduced impact logging

RIL aims to minimize damage to residual growth as well as other environmental damage and thus improves the pace of recovery after harvesting. RIL substantially reduces wastage of wood and improves recovery. Consequently, RIL reduces carbon emissions in comparison with conventional logging. A number of organizations, including FAO, are involved in promoting RIL in the Asia-Pacific region. ITTO, for example, has financed projects in Sarawak, Malaysia and East Kalimantan, Indonesia. ITTO is also implementing a project to establish a logging school to facilitate the adoption of RIL in the Asia-Pacific region. The activities of the Tropical Forest Foundation (TFF) include collection and dissemination of information, organizing training programmes and development of guidelines, training materials and technical manuals in support of RIL.

Capacity building and institutional strengthening in relation to forest harvesting are necessary across the region although even with improvements, the legacy of high impact logging in the past is likely to curtail the economic viability of future sustainable production in some countries. This is particularly likely in forest types where stocking densities are low or where commercial species are scarcer or disproportionately affected by logging. In many cases forest restoration efforts are necessary to bring secondary forests back to full productive capacity.

Certification

Certification aims to create a separate market for products from sustainably managed areas, providing an incentive to move away from unsustainable production. However, obtaining certification often entails significant costs to fulfill the stipulated criteria for sustainable forest management, as well as the costs associated with third party verification. While certification enhances market access, to date, price premiums have not been commensurate with the additional costs involved. For countries applying only rudimentary formal management to their forests, reaching a level that will make them eligible for certification will require significant changes in management practices entailing substantial expenditure and, often, significant reductions in volumes of wood extracted and potential revenues.

Consequently, the extent of adoption of certification remains extremely low. The Asia-Pacific region has about 5 percent of the 306 million hectares of certified forests in the world, mainly in Australia, New Zealand, Malaysia and Indonesia (ITTO 2008). Two principal international programmes for certifying sustainable forest management are operational in the region. These are the Forest Stewardship Council (FSC) system and the Programme for Endorsement of Forest Certification (PEFC). In addition, several countries have developed their own certification systems, often drawing on the principles outlined by the FSC and PEFC. The most notable of these national certification systems are those of Indonesia, Malaysia, Myanmar, New Zealand and Australia (**Box 2.12**).

In 2008, 4.4 million hectares of forest were certified under the Forest Stewardship Council (FSC) scheme in the Asia-Pacific region (**Figure 2.9**). The area is divided relatively evenly between natural forests (28 percent), semi-natural and mixed plantation and natural forest (34 percent) and plantation forest (37 percent). Sixty-nine percent of the total area is divided between three countries: China, New Zealand and Indonesia. Smaller areas exist in Australia, Japan and Malaysia. Growth rates in areas certified have been high in recent years in China and Indonesia, whereas in the Pacific, rates of increase have been much lower and in South Asia the area certified remains negligible.



Figure 2.9. Area of FSC-certified forest in Asia-Pacific subregions

Box 2.12 National certification systems in Asia and the Pacific

In addition to the various international certification systems, a number of countries have developed their own national certification systems. Lembaga Ekolabel Indonesia (LEI) was established in 1998, with the main objective of ensuring sustainable natural resources and environmental management by applying a credible ecolabelling system. Malaysia has established the Malaysian Timber Certification Council (MTCC), which has developed a set of national criteria and indicators based on the ITTO framework. MTCC is responsible for planning and operating a voluntary certification scheme. In Myanmar, a Timber Certification Committee is in the process of developing a National Certification Scheme. India is also in the process of developing a system for certification. New Zealand is developing a Verification of Environmental Performance report card system for plantation forests. Commonwealth and state governments in Australia have launched an Australian Forestry Standard that will allow forest products to be independently certified.

Bans on logging natural forests

Several countries have opted for partial or total bans on wood production from natural forests, largely for environmental reasons (**Box 2.13**).

Box 2.13	Effectiveness of logging bans in natural forests in the Asia-Pacific region				
The Asia-Pacific Forestry Commission conducted an in-depth assessment of the impact and efficacy of logging bans, drawing upon the experiences of six countries; namely China, New Zealand, Philippines, Sri Lanka, Thailand and Viet Nam. Important conclusions of the study include:					
1. Log policy	ging bans are neither inherently good nor bad as natural forest conservation and protection instruments.				
2. If b instrun contrib	ans are adopted selectively and used in combination with other complementary policy nents, they can help ensure that natural forests will be sustained and will continue to pute to enhancing the well-being of the people of the region.				
3. Ineffective implementation of logging bans has often contributed to further deforestation and degradation through the lack of enforcement and control, and through the inadvertent creation of perverse incentives and impacts. Such unanticipated impacts and perverse incentives have arisen both within the country imposing harvesting restrictions, as well as in neighbouring countries or among emerging timber exporters as far away as Africa or South America.					
There of fore increas	are also instances where declining incomes due to logging bans have led to the neglect st management, exposing forests to a wide array of risks, including illicit felling as well as sed incidence of problems like forest fires.				
Source: FAO	(2001b).				

Often natural calamities, such as floods and landslides have triggered such actions (for example, in China and Thailand). Even in countries where natural forests remain important sources of wood supply, large portions of forests have been excluded from wood production, giving them protected status. Factors that have enabled a reduction in the dependence on natural forests as a source of wood supply include:

- Diversification of sources of income and forests becoming less important in national economies;
- Scope for wood imports at relatively lower prices; and
- Increased wood supply from forest plantations and trees outside forests.

Several countries in the Asia-Pacific region have significantly reduced their dependence on natural forests as a source of wood supply. For example, New Zealand obtains almost all of its wood supply from plantations and all natural forests are set aside exclusively for provision of ecosystem services. In the case of Sri Lanka, no logging is allowed in natural forests. Partial or total bans on logging exist in other countries, including China, India, Pakistan, Philippines, Thailand and Viet Nam.

Regeneration and future management of natural forests

In most cases, logged-over natural forests are left to regenerate naturally. Natural regeneration depends on postlogging conditions, especially the presence of seedlings or potential for seeding from the trees retained and, more importantly, the soil, moisture and light conditions. Studies in ecology and management have provided a wealth of information on the treatment of logged-over areas. Assisted natural regeneration – including planting of preferred species in gaps and lines, weeding, climber cutting and other tending operations – has been attempted in a number of countries (for example India and Malaysia). However, this has been largely abandoned in most countries, especially in the context of the shift to wood production from plantations and logging bans in natural forests. Costs of ensuring regeneration have been extremely high, especially in forests that have been opened up substantially on account of high intensity logging. Vast stretches

of forests have been converted into *Imperata* grasslands on account of logging, followed by anthropic disturbances such as fire. Reconversion of these areas into forest is achievable through fire prevention and tending activities, but has not so far become widespread in the region.

As management of natural forests has become technically and economically more challenging, wood production has shifted towards planted forests.

Planted forests

With a total extent of 120 million hectares, or about 45 percent of global planted forests (**Box 2.14**), the Asia-Pacific region is in the forefront of plantation forestry.

Box 2.14 Definition of planted forests

Planted forests encompass the planted components of semi-natural forests, established through planting, seeding and coppice in addition to forest plantations of native and introduced species established through planting or seeding for production of wood and non-wood forest products and provision of ecosystem services.

Source: FAO (2006c).

The annual growth rate in area of planted forests in the Asia-Pacific region during the period 2005 to 2010 has been 2.2 percent, significantly higher than the global rate of growth (**Table 2.5**). Some of the key features of planted forests in the Asia-Pacific region are outlined below

	Exte	ent of plan (million he	ited fores ectares)	Annual change (%)			
	1990	2000	2005	2010	1990- 2000	2000- 2005	2005- 2010
Asia-Pacific	68.8	90.6	107.5	119.9	2.79	3.50	2.20
World	171.3	214.6	243.0	264.0	2.28	2.51	1.67
Asia-Pacific proportion of global total (%)	40.2	42.2	44.3	45.4			

Table 2.5. Planted forest area change in the Asia-Pacific region (million hectares)

Source: FAO (2010b).

A few countries – namely China, Viet Nam, Thailand, India, Indonesia, Japan and Australia – account for most of the region's plantations and most of the annual planting. However, China is by far the dominant force in planted forests. In 2010, China accounted for 64 percent of planted forests in the Asia-Pacific region and, over the preceding five years, 80 percent of the regional expansion in planted forests was in China. China's rapid expansion of plantations is based on highly focused, state-supported programmes (Box 2.15).

In the late 1990s, China started the Six Key Forestry Programmes (SKFP) to promote afforestation. The six programmes are:

- (i) National Forest Protection Programme (NFPP);
- (ii) Conversion of Cropland to Forest and Grass Programme (CCTF);
- (iii) Combating Sandification around Beijing and Tianjin Programme (CSPABT);
- (iv) Key Regions' Shelter Forest Programme (SFP), which is a combination of the fourth stage of the Three North Shelter Forests (TNSF) and the SFP along the Yangtze and other Key Rivers (SFAKR);
- (v) Wildlife Protection and Nature Reserves Programme (WPNRP); and
- (vi) Programme for Fast-Growing and High-Yielding Forest in Key Areas (FGHYFP).

The six programmes commenced as individual programmes in 1998, and were reorganized into SKFP during the 10th Five-Year Plan. Although the initial purposes of SKFP, with the exception of FGHYFP, were to protect natural forests, address water and soil erosion problems and protect wildlife and endangered species, all the programmes used afforestation as their main thrust, backed by a number of supporting policies and activities. Including areas planted and naturally regenerated, the total area afforested under the SKFP, to 2005, was 58 million hectares, with a total expenditure of US\$22 billion.

Source: SFA (2009).

 Most of the early efforts in forest plantation establishment focused on slow growing, long rotation species (Box 2.16), aimed to produce saw and veneer logs. Since 1980, and more so in most recent times, there has been a significant shift to short rotation fastgrowing species, mainly intended to produce pulp and other fibre products. Changes in wood-processing technologies enabling the use of small dimension logs have particularly influenced the choice of species and management practices, including rotation age.

Box 2.16 Main species planted

Information collected from ten countries in the Asia-Pacific region as part of FAO's assessment of global planted forests suggests that a small number of species account for most of the planted forests in the region:

- In China, the most important species for plantation forestry are *Cunninghamia lanceolata, Castanea molissima* and *Eucalyptus* spp.
- In India, the most widely planted species are *Tectona grandis, Eucalyptus spp, Shorea robusta, Dalbergia sissoo, Pinus roxburghii, Acacia nilotica* and *Acacia mangium.*
- *Tectona grandis* remains the most important plantation species for Indonesia and Myanmar; *Pinus merkusii* is another widely planted species in Indonesia.
- Viet Nam's plantation programme is largely focused on *Acacia* and *Eucalyptus* species. In addition, a wide variety of species are used in establishing planted forests for protective functions.
- *Pinus radiata* and *Eucalyptus globulus* account for almost three-fourths of the planted forests in the Pacific.

Source: FAO (2006c).

Historically, most plantations were under public ownership and management. However, this
is changing in view of the increasing involvement of corporate investors, local communities
and smallholders. In particular, there was a significant expansion of the area of planted
forests under smallholder ownership between 1990 and 2005 (Figure 2.10), with East Asia
accounting for a large part of the increase.



Figure 2.10. Changes in planted forest ownership in Asia and the Pacific Source: FAO (2006c).

 Stagnation in planted forest area under public sector management is indicative of larger institutional and environmental challenges. The replacement of natural forests with plantations is slowing down in view of an increasing emphasis on environmental protection. Future expansion of plantations will be largely driven by the private sector, including smallholders; with commercial viability being a major consideration.

In almost all Asia-Pacific countries, governments have provided various incentives to promote forest plantations (**Table 2.6**). While direct incentives provide some impetus in the early stages of plantation development, as the pace of plantation development matures and accelerates, enabling incentives – especially removal of constraints – are more important.

Table 2.6. Plantation development and incentives (reported examples)

Country/ state	State plant- ing	Low- cost seed- ling	Land grants	Nurs- ery sub- si- dies	Sur- vival in- cen- tives	Grants to grow- ers	Con- ces- sion- ary loans	Tax con- ces- sions	Joint venture arrange- ments	Re- search and exten- sion	Re- source secu- rity	Focus on enabling incentives and removal of structural constraints
Australia	Х						Х	Х	Х	Х	Х	High
China	Х	Х	Х			х	Х			Х	Х	Medium
India	Х	Х	Х	Х	Х	Х	Х		Х	Х		Low
Indonesia	Х					х	Х	Х	Х	Х		Low
N. Zealand	Х	Х	Х			Х	Х	Х		Х	Х	High
Philippines	Х		Х				Х	Х		Х		Low
Sabah	Х							Х		Х		Medium
Thailand	Х	Х				Х	х			Х		Low

Source: Enters and Durst (2004).

Rehabilitation of degraded areas has received considerable attention in many countries. The Global Assessment of Soil Degradation (GLASOD) estimated that about 13 percent of the land in Asia and

the Pacific is degraded – most of this is in Asia, but 104 million hectares were estimated to be degraded in the Pacific subregion, where large-scale clearance of forest land has caused a decline in soil structure and fertility (UNEP 2003). There are also degraded forest lands, which include areas where forests have been substantially damaged and debased, as well as lands on which forests have been cleared, but remain legally classified as 'forest lands'. For example, intensive logging, shifting cultivation and more particularly the incidence of fire have led to the creation of vast tracts of Imperata grasslands, especially in Southeast Asia (**Box 2.1**7).

Box 2.17 Rehabilitation of *Imperata* grasslands in Indonesia

Indonesia has about 97 million hectares of degraded forest lands due primarily to forest conversion, unmanaged agricultural expansion, illegal logging, forest fires and social conflict over forest resources. An estimated 55 million hectares of this area include production forests and conservation and protection forests, while 42 million hectares of degraded forest land are now outside forested areas. *Imperata cylindrica (alang-alang)* grasslands in Indonesia cover at least 8.6 million hectares (although some estimates tally over 20 million hectares) of land, most of which is classified as degraded. The grasslands have spread across previously forested lands as a result of logging and slash-and-burn cultivation and are sustained by regular burning.

Efforts to reforest Indonesia's grasslands have struggled. A primary reason is fire, caused in part by accident as well as by intention; fires may be set to provide cattle fodder, to make room for cultivation or to make hunting easier. Frequent fires maintain *Imperata* grasslands, which would otherwise be succeeded by regenerating trees and shrubs. Human-induced fires are the result of social constraints rather than technical ones, as farmers typically have measures to control burning in their own fields.

In some areas, trees have been planted in efforts to rehabilitate *Imperata* grasslands. However, local farmers have few incentives to protect these plantations. Inadequate communication and cooperation between the government (or the funding body) and local farmers and a lack of secure land tenure mean farmers usually see few benefits in protecting plantations. Most planting projects have also been dependent on donor funding, but local bodies have often been left without adequate resources to continue efforts when the external funding terminates. Most initiatives focus primarily on technical aspects, while institutional arrangements on the ground are inadequately developed, resulting in minimal adoption of techniques by local people. An assessment by CIFOR in 2007 identified the following reasons for ineffectiveness of rehabilitation programmes:

- Targeting of forest resources as the main source of national income.
- Complexity of the direct and indirect causes of deforestation and degradation.
- Regular changes in the policies relating to rehabilitation.
- Project-based approaches that lead to inadequate maintenance of planted trees, lack of funding to sustain the initiatives beyond their project periods and inadequate assessment of economic viability.
- Limited community participation due to unresolved tenure problems and ineffective community organization.

Rates of rehabilitation have lagged behind degradation with the extent of degraded areas doubling since the 1970s.

Sources: Nawir and Murniati (2007); Dalfelt et al. (1996).

Management of forests for environmental protection

In almost all countries there has been a shift in management de-emphasizing wood production, with greater thrust on the provision of ecosystem services. Natural forests are withdrawn from wood production and logging banned in response to natural calamities like flooding and landslides. Most countries have enacted legislation protecting fauna and flora, with considerable thrust on the establishment of protected areas. Conversion of forests into non-forestry activities is discouraged through legislation and, in many countries, development projects have to secure specific environmental clearances that require *ex-ante* environmental impact assessments.

The extent of protected areas varies among the Asia-Pacific subregions (**Table 2.7**). Major efforts to establish protected areas were made following the Earth Summit in Rio in 1992 and their extent in the Asia-Pacific region increased relatively continuously until 2002. In recent years the area has stabilized (**Figure 2.11**) suggesting limited scope for further expansion, especially in view of high population densities and continuing population growth.

Subregion/countries	Land area (%)
Australia and New Zealand	9.6
East Asia	8.5
Pacific	2.1
South Asia	6.8
Southeast Asia	14.8

Table 2.7. Extent of terrestrial protected area in Asia and the Pacific

Source: IUCN (2003).

Management of forests for the provision of ecosystem services suffers from a range of challenges – especially when the focus on ecosystem services is a significant change from the previous forest use – including illegal logging, ongoing deforestation and degradation and poaching of animals and plants. With the public sector playing a dominant role, the thrust of protected area management has been on enforcement of legislation to: (a) prevent conversion of forests to alternative uses; and (b) protect fauna and flora from poaching and other illegal activities.



Figure 2.11. Protected area in Asia and the Pacific, 1990-2007 Source: UN (2008b).

Box 2.18 Protected areas and investment in the lower Mekong countries

Protected area systems have expanded rapidly in the lower Mekong countries. Including locally and provincially managed areas, they cover close to a fifth of the total land area in Cambodia, Lao PDR and Thailand (see table). Protected areas are mostly located in forested uplands and have expanded from virtually none over the past three decades. Estimates suggest that by 2005, around 53 percent of natural forests in the lower Mekong countries were within protected areas.

Forests and protected areas in the lower Mekong Basin (2003)

	Cambodia	Lao PDR	Thailand	Viet Nam
Protected areas as a % of land area	21%	21%	19%	8%
Estimate of forests in existing and proposed protected areas as a % of total forest	40%	39%	65%	26%

In general, domestic investment in protected areas, especially relating to recurrent costs associated with staff and maintenance, has increased as new areas have been established. Overseas funding increased rapidly between 1990 and 2000, but fell off subsequently.

Despite their extent, limited capacity and relaxed enforcement at the community level means that most protected areas in the lower Mekong Basin are multiple-use areas. The collection of non-wood forest products is eroding biodiversity values and most of the main trade routes from Lao PDR and Cambodia are directly linked to protected areas. Additionally, encroachment by local communities and commercial interests are reducing the size of protected areas. Despite many small-scale logging infringements within protected areas, and notwithstanding a number of serious exceptions, destruction within protected areas has been less than in surrounding landscapes in the lower Mekong countries.

Source: ICEM (2003).

Throughout the world, consumptive use of biological resources, and predominantly poaching, along with habitat conversion and modification of ecological processes represent serious threats to conservation. The huge demand for wildlife for food, medicine, pets, display and fashion, particularly from China, has led to increased trafficking and many wildlife species with high commercial value are now rare, endangered or locally extinct. The trade not only undermines biodiversity, but also curtails sustainable development and poverty alleviation for those dependent on wildlife for subsistence. This is particularly prevalent in lesser developed areas within the region. Development of roads and infrastructure, expansion of logging and encroachment into pristine areas have increased access to wildlife and levels of extraction have risen markedly in the past decade.

The World Parks Congress in 2003 highlighted concerns that many protected areas exist only on paper, especially in developing nations, and that costs associated with protected areas are often borne locally while benefits accrue globally (IUCN 2003). Global financing for conservation of forests in the humid tropics is particularly necessary given the low level of domestic benefits that are generally available. In the Philippines, for example, forest allocated for biodiversity conservation and forest reserves cover at least 28 percent of the total classified forest land but are poorly supported and only an eighth of legislated protected areas have an annual budget allocation (Guiang and Castillo 2006). Only half of the 430 protected areas have protected areas management boards and most are highly centralized. In Myanmar, 45 protected areas covering over 3.5 million hectares or 5.4 percent of the total land area had been established by 2003. However, only 22 have active management with wardens and staff present (Thaung 2008).

A consistently challenging issue in protected area management is the inclusion of local people in management decisions and aligning livelihood improvement activities with conservation objectives. Surveys have shown that protected area effectiveness declines with the extent to which people have access and that participation of local and indigenous people in management decisions does not necessarily increase the effectiveness of protected area management. It has, nonetheless, become impossible in many areas, and particularly in densely populated subregions such as South Asia, to adhere to the strict principles of traditional protected area management i.e., excluding all human interferences. A shift in approach has therefore come about, especially due to:

- Greater involvement of local communities in managing protected areas through participatory approaches; and
- Fine-tuning management based on research on ecological processes and population behaviour.

There is greater recognition that protected areas cannot function in a vacuum, isolated from the surrounding human-modified ecosystems (Shahabuddin 2009). Increasingly, there are also efforts to adopt landscape approaches, involving integrated management of large tracts of land with a range of diverse land uses including conservation areas. An example of such an approach is the Terai Arc landscape, covering parts of Northern India and the plains in Nepal, where habitats for tiger, rhinoceros and elephant are being conserved in a contiguous territory. By providing an integrated framework, the landscape approach avoids protected areas becoming 'islands' surrounded by land uses that potentially may undermine their existence.

Community conservation areas address human dimensions, ensuring that local communities retain full ownership and control of managing protected areas. Many community conservation areas evolve on the basis of local initiatives, eventually receiving recognition from governments. Community conservation areas include, for example, the sacred groves in several Asia-Pacific countries. Nepal has made significant strides in developing community conservation areas, with the Annapurna Conservation Area and the Kanchenjunga Conservation Area being two notable examples.

Where protected areas generate substantial income through ecotourism, benefit sharing with local communities has helped to improve management. However, for a vast majority of protected areas this type of positive outcome remains elusive. Where local communities are dependent on forests for livelihoods, resource-use conflicts are intensifying. Increasing human populations and shrinking animal habitats are increasing people-animal conflicts (**Box 2.19**).

Box 2.19 Sunderbans: people and tiger conflicts

The Sunderbans is the world's largest inter-tidal area, extending over 26 000 km² spread across Bangladesh and India. The Sunderbans constitute the largest mangrove reserve in the world; but the reserve adjoins populated villages dependent on fishing, collection of honey, collection of wood and other forest uses. This brings communities into direct conflict with tigers; the Sunderbans' tiger population is estimated at about 440. Man-eating tigers have been a major problem in the area, resulting in large numbers of 'tiger-widows'. Since a major cyclone in 2007, the problem has worsened, especially as a large part of the forest was destroyed, forcing tigers to move to areas outside their normal territories. As degradation sets in, the natural prey of tigers is declining, leading to cattle-lifting and man-eating. At the same time, destruction of cultivated areas has increased the livelihood dependency on mangroves for many people, increasing contact with tigers.

Illegal trade in plants and animals (and in particular animal parts) is a major problem facing Asia-Pacific countries. As incomes increase, the demands for medicines and other preparations based on animal parts (for example, from tiger, elephant, rhinoceros, pangolin, and bears) – along with demands for various birds, animals and reptiles as pets – are also on the increase, leading to poaching and illegal trade, impacting severely on rare and endangered species (**Box 2.20**).

Box 2.20 Asian demand driving illegal trade in endangered animals

Income and population increases have led to a significant escalation in demands for animal and plant products. These demands are threatening endangered species within and outside the region. A 2009 Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) standing committee meeting revealed that illegal rhinoceros horn trade to destinations in Asia is the major driver of rhinoceros poaching; most notably in Africa, but also in Asian countries such as India. Rhinoceros poaching has risen to a 15 year high. Similarly, demand for pangolin scales is forcing this endangered species closer to extinction. The pangolin decline comes despite national legislation that bans hunting the species throughout its Southeast Asia range and a CITES prohibition against pangolin trade across borders.

Declining populations and increasing efforts to prevent illegal cross-border trade have driven up prices for many animal products – further stimulating associated organized crime networks. A kilogram of pangolin scales worth 80 yuan (US\$10) in the early 1990s is now priced at 1 200 yuan (US\$175) on the Chinese black market. Inadequate funding, insufficient community-level participation and lack of supportive policies and legislation remain major hurdles in protecting the species and combating illegal trade.

Sources: Block (2009); CITES (2009); ENS (2009); O'Brien (2007).

FOREST POLICIES, LEGISLATION AND INSTITUTIONS

Forest policies, legislation and institutions together determine how forest resources are actually managed; although, in practice, extra-sectoral policies and institutions possibly have greater impacts on forests and forestry. The pace of change in forest policies, legislation and institutions has been extremely varied and often, too slow in responding to the emergence of challenges affecting forest management. Overall trends in policies, legislation and institutions, drawing upon a recent review (Yasmi *et al.* 2010), are outlined below.

Forest policies

Forest policies in the Asia-Pacific region have undergone major changes, involving a shift from timber-focused management to multiple-use management that gives due attention to a wide range of goods and services. In many cases, provision of ecosystem services has become a major thrust. Economic growth, globalization, trade liberalization and UNCED-related attention on sustainable development, have all directly and indirectly influenced forest policies. Some key trends in forest policies include (**Table 2.8**):

- Increased thrust on ecological aspects with provision of ecosystem services gaining primacy.
- Emphasis on increased involvement of stakeholders in forest management, including in forest policy formulation.

A number of internal and external factors have contributed to these changes. Increased pressure from growing populations has undermined the efficacy of traditional approaches to resource management, compelling public sector forestry agencies to involve local communities and other players. Major policy changes have often been made in response to natural disasters, as in the case of logging bans in the context of floods and landslides.

Country	Current policy objectives	Remarks
China (Xiaoqian 2008)	 Improve biodiversity conservation and secure adequate national ecological management Restore key ecosystems Promote sustainable forest management (SFM) Clarify forest land tenure and farmers' rights and responsibilities <i>vis-à-vis</i> forest and forest land management Promote forest industries Strengthen international cooperation 	Forest policies in China show a clear shift from primarily timber production to SFM in recent decades.
India (Rao 2008)	 Maintenance of environmental stability, restoration of ecological balance and soil and water conservation Meeting the needs of local communities through partnerships between forest departments and local communities Achieve a target of 33% of national land area under tree cover Promote partnerships between industries and farmers to produce raw materials 	Forest policies have shifted radically from regulatory to participatory management embracing SFM objectives.
Myanmar (Thaung 2008)	 Protection of soil, water, wildlife, biodiversity and environment Sustainability of forest resources Support basic needs of people Harness economic benefits Participation of people Public awareness of the vital role of the forests in the well-being and socio-economic development of the nation 	Forest policies embody the broader concept of SFM, biodiversity conservation and people participation – both for- est and people-focused
PNG (Hurahura 2008)	 Commercial logging based on SFM principles Conserving natural forest for the benefit of people 	SFM objectives are used as guiding principles

Table 2.8. Examples of current forest policy objectives in the Asia-Pacific region

Source: Yasmi et al. (2010).

Almost all countries in the Asia-Pacific region have adopted sustainable forest management as the main objective of their forest policies, giving due consideration to social, economic and environmental dimensions. Several countries have shifted their orientation from timber production to broader sustainable forest management. In China, for example, one of the main policy objectives is environmental protection and restoration. India, Indonesia and Viet Nam have implemented major reforestation and afforestation projects, focusing on environmental improvement, reflecting a shift in policy objectives (**Table 2.9**). However, establishment of trade-offs between competing objectives remains challenging. In the quest for rapid economic growth, extraction of minerals, energy production and infrastructure development have become major threats to forests; but forest policies seldom provide a robust framework to deal with the changing situation.

Country	Environmental protection/ restoration	Forest plantation expansion	Decentralization & devolution
Cambodia	Low to moderate	High	High
China	High	High	High
India	High	Low	High
Indonesia	High	Low	High
Lao PDR	Moderate	High	High
Malaysia	High	High	Moderate
Myanmar	Low	High	Low
Nepal	High	Low	High
PNG	Low	High	High
Philippines	High	Low	High
Thailand	High	Medium	Moderate
Viet Nam	High	High	High

Table 2.9. Recent priorities of forest policies in selected Asia-Pacific countries

Source: APFSOS II country papers.

Other themes that have been included in forestry policy include forest rehabilitation (particularly in China, Indonesia, the Philippines and Viet Nam), community involvement, poverty reduction, forest law enforcement and governance and tackling of illegal logging and trade. Support for the forest product industry to promote domestic value addition has been another key theme, although at the same time excessive wood-processing capacity has also led to policies promoting industrial rationalization. Logging bans have also been imposed at different stages in a number of countries – more recently including China and Cambodia. In Viet Nam, China and the Philippines granting of land rights to individuals, families and indigenous groups has had a huge influence on the forestry sector. In Viet Nam the forest land allocation policy has been combined with major programmes to increase forest cover, wood product manufacturing and rural incomes through afforestation.

However, in many countries actual implementation of policies based on sustainable forest management has been weak because of field level issues including high demand for forest land and forest resources, limited sources of alternative employment and low human resources capacity. Poor governance and low demand for alternative outcomes, for example greater production of environmental services, has also played a part. Similarly, permanent forest estates have often not been demarcated, agricultural frontiers have continued to advance and uncontrolled logging has often remained widespread.

In addition to forest policies, a plethora of extra-sectoral policies impinge on forests and forestry. Some overlap, for example, policies dealing with biodiversity, climate change mitigation, protection of wildlife and desertification control, all of which transcend traditional sectoral boundaries. To some extent this has fragmented forestry agendas all the more so when several institutions are involved in policy implementation. Often such overlap mirrors the international situation, where almost every new convention also entails the creation of a new institution.

More importantly, policies in other sectors – agriculture, industry, energy, rural development, trade, etc. – heavily influence the forest sector, although these policies are usually primarily directed at issues far outside the forest sector. While there is considerable awareness about the impact of extrasectoral policies on forests and forestry (and vice versa), difficulties persist in resolving intersectoral issues. In the event of conflicting objectives, forest policy objectives are often superseded by other policies that may appear to more directly and immediately affect human welfare.

Legislation

As a policy instrument, legislation provides the legal mandate for policy implementation. One of the main concerns regarding legislation is whether it remains relevant in view of rapidly changing circumstances. Forest legislation is often fairly old in many countries (**Table 2.10**). For example, in India and the Philippines, the base legislation dates back to the early 1900s. Implementing these laws in societies undergoing rapid social, economic and political changes tends to create substantial social tensions. A number of countries are in the process or have recently completed revising their forest legislation.

Countries	Legislation	Year enacted
Cambodia	Forestry Law	2002
China	Forest Law	1970 and revised 2006
India	Indian Forest Act	1927
Indonesia	Basic Forestry Law	1999
Lao PDR	Forest Law	2008 (latest)
Malaysia	National Forest Act	1984 and amended in 1993
Myanmar	Forest Act	1942
Nepal	Forest Act	1993
Philippines	Forestry Act	1904 (Amended 1975 Revised Forestry Reform Code)
PNG	Forestry Act	1992
Thailand	National Forest Act	1941 and amended in 1986
Viet Nam	Forestry Law	1991 and revised in 2004

Table 2.10. Key forestry	/ legislation	in Asia-Pacific
--------------------------	---------------	-----------------

Source: Yasmi et al. (2010).

Invariably one of the primary thrusts of most forest legislation is on defining forest ownership. Who formally owns the forests generally determines – from a legal perspective – who manages the forest. The overall forest ownership pattern in the Asia-Pacific region can be summarized as follows:

In the developed industrialized countries, private ownership is widespread. For example, 24 percent of indigenous forests in Australia is privately owned and another 46 percent is on leasehold land under private management. As regards plantations, there have been significant changes and currently only 37 percent of the plantations is under government ownership. The extent of private forest ownership is about 60 percent in Japan. Ninety-three percent of the 1.8 million hectares of plantations in New Zealand is under private ownership (Box 2.21). Most forests in ROK are also under private ownership.

Box 2.21 Ownership of plantations in Australia and New Zealand

Private ownership of plantations in Australia has increased significantly in the past 15 years, from about 30 percent in 1994 to 59 percent in 2006. During this period, two state governments have sold extensive tracts of plantations. At the same time, significant private sector investments in plantations have been made. A trend towards involvement of Timber Investment Management Organizations (TIMOs) in New Zealand is mirrored in Australia, with about 38 percent of forest plantations in Australia presently owned by TIMOs.

The vast majority of plantations – about 93 percent – in New Zealand are under private ownership, including some Maori (indigenous groups) incorporations. Since 2003, the advent of TIMOs as substantial plantation owners is a major change in the ownership structure. Currently TIMOs own about 40 percent of New Zealand's plantation forests.

- Most forests in particular natural forests in developing countries in Asia are under public ownership, although governments may not have the necessary capacities to fully exercise ownership rights for various reasons (Box 2.22).
- Forests in Pacific Island Countries are primarily under customary community ownership (Box 2.22). Here again, the ability of communities to fully exercise their ownership rights varies depending on local level institutions.

Box 2.22 Forest ownership in South and Southeast Asia

Forest tenure is a key element determining who can use a forest and, consequently, how the forest is used. In 2006, FAO and other partners conducted a survey in 17 countries to assess typology of ownership and levels of control and access to resources. Of the 365 million hectares of forests in the 17 countries studied, at least 92 percent was publicly owned and most of this – about 67 percent – was under direct control of central governments. As regards actual management, 65 percent of publicly owned forests is managed directly and exclusively by central or local governments. Although user rights for home consumption are granted in many (41 percent) of these forests, this category comprises mainly open access, non-protected forests that are often de facto unmanaged owing to lack of government capacity.

Source: FAO (2006b).

Forest ownership in Pacific Island Countries

Landholding in many Pacific countries is largely communal under systems of customary ownership, with some alienated land owned by government or privately owned under freehold titles (see table below). Increasing ownership disputes are a major deterrent to long-term investments and these are particularly severe in resource-rich countries like PNG, Solomon Islands and Vanuatu. However, too often logging companies easily bribe individual chiefs and obtain their approval for timber harvesting. In the absence of community dispute, the loggers move in quickly and ravage the forest with little or no monitoring.

Country	Customary land (%)	Government land (%)	Freehold (%)
Fiji	83	9	8
PNG	97	3	0
Vanuatu	98	2	NA
Solomon Islands	97	3	NA
FSM*	NA	60	40
Kiribati	40	60	NA
Marshall Islands	100	NA	NA
Tonga	NA	100	NA
*Federated States of Mic	ronesia.	~	

Landownership in selected Pacific Island Countries (Siwatibau 2009; PNG Investment Promotion Authority 2010)

Forest ownership has been a contentious issue in many countries in the Asia-Pacific region, especially in the context of contested claims arising from how forest laws, rules and regulations are formulated and who drives such legislation. In several countries, forest reservation has led to the appropriation of traditional rights, undermining the livelihoods of local communities. Often, strict interpretation of the rules and regulations makes collection of woodfuel, grazing, collection of non-wood forest products, etc., illegal. There is increasing recognition of the need for restoration of traditional rights of indigenous and other forest-dependent communities. A number of countries have enacted legislation in this direction (**Box 2.23**).

Box 2.23 Restoration of rights to indigenous communities

Conferring legal rights to traditional landowners has been addressed by a number of countries in the Asia-Pacific region. Many of these have a long history, beginning from a period of colonization and appropriation or termination of community rights over land and forests. Notable legislations that has attempted to enforce or restore indigenous community rights include:

- New Zealand Treaty of Waitangi (1840);
- Malaysia Land Ordinance of Sabah (1930);
- PNG Native Land Registration Ordinance (1952);
- Australia Native Title Act (1993);
- Philippines Indigenous Peoples Rights Act (1997); and
- India Forest Rights Act (2006).

The experience of transfer of forests to indigenous communities varies between countries. One of the most successful efforts has been the transfer of Crown forests to Maori communities in New Zealand. Very recently (July 2009), 176 000 hectares of plantations were transferred to CNI lwi Holdings, owned by the eight iwi that make up the Central and North Island Iwi Collective (iwi are Maori tribal units).

In other countries, the effectiveness of implementation varies and the actual process of availing these rights is fraught with difficulties. India is in the process of implementing a Forest Rights Act (2006). In the Philippines, the Indigenous People's Rights Act (1997) requires prior and informed consent of local communities for logging, even if logging concessions have been awarded prior to the Acts' entry into force. Effective implementation of these types of legislation largely depends on democratic governance, transparency and rule of law. Interventions by civil society organizations have significantly helped in this regard.

Source: Asia Forest Network (2009).

A number of countries have made substantial efforts to change land tenure arrangements and to empower local communities. China and Viet Nam have been in the forefront of such changes. Viet Nam has allocated significant areas of forests and forest land to individuals, communities and the private sector (**Box 2.24**). Public ownership of productive plantations fell from 48 percent in 1990 to 27 percent in 2005, while smallholder ownership rose from 46 percent to 64 percent. The impacts of such tenure changes remain inconclusive and will largely depend on the abilities of landowners (including communities) to manage the resources sustainably.

Box 2.24 The contribution of forest land allocation in Viet Nam to SFM and livelihoods

Land allocation by the state has been in progress in Viet Nam since 1994 and finalization is planned for 2010 (MARD 2007). Previously, forest in Viet Nam belonged exclusively to the state and was managed by state-owned entities but more recently forest has been allocated to households, individuals, communities and the private sector. This has had a range of effects on forest management, income generation and poverty.

In early 2005, there were 1.2 million forest landowners in Viet Nam; almost all were households or individuals. In 2006, 19 percent (1.9 million hectares) of the total natural forest area and 40 percent of plantation forests were owned by households, individuals and the private sector (see figure). By September 2007, more than 8 million hectares of forest land were reported to have been allocated.



In general, private and community rights contribute more to livelihood improvement and, to a lesser extent, poverty alleviation than organizational ownership. Results from a study in Dak Lak and Hoa Binh provinces show that forest land allocation also has a positive effect on forest resources – primarily in sites with donor support (Nguyen *et al.* 2008). In areas of critical environmental importance, state management appears to be more suitable than other tenure arrangements. In less critical protection and production forests, local management may be better suited to reducing poverty and achieving sustainable forest management.

Source: FSIV (2009) except where cited otherwise.

Forestry institutions

The forestry institutional landscape is extremely varied. There has been significant progress towards pluralism, with a wide array of institutions – public sector forestry agencies, private sector firms, community organizations, civil society organizations and international institutions – being involved in forestry and other forest-related issues. The overall trend is towards reducing public sector involvement, thereby increasing the space for other players.

Public sector forestry institutions

Historically, in almost every country, government forestry departments undertook a full range of forestry functions – from wood production to processing and marketing. Government activities also included activities such as policy development, research, education, forest health, training and extension. However, the roles of the public sector are being redefined as more efficient institutions emerge and take over some of these functions, requiring revamping and reinvention of public sector forestry organizations. During the past 20 years, there have been significant changes in the functions and structures of forestry institutions in the Asia-Pacific region, although the direction and pace of such changes differ considerably among countries (**Box 2.25**).

Box 2.25 Reinventing forestry agencies

In 2008, FAO undertook a regional assessment of changes taking place in the functions and structures of forestry institutions, with particular focus on government forestry agencies. The assessment involved nine country studies analysing efforts at institutional restructuring and key outcomes. The study concluded that there is no panacea for institutional restructuring and reform processes, considering that social, economic, physical and political factors are markedly different among the countries in the Asia-Pacific region. To be successful and remain relevant, institutions need to ensure flexibility, strategic management capabilities, strong 'sensory' capacities and an institutional culture that responds to change.

Source: FAO (2008b).

The overall pattern of change as regards public sector forestry agencies can be summarized as follows:

- Where forests are under government ownership, their protection from encroachment, illegal logging, etc. still dominates the functions of many public forestry departments. This is especially the case where land-use pressures are high.
- Management of forests for the production of goods and services is the other main function
 of public forestry departments. However, many departments face difficulties in combining
 policing and management functions in view of the very different skill sets and competencies
 required. Fulfilling management functions, especially in the context of commercial wood
 production, requires considerable operational flexibility. Many public forestry agencies
 operating within the framework of civil services may not have such flexibility. Since
 privatization of forests is often politically unacceptable, one approach has been to establish
 semi-autonomous public sector corporations (Box 2.26). A number of countries have
 pursued this path, but the efficacy and impacts of this option have been at best mixed. In
 many cases, larger governance constraints undermine the effectiveness of public sector
 corporations.

Box 2.26 | Fiji Pine Ltd.

Fiji Pine, Ltd. (FPL), a former government-managed asset (state-owned enterprise), was incorporated in 1990 as a step towards privatization of Fiji's pine plantation forests. The ultimate intention is to transfer ownership of the plantations into the hands of private landowners. At present, the shareholders of the company are the Government of Fiji and the Fiji Pine Trust, which represents the landowners who have leased their land to FPL. The company's management has to balance the demands of a variety of stakeholders, including the government (the majority shareholder), the forest landowners, the extension (leased) forest owners, managers, employees, contract labour, the labour union, village communities and external funding agencies, all with conflicting needs and expectations.

Source: Van Deusen (2008).

Provision of an appropriate policy and regulatory framework is another important function
of public forestry agencies. This includes policy analysis and strategic planning to assist
governments and other players to understand long-term developments and emerging
opportunities and challenges. In many cases in Asia and the Pacific, the removal of
constraints to efficient operations in the forestry sector – especially restrictive rules and
regulations – will be a major step forward. Institutional theory suggests there is significant
merit in dividing managerial and regulatory functions into separate agencies. For many
forestry agencies in the region, trends in this direction are a major shift requiring significant

restructuring. Organizational structures and skill sets required to deliver the regulatory functions are very different from those required to fulfill managerial functions.

 As other players assume the major responsibility for producing forestry goods and services, increasingly the public sector is gearing to function as a facilitator. There are several examples that demonstrate how public sector forestry agencies have facilitated and supported smallholders and communities in sustainably managing forest and tree resources. The success of social forestry and community forestry in several countries in the region clearly indicates what could be accomplished through reorienting forestry agencies, shifting emphasis to the facilitation function.

The fragmentation of national forestry agendas with involvement by a multitude of government agencies (**Box 2.27**) is a major problem facing a number of countries. With several departments and ministries working in related areas, coherence and coordination have become major concerns.

Box 2.27 Public sector institutions involved in forestry

There is no single, or even prevailing, institutional model among government forestry agencies in Asia and the Pacific. A wide variety of different structures and agencies operate to address forest management, land-use planning, research and extension, forest protection and conservation. In Indonesia and Myanmar, forests and forestry are under the jurisdiction of a specific and specialist Ministry of Forestry. In other countries (e.g. Cambodia, India, Lao PDR, Philippines), a 'hybrid ministry' exists. In India, for example, the Ministry of Environment and Forests is in charge of forestry matters. Lao PDR has a Ministry of Agriculture and Forests while Cambodia has a broader Ministry of Agriculture, Forestry and Fishery. Many countries designate forestry as a subordinate department within an overarching Ministry of Agriculture or Ministry of Environment. In Thailand, forestry is under the jurisdiction of both the Royal Forest Department and the National Park, Wildlife and Plant Conservation Department. The size of government forestry institutions is also diverse. In Myanmar, the Ministry of Forestry employs some 20 000 staff, while the Indonesian Ministry of Forestry employs around 35 000 staff. Conversely, in some of the small island countries a small handful of staff deals with forestry issues among other responsibilities. State forestry agencies are generally divided into a variety of divisions or groups that have different roles and responsibilities at various levels (i.e., national, provincial, or district) for activities such as forest management, policy development, planning, research, extension and training. Very often, the roles of these groups overlap due to changes in functions, legislation and policy that have outpaced institutional development.

Source: Yasmi et al. (2010).

Research, education and training are other important functions that have remained largely within the public sector domain. Capacities in this regard vary among countries, largely reflecting the overall importance of the forestry sector within individual countries. While research and development and educational capacities are very well developed in countries such as Australia, China, Japan, India, Indonesia, Malaysia, New Zealand and Thailand, there are others where forestry is important, but capacities remain weak. Similarly, in many countries there are major barriers to translating research into practical applications. Public sector research has largely focused on biophysical and ecological aspects with much less attention being given to economic and social dimensions. To some extent, this imbalance is being remedied by the private sector and civil society organizations that are compelled to consider social and economic issues in their action-oriented research agendas.

The private sector

The degree of private sector involvement in forestry varies considerably in the Asia-Pacific region. While the private sector plays a key role in wood processing in most countries, its role

in managing forests depends on the overall policy and legal framework as well as economic viability. As indicated earlier, private ownership and management of forests is more predominant in the developed countries, especially Australia, Japan, New Zealand and ROK, compared with developing countries. Three key areas of private sector involvement are:

- Management of natural forests primarily for production through long-term concessions, especially in Southeast Asia and to some extent in the Pacific countries.
- Forest plantation management.
- Wood processing.

In the past, managing long-term natural forest concessions has proven attractive to the private sector, as the payback period on investments is relatively short. However, with increasing concerns about the environmental values of natural forests, forest concession management is facing considerable challenges, especially on account of cost increases and the need to demonstrate that forests are managed sustainably, taking into account a wide range of social and environmental values. Consequently, the private sector focus is increasingly shifting to establishment and management of plantations.

In addition to traditional forestry players, particularly firms that manage forest concessions and plantations as part of vertically integrated forest industry companies, a number of new players have emerged on the forestry scene in recent years, especially institutional investors. TIMOs have been particularly active in Australia and New Zealand and, more recently, in China. However, many of these investments respond to short-term market sentiments, causing considerable uncertainty in management (**Box 2.28**).

Box 2.28 Mobility of institutional investments and stability of wood supply

"While planted forest investments are very immobile (being locked into the land they are planted on) planted forest investment funds by contrast have become very mobile in recent years. It is now commonplace for TIMOs especially, to buy planted forests and managed natural forests and then sell down part or all of them in a decade. TIMO funds are set to have about a ten-year life span and it is most common for them to be wound up at the end of those periods, or before. Even endowment funds may buy and sell on very short time frames."

"This short-termism of the new planted and managed native forest owners may be creating a new set of problems, including fire management and long-term wood supply security (or lack of it) for woodprocessing companies."

Source: Neilson (2009).

In many countries, the rules and regulations intended to protect public forests have discouraged private sector involvement in tree growing. For example, until recently, in India, the government maintained ownership of species like sandalwood, including trees growing on private lands. These restrictive rules, which discouraged private sector initiatives, are gradually being removed.

Smallholders and enterprises

Throughout the Asia-Pacific region smallholders have become significant players in the forest sector producing a substantial quantity of wood. The main factors contributing to this increased involvement of farmers in tree growing are:

- Secure tenure.
- Increasing local demands for wood, especially in the context of declining supplies from forests.

- Reduced profitability of agriculture, especially in the context of increasing input prices (especially labour) and consequent shift to low input tree cropping.
- Diversification towards income generation from non-agricultural activities and consequent reduced dependence on agriculture.

A diverse array of support mechanisms has promoted farm tree planting. The most important has often been the removal of restrictive rules and regulations, including those related to transport of wood and wood products. Others include:

- Technical advice and supply of seedlings under social forestry and farm forestry programmes implemented by forestry departments.
- Financial and technical support through joint initiatives by financing institutions and industries.
- Provision of incentives including more favourable taxation rules.
- Outgrower schemes implemented by industries, providing technical support (including high quality seedlings) with guarantees to procure wood at agreed prices.

Despite the relatively small size of typical farm woodlots, there are indications of continued expansion of tree growing by farmers. Increasingly, the activities of tree growers are being supported by cooperatives, as in the case of tree growers' cooperative societies in India. The National Tree Growers' Cooperative Federation, established in 1986, provides support to all tree growers' cooperatives in India. In a number of Indian states, tree growers' cooperatives have also taken up afforestation and reforestation of public land, which provides opportunities for the landless.

Local communities

Community forestry has a long history in the Asia-Pacific region, although government dominance – especially through forest reservation during colonial periods – led to a marginalization of such community-managed systems. The importance of community involvement has been rediscovered over the past 30 years, especially in the context of failures by public forestry organizations to effectively protect and manage forests sustainably. Nepal has made pioneering efforts in this regard, through the establishment of Forest User Groups. These have become an effective grassroots mechanism for sustainable management of forests and other resources (**Box 2.29**).

Box 2.29 Community forestry in Nepal

Community forestry in Nepal emerged in the mid-1970s and led to the transfer of management responsibilities and rights to products to Forest User Groups, with the objective of conserving and arresting degradation in hill forests. During the past three decades, the country's community forestry programme has evolved in terms of coverage and institutional innovation, supported by changes in policies and legislation that empowered local communities. Substantial international support has also helped to sustain community participation. As of September 2007, a total of 1.2 million hectares of forests had been handed over to approximately 14 500 Forest User Groups. An important development has been the establishment of the Federation of Community Forestry Users, Nepal (FECOFUN), which has become a powerful institution in helping Forest User Groups to improve their efficacy, sustainability and equity. FECOFUN is one of the most effective community-based organizations in the Asia-Pacific region and has been highly successful in articulating the needs of Forest User Groups and influencing policy processes at various levels.

Source: FECOFUN (2009).

Joint Forest Management (JFM) in India is a similar model of community participation. Unlike Forest User Groups, there is much more involvement of state forest departments in regulating the functions of communities under JFM. In many cases, the real power in managing forests still rests with the forest departments. For example, Forest Protection Committees at the local level are seldom given the power to develop management plans or to exercise executive and legal functions. Currently, about 22 million hectares are under JFM, covering about 125 000 villages and involving about 100 000 JFM committees (Ministry of Environment and Forests, Government of India 2009). Although the evolution of JFM is a major institutional innovation in forest management in India, the commitment of state governments and forest departments to implement it varies across the country (Damodaran and Engel 2003).

Civil society organizations

Civil society organizations include a wide spectrum of institutions, other than government and private sector organizations, operating at local, national and global levels. They have emerged as major players in the forestry scene in the Asia-Pacific region, especially during the last three decades (Keong 2009). Civil society organizations include local and international NGOs, indigenous groups, churches, the media and academic and research institutions, and form an important constituency in advocating changes and monitoring progress (Elges 2009). The scope of their interventions varies considerably, largely reflecting overall political environments. Civil society organizations particularly thrive in democratic environments. At grassroots levels, non-governmental organizations (NGOs) take up tasks that are perceived to be inadequately performed by public and private sectors. Many provide critical services, including technical advice to local communities on a wide array of topics like tree growing, and management, collection, processing and marketing of non-wood forest products. In many cases, governments depend on NGOs to implement various programmes, especially when the outreach capacities of governments are limited.

The advocacy roles of NGOs have become increasingly important, helping to bring about changes in policies, legislation and institutional arrangements. NGOs have played a key role in the shift in forest management objectives, emphasizing social and environmental dimensions. Establishment of protected areas, conferring forest rights to indigenous communities and promotion of community management of forests are some of the major issues that advocacy by NGOs has strongly influenced in the Asia-Pacific region. Many of the accomplishments in these areas are largely due to the advocacy role of civil society organizations, especially NGOs.

Forest law enforcement and governance (FLEG) has become a key issue for civil society organizations in the region. Concerted efforts by NGO major players such as Transparency International, Greenpeace, TRAFFIC, Global Witness and other such organizations have compelled governments to pursue action to address rampant illegal logging and associated trade in several countries in the region. Especially in the context of large-scale global trade in illegally procured wood and other products, the role of NGOs that have global reach becomes critical. Largely, it is their efforts that have led the private sector to give significant attention to corporate social responsibility.

While NGOs have had major impacts on the forest sector, there are considerable differences in the performance of individual organizations. Improved access to information (often facilitated by legislation relating to rights to information and advancements in information and communication technologies) will certainly enhance the role of civil society organizations as important players in the forest sector. A number of civil society organizations have well-established research facilities to back up their advocacy and action roles. However, there are also opportunistic organizations driven by individual interests, as well as those that have become large bureaucracies, undermining

efficiency and effectiveness. As in the case of other institutions, significant changes should be expected in the roles and responsibilities of civil society organizations, including some consolidation as more inefficient groups are weeded out.

AN OVERVIEW OF RESOURCES, POLICIES AND INSTITUTIONS

The Asia-Pacific region is less endowed with forests in comparison with much of the rest of the world. Further, there is considerable imbalance in the distribution of forests and human populations, with East Asia and South Asia being the least forested in relation to populations. Although a number of countries have achieved stability in forest areas through high investments in reforestation and afforestation, and despite the increased focus on provision of ecosystem services, deforestation and degradation remain major problems in most Asia-Pacific countries. However, tree planting by farmers is a positive development in several countries, boosting wood supplies considerably. Most countries have also invested in expanding the extent of protected areas and improving their forest management, especially through community involvement.

Forest policies have undergone major changes in the last two decades, with a significant shift away from timber-focused management to the provision of ecosystem services. In response to perceived environmental problems, several Asia-Pacific countries have banned logging in natural forests. Although sustainable forest management that balances economic, social and ecological objectives remains the basic tenet of most forest policies, its actual implementation remains elusive. Extraction of timber often far exceeds the levels of sustainability; at the other extreme negative reactions to logging have led to total bans on logging in a number of countries.

Changes in legislation and institutions have often lagged behind forest policy changes. Forest tenure remains a critical issue, considering that more than 80 percent of forests are under government control. However, communities are gaining greater voice in resource management through various initiatives. Of particular significance is the restoration of forest and land rights to indigenous communities and other forest-dependent people. However, changes in the institutional environment remain highly variable. While public sector forestry agencies maintain a dominant position in many countries, the involvement of the private sector, farmers, local communities and NGOs is on the increase, creating a dynamic, pluralistic, institutional environment.
3 ECONOMIC, SOCIAL AND ENVIRONMENTAL FUNCTIONS OF FORESTS

Forests in Asia and the Pacific produce a range of goods and services; the balance of which may be altered by changes in policy objectives or in response to rising or falling demand. Recent years have seen a greater thrust on ecosystem services, especially as society becomes increasingly concerned about the impacts of climate change, loss of biodiversity and declining supplies of water. Social and cultural functions of forests are also garnering increasing attention. This chapter provides an overview of the economic, social and environmental roles of Asia-Pacific forests.

WOOD AND WOOD PRODUCTS

Although provision of ecosystem services is gaining importance, wood production remains a major thrust of forest management in most Asia-Pacific countries. However, a paucity of reliable data remains a major challenge in assessing overall trends in production and consumption of forest products. Official statistics seldom provide a complete picture, especially in view of the significant share of unrecorded production and trade taking place in the informal sector. In some countries, production through illegal logging is estimated as high as 50 percent of legally procured timber. Furthermore, as the source of wood supplies shifts towards trees grown outside forests, especially by smallholder farmers, collection of statistics on actual supplies becomes more complex. Hence, estimates of production and consumption provide, at best, a partial indication of the overall situation.

The Asia-Pacific share of global consumption of key wood products varies between 20 percent (for industrial roundwood) and 40 percent (for wood-based panels). Total wood product consumption in Asia and the Pacific is generally equivalent with total consumption in North America and Europe. However, in per capita terms the region's share in the consumption of various products remains relatively low (**Table 3.1**). In view of the limited forest resources in some key countries, the region is a net importer of most wood products. Trends in the production and consumption of key products are discussed in the following sections.

Product	Produc- tion ('000)	Exports ('000)	Imports ('000)	Consump- tion ('000)	Share of global consumption (%)	Asia-Pacific per capita consumption (m³/ tonnes)	Global per capita consumption (m ^{3/} tonnes)
Industrial round- wood (m ³)	278 824	19 418	52 692	312 098	20	0.084	0.23
Sawnwood (m ³)	91 537	7 166	18 574	102 945	26	0.028	0.06
Wood-based panels(m ³)	114 117	25 280	13 263	102 100	40	0.027	0.04
Pulp for paper (tonnes)	46 374	3 964	16 862	59 272	31	0.016	0.03
Paper and paper board (tonnes)	147 047	16 056	17 467	148 457	39	0.040	0.06
Newsprint (tonnes)	12 585	1 693	2 898	13 790	37	0.004	0.01

Table 3.1. Production, consum	ption and trade of key	industrial wood produc	ts, 2008
-------------------------------	------------------------	------------------------	----------

Source: FAO (2010a).

Industrial roundwood

Demand for industrial roundwood is contingent on demand for various secondary products, in particular sawnwood, wood-based panels and paper and paper products. Changes in processing technologies and availability of substitutes affect industrial roundwood demand. At the regional level, industrial roundwood production and consumption have remained relatively stable since 1980, with production marginally increasing from about 248 million m³ in 1980, to 279 million m³ in 2008 (**Figure 3.1**). Wood production increased until about 1989, then remained relatively stable till about 1997. The Asian economic crisis led to a decline in industrial roundwood production between 1997 and 2001, but it has been increasing slightly since then. Industrial roundwood consumption has increased from 276 million m³ in 1980, to 312 million m³ in 2008 increasing the region's dependence on log imports by approximately 16 million m³. However, trends in production and consumption differ significantly between the various subregions:



Figure 3.1. Asia-Pacific industrial roundwood production 1990-2008 Source: FAO (2010a).

- East Asia, which in 2008 accounted for about 42 percent of the region's industrial roundwood production and 53 percent of consumption, reflects some interesting national trends. While the subregion's overall production-consumption gap has remained unchanged, there has been a major shift in consumption from Japan to China. Between 1980 and 2008, Japan's consumption of industrial roundwood declined from 72 million m³ to 24 million m³, while that of China increased from 87 million m³ to 133 million m³. During this period, China's industrial roundwood production increased from 79 million m³ to 96 million m³ while that of Japan declined from 34 million to 18 million. China's production-consumption gap increased from 8 million m³ to 37 million m³, making it one of the world's major industrial roundwood importers. Meanwhile, Japan's role as an important producer of primary wood products has declined in the context of its larger social and economic changes.
- Southeast Asia is also an important industrial roundwood producing and consuming region. Industrial roundwood production in Southeast Asia has declined since 1980, especially from a peak in the period 1988 to 1993 when about 100 million m³ were produced *per annum*, to 79 million m³ in 2008. This is largely due to output reductions in the two main producer countries: Indonesia and Malaysia. Some of the apparent decline in production is due to unreported production, particularly in Indonesia. This is not necessarily all illegal production,

but often reflects data anomalies caused by a transition from natural forests to plantations, and especially from forests managed by government agencies to forests managed by the private sector. During the 1980s and 1990s, Southeast Asia was one of the world's most important industrial roundwood exporting areas. However, as the gap between roundwood production and consumption in Southeast Asia has narrowed, the subregion has become a much less prominent log exporter.

- Oceania is another significant industrial roundwood producing subregion, with Australia and New Zealand accounting for about 90 percent of the subregion's wood production. Between 1980 and 2008, wood production in Oceania expanded from 28 million m³ to about 52 million m³, largely due to wood supply from maturing forest plantations. Industrial roundwood consumption has also increased in Oceania, but at a much lower rate than production, making the subregion (especially Australia and New Zealand) an important source of industrial wood supplies.
- South Asia accounted for only about 10 percent of the region's industrial roundwood production in 2008. Obviously, as elsewhere, official statistics provide only a partial picture in view of the preponderance of unreported production in the informal sector. With increasing consumption (mostly by India), the production-consumption gap is widening, increasing the subregion's dependence on imports.

Sawnwood

No clear pattern is evident as regards production and consumption of sawnwood in the region, quite possibly on account of data deficiencies. Data show production increasing through to 1990, declining between 1990 and 2000 and increasing again between 2000 and 2008 (**Table 3.2**). Changes in production and consumption are particularly erratic in East Asia and South Asia, in part reflecting weaknesses in the systems of collecting information.

Subregion/	Production				Consumption			
region	1980	1990	2000	2008	1980	1990	2000	2008
East Asia	62.1	58.0	29.6	45.1	67.5	68.7	45.0	60.0
South Asia	11.5	19.6	9.7	17.3	11.6	19.7	9.8	17.5
Southeast Asia	15.9	21.5	16.3	19.5	11.0	16.9	13.8	17.5
Oceania	5.9	5.6	8.2	9.6	6.1	6.5	7.68	8.0
Asia-Pacific total	95.3	104.8	63.8	91.6	96.2	111.6	76.1	102.9

Table 3.2. Production and	I consumption of	sawnwood in f	the Asia-Pacific	region	(million m ³)
---------------------------	------------------	---------------	------------------	--------	---------------------------

Source: FAO (2010a).

Although it is difficult to provide definitive analysis in view of data constraints, the broad trends in sawnwood production and consumption in the region are:

- Overall, sawnwood production has remained lower than consumption, making the region a net importer of sawnwood. East Asia accounts for a major share of the regional gap between production and consumption.
- From being one of the world's largest producers of sawnwood, both production and consumption of sawnwood in Japan have declined markedly since 1980. Japan's current sawnwood production is less than one-third its 1980 production; a reflection of the larger socio-economic changes that the country has witnessed.

- China is currently the region's largest producer and consumer of sawnwood. Since 2000, Chinese production of sawnwood has been growing rapidly, but at a much slower pace than consumption. Consequently, Chinese imports of sawnwood have also accelerated during the past decade.
- Considerable inconsistency is observed in sawnwood production statistics from South Asia, which are dominated by India's production and consumption. Both production and consumption declined sharply between 1990 and 2000, recovering through to 2008. With many small-scale sawmills operating in the informal sector there are obvious difficulties in capturing the full extent of production and consumption in the subregion.
- In Southeast Asia and Oceania sawnwood production exceeds consumption and both subregions are net exporters. Between 1980 and 1990 the surplus of production over consumption of Southeast Asia dropped significantly, but has been relatively stable since 1990. Oceania has become a major net exporter of sawnwood in view of rapid increases in production over consumption. The increases are almost entirely accounted for by Australia and New Zealand and are largely driven by increased supplies of wood from planted forests.

On a per capita basis there has been a significant decline in sawnwood consumption in the region, notwithstanding increases in housing construction rates. Some of this decline appears to be accounted for by the substitution by other building materials including panel products.

Wood-based panels

In contrast to declining sawnwood production and consumption, wood-based panel production has increased significantly during the past three decades. Overall production increased from 27 million m³ in 1990, to more than 114 million m³ in 2008. East Asia registered a production increase from 13 million m³ to 88 million m³ between 1990 and 2008, with the bulk of the increase attributable to China. While there was an increase in panel production in Southeast Asia till 1997, this has since fallen with the subregion's relative share of Asia-Pacific production declining much faster in view of the rapid expansion in China's production (**Figure 3.2**). To some extent China's increased wood panel production stems from better statistical accounting, especially resulting from a shift from small-scale production (which often may not be fully accounted) to more organized medium and large enterprises.



Figure 3.2. Asia-Pacific wood-based panel production, 1990-2008 Source: FAO (2010a).

Within the wood-based panel industry, there has been a shift away from the production and consumption

of plywood to the more value added, but less wood-intensive, particle board and fibreboard. This has had a significant impact on the demand for wood, to some extent reducing the need for large-sized veneer logs, and enabling a focus on fibre production rather than solidwood. The experience of ROK's panel industry typifies the nature of transition from low- to high-valued products (**Box 3.1**).

Box 3.1 Republic of Korea (ROK): changes in the wood-based panel industry

Changes in the ROK wood-based panel industry are indicative of some of the broad trends in woodprocessing industries in the context of technological changes and the emergence of new products. Consumption of wood-based panels in ROK increased from 40 000 m³ in 1970 to 5.5 million m³ in 2005. However, within the wood-based panel sector plywood is being replaced by other panel products, namely particle board and fibreboard. Until the mid-1980s, plywood accounted for most of the consumption of wood-based panels. In 2005 the share of plywood in the consumption of panel products declined to 34 percent with the remainder being accounted for by fibreboard (37 percent) and particle board (29 percent). Production of particle board and fibreboard started to increase from the mid-1980s to meet rapid growth in domestic demand. The figure below indicates the changes in consumption of three different panel products.





This change in the share of different panel products has a close link with the nature of raw materials used and their sources of supply. In the 1970s and 1980s ROK's plywood industry was largely dependent on imported veneer logs, especially from Indonesia and Malaysia. Declining log supply (in the context of log export bans by Indonesia and some other Southeast Asian countries) has led to drastic scaling down of plywood industry capacity. On the other hand, particle board and fibreboard rely on waste wood. For example, about 50 percent of the raw materials for fibreboard comes from softwood waste from sawmills, and the other half comes from domestically produced Pitch pine (*Pinus rigida*) roundwood. The particle board industry is almost entirely dependent on wood residues, with 75 percent from the construction sector, 10 percent from sawmilling and the rest from industrial and household waste wood.

In the 1980s ROK was a major exporter of plywood with the United States as an important market. Reduced log supplies and increased production in countries like Indonesia and Malaysia reduced ROK's competitiveness. In fact ROK became an importer of plywood, especially from countries that were earlier its sources of veneer log supplies. ROK also continues to import fibreboard and particle board to meet its domestic demand.

Source: Rin Won Joo et al. (2009).

Paper and paper board

Paper and paper board is another product group that has witnessed significant expansion in production and consumption. Overall production in the Asia-Pacific region increased from about 58 million tonnes in 1990 to 147 million tonnes in 2008, with most of the increase in production attributable to East Asia (**Figure 3.3**), mainly China. There has been some expansion of paper and paper board production in Southeast Asia and a very modest increase in South Asia. Growth in consumption in South Asia has been significant resulting in a substantial increase in imports since 1990.



Figure 3.3. Asia-Pacific paper and paper board production, 1990-2008 Source: FAO (2010a).

Of the three main paper types, newsprint accounts for a very small share of total production and consumption (about 10 percent), and growth in Asia-Pacific markets has stagnated. With the expansion of other types of media (television and the Internet) growth in newspaper circulations has slowed and this trend is likely to persist. However, newspapers retain significant popularity in Asia, with China, India and Japan having the world's highest daily newspaper circulations. Printing and writing paper is the second largest part in this market, with production and consumption comprising about 25 percent of the total paper and paper board sector. Production of printing and writing paper has increased markedly in the region, doubling since 1994, from 19 million tonnes to 39 million tonnes in 2008. The region, as a whole, is a net exporter of printing and writing paper, with most exports coming from East Asia and Southeast Asia. Other paper and paper board accounts for the remaining 65 percent of the paper and paper board market (Jonsson and Whiteman 2008). A large share of the demand for other paper and paper board is dependent on growth in the industrial and services sectors (especially demand for packaging materials). Asia-Pacific production of other paper and paper board has also increased markedly in recent times, doubling since 1994 to 95 million tonnes in 2008. The global economic downturn and consequent reductions in trade during 2008 to 2009 affected paper board consumption, but demand is expected to rebound as growth and trade recover. Ease of recycling is a major advantage of paper board over competing alternatives based on plastics.

Paper and paper board

Paper and paper board is another product group that has witnessed significant expansion in production and consumption. Overall production in the Asia-Pacific region increased from about 58 million tonnes in 1990 to 147 million tonnes in 2008, with most of the increase in production attributable to East Asia (**Figure 3.3**), mainly China. There has been some expansion of paper and paper board production in Southeast Asia and a very modest increase in South Asia. Growth in consumption in South Asia has been significant resulting in a substantial increase in imports since 1990.



Figure 3.3. Asia-Pacific paper and paper board production, 1990-2008 Source: FAO (2010a).

Of the three main paper types, newsprint accounts for a very small share of total production and consumption (about 10 percent), and growth in Asia-Pacific markets has stagnated. With the expansion of other types of media (television and the Internet) growth in newspaper circulations has slowed and this trend is likely to persist. However, newspapers retain significant popularity in Asia, with China, India and Japan having the world's highest daily newspaper circulations. Printing and writing paper is the second largest part in this market, with production and consumption comprising about 25 percent of the total paper and paper board sector. Production of printing and writing paper has increased markedly in the region, doubling since 1994, from 19 million tonnes to 39 million tonnes in 2008. The region, as a whole, is a net exporter of printing and writing paper, with most exports coming from East Asia and Southeast Asia. Other paper and paper board accounts for the remaining 65 percent of the paper and paper board market (Jonsson and Whiteman 2008). A large share of the demand for other paper and paper board is dependent on growth in the industrial and services sectors (especially demand for packaging materials). Asia-Pacific production of other paper and paper board has also increased markedly in recent times, doubling since 1994 to 95 million tonnes in 2008. The global economic downturn and consequent reductions in trade during 2008 to 2009 affected paper board consumption, but demand is expected to rebound as growth and trade recover. Ease of recycling is a major advantage of paper board over competing alternatives based on plastics.

Forest product trade

Trade is a crucial driver of forestry change in the Asia-Pacific region due to the enormous volume and value of goods traded. In 2008, the total value of imports of primary forest products¹ to Asia-Pacific countries amounted to US\$63.3 billion.

Globally, the value of imports of primary wood products increased from about US\$113 billion in 1990 to US\$243 billion in 2008. Although Asia and the Pacific's share in primary forest product imports remained relatively constant between 1990 and 2008, at about 25 percent, their absolute value has more than doubled (**Table 3.3**).

	1990 (US\$ billion)	Share of global trade (%)	2008 (US\$ billion)	Share of global trade(%)
East Asia	21.4	19.0	47.4	19.5
South Asia	0.8	0.7	4.4	1.8
Southeast Asia	3.1	2.8	8.6	3.5
Pacific	1.7	1.5	2.8	1.2
Asia-Pacific	27.1	24.0	63.3	26.0
World	112.6	100.0	243.4	100.0

Table 3.3. Value of imports of primary forest products

Source: FAO (2010a).

The value of primary forest product exports from Asia-Pacific countries totaled US\$33.7 billion in 2008, making the region a net importer of primary forest products. Net forestry imports sourced from outside the region amount to almost 40 percent of the total value of imports. However, Asia and the Pacific's share of global forestry exports grew from 12.5 percent in 1990 to 14.3 percent in 2008 (**Table 3.4**).

Table 3.4. Value of primary forest product exports

	1990 (US\$ billion)	Share of global trade (%)	2008 (US\$ billion)	Share of global trade (%)
East Asia	3.6	3.5	14.9	6.3
South Asia	0.1	0.1	0.5	0.2
Southeast Asia	7.6	7.5	13.7	5.8
Pacific	1.4	1.4	4.5	1.9
Asia-Pacific	12.6	12.5	33.7	14.3
World	100.2	100.0	235.1	100.0

Source: FAO (2010a).

The importance of forestry trade differs among the various subregions and countries.

• The East Asia subregion is both the largest importer and exporter of primary forestry products, with China, Japan and, to a lesser extent, ROK accounting for most of the trade. East Asia is the major net importing subregion, with the value of primary forestry imports

¹ Primary forest products include industrial roundwood, sawnwood, panel products, wood pulp and paper products.

exceeding the value of forestry exports by nearly US\$30 billion in 2008. Japan's share in global primary forest product imports declined from 11.7 percent in 1990 to 5.1 percent in 2008, while China's share increased from 4.8 percent to 12.1 percent of the global value of imports during the same period. China's importance as a processor and re-exporter of forestry products is reflected in its growth in value of primary forestry exports, from 1.5 percent of global exports in 1990, to 4.1 percent in 2008.

- Despite the generally scarce forest situation in South Asia, the subregion is a relatively
 modest net importer of forest products. In part, this reflects the lower per capita use of
 processed wood and paper products largely stemming from low incomes and, historically,
 high tariffs and taxes on imports. Exports of primary wood products from South Asia are
 also relatively insignificant, considering the limited resource base. However, since 1990
 imports of primary wood products into the subregion, particularly to India, have increased
 markedly. In 2008, South Asia accounted for 1.8 percent of global imports of primary wood
 products.
- With greater endowments of forest wealth, Southeast Asia is a major forest product net exporting subregion in Asia and the Pacific. Exports of forest products from Southeast Asia totaled US\$13.7 billion in 2008, with Indonesia (48.7 percent), Malaysia (27.9 percent) and Thailand (13.4 percent) being the largest exporters, accounting for 90 percent of the subregion's exports. These three countries are also the subregion's largest importers of forest products, collectively accounting for 75 percent of the value of Southeast Asia's imports. Viet Nam, Singapore and the Philippines are also significant importers of forest products. Paper and paper board form the largest component of the subregion's imports.
- The Pacific subregion is also a significant net exporting region, particularly given the relatively low population (implying low domestic demand and a more favourable resource situation). In 2008, exports of forestry products from the Pacific totaled US\$4.5 billion, while the value of forest product imports totaled US\$2.8 billion. New Zealand (48.6 percent) and Australia (38 percent), and to a lesser extent Papua New Guinea (PNG) (10.1 percent) form the major exporters in the subregion. Industrial roundwood, including logs from New Zealand, PNG and Solomon Islands, and woodchips from Australia, is the most significant exported item. Imports of paper and paper board account for approximately two-thirds of the subregional total.

Although trade in forest products has expanded proportionately more rapidly than production globally, there is considerable variation between regions, subregions and countries, depending on the state of resources, domestic demand, competitiveness of domestic production and trade policies. With more production being exported and the share of imports in consumption also increasing, it appears that local value chains are increasingly being replaced by global value chains. A disaggregated analysis of exports and imports provides an indication of key changes in the nature of products traded.

Trade in industrial roundwood

In 2008, the four largest importers of industrial roundwood in the Asia-Pacific region were China (38 million m³), Japan (6.8 million m³), ROK (4.9 million m³) and India (1.8 million m³). Additionally, Japan (19.8 million m³) and China (3.6 million m³) imported significant volumes of woodchips.

A major change in the mix of imports of industrial roundwood (and woodchips) has resulted from a shift in sources of supplies. For example, the Russian Federation has emerged as the most important source of industrial roundwood supply to China and Japan. In 1997, Russia accounted for only 22 percent of Chinese industrial roundwood imports, but its share has increased – to 55 percent in 2002 and 77 percent in 2007 (**Figure 3.4**).



Figure 3.4. Trends in industrial roundwood imports to Japan, India and China Source: FAO (2010a)

Russia's increased share of roundwood exports is matched by a corresponding reduction in the share of imports from a number of tropical countries (for example, Malaysia, Cameroon and Gabon).

In the case of Japan, the major sources of roundwood and woodchip supply are Australia, Russia, South Africa and the United States. Changes in the suppliers of industrial wood to India are even more dramatic. In 1997, 95 percent of India's roundwood supplies were obtained from many countries (in view of the small quantity sourced from each, these countries were aggregated in statistics as 'others'). However, by 2007, New Zealand and Australia collectively supplied 85 percent of India's roundwood and chip imports, while the share of 'others' declined to about 1 percent. Russia has also become an important supplier of industrial roundwood to India, accounting for 14 percent of imports in 2007. A significant trend is that major wood-importing countries are increasingly focusing on assured and stable supplies, reducing their reliance on diminishing tropical sources.

Within the Asia-Pacific region, the most significant exporters of industrial roundwood include Malaysia, Myanmar, New Zealand and PNG. **Table 3.5** shows trends in industrial roundwood exports in major exporting countries.

Table 3.5. Principal industrial roundwood exporting countries in Asia and the Pacific 1992-2007 (million m³)

Country	1992	1997	2002	2007
Malaysia	17.86	6. 68	5.18	4.94
New Zealand	4.28	5.95	7.88	5.98
PNG	1.82	3.01	1.86	2.72
Myanmar	1.34	0.45	1.14	1.48
Australia	0.18	0.69	1.28	1.06
Solomon Islands	0.51	0.70	0.40	1.01
China	0.80	0.66	0.69	0.69

Source: FAO (2010a).

Australia's regional significance as a supplier of raw material increases markedly if woodchip exports are added to industrial roundwood (log) exports. In 2007, Australia exported 9.7 million m³ of woodchips, 68 percent of the regional total.

Trade in sawntimber

The Asia-Pacific region is a significant net importer of sawnwood. In 2008, the region's largest sawnwood importers were China (8.7 million m³), Japan (6.5 million m³), ROK (0.56 million m³) and Viet Nam (0.56 million m³). These countries collectively accounted for 84 percent of the region's imports of sawnwood.

Many of the region's largest sawnwood importers are also among the largest sawnwood exporters. In 2008, Malaysia (2.5 million m³), New Zealand (1.8 million m³), China (0.9 million m³) and Thailand (0.4 million m³) accounted for about 78 percent of the region's total sawnwood exports.

Nonetheless, intra-regional trade accounts for less than 35 percent of the region's total imports. Sawnwood is imported from many countries outside the region; from North and South America, Europe and Africa. However, the majority of imports come from Canada, the Russian Federation, the United States and Finland.

Trade in wood-based panels

Trade in wood-based panels largely comprises plywood, medium density fibreboard (MDF) and particle board. The overall Asia-Pacific trade is dominated by plywood, which in 2008 comprised 63.3 percent of regional wood panel exports and 51.3 percent of imports (**Figure 3.5**).



Figure 3.5. Asia-Pacific trade in wood-based panels, 2008 Source: FAO (2010a).

Until the early 2000s, Indonesia and – to a lesser extent – Malaysia, were the world's predominant plywood-exporting countries. However, in recent years, a sharp decline in Indonesia's plywood industry has been matched by rapid growth in China's plywood industry, and China is now the pre-eminent plywood producer and exporter in the region. In 2008, China exported 7.5 million m³ of plywood, while Malaysia and Indonesia exported 5.5 million m³ and 2.6 million m³ respectively. Japan is the region's largest plywood importer, accounting for 53 percent of plywood imports, while China (19 percent) and ROK (12 percent) are the other major importers.

With 47 percent of the region's exports, China is also the region's largest exporter of MDF. Other significant MDF exporters in the region in 2008 were Thailand (22 percent) and New Zealand (9 percent). Particle board trade comprises a lesser proportion of trade in wood-based panels, with Thailand (65 percent) being the region's largest exporter and China (30 percent) the largest importer in 2008.

Overall, the Asia-Pacific region is a significant net exporter of wood-based panels. In 2008, wood-based panel exports comprised 25.3 million m³, while imports totaled 13.2 million m³. North America and Europe are key external markets.

Trade in paper, paper board and wood pulp

In 2008, the Asia-Pacific region was a modest net importer of paper and paper board. Imports of paper and paper board totaled 17.4 million tonnes, while exports of paper and paper board totaled 16 million tonnes. East Asia and Southeast Asia were net exporters of paper and paper board, while South Asia and the Pacific were net importing subregions.

In 2008, China (5.4 million tonnes), Malaysia (2 million tonnes), India (1.7 million tonnes), Japan (1.5 million tonnes) and Australia (1.5 million tonnes) were countries that imported more than 1 million tonnes of paper and paper board. The largest exporters of paper and paper board were China (4.9 million tonnes), Indonesia (3.6 million tonnes) and ROK (2.7 million tonnes).

Overall, the Asia-Pacific region is a major net importer of wood pulp, reflecting the raw material deficit situation. Imports of wood pulp in 2008 totaled 18 million tonnes, compared with exports

of 4 million tonnes. Imports of wood pulp to China, ROK and Japan collectively account for 82 percent of the regional total. Indonesia (2.7 million tonnes) and New Zealand (0.8 million tonnes) are the main pulp exporters in the region, collectively accounting for 88 percent of the region's wood pulp exports.

In addition to wood pulp, the region is also a major net importer of recovered paper. In 2008, recovered paper imports totaled 32.8 million tonnes, while regional exports of recovered paper amounted to 5.8 million tonnes. China is the dominant importer of recovered paper. In 2008, China imported 25 million tonnes of recovered paper, 77 percent of the regional total.

Trade in other forest products

Other forest products include a wide range of manufactured and finished products, including wooden furniture and furniture parts, mouldings, manufactured wood products such as flooring, doors and window frames, manufactures of paper and paper board, as well as fuelwood, charcoal and wood pellets, and non-wood forest products. Of particular interest is the emergence of the Asia-Pacific region (led by China) as a major producer and exporter of wooden furniture. Production is mostly by small- and medium-sized enterprises, many of which operate in the informal sector; consequently, obtaining reliable production statistics is difficult. The surge in production is evident from a rapid increase in the value of furniture exported from the region, which increased from about US\$1.56 billion in 1990 to about US\$17.7 billion in 2007 (**Figure 3.6**). In 1990, the region's share in exports was about 9 percent of total global exports but, by 2007, the Asia-Pacific's share of the global furniture trade had reached about 33 percent.



Figure 3.6. Value of wooden furniture exports, (US\$ billion) Source: Lebedys (2008).

Much of the increase in furniture production is the result of rapid expansion in export-oriented production in China, whose exports increased from about US\$111 million in 1990 to US\$10.68 billion in 2007, thus making it the largest exporter of furniture in the world. In 2007, China had more than 2 300 furniture-producing enterprises, employing about 530 000 workers (UNECE and FAO 2008). Other countries that have expanded production and exports are Indonesia, Malaysia and Viet Nam. A notable feature is the expansion of rubberwood furniture production, particularly from Malaysia.

Wooden furniture production is highly labour intensive; low wages in many Asian countries provide competitive advantage. Low labour costs combined with improved design and access to world markets facilitated by global retailers has enhanced the competitiveness of Asian furniture production. Domestic furniture demand has also increased significantly, especially in emerging economies such as China and India, attracting investments in retail outlets by transnational producers and retailers.

Emerging patterns of trade

In general, globalization has led to expansion of trade in most products, including many 'other forest products', although comprehensive trade data for several of these are not readily available. Key drivers of increased trade include:

- Exporters of primary products adding value to improve profitability and avoid strong cyclical movements associated with commodity products.
- Shifts in manufacturing location reflecting differences in competitiveness, especially lower wages, better productivity and easy access to markets and raw materials.
- International agreements reducing tariffs and other trade barriers creating new trading opportunities (UNECE Timber Committee).

In relation to exports, the share of industrial roundwood in the total value of exports has declined, while the share of value-added products, especially wood-based panels, paper and paper board and secondary wood products has increased significantly. On the import side, industrial roundwood, pulp for paper, and sawnwood remain major items (**Figure 3.7**). Although there are intercountry differences, on the whole the Asia-Pacific region is increasingly becoming a producer and exporter of value-added products, relying on imports of lower value-added items. Developments in China and a few other countries – especially Indonesia and Malaysia – account for the major part of this shift in production and trade in forest products in the region. While increasing domestic demand has led to higher investments in processing capacity (especially for panel products and paper and paper products) low wages and access to technology have spurred export-oriented production (in particular for secondary and finished wood products).



Figure 3.7. Trends in the value of Asia-Pacific wood products imports and exports

Source:FAO (2010a); Lebedys (2008).

Key trade issues

Perhaps not surprisingly, the key issues pertaining to forest product trade relate to access, especially access for products to markets and access by manufacturing countries to raw materials.

Market access issues are centred on tariff and non-tariff barriers. Tariff barriers for forest products are generally low in Asia-Pacific countries, with a number of (especially developed) countries having eliminated tariffs on many products. In addition, several regional free-trade agreements are in place, including the ASEAN Free Trade Agreement, the South Asian Association for Regional Cooperation (SAARC) and the South Pacific Regional Trade and Economic Cooperation Agreement (SPARTECA), as well as bilateral trade agreements, for example, between Australia and New Zealand (Australia and New Zealand Closer Economic Relations Trade Agreement [ANZCERTA]) and between ASEAN and several other Asia-Pacific countries (including China, India and the two ANZCERTA countries). Although tariffs have been reduced, a number of countries maintain significant tariffs on wood products (**Box 3.2**).

Box 3.2 Tariff reforms in India

Until the early 1990s, India applied extremely high tariffs to forest products. For example, the 1986 base tariff rates for panel products ranged from 105 percent to 145 percent. Actual rates applied immediately prior to the conclusion of the GATT Uruguay round were considerably lower, though escalatory, reaching 35 percent for some carpentry and furniture, 30 percent for fine papers and plywood, and 20 percent for other panel products.

"The domestic supply of timber has been dramatically reduced over the past few years and the wood products industry is now, and will continue to be, heavily dependent on imported timber. In recognition of this, the Indian government is continuing to adopt policies to encourage timber imports. Tariff reductions on imports of logs and wood chips have eased, compensating for some of the shortage in raw materials that the Indian wood-based industry was facing. India's imports of wood and wood-based products doubled between 1999 and 2005, nearing US\$ 1 billion in 2005. India currently is importing mostly commodity products as raw materials to supply the wood based industry.

Import statistics show that over 90% of India's forest product imports are logs. The plethora of import duties, taxes, tariffs and fees, continue to represent a significant barrier to exporters of wood products, particularly value-added wood products. However, despite the high tariff rates, the imports of engineered wood products tripled between 2000 and 2005."

Source: Ganguly and Eastin (2007).

Tariff escalation – i.e. a tariff structure that applies higher import duties to more processed products – remains a core feature in many countries where forestry tariffs persist. As part of the WTO Advanced Tariff Liberalization (ATL) initiative, a global free trade agreement on forest products is being advocated.

A range of non-tariff measures (NTMs) also affects market access for wood products, including import taxes, quotas, bans, sanitary and phytosanitary measures, technical barriers to trade (e.g. building standards) as well as voluntary measures such as certification and labeling. Provisions relating to illegal logging and associated trade, such as the amended Lacey Act (discussed elsewhere) may also have significant trade implications.

Conversely, forest policies in most countries stipulate a desire to further develop domestic woodprocessing industries. However, many less developed countries struggle to access capital and expertise to establish internationally competitive processing facilities. During the past 40 years, a number of forest-rich developing countries have seen their forests exploited and depleted through exporting logs to more developed countries. Many of these countries have resorted to log export bans as a means of establishing and supporting domestic processing industries.

WOOD AS A SOURCE OF ENERGY

Despite the increasing use of fossil fuels, wood from trees outside forests and from forests and other woodlands remain an important source of energy in many Asia-Pacific countries. A major challenge in assessing the current situation and long-term outlook is the absence of reliable statistics, especially relating to quantities collected and sources of supply. Available information indicates that wood accounts for a significant share of total energy consumption in developing Asia-Pacific economies. There are several countries where wood provides more than half of the energy needs (**Figure 3.8**). In particular the dependence on wood as a source

of energy is very high among low income countries, suggesting a strong linkage between income and type of energy used. As economies grow and consumption of energy in industrial and service sectors increases, the share of wood energy declines. As more households switch to other sources of energy, dependence on wood – and hence pressure on forests – declines



Figure 3.8. Share of wood energy in total energy consumption in selected Asia-Pacific countries

Source: FAO (1997).

General trends in the use of wood energy

In view of differences in the nature of wood energy use between domestic (household) and industrial uses, trends in consumption diverge among the region's countries. Higher household incomes and urbanization are associated with declines in per capita household use of wood energy. However, population growth keeps aggregate national consumption relatively stable. As regards industrial use, there is renewed interest in biomass energy, especially in the context of escalating fossil fuel prices, energy security and climate change policies.

Production and consumption of woodfuel have remained more or less unchanged in the Asia-Pacific region during the past two decades, with a marginal decrease in production from about 781 million m³ in 1990 to 762 million m³ in 2008 (**Figure 3.9**). Almost three-quarters of the wood produced in Asia and the Pacific is burned as fuel. In South Asia, fuelwood accounts for 93 percent of total wood production, while in Southeast Asia, fuelwood's share in total wood production is 72 percent. In contrast, woodfuel accounts for less than 1 percent of roundwood production in Japan. A major challenge in assessing long-term trends in woodfuel production and consumption is the preponderance of informal collection and trade. This is particularly the case in most developing countries, where subsistence consumption is high and official statistics tend to be estimates rather than actual data based on surveys of production and trade.





Some general trends in the production and consumption of woodfuel include:

- South Asia accounts for nearly half of the Asia-Pacific region's woodfuel consumption and is the subregion that accounted for most of the region's increased consumption since 1990. However, there are signs that wood energy use is reaching a plateau, and even declining in some parts of South Asia, especially as alternative energy resources become more accessible. With India accounting for about 79 percent of South Asia's woodfuel consumption in 2008, changes in the energy mix in India will have a significant impact on the subregional and regional wood energy situation.
- In all the other regions, consumption is plateauing and, in some cases, declining, as in the case of most countries in East Asia (**Box 3.3**).

Box 3.3	Woodfuel consumption in Japan
Woodfuel cons of wood bioma change goals. primarily in the sawmills comp the remainder.	sumption accounts for less than 1 percent of wood produced in Japan. However, utilization ass is being promoted as part of a government initiative to assist in meeting climate According to a 2008 report, Japan used about 8.6 million m ³ of wood biomass as fuel, e form of waste wood to generate electricity and in pellet stoves. Waste materials from prised more than half of the total, with waste material from construction sites providing.

Source: MAFF, Japan (2008).

 Declining woodfuel use is largely related to increases in income, relative costs of various fuels and their availability and accessibility. The price of fossil fuels will be an important determinant as to whether there will be a progressive reduction in woodfuel use through substitution by commercial energy. However, price volatility of fossil fuels – for example, as witnessed during 2008 to 2009, when oil prices rocketed to US\$148 per barrel in July 2008, then plunged to about US\$40 by March 2009 – makes it extremely difficult to predict changes in the energy mix, including changes in the importance of wood as a source of energy.

Wood energy systems

Two distinct wood energy subsystems exist in the Asia-Pacific region (Perley 2008), namely:

- A highly localized and well-established 'traditional' wood energy subsystem focused on households and small industry, especially in rural areas of developing countries.
- An industrial wood-sourced bioenergy subsystem with emerging potential to substitute for fossil fuels.

Each of the above subsystems has unique characteristics, in terms of end users, end uses, production and processing. Traditional household fuel use, largely focused on cooking and space heating, accounts for most woodfuel use in developing and emerging economies. Efficiency improvement has been a key thrust in past efforts to enhance woodfuel security, with considerable attention being given to development and popularization of improved cook-stoves (**Box 3.4**). However, the uptake of improved technologies has been extremely varied, largely due to economic and institutional constraints. Nonetheless, there are indications of change, especially due to increasing awareness of health implications of inhaling smoke from traditional stoves, encouraging the use of improved stoves.

Box 3.4 Adoption of energy efficient cook-stoves in Asia and the Pacific

Efforts to develop and promote improved cook-stoves have a long history. As far back as the 1950s, such stoves were under development in countries such as India, Indonesia and Sri Lanka. However, it was the energy crisis in the 1970s – including a perceived wood energy crisis – that drew widespread attention to the issue, leading to concerted efforts, often with the support of international organizations, to improve the design and dissemination of simple, low-cost, energy-efficient cook-stoves. China and India have led these efforts, with millions of households now using improved cook-stoves. Many governments in the region actively support the dissemination of these higher efficiency stoves.

Despite more than 50 years of efforts, experiences in adoption of improved cook-stoves remain mixed, largely on account of inadequate consideration of social, economic and cultural dimensions of household energy use. In many rural areas, biomass energy is collected free-of-cost (excepting the opportunity costs associated with time spent in collection); hence, there is little incentive to adopt more efficient stoves, even when the costs of the devices are low. However, increasing awareness about health implications of using inferior stoves, especially respiratory illnesses stemming from in-door pollution, could trigger wider adoption of energy-efficient stoves that could incidentally reduce woodfuel demand.

There were efforts in the Asia-Pacific region through the 1970s and 1980s to produce woodbased energy on an industrial scale, especially through dendrothermal power plants based on dedicated woodfuel plantations. The viability of dendrothermal power generation has fluctuated in line with changes in fossil fuel prices. Energy production through gasification of biomass is another option that has received considerable attention. China and India are at the forefront of biomass gasification technologies, with several units established in rural areas using a wide array of biomass inputs, including crop residues and wood. Use of wood and other forms of biomass to make wood pellets for fuel is also receiving attention and wood pellet production is likely to expand, especially in the context of climate change mitigation policies and changes in fossil fuel prices (**Box 3.5**).

Box 3.5 Wood pellet markets in Asia and the Pacific

Global demand for wood pellets is increasing as consumers (especially in Europe and North America) search for alternative energy sources. High density, convenience in transport and use and renewability are making wood pellets an attractive source of energy especially in the context of climate change policies. Although still nascent, demand for wood pellets is expected to increase in the coming years, which may have both positive and negative implications on forest resources in the region, depending on whether wood for pellets is sourced from sustainably managed forests.

A major initiative in wood pellet production is the lease of Indonesian forest land by ROK. The Republic of Korea Forest Service signed a Memorandum of Understanding with the Indonesian Ministry of Forestry entailing a lease of 200 000 hectares of forest land to produce wood pellets and to develop export-focused wood pellet plants in Indonesia. Already an ROK company has established a wood pellet plant in Central Java. This is being done as part of a 'green economy' policy in ROK, to reduce dependence on greenhouse gas-emitting, coal-based power generation.

Wood pellet production is also emerging in other countries; for example, Australia, China, New Zealand, Singapore and Thailand (where some pellets are being made from bamboo). At present, the wood pellet market in Asia and the Pacific remains relatively small. However, wood pellets are presently the world's fastest growing means of accessing bioenergy; hence, rapid growth should also be anticipated in the Asia-Pacific region. Increasing investments in local pellet production facilities and in making pellet stoves affordable will boost the use of wood pellets.

Source: Thaindian (2009); IEA (2007).

High fuel prices have also encouraged investments in biofuel crops, for production of biodiesel. Although this focuses on a very different market segment – mainly production of transport fuel – there are potential implications on woodfuel supplies. *Jatropha* and *Pongamia* are two species that are being planted extensively, with large-scale plantations of *Jatropha* established in a number of countries (including China, India, Philippines, Thailand and Viet Nam). *Jatropha*'s popularity is based on its purported ability to grow on marginal or degraded lands. However, there is increased concern about land-use conflicts as some so-called 'waste lands' being planted with *Jatropha* provide a number of products and services required by local communities. Projected yields (often based on trials in small areas) could be unrealistic, especially in degraded marginal lands and there is concern about the net energy yield. Environmental issues are also under the spotlight in the case of crops like oil-palm, especially when their planting replaces natural forests and peat lands as is happening in Malaysia and Indonesia. Increased carbon emissions from peat land cultivation negate many of the potential mitigation advantages of substituting petro-diesel with palm oil-based biodiesel.

Economies of scale versus economics of location

A wide array of wood energy technologies is available and more are likely to emerge as society addresses issues like energy security, climate change and human health. Adoption of these technologies will largely depend on: (a) incomes of households and affordability of technologies; (b) economies of scale in production and distribution of energy; and (c) economics of supply of wood and other biomass.

Traditionally, rural communities have been dependent on highly dispersed supplies of biomass from divergent sources, requiring very little financial investment, and collected and used largely utilizing labour with very low opportunity costs. Unless the costs of such energy increase significantly, or new technologies reduce costs significantly, there will be little incentive to switch to new technologies (including improved cook-stoves) or fuels.

Improved wood energy technologies, including pelletization, gasification and cellulosic biofuel production, will have to address challenges of scale in the production and processing of wood. Although efforts are being made to develop smaller-scale production units, which could be sustained from smaller areas dedicated to wood (and other raw material) production, the economic viability of most energy production technologies is highly scale-dependent. Often these facilities require large-scale production of wood, either from natural forests or forest plantations. Long-term economic viability thus depends on unit costs of production and processing, which to a large extent depend on land availability. Establishing a balance in trade-offs between competing land uses will be particularly challenging in the most densely populated Asia-Pacific countries, especially in view of competition for land and water.

Wood energy overview

The overall situation in regard to wood energy can be summarized as:

- The use of wood as a traditional source of energy will continue in many countries especially among low income rural households, whose access to commercial energy is limited.
- Awareness of health hazards caused by smoke from the use of wood and other biomass in traditional stoves is encouraging the introduction of better technologies that also enhance energy efficiency.
- Increases in income, improved access to liquefied petroleum gas, rural electrification programmes and urbanization are encouraging a switch away from wood energy.
- Climate change policies will encourage increased use of wood as a source of energy in wealthier countries. The use of wood pellets is already receiving attention and several countries are installing biomass gasifiers to enhance energy supplies, especially to rural areas not connected to electricity grids.
- More refined technologies such as cellulosic biofuel production may take some years before becoming commercially viable and widely adopted. In the future, these technologies can be expected to have significant implications on the way wood is used.

NON-WOOD FOREST PRODUCTS

Non-wood forest products (NWFPs) are a broad 'group' of products that encompass all plant and animal resources produced by forests, excluding wood. They can be defined as 'goods of biological origin other than wood'. Most NWFPs are gathered, rather than cultivated, and there is usually limited value addition at the source. Estimates of the extent of people's dependence on NWFPs vary; often extrapolation of local level studies fails to provide a realistic picture of the overall importance of NWFPs in the livelihoods of people at larger scales. Certainly NWFPs are critical to the livelihoods of forest-dependent people, but such dependence declines when agriculture and other activities become major sources of income.

NWFPs produced in the region are diverse, reflecting ecological diversity, and include foods, medicines, fibres, gums, resins, cosmetics and cultural products. The diversity of NWFPs in the region, in tandem with varying levels of socio-economic development, results in highly divergent patterns of production, processing, consumption and trade (**Table 3.6**). Subsistence use of many NWFPs often declines in the context of social and economic development, especially as many are considered to be 'inferior goods'. However, there are several products that have gained ground with the discovery of new uses largely due to developments in science and technology.

Category	Examples of NWFPs within the category	Characteristics
Subsistence use	 Mahua (Madhuca latifolia) flowers and fruits, sal (Shorea robusta) leaves (India, Bhutan, Sri Lanka, Nepal, Myanmar) Rattan (Calamus spp.) (Lao PDR, Myanmar, Sri Lanka) Locally collected medicinal plants (those related to traditional health care in most countries) Lard fruit (Hodgsonia macrocarpa) for oil-seed (Indonesia, Thailand, Viet Nam and Lao PDR) Jujube (Zizyphus jujuba) (China) Sago (Metroxylon sagu) (Indonesia) Illipe nuts, Pili nuts (Canarium ovatum) (Philippines) Polynesian chestnut (Inocarpus fagifer), Galip nuts (Canarium indicum), Okari nuts (Terminalia kaernbachii), Pao (Barringtonia procera) in Pacific Island Countries 	 Low economic importance (cater only to small markets) Crucial for basic food, clothing, shelter and health needs and based on traditional knowledge Typically bulky and low value per unit volume that makes long distance transport uneconomical
Traded for consumption in regional and na- tional markets	 Harra (<i>Terminalia chebula</i>) Baheda (<i>Terminalia bellerica</i>) Aonla (<i>Emblica officinalis</i>) Tendu (<i>Diospyros melanoxylon</i>) leaves Resins (<i>Dipterocarpus alatus, Pinus spp.</i>) and gums (<i>Sterculia urens</i>) Shellac and latex (especially <i>Hevea brasiliensis</i>) Edible insects 	 Industrial applications in both food (confectionery, beverage industries) and non-food industries (paint and varnish industries) Natural health care products Synthetic substitutes either not available or use of products from natural sources preferred for cost and quality reasons
Traded at the global level	 Mushrooms (e.g. shiitake and matsutake) Sandalwood oil (Santalum spp.) Agarwood oil (Aquilaria spp.) Medicinal and aromatic plants (ginseng, senna leaves) Rattan- and bamboo-based speciality products Gums and resins 	 Value per unit of volume generally high Mostly country-specific Rising incomes and changing societal preferences are key drivers for such products to reach global markets

Table 3.6. Types,	characteristics and end uses	of representative N	NFPs from Asia-Pacific
countries			

Source: Hansda (2009).

While most NWFPs are consumed as subsistence items or sold primarily in local markets, an increasing number of items are traded in response to growth in national, regional and global demand. A shift to national and global value chains will require significant improvements in production, processing and trading arrangements. There are more than 150 NWFPs from the Asia-Pacific region that are traded internationally, usually in small, unstable quantities. Bamboo and rattan are significant exceptions, traded in large volumes. Perceived health advantages of natural products are drawing increased attention to a number of NWFPs, increasing their trade.

For example, rapid growth in the demand for traditional medicines has boosted the trade – both legal and illegal – of NWFPs. Illegal trade, especially of endangered plants and animals and their parts, is flourishing despite various national and international efforts.

In view of the preponderance of subsistence use and large share of informal transactions, trade statistics seldom capture the actual contribution of NWFPs to national economies. The value of exports of NWFPs has increased significantly during the last decade, especially due to the emergence of niche markets (**Table 3.7**). The global value of NWFP exports in 2005 was approximately US\$12.9 billion, or about 7 percent of the value of primary forest product exports. The Asia-Pacific region's NWFP exports accounted for about 19 percent of the region's total export value of forest products. East Asia, especially China, has emerged as a major exporter of NWFPs, accounting for about 64 percent of regional exports (**Figure 3.10**).

Table 3.7. Global and regional NWFP exports

	1996 (million US\$)	2000 (million US\$)	2005 (million US\$)
Total global exports	7 082.2	8 001.6	12 873.8
Exports (Asia-Pacific)	3 466.6	3 487.9	5 186.5
Share of Asia-Pacific in global exports	49%	44%	40%

Source: Hansda (2009). Based on UN Comtrade data as of 31 August 2007.



Figure 3.10. Subregional proportions of NWFP exports by value (2005) Source: Hansda (2009) (based on UN Comtrade data as of 31 August 2007).

A wide range of production systems are used for NWFPs and these can be broadly grouped as:

- a) collection from the wild;
- b) cultivation integrated with other agricultural crops; and
- c) monocultural production.

Collection from wild sources is carried out on a small scale and forms the mainstay of livelihoods for many forest-dependent communities. While many NWFPs, especially food items, are consumed locally, others are bartered or sold in local markets to supplement household incomes.

In some situations, more than 50 percent of household income (in kind and cash) is derived from NWFPs. Typically, forest-dependent communities collect a wide array of products using traditional technologies. Because production is entirely dependent on natural factors, collection is usually carried out across large areas. In addition to local subsistence use several products collected from the wild are traded nationally and internationally, involving a number of intermediaries. Subsistence use rarely results in resource depletion; but this is not the case of products that are traded. With trade, the disconnect between producers and users can cause significant imbalances between demand and supply, leading to overexploitation and depletion.

In the case of integrated agriculture, NWFPs are among many commodities cultivated with other crops. Most of the production is sold in local and intermediary markets. Enhancing income is usually the primary objective of cultivation; hence many producers also undertake some primary processing.

In the case of monoculture production, substantial resources are invested and cultivation is more systematic. Most cultivators have a relatively strong degree of economic security and are likely to be less risk averse than subsistence farmers. Production is invariably geared towards national and international markets.

Two broad patterns of change can be observed in systems for production of NWFPs in the Asia-Pacific region:

- a) shifts from subsistence use to commercialization; and
- b) changes in production systems, from collection in the wild to domestication and cultivation.

Improvement in income generation opportunities is a major driver of shifts from subsistence use to commercial production. Commercialization is often an outcome of a chance discovery of certain properties, as in the case of wattle seed (*Acacia* spp). The production of flour from dried wattle seeds has contributed to the creation of a new cottage bush food industry in Australia. The growth in popularity of bush food in some countries indicates a change in society's preferences and a willingness to pay premiums for products that were earlier considered as 'inferior'. Another example of NWFP commercialization is edible insects, for example, in Thailand (**Box 3.6**)

Box 3.6 Edible forest insects

Insects have been an important source of nutrition for human beings for a long time. More than 1 400 insect species are used, worldwide, as human food; in the Asia-Pacific region entomophagy (the practice of eating insects) is reported in 23 countries. Some insects contain as much protein as the same weight of fish and meat. Most are harvested from natural forests. Bamboo caterpillars, sago grubs, grasshoppers, dung beetles, silkworms, giant water bugs, Vespa wasps, green tree ants, Hymenoptera brood, cicadas and crickets are considered to be the most important food species in the Asia-Pacific region. In February 2008, FAO in collaboration with Chiang Mai University organized a workshop on Forest Insects as Food: Humans Bite Back to assess the state of knowledge on edible forest insects and to review what needs be done to improve their sustainable production and marketing. While traditionally edible insects were collected from the wild, in countries such as Thailand they are now being reared systematically. In Khon Khaen Province of Thailand, 15 000 farmers are involved in the production of edible insects; these are processed and marketed commercially. Cricket-raising and production of bamboo worms have become major cottage industries in Thailand.

Source: FAO (2009a).

Once products are domesticated and cultivated on farms, they are no longer classified as forest products, but rather become agricultural products. Examples of previous subsistence-use products that are now produced commercially include sago in Southeast Asia (Indonesia,

Philippines, Malaysia and Thailand); wattle seed and quandong fruit in Australia; mushrooms, truffles, and bamboo in China; and yaquona (from which kava is made) in Fiji. Shifts in production and use have evolved differently for various NWFPs and patterns of change are not uniform among countries.

Increasing demand and uncertain supply from wild sources have led to the domestication of some commercially important products. The demand for health and beauty products (in particular medicinal plants) and food items (for example, mushrooms) have led to more organized, farmbased cultivation. Increasingly, NWFP-processing companies are encouraging farmers to cultivate profitable items, through provision of technical support and product buy-back arrangements. An example of this is the efforts by Dabur Limited (a leading Ayurvedic health care and food company based in India) in Nepal and India.

A major issue in large-scale cultivation of NWFPs is price volatility due to cyclical booms and busts (see **Box 3.7**). The quantities of many NWFPs demanded in markets tend to be small. A spurt in prices encourages a rapid expansion of cultivation leading to oversupply and subsequent crash of prices in some instances.

Box 3.7 Price volatility of safed musli in India

Safed musli (*Chlorophytum borivillianum*) – also known as Indian ginseng – is a crop that has impacted many farmers in different ways in India. Some have been made rich in a short period of time, while others have been frustrated by frequent price fluctuations.

Markets for safed musli have typically been very volatile. Madhya Pradesh, one of the leading states in safed musli cultivation, saw prices crash from US\$50/kg in 2001-2002, to US\$15/kg in 2003. Reports of many farmers suffering losses under contractual buy-back arrangements for safed musli by individuals or organized institutions are unsurprising, yet people continue to cultivate this 'wonder crop' without due regard for market conditions. Demand for the several musli-based products in the market does not match the extent of production. However, there are no official estimates available to indicate supply-demand balances. Indications are that large-scale plantation of high-input safed musli occurring after 2000 has been more subsidy-driven than based on actual market demands.

Source: Hansda (2009).

Development of new processes and products

New value addition technologies are bringing about major changes in the NWFP sector. For example, bamboo, which was considered a 'poor man's timber' is now being transformed into a number of high value added products (**Table 3.8**). Significant developments in value addition are also taking place in the case of beauty and health care products. Technologies for extraction of active ingredients have improved significantly and a wide array of products combining desirable characteristics is being marketed.

Trophy hunting is a high-revenue NWFP industry that is increasing in several countries in the region. Driven by demand from wealthy hunters worldwide, hunting is a major source of income for Mongolia, although reliable estimates of revenues are not available. Generally, regulation of the trophy industry appears weak, with laws that specify the reinvestment of natural resource-use fees for conservation and restoration of natural resources not broadly implemented and rare species such as the argali sheep (*Ovis ammon*) suffering significant population declines. Another rapidly growing NWFP industry based on forest animals is trade in animals and animal parts, often controlled by criminal networks, undermining conservation efforts.

Processing industry	Type of products	Characteristics	Likely impact
Low-value and bulk-processing industries	Charcoal	Industry achieves only marginally higher levels of income compared to those selling unprocessed raw bamboo culms. Industry can utilize low quality bamboo, leftovers and processing waste from other industries, and various species	Large-scale livelihood opportunities for the poor; however, impacts are marginal on a per capita basis because incomes from employment are low
Medium-value processing industries	Chopsticks, bamboo vinegar, bamboo juice, mat boards, and handicrafts	Industries are able to use lower grades of bamboo than in premium processing industries	Employment opportunities for relatively higher skilled people, rates of employment moderate
Premium processing industries	Bamboo flooring and ceilings, high quality yarns and fabrics	Premium quality bamboo is required. Industries' economic impacts are twice the level of medium-value processors and five times the level of low-value and bulk processors	Livelihood opportunities for relatively fewer people; high rates of employment

Table 3.8. The emerging bamboo-processing	industry and its characteristics
---	----------------------------------

Source: Hansda (2009).

New institutional arrangements

The widespread interest in NWFPs has generated a proliferation of institutions and projects involved in supporting and advising on their production, processing and marketing. Of particular significance are cooperatives and similar arrangements that help to empower growers and collectors (**Box 3.8**). With improved access to information, these institutions are able to provide timely advice to producers and, more importantly, help to improve economies of scale, thereby overcoming some of the inherent problems of small-scale production.

Box 3.8 Grama Mooligai Company Limited: scaling up through collective action in India

Established in 2000, the Grama Mooligai Company Limited (GMCL) successfully created a structure to bring together collectors and cultivators of medicinal plants. The establishment of GMCL was promoted by the Foundation for Revitalization of Local Health Traditions (FRLHT), an NGO based in Southern India.

GMCL is a member-owned enterprise with shareholding restricted to medicinal and aromatic plant (MAP) gatherers and cultivators. At present, its shares are held by 30 groups representing 1 200 members. GMCL has collaborated with 13 NGOs in seven states, to involve local community-based organizations in activities to increase the scale of operations.

GMCL has linked with 1 200 retail outlets and several large pharmaceutical companies to market processed raw herbs and finished products, mainly honey. The company's turnover increased from a modest US\$60 000 in 2001 to 2002 to US\$170 000 in 2003 to 2004.

GMCL is attempting to link producer groups in national and global value chains, to increase market power and ensure fair prices. The members, mostly women, have been trained in simple value-addition techniques including sorting, grading and packing produce, as well as sustainable harvesting techniques, and skills to handle most aspects of trade. GMCL has launched a set of specialty herbal remedies for primary health care under the brand name 'Village Herbs.'

A major issue with regard to NWFPs is quality assurance. This is particularly important in the case of ingredients required for health and beauty care products. Certification and fair trade arrangements are gaining increased attention, especially in the context of increased demand for natural products. Nepal has used its local community forestry organization to implement a certification programme to improve NWFP collection (**Box 3.9**). Such a shift towards greater local involvement has helped in the 'formalization' of the informal sector. NWFPs are increasingly recognized as being vital to employment and income for rural people.

Box 3.9 NWFP certification in Nepal

In Nepal's Himalayan highlands, the collection and sale of NWFPs represent an important source of income for local villagers. However, the villagers typically sell their goods to intermediaries and traders, who encourage them to harvest as much as they can, while paying them poorly for their products.

The growing demand for environmentally friendly products in Europe and North America has created an opportunity for NWFP producers through sustainable, certified harvesting of NWFPs. Certification, supported by the Forest Stewardship Council (FSC), is aimed at creating a new market niche that encourages sustainable practices in the collection and processing of NWFPs. FSC certification in Nepal has required extensive capacity building for stakeholders. In 2005, the Rainforest Alliance and SmartWood awarded FSC certification to the Federation of Community Forestry Users Nepal (FECOFUN). FECOFUN's members practice sustainable harvesting of local non-wood resources; processing and marketing products including handmade (lokta) paper, essential oils, Ayurvedic medicines and supplements, herbal teas, pain relief oil, personal care products and raw herbs. According to FECOFUN, 23 species of NWFPs have been certified by the FSC.

Source: Rainforest Alliance Newsletter (2009).

ECOSYSTEM SERVICES

Society has become increasingly aware of the ecosystem services provided by forests and trees and in some countries such services have become more important than production of wood and non-wood products. The setting aside of large tracts of forests as protected areas allied with changes in management objectives including, in some cases, a total ban on logging, reflect the changes in society's priorities. Conservation of biological diversity, maintenance and improvement of watershed values, combating desertification and land degradation, and climate change mitigation and adaptation are some of the key ecosystem services provided by forests. With climate change becoming a key global issue, the role of forests in climate change mitigation and adaptation has become a high profile issue in recent times. Provision of recreational services has also garnered significant attention and in many countries ecotourism, domestic and international, is already an important source of income.

Flows of ecosystem services are adversely affected by deforestation and degradation in most Asia-Pacific countries. However, measurement and valuation remain a major constraint in assessing impacts on ecosystem services. Often, slow changes will go unnoticed, delaying action to arrest declines. Establishing trade-offs between competing uses remains a major challenge; often resulting in the provision of ecosystem services being assigned a low priority in resource-use decision-making. The following provides an overview of the current state of provision of forestlinked ecosystem services including measures being taken to enhance these services in the context of increasing demands.

Biodiversity conservation

While the Asia-Pacific region is extremely rich in biodiversity, it is also a region where biodiversity is under threat, having 13 of the world's 34 identified biodiversity hotspots (**Box 3.10**). Despite a long history of conservation efforts, the threat of major losses of biodiversity persists in view of intense human pressures. Rapid growth of economies and associated direct and indirect impacts on land use have led to significant erosion of biodiversity. To counter this, almost all countries are signatories to the Convention on Biological Diversity and many have prepared national biodiversity strategies and action plans. Management of sanctuaries and national parks, many of which were initially established as hunting or game reserves, has been broadened with greater thrust on managing ecosystems in their totality. Further, there has been a shift in the approach to protected area management, with more thrust being given to involve local communities in conservation efforts.

Box 3.10 Biodiversity hotspots in Asia and the Pacific

A biodiversity hotspot is a geographic region with a significant reservoir of biodiversity that is threatened with destruction. To qualify as a hotspot a region must meet two strict criteria: it must contain at least 1 500 species of vascular plants (0.5 percent of the world's total) as endemic species and it must have lost at least 70 percent of its original habitat. The Asia-Pacific region is home to 13 of the world's 34 hotspots.

East Melanesian Islands: Comprising 1 600 islands, this hotspot contains 3 000 endemic plant species in a geographically complex area. However, biodiversity is threatened due to excessive mining and logging activities, and agricultural encroachment.

Himalayas: Due to variations in altitude, this hotspot is extremely diverse; ranging from alluvial grasslands to subtropical broadleaf forests. Agricultural encroachment, overgrazing and logging are among the key threats to this hotspot.

Indo-Burma: This region is considered a 'biological treasure' with a high number of endemic species found in tropical forests. This includes 7 000 endemic plant species, 1 300 bird species and six large mammals discovered in the last decade. Indo-Burma is one of the most threatened biodiversity hotspots, due to the rate of resource exploitation and habitat loss. Only about 5 percent of natural habitats remain in relatively pristine condition.

Japan: Urban development has significantly affected biodiversity in Japan. However, a quarter of vertebrae species found in the Japanese Archipelago are endemic, including a large diversity of endemic amphibians.

Mountains of southwest China: Similar to the Himalayas, biodiversity in this area is also diverse due to variations in altitude. Forest flora in this area is considered the most endemic species-rich in the world. However, biodiversity is threatened due to the building of the enormous Three Gorges Dam, as well as illegal hunting, overgrazing and fuelwood collection.

New Caledonia: A small island in the South Pacific, New Caledonia is nonetheless home to more than 5 000 endemic plant species. However, nickel mining, forest destruction and invasive species are threats to biodiversity.

New Zealand: Biodiversity in New Zealand is unique with high levels of endemism due to geographic isolation. However, many species, especially birds, are threatened; primarily by invasive species.

Philippines: Comprising an archipelago of more than 7 100 islands, this hotspot is one of the most biologically rich. A combination of mining, logging for timber, newly constructed roads to service these activities, as well as population pressures and conversion of forests to agricultural land have threatened biodiversity in this area.

Polynesia-Micronesia: This area is considered the 'epicentre' of the current global extinction crisis due to introduced invasive species and excessive hunting of birds and animals.

Southwest Australia: Forests, woodlands and shrub lands and heath constitute a hotspot that is characterized by a high level of endemism in plants and reptiles. Agricultural expansion and invasive species pose the key threats to biodiversity in this area.

Sundaland: Consisting of 17 000 islands and two of the world's largest islands – Borneo and Sumatra – this hotspot is home to the orangutan, found nowhere else on earth. However, this hotspot is subject to forest degradation due to logging, conversion to rubber and palm oil production and the international trade in animal products.

Wallacea: The islands that make up this mainly Indonesian hotspot are home to the Komodo Dragon and have the second-highest number of endemic bird species in the world. This area is threatened due to overpopulation, transmigration and deforestation.

Western Ghats and Sri Lanka: Forests with rich endemic plant and animal species are under threat due to high population pressures, logging and agricultural encroachment.

Source: Conservation International (2007).

Despite these efforts, biodiversity conservation faces the following challenges:

- While parks and reserves are easily established, funds and capacity to manage them generally remain deficient, defeating the purpose of protected areas. There are several examples of such 'paper parks' in the Asia-Pacific region.
- Often conservation efforts are focused entirely on land (or forests) earmarked as protected areas and biodiversity outside such areas gets very little attention, even though 'unprotected' areas may harbour high levels of diversity.
- Rapid expansion of infrastructure, mining, etc. has increased the vulnerability of many protected areas. In many cases, short-term economic interests dominate decisions, notwithstanding the various policies and legislation relating to biodiversity conservation. Although a number of countries undertake environmental impact assessments as part of project feasibility studies, these seldom tilt the balance of decisions to abandon 'development' projects in favour of leaving the land and forests intact.
- Encroachment of agriculture both commercial and subsistence.
- Increasing infrastructure development in previously remote areas.

In establishing trade-offs between competing uses, particularly where poverty is a major issue, identifying economic benefits deriving from biodiversity becomes critical. In recent times, much hope was pinned on bioprospecting as a means of ensuring biodiversity conservation; however, hitherto there are only a handful of examples of successful bioprospecting initiatives (**Box 3.11**). Benefits from biodiversity conservation today, will largely accrue in the future; in the meantime, maintaining species diversity is an issue of intergenerational equity and preserving the wealth of nature for the benefit of future societies. This limits the scope for market-based approaches to management, requiring the public sector to play leading roles in biodiversity conservation.

Box 3.11 Biodiversity hotspots in Asia and the Pacific

'Bioprospecting' is the practice of searching for useful biological materials in the natural environment to develop or improve products such as medicines, cosmetics and food. The Bonn *Guidelines of the Convention on Biological Diversity* provide a framework for establishing contractual arrangements relating to various aspects of bioprospecting, with particular emphasis on access to genetic resources and equitable benefit sharing. Bioprospecting generally occurs in two forms:

- The 'prospecting' and then wider spread of already existing knowledge and practices; or
- New discoveries generated by independent exploration.

Bioprospecting potentially represents a means of generating income – particularly for highly biodiverse areas – and may provide an economic justification for protecting biodiversity. However, substantial hype in the 1990s surrounding potential revenues from bioprospecting has been found to be unrealistic and incomes actually accruing to resource owners have remained very limited.

A wide array of technical, policy, legal and institutional issues affect bioprospecting, including issues relating to development of new products and sharing of income. Several countries – both globally and in Asia and the Pacific – have devised rules and regulations governing bioprospecting; nonetheless, there are ambiguities, especially with regard to rewarding the owners of the resources and the keepers of traditional knowledge. Although the pharmaceutical industry relies heavily on plant-based ingredients, their identification, development, testing, approval and production is a time-consuming process with considerable uncertainties. Often new product development has drawn heavily on traditional knowledge of local communities, helping to narrow the focus of bioprospecting. This raises questions about intellectual property rights and rewarding the keepers of traditional knowledge. Bio-piracy, whereby prospectors appropriate knowledge and materials without recognizing, acknowledging or rewarding owners of resources and knowledge remains a major challenge.

There are very few instances of systematic bioprospecting in the Asia-Pacific region. One example occurs in Locally Managed Marine Areas in Fiji, enabling local communities to regulate access to biodiversity through contractual arrangements between private companies and local communities. The arrangements for bioprospecting initiatives in Fiji are government-regulated with benefits channeled to traditional marine resource owners. As of mid-2008, two agreements have been signed involving a Scottish-based research institute.

Another well-publicized example is the development of 'Jeevani' – an energy and stamina boosting anti-stress product derived from *Trichpsis zeylanicus* – based on the traditional knowledge of the forest-dwelling Kani community in the Indian state of Kerala. Although upheld as a success story of bioprospecting, loopholes in intellectual property regulations have led to a failure to realize the potential benefits for local people. Jeevani is now manufactured and marketed in the United States, without any reward accruing to the local community, whose knowledge formed the basis of product development.

The absence of a real surge in bioprospecting has led to increased questioning of its true economic viability in view of the low probability of identifying new ingredients and developing them commercially. Developments in combinatorial chemistry are reducing dependence on sourcing biologically active molecules from natural organisms, undermining the scope for income generation through bioprospecting. Further, most pharmaceutical companies prefer to have total control over the production process and thus prefer synthetic production routes rather than rely on supplies from less certain natural sources.

Source: Aalbersberg (2008).

Combating desertification

The Asia-Pacific region has large tracts of highly fragile, dry lands. Traditional agriculture in these areas has evolved into complex production systems to minimize degradation threats. However, increased human pressure, especially on account of population growth and intensive use of marginal lands for cultivation and livestock production, has led to dryland degradation and desertification. Political, social and economic changes have undermined traditional community resource management systems, leading to overexploitation of dry lands. In tandem with climatic variations, this has contributed to desertification. As elsewhere, agriculture, overgrazing and woodfuel collection have been some of the important causes of dryland degradation and desertification.

Several countries in the Asia-Pacific region have high levels of desertification risk, which is calculated on the basis of two indicators: (i) the area of dry lands as a percentage of productive agricultural land; and (ii) the population occupying dry lands as a percentage of population on agriculturally productive land. Countries with more than 50 percent risk of desertification include Australia, China, India, Mongolia and Pakistan (**Table 3.9** and **Box 3.12**).

Country	Desertification risk (%)
Australia	77
Bhutan	9
China	57
India	72
Indonesia	1
Japan	4
Korea, DPR	31
Lao PDR	1
Mongolia	100
Myanmar	1
Nepal	42
Pakistan	100
Sri Lanka	6
Viet Nam	2

Table 3.9. Calculated desertification risk in Asia and the Pacific

Source: FAO (2003).

There are several national and international initiatives to combat land degradation and desertification. All countries in the Asia-Pacific region are signatories to the United Nations Convention to Combat Desertification (UNCCD), with some 13 countries implementing national action plans to combat dryland degradation and desertification. Forests and forestry play important roles in ameliorating the situation and tree growing is an integral part of arresting degradation and desertification and the rehabilitation of affected areas. Establishment of windbreaks and shelterbelts has been a standard practice in arid zones in most countries, especially to protect agricultural land and habitations from desertification. A substantial wealth of knowledge exists on technical aspects of desertification control and several countries are implementing major initiatives to control desertification. For example:

- In China, three of the country's Key Forestry Programmes (KFPs) directly focus on controlling desertification: (i) Combating Sandification around Beijing and Tianjin Programme; (ii) Key Regions' Shelter Forest Programme (the fourth phase of the Three Norths Shelter Forests); and (iii) Conversion of Cropland to Forest and Grass Programme.
- In Mongolia, a 'Green Wall' programme has been initiated, which aims to afforest and reforest transitional areas between the Mongolian Gobi desert and steppe regions, in an effort to reduce loss of forest reserves, desertification, sand movement and dust and sand storms, caused by climate change and inappropriate anthropogenic activities (Box 3.12).

Box 3.12 Desertification in Mongolia

Mongolia's location – as a landlocked continental country at the heart of Central Asia – combined with low precipitation and average elevation of about 1 500 metres above sea level, makes it highly susceptible to desertification. The Gobi Desert region constitutes 42.5 percent of the country's territory.

Over the past 60 years, the annual average air temperature in Mongolia has increased by 1.56° Celsius. The increase is attributed to global warming and climate change. Surveys show that droughts that encompass at least 25 percent of the country's territory occur with a frequency of 2-3 years; droughts encompassing 50 percent of the territory happen every 4-5 years. In comparison with the 1960s, dust storms on the steppes and in the Gobi Desert region are now three to four times more frequent.

Intensification of the desertification process, in the wake of climate change, has resulted in the melting of previously perpetual snow, drying up of lakes, rivers and streams, a sharp decline in the yield of pastures, salinization of soil and water, soil erosion, land degradation, loss in fertility, acceleration of sand movement and an increase in the frequency of natural disasters. A Green Wall programme is being initiated to help combat this desertification.

Source: Ykhanbai (2009).

Recognizing the limitations of sector-focused approaches to combating desertification, more thrust is being given for the adoption of integrated approaches to land use. As regards institutional arrangements, considerable attention is being given to fully involve local communities in land management. However, eventually all these efforts boil down to tackling fundamental policy, legal and institutional issues, which are extremely difficult (**Box 3.13**).

Box 3.13 Local level efforts to combat desertification in Pakistan

Pakistan is under threat from desertification; it is estimated that the area desertified is expanding at a rate exceeding 1 percent per annum. Increased extraction of woodfuels and monoculture agricultural practices are the main causes of land degradation. A number of initiatives to combat desertification are being implemented; many being focused on improving resource management by involving local communities. An example of such efforts is in Morkhoon village in the far north of Pakistan where, supported by the Aga Khan Foundation (AKF), several women's organizations have been established to provide institutional support to run a credit and savings programme to better manage natural resources. The AKF has promoted forest plantations on the boundaries of fields, communal land, private land and any other areas where original vegetative cover has disappeared. This has helped to overcome fuelwood and fodder shortages. The women have created committees to monitor forest use and grazing. Women have also planted trees on family land and have switched from monocultural practices to crop rotation to prevent degradation.

Source: UNCCD (2007).

Forests and climate change

With climate change becoming one of the most critical environmental issues, forests and forestry are gaining increasing attention in mitigation and adaptation strategies; deforestation and forest degradation account for about 17 percent of carbon emissions. Forestry's role in climate change mitigation largely depends on progress in implementation of sustainable forest management, thus arresting deforestation and degradation (reducing carbon emissions) and increased afforestation and reforestation efforts (increasing carbon stocks).

Reducing carbon emissions and improving sequestration are global public goods; hence, much of the thrust of climate change mitigation is to develop a globally acceptable policy framework that encourages significant emission reductions. The Kyoto Protocol was an important step in this direction, providing a framework for climate change mitigation and adaptation till 2012. An outcome of the Kyoto Protocol

and other climate discussions has been the development of cap and trade systems, helping to develop carbon markets. All Asia-Pacific countries (with the exception of Brunei Darussalam and a handful of Pacific Island Countries) are signatories to and/or have ratified the Kyoto Protocol. Despite concerted efforts, the development of a post-Kyoto arrangement on climate change mitigation and adaptation has remained elusive, especially in view of the failure to articulate a legally-binding agreement during COP 15. Narrow short-term interests have undermined a binding legal agreement on reducing emissions and much depends on how the major emitters of CO_2 will deal with the problem.

Forestry under the Kyoto Protocol

Under the Kyoto Protocol three flexible mechanisms were created:

- (i) the Clean Development Mechanism (CDM);
- (ii) joint implementation; and
- (iii) emission trading.

Under the CDM, Annex I countries may offset a certain part of their emissions through investment in carbon sequestration or substitution projects in non-Annex I (developing) countries, thus acquiring tradable certified emission reductions. Afforestation and reforestation projects were included in the CDM as one of several carbon sequestration options.

While the appeal of afforestation and reforestation as a climate change mitigation strategy is considerable, forest-based carbon offset projects face several challenges, including setting baselines, ensuring permanence in reductions achieved, and leakage prevention (whereby emissions reductions in one country prompt increased emissions in another). Rigorous stipulations and complex processes have marginalized forestry participation in the CDM, which is largely dominated by less complex projects in the energy sector. Thus, although there were about 2 100 registered CDM projects by March 2010, only 13 of these accounting for just 0.51 percent deal with afforestation and reforestation. Of these, six are in the Asia-Pacific region (China (two projects), India (three projects) and Viet Nam (one project)) (**Box 3.14**). It is worth noting that these three countries are at the forefront of afforestation and reforestation efforts, even without support under the CDM.

Box 3.14	CDM afforestation and reforestation projects in the Asia-Pacific region*	
China		
China has tw	o registered CDM afforestation and reforestation projects:	
1. Facilita 2006,	ating reforestation for Guangxi Watershed Management in Pearl River Basin, registered in aims to:	
•	Afforest 4 000 hectares through establishment of new plantations and multiple-use forests on degraded lands.	
•	Sequester CO_2 through forest restoration (it is expected that plantations could sequester around 0.34 million tonnes by 2012 and 0.46 million tonnes by 2017).	
•	Connect fragmented forests to create biodiversity corridors, reduce soil erosion, improve hydrological flows and reduce risks of flooding and droughts.	
2. Affore 2009,	station and reforestation on degraded lands in Northwest Sichuan, China, registered in aims to:	
•	Establish 2 250 hectares of multiple-use forests by direct planting on degraded lands in five counties.	
•	Sequester 23 000 tonnes CO_2 equivalent <i>per annum</i> , with an operational lifetime of 60 years.	
	violation offerentiation and referentation preiode under the CDM nemely.	
	istered three anorestation and represtation projects under the CDM, namely:	
by shi cropla farmei 11 600	fting sand dunes in Sirsa, Haryana, approved in 2009. This project will improve degraded nds surrounding eight villages. The croplands comprise 370 hectares belonging to 227 rs. These have been planted with a number of indigenous and exotic species to sequester 0 tonnes of CO_2 .	
2. The F India u 000 he of CO	Reforestation of severely degraded landmass in Khammam District of Andhra Pradesh, under ITC Social Forestry project, approved in 2009. This project covers an area of about 3 ectares of severely degraded wasteland and is expected to sequester about 57 800 tonnes ₂ . At the same time, the project will provide income security to the local community.	
3. The Ir in 201 expec	ternational Small Group and Tree Planting Program (TIST), Tamil Nadu, India, approved 0, is a small-scale project for the reforestation of degraded grasslands and croplands, that ts to sequester 107 800 tonnes of CO_2 equivalent by 2033 (planting began in 2004).	
Viet Nam		
Viet Nam sec 365 hectares Phong comm be planted o CO_2 during t	cured registration for the Cao Phong Reforestation Project in 2009, which plans to establish s of tree plantations on degraded grasslands and shrublands in Xuan Phong and Bac nunes in Cao Phong District. Plantations of <i>Acacia mangium</i> and <i>Acacia auriculiformis</i> will n a 15 year rotation for wood production, in the process sequestering 42 650 tonnes of he first credit period.	
As of 17 Ma	rrch 2010.	
Source: UNFCCC (2010).		

Exclusion of afforestation and reforestation by most major emission trading schemes linked to the compliance market has been an important factor contributing to the low share of forestry in carbon trading. For example, the European Emission Trading Scheme, which in 2008 accounted for over 60 percent of the volume and close to two-thirds of the value of all carbon markets, does not recognize offsets generated through afforestation and reforestation. Some of the inherent technical and institutional problems (especially to demonstrate that sequestration is additional and that there will be no leakages) along with the protracted and complex process of CDM approval makes afforestation/reforestation less attractive in comparison with other projects, especially energy conservation. The New Zealand Emissions Trading Scheme is exceptional in that it incorporates forestry within its provisions (**Box 3.15**). Forestry projects have garnered greater prominence in the less regulated, voluntary carbon markets. Although voluntary markets have grown rapidly during the last few years, their overall share in the carbon offset market remains very low.

Reduced Emissions from Deforestation and Degradation (REDD)

Since deforestation and forest degradation have been identified as major sources of carbon emissions, providing incentives to promote forest conservation has become an important thrust of the post-Kyoto climate change mitigation arrangements. The issue was discussed and included under the Bali Action Plan agreed during the 13th Conference of the Parties (COP 13) in December 2007. Although there has been a broad agreement during COP 15 on REDD under the post-Kyoto arrangements with some countries pledging financial support, several issues are yet to be resolved. Better clarity on REDD implementation is expected from COP 16 to be held in Mexico in December 2010.

The thrust of REDD programmes is to pay compensation to forest owners and other involved parties for potential income losses and costs accruing as a result of maintaining forests intact and forgoing alternative land-use options that involve forest clearance. Anticipating international arrangements, preliminary efforts are underway to develop baseline information and methodologies for effective monitoring, assessment, reporting and verification. Currently in the Asia-Pacific region, Cambodia, Indonesia, Lao PDR, Nepal, PNG, Thailand, and Viet Nam are developing 'REDD-readiness' under the UN-REDD Programme and several other countries are in the process of joining this initiative. Several other countries' REDD-readiness is being supported by other initiatives. In addition to the technical challenges of development of baseline information, implementation of REDD will require overcoming major policy, legal and institutional hurdles. Uncertainty in carbon markets (especially volatility of carbon prices) could adversely affect financial support to REDD.

Country-level action

Notwithstanding some of the uncertainties, a number of countries in the Asia-Pacific region have included forests and forestry as important components of climate change strategies. Some of the notable national programmes include:

- Tree planting and forest restoration and protection form the central focus of China's National Climate Change Programme.
- India's Climate Change Strategy envisages afforestation of 6 million hectares within the next decade.
- Japan and ROK have included forests as a central part of climate change mitigation efforts to enhance carbon sinks. Considering the relatively high proportion of land under forests in these countries, much of the thrust is towards improved tending to enhance carbon sequestration by existing forests. Other initiatives being implemented include promotion of urban tree planting, prevention of forest degradation and increasing the use of biomass as a source of energy.
New Zealand enacted an initial Emission Trading Scheme in 2008 with forestry the first sector to apply the scheme (**Box 3.15**). Following a change in the government at the end of 2008, the scheme has been revised, with several substantive changes to forestry provisions. New Zealand has also implemented an Afforestation Grant Scheme, which offers grants to plant forests on land that was not forested on 31 December 1989 (the Kyoto compliance date); and a Permanent Forest Sink Initiative, which enables private forest owners to receive carbon credits in the form of Assigned Amount Units when they establish new permanent forests (i.e. forests that will never be harvested).

Box 3.15

The New Zealand Emissions Trading Scheme (ETS) and forestry

The New Zealand ETS follows many of the Kyoto Protocol rules although it does contain additional restrictions for pre-1990 forest owners. It treats forests differently depending on when they were first established and also, if they have been on-sold. Under New Zealand's implementation of the Kyoto Protocol, forests first established before 1990 (called pre-1990 forests) are treated differently from post-1989 established 'Kyoto' forests.

Owners of pre-1990 forests will receive a carbon credit allocation of 60 New Zealand Units (NZUs) for each hectare of forest owned, if they established their forest or purchased the forest prior to 2002. If the forest was purchased since 2001, the owner will receive only 39 NZUs. If pre-1990 established forest land is deforested (i.e. harvested and converted to another land use) the owner will be liable for the total amount of carbon contained in the forest at maturity. Participation in the ETS is mandatory for pre-1990 forest owners who deforest their land.

Owners of post-1989 forest land can choose to enter the ETS. Owners who enter the scheme receive all of the credits and associated liabilities linked with this forest land: they receive NZUs if their forests' carbon stocks increase as a result of tree growth and they must surrender NZUs if those stocks decrease (for example, due to harvesting or fire). Where owners opt not to enter the ETS, the Crown takes responsibility for changes in carbon stocks and for the associated credits and liabilities.

Source: NZMAF (2009); NZFOA, personal communication.

In April 2010, the implementation of Australia's Carbon Pollution Reductions Scheme (CPRS) was deferred until 2013. The proposed Australian scheme would sell licenses to emit carbon. The Australian forestry industry has strongly advocated for forestry to be included in the CPRS, similar to the New Zealand scheme and the Australian Government is still considering whether and how credits from carbon offsets offered by sectors such as forestry would be included in the scheme.

Other Australian initiatives that encourage establishment of forests as carbon sinks include the Greenhouse Challenge Plus initiative, which allows companies to offset carbon emissions through the establishment of forest sinks. Various state governments have also implemented schemes incorporating carbon sinks, such as the New South Wales Government's Greenhouse Gas Abatement Scheme.

 Perhaps the most proactive developing country on climate change issues has been PNG, which has championed the cause of REDD through the Coalition of Rainforest Nations. The Coalition aims to have emission offsets related to deforestation (in addition to afforestation and reforestation) incorporated into global carbon emissions markets. The Papua New Guinea Government has also made progress in developing a carbon trading policy incorporating forestry, designation of potential CDM project areas in provincial and national forest plans, and established a Climate Change and Environmental Sustainability Office (though this was subsequently closed due to alleged improprieties).

² In steep areas with wet climates, unpaved roads commonly associated with logging operations can cause a 10-300-fold increase in landslide erosion rate in forested catchments (Dolidon *et al.* 2009).

Potential challenges

While forests play an important role in climate change mitigation, there are various challenges that countries must overcome if they are to take advantage of the emerging opportunities, as is already evident from the marginalization of afforestation and reforestation under the CDM. There is also increasing criticism of the effectiveness of the cap and trade system in addressing climate change and, already, efforts are being made to introduce more direct approaches such as taxes on carbon. The success of initiatives like REDD is primarily dependent on improving policy and institutional environments, which continues to be extremely challenging, especially in countries where the problems of deforestation and degradation are severe. There are also increasing concerns that credits generated by REDD could drastically reduce carbon prices, thus undermining any meaningful efforts to reduce emissions through improved technologies. Along with uncertainties related to international transfers of resources, these issues pose major challenges to forestry-based climate change mitigation efforts.

Forests and water

Several countries in Asia and the Pacific suffer from severe water scarcity and this is expected to worsen in the context of climate change and increasing populations. Continued growth of the region's economies will depend on sustained supplies of freshwater. The role of forests in minimizing erosion and maintaining water quality is of particular importance in:

- 1. hydroelectric schemes where sediment can reduce reservoir capacity and wear down turbine blades;
- 2. maintaining aquatic habitats and river navigation by preventing excessive sedimentation and sediment deposition; and
- 3. maintenance of water quality for drinking (Hamilton 2008).

Because fertilizers and pesticides are seldom used in natural forests, forests are preferable to other land uses in the context of providing drinking water supplies. Riparian buffer zones are particularly important in preventing sediments and pollutants from entering rivers and in stabilizing river banks. Erosion control and entrapment of sediments is also of relevance in coastal ecosystems where removal of mangroves can lead to loss of land, saline intrusion and exposure of coastal populations and assets to increased risk from coastal hazards.

Trees also play an important role in averting landslides under less extreme conditions, although deep landslides resulting from continuous heavy rainfall or earthquakes are unlikely to be affected (Hamilton 2008). Deep-rooted trees and shrubs strengthen shallow soil layers and improve drainage, thereby reducing the occurrence of shallow landslides. Transpiration from extensive tree canopies can also decrease soil water content and reduce landslide risk. Conversion of forests on sloping land reduces rooting strength for up to two decades even with subsequent regeneration and increases landslide risk. Maintenance of forest cover in slip-prone areas where slopes are greater than 45 percent, where slopes are concave or soils have low cohesion, or are shallow and cover bedrock, is particularly important.

Land uses that increase surface erosion and slope instability in tropical uplands include logging², road and trail construction and forest conversion, while surface erosion is usually low in undisturbed forest catchments. Increased occurrence of storms and increased logging and infrastructure development in sloping areas are likely to raise the incidence of erosion and landslides in the coming years. Although regulations preventing logging in riparian zones and on steep slopes are generally included in forest harvesting guidelines in most countries, they are often not strictly adhered to nor enforced. Lack of certainty regarding the precise nature of the hydrological functions of forests, particularly in relation to flooding and droughts, has brought some uncertainty to forest protection for watershed management. Water-related issues have, however, been perhaps the most significant driver of forestryrelated policy change in the Asia-Pacific region. Landslides following heavy rains in southern Thailand in 1988 were linked to deforestation of steep slopes, leading to a ban on logging. Similarly, recurrent devastating floods and landslides in the Philippines were attributed to illegal logging and led to the pronouncement of logging bans, most recently in 2004. Pakistan is another country that imposed a logging ban in the aftermath of catastrophic floods in 1992. Although links between forestry activities and erosion, floods and droughts are sometimes imprecise, natural disasters are likely to remain a key driver of forest policy in the coming years.

Almost all countries in the region are paying increased attention to watershed management with particular focus on forest conservation and afforestation/reforestation (**Box 3.16**). Forests and trees occupy a prominent place in watershed management regimes and the emphasis is on adoption of integrated approaches taking into account the linkages between different uses and adopting landscape-scale approaches. Key issues relating to forests and watersheds include:

- Improved assessment of the roles of forests in upland areas and adoption of locally appropriate, integrated approaches to watershed management.
- Reviewing forestry practices, including afforestation, specifically taking into account water requirements. Species and practices that are water-demanding may have to be phased-out as competition for water becomes intense. This will be of particular importance for large scale industrial plantations using fast-growing species.

Box 3.16 'Green dams' for water conservation in Republic of Korea (ROK)

ROK has a long history of managing forests for water conservation with particular focus on maintaining water quality. A system of water conservation forests was provided in the Forest Decree of 1911. Additional provisions to this decree were incorporated in the 1961 Forest Act and subsequently into the Act to Create and Manage Forest Resources 2005. Seven types of protected forests, including types such as erosion control forests and fish shelter forests, are designated by the Act.

There are three types of water conservation forests:

- Type I is forests designated around reservoirs, which are critical for water supply for agriculture, power generation and industrial uses. Forests within 1 000 metres of maximum reservoir water levels are included under Type I.
- Type II is forests located in the zone of upstream water resources. Forests whose valleys are steep or where tree growth is poor presenting challenges due to the natural environment are included in Type II.
- Type III water conservation forests are publicly-owned forests which are managed for the quality of upstream water resources and are designated within five kilometres from each bank of the watercourse boundary.

In 2005 the extent of water conservation forests under Type I, II and III was 135 700 hectares, 15 711 hectares and 155 267 hectares respectively.

There is considerable public awareness about managing forests, often called 'green-dams', to provide clean and abundant water supplies.

The Korean Forest Service, in collaboration with the Korea Water Resources Corporation, is also implementing a green-dam project to manage upstream forests surrounding large reservoirs. By 2006 the green-dam project was completed in four forest regions and new green-dam projects will be implemented in 16 forest regions.

Source: Rin Woo Joo et al. (2009).

Watershed management in most Asia-Pacific countries is publicly funded. Because water is considered as 'god-given', development of markets for water, including privatization, finds very little public support. However, increasing water shortages are paving the way for market-driven approaches, including for watershed management through payments to upland owners by downstream water users; although most are still in the pilot stages of implementation. Demand among potential ecosystem service buyers is limited due to lack of awareness of the concept; absence of information on clear linkages between land use, water yield and its quality; and resistance to additional taxes or fees. The highly fragmented nature of land use and ownership in upland areas, the lack of sellers' bargaining power, high transaction costs, unclear land tenure and low capacities of local institutions to act as intermediaries are other impediments. Absence of policies and laws supportive of payments for ecosystem services (PES) is another factor constraining wider adoption of PES.

If payment schemes for watershed services are to be successful, acceptance from water users must increase and for this to happen, better evidence of the benefits of watershed protection and the effects of payments on the flow of benefits is needed. In most cases, payment for watershed services is likely to remain 'government directed' levying additional taxes on electricity or water used, rather than true markets where payment is directly linked to the service provided.

Amenity values – ecotourism and urban forestry

Increasingly, the amenity values of forests are receiving greater recognition – for example, ecotourism and urban forestry (**Box 3.17**). Ecotourism is a rapidly expanding segment of the wider tourism industry. Based on information from countries with data available, the worldwide contribution of tourism, including international passenger transport, amounted to US\$1.1 trillion in 2008, or over US\$3 billion a day. Tourism's contribution to employment is estimated at 6 to 7 percent of the overall number of jobs (direct and indirect), Receipts from international tourism in the Asia-Pacific region were estimated at about US\$206 billion for 2008, with total international tourist arrivals of 184 million visitors in the same year (UNWTO 2009). No precise information is available on how much of this can be categorized as ecotourism (nor can the share of forests in overall tourism, especially as society accords greater value and importance to natural landscapes. Rapid economic growth and a burgeoning middle class are important factors in the expansion of domestic ecotourism. Expanding partnerships between communities, governments and private investors has helped to boost ecotourism in many Asia-Pacific countries.

Box 3.17 So

Some examples of urban greening in the Asia-Pacific region

Urban greening is receiving increased attention in most Asia-Pacific countries, in the context of the rapid urbanization, as higher incomes generate demand for healthier and more attractive urban landscapes. Urban forestry has a long history in the region and there have been substantial efforts in some countries to develop and manage urban green spaces for environmental and recreational purposes. Examples include:

- Sanjay Gandhi National Park is the world's largest urban forest and one of Asia's most visited national parks. The park has an area of 104 km² and is surrounded on three sides by Mumbai – the world's most populous city.
- In ROK, urban parks are an integral component of healthy urban living. The Seoul metropolitan
 area hosts six major parks including Seoul Forest a park somewhat modeled on New York's
 Central Park. Seoul Forest opened in 2005 and contains 400 000 trees. The Seoul National
 Capital Area also contains a green belt aimed at preventing urban sprawl.
- The Philippines hosts an impressive green belt in Makati City, as does Adelaide's Central Business District in Australia, which is enclosed by the Adelaide Parklands.
- Parks and green belts are outstanding features in all New Zealand cities. Christchurch, 'The Garden City', is a notable example, with Hagley Park occupying 164 hectares adjoining the central business district, one of numerous urban parks.
- Sri Lanka's 'Greening Package' under the multi-stakeholder Urban Greening Partnership Program has used community initiatives in urban greening as a strategy to reduce poverty and enhance the environment in Moratuwa, Badulla and Matale cities.
- Singapore and Kuala Lumpur have ambitious greening programmes, notably utilizing rooftops of many public and private buildings.
- Bamboo is widely used for urban greening across Asia. In China and the Philippines, for example, bamboo is planted in parks and along walk-ways and the verges of highways to prevent erosion and improve the landscape.

However, given the rapid pace of urbanization, especially in South Asia and East Asia, investments in urban greening have fallen far short of what is required. Most greening is limited to high income areas, where the more affluent residents are able to exert pressure on governments. Conversely, shanty towns and informal housing settlements are usually left without much investment of any kind, least of all for aesthetic and ecological improvements.

Major challenges in managing ecotourism in the context of increasing demand are:

- Preventing environmental degradation due to rapid growth of tourism undermining long-term sustainability.
- Managing tourist numbers and competing ecobusinesses to maintain the quality of ecoexperiences.
- Resolving tensions between ecotourism and other productive sectors.
- Enhancing revenues accruing to local communities and thus generating long-term interest among communities to protect and manage tourism assets (**Box 3.18**).

Bhutan provides an example of a country that has adopted policies to ensure that the country does not become another mass tourism destination, undermining its cultural and social traditions. Greater involvement of stakeholders, in particular civil society organizations, is helping to avoid the pitfalls that mass tourism has faced in several countries. In some cases, former poachers have changed roles to become actively involved in forest and wildlife protection, as seen in the Kaeng Krachan National Park in Thailand and in the Periyar Tiger Reserve in India.

Box 3.18 Some examples of pro-poor community-based tourism

Mongolia

In order to improve conditions for poor, rural communities in Mongolia, the government has attempted to promote tourism by linking nomadic groups to the public and private sectors. At present, 12 communities are participating in nomadic community-based tourism through which they not only earn incomes from tourism, but are gaining valuable knowledge and skills on how to work with the public and private sectors to develop sustainable sources of income. Fifty-five percent of the revenues earned go directly to participating families and an additional 10 percent of revenues accrue to community environmental funds. These initiatives have empowered participating nomadic groups – economically and socially – while enabling the communities to invest in sustaining the landscapes they depend upon.

Source: UNESCAP (2007).

Malaysia

The Model Ecologically Sustainable Community Tourism (MESCOT) project funded by the World Wide Fund for Nature in Malaysia is offering communities an alternative source of livelihood – through community-based tourism –rather than engaging in palm oil production and logging. The project builds capacity at local levels by offering training in hospitality, finance, marketing, computer skills and English; local communities have thereby been able to prevent further deforestation along the lower reaches of the Kinabatangan River. Participation in such pro-poor tourism activities has encouraged clearance of rubbish, local landscape improvements, and a forest rehabilitation programme.

Source: WWF (2001).

Tourism in general – and ecotourism in particular – is one of the fastest growing sectors in the Asia-Pacific region, especially in view of rapid growth in incomes. Ecotourism provides unique opportunities to protect and manage rural landscapes, including forests, and to revitalize local economies. Most countries have developed national policies and strategies to promote ecotourism (**Box 3.19**). While ecotourism has significant potential for livelihood enhancement and sustainable development, its effectiveness will vary depending on location-specific conditions. Many popular ecotourism areas are suffering from large inflows of visitors, far exceeding carrying capacities, significantly undermining the quality of assets.

Box 3.19 Ecotourism development in Asia and the Pacific

The tourism industry is an important source of revenue for many countries in Asia and the Pacific, with revenues expected to top US\$4.6 trillion by 2010 and tourist arrivals growing at around 6 percent annually. China, Lao PDR and Viet Nam are among the ten countries with the fastest growing tourism industries in the world. Ecotourism is growing in popularity as local and international travelers demand nature-based experiences that help to conserve the environment and generate revenues for local communities. In some countries, including Indonesia and China, ecotourism is now an official conservation strategy. The region has more than 20 national and regional ecotourism associations.

Source: PATA (2008); UNWTO (2008); TIES (2007).

Payments for ecosystem services

Payments for ecosystem services (PES) (**Box 3.20**) are potential tools for environmental protection as well as poverty alleviation. Increasing areas of forests are being excluded from wood production (especially in the context of logging bans and other restrictions) to enhance provision of environmental benefits. This is resulting in declining incomes from forests in many countries. Making forest management more environmentally friendly involves additional costs, especially opportunity costs of incomes foregone from the production of wood and other products. Charging fees for ecosystem services is seen as an option to mobilize additional resources to finance sustainable forest management. Poverty alleviation has also become an objective of PES, especially when the rural poor can be compensated for the ecosystem services provided by the lands they own; although in many cases poverty is caused by lack of ownership of any assets.

Box 3.20 Definition of payments for ecosystem services

A payment for ecosystem services is defined as "a voluntary transaction where a well-defined environmental service (or a land use likely to secure that service) is being bought by a minimum of one environmental-service buyer from an environmental service provider and the service is provided continuously." PES constitute commercial transactions whereby payments are made periodically so that providers have ongoing incentives to provide the services and adhere to contractual obligations.

Source: Wunder (2005).

Globally and regionally, PES have been applied for securing watershed protection, carbon sequestration and, to some extent, biodiversity conservation. PES in the case of watershed management typically involve payments to upstream land users for improving or stabilizing land use in catchments (often through encouraging land users to forego certain resource-use options that adversely affect water quality, quantity and stability of flows). This has been particularly the case where payments have been made by irrigation and hydroelectric utilities. Most of the examples of payments for watershed services relate to financial transfers from utility companies (those managing water supplies for municipalities or generating electricity) to land users who have refrained from actions that may jeopardize the quantity and quality of water available and to enhance conservation efforts. Viet Nam has been a leader in establishing PES schemes in the Southeast Asia subregion (**Box 3.21**).

Box 3.21 Lessons from Viet Nam's experiences with creating successful PES schemes

Towards the end of the 1990s, the Vietnamese Government enacted a number of laws – including the Law on Water Resources (1998), Law on Land (2003), Law on Forest Protection and Development (2004) and Law on Environmental Protection (2005) – that recognized ecosystem services provided by ecosystems such as biodiversity conservation, watershed protection, carbon sequestration and landscape beauty. Several resolutions were endorsed as economic instruments for environmental management, notably the Law on Environmental Protection and Law on Water Resources, which specify taxes be paid by users of ecosystem services. PES projects that have been developed under this legislation include:

- Maintaining the Tri An Watershed through a collaborative scheme between water supply companies and upstream groups that were previously polluting the river.
- A sustainable financing model for landscape beauty in Bash Ma National Park in central Viet Nam, covering about 37 500 hectares, of which about 32 000 hectares are upland forests.
- A carbon sequestration project in Cao Phong District, located in the northwest region of Viet Nam, and undertaken by the Department of Forestry, Japan International Cooperation Agency, Vietnam Forestry University and the Research Center for Forest Ecology and Environment. It is estimated that about 60 000 to 80 000 carbon credits will potentially be obtained through certified emission reductions (CERs). Beneficiaries include 300 local households that will benefit from sale of carbon credits and from the rehabilitated forests. Several lessons can be drawn from the pilot PES initiatives in Viet Nam, including the importance of:
- Clearly identified costs and benefits of watershed protection for relevant stakeholders. Technical studies that link upstream land uses and downstream water quality are vital.
- Enabling government policies and the voluntary involvement of buyers and sellers. Microcredit can be instrumental if farmers have to modify their current land uses to adopt the PES scheme.
- Formal contracts between buyers and sellers.
- Demonstrated quality of ecosystem services. For example, visibly improving services is a key to attracting visitors that subsequently help raise revenues to finance conservation and reward local people for the ecosystem services they provide.
- Clear and transparent benefit-sharing systems with a strong equity component.
- Support from government agencies in the area of capacity building and technical assistance, as well as to ensure sound policies, community-wide benefits and the enforcement of contracts.

Source: Hoang et al. (2008).

Recent reviews of experiences in the Asia-Pacific region (FAO 2006d; Adhikarai 2009; Huang and Upadhyaya 2007) highlight a number of issues relating to the development of PES. Some of the important conclusions drawn include:

- Development of ecosystem markets is largely related to overall social and economic development. Consequently, these markets are relatively better developed in industrial and post-industrial societies, where willingness and ability to pay for ecosystem services is high. In view of this, PES may take a long time to find wider adoption in many developing countries. For the foreseeable future, PES in most developing countries is more likely to be funded through international transfers, mostly through proto-markets.
- Development of systems for PES will involve high transaction costs, including investments in strengthening legal and institutional capacities and to provide reliable information on the complex biophysical processes underlying the provision of most ecosystem services.

 Since ecosystem markets are in the very early stages of development, their potential to become an important source of financing for sustainable forest management remains doubtful. Similarly, the potential of ecosystem service markets to alleviate poverty is relatively low. Most rural poverty is to due to absence of ownership of land and other resources; consequently, the poor are unlikely to become key providers of ecosystem services.

FORESTRY AND POVERTY REDUCTION

Although the Asia-Pacific region has made impressive strides in reducing poverty, it is still home to more than two-thirds of the world's poor. The total number of poor (based on a poverty line of US\$1.25 per person per day) in the Asia-Pacific region is estimated at 912 million (ICOMP 2009) with South Asia having 600 million of the poor. Further, forested areas have very high incidence of poverty, often attributed to their remoteness as well as low levels of investments in infrastructure, education, health care, etc. More importantly, most of the resources are seldom managed to give due consideration to the well being of local communities. Often resource exploitation undertaken in the name of development curtails access to resources accentuating poverty. The attendant social problems, including conflicts, are drawing attention to how forests could be managed to help in poverty reduction and alleviation.

The pros and cons of poverty reduction through forestry have been discussed at length (see RECOFTC 2009a). Traditionally, much of the thrust of poverty reduction efforts in forested countries has been to alter land use, by converting forests to more intensive uses, thereby enhancing incomes and production of food and other necessities. Harvesting wood and reinvesting timber revenues in education, health and infrastructure has been another approach that many countries continue to pursue – at least, in principle. As discussed earlier, there are also a number of initiatives to enhance incomes from the provision of ecosystem services, for example ecotourism and payments for watershed protection.

Several studies (for example Banerjee 2007; Vedeld *et al.* 2007) have shown that the poor households often derive 30-50 percent of their incomes from forests (including wage employment in logging, and NWFP collection and trade). Most studies also conclude that as incomes increase, there is a significant drop in the share of income derived from forests and forestry. In general high dependence on forests by the poor is symptomatic of a larger problem of absence of better alternative livelihoods. Changes in opportunities (that enhance human capital, improve access to resources, or strengthen bargaining power) can increase incomes, enabling people to move out of poverty and thus reducing forest dependency.

Poverty reduction efforts under forestry have given impetus to:

- Strengthening forest tenure arrangements and thereby enhancing the asset base of the poor.
- Improving the management of resources, with greater emphasis on producing goods and services – and providing employment – that directly and indirectly enhances the incomes of the poor.
- Strengthening policy, legal and institutional frameworks (including market and non-market mechanisms) to increase the share of benefits accruing to the poor.

During the past few years, there have been considerable efforts to confer rights to land, forests and forest products to local communities through various community forest management initiatives; as in the case of Forest User Groups (FUGs) in Nepal, Joint Forest Management (JFM) in India, and Community-Based Forest Management (CBFM) in the Philippines. A number of countries, including China and Viet Nam, have assigned rights to state-owned land to communities and individuals. However, strong evidence showing significant contributions to reducing poverty through devolution of forest management responsibilities is lacking (**Box 3.22**).

Box 3.22	Why devolution has not reduced poverty
Empirical evi ing poverty, i forestry are:	dence that devolved forest management has contributed to reaching the MDG of eradicat- s lacking. According to Edmunds and Wollenburg (2004) the effects of decentralization in
Limite transfe impact	ed transfer of authority with limited pro-poor effects: Devolution appears to be erring little or no authority to local forest users and is having, at best, no significant positive t on the livelihoods of the poor.
 Lack account the po 	of local accountability: Local institutions set up under devolution have often been ntable to forest departments and other government offices, rather than to local people with ssibilities of genuine co-management being quite limited.
 Disad the ve unawa their in 	vantaging the marginalized: Not proportionately benefiting women, ethnic minorities or ry poor (i.e. those groups who are generally politically disadvantaged who were often ire of the implications of policy reform or unable to affect policy implementation to protect interests).
Small often c	income improvements: Gains in income have been relatively small for most people and overshadowed by negative trade-offs in resource access and control.
Under lack of sponse	mining local institutions: Pre-existing local institutions have been undermined by their f legal standing and clear property rights relative to institutions that are newly created or pred by government.
• Trade product within	taken over by elites: Under policies that expanded opportunities for locals to sell forest cts directly, poor and minority men and women often lost their place in the trade to elites and outside the local community.
 Regul regula 	atory frameworks: Serving as major barriers, states impose excessively burdensome tory frameworks making it difficult (time and financial costs) for the poor to enter markets.
Increa contro contro	sed state penetration — territorially and in terms of decision-making: The state retained I over management decision-making (India); through JFM arrangements it extended its I into local areas, building alliances with local elites to control decision-making.
Source: REC	COFTC (2009a).
Once owners are managed out not suffic	hip and access issues are settled, an increase in income depends on how assets and what products and services are produced. Security of tenure is a necessary, ient, condition to enhance incomes and lift people out of poverty. Technical and kills of owners, entrepreneurship, adequate financing and access to resources, a

but not sufficient, condition to enhance incomes and lift people out of poverty. Technical and managerial skills of owners, entrepreneurship, adequate financing and access to resources, a supportive regulatory environment and access to markets are among other critical factors; most of which are scarce or unfavourable in many impoverished areas. Substantial increases in incomes through low intensity management would require access to vast tracts of land (as in the case of extractive reserves in the Amazon region). Such an option is unavailable to the more densely populated Asia-Pacific countries, especially in South Asia, which accounts for about two-thirds of the poor in the Asia-Pacific region. Consequently, it becomes imperative to intensify land use, including agroforestry as well as cultivation of agricultural and horticultural crops. While this could reduce poverty, it is unlikely that much impact would be attributable to forests and forestry.

Significant increases in incomes depend on the volume and value of products and services sold. Market imperfections, including lack of direct access to lucrative retail markets and limited access to market information, affect the share that accrues to the poor. Efforts to reduce exploitation by intermediaries have led to the development of alternative institutional arrangements like corporations and cooperatives. However, experiences in this regard have still been mixed. PES, especially for watershed protection, ecotourism and, more recently, carbon sequestration, are often seen as means of poverty alleviation. However, since PES are still in the early stages of development (and many PES schemes have been developed with substantial external support), this is yet to be widely demonstrated. The ability to provide ecosystem services is largely dependent on ownership of natural resources and a host of other policy and institutional factors. Considering the fundamental issues that underlie poverty, ecosystem markets may have, at best, a limited role in poverty alleviation. Contrarily under certain circumstances, PES could have negative impacts: for example, where markets for ecosystem services serve those with better willingness and ability to pay, marginalized community members and landless farmers could lose access to common lands and experience declining livelihoods (Huang and Upadhyaya 2007).

CONTRIBUTION OF FORESTRY TO INCOMES AND EMPLOYMENT

Gross value added

Gross value added is an important, although imperfect, measure of the economic importance of a sector. The total value added by the Asia-Pacific forest sector, consisting of wood production (including logging), wood processing (in particular production of sawnwood and panel products), pulp and paper and furniture manufacturing, has increased from about US\$110.7 billion in 1990 to US\$116.9 billion in 2000 and to US\$141.0 billion in 2006 (**Table 3.10**). Between 1990 and 2006, the Asia-Pacific region's share in global forest sector value added, increased from about 20.5 percent to 24.4 percent. The Asia-Pacific region has increasingly emerged as an important region as regards forestry value addition. Most of the growth has been in the pulp and paper and wood processing subsectors, while increases in the value added in forestry (mainly wood production from natural and planted forests) have been relatively modest.

	Gross value added (in US\$ billion at 2006 prices and exchange rates)								
Sector/subsector	1990		2000		2006				
	US\$ billion	(%)	US\$ billion	(%)	US\$ billion	(%)			
Forestry (wood production)	28.6	29.2	30.4	28.2	32.8	27.9			
Wood processing	21.5	17.4	22.0	15.9	30.0	20.0			
Pulp and paper	39.9	19.8	46.9	21.6	56.2	28.0			
Asia-Pacific forestry sector subtotal	90.0	21.2	99.3	21.4	119.0	25.4			
Furniture	20.7	17.6	17.6	14.0	22.0	18.4			
Total Asia-Pacific including furniture	110.7	20.5	116.9	19.8	141.0	24.4			
World total (forestry sector gross value added including furniture)	540.9		589.0		577.4				

Table 3.10. Value added* by the forest sector and share of Asia and the Pacific in global value added, by item

* Percentage figures relate to the Asia-Pacific region's share in total value added globally. Source: FAO (2010b).

Despite the absolute value added in Asia and the Pacific registering a significant increase, the share of the forest sector in the gross regional product declined from about 1.4 percent in 1990 to 1.0 percent in 2006 due to the much faster growth of other sectors. A similar decline in forestry's contribution to GDP has taken place at the global level. However, it should be noted that national income statistics have a number of limitations. In particular, they fail to fully capture non-market transactions, which are particularly significant in the forest sector (**Box 3.23**).

Box 3.23 Contribution of forestry to gross domestic product (GDP)

According to official statistics, forestry's contribution to Gross Domestic Product in the Asia-Pacific region was about 1 percent in 2006. There are only a few countries where forestry's share of GDP exceeds 2.5 percent; these include Bhutan, Cambodia, DPRK, Fiji, Indonesia, Lao PDR, Malaysia, Nepal, PNG and the Solomon Islands. In almost all countries, the share of the forestry sector has been on the decline, largely on account of faster growth of other sectors. However, official statistics have a number of limitations.

A significant share of activities in the forest sector – especially collection of woodfuel and NWFPs – takes place in the informal sector and is, consequently, excluded from national income statistics. Further, illegal logging and trade are also not registered in official statistics and can be of considerable importance.

Misclassification or ambiguities in attribution of activities are also problems (for example, income from forest-based ecotourism is usually attributed to the tourism sector). Many of the problems stem from overall weaknesses in data collection and analysis. Misunderstanding of terminologies is also not uncommon and often contributions from the forestry sector are incorrectly estimated, based on sale price and not the 'value added' (which is sale price minus costs of material inputs).

Assessing the value of forest-derived ecosystem services and incorporating this into income statistics is a contentious issue. In the absence of an economy-wide approach to ecosystem accounting, a sector-focused approach is unlikely to find much acceptance. Estimating the technical coefficients and calculating a valuation remain major challenges.

Disaggregation of value-added components of production provides useful insights into intra-country changes as outlined below:

- Gross value added in forestry (especially logging) (**Figure 3.11**) in China increased from US\$7.4 billion in 1990 to US\$ 13.7 billion in 2006.
- In Japan, the trend is in the opposite direction: gross value added in forestry declined from US\$5.4 billion in 1990 to US\$0.9 billion in 2006. All other segments of forestry in Japan (including wood processing, pulp and paper and furniture) also registered significant declines in value added during 1990 to 2006.
- Both India and Indonesia registered increases in gross value added during 1990 and 2006, each by approximately US\$1.0 billion.
- Malaysia has also experienced a decline in the gross value added in wood production from US\$2.9 billion to US\$2.4 billion, but value added in other segments (wood processing, pulp and paper and furniture manufacturing) registered significant increases.

An increase in value added in wood production reflects one or more of the following, namely:

- a) an increase in the quantity of wood produced;
- b) a reduction in the costs of production; and/or
- c) an increase in the unit sale value.

Total gross value added in forestry and logging tends to increase when countries switch from low productivity natural forests to high productivity plantations, due to significantly increased volumes of wood produced.



Figure 3.11. Gross value added in forestry and logging in 2006 Source: FAO (2008).

- Gross value added in wood processing has registered a significant increase, especially between 2000 and 2006, largely due to significant increases in China's production. China's share in Asia and the Pacific's gross value added increased from about 11 percent in 2000, to more than 26 percent in 2006. The shares of other major wood industry players have largely declined proportionately.
- The pulp and paper industry has undergone the most dramatic change in gross value added, with China accounting for most of the increase (Figure 3.12). Gross value added by the Chinese pulp and paper sector increased from US\$2.7 billion in 1990 to US\$17.4 billion in 2006. Indonesia and ROK also registered significant increases in gross value added in the pulp and paper sector. Japan is still the region's largest pulp and paper producer, but its gross value added declined by about US\$5.0 billion between 1990 and 2006.



Figure 3.12. Changes in the share of value added in the pulp and paper subsector (US\$ billion) Source: Lebedys (2008).

- The furniture industry has also experienced major intra-regional and intercountry shifts in value added (**Figure 3.13**). Growth in China's furniture industry has been phenomenal, from US\$0.6 billion in 1990 to US\$6.3 billion in 2006.
- During the same period, Japan experienced a decline in furniture value added from US\$14.4 billion to US\$6.5 billion.
- Other countries that have increased furniture value added include Indonesia, ROK, Malaysia and Viet Nam. Viet Nam's emergence as a furniture producer has been particularly dramatic. In 2000, gross value added of Viet Nam's furniture production was just US\$54 million; by 2006 this had accelerated to almost US\$900 million.



Figure 3.13. Changes in the share of value added in the furniture sector Source: Lebedys (2008).

The emergence of China and several other countries as key producers of wood and wood products stems from their competitiveness, especially low costs of inputs, in particular labour, and possibly raw materials (partly on account of increased shares of wood from plantations or ability to procure wood at low costs from distant sources. This may include illegally-procured wood, which tends to be cheaper than that produced from legal and sustainably managed areas). In the long run, increases in wages and/or transport costs (especially in the context of rising fuel costs) could significantly reduce the competitive advantage of some countries.

Employment in the forest sector

Forestry's significance in generating rural employment has been highlighted in a number of studies. However, data limitations make it difficult to provide a clear indication of the actual magnitude of employment in the sector. Partly, these difficulties stem from definitional problems, especially as employment statistics are often ambiguous in terms of measurement units. In some developing countries, the thousands (or millions) of people reported to be employed in aspects of forestry (for example, in the collection of NWFPs and woodfuel) are actually in part-time, seasonal employment for only a few days or weeks in a year. When converted into full-time equivalents, the number of people employed is often much lower than reported.



Figure 3.14. Employment in the forest sector including furniture (full-time equivalent) Source: Lebedys (2008).

On a full time equivalent basis, forest sector employment in the Asia-Pacific region was estimated as about 5.8 million people in 2006. If employment in the furniture sector is included (1.6 million people in 2006), then total forestry employment was about 7.4 million people (**Figure 3.14**). However, growth in employment in the forest sector in the Asia-Pacific region between 1990 and 2006 was relatively negligible. Globally, employment in the forest sector declined from about 20 million to 18.2 million during the same period. However, two caveats need to be considered:

- Official statistics rarely capture the full extent of employment, especially in the context of the preponderance of informal sectors. In many cases, many small and medium enterprises are excluded from national employment surveys. According to a study by the International Labour Organization (Poschen 1997), formal sector employment accounts for only about 37 percent of the employment in the forestry sector, while the remaining 63 percent comprises the 'invisible sector', including woodfuel production and industries that operate in the informal sector. Quite possibly, the share of the invisible sector in the Asia-Pacific region could be much larger than the global average. A conservative estimate – adopting the global average – of forestry employment in the Asia region is about 20 million people.
- A comparison of employment and value added (Figure 3.15) indicates some contrasting trends. While value added in the forest sector, including furniture, increased by 27 percent between 1990 and 2006, the increase in employment has been a relatively negligible 0.6 percent. There are also significant differences between industry sectors. For example, the value added in wood production has increased by about 14.6 percent, but employment has declined by about 30 percent. This suggests either:

(a) improvement in the efficiency in wood production, possibly due to an increase in the share of productive planted forests; or

(b) an increase in the share of wood produced by those employed in informal activities (including illegal logging).

One of the most dramatic changes is in the furniture subsector, where value added increased by about 6 percent, while employment increased by about 52 percent. This largely reflects a shift in the location of furniture manufacturing towards low wage countries including China and Viet Nam.



Figure 3.15. Relative changes in employment and value added, 1990-2006 Source: Lebedys (2008).

On the whole, the forest sector in the Asia-Pacific region is characterized by 'jobless growth'. In some countries demographic changes are resulting in twin problems for forestry employment, namely: (i) a decline in the number of available workers; and (ii) ageing of the existing workforce. This is particularly the case for some of the developed economies (**Box 3.24**). Employment decline is also due to rapid increases in the share of value added of the capital-intensive pulp and paper sector and technological advancements in processing, reducing labour demand.

Box 3.24 Changing employment situation in Japanese forestry

"The number of workers engaged in forestry has been decreasing for the long term due to the stagnation of forestry production. Over the recent 10 years, the number of workers engaged in forestry has decreased from about 90,000 persons in 1995 to about 50,000 persons in 2005. Also, the ratio of workers over 65 years accounts for more than 25% of the total and the aging of workers has been advancing."

Source: Ministry of Forestry, Japan (2009).

OVERVIEW OF ECONOMIC, ENVIRONMENTAL AND SOCIAL BENEFITS FROM FORESTS

The pressure on forests in the Asia-Pacific region to produce more products and services has increased enormously. As demands for wood and other products are increasing, so too are demands for ecosystem services. With countries at different stages of development, there are major inter-country shifts in demand for wood and wood products. Although there has been a reduction in demand for wood and wood products in some developed countries such as Japan, this has been more than balanced by rapid growth of demand in China. Demand from India is also increasing rapidly and there are indications that the Indian market will burgeon in coming years. There has also been a shift in wood industries in favour of more value-added products. To some extent this is enabling higher wood recovery, reducing the demand for wood raw material.

Demand for wood and wood products is increasing and at the same time the overall forest resource situation, outside a few countries, has deteriorated. While increasing incomes are resulting in increased demand for products, affluent segments of society are more conscious of the important roles of ecosystem services. This has led to the setting aside of more forests as protected areas, and more drastic actions such as logging bans in response to natural calamities such as floods and landslides. Many key wood-producing countries have scaled down production, often on account of depletion of forests or shifts in priorities that place greater emphasis on the provision of ecosystem services. An important trend has been towards an increased dependence on imports from forest-rich countries, both from within the Asia-Pacific region and outside.

Dependence on wood as a source of energy is very high in the region, in particular in the South Asia subregion. Economic growth and improved access to alternative fuels are resulting in fuelswitching. Climate change concerns and growing interest in renewable energy sources are reviving interest in wood energy. While there is uncertainty over the future of new technologies such as ligno-cellulosic biofuel production, there are increased efforts to enhance the efficiency of use, including through wider adoption of more efficient biomass-burning stoves, gasification and co-generation.

An important challenge will be to establish the trade-offs between competing uses for forests and wood, especially to weigh immediate economic benefits against the longer term provision of ecosystem services. With climate change becoming a major environmental issue, forests and forestry are receiving considerable global attention, while other forest-linked environmental issues including watershed protection, conservation of biodiversity and arresting land degradation and desertification are key issues at local and national levels. Forest-based recreation is particularly gaining importance in the context of higher incomes and urbanization.

Adding to the complexity of managing forests for the provision of goods and services are the social dimensions of forestry, especially the high level of subsistence and semi-subsistence dependence of the poor on forests. Although forests and forestry have serious limitations in raising standards of living for impoverished people above the poverty line, forestry decision-makers must still take account of the needs of the poor, and often, in particular, the needs of indigenous communities.

Forest management in the Asia-Pacific region has become significantly more complex in the past 30 years. The situation continues to change and the state of forests and forestry and the flows of goods and services in the next decade and beyond will be very different from today. The manner in which the sector evolves will depend on the collective impacts of a number of drivers of change. These are discussed in the next chapter.

4 DRIVERS IMPACTING THE FOREST SECTOR

INTRODUCTION

The direction of forest and forestry development is largely determined by factors external to the sector and, in particular, larger societal changes. The impacts of these on forests and forestry may be direct or indirect. External factors may include changes in demography, the economic situation, policies and institutions, advancements in science and technology and, perhaps most importantly, the responses of society to critical environmental changes; these often have an overwhelming impact on how forests are managed. Growing concerns about the provision of ecosystem services, especially in the context of climate change mitigation and adaptation, have added new dimensions to the sphere of forest management. Collectively, these changes modify society's behaviours, altering the nature of goods and services demanded and how these are produced and consumed. These larger changes also affect policies and programmes in other sectors, impacting on forests and forestry through backward and forward linkages. The main drivers of change and their impacts on forests and forestry are outlined in the following sections.

DEMOGRAPHIC CHANGES

Demographic changes have an overwhelming impact on land use, in general, and forestry, in particular. Population size, growth rates, densities, urbanization, migration and changing age structures impact forests and forestry, both directly and indirectly. However, in general, it is not so much the number of human beings that has the crucial impact on forests, as the way in which human society is organized (Westoby 1989).

Population growth

With a population of 3.6 billion people, the Asia-Pacific region accounted for about 55 percent of the world's population in 2005. By 2020, the population in the region will increase by 600 million, resulting in a total population of 4.2 billion (**Figure 4.1**). This will account for about 60 percent of the global population increase, escalating demands for food, fuel, water and fibre – placing tremendous pressure on resources, including land and forests, within and outside the region.



Figure 4.1. Population growth in Asia and the Pacific* (millions), 1980-2020 Source: UN (2009). * Medium variant.

Within the Asia-Pacific region, South Asia will become the most populous subregion, overtaking East Asia. Primarily, this is an outcome of negative growth in population in Japan and very low growth rates in China (largely due to the rigid population policies), Mongolia and Republic of Korea (ROK); conversely high population growth rates continue to be the norm in most South Asian countries.

The Asia-Pacific regional population grew at an annual rate of 1.2 percent between 2000 and 2005, and has continued (and will continue) to grow – though at a declining rate – in the next decade:

a) at 1.06 percent between 2005 and 2010;

- b) at 0.97 percent between 2010 and 2015; and
- c) at 0.86 percent between 2015 and 2020.

However, growth rates differ among subregions and among countries within each subregion. In several countries, population growth rates are above 2 percent and will continue to remain high in the coming years. At the other end of the spectrum are countries with growth rates of less than 0.5 percent or, as is the case of Japan, negative growth.

Population growth has important implications for the forest sector. In addition to affecting the demand for forest products and services, population growth affects demands for other goods and services and thus has multiple and derived impacts on forests, for example, through demands for packaging or through increasing newspaper circulations.

Population density provides an indication of the pressure on land and other natural resources including forests. The Asia-Pacific region is the world's most densely populated region and projections suggest continued increases in population densities, which will likely increase pressures on land and other resources (**Table 4.1**). Population growth is generally fastest in developing countries in the region, many of which are already very densely populated. While the overall density of population provides a general picture, density per unit of arable land and forest provides a better indication of potential pressures on natural resources.

Regions	1980	1990	2000	2005	2010	2020
East Asia	101	117	128	133	136	143
South Asia	218	274	334	363	392	446
Southeast Asia	82	101	119	128	136	151
Oceania	3	3	4	4	4	5
Asia and the Pacific total	86	103	120	127	134	147
World	34	41	47	50	53	59

Table 4.1. Population density in the Asia-Pacific region (number/km²)

Sources: Based on FAO (2009a) and UN (2009).

Among the various subregions, South Asia has the highest population density, close to three-times that of the regional average and more than seven-fold the global average. South Asia's population density will continue to increase, in view of the rapid growth of population in the subregion. Within South Asia, population density varies; Bhutan has the lowest density, 14 persons/km², while Bangladesh is the most densely populated with 1 180 persons/km². The density of population in relation to forest area has increased significantly in South Asia during the past 20 years (**Figure 4.2**). Comparatively, the ratio of people to forest area in East Asia has declined – largely on account of increases in planted forest area and very low population growth rates. In contrast population density in relation to forest area has increased in all other subregions, with the highest absolute increase in South Asia.



Figure 4.2. Population per unit forest area in the Asia-Pacific Source: Based on FAO (2010) and UN (2009).

Population densities in Southeast Asia are variable, with many countries having significant areas of very dense population, offset by large areas with very low population density. For example, the island of Java in Indonesia has a population density in excess of 800 people/km², whereas other parts of Indonesia such as Kalimantan (17 people/km²) and Irian Jaya (4 people/km²) have relatively low populations. Viet Nam (252 people/km²) is the most densely populated country in Southeast Asia, while Lao PDR (25 people/km²) has the lowest population density.

Population density in the Oceania subregion is very low, largely on account of Australia's very large geographic area and a very low population density of three people/km². Similarly, both New

Zealand and PNG have relatively large areas and low population densities. However, population pressures on resources are significant in some of the small Pacific Island Countries, such as the Marshall Islands (330 people/km²) and South Tarawa (2 330 people/km²) in Kiribati.

Population density is a critical factor when land and other natural resources are the most important source of income. Where dependence on agriculture for employment and incomes is high, forest conservation faces enormous challenges. Conversely, in countries where dependence on land has declined significantly (for example Japan), high levels of forest cover have been maintained notwithstanding high population densities. However, often more developed countries have transferred potential land-use pressures to less developed countries through trade.

Changing age structures

Change in population age structures is an important demographic factor that indirectly affects land use and forestry. Two contrasting trends that could potentially bring about important changes in demands for forest-derived goods and services are observed in the region:

- Increasing proportions of elderly people in the populations of developed countries including Australia, Brunei Darussalam, Japan, New Zealand, Republic of Korea and Singapore (Box 4.1). In many of these countries, more than 15 percent of the population is over 65 years old; in Japan more than one-quarter of the population exceeds 60 years of age. Ageing will also be a major issue in China, where birth rates continue to decline in response to the rigid population policies.
- In contrast, most other countries, especially in South Asia, will have a high proportion of working age people by 2020, especially as large numbers of people presently in younger age groups move into the working age group (see **Table 4.2**).

	Popula	Population aged 0-14			Population aged 15-59			Population aged 60+		
	1980	2000	2020	1980	2000	2020	1980	2000	2020	
East Asia	34	25	18	58	64	64	8	11	18	
South Asia	40	36	27	54	58	63	6	6	9	
Southeast Asia	41	32	24	53	61	64	6	7	12	
Oceania	30	26	23	59	61	59	12	13	18	
Asia and the Pacific	37	30	23	56	61	64	7	9	13	

Table 4.2. Age structure	s in Asia and the l	Pacific (percentage	of total population)
--------------------------	---------------------	---------------------	----------------------

Source: Basnyat (2008, updated: UN 2009).

Box 4.1 Population ageing in Japan

Population ageing in Japan will have significant impacts on the work force as well as implications for the nature of demand for services and products, including for forests, wood and wood products. Japan's demographic transition is characterized by a declining population and significant change in the population age structure (see figure below). The total population is already in decline, largely due to very low birth rates. At present, the proportion of people aged above 65 is increasing, while the proportion of those of working age is declining rapidly. In forestry, labour scarcity has become a significant challenge, with fewer young people willing and available to undertake forestry careers – especially low-skilled labouring employment. A number of economists and demographers have outlined the implications of such demographic changes (including for example a significant slowing down of the economy, reductions in savings, and changes in patterns of consumption, etc.); the linkages between different variables and potential impacts on forests are complex, with income and substitution effects relating to people's preferences playing important roles in determining outcomes.



Implications of changing age structures on forests and forestry could vary considerably, as outlined below:

- Projected increases in working age populations in many developing countries imply a high potential demand for housing and concomitant growth in demand for wood and wood products. Partly this may be offset by demand contractions in countries with ageing populations.
- Changing age structures could also affect overall economic performance. Productivity tends to decline in economies with high proportions of elderly in their populations. In the absence of immigration, the ratio of the aged non-working population to the working population increases, increasing levels of dependency and, where available, affecting expenditure on social security. Changes in the proportions of population in various age groups may also change the composition of goods and services demanded. For example, differences in overall demand for housing, and the types and size of houses demanded. The competitiveness of economies where based on abundant supplies of labour could decline in the context of ageing populations, encouraging relocation of labour-intensive industries (for example, sawmilling, furniture manufacturing, etc.) to countries with abundant and cheap labour.
- · Ageing populations also have a direct impact on labour availability. Labour shortages are

already evident in many developed and emerging economies, especially affecting agriculture, fisheries and forestry (**Box 4.2**)

Box 4.2 Population ageing and skills shortages in Australia

"Over the next five years the estimated impact of population aging will be equivalent to a shortfall of 195,000 workers. Modeling has shown that every industry is likely to be adversely affected by population aging. As the population ages, skill shortages will become more acute, particularly in industries where there is already a high proportion of older workers. For example, the proportion of workers who are 45 years and older ranges from 52.1 percent in agriculture, fisheries and forestry industries to 24.4 percent in the retail sector."

Source: NAFI and A3P (2006).

Urbanization

Urbanization is a key demographic variable, which impacts land use, in general – and forests and forestry, in particular. The Asia-Pacific region is urbanizing at a very rapid rate. In 2005, about 38 percent of the region's population was urban and urban populations are expected to increase to about 47 percent by 2020 (**Figure 4.3**). Of particular interest is rapid urbanization in East Asia, especially in China, where the urban population is expected to increase by about 230 million by 2020, while the rural population will decline by about 120 million.



Figure 4.3. Percentage of Asia-Pacific population living in urban areas, 1990-2020 Source: Basnyat (2008, updated: UN 2009).

Among the various subregions South Asia will remain the least urbanized, while the Oceania subregion will be the most urbanized largely due to already high levels of urbanization in Australia and New Zealand. Changes in the rural-urban distribution of populations tend to have complex direct and indirect impacts on land use and forests. In general, urbanization brings about a change in the characteristics of labour markets and primary sources of income, reducing the dependence on land. If the share of agriculture in employment and income declines, so does the pressure to expand cultivation onto forest land. Urbanization and industrial development also change relative costs and prices; for example, while inputs like fertilizers help to enhance land productivity, increasing labour costs make

cultivation of marginal areas less economic. There are several instances where urbanization and consequent rural de-population have encouraged tree growing – intentionally or incidentally.

However, urbanization can also have direct and indirect negative impacts on forests. For example, coastal areas of the Asia-Pacific region have witnessed rapid expansion of urban settlements, affecting coastal ecosystems like mangroves. Often mangrove areas have been destroyed to accommodate expanding urban settlements or shrimp farming, and even when they are spared immediate destruction, many are affected by unsustainable removal of wood and other products. Similarly, expansion of urban settlements onto prime agricultural land may trigger forest clearance elsewhere. Construction booms in rural and urban areas have led to clearance of forests and woodlands and there are instances where even culturally or environmentally precious tracts (for example, sacred groves) have been cleared to make way for residential and commercial buildings.

The economic crisis and concomitant loss of jobs in industrial and services sectors during 2008/2009 slowed migration to urban areas. There is anecdotal evidence of workers returning to rural areas, driven back to their origins by job losses in urban areas. Such short-term reversals were also reported in the aftermath of the 1997-1998 Asian economic crisis; once growth recovers, the normal trend of urbanization is expected to resume.

International migration

A major development in the last two decades has been growth in international migration. In 2007, the number of migrants originating in the Asia-Pacific region was estimated at 50 million people or about one-fourth of total migrant workers in the world. Annual remittance flows to developing countries in the Asia-Pacific region in 2008 were estimated as about US\$152 billion, or about 46 percent of remittances to all developing countries in the world (Ratha *et al.* 2009). For a number of countries, remittances are critical to national income (**Table 4.3**) and often far exceed Foreign Direct Investments (FDI) and official development assistance.

Country	Remittances (US\$ billion)	Remittances as share of GDP (%)
Bangladesh	8.98	9.6
Cambodia	0.32	4.2
China	40.64	1.0
Fiji	0.18	4.8
India	51.97	3.3
Indonesia	6.80	1.4
Nepal	2.73	16.8
Pakistan	7.03	4.2
Philippines	18.64	11.3
Samoa	0.14	22.8
Sri Lanka	2.95	7.8
Viet Nam	7.20	8.0

Table 4.3.	Remittance	flows to	selected	Asia-Pacific	developina	countries.	2008

Source: Ratha et al. (2009).

Migration and remittances have important implications for land uses, as indicated below:

- Migration significantly reduces pressures on land by providing families of migrant workers with an alternative source of livelihood. Households in receipt of remittances often move away from subsistence cultivation and, in many cases, invest in small enterprises, reducing their dependence on land.
- Most migrants are of working age, especially, from younger age groups. This reduces the availability of workers in their country of origin, increases wage rates and often encourages abandonment of cultivation of marginal areas, enabling natural regeneration of forests. Often, labour-intensive annual and seasonal crops are replaced by less labour-demanding tree crops, or land is left fallow, enabling regrowth of natural vegetation.

There are contrasting views on the impact of the recent economic crisis on international migration and remittances. While some decline in remittances in the short run is expected, the long-term upward trend is expected to resume once global economic recovery commences. In the meantime, the numbers of workers seeking opportunities abroad may have increased. The declining proportion of population of working age in many countries (especially where birth rates are low) will increase the demand for migrant workers; notwithstanding the anti-immigrant sentiments of some segments of society.

Demographic changes: an overview

The relationship between demographic changes and forests and forestry is not linear; it is influenced, or mediated, by other factors such as growth of economies, developments in science and technology and, most importantly, policy and institutional changes driven by social and political evolution, which help societies to alter resource-use patterns. Obviously, patterns of resource use may change significantly in time and space depending on the collective impact of these factors, as outlined in **Figure 4.4**.



Figure 4.4. Conceptual framework supporting analysis of demographic changes and forests and forestry

Source: Modified from Hunter (2000).

ECONOMIC CHANGES

Changes in economic situations directly and indirectly impact on the use of natural resources, including forests. Demands for goods and services change in response to changes in income, as does the ability of society to alter systems of production including the technology adopted. As incomes increase, the composition of the basket of goods and services consumed changes and society is willing and able to pay more for ecosystem services. Consequently, economic changes are likely to have an overwhelming impact on forests and forestry. The emerging changes in economic situations and how these may affect the forest sector are outlined below.

Growth in incomes

The Asia-Pacific region has registered impressive economic growth and is the most economically dynamic region in the world. In 2007, the region accounted for 27 percent of world GDP (World Bank 2009b), an increase of 2 percentage points on its share of 25 percent in 1990 (**Figure 4.5**). Growth rates in the post-1997 period averaged 5 percent for the whole region, with East Asia, and particularly China, taking the lead. Since 2006, Asia and the Pacific has become the world's second largest aggregated economy, accounting for 29 percent, or nearly a third of global GDP (UNESCAP 2010). The Asia-Pacific regional GDP has registered an increase from about US\$7.7 trillion in 1996 to US\$10.7 trillion in 2006 (at 2000 constant prices). Much of this increase is due to rapid growth in China and India, the most populous countries in the region. Rapid economic growth has led to significant reductions in the number of impoverished people. The region is on target to accomplish the Millennium Development Goal of halving poverty by 2015.

Although, at the aggregate level, the region's economic performance is unparalleled, there are considerable intercountry differences in the state of national economies, including per capita incomes and GDP growth rates (**Table 4.4**). The region has some of the poorest and richest countries in the world, with national per capita income (measured in terms of Purchasing Power Parity [PPP]) varying from US\$960 in Nepal to over US\$30 000 in Australia and Japan. The annual growth rates of national economies have also varied during the past decade, from less than 1 percent (and even stagnation as in the case of Japan) to more than 10 percent in the case of China. These disparities stem from differences in resource endowments including human and financial capital, the state of technology, and the policy and institutional frameworks that enable the effective use of the human and natural resources. Countries in various income groups have been growing at different rates, as summarized in **Table 4.4**.

Table 4.4. Distribution of countries based on per capita income and GDP growth rates with share of population per grouping, 2000-2007 averages¹

Income aroun (nor		GDP growth rate %								
capita income 2005 US\$ international PPP)	<2	2-4	4-6	6-8	8-10	>10	Proportion of the regional population in income groupings (%)			
<us\$1 000<="" th=""><th></th><th>Nepal, Timor-Leste</th><th></th><th>Myanmar</th><th></th><th></th><th>2.8</th></us\$1>		Nepal, Timor-Leste		Myanmar			2.8			
US\$1 000-2 000	Kiribati, PNG, Solomon Islands		Bangladesh	Lao PDR, Viet Nam	Cambodia		7.4			
US\$2 000-4 000	Tonga	Vanuatu	Indonesia, Pakistan, Philippines, Samoa, Sri Lanka	India, Mongolia	Bhutan	China	81.4			
US\$4 000-6 000	Fiji			Maldives			0.03			
US\$6 000-10 000		Thailand					1.8			
US\$10 000-20 000		Malaysia					0.7			
US\$>20 000	Japan	Australia, Brunei Darussalam, New Zealand	ROK, Singapore				5.9			
Proportion of the regional population in GDP growth groupings (%)	4.5	4.0	19.2	34.7	0.4	37.1				

Sources: World Bank (2007a); ADB (2008).

More than 81 percent of the Asia-Pacific population lives in countries with per capita incomes in the range US2000 - 4000 (PPP). Within this group, the fastest growing countries (with growth rates exceeding 6 percent) account for 83 percent of the population of the group, largely due to China and India. However, this group also has the largest number of people living in poverty, with India alone accounting for nearly one-third of the global poor (World Bank 2008b).

In several countries, both incomes and economic growth rates are extremely low. These include Nepal, Timor-Leste, PNG and Solomon Islands. Most of these countries are endowed with significant natural resources including forests. However, policy and institutional constraints are impeding capacities to use these resources to support rapid sustainable development.

The high income economies – Japan, Australia, Brunei Darussalam, New Zealand, ROK and Singapore account for about 6 percent of the regional population. Although these countries' growth rates have been slow in recent times, the absolute increases in income have been substantial and these countries account for a high proportion of final consumption of wood and wood products. However, considering the low population growth rates (negative growth rate in Japan) and low income growth rates, demands for wood and wood products in these countries are unlikely to increase significantly.

Outlook for growth

Until early 2008, growth forecasts for the Asia-Pacific region have been buoyant, with considerable optimism about future economic growth in the region. With the exceptions of 1997/1998 and 2001/2002, the overall economic growth rate for the region has been impressive, at more than 5 percent. Since

¹ Information is unavailable for DPR Korea.

1996, China has maintained exceptionally high growth rates, above 10 percent for several years, helping the country to transform into a global economic power. India has also performed very well, with growth rates exceeding 8 percent in a number of years in the last decade. Although there have been periodic downturns – for example, the long-term stagnation of the Japanese economy since 1990, the downturn of some of the Southeast and East Asian economies in 1997/1998, and a slowing down in 2001/2002 on account of the global economic downturn – many Asia-Pacific economies have maintained high growth rates. Largely this is attributed to:

- High savings and investments: in some countries (in particular the most populous emerging economies) this has exceeded 30 percent of GDP.
- Favourable investment climates, resulting in very high inflows of FDI: the Asia-Pacific region accounted for about 17 percent of global FDI net inflows in 2007. Countries such as China and India remain highly attractive destinations for FDI in many sectors.
- The Asia-Pacific region's ability to take advantage of trade opportunities: in 1990, the region exported goods and services worth about US\$773 billion (in constant 2000 US dollars) accounting for 19 percent of global exports. By 2007, regional exports had increased to US\$2.8 trillion (in constant 2000 US dollars), approximately 23 percent of the global value of exports (Inoguchi 2010).

These factors have contributed to high rates of growth and, until recently, forecasts of future growth have been very optimistic. By 2020, the regional total GDP is expected to exceed US\$22 trillion (**Figure 4.5**).



Figure 4.5. Trends and forecasts of GDP growth, 1990-2015 Sources: Based on World Bank (2007a); UN (2008a).

The 2008/2009 global economic crisis has led to some decline in growth of incomes, especially for countries whose growth has been dependent on exports and FDI. However, there are signs of an early recovery, especially of the emerging economies. (**Box 4.3**).

Box 4.3 Impact of the global economic crisis

The recent global economic crisis has cast doubts on previously upbeat forecasts for Asia-Pacific economies, which have been revised downwards (IMF 2008; World Bank 2009a). The economic downturn, especially the collapse of the housing sector in the United States, initially affected financial markets and subsequently cascaded into a global economic crisis. While it was initially believed that impacts on Asia-Pacific economies would be limited (some analysts argued that the economies have been 'decoupled'), this proved to be incorrect. There has been a significant slowing in regional economies, especially those that are highly dependent on FDI and exports. De-leveraging by banks has led to a severe credit squeeze and capital flight from Asia-Pacific economies, wiping billions of dollars from stock values. The credit squeeze has reduced availability of investment funds and operational capital. More importantly, recession in OECD economies – important markets for goods from the Asia-Pacific region – has particularly affected export-dependent Asia-Pacific economies. Reduced demand for export goods has led to closure of production facilities and consequent increases in unemployment. Closure of factories has led to the return of migrants to rural areas and there is anecdotal evidence of migrants from other countries returning to their home countries, affecting remittances and accentuating unemployment problems.

Although most countries are attempting to overcome problems through various stimulus packages, uncertainties about future growth rates persist. What is now being witnessed is very different from most previous financial recessions in terms of magnitude; recovery will be a very slow and gradual process (IMF 2009). A number of authors have postulated three possible scenarios for future growth of the global economy:

- Rapid recovery: 'The good scenario': this assumes that the current crisis is part of the normal business cycle and there will be rapid recovery of investment, production, consumption and trade, supported by various interventions. The global economy will soon revert to a business-asusual scenario. However, to date the evidence fails to support this scenario.
- Slow and prolonged recovery: 'The bad scenario': many analysts point out signs that the decline
 of the global economy is bottoming and the process of recovery is underway. However, the
 current crisis is an outcome of fundamental weaknesses in economic and financial systems.
 Repairing these will be a prolonged process and economic recovery will likely be extremely slow
 and anaemic.
- Further decline: 'The ugly scenario': there are a number of analysts of the view that the decline is yet to reach its bottom and the worst is yet to come. Production, consumptionand trade will decline further, as will employment and living standards, with significant increase in the number of impoverished people.

While growth rates in Asia-Pacific economies may decline, the region as a whole is expected to perform better than other regions in view of high savings and investment rates and the robust domestic demand in many countries. There are already indications of stabilization and improvement in the economic situation in view of the stability in the Asia-Pacific financial sector, lower costs of oil imports, and the impacts of economic stimulus packages that a number of countries have initiated.

Income distribution, inequality and poverty

High growth rates since 1990, especially in China and India, have led to significant reductions in poverty, although the region still accounts for the largest number of the world's impoverished people – of any region – as well as the largest number of undernourished (**Table 4.5**). Notwithstanding the declining proportion of poor people in Asia and the Pacific, the region still has more than 900 million people living on less than US\$1.25 per day (UNESCAP 2010). In terms of income distribution, Asian Development Bank analysis shows that, for a set of 15 selected Asian countries, the ratio of income/expenditure shares between the richest 20 percent in the population and the

poorest 20 percent in the population ranges from 4.46² (Pakistan) to 11.37 (China) (ADB 2007).

In addition to income differentials between countries, disparities within individual countries are on the increase, between different regions within countries. Most often, growth has remained centred on the segments of society and localities that are already relatively better off and are able to take advantage of opportunities provided by growth and globalization. Intra-national differences are particularly evident in large countries such as China and India. Under current models of development, largely relying on growth and 'trickle-down' effects, continued reduction of poverty will require that high growth rates are sustained.

	1990 [.]	-1992	1995 [.]	-1997	2003-2005		
Subregion/region	millions	% share in total population	millions	% share in total population	millions	% share in total population	
East Asia	183.5	15	152.0	12	131.8	10	
South Asia	282.5	25	284.8	22	313.6	21	
Southeast Asia	105.6	24	88.6	18	86.9	16	
Oceania	0.7	2	0.5	2	0.9	3	
Asia and the Pacific	572.3		52	5.9	53	3.2	

Table 4.5. Undernourished	ро	pulations	in	Asia	and	the	Pacific
---------------------------	----	-----------	----	------	-----	-----	---------

Source: FAO (2008a).

The incidental correlation between high levels of poverty and the distribution of forests has led to detailed analysis of forest-poverty linkages (RECOFTC 2009a). Much of the poverty in forested areas stems from lack of access to resources and poorly developed infrastructure – education, health care, transportation, etc. – curtailing opportunities. Ethnic and caste prejudices may also limit opportunities, although a number of countries are attempting to remedy this.

Policies and strategies pursued to address these inequities will have important implications on the forest sector. Two broad approaches are being used to 'bring development' to these hitherto neglected areas, with differing implications for forests and forestry.

- The most commonly pursued approach to improve linkages to underdeveloped areas involves intensified resource extraction (for example, logging, mining, large-scale commercial agriculture, tapping energy resources, etc.). However, such accelerated resource extraction seldom helps in sustainable development; while there may be some improvement in living standards through trickle-down processes, this approach fails to address basic issues of growing inequalities. There are several instances where such efforts (for example, logging and mining) have adversely affected the livelihoods of local communities. For example, logging in Sarawak during the 1990s engendered clashes with the indigenous Dayak population (UNHCR 2004).
- Alternatively, investments in human resources and technological developments lead to more people-centred development and this may also have a positive impact on forests and forestry, promoting sustainable resource management. Increasing incomes through the provision of ecosystem services (for example, ecotourism) will be an integral part of such development.

Economic growth can be expected to proceed at varying rates across countries, provinces and

² i.e. in Pakistan, total expenditure of the most wealthy quintile (20 percent) is greater than expenditure by the least wealthy quintile, by a factor of 4.46.

localities according to variances in initial conditions, factor endowments, quality of institutions and economic policies of countries. Inequalities between and within countries are unlikely to diminish during the outlook period and poverty, both relative and absolute, will still be a significant problem.

Furthermore, the number of impoverished and food-insecure people is projected to increase in the context of the current economic crisis, primarily due to significant increases in unemployment. Declines in demand for all products (especially in developed countries, which are severely affected by the economic crisis) have led to significant reductions in employment, consequent income losses and increases in poverty (**Box 4.4**). Governments in the region are pursuing a number of countermeasures, the effectiveness of which, in reviving economies, will be evident in due course.

Box 4.4

Economic crisis, unemployment and poverty

One of the major consequences of the economic crisis is escalating unemployment. Slackening in demand for products has led to closure of factories on an unprecedented scale. Loss of employment and consequent reductions in incomes have led to further declines in demand and further scaling down of production. Estimates by the International Labour Organization indicate sharp increases in unemployment as indicated in the table below.

				2009	
Region 2007 20		2008	Scenario 1	Scenario 2	Scenario 3
East Asia	32.2	36.2	39.6	39.1	49.0
Southeast Asia and the Pacific	15.7	15.8	16.0	18.0	18.4
South Asia	31.8	32.2	32.6	35.7	37.1
Asia-Pacific	79.7	84.2	88.2	92,8	104.5
World	180.2	188.6	209.6	219.6	239.9

Unemployment scenarios (millions of people).

Source: ILO (2009a).

A potential consequence of loss of employment is reverse migration, especially migrant workers returning to their countries of origin and urban workers returning to their rural homes. It is too early to assess potential impacts, although there is anecdotal evidence of unemployed workers returning to rural areas. Loss of income and increases in poverty are major consequences.

Emergence of a middle class

While poverty persists in many areas, the rapid growth of a middle class in the Asia-Pacific region is a notable development, particularly in the most populous countries, namely China and India. The number of people likely to move into middle income categories in the next two decades is estimated at 800 million to 1 billion individuals. (**Box 4.5**). This will have a tremendous impact on demands for all products, including food, fibre and fuel and will have major consequences for natural resources, especially land, water and forests.

Box 4.5	The surging middle class in China and India
---------	---

'Middle class' is defined by the World Bank as, "persons with a per capita income of \$4 000 to \$17 000 (in 2000 international dollars)". In 2006, developing countries were home to 56 percent of the global middle class. According to the World Bank, this figure is expected to reach 92 percent by 2030, with China and India accounting for two-thirds of the expansion (contributing 52 percent and 12 percent of the total increase respectively).

China

- China was home to 56 million people in the global middle class in 2000.
- Driven by rapid economic growth, China's middle class is predicted to rise to 361 million people by 2030, and will represent nearly 25 percent of the country's total population.
- China's middle class is expected to become one of the world's largest consumer market segments.

India

- Between 1985 and 2005 the annual average growth rate of household incomes in India was 3.6 percent. This is expected to accelerate to 5.3 percent between 2005 and 2025, significantly altering the shape of India's income pyramid.
- Average household incomes will triple by 2025. Taking into account the distribution of income, the number of middle class people is expected to increase more than ten-fold; from about 50 million in 2005, to 583 million in 2025.
- India will become the fifth largest consumer market in the world with consumption expected to quadruple by 2025.
- Housing construction and provision of other utilities are expected to grow at an annual rate of 6.1 percent.

This growth in middle class consumers will have a tremendous impact on the global demand for goods and services. For example, construction and the demand for wood and wood products are expected to continue swelling in these countries despite the slowdown during late 2008 and early 2009.

Sources: World Bank (2007c); Beinhocker et al. (2007).

More importantly, the next decade and beyond will see a more informed generation with very different values and perceptions. While aspiring to higher living standards, there will also be a growing emphasis on quality of products and services. Green products will be in greater demand, as will ecosystem services. People's willingness and ability to pay for ecosystem services will increase, including intensification of demand for recreational services – including ecotourism. To some extent this trend is already evident.

Structural changes and dependence on land

Changes in the shares of various sectors in terms of contribution to national incomes and employment provide an indication of structural transformation of national economies. From economies based predominantly on subsistence agriculture in the early half of the twentieth century, the share of the manufacturing and services sectors in Asia-Pacific economies has increased significantly during the last few decades. Growth of the industrial and services sectors have reduced dependence on agriculture for income and employment (**Table 4.6**).

Country	Contribution of agriculture to GDP (%)		Agricultural population as % of total population		Agriculture share in employment	
	1990	2007	1990	2007	(year: %)	
Lao PDR	61	42	78	75	1995: 85.4	
Bhutan	36	21	66	65	n.a. (outdated figures only)	
PNG	31	35	82	74	2003: 72.3	
India	29	18	58	51	1995: 66.7	
China	27	11	72	63	1990: 53.4	
					2002: 44.1	
Malaysia	15	10	26	14	1990: 26	
Ivialaysia	15	10	20		2004: 14.8	
Thailand	10	11	57	44	1990: 64	
Thailanu	12	I I	57		2005: 42.6	
POK	0	2	16	6	1990: 17.9	
RUN	Э	3	10		2005: 7.9	
Australia	stralia 5 2 6 4	1	1990: 5.6			
Auslidiid		2	U	4	2005: 3.6	
lonon	3 1 7 3	2	1990: 7.2			
Japan		I	1	5	2005: 4.4	

Table 4.6. Agriculture's contribution to GDP and agricultural populations* in selected countries

* Agricultural population is defined by FAO as "all persons depending for their livelihood on agriculture, hunting, fishing and forestry. It comprises all persons economically active in agriculture as well as their non-working dependents."

Sources: World Bank (2007a); FAO (2010b).

While the share of agriculture in GDP has declined rapidly (largely due to rapid growth of the industrial and services sectors), agriculture still provides the majority of employment and income in some countries. Globally, the share of employment in agriculture has declined from about 40.8 percent in 1998 to 33.5 percent in 2008 (ILO 2009b). The decline in the number of people involved (either partially or fully) in agriculture in the various subregions is indicated in **Table 4.7**. However, the absolute number of those involved in agriculture in the region is rising, especially in South Asia, while in other subregions the agricultural populations remain relatively stable (Figure 4.6).

Table 4.7. Share of agricultura	I population in	total population	(%)
---------------------------------	-----------------	------------------	-----

Region/ subregion	1990	2000	2006
East Asia	64	59	56
South Asia	59	54	51
Southeast Asia	55	49	46
Oceania	21	21	20
Asia Pacific	60	55	52
World	46	42	40

Source: FAO (2010a).



Figure 4.6. Population partially or fully involved in agricultural activities and percentage in regional population, 1990-2006

Source: FAO (2010a).

Taking into account the share of agricultural income and employment, the degree of structural transformation in Asia-Pacific economies varies:

- In several low income economies, the share of agriculture in GDP and employment, although declining, remains high. This implies continued dependence on land as an important source of income, with consequences for forests, especially in the context of high population growth rates.
- Middle income and emerging economies have witnessed significant reductions in the share
 of agriculture in GDP, largely due to rapid growth in the manufacturing and services sectors.
 However, agriculture continues to provide the majority of employment. Employment growth
 in non-agricultural sectors has often been extremely slow. More importantly, this also implies
 very low per capita incomes in the agriculture sector, increasing pressures on forests
 to provide income through a diverse array of activities, including collection of woodfuel,
 NWFPs, grazing, etc and further clearance for agriculture.
- In developed economies, agriculture's share in GDP and employment has declined significantly, reflecting major structural transformations. Even when agriculture remains important, for example in New Zealand, it is highly capital-intensive and the proportion of population directly dependent on agriculture is low. In some countries, for example Japan, agriculture receives significant subsidies and often the share of income derived from agriculture by farming households remains low.

Structural change and evolution in economies has important implications on land use, in general; and the forest sector, in particular. Land-use conflicts, especially on account of continued expansion of agriculture, are particularly severe in countries where most income and employment are from agriculture and where the pace of structural transformation is slow. Most deforestation occurs in these countries. Stabilization of national forest situations begins when dependence on agriculture declines, although in many cases there may initially be accelerated deforestation, as a result of investments in infrastructure, urban development and expansion of industrial cash crops. In general, reversal of agricultural expansion starts once economies increasingly come to rely on the industrial and services sectors for income and employment and agricultural growth takes place through enhancing the productivity of land. Along with income increases, demands for ecosystem

services and the ability to pay for them also increase, helping to improve the forest situation

While such transitions are taking place in the Asia-Pacific region, the pace of change will vary considerably among countries. Within the time horizon of this outlook (the year 2020), several countries will remain largely agrarian, depending primarily on agriculture and forests and forestry for significant shares of incomes and livelihoods. The pace of transition will largely depend on how quickly countries are able to recover from the current economic crisis. A 'job-less recovery' could increase dependence on agriculture and other informal sector activities with possible negative impacts on forests.

Investments in industries and infrastructure

While development of the industrial and services sectors could reduce land dependency and thus the compulsion to clear forests for farming, this in no way guarantees the protection of forests. Surging industrial demand has led to a different kind of pressure on forests, especially mining and infrastructure development. Mineral-rich forest lands are under severe threat and in many cases mining concessions have been justified under the pretext of 'national development' and bringing development to backward areas. Vast areas of hinterland are being opened up through road and rail networks, profoundly changing the economy of rural areas and land values. China and India have already invested huge sums in improving transportation networks, enhancing connectivity of areas (including forests) that have remained remote. Similar impacts can be expected from advances in the economic development corridors in the Mekong subregion, which could significantly affect forests in Lao PDR and Cambodia. A real estate investment boom has led to land price escalation and there are several instances of forest land being encroached upon to build resorts, golf courses, etc. Small-scale encroachment by landless farmers is being complemented or replaced by encroachment by real estate developers.

Rapid growth in demand for industrial raw materials will accelerate the pace of exploitation of minerals and water (for energy and irrigation) in the Asia-Pacific region. This will be particularly the case for resource-rich countries, which are responding to the growth in demand for raw materials and energy in the emerging economies. For example, Bhutan and Lao PDR are giving considerable thrust to hydropower generation as an important source of foreign exchange earnings. This has important implications on forests and forestry in such countries. Land-use conflicts are expected to continue and intensify as the sources of pressure on forest land shift from agriculture to the industrial and services sectors.

Globalization and its impacts

Globalization – involving accelerated flows of investments, technology and goods and services across national borders – has been a major factor in the development of the Asia-Pacific region (Inoguchi 2010). Globalization also encompasses information exchange, travel, cultural interaction and global agreements and regulations to support the increased interaction among people. Although the extent to which Asia-Pacific economies have been integrated into the global economy is variable (**Box 4.6**), the rapid growth of many Asia-Pacific economies can, to a significant extent, be attributed to their ability to take advantage of the opportunities provided by globalization.



Factors that have accelerated globalization processes include:

- Global and regional economic cooperation and trade agreements. Although there has been
 a stalemate as regards the Doha round of WTO trade negotiations, several regional and
 bilateral agreements have helped to liberalize trade in the region. Tariff barriers have been
 significantly reduced and reductions are expected to continue, notwithstanding potential
 short-term setbacks.
- *Expansions in FDI and trade.* The Asia-Pacific region's share in FDI and trade has expanded phenomenally during the last two decades. However, the ability of countries to take advantage of these opportunities has varied depending largely on national political and institutional environments.

Three broad patterns of globalization have been observed in the Asia-Pacific region:

 Growing affluence and increasing demand for consumer products in some countries have attracted FDI, largely to take advantage of market opportunities. Transnational corporations, already well-established in many developed and emerging economies, have invested heavily in industrial and infrastructure facilities intended to cater to the growing demand for products and services. A typical example, in the forest sector, is the pulp and paper industry. Economic growth implies a rapid expansion in markets for a wide array of paper
products and this has led to an enormous capacity expansion in the sector, during the last two decades. More than half of all new investments in pulp and paper facilities have been in the Asia-Pacific region.

2. For a number of countries, especially those rich in natural resources (including minerals, land and forests) and/or with abundant labour supply – and where regulatory environments are weak – globalization has led to intense exploitation of these resources. Examples include large-scale logging in many Southeast Asian countries, and rapid expansion of labour-intensive production of furniture (for example in China, Viet Nam, Indonesia, etc.). Escalating prices of food and other agricultural products have led to large-scale public and private sector land acquisition by capital-rich countries (Box 4.7).

Box 4.7 Agricultural land acquisitions in Asia

Soaring food prices in 2007 and 2008 led to a scramble to acquire agricultural land by governments and private investors from countries with limited arable land and growing demand for food and other products (for example rubber), including biofuel crops. Such acquisitions have been reported in Cambodia, Indonesia, Lao PDR, Mongolia, Pakistan and the Philippines. Key Asia-Pacific countries acquiring land include China, India and ROK. Globally, behind Africa, Asia is arguably the hottest target for farmland investments. The International Food Policy Research Institute has highlighted several proposed or finalized Asia-based deals in excess of 100 000 hectares. Because most Asian countries limit foreign ownership of land, leasing is the easiest and most common form of international land investment in Asia. A number of studies have highlighted the economic, social and environmental impacts of such overseas acquisitions. Forest clearance and displacement of traditional users, including small farmers, are major issues relating to such land acquisitions. Local communities are sometimes 'pressured and intimidated' into leasing their land.

Source: Kugelman and Levenstein (2009).

3. Moving production facilities offshore – from high cost countries to the relatively low-wage Asian countries – is another important trend.

As described earlier (**Box 4.3**) the recent economic crisis has had a negative impact on these aspects of globalization, especially as consumer demand slumped in developed country markets.

While the globalization process will persist and strengthen in coming years, globally-driven development could proceed in new directions (Inoguchi 2010). Much of the earlier globalization process has been driven by the corporate sector, in particular transnational corporations focused primarily on profit generation. This has led to considerable economic asymmetries, with most of the benefits accruing to small segments of the population. Reactions to such exploitative globalization could lead to:

- a) Strengthening of anti-globalization sentiments, driven by a coalition of diverse interests; resulting in protectionist measures and a reversal of the globalization process; and
- b) A more inclusive approach to globalization, involving all stakeholders and fully taking into account the social and environmental implications of globalization.

Considering the diverse situations prevailing in the region, it is difficult to make generalized predictions about how the process of globalization will evolve in coming years.

POLITICS, POLICIES AND INSTITUTIONS

Changes in the larger policy and institutional environments are probably the most important drivers of change affecting the forest sector – directly and indirectly. Overall, national economic development is largely a function of the performance of the larger political system, especially, its effectiveness in creating a favourable policy and institutional environment, including capacity to resolve intersectoral and interstakeholder conflicts.

Politics and governance

Changes in the larger political and institutional environment directly and indirectly impact forests and forestry. The overall political frameworks in Asia-Pacific countries differ considerably, ranging from democratic governments elected through transparent processes to authoritarian regimes providing little space for people's participation. In between there are flawed democracies and hybrid regimes (Economic Intelligence Unit 2009 – see **Box 4.8**). While it is possible to characterize political systems, often subjectively, envisioning the direction of future changes is extremely difficult. Although there has been some shift from authoritarian regimes and an environment for pluralism is emerging (empowering a multitude of players), the majority of the people continue to live under hybrid or flawed democratic environments.

Box 4.8 Democracy Index 2008

The Economic Intelligence Unit has developed a composite system of democracy ranking for countries based on (a) electoral processes and pluralism, (b) functioning of government, (c) political participation, (d) political culture and (e) civil liberties. Full democracies have a composite score of 8 to 10, while countries with less than 4 are grouped as authoritarian regimes. Between these extremes are (a) flawed democracies with a score of 6 to 7.9 and (b) hybrid regimes with a score of 4 to 5.9.

In the Asia-Pacific region, only four countries are characterized as full democracies (Australia, Japan, ROK and New Zealand), while the majority are categorized as flawed democracies or hybrid regimes. Although there has been some shift from authoritarian to hybrid regimes, on the whole the development of true democratic systems and pluralism has stagnated.

Source: Economic Intelligence Unit (2008).

While authoritarian and hybrid regimes will present semblances of outward stability, 'flawed democracies' could witness considerable turmoil, especially as diverse groups, including those who have been marginalized for a long time, exert pressure to gain a share of power. Improved opportunities for education and better access to information will have profound impacts, helping in the transition to full democracies. However, there could be polarization of divergent groups, with potential for continued conflicts and instability. State capitalism and government-business coalitions are gaining traction in many countries. Often such coalitions promote appropriation of public resources (through less-than-transparent privatization processes), accentuating conflicts (**Box 4.9**) and undermining the emergence of fully functional democracies.

Box 4.9 Po

Politics, governance and forest conflicts

In view of high population densities and growing demands for goods and services, competition for limited natural and financial resources is very intense in many Asia-Pacific countries. Failure to develop efficient political processes, corruption and poor governance have increased conflicts, some of which – over time – have transformed into religious, political and ethnic conflicts. For various reasons, forests are often the most affected areas. Forests adjoin some of the most underdeveloped and deprived areas, often populated by the most marginalized groups in society. Government presence is often very limited in these areas and, when present, is often seen as an agent of exploitation. With increasing demand for resources, vast tracts of forests have been opened up for logging, mining, etc, undermining the livelihoods of local communities. Such marginalization has provided a fertile ground for the emergence of extremist movements in many countries in the Asia-Pacific region. In some countries, vast tracts of forests receive little or no effective management, due to the presence of insurgents. Often timber and other products are important sources of income to support conflicts.

Policy changes

Overall political changes are unleashing changes in policies in several spheres, affecting forests and forestry directly and indirectly. Some of the major changes in the larger policy environment, outside the forest sector, are outlined below:

1. Changes in economic policies, especially an emphasis on market-oriented approaches, including privatization. This has been a major thrust for most governments in the Asia-Pacific region, although the pace of reform has varied, depending on political systems. Through the second half of the twentieth century, several countries in the region were pursuing a socialist planning framework with substantial government control on economic activities. These economic regimes are now changing, though the pace of change is variable. While some have opted for a gradualist approach, in others changes have been abrupt; often in response to political and economic crises. Considering that Asia-Pacific countries have generally benefited from more open economic policies, economic liberalization will continue, notwithstanding the occasional protectionist sentiments aired in the context of the current economic crisis.

2. Broad national economic policies also affect other policies relating to land use, energy, industry, trade and environment, all in turn affecting forests and forestry – directly and indirectly. Of particular importance in regard to land use are policies that assign ownership, tenure, or rights to use of land. Ownership and security of tenure form the backbone of efficient land use and have a direct bearing on forests and forestry. For example, China is implementing changes in tenure relating to forest ownership and these will have significant impacts on conservation and management of forest resources (**Box 4.10**). Similar changes in land tenure are being made in several other countries – for example the Forest Rights Act in India and similar legislation in other countries (see **Box 2.23**).

Box 4.10.	Forest tenure reform in China
-----------	-------------------------------

Collective forests in China account for 58 percent of forest land and have great potential to significantly contribute to rural livelihoods. Tenure in China's collective forests has undergone many changes in the past 30 years. While these forests were originally managed by village-level administrations, in 1980 some provinces initiated a partial transfer of user rights to households. However, a lack of clear and secure rights and few guaranteed tangible benefits from the forests, combined with little input into decision making, resulted in low motivation for forest management by local populations and resulted in continuous forest degradation.

In 2003, China embarked on a new phase of reform of the tenure system for collective forests in order to address this problem. The reforms will have far-reaching impacts and historical significance. The reforms focus on devolution of land-use rights and forest ownership in collective forest areas to individual households, allowing households to exclusively use these lands and forests for income generation and livelihood improvement. To date, 59 million hectares of collective forests have been transferred to individual households, accounting for 34.5 percent of the total collective forest area. By 2013, it is expected that nearly all provinces in China will have undertaken tenure reform for collective forests.

Tenure reform for collective forests is a top priority for the State Forestry Administration and also receives political support from the highest levels, under the New Countryside Development Initiative. In June 2008, the Central Committee of the Communist Party of China and the State Council of China issued a set of guidelines promoting tenure reform for collective forests. The guidelines confirm the importance of collective forest tenure reform to increase forest farmers' incomes and in promoting forestry development. In tandem with collective forest transfers to individual households, five key areas will be addressed to secure the new tenure system:

- 1. Reform of the current harvesting management mechanism including development of a new harvesting quota system to ensure that farmers have real rights to the forests.
- 2. Regulate forest land markets and forestry markets to ensure fair and efficient trade.
- 3. Support the public finance system, for example, by establishing and refining compensation systems for provision of ecological benefits through forests.
- 4. Increase sources of forest investment, for example, promoting mortgage loans secured by forest ownership or land-use rights.
- 5. Refine social services systems for forestry, including development of Forest Farmer Cooperatives.

Sources: SFA (2009); Ma Qiang (personal communication, 2009).

3. Policies relating to liberalization of investments and trade have had a range of impacts on the forest sector. Rapid expansion of FDI (especially in wood industries) and increased trade in forest products are two major outcomes. Trade liberalization on account of several countries' accession to the WTO, and other bilateral and multilateral trade agreements, has also impacted forestry in several ways. Local and national supply chains have expanded into global supply chains; local availability of wood and other raw materials has become less important in developing a viable wood products industry.

The larger policy changes – in economics, industries, agriculture, trade, environment, energy, etc. – have brought about significant changes in forest policies, reflecting society's changing perceptions about the roles of forests and forestry. Although land-use conflicts persist in most countries, there has been increasing recognition of the multiple functions of forests. While direct economic benefits – from converting forest land to grow more profitable crops, or focusing on commercial wood production – dominated forest policies a few decades ago, this has changed in

many countries; an increasingly environmentally-conscious public has brought about major policy shifts, with large tracts of forests set aside exclusively for service functions.

Institutional changes

Shifts in policies have led to concomitant institutional development within and outside the forest sector, at different paces in different countries. Institutional changes largely reflect a shift from centralized control at the national level, to greater involvement of subnational and supra-national entities. These changes stem from two broad tendencies; towards localization and towards globalization.

The shift from centralized national level institutions to the greater involvement of both local and international institutions has created substantial tensions. Economic and environmental implications of globalized resource use have necessitated a series of international initiatives relating to economic cooperation and trade. Similarly, a number of initiatives intended to address global environmental problems have taken root, especially since the 1992 United Nations Conference on Environment and Development (UNCED).

Forestry institutions are under tremendous pressure to bring about changes in their functions and structures (FAO 2008b) and there have been some major changes in this regard in the Asia-Pacific region. Although public sector forestry agencies have dominated the institutional scene for a long time, the last couple of decades have witnessed a significant pluralization of institutional arrangements. Some of the major changes in this regard include:

- Privatization of many commercial functions, especially logging, plantation management and wood processing.
- Separation of policy and regulatory functions from management functions within the public sector, leading to the establishment of commercially-managed, public sector corporations.
- Greater involvement of local communities in the management of forest resources. Pioneering
 efforts in this regard include systems of Forest User Groups in Nepal, Community-Based
 Forest Management in the Philippines and Joint Forest Management in India. In most South
 Pacific countries, communal ownership has been the norm for centuries, although presently
 many of the benefits from management of natural resources do not accrue to communities.
 In many countries, marginalization of local communities during colonial periods is being
 remedied through changes in policies and legislation.
- Civil society organizations are increasingly active, although the extent of their involvement depends on overall political frameworks. Both national and international civil society organizations are actively shaping the forest agenda at local, national and international levels and this involvement is expected to continue.

Forest governance issues

In many countries with weak political frameworks, forest governance continues to be a major challenge on account of corruption. Increasing international attention is being given to improving forest law enforcement to counter illegal logging and its associated trade, and corruption. In the context of rapid escalation of wood product demand and growing trade, countries with large tracts of forests and inadequately developed policy and institutional frameworks have particularly suffered from increased illegal logging. Illegal logging and corruption have the following consequences:

• Loss of legitimate income from forests as a significant share is appropriated by those involved in illegal logging and other corrupt practices.

- Diminished attractiveness of countries as destinations for FDI, especially where corruption imposes significant informal costs on investors.
- Illegal logging makes sustainable forest management less attractive. The expansion of illegal logging and trade promotes a parallel economy, which undermines legal operations. There is growing concern about the larger ramifications of illegal logging. The criminality associated with illegal logging tends to undermine the rule of law and affects democratic institutions.

A number of initiatives are underway to improve forest governance, law enforcement and legal trade. The most important of these is the Asian FLEGT (trade) process, involving key forestry countries, especially in Southeast Asia. With greater cooperation among law enforcement agencies of the countries (see **Box 4.11**), tracking illegal production and trade of forest products is garnering increased attention. Some recent developments, such as inclusion of illegal trade of wood under the purview of the United States' Lacey Act and due diligence procedures developed by the European Union will have far reaching implications on forest products trade in Asia and the Pacific (**Box 4.12**).

Box 4.11 Forest law enforcement and governance in Asia

In Asia, multilateral arrangements on forest law enforcement and governance (FLEG) have targeted explicit improvement in reducing corruption and illegal activities within – and associated with – forests and forestry. In East Asia, a FLEG process emerged out of a series of multistakeholder consultations in 2001. The Bali Declaration, arising from a 2001 Bali Ministerial FLEG meeting, affirmed commitments to eliminate illegal logging and associated trade, and corruption. It also developed a comprehensive list of actions – encompassing a range of dimensions across the political, legislative, judicial, institutional, administrative, research, policy and advocacy spheres, as well as agreement to share expertise and disclose information relating to conservation and protection – to be undertaken at national and international levels. However, while the FLEG process has certainly helped to raise the profile and level of debate on forest governance, it is more difficult to ascertain its impacts on the ground.

Box 4.12	New trade and procurement policies impacting timber trade and illegal
	harvesting

Amended Lacey Act

In May 2008, the United States Congress passed landmark legislation to address the role of the United States market in the global 'illegal logging crisis'; thereby becoming the first country to ban imports of illegally harvested wood and wood products. A 2007 analysis by the Environmental Investigation Agency (EIA) estimated that United States consumption of high-risk timber and wood products (not including pulp and paper) comprised up to 10 percent of annual wood imports, to the value of US\$3.8 billion, in 2006. The Lacey Act – a longstanding wildlife trafficking statute (originally passed in 1900) – was amended to prohibit commerce in plants and derived products, including all timber and wood products that are illegally harvested or traded. It also increased transparency by requiring importers to declare information on species, country of origin and similar information that can be used to validate the legality of imports. The legislation also prohibits trade in animals and plants sourced in contravention of another country's laws. The effects of the revised Lacey Act are already being felt in the market.

EU due diligence

In April 2009, the European Parliament passed a proposal to strengthen legislation to crack down on the illegal timber trade in its member states. The new 'due diligence system' makes it an offence to sell wood products and timber derived from illegal logging, and increases the responsibility of operators by requiring information on the source of products, including country and forest of origin. Data on suppliers and intermediaries will also be required. EU member states must ensure – within two years of the regulation's entry into force – that all timber and timber products be labeled with this information. Financial penalties, to be set by EU member states, must reflect the degree of environmental and economic damage caused by the illegal activity.

Sources: EIA (2009a); EIA (2009b); European Forest Institute (2009); NEPCON (2009).

Illegality is not confined only to timber products. In recent years, there has been rapid growth in trade of NWFPs, including plants and animals. A number of (mainly developed) countries have established mechanisms – for example Wildlife Crime Bureaus – to detect and prevent illegal trade in animals and animal parts. Forensic laboratories specifically aimed at fighting wildlife crimes have been established in a number of countries. However, the variability and complexity of wildlife trade chains, the porosity of borders and difficulties in guarding large areas against the threat of wildlife removal, makes wildlife depletion difficult to address (Traffic 2008a).

ENVIRONMENTAL DRIVERS

Increasing demands for goods – in response to population and income growth – have led to rapid depletion of natural resources and declines in environmental quality; often adversely affecting some people's livelihoods. A number of societies in Asia and the Pacific have a strong environmental ethic, rooted in religious and cultural beliefs; some of which are being reinforced in the context of growing ecological knowledge and awareness. Instances of adverse environmental impacts stemming from inappropriate resource use (and impacts on livelihoods) have created substantial awareness among the general public of the need to pursue paths of sustainable development.

Key environmental drivers that influence the use of natural resources are discussed in the following sections.

Local environmental issues

There are numerous instances of local environmental issues mobilizing public action to protect forests and other natural resources. An early example of local action that created widespread concern about the adverse impacts of deforestation was the 'Chipko movement' in the Indian Himalayas. Forest management that focused largely on wood production came under increasing criticism from local communities and civil society organizations in view of adverse impacts on biodiversity, declines in the quality, quantity and regularity of water supplies, and degradation of land. Similar examples have been, and remain, widespread throughout the region – including protests against natural forest logging in New Zealand through the 1970s and 1980s; ongoing protests against logging old-growth forests in Tasmania, Australia; indigenous people's protests against logging in Sarawak, Malaysia; and protests against land clearing in Papua and Kalimantan in Indonesia. More recently, instances of developmental activities – for example construction of large irrigation and hydropower projects and mining – are affecting the livelihoods of people through environmental degradation.

Protests by local communities are resulting in more systematic efforts to assess the impacts of developmental activities on the environment and livelihoods. Many countries are making ex-ante environmental impact assessments a prerequisite for implementation of development projects. Systems of public hearings have been introduced in a number of countries to ensure broad-based participation in making decisions that have environmental implications. For example, in Pakistan the Environmental Protection Agency conducts public consultation and hearings on a wide range of environment-related issues.

National environmental issues

National level environmental disasters, such as floods and landslides, have often triggered responses by governments. This has led to some drastic interventions including partial and total logging bans, as well as increased investments in afforestation in a number of countries. A growing constituency of environmentally-conscious citizens, including relatively high income groups, is demanding improvements in the quality of environmental management and wields sufficient influence to sway policy decisions. Increasingly affluent middle-classes are willing and able to pay for some ecosystem services. In many Asia-Pacific countries a very active domestic constituency, including civil society organizations, is driving the environmental agenda.

In response to local and national environmental issues, a number of countries have strengthened their environmental legislation. New institutions, including 'green courts', have been established in some countries to resolve disputes relating to the environment (**Box 4.13**).

Box 4.13 'Green courts' in Asia-Pacific countries

'Green courts' are trial courts especially designated to adjudicate cases involving environmental disputes and violations of environmental laws, including forestry laws. Motivation to establish green courts has come mainly from heightened awareness in different sectors of society regarding environmental injustices and intergenerational inequities, driving a continuing increase in numbers of environmental cases pending in courts.

A growing number of legal practitioners acknowledge that the traditional lenses through which the judicial eye interprets legal provisions and applies them to environmental cases have become inadequate. Environmental law has grown as a specialized area of law, requiring separate adjudication due to certain unique features (Sharma 2008) including:

- 1. Requirements to resolve complex technical and scientific questions.
- 2. Overlapping of civil and criminal remedies, as well as public and private interests in environmental adjudication.
- Rapid evolution of a substantial body of international environmental instruments spanning a range of issues including: trade in endangered species including timber, ocean and marine pollution, illegal transnational shipments of hazardous wastes, and global climate change.
- 4. Development of fundamental environmental principles such as the precautionary approach, polluter-pays, sustainable development, prevention at source and procedural transparency.

Asia-Pacific countries that have established green courts include Australia (1979), New Zealand (1991) and the Philippines (2008). India has developed draft legislation to create a similar mechanism.

Australia's Land and Environment Court and New Zealand's Environment Court act as 'one-stop shops' or single windows for all environmental adjudication. They comprise judges and commissioners who are required to have a wide mix of qualifications. Both courts have 'reviewing and enforcement jurisdiction' in relation to environmental and planning statutes.

In the Philippines, green courts comprise 117 trial courts at municipal and regional levels, mandated to prioritize hearings of environmental cases over those that are criminal and civil in nature. Forty-five of these 117 green courts have been designated as 'Forestry Courts'. In 2006, cases related to violations of the Forestry Code represented 65 percent of 2 353 pending environmental cases.

In India, although legislation to establish a green court is pending, a 'Forest Bench' is already operational within the Supreme Court. The Forest Bench is a three-judge bench that deals with prominent issues including conversion of forest land for non-forest purposes, illegal felling, potentially threatening mining operations, afforestation and compensation by private user agencies for using forest land. Around 2 000 interlocutory applications relating to forest issues have been disposed under India's Forest Bench. However, the Forest Bench has been criticized as providing micromanagement of forest issues and being a backwards step – towards recentralizing forest management through widening of the government approval window in respect of non-forest uses and working plans for timber felling.

Sources: Sharma (2008); Soriaga (personal communication, 2009).

Regional and global environmental issues

Transboundary issues such as smoke haze, wildlife enforcement networks and shared ecological corridors, present challenges to countries in the region. Shared ecosystem and water resources are notably contentious, including zones around the Mekong River Basin and the Bay of Bengal. Initiatives such as the Mekong River Commission (MRC), involving neighbouring countries (in the case of the MRC – Thailand, Lao PDR, Cambodia and Viet Nam) have been created in an attempt to coordinate joint management of shared water and related resources for mutual benefits.

Increasingly, global environmental issues are influencing resource-use decisions. This largely stems from the fact that many environmental problems are global in nature, affecting all human beings, and need to be addressed through collective global action. Climate change is one of the most important of these and, not surprisingly, international initiatives are becoming a major driver of climate change mitigation and adaptation efforts (Box 4.14). Following UNCED there have been a number of international conventions relating to various aspects of the environment - for example, the Convention on Biological Diversity (CBD), the United Nations Convention to Combat Desertification (UNCCD) and the United Nations Framework Convention on Climate Change (UNFCCC). Several other agreements and conventions precede UNCED, for example, the Convention on International Trade in Endangered Species (CITES) and the Convention on Wetlands of International Importance (Ramsar Convention). Most international environment conventions and agreements are backed by various implementation mechanisms, providing technical and financial assistance to facilitate country level action. Many countries have developed national strategies and action plans for aspects such as biodiversity conservation, control of desertification and climate change mitigation and adaptation, taking advantage of the various conventions. However, implementation often lags behind policy development on account of resource and institutional constraints.

In general, there is greater awareness of environmental issues at local, national and global levels. However, important questions surround the extent to which these global issues will lead to concerted national and local actions. While international financial and technical assistance will encourage some action, overall impacts will largely depend on national level commitments and will likely be reliant on market-based solutions.

Climate change mechanisms: a key global and regional driver

Climate change mitigation and adaptation have become major issues impacting forests and forestry. International attention is focusing on carbon emissions from deforestation and forest degradation, as well as the potential for conservation, afforestation and reforestation to significantly enhance carbon sequestration. A variety of mechanisms have been developed to potentially support forestry-related climate change initiatives. These include:

- Compliance carbon markets, particularly the afforestation and reforestation provisions of the Clean Development Mechanism (CDM); a system under the Kyoto Protocol through which developed countries can accrue credits by financing greenhouse gas emissions reductions – or sequestration – projects in developing countries.
- Voluntary carbon markets, which for forestry include a wide range of voluntary arrangements and contracts under which one party voluntarily commissions another party to reduce emissions through forestry activities. The arrangements are voluntary in the sense that the parties are not forced to enter such an arrangement by legislation or global treaty and the nature of the arrangement is flexible according to the parties' requirements.
- Reducing Emissions from Deforestation and Forest Degradation (REDD), which envisages the utilization of funding from developed countries to reduce deforestation and forest degradation in developing countries, thereby reducing carbon emissions, but with potential co-benefits such as biodiversity conservation (**Box 4.14**).

During the past decade, climate change has garnered enormous international attention and has been instrumental in returning forestry to centre-stage in global environmental discussions. Given this dominance of climate change policy – especially potential to change the ground rules and playing field – forestry in many countries has been in something of a holding pattern, as governments, the private sector and civil society organizations await clear direction from global discussions.

For developed countries, most are seeking to align climate change policy responses with others; seeking not to place their industries at a substantial disadvantage to competing nations. In New Zealand, for example, forestry was the first sector included within the national Emissions Trading Scheme (ETS). However, the rules of the scheme have been amended several times, most recently – after a change of government – in December 2009. Similarly, Australia has deferred implementation of its Carbon Pollution Reductions Scheme (CPRS); initially to July 2011, and more recently until 2013, and is still considering whether and how forestry will be included in the scheme.

Developing countries have mainly been awaiting decisions on the implementation of REDD and related instruments, including clarification of funding mechanisms. In this regard, the 2009 Copenhagen Accord delivered a mixed result. On the one hand, it affirmed the need for immediate establishment of mechanisms to mobilize resources for REDD-plus, but on the other hand, the timetable for implementation and more detailed guidance on mechanisms and specific funding has yet to be developed (**Box 4.14**).

Box 4.14 Forestry provisions in the Copenhagen Accord 2009

Forest-specific text in the Copenhagen Accord occurs in two sections.

Section 6: We recognize the crucial role of reducing emission from deforestation and forest degradation and the need to enhance removals of greenhouse gas emission by forests and agree on the need to provide positive incentives to such actions through the immediate establishment of a mechanism including REDD-plus, to enable the mobilization of financial resources from developed countries.

Section 8: Scaled up, new and additional, predictable and adequate funding as well as improved access shall be provided to developing countries, in accordance with the relevant provisions of the Convention, to enable and support enhanced action on mitigation, including substantial finance to reduce emissions from deforestation and forest degradation (REDD-plus), adaptation, technology development and transfer and capacity-building, for enhanced implementation of the Convention.

Source: UNFCCC (2009).

In general, it is fair to conclude that over the coming decade, "where climate change goes, forestry will follow". Climate change will be the key determinant in shaping new forestry policies; for better or worse:

- 'For better' if international negotiations yield significant new and additional funding for forestry; within workable mechanisms that encourage and enable real change on the ground. Similarly, if discussions create a global environment in which compliance and voluntary markets for forest-based carbon sequestration can flourish. At present, it seems unlikely that discussions will progress rapidly enough that visible changes to forests in the Asia-Pacific region will be seen by 2020. However, it should be hoped that necessary international agreements, conventions and policy foundations can be put in place. The onus will then be on the forestry sector to deliver on its carbon sequestration potential and promises.
- 'For worse' if protracted negotiations on forestry and climate change unravel, yielding no new mechanisms for support; or if new mechanisms are either too unwieldy to be workable, or if supporting funding and resources are negligible. In this case, there is potential that forestry may have spent a decade, debating and planning for a future that never arrived. Such a scenario could be envisaged if the world concludes that it is far easier to achieve carbon gains from approaches devoid of the difficulties and complexities associated with forestry and REDD. In this case, forestry might move back to the sidelines of international attention.

TECHNOLOGICAL CHANGES

Technological changes will be a major driver impacting forests and forestry, affecting all parts of the sector; although in many countries, the uptake of cutting-edge technologies is slow and uncertain and may not have widespread impacts in the period to 2020. Technology will determine which goods and services are produced; how and where these are produced; which processes are used; how they are transported to markets; where they are sold; and even how they are disposed of at the end of their useful life. Enhancing productivity and resource-use efficiency will become critical in the resource-constrained situations that exist in many Asia-Pacific countries. Climate change mitigation and adaptation will also require significant changes in science and technology capacities.

Markets and public policies are the main factors impacting technological developments. Demand for goods, including associated costs and prices, has been a major determinant of technologies. For example, labour shortages (and consequent high wages) have led to the development of labour-saving, capital-intensive technologies. As environmental and social issues become important, public policies and legislation (that change cost and incentive structures) are becoming important drivers of technological changes. Direct investments in research and development by governments play a major role in this regard.

The state of science and technology in the Asia-Pacific region differs significantly among countries, primarily reflecting the diverse social and economic conditions. A strong correlation exists between levels of economic development and the sophistication of science and technology. High income countries (for example Japan, Australia, ROK and New Zealand) have been able to invest significantly in science and technology, giving these countries a competitive edge in high technology products. Emerging economies, such as China and India, and middle income countries, such as Malaysia and Thailand, are also investing in science and technology; increasing their competitiveness in producing certain products and services. In most other countries research and development capacity remains underdeveloped, affecting capacities to produce products and services with high components of value added, or to develop more efficient, competitive and cost-effective technologies. The absence of significant domestic science and technology capacity leaves many countries highly dependent on technologies developed elsewhere, notwithstanding that these may not be optimal to meet specific needs. While some technologies can be easily adapted, others require substantial modifications and many countries are lacking such capacity.

Broadly, innovation in forestry can be grouped as follows:

- Productivity-enhancing technologies (for example, genetic enhancement, tree improvement, utilization of wastes and residues, innovations that enhance labour productivity).
- Harvesting and processing technologies that improve recovery (reducing input-output ratios) and reduce energy needs (for example, reduced impact logging and reconstituted wood products).
- Technologies that enhance social and environmental benefits (for example, technologies that enhance carbon sequestration capacities).

These various technologies are discussed in greater detail, below.

Productivity-enhancing technologies

Improving land productivity will remain a major concern in the Asia-Pacific region, considering the very high population densities in many countries. As increasing areas of forest are set aside to provide ecosystem services, it will be imperative to enhance productivity of areas that remain earmarked for wood production. Most countries have a long history of efforts to improve productivity of plantations. Much of the thrust of conventional tree improvement programmes has been to take advantage of natural differences in productivity and other desirable characteristics (for example, resistance to pests and diseases, or tolerance of salinity and alkalinity).

Advances in gene transfer technologies and tree genomics are providing new avenues for genetic modification of trees. Qualities considered for genetic modification include herbicide tolerance, reduced flowering or sterility, insect resistance, wood chemistry (especially lower lignin content) and fibre quality. Reducing lignin content is receiving increased attention in the context of production of cellulosic biofuels. However, research and deployment, including field trials of genetically modified trees, remain contentious issues. Concerns have been raised about impacts on ecosystems, especially potential invasiveness, impacts on biodiversity and the transfer of genes to other organisms.

Harvesting and processing technologies

Improving economic efficiency and minimizing environmental damage have been the primary objectives of harvesting innovations. Labour scarcity, allied with increasing costs of labour, has encouraged significant mechanization of logging and transport industries. Sophisticated harvesting, conversion and transportation technologies have been deployed in a number of countries, especially in industrial forest plantations.

New techniques have been developed to identify the source of logs; using tags, paints and chemical compounds that can be read by detection devices. New-generation radio frequency identification tags and bar codes can easily track the movements of logs from forests to markets, helping to distinguish legal timber from illegally-sourced wood. Tree genome studies could eventually help to identify genetic differences between individual trees and this could be a powerful tool in combating illegal logging, especially when logs are processed as furniture and other products (Oi 2009, see **Box 4.15**).

Box 4.15 Tree genome technologies to fight illegal logging

In the past, systems of permits to collect and transport timber from forests provided a relatively effective approach to prevent illegal logging. However, rapid growth of international trade in highly processed products has created a number of challenges, as wood is converted into processed products – including furniture, paper and panel products – transported over long distances and sold in distant markets. Once converted into processed products, it becomes very difficult to identify sources of supply or to determine whether the timber was collected legally or illegally. Ongoing efforts to develop genome technologies that are able to identify differences in tree DNA could significantly improve the ability to track origin of products. Proving that a particular product has been produced from illegally procured timber remains a major problem and is extremely expensive. DNA analysis could provide strong evidential techniques, even when timber has been transformed into furniture, panel products, paper, etc. This technology should increase the probability of detection of illegal logging and trade, providing an important tool to control and reduce illegal logging.

Source: Oi (2009).

Technological developments in wood processing largely focus on:

- Economic competitiveness with emphasis on reducing costs, improving quality and developing new products.
- Energy efficiency and production of energy during wood processing.
- Compliance with environmental standards. For example by reducing effluents and reusing water through 'closed-loop processing' in the pulp and paper industry.

Many technological developments in wood processing have been consumer driven. Wood processing is towards the end of the forest product value chain, close to consumers and, consequently, compelled to respond to changing demands. Intense competition has also encouraged innovation.

Traditional wood use was largely based on structural properties, especially strength, durability, working quality and appearance. Wood-processing technologies have improved structural and chemical properties, expanding uses and making it possible to employ species that were once considered less useful – for example, the use of rubberwood for furniture and to produce MDF.

New sawmilling technologies include laser and X-ray scanners combined with high-power computing, which makes it possible to scan and store information on log diameter, length and shape and to produce optimal sawing patterns for each log to maximize sawnwood recovery (Bowe *et al.* 2002). Picture analysis to determine surface properties (e.g. knots and colour) has improved the quality of sorting and grading of sawnwood. New methods have been introduced to control drying processes and to measure physical strength, including revealing possible defects (Baudin *et al.* 2005). A number of institutions are involved in research focusing on the development of biomaterials, combining wood and other materials that could have properties far superior to traditional wood. (**Box 4.16**).

Box 4.16 New generation biomaterials

Using a combination of biotechnology applications and new industrial processes, residues from traditional forest operations and new forest plantation resources can become the basis for new products such as bioplastics, natural chemicals, bioenergy and pharmaceuticals. The SCION research group in New Zealand is active in developing new products such as specialty chemicals and intermediates, and functional polymers and additives, for use in adhesives, coatings and plastics. This could result in development of new biocomposite products, bioplastics and thermoset resins that are renewably produced and more easily recycled and degraded at the end of their product life.

Other technological developments in wood processing include:

- Improved rates of recovery and the use of small-dimension timber, largely through improvements in sawmilling technologies and production of sliced veneer and reconstituted boards and panels.
- Recycling for example, use of recovered paper.
- The use of micro-organisms to bleach pulp and treat effluents in the paper industry, reducing costs and environmental impacts.
- 'Total use' of wood through biorefineries producing a range of biomaterials.

Energy technologies

Woodfuel remains the main source of domestic energy for cooking and heating in most developing countries in the Asia-Pacific region and, although its use may decline, it will still remain an important source of household energy. Perceived risks of fossil fuel dependence and increasing concern about greenhouse gas emissions are drawing attention to the potential of wood as a source of clean energy.

Traditional wood energy systems rely on low-cost technologies, affordable to low-income consumers. The technologies used vary in terms of costs and in production and conversion efficiency. For example, charcoal is produced using a range of kiln types, from traditional mud to metal. Modern wood energy production using co-firing (combustion of biomass together with other fuels such as coal) or wood pellets involves considerably higher investments, but also has much higher energy efficiency. In a number of countries, efforts are being made to develop small-scale wood gasifier units, suitable for households and small-scale enterprises.

Substantial investments are being made to develop and commercialize technologies for producing biofuels from cellulose. The success of cellulosic biofuel will largely depend on its cost competitiveness relative to fossil fuels and other alternatives. The impact on the forest sector remains uncertain, especially considering significant increases in investments in other renewable energy sources, especially solar and wind power.

Technologies from outside the forest sector

Scientific advancements in sectors beyond forestry have led to the emergence of a wide array of new technologies that have profoundly changed forestry, with impacts often much greater than those of technologies developed within the forest sector, itself. For example, many technologies used in forest resource assessment, wood production, wood processing and trade, are outcomes of general purpose technologies developed in other sectors, especially through the integration of different components.

Information and communication technologies

Information and communication technologies (ICTs) have revolutionized many people's lives and change will accelerate as new technologies are developed and deployed. Developments in ICT have played a key role in driving the globalization process by connecting people and sharing information (Hetemäki and Nilsson 2005). Some of the impacts of rapidly changing ICTs include:

- Rapid growth of Internet and mobile communications has created unprecedented opportunities for those who previously remained outside global information loops, including small and medium enterprises. Product marketing has been revolutionized and rawmaterial procurement, logistics and production processes vastly improved. Adoption of ICT has increased labour productivity, reduced costs and increased turnover (Hetamaki *et al.* 2005).
- The ability of wood products and service suppliers to offer their products through Internetbased stores, or through value-integrating market makers that assimilate wood-based value chains (Nyrud and Devine 2005).
- Fundamental institutional changes, which undermine the power of vertically structured organizations and foster the development of small, active and increasingly networked organizations spanning continents.
- Increased awareness about various forest-related issues, including deforestation, loss of

biodiversity, impacts of forest fires, marginalization of indigenous communities, etc. This has also helped to promote transparency and accountability, with information being increasingly accessible to public scrutiny.

Remote sensing, geographic information systems and global positioning systems

Advancements in remote sensing, geographical information systems and global positioning systems are collectively impacting forest management. The speed at which vast amounts of spatial and temporal data can be analysed and synthesized is revolutionizing forest management in a number of countries and this technology is expected to spread rapidly throughout the region. Improvements in the resolution of satellite imagery and the development of software to interpret images will contribute to real-time monitoring of deforestation, pests and diseases, fires, and other potentially devastating events, while also improving silviculture and management practices.

Low-cost devices for large-scale data storage, graphic terminal and digitizing and scanning devices and the integration of satellite and airborne sensors, GIS and global positioning systems are all providing forest managers with new levels of precision and understanding of the nature and condition of forest resources. Together with high speed processing and communication systems, data can be processed and transmitted directly throughout office networks and to remote locations. These technologies also enhance opportunities for evidence-based public consultation, verification of legality and third-party certification (Bird and Thiel 2007).

Nanotechnology

A number of countries in the Asia-Pacific region, and elsewhere, are undertaking research into nanotechnology, which has the potential to produce a wide array of new, more efficient products (Box 4.17). However, pace of development and wider application of nanotechnologies in the forest sector will be highly unpredictable, depending on scientific breakthroughs and then development of cost-effective technologies. In view of the sophistication required, development and wider adoption of nanotechnology forestry applications are more likely to be confined to only a few countries in the region, at least within the next decade.

Box 4.17 Nanotechnology

Nanotechnology – defined as the manipulation of materials measuring less than 100 nanometres (a nanometre is one-billionth of a metre) – could have considerable direct and indirect impacts on the forest sector by enhancing the efficient use of raw materials and energy. Nanotechnology has the potential to revolutionize all aspects of production and processing, creating new products with unique properties. Most leading wood product producing countries are working on nanotechnology applications.

The report *Nanotechnology for the forest products industry: vision and technology roadmap* envisages potential uses for nanotechnology that include:

- Developing intelligent wood- and paper-based products with an array of nano-sensors built in to measure forces, loads, moisture levels, temperature, pressure, chemical emissions, attack by wood decaying fungi, et cetera.
- Building functionality onto lignocellulosic surfaces at the nano-scale could open new opportunities for such things as pharmaceutical products, self-sterilizing surfaces, and electronic lignocellulosic devices.
- Use of nanodimensional building blocks will enable the assembly of functional materials and substrates with substantially higher strength properties, which will allow the production of lighter-weight products from less material and with less energy requirements.
- Significant improvements in surface properties and functionality will be possible, making existing products much more effective and enabling the development of many more new products.
- Nanotechnology can be used to improve processing of wood-based materials into a myriad of paper and wood products by improving water removal and eliminating rewetting; reducing energy usage in drying; and tagging fibers, flakes, and particles to allow customized property enhancement in processing.

Source: Atalla et al. (2005).

OVERVIEW OF DRIVERS AND CHANGES

Societies in the Asia-Pacific region are undergoing profound changes driven by the combined effects of several factors. The regional population is projected to reach about 4.2 billion people by 2020, an increase of about 600 million from 2005. Most growth will take place in countries where population densities are already very high and severe resource constraints are being faced. Factors such as urbanization and employment-related migration will bring about important changes, especially to people's values and perceptions across a broad range of spheres, including in regard to the nature of demands placed on forests and forestry. Less-populous, forest-rich countries will be affected, both directly and indirectly, by the pressures emanating from countries characterized by high populations, rapid economic growth and natural resource deficits.

The main economic drivers that will impact natural resource use, and in particular forestry, include: current levels of income, income growth rates, distribution of income and extent of poverty. Although the global economic crisis has slowed growth, the Asia-Pacific region has, nonetheless, been growing rapidly during the past decade; spearheaded by emerging economies such as China and India. Along with rapid growth, there have also been major structural changes in many national economies, involving significant reductions in the share of agriculture in income and employment. Most growth is based on the expansion of the manufacturing and services sectors. Rapid growth of national economies will significantly increase the demand for resources, especially food, fuel and fibre, exerting pressures on land and other natural resources, including forests, within and outside the region. Most countries are pursuing 'growth and trickle down' strategies to reduce poverty, which is assumed, will also help to improve the environment. However, achieving rapid economic growth will require substantial resources,

both renewables and non-renewables, which could accelerate the scramble for resources.

Political and institutional changes are another important set of drivers impacting the forest sector. Overall, the region is witnessing important changes in political systems and the institutions that support them. Although authoritarian regimes and flawed democratic processes persist, on the whole, important changes, including strong moves towards market-oriented systems, are leading to the development of more open societies and a pluralistic institutional environment. Greater involvement of the private sector, communities and civil society organizations is bringing about important changes in resource management. This has necessitated a redefining of the roles and responsibilities of public sector organizations that previously dominated the institutional landscape.

Concern about declines in ecosystem services is becoming a major change driver. There is growing awareness about negative impacts of environmental degradation, as well as increased willingness and capacity to bear the costs of protecting the environment. There are several instances of local and national environmental issues that have acted as catalysts for major changes in forest management, including outright logging bans in response to calamities such as floods and landslides. In addition to traditional concerns such as biodiversity loss, watershed degradation and desertification; climate change issues are expected to have significant impacts on the forest sector. The ongoing evolution of environmental policies will continue to affect forest management practices.

Changes in technologies – within and outside the forest sector – form an important driver of change. Rapid developments in information and communications technologies will continue to bring about major changes in all aspects of life, although the digital divide may still persist. Improved access to information will impact on political processes and institutions, with shifts in power away from nation states and large corporations, in favour of civil society organizations, local communities and individuals. Developments in cutting-edge technologies that enhance material and energy efficiency – especially biotechnology and nanotechnology – will also have profound impacts on forests and forestry.

However, the incidence of change will be extremely uneven and forestry in the region will continue to comprise a mosaic of contrasting contexts and situations, as indicated below:

- Notwithstanding the rapid pace of industrialization, the region will maintain a large agrarian society, primarily dependent on land and forests for livelihoods. With land remaining the foundation of livelihoods, conflicts are bound to emerge in the context of population growth and low levels of technology.
- Many countries and localities are witnessing the emergence of industrial societies, taking advantage of opportunities provided by globalization. Demands for food, fuel and fibre as 'feedstock' for rapidly industrializing countries and localities are surging, increasing pressures in countries (within the region, as well as outside) with relatively abundant resources and low population densities. This is particularly the case in developing country contexts. The shift in industrializing countries towards importing substantial components of their wood supplies should reduce pressures on domestic resources, enabling some countries to invest in afforestation and reforestation, to enhance and rebuild domestic resource bases.
- The Asia-Pacific region is also developing expanding knowledge-based, post-industrial societies, predominantly in the advanced industrialized countries, but also encompassing some middle income and emerging economies. Enhancing quality of life (including environmental quality) is a major thrust in such societies, with higher incomes based on knowledge-based activities enabling more attention to be paid to environmental issues.

The Asia-Pacific region clearly presents a range of highly diverse and complex situations. It has some

of the richest countries and also some of the poorest. Even within a given country, inequalities may persist and widen. With the largest number of world's poor and deprived people and a rapidly expanding middle class, disparities within the region will remain stark. Asymmetrical globalization will result in some of the world's most globalized economies, as well as some of the most closed economies. These differences will lead to a broad spectrum of forestry situations, discussed in Chapter 5.

5 SCENARIOS FOR THE ASIA-PACIFIC REGION

The change drivers described in the previous chapter will collectively influence society's demands for forest products and services, as well as how these demands are met. Diversity of conditions in various countries and the multiple feedback loops that link various drivers make it difficult to identify a single path for likely social and economic development. Indeed, the current mosaic of situations, which reflects a wide array of society-forest interaction, will likely evolve into an equally or more complex mosaic, very different from that which currently exists. This chapter identifies some probable scenarios and major uncertainties for larger economic and social changes and potential implications for the forest sector.

RATIONALE FOR DEFINING SCENARIOS

Changes in demographics and national economies, extra-sectoral policies and institutions, as well as environmental issues and developments in science and technology will all contribute to major changes in society. As a result demands for goods and services will be significantly altered as will capacities to provide them. Traditionally, econometric models have been used in forecasting demand and supply for different goods and services. However, such forecasts have important limitations:

- Projecting historical trends implicitly assumes that the underlying technical coefficients are valid during the time horizon for which forecasts are made. However, this may not be the case when social and economic developments result in fundamental changes.
- Several variables that impact on the future state of resources and levels of production and consumption are extremely difficult to quantify. For example, it is hard to provide a measurable indicator of policy and institutional changes that can be used to assess how these could affect the condition of forests and their effects on forestry.
- More importantly, there are considerable uncertainties in statistically evaluating some critical parameters. For example, it is difficult to reliably predict future changes in political developments, which often take place in an erratic and unpredictable manner. With long time horizons, uncertainties tend to multiply.

Scenario analysis (**Box 5.1**) helps to overcome some of the inherent difficulties encountered in conventional forecasting approaches, especially addressing the various uncertainties. The approach to scenario analysis in this report consists of:

- Broad grouping or clustering of the countries based on common characteristics. For example, the state and pace of economic development.
- Identification of key uncertainties relating to selected drivers of change.
- Description of how societies in different clusters of countries may evolve in the context of the impacts of uncertain drivers.
- Identification of ways in which forests and forestry may respond to change, specifically focusing on the state of forest resources and flows of various goods and services.

Box 5.1 Scenario analysis

Scenarios are plausible, challenging and relevant stories about how the future might unfold, which can be told in both words and numbers. Scenarios are not forecasts, projections or predictions. They are about envisioning future pathways and accounting for critical uncertainties. They are stories about the future. They are built on a thorough analysis of social, political, economic, environmental and technological factors that could shape the future environment of a given business, region or policy area. They explore three or four diverse eventualities of how the world might look if the most uncertain and important drivers unfold in different ways.

Sources: MEA (2005); World Economic Forum (2009).

THE ASIA-PACIFIC REGION: DIFFERING INITIAL CONDITIONS

The way in which the future for forests unfolds will depend on initial conditions, especially the state of national economies and the overall resource situation. Taking into account the broad state of economic development, countries can be grouped into four clusters (**Table 5.1**). As small island countries face a number of unique economic and environmental challenges, they are included as a distinct cluster.

Subregion	Low-income economies	Middle-income and emerging economies	Developed economies	Small island countries
East Asia	DPRK	China, Mongolia	Japan, ROK	
South Asia	Bangladesh, Bhutan, Nepal, Pakistan	India, Sri Lanka		Maldives
Southeast Asia	Cambodia, Lao PDR, Myanmar, Timor-Leste	Indonesia, Malaysia, Philippines, Thailand, Viet Nam	Brunei Darussalam, Singapore	
Oceania	PNG, Solomon Islands	Fiji, Vanuatu	Australia, New Zealand	Kiribati, Samoa, Tonga, Tuvalu

Table 5.1. Asia-Pacific country clusters

Social and economic change occurs across a continuum, hence most country groupings that are based on only one or two characteristics tend to be arbitrary and with considerable overlaps among groups. However, the thrust of this analysis is to provide a broad framework that takes on board the enormous diversity that is characteristic of the Asia-Pacific region. Some of the important country characteristics that will have a bearing on their current and future situations are outlined below.

Low-income countries

Low-income countries are the least economically developed countries in the region and have the following important characteristics:

• Low incomes – predominantly below US\$5 000 at purchasing power parity – limit the demand for many products and also imply limited ability to mobilize resources for investments.

- Although the industrial and services sectors in some low-income countries are growing rapidly, most of the countries are agrarian, with the agriculture sector accounting for a major share of employment and income. High dependence on land and other natural resources increases the potential for resource-use conflicts, especially in the more densely populated countries.
- In view of low incomes, the ability of most governments to invest in education and health care has been limited and most countries rank low in global human development indices as a consequence. Development of physical and human capital (especially infrastructure, including communications, transportation and education) remains neglected, partly on account of resource constraints and partly on account of weak policy and institutional environments.
- These weaknesses are also reflected in the state of science and technology, which remains undeveloped in many low-income economies. More importantly, in many cases even capacity to apply known technologies is very limited.
- Although the formal sector is expanding, in many countries and segments of economies, the informal sector tends to dominate. This is particularly the case in the forest sector. This dominance by the informal sector limits the scope for formal interventions.

Broadly, low-income economies can be divided into two subgroups, depending on the relative abundance of natural resources:

- 1) resource-rich, low-income countries
- 2) resource-poor, low-income countries.

Resource-rich countries

Several low-income countries in the region (for example, Lao PDR, Myanmar and PNG) have low population densities and very high levels of per capita natural resource availability, including land, water, forests and minerals. However, these resources are relatively less developed than many other countries for several reasons including limited domestic markets, tenure issues, low investment levels and technological constraints. Tapping natural resources and reinvesting in human and physical capital, thus building the base for future development, is an important option for many of these countries. However, the success of such an economic strategy depends on the robustness of policy and institutional frameworks. Poorly developed political and institutional environments lead to inequitable and unsustainable exploitation of resources, and seldom contribute positively to overall social and economic development. Resource utilization needs to be coupled with strong policies and institutional capacities to enforce regulatory requirements, ensure benefits are distributed equitably and make certain that development targets are met.

Resource-poor countries

The group of low-income, resource-poor countries consists of more densely populated nations with low per capita natural resource availability (for example, Bangladesh, Pakistan and DPRK). In such countries, natural resources have usually been exploited intensively with minimal reinvestment in maintaining or improving the resource base. Resource degradation remains a major problem in most of these countries. Limited resources and significant inequities in the distribution of wealth and income imply high levels of poverty. Most countries in this situation are prone to social conflicts with the potential for emergence of religious and political extremism, as is already happening in some locations. Governments in some of these countries are highly dependent on external assistance. Work-related migration and remittances have helped to reduce the pressure on resources in some instances.

Middle-income and emerging economies

Middle-income and emerging economies constitute the largest grouping of countries, accounting for four-fifths of the region's population. Some important features of these countries include:

- Relatively high per capita incomes, well above US\$5 000 at purchasing power parity with most countries registering high GDP growth rates, notwithstanding some decline during the 1997/1998 Asian economic crisis and the recent worldwide downturn.
- Rapid growth in incomes that has led to a significant reduction in the proportion of those living below the poverty line, although the absolute number remains high.
- A rapidly expanding middle class, generating substantial demand for a wide range of products, and growing interest and investment in environmental rehabilitation.
- Maintenance of high growth rates as a critical strategy for reducing poverty. However, policies of 'inclusive growth' espoused by a number of these countries, largely remain focused on 'growth and trickle down' or 'growth and redistribution'; the latter depending on the effectiveness of public policies and institutions.
- In general, inequality is on the increase in most countries because of high growth rates combined with unequal access to resources and opportunities.

Although population growth rates are declining, the middle-income, emerging countries are some of the region's most populous and account for over 80 percent of the Asia-Pacific population. Some of these countries also have very high population densities with low per capita availability of natural resources – including land, water and forests – making them highly dependent on imported resources. However, most middle-income countries have been able to take advantage of globalization, especially improving their access to markets, including importing raw materials and exporting processed products. Rapid growth in industrial and services sectors has reduced the agriculture sector's share in national incomes and employment in most of these countries.

Rapid growth of economies in this cluster implies surging demand for energy, raw materials, food and water to meet increasing domestic consumption and to generate revenues from exports of manufactured goods. Such demand increase will be particularly challenging for countries with high population densities and limited resources and will likely increase import dependencies. Increasing competition for energy and raw materials, imported from other countries, will help to reshape global and regional geopolitics. Rapid economic growth is also raising concern about increased carbon emissions and their impacts on climate change. While per capita emissions in emerging economies remain relatively low, the large size of the cluster's total population implies a significant increase in emissions. A subsidiary problem is that industrial production in developed countries is increasingly shifting to less carbon-efficient (but more cost-efficient) production in emerging economies.

A number of countries have strengthened human and physical capital resources over recent years. Higher incomes have enhanced investments in science and technology leading to stronger and more sophisticated capacities. Nonetheless, dichotomous development is a major challenge facing many middle-income and emerging economies, especially on account of widening gaps between rural and urban economies and between rich and poor. Unbalanced development is increasing disparities between different regions in many countries. Failure to address these disparities will impair social and economic development.

Developed economies

Countries ranked as developed economies in the region are Australia, Brunei Darussalam, Japan, New Zealand, ROK and Singapore. The main characteristics of developed economies in the Asia-Pacific region include:

- High levels of income (over US\$15 000 per capita at purchasing power parity) and, although economic growth rates may be low, absolute increases in income remain high. High incomes also imply increased ability (and usually willingness) to pay for ecosystem services. Consequently environmental protection is a major concern for most countries in this cluster.
- Highly diversified economies with well-developed industrial and services sectors. The
 agriculture sector's share in income and employment is very low in most countries.
 However, for several low population density countries most notably Australia and New
 Zealand agriculture and allied sectors, including forestry, play important roles in national
 economies.
- Low growth or even declining populations (in Japan). The ageing of developed country populations implies changes in patterns of consumption.
- Well-developed human and physical capital and strong science and technology capacities. These factors contribute significantly to transformations towards post-industrial, knowledge economies.
- Relatively well-developed policy and institutional frameworks. On the whole, democratic institutions are well developed and private sector and civil society organizations play important roles in most spheres of development.

In view of the significant reduction in dependence on land, the pressures on forests in developed economies are considerably lower than in most other countries. In general, forest loss in developed countries is not a major problem, although there are exceptions – as in the case of Australia, where severe droughts have seen the loss of a huge forest area (though proportionately to the national forest estate, relatively small) during the last decade. In general policy and institutional frameworks are robust and well enforced, so that forestry is effectively regulated and managed. Predominance of private ownership implies potential changes in ownership and land uses as owners respond to changing market opportunities. In some cases, the costs of logging in developed countries are sufficiently high to make most operations uneconomic – thereby transferring additional pressures to developing countries. Concerns about the environment are encouraging significant policy changes, especially as regards energy use, with a greater thrust on renewables. With better developed science and technology capacities, there is increasing emphasis on transforming developed economies into 'green economies' and this is likely to increase consumption of renewable resources – internally and externally.

Small island countries

Small island countries are unique in view of their extreme economic and ecological vulnerability. Some of the key characteristics of small island countries are:

- Although total populations remain low, growth rates and population densities are often high. Work-related migration to neighbouring developed countries is high and remittances form an important source of income for many island countries (for example, remittances account for about one-fourth of Samoa's GDP; Table 4.3).
- · The small size of many island economies and their dependence on a very few sectors (for

example, fisheries and tourism) leaves them highly vulnerable to exogenous changes. Even a small reduction in income from the main sectors of the economy may have devastating impacts.

- Distinct locational disadvantages in economic terms, due to their distance from large markets and, often, from well-developed trade routes. With small domestic markets and significant transportation costs, cost competitiveness is a major barrier to exports of most forestry products.
- Overall resource constraints and weaknesses in policies and institutions, which leave island countries highly dependent on external support. In the case of some countries, a significant share of the government's budget comes from overseas development assistance.
- Relatively unskilled human resources. In view of the limited opportunities, many qualified people opt to migrate to more developed countries.
- Potential exposure to climate change-induced impacts, especially rise in sea level. Adaptation to climate change will be a major thrust of development policy in most small island countries.

Countries in these various economic clusters interact with others within and outside the clusters, as well as with countries outside the region, including through trade, investments, travel and migration. Such interaction also impacts through shared resources such as atmosphere – for example, through emissions of greenhouse gases. Across many spheres, countries may compete or cooperate. For example, rapid industrialization in some countries may undermine or slow the pace of industrialization in others. Conversely, some countries may invest in industrialization in others.

FOUNDATIONS FOR SCENARIOS

Scenarios are descriptions of possible pathways of development. Although the Asia-Pacific situation is extremely varied, with an enormous diversity of situations and countries, it is possible to identify broad scenarios taking into account the main uncertainties faced by most countries – particularly in the spheres of:

- 1) income growth; and
- 2) ecological and social sustainability.

Income growth

Although there is considerable variation, the Asia-Pacific region's economies have generally been growing rapidly, taking advantage of favourable internal and external factors. High savings and investment rates and well-developed policies and institutions (which have significantly increased foreign direct investments [FDI] and trade) have been important internal factors contributing to high growth rates in many countries. Increasing openness to the global economy – and consequent access to markets, raw materials, investments and technology – is another important factor that has contributed to rapid growth in many Asian economies. With the exception of a few countries, especially some of the developed countries and among low-income economies, relatively high growth rates have been registered during the last two decades.

However, the 1997/1998 Asian economic crisis and the recent global economic downturn have exposed vulnerabilities in many Asia-Pacific economies. While the earlier recession had its origins in domestic financial markets, the current crisis was primarily precipitated externally, but has led to a reduction in inflows of investments and in demand for exports. Asian economies that have a

high degree of dependence on exports to the United States and Europe have been particularly affected. Interventions by governments, especially through economic stimulus packages aimed at boosting domestic demand, are having some impact with signs of improvement in early 2010. However, considerable uncertainty remains about future income growth in Asia-Pacific countries, which are largely dependent on a sustained global economic recovery.

Ecological and social sustainability

The ecological and social sustainability of development is a major concern for most Asia-Pacific countries. Several countries are already facing severe resource constraints – especially with respect to arable land, water and energy – and current rates of economic growth will require accelerated exploitation of such resources, with potential significant undermining of ecological sustainability. Dependence on imports – especially food, raw materials and energy – is increasing in many countries. Other countries – especially those where access to outside resources is limited by political or economic constraints – are overexploiting domestic resources, thereby compromising long-term sustainability (**Box 5.2**).

Box 5.2 Decline of industrial forestry in Samoa

"The combined effect of commercial exploitation for wood processing, tropical cyclones and agrodeforestation has left Samoa with only a few years of merchantable forests remaining. By all estimates, Samoa's merchantable forest resource will run out in a few years, at most five years. The existing plantation resource will not reach harvestable diameters until around 2021 and a gap in sawlog supply will mean the demise of the existing sawmills. All of Samoa's sawntimber requirements will then depend on imports. Matching the steady depletion of the forest resources, inevitably, is the decline in the sawmilling industry. Of the four sawmills operating in 2000, only two remained by the end of 2004, but in significantly reduced sizes."

Source: Sesega (2009).

Climate change will increase social and ecological vulnerability – at least for some people. Natural disasters may become more frequent as weather patterns change and rising population densities force people to live in more marginal areas. In forestry, increased roading and logging in steep sloping areas combined with more extreme weather events may precipitate landslides and mudflows while flooding may also become a more frequent occurrence. Erratic monsoon patterns and declining water supplies are already impacting agriculture in some countries, with potentially disastrous impacts on some economies and livelihoods if agricultural production is further compromised. On the other hand, some localities are likely to receive higher rainfall and increase crop yields. Climate change mitigation and adaptation will require significant departures from the business-as-usual approach to growth.

High levels of poverty, growing inequities in the distribution of income, and weak political and institutional frameworks leading to governance deficiencies, could enhance social vulnerabilities. Conflicts are likely to intensify in the context of poor governance, especially in resource-scarce situations. This is already evident in several countries in the form of religious and political extremist movements – or in strong 'inter-class' rivalries. Collective action could be undermined by divisive politics, exacerbating conflicts and undermining social and economic development. Robust policies and institutions with capacity to effectively deal with emerging challenges will be critical to sustained social and economic development.

POSSIBLE SCENARIOS

Taking into account changes in national incomes and in overall social and economic sustainability, it is possible to identify several broad development paths, as illustrated in **Figure 5.1**. Every country will chart its own path depending on initial conditions, the choices made and differing challenges and opportunities. While three broad paths that potentially capture most of what is likely to occur are identified in the following analysis, a wide array of possibilities exist – as intermediate and hybrid pathways that encompass features of two or three of the identified scenarios, as well as more extreme pathways that fall outside the likely bounds drawn below. Some of these alternative scenarios are elaborated in APFSOS country and subregional reports.



Figure 5.1. Potential development paths

Three broad paths

This analysis focuses on three distinct scenarios. Two scenarios are driven by analysis of developments based on either: (i) high economic growth and recovery; or (ii) low economic growth and recovery. A more eclectic scenario focuses on: (iii) social and economic stability and development of 'green economies'.

(i) High economic growth and recovery: the 'boom' scenario: Several low- and middleincome countries in the Asia-Pacific region are on a high economic growth path, but with social and ecological sustainability being accorded low priority, at least in the initial stages. High economic growth rates are being targeted as a prerequisite to poverty alleviation through trickle-down processes. Environmental issues are accorded lower priority using the argument that these can be addressed later, when incomes rise, thus increasing the willingness and ability to tackle environmental issues. A rapid recovery from the 2008/2009 global recession and a buoyant global economy will lead many countries towards this scenario.

- (ii) Low economic growth and stagnation: the 'bust' scenario: A number of resource-poor countries are on a low income and low growth path owing to various constraints. While economic growth remains low, high population densities and low levels of human development promote unsustainable use of natural resources land, water, forests, among others enhancing social and ecological vulnerabilities. In some cases, resources are being exploited by outsiders, or by small elite groups, with most local people receiving few benefits including only marginal investments in infrastructure, education and health. Many rapidly growing economies, especially those with limited domestic resources, may also be vulnerable to shifts towards the low growth and stagnation scenario. Such shifts could stem from social conflicts, especially those driven by intense competition for various resources against a background of policy and institutional deficiencies. More generally, persistence of the 2008/2009 economic downturn into the next decade will draw many countries into pathways approximating this scenario.
- (iii) Social and ecological stability: the 'green economy' scenario: In contrast to the economic growth pathways, this is primarily an ideal development vision, requiring the pursuit of an inclusive approach that addresses social and ecological problems, paving the way for the development of green economies. Considerable thrust is given to human resource development and improving the efficiency of energy and raw material use. Countries currently on the high growth path, as well as countries in the low growth and stagnation scenario, could potentially move towards the green economy scenario provided significant changes are made in policy and institutional environments, thereby enhancing social and ecological stability.

The key characteristics of these scenarios are outlined below.

The high growth 'boom' scenario

Despite the 1997/1998 crisis, the stagnation of the Japanese economy since 1990 and the recent downturn in the context of the global economic crisis, there is considerable optimism about continued growth in the Asia-Pacific region, largely led by the rapid economic growth in emerging economies. Under the high growth 'boom' scenario, the 2008/2009 downturn will be a short-lived event with global recovery occurring rapidly and the Asia-Pacific region rapidly returning to a pathway with economic growth at about 5 to 6 percent per annum. The region will continue to be led by very rapid growth in emerging economies, especially China and India. At the time of publication (May 2010) there is already some indication of an economic upswing suggesting that some countries may soon be back to their pre-crisis growth paths. Economic stimulus packages implemented in several countries are resulting in increases in domestic consumption, helping to compensate for falls in export demand.

The 'boom' scenario envisages much of the growth in emerging economies will continue to be due to expansion of the manufacturing and services sectors, catering to both domestic and external demand. Rapid growth in manufacturing and services will continue to reduce dependence on agriculture and allied activities as a major source of income and employment. Agriculture also becomes less remunerative in view of increasing costs of production and relatively low prices,

which are also kept down through increased imports and intensified practices. Meanwhile, rapid growth creates enormous demand for raw materials and energy providing lucrative markets for some natural resource-rich countries in the region. Increased public and private sector investments especially in emerging economies help to tap natural resources, often sourced from resource-rich exporting countries – wood, energy, minerals, arable land, etc. – generating substantial income. Energy use increases rapidly in line with GDP growth, although some reduction in energy input per unit of GDP might be anticipated. A shift from traditional woodfuels to more convenient fossil fuels will be expected, along with efforts to develop alternative energy sources, including bioenergy.

A high growth scenario would foresee concerns about economic protectionism in the context of the 2008/2009 global economic crisis addressed, through the conclusion of the Doha trade talks; paving the way for increased investments and global trade. The pace of globalization would accelerate, increasing FDI, trade, travel and access to technology. Growth in transport and information and communication technologies would improve contact and interaction among people and countries. Establishment of free trade zones and economic corridors would increase production and trade. Economic growth would be largely driven by the private sector, and in particular for forestry, by large transnational corporations. Government approaches are envisaged to increasingly focus on facilitating private sector involvement through appropriate policies and legislation.

Under the 'boom' scenario, increasing incomes create a surge in the size of the middle class, especially in emerging economies, but also in some low-income economies. This increases demand for a wide array of products, including industrial forest products, as well as ecosystem services. As incomes increase, there is greater concern over the quality of the environment and hence greater willingness in society to enhance provision of ecosystem services. However, in many countries 'growth and trickle down' remains the basic strategy for addressing poverty and environmental degradation; with the speed and volume of trickle-down effects depending on political and institutional structures. The pursuit of 'growth-first' approaches might well fail to take adequate account of growing social and environmental problems. Sustainability may be compromised, marginalized people and localities may precipitate civil unrest and irreversible losses in biodiversity and natural habitats may occur.

Other less positive impacts of the 'boom' scenario might also appear. The scenario might encompass failures in efforts to improve corporate social responsibility where short-term profitability remains the basic tenet of private sector operations. Under such circumstances, non-compliance with environmental and social regulations could be expected to remain widespread, especially where institutional structures are weak and incapable of adequately enforcing policies and regulations. Growth-focused policies and legislation in some emerging and low-income countries are likely to continue to assign low priority to social and environmental issues. Consequently, some high profile international initiatives may fail to have significant impacts. Notwithstanding wider concerns about climate change, conflicting priorities might be envisaged to lead to a highly watered down post-Kyoto agreement under which there is very little willingness to curtail growth and consumption to reduce carbon emissions.

The impacts of the high growth scenario will differ considerably among the clusters of countries as indicated in **Table 5.2**.

Country cluster	Overall impacts
Low-income economies with limited natural resources	 In view of limited natural and human resources, most countries in this group are unable to take advantage of high growth rates in emerging/middle-income countries. A large segment of the economy – mainly focused on subsistence consumption – remains isolated from the changes taking place. Demand for labour-intensive products and services from the middle-income/ emerging/developed economies increases employment and incomes, especially in urban areas. Increasing population pressures and low levels of technology result in intense pressure on natural resources, especially land and forests. Work-related migration and related remittances help to moderate pressures on natural resources.
Low-income natural resource- rich economies	 Intense exploitation of resources – land, forests, minerals, etc. – primarily to meet growing demand from middle-income/emerging/ developed economies. Long-term benefits from resource exploitation largely depend on the effectiveness of policy and institutional frameworks. In the context of weak governance and corruption, benefits from resource exploitation will be inequitable, environmentally unsustainable and will fail to result in long-term social and economic development.
Middle-income/ emerging economies	 Rapid growth of the manufacturing and services sectors reduces pressure on land and forests. Some reduction in poverty, which could reduce pressures on natural resources, including forests. A swelling middle class with very different values, perceptions and consumption needs compared to traditional frameworks. Demands for ecosystem services increase significantly. Investments in science and technology improve efficiency and productivity.
Developed economies	 Consumption-driven growth provides markets for a wide array of products from abroad. Most consumption comprises manufactured products and services. Increases in demand from middle-income/emerging economies enable growth of transnational corporations (especially those based in developed economies). Demand for ecosystem services continues to grow as does willingness to pay. Increased ability to provide development assistance/FDI to low-income/middle-income/emerging economies.
Small island countries	 Growth in tourism and remittances strengthens small island economies. Rapid expansion of tourism infrastructure increases ecological vulnerability. Global warming and its associated impacts.

Table 5.2. High growth 'boom' scenario: country implications

The low growth and stagnation 'bust' scenario

The low growth and stagnation 'bust' scenario envisages a future in which economic growth stalls for a protracted period and the Asia-Pacific region takes a very long time to recover from the current economic downturn. Although there are presently signs of some recovery from the current economic crisis, most countries remain vulnerable to recession if the global economic situation fails to continue its improvement. Even if a rapid global recovery takes place, domestic social and environmental problems could push some developing country economies towards low growth and stagnation pathways.

The basic tenet of the 'bust' scenario is that despite all economic interventions, global economic recovery remains anaemic and recessionary conditions prevail for a significant part of the forthcoming decade. Consumption-driven economies drastically curtail expenditure, especially in the context of high unemployment and a credit squeeze. Construction and related activities stagnate at low levels (**Box 5.3**). Asia-Pacific economies that have thrived on exporting to North America and Europe experience significant contractions as these markets remain depressed. The global nature of the economic crisis means that export-dependent countries face severe competition in finding alternative markets. Efforts to bolster domestic consumption through economic stimulus in some countries have only short-term impacts.

Box 5.3

Recession in 2008/09: Impacts on housing construction in New Zealand

In New Zealand, forestry and construction statistics showed significant declines for 2008. The volume of New Zealand's sawntimber exports in the year to September 2008 declined by 14.7 percent on the previous September year. Similar declines were recorded for volumes of log exports (3.6 percent), wood-based panels (8.2 percent) and total value of forestry exports (6.6 percent). However, perhaps the most telling decline was in the monthly number of new dwelling authorizations issued.





In January 2009, just 812 new dwelling units were authorized, the lowest monthly total since records began in 1965. This was a 73 percent decline from the highest recorded level of authorizations in March 2005. Notably, however, there has been significant rebound from this low point in subsequent months. Source: FAO (2010c).

The envisaged protracted economic downturn also affects inflows of external resources. The 2008/2009 crisis in financial markets has already led to a contraction in FDI, which remains subdued in the context of tighter financial regulations and reduced demand for goods and services. A low growth 'bust' scenario would foresee increasing unemployment forcing many migrant workers to return to their home countries. While this might create a short-term spurt in foreign exchange flows as savings are repatriated, remittances would decline significantly in subsequent years.

More subtle impacts of persistent economic stagnation might also be predicted. A protracted global recession might reinforce the voice of protectionism, putting globalization into reverse.

Although almost all countries are in principle committed to avoidance, protectionism in more subtle ways could emerge. This would have negative impacts on trade-dependent Asia-Pacific economies, significantly reducing their growth rates.

Stagnation and deceleration of growth would be likely to exacerbate ecological and social problems. While reductions in global demand for natural resources might have some positive impacts by reducing the pace of exploitation, several countries dependent on export of industrial products and services could experience severe impacts. As employment in manufacturing and services shrinks, pressure on land and other natural resources would increase, leading to unsustainable management. In some countries, people who have moved to urban areas for employment may be forced back to their rural homelands and into subsistence or semi-subsistence livelihoods, thereby aggravating land-use pressures. This would particularly be the case in countries where degradation of land and forests is already a major problem and population densities are high. With population increases and potential adverse impacts of climate change, the pace of degradation could be expected to accelerate, reducing productivity and increasing poverty and ecological stresses including loss of biodiversity and inadequacy of water supplies.

The 'bust' scenario would foresee key institutions including governments unable to stem the decline, especially in view of diminished government budget resources. Social conflicts could become pervasive in the context of the emergence of extremist political and religious movements taking advantage of widespread disillusionment.

The impacts of the downturn will to some extent depend on the effectiveness of countermeasures adopted by governments. While some countries are able to implement economic stimulus packages and could accelerate domestic demand and growth, this option is not available to many – especially less developed countries – whose domestic economic situations will remain unfavourable. Access to international assistance also remains problematic in the context of an overall decline in most developed economies, which have been the traditional source of development assistance.

The low growth and stagnation scenario will impact country groups in different ways as outlined below (**Table 5.3**).

Country cluster	Overall impacts
Low-income economies with limited natural resources	 Demand for labour-intensive products and services from the middle-income/ emerging/developed economies declines significantly affecting employment and income.
	 A large segment of the economy – mainly focused on subsistence consumption – remains isolated from the economic downturn.
	 Increasing populations and low levels of technology imply intense pressure on natural resources, especially land and forests.
	 Returning migrant workers and reduced inflow of remittances affect incomes and increase unemployment, with repercussions on land use.

Table 5.3. Implications of the low growth and stagnation scenario

Low-income natural resource- rich economies	 Reduced demand for products and services by middle-income/emerging/ developed economies and consequent scaling down of exploitation of natural resources.
	 Lower incomes affecting the ability of society to invest in human and physical capital.
	 Land-use changes, especially on account of the growth of subsistence agriculture.
Middle-income/ emerging economies	 Drastic reduction in the growth of manufacturing and services sectors, increasing the pressure on land and forests.
	 Poverty reduction through trickle-down effects ceases; numbers in the middle classes decline. This significantly affects the nature of demand for goods and services and ecosystem services become less of a priority.
	 Reduced prices for fossil fuels affect investments in alternative energy sources.
	 Investments in science and technology decline, affecting long-term prospects for improving production and processing.
Developed economies	 Significant reductions in consumption affecting demand for products and services.
	Rapid increases in unemployment.
	Reduced willingness to pay for ecosystem services.
	Emergence of protectionist tendencies.
	 Reduced ability to provide development assistance/FDI to the low-income/ middle-income/emerging economies.
Small island countries	 Declining tourism and remittances and increased economic vulnerability of small island economies

Social and ecological stability: the 'green economy' scenario

The economic downturn has helped to promote a rethinking of the development paths currently being pursued. Awareness of climate change and other environmental problems such as loss of biodiversity, land degradation and desertification, and declining water supplies are supporting articulation of ideas for development paths that are more sustainable, both ecologically and socially. There is increasing realization that the economic downturn is not merely a problem of lax regulation in financial markets, but also stems from failures to understand the ecological limits to current growth-focused and consumption-driven development. Efforts at various levels, often pioneered by local communities and civil society organizations, are providing 'green economy' models that are more focused on social and environmental values. A plethora of these efforts could coalesce into momentum for a major shift onto more sustainable development paths, as indicated below:

A 'green economy' scenario unfolding at a regional level would entail a major shift in the policy directions, attitudes and values that currently prevail throughout the region. Thus, to a large extent it provides an alternative target, rather than one of the more probable pathways to 2020. Under a 'green economy' scenario countries would embark on major policy and institutional reforms to provide stable social and political environments, providing equal opportunities and removing various inequities. 'Level playing fields' and transparent administration would provide the greatest opportunities for all citizens. Well-designed decentralization and devolution policies would enhance local community involvement in management of resources. Environment and energy policies and regulations – coupled with increased investments in renewable energy technologies

– would make solar, wind and biomass energy competitive with fossil fuels, thereby encouraging substantial energy switching. Wood and forest biomass would become important sources of energy as use efficiency improves (including through small-scale gasification plants) and second generation cellulosic biofuel production. Recycling technologies would significantly reduce raw material requirements for manufacturing. Energy-intensive products would be phased out and there would be much greater emphasis on using natural materials such as wood. This trend would be supported by adherence to, for example, green building standards. Considering the global nature of the challenges, instead of using technologies to maintain and improve competitiveness, countries would adopt open policies to share available technologies.

A 'green economy' scenario would envisage efforts at various levels, especially at the community level, to improve land and water management, improve productivity and conserve biological diversity. Water-scarce countries and regions would invest substantially in water conservation and rainwater harvesting. Mixed cropping systems, including agroforestry, would help to diversify production and increase stability in the context of potential climate change impacts.

Although the most recent negotiations (COP 15) did not produce any legally binding climate change agreement, a 'green economy' scenario would anticipate that future negotiations will lead to well-defined policies and action plans at international and national levels to reduce greenhouse gas emissions. Rather than pursuing low-cost, less effective options, countries would agree to significantly reduce emissions particularly focusing on the sectors and industries responsible for the largest emissions. At present, climate change and incontrovertible evidence – and acceptance – of a need for drastic change in current economic systems, seems the most likely driver that would push the Asia-Pacific region, along with the rest of the world, onto a 'green economy' pathway.

There would be some negative impacts associated with a shift to 'green economy' scenarios. For many industries, the costs of production would rise and force up overall costs of goods and services to consumers. This could be expected to have most severe impacts on the poor. There would be undoubted wealth redistribution impacts – among individuals and probably among countries – with more wealthy countries, with access to better technologies, likely winners. A 'green economy' scenario would anticipate the rise of numerous new green industries, which would provide some economic stimulus; however, the more regulated industrial environment that would surely prevail under such a scenario would almost certainly have negative impacts on global productivity and overall welfare. Consequently, there is significant reluctance by individual countries to move rapidly onto 'green economy' pathways, because such pathways will likely compromise at least short-term industrial competitiveness. In the absence of a catastrophic driver, incremental progress, with countries moving in a gradual and harmonized fashion towards greener pathways, seems the most likely outcome.

There are already some efforts to pursue green pathways especially in the context of the current economic crisis. A number of Asia-Pacific economies are already investing substantial resources in renewable technologies and improving material-use efficiency to move onto low-carbon growth paths (**Box 5.4**).

Box 5.4 'Green economy' initiatives in the Asia-Pacific region

- Several Asia-Pacific countries are making efforts to develop as green economies, giving particular attention to developing renewable energy. China, Japan and ROK have already initiated multibillion dollar investment programmes for clean energy including smart grids. A number of countries are in the process of developing emission regulations, including carbon markets through regional, federal and voluntary initiatives. Rapidly mounting concerns over global climate change, volatile fossil fuel prices and the recent economic crisis have been the main factors encouraging the pursuit of green paths. With a total installed capacity of 11-12.5 GW in 2008, China has become the regional leader in wind power. China has also become the world's largest photovoltaic (PV) manufacturer, with 95 percent of its production destined for the export market. In 2008, China added around 800 MW of biomass power-generating capacity, bringing the total installed capacity for agriculture waste-fired power plants to 2.88 GW.
- In India, the largest portion of new energy investment is currently in the wind sector, which grew 17 percent to US\$2.6 billion in 2008. A supportive policy environment stimulated growth in solar investments; from US\$18 million in 2007 to US\$347 million in 2008. The National Solar Mission envisages a target of 20 GW of solar generation capacity by 2020. Small-scale hydropower is another thrust area; small-scale hydropower investment grew nearly four-fold, to US\$543 million in 2008.
- Japan is also increasing investment in renewable energy. At the end of 2008, the country launched a US\$9 billion subsidy package for solar roofs, granting US\$785/kW for rooftop PV installation. Geothermal energy is also receiving increased attention and in early 2009, plans for a 60 MW geothermal plant were announced.
- ROK used the economic crisis to devise one the world's 'greenest' stimulus packages, one intended to stimulate job creation through green growth. Eighty percent of the initial overall US\$38 billion was dedicated to environmental measures. Of this, US\$7.7 billion is earmarked for clean energy, with improvements in efficiency as the main thrust. In mid-2009, an additional US\$85 billion was provided to encourage the growth of green industries and technologies over the next five years (Mee-young 2009).
- Australia has established a US\$436 million Renewable Energy Fund to accelerate development of renewable energy with particular focus on geothermal and wind energy. By 2030, geothermal energy is expected to provide about 7 percent of the country's baseload power, while wind energy will account for the 2020 target of 20 percent renewable energy.
- Other Asian countries, including the Philippines, Thailand and Malaysia, are taking steps to green their economies. In late 2008, the Philippines Government signed a new Renewable Energy Law, offering specific incentives (mainly tax breaks) for renewable energy generation. Thailand and Malaysia have discussed the introduction of renewable energy legislation. Some countries are also planning biofuel-blending mandates, similar to those introduced by the Philippines in 2007, and subsequently by Thailand.
- In the Pacific, Tuvalu has committed to becoming the world's first country to obtain 100 percent of its electricity from renewable sources by 2020. It is estimated that the programme will cost US\$20 million and will be based on solar and wind power.
- The drivers that have stimulated investment in the sustainable energy sector and in promoting more green economies throughout recent years are still in motion, including concern over global climate change, energy insecurity, and fossil fuel depletion as well as the advent of new technologies. Additionally, there is significant demand for clean energy based on mandates such as feed-in tariffs, renewable portfolio standards, renewable fuel standards, building codes and efficiency regulations. Clean energy also offers strong economic returns in some markets, particularly green jobs, even during periods of lower energy prices.

Source: UNEP SEFI and New Energy Finance (2009)

Depending on initial social, economic and environmental conditions, priorities and outcomes may vary among countries in each cluster and in different clusters. Particular areas where countries will apply emphasis to green efforts are listed below (**Table 5.4**).

Country clusters	Areas for emphasis
Low-income economies with limited natural resources	 Increased emphasis on resource conservation and efficiency-enhancing alternatives with particular focus on water and soil conservation. Rehabilitation of degraded lands. Simple and affordable technologies for improving efficiency of energy use. Improvement of policy and institutional environment to strengthen governance. Thrust on creation of green jobs to improve the natural resource asset base.
Low-income natural resource- rich economies	 Improved land-use planning to ensure the sustainability of resource use. Wider application of sustainable forest management including reduced impact logging, certification, etc. Resource-use governance improved to enhance equity and sustainability.
Middle-income/ emerging economies	 Increased focus on improvement in efficiency of energy and resource use. Thrust on recycling. Substantial increase in investments in green technologies, especially renewable energy. Stabilization and reduction in per capita carbon emissions.
Developed economies	 Increased investments in green technologies, including renewable energy sources and a significant reduction in the use of fossil fuels. Significant reduction in per capita carbon emissions. Greater interest in paying for ecosystem services produced in developing countries.
Small island countries	 Development of economies based on recycling and renewable energy. Pilot exemplars of green economy. Shift to green tourism ensuring long-term sustainability. Climate change adaptation.

Table 5.4 'Green economy' scenario: areas for emphasis

THE LIKELY SITUATION

While these three scenarios provide a picture of the possible, but divergent, paths of development, the enormous social, economic, political and institutional diversity in the region implies that what actually emerges will most likely be a mix of the three scenarios, depending on the policies pursued at the local, national and international levels. The overall situation in the region till 2020 could be:

- Most middle-income and emerging economies are likely to pursue the high growth scenario. Political and institutional conditions will encourage adoption of this path, except in the context of catastrophic problems (including a prolonged global recession or climate change-related events). However, some efforts will be made to develop green energy, especially in the context of increasing costs of fossil fuels and growing concern about energy security.
- Resource-rich low-income countries are likely to grow rapidly, taking advantage of the demand for raw materials from emerging economies. Given the thrust on rapid growth and natural resource exploitation, sustainability is unlikely to receive much attention, especially in those countries with inadequately developed policies and institutions.
- Low-income resource-poor countries (and poor regions within countries) are likely to face considerable challenges, with the likelihood of maintaining a low growth and stagnation
scenario, especially if there are no efforts to improve human resources and infrastructure. Continued growth of the global economy will provide some respite through migration and remittances and demand for labour-intensive products. This may reduce the pressures on land and other resources in some areas. A prolonged contraction of the global economy will have opposite impacts, aggravating unsustainable exploitation and use of natural resources (including land, water and forests).

- Most developed economies are likely to remain in a low growth (or even a stagnation) scenario, based on increasingly competitive global markets where countries with low labour costs accrue increased comparative advantage. However, in view of well-developed policy and institutional frameworks and capacities to invest in science and technology, there will be greater efforts to shift to a 'green economy' scenario.
- Small island countries will have fluctuating fortunes. While continued rapid growth of the global economy will keep the tourism sector vibrant, declining fisheries and absence of scale economies in other sectors may narrow their economic bases. Some may face an existential challenge in the context of climate change-linked sea level rise. A global economic decline implies a significant reduction in tourism with attendant consequences on economies.

The unfolding of the different scenarios will have important implications on the forest sector, as outlined in the next chapter.

6 THE ASIA-PACIFIC FOREST SECTOR IN 2020

The overall forestry situation in the Asia-Pacific region in 2020 will be determined by the dominant scenario that unfolds in the various clusters of countries. Although the region will continue to grow rapidly – probably at a slower rate than in the past, but still substantially faster than other global regions – there will be significant differences between countries on account of differences in initial conditions, differences in paths of development and differing interactions among countries. Emerging economies, especially China and India, will provide substantial momentum for growth. The huge populations involved and surging demand for forest products will remain the major factors impacting forests and forestry in the region. On the other hand there will be some countries that remain on a 'low growth path' on account of internal and external factors.

This chapter provides an overview of what is likely to happen to forests and forestry in the period to 2020. The principal assumption is that economic recovery in the region is rapid and robust; i.e., that the high economic growth and recovery 'boom' scenario will prevail during the forthcoming decade. At the time of publication (May 2010) many indicators are showing promising, though sometimes fragile, signs of recovery and the majority sentiment among economic commentators – though by no means unanimous – is of cautious optimism in regard to medium- and longer-run economic prospects **(Box 6.1)**.

Box 6.1 World Bank 'Global Economic Prospects 2010'

The World Bank's 'Global Economic Prospects 2010' report published in January 2010 summarizes the world economic outlook for the short and medium term. Some key features include:

- The acute phase of the global crisis is over.
- Overall, after falling for two to three quarters, global GDP has begun recovering; output grew rapidly during the second half of 2009 and is expected to continue to do so during the first half of 2010... global GDP growth, which is projected to come in at 2.7 percent in 2010 (after an unprecedented 2.2 percent decline in 2009), is expected to accelerate only modestly to 3.2 percent in 2011.
- Combined, GDP growth in developing countries is projected to grow by some 5.2 percent in 2010, after a modest 1.2 percent rise in 2009 (-2.2 percent if India and China are excluded), and by a relatively weak 5.8 percent in 2011. Despite these relatively robust growth rates, the unusual depth of the recession will mean that spare capacity and unemployment will continue to plague economies in 2011 and some sectors may well still be shrinking.
- Over the medium term, international capital costs are going to be higher than they were during the boom period. As a result, developing-country growth potential will remain well below recent highs, which is likely to be a source of frustration for many countries. The rate of growth of potential output in developing countries may be reduced by between 0.2 and 0.7 percentage points annually over the next five to seven years as economies adjust to tighter financial conditions. Overall, the level of potential output in developing countries could be reduced by between 3.4 and 8 percent over the long run, compared with its pre-crisis path.

Source: World Bank (2010).

Consequently, the analysis in this chapter focuses primarily on a future that largely accords with a high *economic growth and recovery 'boom' scenario*. Implications under the alternative *low economic growth and stagnation 'bust' scenario* and *social and ecological stability 'green economy' scenario* are dealt with in lesser detail.

FOREST AREA CHANGE

Forest area change under the high growth 'boom' scenario

At the aggregate level, forests in the Asia-Pacific region are expanding (**Figure 6.1**), with forest area increasing, or stabilizing, largely on account of significant increases in afforestation and reforestation in China, India, Viet Nam and the Philippines. Rapid economic growth, dedicated policy measures, growing demand for forest products and, especially, ecosystem services are helping to bring about forest transition¹ in a number of countries. However, the overall statistics mask considerable losses of natural forests in several countries – especially in Southeast Asia and some of the Melanesian countries – as natural forests are cleared and converted to agriculture and other uses. The overall direction of changes in the various subregions is outlined below.



Figure 6.1. Forest area change under the high growth scenario Source: Løyche-Wilkie (2009).

East Asia

East Asia comprises two developed economies (Japan and the Republic of Korea [ROK]), two middle-income, emerging economies (China and Mongolia) and the lower income, resourceconstrained Democratic People's Republic of Korea (DPRK). In most countries, relatively high levels of income, declining importance of agriculture in income and employment and high or increasing levels of urbanization imply a continued decline in pressures on forest land. Policies and institutions are also better developed than in many other parts of the region and, in view of

¹At its most basic, a forest transition is defined as a reversal in the forest cover trend (e.g. from negative to positive). However, qualitative aspects of change are also important and thus a transition from forest exploitation to sustainable management provides a more complete yet less easily measurable definition. In particular, forest transition in the Asia-Pacific region is used in the context of a transition in focus from exploitative uses towards greater focus on ecosystem services and other social and cultural values, as part of the broader socio-economic transitions occurring in the region.

relatively high incomes, society and governments are able to support substantive conservation efforts. East Asia is also experiencing greater emphasis on forest-derived environmental values, encouraging improved protection and management. While Mongolia and DPRK may face some further forest decline – in the context of both human and livestock pressures and natural events such as forest fires and pest incursions – forest area in East Asia will continue to increase, with most of the expansion taking place in China. China's emphasis on forest rehabilitation and enormous associated increases in forest area has dominated forest area statistics in the Asia-Pacific region during the past decade. Under a high growth scenario, forest area expansion in China can be expected to increase in accordance with national plans and, consequently, continue to drive expansions in forest area in the East Asian subregion and the overall Asia-Pacific region.

South Asia

Most South Asian countries face severe resource constraints, primarily on account of high population densities, which are set to increase. Bhutan is exceptional in having a low population and a high proportion of forest area, although the scope for conversion to agriculture is limited on account of the difficult terrain and poor accessibility. As most of the forest area suitable for agriculture in South Asia has already been converted, further change is not expected on a large scale. Furthermore, there has been significant expansion in planting trees outside forests in recent times, especially through various agroforestry initiatives. This implies a future of relative stability in South Asian forest area, notwithstanding some forest clearance in the context of rapid expansions in mining and infrastructure development.

However, forest degradation will remain a major problem in South Asia, especially in view of widespread collection of woodfuel, fodder and other non-wood forest products (NWFPs). Many of these activities take place in the informal sector, which undermines the potential for implementation of sustainable management. Community management initiatives are attempting to provide a formal framework for forest management, but their effectiveness depends on significant institutional innovation, including improvements in technical and governance capacities at local levels and more equitable benefit-sharing arrangements.

A high economic growth scenario envisages increasing demand for forest products within the formal sector, but potential for reduced demand in the informal sector. With increasing potential for some 'formal' demand to be satisfied by imports, as well as prospects for greater investments in planted forests, the overall situation in regard to forest area – improvement or decline – will be dependent on which of these factors dominate. This will undoubtedly vary across countries and in different localities.

Southeast Asia

The rapid growth of emerging and middle-income economies will continue to exert considerable pressure on forests in Southeast Asia, to supply food, fibre and fuel – particularly as growth begins to accelerate with economic recovery. Consequently, the pace of forest conversion witnessed in the past decade is likely to continue. This will present less densely populated forest-rich countries with opportunities to enhance incomes, resulting in continued forest degradation and clearance, including conversion of forests to plantations of rubber, oil-palm and other crops. Deforestation will be particularly severe in countries with limited policy and institutional capacities – for example Lao PDR, Cambodia and Myanmar – which are sandwiched by much larger, wood-importing economies including China, Thailand and Viet Nam. In low-income, forest-rich countries there will be some expansion of subsistence agriculture, but this will be of little significance in comparison with large-scale clearance for export-oriented cash crop production. In Indonesia, Malaysia and the Philippines, establishment of oil-palm, rubber and bioenergy crops is likely to continue to have significant impacts on forests and forest land, particularly under the high-growth scenario.

Oceania

Overall change in forest area in Oceania will be determined by developments in the forested areas of developed economies – Australia (which dominates subregional forest resource statistics) and New Zealand – and the forest-rich developing countries in Melanesia, especially Fiji, Papua New Guinea (PNG), the Solomon Islands and Vanuatu. Low population densities, high levels of urbanization, well-developed policies and institutions and low dependence on agricultural expansion for economic growth ensures relative stability in forest area in Australia and New Zealand. This may fluctuate at the margins as the private sector (which manages most of the planted forests) responds to changes in profitability of alternative land uses. In Australia, droughts and forest wildfires also play a significant role in forest loss. In many island countries, particularly in forest-rich Melanesia, weak policies and institutions and poor governance have led to unsustainable management, including logging beyond sustainable limits, with resulting high rates of forest degradation and clearance.

Under a high growth scenario, demand for wood products may see accelerated logging in natural forests in Melanesian countries and, potentially in Australia. This could drive significant forest conversion and degradation. However, the dominant trend in Australia and New Zealand will more likely be acceleration in planted forest establishment and increased funding for protected area management. Economic growth would also have the potential to improve funding for forest rehabilitation programmes in Pacific Island Countries.

Forest area change under the low growth and stagnation 'bust' scenario

In view of the complex interactions between growth, employment, consumption and land use, it is difficult to provide a clear indication of what may happen to forests in the context of a prolonged global recession. Often, change will depend on the relative strengths of income effects (reduced consumption as a result of reduced incomes) and substitution effects (shifts in consumption towards cheaper goods as a result of reduced incomes). Some likely changes are:

- Reduced incomes imply some reduction in demand for agricultural crops, including some plantation crops that are often grown after forest clearance. Substantial declines in prices of these commodities (notably oil-palm) could reduce the pace of forest conversion, especially in Southeast Asia and parts of Oceania.
- · Reduced demand for forest products could also reduce logging in natural forests.
- On the other hand a slowing down of the global economy will reduce the demand for manufactured products and services and cause consequent increases in unemployment. In many countries, rapid growth in the manufacturing and services sectors has reduced dependency on land, helping in stability and recovery of forest area. A prolonged recession and stagnation could negatively affect the forest transition if people are forced back to rural areas and subsistence livelihoods although experience from the 1997/1998 Asian economic crisis suggested that return migration to rural areas did not result in accelerated deforestation.
- A prolonged recession could also reduce investments in forest management, including afforestation and reforestation efforts, by governments, the private sector and communities.

Thus while there may be some gains in certain localities and countries, there could be some losses elsewhere. The balance will largely be determined by policy pursued within forestry and other related sectors in the event of a prolonged downturn.

Forest area change under the 'green economy' scenario

A 'green economy' scenario by definition encompasses greater attention to forest management and forest rehabilitation efforts. Consequently, under this scenario significant positive changes – in addition to those envisaged under the 'boom' scenario can be anticipated, while many negative impacts would be mitigated. For developing countries, the 'green scenario' would certainly anticipate successful and large-scale implementation of REDD. This would involve enormous changes in the way forestry is conducted in the region, although visible impacts in forests would be unlikely to become apparent until towards the end of the outlook horizon (2020; **Box 6.2**).

Box 6.2 Implications of REDD and REDD plus on forest area changes

Reducing Emissions from Deforestation and Forest Degradation (REDD) is a potentially far-reaching development in post-Kyoto climate change arrangements that could have major impacts on forest clearance in developing countries. However, even with recent agreement on the significance of REDD in climate change strategies and the decision that REDD plus mechanisms should be immediately established (at COP 15 of the United Nations Framework Convention on Climate Change [UNFCCC] in December 2009), implementation requires a number of challenges be addressed:

- A major technical challenge is determination of baseline emission levels and monitoring changes. In several countries with high deforestation rates, even basic inventory information is not available. Ramping up capacities to make countries 'REDD-ready' will take considerable time.
- Most deforestation and forest degradation is taking place in countries with limited institutional capacities and poor governance. Bringing about necessary policy and institutional changes will take time and resources. Improvement in governance – a fundamental requirement – will be a major challenge in most countries where deforestation and forest degradation problems are severe.

These issues will take considerable time and effort to overcome and, even if there is substantial international funding, which remains questionable, the likelihood of REDD making a significant impact on the ground by 2020 is rather limited. The experience of tapping the Clean Development Mechanism (CDM) for afforestation and reforestation, which is relatively less complex, suggests that REDD implementation will be an extremely slow process. Quite possibly, REDD may be a repeat of the experience of forest certification which, although initially aimed at addressing tropical deforestation, has been largely adopted in developed countries where deforestation is not a major issue and where standards of forest management are already high.

IMPLEMENTATION OF SUSTAINABLE FOREST MANAGEMENT

Sustainable forest management under the high growth 'boom' scenario

Management of natural forests

As indicated in Chapter 2, dependence on natural forests for wood production is declining in many countries, and for the whole region in general, due to various technical and economic reasons. Although multiple-use management for provision of a wide array of goods and services is an attractive concept, actual management tends to gravitate towards two extreme situations:

 Where policy and institutional weaknesses persist, there is a strong tendency to log intensively, with very little consideration for sustainability of wood production or the provision of ecosystem services. In many countries, such uncontrolled logging has persisted, sometimes feeding the trade in illegally sourced wood and undermining the future economic viability of production forest management. 2. At the other extreme is a total ban on logging; ostensibly to enhance the provision of ecosystem services. In the context of increasing wood production from planted forests and technological advancements in wood processing, continued declines in managing natural forests for wood production are inevitable. With declining profitability, there is also a tendency to reduce investments in management. However, halting logging as a means of enhancing delivery of ecosystem services does not always halt the conversion of such forests. For example, large tracts of natural forests have continued to be cleared for cultivation of rubber and oil-palm or mining and infrastructural development, despite protection from logging.

Under a 'boom' scenario, increased demand for wood products can be expected to drive an acceleration in logging in both planted forests and natural forests. To this extent, where regulation is weak, economic growth and recovery will have detrimental impacts on natural forests and exacerbate the effects of poor forest management. On the other hand, as economic development reaches certain threshold points, trends in forest degradation tend to be reversed and economic growth begins to promote improved forest management. Experiences in China, where economic development has enabled reversals in severe deforestation and forest degradation trends, could provide a model for forest rehabilitation in other emerging economies and potentially some low-income countries.

Planted forests

The Asia-Pacific region has been in the global forefront of forest plantation establishment during the past several decades, with countries such as China (1st), Japan (4th), Indonesia (7th), India (8th), Thailand (9th) and Viet Nam (10th) having among the world's largest national plantation estates. However, this trend may not persist given that forest plantation industries are mature and stabilizing in many of the countries that have invested heavily in plantation development. For example, in New Zealand (15th in the world list) there has been a marked decline in new planting in recent times, down from peaks of almost 100 000 hectares *per annum* in the mid-1990s, to just over 2 000 hectares *per annum* in 2007 (**Box 6.3**). Most planting in New Zealand is presently reforestation of harvested areas and there is very little increase in the net planted area.

Box 6.3 Economic viability of forest plantations in New Zealand

Reductions in new planting rates and in the proportions of forest plantations subject to pruning and thinning have occurred in New Zealand in recent times. In general, these reductions reflect low returns to plantation forestry in the past decade, allied with increasing importance of reconstituted board products (especially MDF) relative to sawntimber. A notable trend is that, during the past five years, some areas of planted production forests have been converted to pasture, reflecting very high returns in dairy farming compared with forestry.

Source: FAO (2010c).

A 'boom' scenario would most likely lead to an acceleration in forest plantation establishment, though in countries where planting is dominated by the private sector, this will be partially dependent on the perceived relative competitiveness of planted forestry *vis-à-vis* other potential land uses. Growth in populations and incomes will also increase demands for food – including demand for extensively-farmed beef and lamb. This is likely to intensify competition for land and water in more densely populated countries and affect the scope for expansion of plantations. Where land productivity is high, forest plantations will have to compete with more remunerative crops including oil-palm and intensive agricultural crops as well as dairying. Countries such as

China and India, where significant plantation expansion took place in the last decade, could also witness some leveling off, especially as availability of suitable land for afforestation declines. This will be particularly significant for large-scale industrial plantations.

Contract tree farming, whereby forestry companies commission smallholders to grow trees, is an alternative option being pursued in some countries to overcome land constraints. Some scope also exists for plantations to be expanded onto degraded lands including, for example, large tracts of *Imperata* grasslands in Southeast Asia. However, the costs of managing forest plantations in such areas tend to be substantial. Degraded areas in more densely populated countries (for example India) are also often used by local communities to meet basic needs for woodfuel, fodder, NWFPs and so forth. Expansion of forest plantations into such areas will have to first address potential negative impacts on the welfare of local communities.

With the exception of a few countries, plantation productivity remains far below potential. Public sector plantations are particularly prone to poor management and low productivity, largely stemming from institutional problems. Although substantial work has been done on productivity-enhancing technologies – including tree improvement, management of pests and diseases, silvicultural regimes and maintaining site productivity – there are considerable gaps in application of research in the field. Managing existing plantations more intensively to enhance productivity will be a better and more appropriate option than merely expanding plantation areas. This is most likely to occur under a high growth scenario where higher returns to forest growers are likely to encourage improved silviculture and tending regimes.

Sustainable forest management under alternative scenarios

Under a low growth 'bust' scenario, lower demand for industrial wood products is likely to reduce harvesting pressure in natural forests while also reducing incentives for plantation establishment. Fewer resources will also be available to improve forest management and thresholds at which resources become available to improve forest management will be reached more slowly. Under such circumstances, forest management will be likely to stagnate, along with many other economic sectors.

Under a 'green' economy scenario, forest management will receive significantly increased attention. Forest management regulation and enforcement would be tightened and greater funding would be forthcoming for various management interventions. Planted forests could be expected to expand, especially in response to vigorous carbon markets, although some of the criticisms of planted forests in terms of their limited biodiversity, common association with clear-felling and other unpopular management practices may need to be further addressed.

DEMAND AND SUPPLY FOR WOOD AND WOOD PRODUCTS

Supply and demand of wood products is one of the more quantifiable aspects of forestry and a variety of global-scale models have been developed to investigate these, including a suite of models developed by FAO and used in this analysis. Projections have been prepared based on statistical analysis and modeling of historical forest product production and consumption data as a means of describing the possible future situation for different products under a defined set of parameters (Jonsson and Whiteman 2008). Forecasts assume continuation of growth on the basis of trends in evidence prior to the 2008/2009 economic crisis. The projections do not take into account the effects of the recent downturn, but could be realized if the current economic rebound is strongly sustained. Consequently, the modeled results approximate a very robust *high economic growth and recovery 'boom' scenario*. The forecasts are based on multiple linear regression and, as such, are largely dependent on historical production data. Subsequent

structural changes in many variables including forest depletion, policies and governance are not accounted for. Consequently the projections are aimed at providing a broad sense of production and consumption for different products and subregions to 2020 as a point of departure for policy discussions.

Demand for wood and wood products under the high growth 'boom' scenario

Under the high growth scenario, demand for wood and all wood products is expected to increase significantly.

Industrial roundwood

Overall consumption of industrial roundwood in the Asia-Pacific region, taking into account demand for various processed products, is projected to increase from about 317 million m³ in 2005 to nearly 550 million m³ in 2020 (**Figure 6.2**), an increase of about 232 million m³. There will be significant subregional differences as outlined below.



Figure 6.2. Forecasts of industrial roundwood consumption, 2005-2020 Source: Jonsson and Whiteman (2008).

- In East Asia, industrial roundwood consumption will increase from 185 million m³ to 330 million m³. East Asia will account for most of the region's increase in demand, with China's share of industrial roundwood reaching 80 percent of the East Asian subregion's consumption. Japan, the other major consumer of industrial roundwood in the subregion, will reduce consumption from about 51 million m³ in 2005 to about 49 million m³ in 2020.
- Southeast Asia will continue to be a large industrial roundwood producing and consuming subregion, with industrial roundwood consumption predicted to increase from about 69 million m³ in 2005 to about 112 million m³ in 2020. Much of this increase will be accounted for by Indonesia, in view of internal increases in population and incomes. Malaysia, Thailand and Viet Nam will also witness significant increases in consumption.
- South Asia will experience an increase in industrial roundwood consumption of 62 percent between 2005 and 2020. The subregion's annual consumption will reach 66 million m³ by 2020. Over 80 percent of total South Asian consumption will be accounted for by India.

• Oceania's consumption of industrial roundwood will register a modest increase of 11 million m³, reaching a total consumption of 41 million m³ by 2020. More than 90 percent of consumption will be accounted for by Australia and New Zealand.

In many cases, increased consumption of industrial roundwood will be directed towards manufacture of wood products destined for sale in export markets, including some substitution of products currently produced in other regions.

While future demand can be estimated based on parameters such as population, income and price elasticity, there are significant difficulties in projecting levels of production, including predicting future relative prices for various forest products and for substitute commodities. The following analysis estimates future production by projecting past trends in the gaps between production and consumption (**Figure 6.3**). Notwithstanding some of the inherent problems relating to reliability of data, this gives a broad indication of emerging gaps in the various subregions.



Figure 6.3. Industrial roundwood: changes in production shortfalls and surpluses Source: Jonsson and Whiteman (2008).

One of the most obvious trends, at the regional level, is a growing gap between consumption and production of industrial roundwood, which will increase from 44 million m³ in 2005 to 84 million m³ in 2020. This is mainly due to an increasing supply deficit in East Asia and South Asia, largely accounted for by China, Japan and India. Oceania will increase its industrial roundwood production surplus as a result of increasing plantation harvests in Australia and New Zealand. In Southeast Asia there is projected to be a marginal increase in the industrial roundwood surplus although diminishing supplies from natural forests may preclude this development.

As a consequence of the increasing supply gap, the region's dependence on imports will increase markedly, notwithstanding a significant expansion in wood production from planted forests.

Sawnwood

Demand for sawnwood is projected to increase from about 81 million m³ in 2005 to about 103 million m³ in 2020, with most of the increase taking place in South Asia and Southeast Asia **(Figure 6.4)**. In East Asia and Oceania, sawnwood consumption is projected to increase only

marginally. However, data deficiencies make it difficult to draw definitive conclusions. As in the case of industrial roundwood production and consumption, a significant share of sawnwood production goes unreported in official statistics, especially in view of the preponderance of small and medium enterprises that largely operate in the informal sector.



Figure 6.4. Sawnwood demand, 2005-2020 Source: Jonsson and Whiteman (2008).

On the whole, production of sawnwood will fall significantly short of consumption (Figure 6.5). Projections of historical trends in sawnwood production indicate an increase in production from about 69 million m³ in 2005, to 89 million m³ in 2020. East Asia accounts for the most of the production shortfall in both 2005 and 2020. China and Japan have the highest deficits between production and consumption, while New Zealand, Malaysia and Indonesia will remain significant surplus producers of sawnwood. However, the East Asian sawnwood deficit far exceeds production surpluses in Southeast Asia and Oceania and hence the Asia-Pacific region will remain a net importer of sawnwood.



Figure 6.5. Sawnwood: changes in production shortfalls and surpluses Source: Jonsson and Whiteman (2008).

Wood-based panels

The wood-based panel segment of forest product markets has witnessed unprecedented production and consumption growth in recent years, and is poised to further expand rapidly in the future. Panel consumption is projected to increase from about 77 million m³ in 2005 to about 188 million m³ in 2020 (**Figure 6.6**), with about 90 percent of the predicted increase taking place in China.





However, while this analysis provides an overall indication of future demand for panel products, caution has to be exercised in view of potential inaccuracies stemming from production and consumption data (**Box 6.4**).

Box 6.4 Inconsistencies in demand projections for wood-based panels in India

Projecting historical trends in demand for wood-based panels in India indicates consumption growth from 2.6 million m³ in 2005 to about 4.1 million m³ in 2020. This equates to an increase of about 58 percent over a period of 15 years, during which time, the population will increase from about 1.1 billion people to about 1.4 billion people. At the same time, incomes will also increase and rapid growth of construction is anticipated.

However, it is likely that there is considerable under-reporting of past and current wood-panel consumption, which leads most forecasting models to underestimate future consumption. A Government of India study (Government of India, 1998 quoted in Pandey and Rangaraju 2008) forecast that demand for wood-based panels would increase to 14.7 million m³ in 2005 and 30.5 million m³ in 2020. This is almost ten times that estimated by FAO on the basis of past trends and official statistics.

Source: Pandey and Rangaraju (2008).

While inaccuracies associated with weak baseline information are serious, an indisputable fact is that demand for panel products is growing rapidly. While China has become the lead consumer of panel products, significant increases in demand should also be expected in India and Indonesia, most likely much greater than indicated by the forecasts. Currently Southeast Asia produces a much greater volume of panel products than it consumes, while statistics reported in 2005 indicated that East Asia's production was inadequate to meet the subregion's consumption (although this figure includes the very significant volumes of wood-based panels that are eventually exported from

East Asia as finished products). However, wood-based panel capacity expansion in East Asia since 2005 already suggests major producer reaction to supply shortfalls, while declining wood supplies in Southeast Asia may inhibit the projected expansion of the subregion's surplus. As such there is considered to be great scope for significant reallocation of wood-based panel capacity between subregions.



Figure 6.7. Wood-based panels: changes in production shortfalls and surpluses Source: Jonsson and Whiteman (2008).

Paper and paper board

If past trends are maintained, consumption of paper and paper board will grow rapidly, with the emerging economies accounting for most of the increase (**Figure 6.8**). Paper and paper board consumption is projected to increase from about 123 million tonnes in 2005, to 259 million tonnes by 2020. The largest increase will be in China, (increase estimated to be about 96 million tonnes), followed by India and Indonesia.



Figure 6.8. Forecasts of paper and paper board consumption, 2005-2020 Source: Jonsson and Whiteman (2008).

There is considerable uncertainty over future demand for paper and paper board, which is highly sensitive to changes in income and changes in information technology. Emerging economies in the Asia-Pacific region have very low levels of per capita consumption. As income and educational levels increase and trade-related consumption of packaging materials grow, paper and paper board consumption can be expected to grow. However, technological change could act to reduce consumption, especially in relation to the growth of electronic media. Newsprint consumption is already being particularly affected by this. Increased attention to recycling could also significantly deflect pulpwood consumption growth trends. The region's production shortfall in 2020 could also be significantly reduced by rapid increases in pulp and paper manufacturing capacities and recent data suggest that increases in capacity in China are already having such an effect (**Figure 6.9**).



Figure 6.9. Paper and paper board: changes in production shortfalls and surpluses Source: Jonsson and Whiteman (2008).

Demand for wood and wood products under the low growth and stagnation 'bust' scenario

The forecasts of demand for wood and wood products estimated above assume continuation, to 2020, of high economic growth rates achieved in many Asia-Pacific economies during the past two decades. However, potential economic stagnation and slow recovery, including in developed economies outside the region, would impact on Asia-Pacific's demand for wood and wood products, as indicated below.

- Most Asia-Pacific economies have witnessed rapid growth in investments in housing and other building construction. An overall economic deceleration would likely reduce demand for sawnwood, panel products and other wood-based construction materials, depending on the income elasticity of demand for new buildings and renovations, as well as changes in the relative prices of competing products.
- Capacity expansion in the paper and paper board sector could slow significantly, especially
 in relation to expectations of slow growth in demand and, perhaps even more importantly,
 falling credit availability. In some countries those in Europe included there is already
 excess capacity in the paper and paper board sector and this will dissuade further capacity
 expansion. Continued stagnation in the sector could see some plants forced into closure
 along with likely consolidation through mergers and acquisitions.
- Some Asia-Pacific countries have become major producers and exporters of wooden furniture, largely taking advantage of lower wage costs and outcompeting traditional furniture

producers, especially in Europe. A drastic contraction in the housing sectors of many countries has led to a decline in furniture demand precipitating closure of many production units. Uncertainty in housing sector revival will continue to hamper growth in the furniture sector. This will also have significant impacts on demand for sawnwood and panel products used in furniture manufacturing.

Figure 6.10 indicates likely changes in consumption of forest products under a low growth scenario, in which economic growth rates are dampened by 25 percent.



Figure 6.10. Demand for wood products under high growth and low growth scenarios, 2005-2020

Source: Jonsson and Whiteman (2008).

If national economic growth rates were persistently 25 percent below those anticipated under a high growth scenario, a significant decline in demand and consumption of all forest products would result. For example, projected industrial roundwood consumption would shift downwards from 550 million m³ in 2020 to 462 million m³. As the largest consumer of industrial roundwood, China would account for a major share of the reduction under the low growth 'bust' scenario. Under the lower growth scenario, consumption of wood-based panels and paper and paper board will decline by around 23 percent and 18 percent respectively, with most of the reduction accounted for by China. Sawnwood is the product for which consumption is least affected by a reduction in growth rates given that the most important constraints on sawnwood markets are falling supplies of larger logs and preferences moving towards manufactured board types.

While a number of assumptions underlie these projections, the 'boom and bust' scenarios provide some likely boundaries for increases in demand for wood and wood products over time. With the exception of sawnwood, the Asia-Pacific region's share in global wood product consumption is expected to increase considerably between 2005 and 2020, even under a low growth scenario **(Table 6.1).**

Broducto	Share in 2005 (percent)	Share in 2020 (percent)	
FIDUUCIS		High growth scenario	Low growth scenario
Industrial roundwood	18	25	22
Sawnwood	19	20	19
Wood-based panels	32	47	41
Paper and paper board	34	46	42

Table 6.1. Asia-Pacific's share of wood and wood	product consumption in	alobal consumption
	p	g

Source: Jonsson and Whiteman (2008).

Demand for wood and wood products under the 'green economy' scenario

The pursuit of 'green economies' may have a mixed impact on demand for wood and wood products. Largely this depends on the state of technology relating to wood use. As indicated below, some developments could increase wood use while others could reduce demand.

- Increased thrust on recycling and reuse of wood will reduce demand as is already being seen.
- Several new technologies are emerging that could enhance efficiency in the use of wood and thus reduce raw material demand. Nanotechnology applications in forestry could lead to development of many new products, including structural products that are stronger, but use only a fraction of the raw material currently used.
- Demand for wood as a green building material replacing energy-intensive materials such as steel, aluminium and cement – could significantly increase use of wood as a more environmentally friendly product (Box 6.5)

Box 6.5	'Green' building in Asia and the Pacific
The concept ongoing trend	of green building is moving forward in several Asia-Pacific countries. Key aspects of the d include:
 It is for convert 	pur-to-six times cheaper to design and build a green building in China than to build a ntional building with high heating, cooling and lighting costs.
 In Jap accept 	an, ROK, Singapore and Taiwan, Province of China (POC) green codes are now well red and rigorous voluntary programmes are going beyond minimum regulated standards.
 Policie buildin eventu 	is in Japan and Singapore are increasingly comprehensive regarding energy-efficient gs, covering most stages of a building's life cycle and targeting building developers and lal occupants.
 Recen in Ho efficier in Sir requiri Mark c 	t energy efficiency policies for buildings in Asian countries include: ng Kong Special Administrative Region(SAR): proposed mandatory building energy- ncy standards – public consultation completed in 2008; and ngapore: establishment of a Green Mark Incentive Scheme (effective April 2007), ng new public sector buildings and those undergoing major retrofitting work to be Green certified.
 China embr development 	and India are also regional leaders that are: acing international certification for green buildings; and loping national standards and coordinating bodies.
 Joint p and R0 Indone 	public/private initiatives for green building have been implemented in China, India, Japan OK; and green commercial and residential developments are already established in China, esia, Singapore and Hong Kong SAR.
Campaigns p in 2007 New benefits of we and concrete house owner	promoting wood as a green building material are helping to increase its use. For example, Zealand started a 'New Zealand Wood' promotional campaign to extol the environmental bod use. As a result, wood is regaining some lost ground in the framing market, from steel . The New Zealand wood programme also provides information to builders, architects and s on available choices, best applications and optimized maintenance.
Sources: Asia	a Business Council (2008); NZ Wood (http://www.nzwood.co.nz).

• Wood is increasingly seen as a raw material producing a wide array of green chemicals and energy. With the wider adoption of biorefinery technologies, the demand for wood as a natural product will increase.

Consequently, the overall consumption of wood and wood products is unlikely to change very much under a 'green economy' scenario. Increased use of wood as a green product is likely to be balanced by improvements in efficiency of use, due to improved technologies.

Industrial wood supply situation under the high growth 'boom' scenario

With demand far exceeding supply, the Asia-Pacific region is already in industrial roundwood deficit, largely on account of rapid growth in demand in East Asia and, to some extent, South Asia. In 2005, the supply shortfall is estimated at about 44 million m³. Under the high growth scenario, demand for industrial wood will be about 550 million m³ in 2020, while estimated supply will be about 466 million m³, resulting in a deficit of 84 million m³. China, Japan, India and ROK are the countries with the greatest current and future deficits in industrial roundwood supply. These countries will rely on wood surpluses from elsewhere, within and outside the region, in addition to efforts to boost domestic supplies for the future. A major issue will be the extent to which the

global demand-supply balance will change to enable the region to bridge the gap, including the potential for significant price increases to lessen demand.

At present, global demand and supply projections indicate that the Asia-Pacific deficit could be largely met through imports from regions with substantial surpluses, especially the Russian Federation, Africa and, to some extent, Latin America and North America (**Figure 6.11**).



Figure 6.11. Shortfalls and surpluses in global demand – supply of industrial roundwood

Source: Jonsson and Whiteman (2008).

Russia is expected to continue to be an important source of industrial roundwood supply to the Asia-Pacific region. Considering the vast resources in Russia, and that Russian removals are far lower than the current annual allowable cut, the potential to increase supply is substantial (see **Box 2.2**); notwithstanding Russia's efforts to promote its own domestic processing industries. Latin America and North America are other potential sources of increased wood supplies to Asian wood-deficit countries. With drastic declines in demand in the United States, resulting from declines in house construction, Asia could become an important market for wood and wood products from Canada and Latin America.

The Asia-Pacific region, in particular wood-deficit countries including China and India, could considerably enhance wood production from existing planted forests, largely through improved management. The 130 million hectares of planted forests in Asia and the Pacific (in 2005) have an estimated potential production of about 542 million m³; almost twice the current estimated production of industrial roundwood from the entire region. Even giving conservative consideration to the unreliability of information on wood production and consumption, and the extent and productivity of planted forests, there is still scope to significantly enhance production from planted forests to help bridge the industrial roundwood deficit predicted for 2020 under both the high and low growth scenarios.

As such, wood supply is unlikely to be a major problem in coming years, unless there is massive diversion of wood for energy production or some catastrophic loss of standing stock. However, in some localities, and for the very poor who are unable to participate in markets, wood scarcity will remain a major challenge.

Industrial wood supply situation under alternative scenarios

Wood supply dynamics will remain largely unchanged under high growth and low growth scenarios. For the next decade, most of the trees that will be harvested (excluding very short rotation pulp supplies) are already in the ground and wood will be supplied to meet demand at prevailing market prices. As shown in **Figure 6.11**, more sluggish economies under a low growth scenario reduce global demand for industrial roundwood (compared to a high growth scenario), resulting in decreases in surpluses and deficits in all global regions.

However, shifts in the Asia-Pacific region's 'wood supply curve' could be anticipated under a 'green economy' scenario. Green economies would likely encompass increased forestry regulation and higher environmental standards that would reduce wood availability, at least in the short and medium term. With a green economy also likely to promote greater demand for wood, significant price increases for industrial roundwood could be expected.

WOOD ENERGY

Wood energy implications under the high growth 'boom' scenario

Wood remains the most important source of energy for the majority of people in the Asia-Pacific region. However, with growth in incomes and increasing availability of alternative, more convenient fuels, the use of wood as a source of energy has been declining. If the high growth scenario persists, this trend is likely to continue to 2020 and beyond (**Figure 6.12**). Regional woodfuel consumption is estimated at about 790 million m³ in 2005 and to be 699 million m³ in 2020. Some of the key subregional trends are outlined below.



Figure 6.12. Trends and forecasts for woodfuel demand, 2005-2020 Source: Jonsson and Whiteman (2008).

 Most of the decline in woodfuel use will be accounted for by East Asia and Southeast Asia. Woodfuel consumption in these two subregions is expected to decline by about 92 million m³ between 2005 and 2020. As indicated earlier, this decline will largely be an outcome of increased incomes and, more importantly, the availability of alternative, more convenient fuels.

- South Asia accounts for close to 49 percent of the region's woodfuel use and wood will remain the most important source of household energy in this subregion. Since 1980, demand for woodfuel has been increasing due to population increases and limited access to alternative fuels. However, there are signs of stabilization and decline in the context of higher incomes and increased supplies of alternative fuels.
- Oceania's woodfuel use is expected to increase slightly from about 10 million m³ in 2005, to 20 million m³ in 2020. Largely this relates to anticipated rapid expansion in production of wood pellets, particularly in Australia, much of which is likely to be exported. In most other Pacific countries, household use of woodfuel will remain important due to limited supplies of commercial fuels.

Overall, a high growth scenario anticipates moderate reductions in household woodfuel use, as well as modest increases in commercially produced wood-based biofuels. Depending on prices for fossil fuels, there may be significant expansion of dedicated biofuel plantations (if fossil fuel prices increase significantly), however most of these would not come onstream until post-2020.

Wood energy implications under the low growth and stagnation 'bust' scenario

A prolonged economic downturn will have mixed impacts on the use of wood as a source of energy. A decline in national incomes would imply a slowing of investment in expanding commercial energy supplies. In addition, slow growth or a decline in household incomes will reduce abilities to move up the energy ladder. Households will have to continue – and even return – to using wood, which is regarded as an inferior fuel source in most developing countries. Costs of switching between energy sources – especially with respect to expenditure on equipment – will be a major consideration. However, high fossil fuel prices may also create disincentives for switching energy sources. If economic growth slows down and levels of poverty increase, dependence on woodfuel, especially wood collected from public lands in many developing countries, is likely to increase.

An economic slowdown could also reduce energy prices and hence improve accessibility. As growth declines, demand for energy may fall, triggering a reduction in prices and enhancing access for those to whom it was previously unaffordable. However, such price reductions are most likely to benefit those who have already switched to commercial fuels.

On the whole, aggregated woodfuel demand under a low growth scenario will probably remain more or less unchanged, on account of multiple feedback loops working in opposing directions.

Wood energy implications under the 'green economy' scenario

Pursuit of a 'green economy' scenario will have significant impacts on the use of wood as a source of energy. Changes will again vary across countries and localities, as indicated below.

 Several countries are making efforts to reduce the use of fossil fuels as an important component of policies to combat energy dependence and climate change. Depending on the various policies, the share of biomass in total energy consumption could increase considerably. For example, production and use of wood pellets are poised to grow in response to policies aimed at reducing dependency on coal and other fossil fuels. Currently wood accounts for between 9 and 18 percent of total energy consumption in Asia depending on assumptions regarding conversion efficiency. Assuming that current patterns of use persist, an increase in the share of woodfuel – by about 5 percent by 2020 – would imply an increase in woodfuel use by about 387 million $m^3 - a$ 50 percent increase over 2010 consumption. However, if assumed conversion efficiencies are low, a 5 percent increase in the share of woodfuel in total energy consumption would equate to a 75 percent increase in woodfuel use.

 However, a shift to a 'green economy' scenario would envisage significant investment in the development and wider adoption of more energy-efficient technologies. Substantial work is underway to improve biomass gasification technologies, including development of gasifier stoves for household use. Commercial production of cellulosic biofuels will also bring about major improvements in efficiency of use, although this will largely be directed at the transportation sector, with its huge potential demand.

A 'green economy' scenario also implies that there will be significant investments in other renewable energy sources, especially wind and solar power. As pointed out earlier (**Box 5.4**), countries such as China and India (which account for a major share of woodfuel consumption in the Asia-Pacific region) are investing heavily in these technologies. As technologies in these areas improve, more households can be expected to adopt them, reducing demand for wood. Consequently, moving towards a 'green economy' scenario is unlikely to markedly increase woodfuel demand because part of energy demand shifts will be balanced by technological improvements and the use of other renewables.

NON-WOOD FOREST PRODUCTS

NWFPs: implications under the high growth 'boom' scenario

Rapid growth of Asia-Pacific economies will have several implications for production, processing and trade of non-wood forest products (NWFPs), as outlined below.

Collection of some NWFPs to decline: As poverty declines and incomes increase there will be much less interest in many subsistence NWFPs. Largely this relates to: (a) increased availability of alternative products; and (b) increases in incomes enabling purchase of superior products. Many NWFPs are often seen as inferior, especially in unprocessed forms and, as incomes increase, collection of products that generate low revenues will decline. Most subsistence use is in rural areas where poor access limits choice. Access to better alternatives will significantly reduce demand for subsistence products. Collection of most NWFPs from the wild is therefore likely to decline, except when such collection is linked with forest-based recreation.

Commercialization of selected products: While several subsistence products may lose importance, a few – especially ingredients in health and beauty products and some specialty foods – will gain prominence. A burgeoning middle class, with high disposable incomes, will create substantial demand for some 'fashionable' NWFPs. While a few high value NWFPs may continue to be sourced from the wild, most will be domesticated and cultivated in farms, where technically viable, due to the revenues available and requirements for stability in supply and product quality.

The few products that cater to niche markets and cannot be easily domesticated will continue to be collected from the wild. Managing these sustainably will remain a challenge, especially in the context of illegal harvesting and removal.

NWFPs: implications under the low growth and stagnation 'bust' scenario

A prolonged economic downturn will have more-or-less opposite implications for NWFPs compared to the high growth scenario. Low incomes and persistent poverty will imply continued dependence on subsistence products as other income-earning opportunities remain limited. This

will be particularly true for a number of low income and emerging economies with high poverty levels. If people from urban areas are forced back to their rural homelands, some who return to areas near forests would likely seek to supplement their livelihoods through NWFP collection.

Under a low growth scenario, resources allocated to regulate collection from the wild would likely decline, encouraging illegal collection and trade in some NWFPs. Collection, processing and trade will continue to be largely dominated by the informal sector, especially as the capacity of formal institutions stagnates or declines.

NWFPs: implications under the 'green economy' scenario

A green economy scenario would envisage more systematic efforts to manage NWFP resources sustainably and to ensure that benefits are shared equitably. Local community organizations would be strengthened and improved communications would allow them to tap into emerging markets for products grown under natural conditions. Certification and fair trade practices could be expected to be widely adopted, ensuring that products are grown under appropriate conditions and collectors and producers are fairly paid. A significant share of processing would be undertaken locally, with attendant increase in local incomes. Cooperatives and producer associations would ensure that markets operate in a transparent manner. Improved information and communication technologies would help to enhance market access enabling small-scale producers to easily supply products to distant consumers.

ECOSYSTEM SERVICES

Provision of ecosystem services will vary significantly under different scenarios largely depending on economic development stages, as outlined below.

Ecosystem services: implications under the high growth 'boom' scenario

The high growth scenario will have a mixed impact on various ecosystem services, primarily depending on how countries deal with the trade-offs involved. Largely, this depends on the overall state of social and economic development; and on political will to establish and enforce appropriate trade-offs between competing products and services.

Conservation of biodiversity

- Developed economies are unlikely to face major challenges with regard to biodiversity conservation. Stability in land use, increased awareness, better developed policies and institutions, and greater willingness and ability to protect the environment ensure that biodiversity is already relatively well protected.
- Middle-income and emerging economies will face considerable challenges in establishing trade-offs between competing uses. While expansion of the industrial and services sectors could reduce pressures on land due to agricultural expansion, investments in infrastructure, mining and urban expansion – critical in achieving high growth rates – could have severe negative impacts on biodiversity. In particular, wetlands and coastal ecosystems (especially mangroves) could be under severe threat. Although many middle-income countries have relatively strong policies and institutions and resources available for conservation, the priority assigned to economic growth will likely adversely affect implementation of conservation policies. In the context of a decision on 'conservation versus economic growth', the latter is more likely to prevail, with only limited efforts to ameliorate the situation.
- Conservation of biodiversity and other ecosystem services will be particularly challenging

for low-income, resource-rich countries under a high growth scenario, in view of enormous internal and external pressures to supply resources. Extraction of wood and the conversion of forests to other uses will be important options for generating income and economic growth. Some tropical countries with high biodiversity, such as Lao PDR and Cambodia – situated in the midst of resource-hungry, emerging economies including China, Thailand and Viet Nam – are highly vulnerable to biodiversity loss.

• Low-income, resource-poor countries will face similar situations, although on much smaller scales. Degradation of available resources due to intense human pressures will remain a major problem, likely to be compounded by policy and institutional weaknesses.

Watershed values

As water is a critical commodity, protection of watershed values receives considerable attention in most countries. Improvement of water quality and – to some extent – stabilization of flow is a major function of upland and riparian forests in most countries. Better developed policies and institutions and the absence of significant land-use conflicts have enabled developed countries to address watershed management issues more effectively, compared with less developed countries. Clearly defined property rights and improved understanding of the linkages between land use and water also present potential for the development of market-based mechanisms to manage forests for watershed values, in countries where people have sufficient ability to pay. While such systems are still embryonic in most Asia-Pacific countries a high growth scenario would provide potential for more widespread implementation.

Most developing countries will face a mixed situation. Although there is recognition of the importance of improving watershed values, other pressing social needs are likely to be accorded higher priority. Many countries will also have to deal with challenges in strengthening policy and institutional frameworks. Improvements can be expected in countries where dependence on land and pressure to convert forests to more intensive land uses declines. In areas where resource pressures are higher, watersheds are likely to be further degraded, unless afforestation programmes such as those implemented in China and Viet Nam in the last decade can be similarly implemented.

Land degradation and desertification

Land degradation and desertification largely stem from poor land and water management. As in the case of biodiversity and watershed values, situations among countries and localities will be somewhat mixed, in view of divergent ecological and economic conditions.

Under a high growth scenario, developed and emerging economies will be in a strong position to deal with land degradation issues on account of:

- Increasing opportunities to earn incomes and gain employment in the manufacturing and services sectors, thereby reducing pressures on marginal lands. In some cases, this may pave the way for natural forest regeneration and rehabilitation.
- Better policy and institutional arrangements and increased financial resources, enabling governments to undertake both preventive and remedial measures including tree planting programmes.

However, land degradation and desertification will continue to be major problems for a number of low-income developing countries. Largely, this stems from policy and institutional constraints coupled with limited financial resources. Both preventive and remedial measures to combat land degradation and desertification require large-scale efforts (for example, regulating land users,

management of surface irrigation, regulation of groundwater extraction, reduction of grazing pressure, stabilization of sand dunes, etc.) and many governments may face severe constraints in mobilizing the various stakeholders for such collective action. A high growth scenario might enable greater resources to be devoted to rehabilitation efforts, but institutional weaknesses will more likely encourage an acceleration in demand-driven degradation.

Landscape values and ecotourism

Under a high growth scenario, recreational use of forests and woodlands is expected to grow rapidly. This is already evident in the growth of ecotourism – both domestic and international – in many countries. An increasing middle class, with higher disposable incomes, improved access to information and better infrastructure, will all contribute to continued growth in ecotourism in most countries in Asia and the Pacific. In a number of countries, at least in key localities, ecotourism is expected to become the most important source of income for local communities and forestry departments. However, under the rapid economic growth scenario, social and ecological sustainability could be significantly compromised. There are already signs of this happening with unplanned tourism accentuating resource degradation.

With more people living in urban areas and incomes increasing, there will be greater demand for urban landscape improvement, especially green zones. While many burgeoning metropolises will have large shanty towns and slums with very little green space, more affluent areas will be better planned and developed with adequate green areas.

Carbon sequestration and storage

A high growth scenario will have mixed implications for carbon sequestration and storage functions of forests as indicated below:

- Developed countries will increasingly rely on forest conservation and afforestation as important components in efforts to reduce carbon emissions and to compensate for emissions from other sectors. In view of relatively low opportunity costs (especially considering significant reductions in dependence on land as an important source of income), carbon sequestration and storage through forestry will likely expand significantly.
- A number of emerging economies are also likely to use forests and forestry as important components in emission reduction strategies. Much of the thrust will be to accelerate afforestation and reforestation to compensate for emissions arising from rapid growth of the agriculture and industrial sectors. For example, both China and India have launched large-scale afforestation programmes as integral parts of their climate change mitigation strategies.
- Low-income, forest-rich countries will face major challenges in managing forests for carbon. These countries have very low levels of industrial emissions and there will be very little domestic compulsion to conserve forests for carbon management. Their willingness to manage forests sustainably will largely depend on the relative costs and benefits of forest conservation *vis-à-vis* alternative uses. Under a high growth scenario, it is likely that mechanisms such as REDD will receive significantly greater funding than under a low growth scenario, hence there will be greater incentives for forest conservation based on carbon payments. The opposite side of the coin is that there will also be significantly higher demand (and prices) for wood, agricultural products and other natural resources creating pressures for deforestation and degradation. Unless carbon sequestration is seen as an economically better option, there will be very little willingness to manage forests for carbon sequestration and storage benefits. Institutional demands associated with conserving forests, and monitoring and accounting for reduced emissions at a national scale may also

be beyond the capability of low-income countries. Certainly, past failures – in many countries – to conserve forests for purposes such as biodiversity conservation, and landscape and intrinsic values, should serve as a warning that forest conservation for carbon sequestration will not be as straightforward and simple as some advocates anticipate.

Low-income, resource-poor countries will continue to face challenges with regard to carbon
management, largely on account of continued degradation of resources arising from intense
human pressures. However, there is scope for improvement if carbon sequestration is
regarded as a bundled service, encouraging farmers and other landholders to plant trees
as part of a package of benefits, with carbon as one of the components.

Ecosystem services: implications under the low growth and stagnation 'bust' scenario

A prolonged downturn and economic stagnation will have a number of direct and indirect effects on the provision of forest-derived ecosystem services, as outlined below.

Conservation of biodiversity

- Long-term economic stagnation is unlikely to have any significant impact on biodiversity in developed economies. Land use has long since stabilized in these countries and very little change is expected on account of slower growth and economic stagnation. Lower government budgets may affect some more marginal conservation projects, but impacts would be at the fringes of national programmes.
- Emerging economies and some middle-income countries will face a very different situation. Many are in transition towards stabilization in land use. A prolonged downturn in the global economy, especially precipitating declines in the industrial and services sectors, would imply increased pressure on land and resources, adversely affecting biodiversity conservation efforts.
- In low-income, forest-rich countries, most large-scale forest clearance is driven by growing global demand for food, fuel and fibre. A widespread slowdown implies declines in demand for most commodities (for example, timber, rubber, palm oil, soybean) and this could, under certain circumstances, reduce the pace of forest clearance, helping to slow the loss of biodiversity. Increasing demand for food and other NWFPs could, however, push selected wildlife populations towards extinction and further deplete numbers of sought-after plant species.
- Low-income, resource-poor countries will witness continued degradation of forests; especially as opportunities for employment in the industrial and services sectors decline and pressures shift towards forests and woodlands for subsistence and employment.

Watershed values

The flow of watershed values under the low growth and stagnation scenario will follow that of biological diversity as they are both closely related to stability in land use and changes in society's ability and willingness to meet costs. As no major land-use changes are expected in developed economies, flow of watershed values in these countries will, on the whole, remain unchanged. A different situation will prevail in emerging and middle-income economies. A prolonged economic downturn will increase pressures on land, as employment in industrial and services sectors declines. On the other hand, a reduced pace of forest clearance in forest-rich, developing countries – in response to declining commodity prices – will act in opposition. Low-income, resource-poor

countries could, however, witness accelerated degradation of watersheds as the economic downturn increases land-use conflicts and institutional weaknesses become more pronounced. Overall, watershed rehabilitation programmes would likely suffer budget cutbacks, along with many other programmes.

Land degradation and desertification

Economic stagnation is similarly unlikely to have significant impacts on land degradation and desertification in developed economies in view of the relative stability of land use. However, the scenario could have some impact on emerging economies as public investment in afforestation and desertification control is scaled down in response to reduced government budgets. However, this would not necessarily be the case if investment in improved land management were seen as a possible economic stimulus and means to create employment in rural areas. A number of countries are already investing in land improvement, including soil and water conservation and afforestation.

Low-income countries would likely face the prospect of increased land degradation and desertification in the context of reduced ability of farmers and other players to invest in improved land management.

Landscape values and ecotourism

Along-term, economic slowdown will have significant impacts on demand for ecotourism, especially as households curtail expenditure on non-essential items. The tourism sector has witnessed a major decline since mid-2008, affecting many countries, in particular, some of the small island economies where a major share of income is derived from tourism.

Carbon sequestration and storage

A prolonged economic downturn will affect both market and non-market carbon mechanisms, although net impacts may be relatively small due to opposing income and substitution effects. Total global carbon emissions can be expected to decline in the context of an economic slowdown, consequently the demand for certified emission reductions should also decline; significantly reducing carbon prices. A decline in carbon prices will be a major disincentive to conserving forests and taking up afforestation and reforestation efforts, especially in relation to activities in voluntary carbon markets. However, a downturn in the global economy also implies a significant reduction in demand for other wood-based commodities, reducing the opportunity cost of forest-based carbon sequestration.

Lower economic growth rates may potentially affect international transfers in support of carbon sequestration, as developed countries could reduce the scale of international assistance. This would affect at least some afforestation and reforestation activities, as well as forest conservation prospects under REDD. However, as for developed countries, under a low growth scenario the lower returns available from industrial forestry and other economic activities that promote deforestation and forest degradation would also reduce the opportunity costs of REDD-based activities.

Ecosystem services: implications under the 'green economy' scenario

The interaction of various factors – desire to reduce energy dependency, health concerns, environmental shocks, calls for social justice and international incentives to introduce sustainable resource management – will help to drive the adoption of green policy paths and move countries

in the direction of green economies. Large-scale investments in renewables, reforestation, clean technologies and energy efficiency have already been made in some economies in the region – although there is still a long way to go.

By definition, a 'green economy' scenario will have significant positive impacts on the provision of ecosystem services. In almost all countries, there are efforts, albeit sometimes isolated, to pursue green approaches to development, especially by civil society organizations and local communities. These include local level efforts to protect forests and sacred groves, manage watersheds and harvest rainwater, adopt improved cook-stoves and afforest degraded areas, among others. These efforts could form starting points for more coordinated efforts to chart courses towards green economies.

Policies and institutional arrangements under the 'green economy' scenario will be founded on improving the wide-ranging flow of ecosystem services. Through alteration of political and economic priorities, a fragmented approach to addressing diverse environmental problems would be replaced by more integrated approaches; simultaneously addressing biodiversity conservation, watershed protection, desertification control and climate change. With broader policy and institutional arrangements, geared to promote green development, existing isolated efforts could be scaled up considerably. These could be supported by investments in efficient technologies, thereby reducing carbon footprints and minimizing adverse effects on the environment. In general, the 'green economy' scenario will have implications similar to those outlined below. However, within a time horizon to 2020, only initial steps are likely to be possible.

Conservation of biodiversity

- In the developed economies the 'green economy' scenario is likely to lead to improved attention to conservation, including enhanced budgets for protected area management. Conservation programmes would be accorded higher priority at all levels, including programme areas that have to date been viewed as less critical. New arrangements, including greater focus on mechanisms such as public-private partnerships, might be expected. Tending of unmanaged forests to improve forest health would also become a priority in countries where such activities have been accorded lower priority in the past.
- In emerging and middle-income economies, greater attention will be paid to ecological diversity. Agricultural intensification rather than extensification will provide room for coexistence of natural habitats alongside more managed areas and improved technologies for utilization of forest and agricultural products will reduce the long-term need for expansion of large-scale monocultural crops. Expansion of markets for green products will provide a premium for sustainable (production) forest management while trade restrictions in highpaying markets will also support increased attention to legal trade in forest products and other FLEG-related activities.
- In low-income, forest-rich countries similar moves to those in emerging and middle-income economies would be expected. Additionally, political agreement over the importance of different land uses will attract funding from international sources to help pay for existence values and ecosystem services associated with biodiversity. Measures regulating trade in wildlife and endangered species will be better enforced while awareness of consequences of ecosystem mismanagement will be raised among consumers and funding for protected areas will be increased.
- In low-income, resource-poor countries, the 'green economy' scenario may have little effect due to scarcity of funding and continuing pressures driven by resource deficits. Policy improvements and greater commitment to a green path could, however, attract greater international funding for biodiversity conservation.

Watershed values

As in the case of biodiversity conservation, a clear approach to land management will help to improve watershed values.

- In the developed economies watershed values are unlikely to be greatly affected by a 'green economy' scenario as pressure on forests in upland areas is generally low and existing levels of watershed protection are adequate.
- In emerging and middle-income economies, the situation is likely to be similar to developed economies following major efforts in recent years to improve watershed management. Countries that have yet to implement strict watershed protection measures are likely to turn the corner, particularly if environmental catastrophes mobilize public opinion. Market and non-market mechanisms will help to ensure that upland communities are compensated to maintain watershed services.
- In low-income, forest-rich countries, watersheds are often affected by shifting cultivation, poor quality roads and forest degradation. Under the 'green economy' scenario, greater efforts are likely to be made to improve sloping land agriculture, often by introducing trees and perennial vegetation. Landslides and floods could also stimulate measures to improve management of protection forests and upland catchments.
- In low-income resource-poor countries the scope for improvements in watershed management will be somewhat dependent on budget availability. However, re-prioritization of government initiatives would likely see even greater focus on provision of safe water supplies and so some improvement of watershed management could be expected, especially in high population areas.

Land degradation and desertification

Land degradation and desertification will slow down considerably in the context of an integrated approach to land use, as will be expected under a 'green economy' scenario. As noted earlier, a wide array of preventive and remedial measures is available to prevent desertification of fragile lands. Careful land husbandry, including through water and soil conservation, will help to restore and improve land productivity and this will be accorded high priority in green economies.

- In developed economies the 'green economy' scenario is likely to lead to improved attention to issues such as desertification, soil salinization, overgrazing, establishment of riparian areas, landslide protection, fire management, and so forth through forest-related measures. Tree planting and implementation of agroforestry to address some of these will also increase carbon sequestration and improve biodiversity conservation.
- In emerging and middle-income economies, existing efforts to control land degradation and desertification are likely to be strengthened and efforts are likely to be made to reduce livestock numbers and introduce stall feeding to allow vegetation to regenerate.
- In most low-income, forest-rich countries, land degradation is not yet a serious problem yet and therefore the 'green economy' scenario may produce little change. However, where problematic, many of the activities noted above are likely to be given increased attention as budgets permit.
- In low-income resource-poor countries budgetary issues will remain a major constraint to implementing measures to arrest land degradation. However, a 'green economy' scenario could be expected to mobilize significant new and additional resources for international

development assistance and this could provide scope for significant improvements in the status quo.

Landscape values and ecotourism

Under the 'green economy' scenario, promotion of landscape values and ecotourism will become a central theme. Improved access to sites of biological and ecological interest will increase flows of visitors from developed and emerging economies. Huge newly wealthy populations in the region may begin to travel much more widely, eager to explore the cultures and natural wonders that abound in the region. Competition to attract visitors will increase and countries with the best preserved and most remarkable sites will become increasingly well known and ecotourism ventures in these areas will flourish. Direct incentives to promote development of ecotourism industries may be offered in some countries. Returning to the countryside – already a popular holiday pastime in much of Asia – will take on a new meaning as growing middle classes become ever more intrepid and seek to rediscover nature.

Provision of sites for recreation is a related ecosystem service that will witness a rapid increase in importance under a 'green economy' scenario, especially in developed and emerging economies, where demands for forest-based recreation will burgeon. Providing adequate recreational resources that are conveniently located near to population hubs will be challenging. Ensuring such recreational forests are managed sustainably, and that benefits are distributed equitably, will also pose a challenge where populations are very high and stakeholders abundant.

Carbon sequestration and storage

A 'green economy' scenario will promote more balanced approaches to land use that will reduce the pace of deforestation and degradation. Rather than shifting responsibilities to undertake carbon sequestration to other countries (especially developing countries with very low emission levels) and to other sectors that can sequester or conserve carbon at lower costs, most countries and sectors would incorporate carbon management as an integral part of all economic activities. This could significantly reduce the demand for forest-based carbon sequestration, although improved forest management under the 'green economy scenario' would nonetheless considerably enhance carbon sequestration.

- In developed economies, the 'green economy scenario' is likely to lead to increased attention to mitigating and adapting to climate change. Greater efforts at home and abroad would be expected from nations endeavouring to reduce carbon footprints. Efforts are likely to include forestry as a low cost means of increasing carbon emission reductions and greater use of wood products is likely to become a growing theme as the relative greenhouse gas implications of increased concrete, steel and brick use are calculated.
- In emerging and middle-income economies, afforestation and reforestation are likely to play a greater role in climate change mitigation. Expansion of forest areas may also play an important role in meeting demand for wood products as forests in low-income forestrich countries are increasingly protected under climate change covenants. Forests are also likely to play a greater role in climate change adaptation, especially in coastal protection and watershed management.
- In low-income resource-rich countries, reduction of deforestation and forest degradation will be a major focus under robust and well-financed REDD programmes. However, widespread success in REDD-based forest conservation may prove elusive even with a change in policy focus due to institutional constraints and demand for land and resources around the region. It may be that the focus of climate change mitigation activities in forestry will be confined to countries with stronger governance and more developed institutional systems.

• Poorly developed institutional frameworks will also be likely to limit the scope of climate change adaptation and mitigation activities in low-income resource-poor countries.

The overall implications for provision of ecosystem services under the three scenarios are indicated in **Table 6.2**.

Table 6.2.	Forest situation in	2020: implications of	various scenarios	for forest-derived e	ecosystem
services					

Ecosystem services	High growth scenario	Low growth and stagnation scenario	'Green economy' scenario
Conservation of biodiversity		Þ	*
Watershed values			×
Mitigation of land degradation and desertification			
Landscape and amenity values		X	1
Carbon sequestration and storage	*		

FORESTRY SITUATION IN 2020: A SUMMARY

The enormous diversity in economic, social, political and institutional conditions among the countries of Asia and the Pacific make it extremely difficult to provide a generalized description of changes in forests and forestry that are likely to be applicable to the whole region. In particular, much of what influences change in forests and forestry will be driven by changes outside the forest sector, rather than actions within the sector, and there is enormous variance in extra-sectoral conditions among countries in the region. The Asia-Pacific forestry situation in 2020 will undoubtedly continue to provide a mosaic of situations, reflecting larger changes in demography, economy, political and institutional environments and developments in science and technology. However, some of the overarching trends likely to dominate in the foreseeable future are described below.

Deforestation and forest degradation will remain a major challenge

Forest clearance for production of wood, food and fuel will continue to be an intractable problem in several low-income, forest-rich countries. Much of this will be in response to demand from emerging and developed economies. Increased infrastructure development, and road construction in particular will bring immense pressure to previously isolated areas by increasing accessibility to markets, thereby raising the opportunity cost of land in these localities. This is likely to result in conversion of forest to more economically attractive land uses. In most cases, even with climate change-related funding and other incentives, forest conservation or sustained management for production are unlikely to be able to compete. Mining, the spreading of urban development, and encroachment of agricultural development into forests areas will also result in reductions in forest area, particularly in low-income forest-rich countries. Improved land-use planning and more open and transparent systems of land allocation will help to lessen potential social and ecological problems. International financing in relation to environmental or climate-related services may also result in some slowing of deforestation. Forest degradation will also remain a major problem, especially in the densely populated low-income countries with limited resources. Demand for food, fibre and fuel will place increasing pressure on these limited resources, especially in the absence of income diversification opportunities. This will be the case especially in more geographically isolated and less globally integrated localities and countries.

Poor logging practices in more forested parts of the region are also causing severe forest degradation. The legacy of uncontrolled logging is likely to influence not only ecosystem integrity and robustness, but also future economic viability and therefore sustainability of natural forest management. Additionally, in equatorial areas where forests are less fire resistant, opening and drying of forests as a result of uncontrolled logging may act together with increased frequency of human-induced fires and climatic anomalies – drought in particular – to precipitate ecosystem collapse over large areas.

Sustainable forest management will remain elusive in practice

Despite wide-ranging efforts to encourage sustainable forest management, actual implementation will continue to be a challenge. Undefined or overlapping property rights, weak governance (largely stemming from ineffective policies and poorly developed institutional capacities) and high demand for wood and wood products will continue to promote unsustainable logging, overexploitation of resources, and clearance of forests for agriculture and other land uses, particularly in less developed countries. The economic viability of management of natural forests for second and third cutting cycles is also likely to fall in many tropical areas given widespread changes in ecosystem composition towards non-commercial species and poor productivity resulting from excessive damage from past logging operations.

While there will continue to be much discussion of provision of ecosystem services, the least attention will be given in countries where it is most needed. Ecosystem services derived from production and protection forests are likely to fall most steeply in these countries, while conservation forests, although under threat, increasingly act as the last bastion for biodiversity. Watershed- and carbon-related services from trees outside forests may partially redress ecosystem service losses from continued forest degradation. In general, the best forest management will continue to occur in countries that have the greatest financial and technical capacities, while continued neglect will be the order of the day in the poorest and least developed countries.

Box 6.6 Incidence of logging bans

Catastrophic environmental problems – especially floods and landslides – have often led to radical responses, logging bans in particular. These types of responses may proliferate in some countries, especially if predictions of extreme weather events come to fruition. However, the effectiveness of such radical measures in the past has been mixed and implementation of bans has often led to deforestation and degradation through abandonment of management, reduction in perceived value of forests and inadvertent creation of perverse incentives. In many cases such bans have also transferred forest degradation to other countries.

Source: Durst *et al.* (2001).

No shortage of industrial wood supplies

Notwithstanding increasing demand for wood and wood products, no major shortfalls are anticipated in regional supplies of wood. A slowing of wood demand in developed economies in Europe and North America will help to offset increasing demands from the Asia-Pacific region, especially wood-deficit subregions of East Asia and South Asia. Shifts in terms of sources of wood supplies to countries like Russia, Australia and New Zealand are already evident. With declining demand in North America, especially the United States, countries supplying the United States' markets will increasingly focus attention on the emerging Asian markets. There is also considerable scope for enhancing domestic wood production in high demand countries such as China and India through improved management of existing forest plantations.

While the overall wood supply situation seems to be satisfactory, there will be areas of acute deficit, especially in densely populated countries and where overall biological productivity is very low. Wood scarcity will be particularly challenging in such localities that are also poorly integrated with larger markets on account of geographical isolation, low purchasing power and governance problems.

Trade patterns will encompass new values

Patterns in Asia-Pacific forest trade are likely to further alter in the next decade by at least as great an extent as during the past ten years. Considerable changes are likely to take place regardless of whether a high or low growth scenario is followed. Two main factors likely to play leading roles are: (i) levels of economic growth; and (ii) product preferences in high paying markets.

Burgeoning growth in emerging economies allied with enormous populations is likely to see enormous growth in demand for wood and wood products. In the same way that China has risen to prominence as a major importer and exporter of wood products and Japan's dominance of regional wood markets has dwindled, so too can marked change be anticipated in the forthcoming decade. Populous countries in South Asia could become major players, far beyond levels anticipated in this analysis, driving important changes in the types of products demanded and dominating consumer preferences and values.

Even with a rapid return to high rates of economic growth, legality-related regulations aimed at imports of wood to European Union and United States' markets are likely to significantly alter trade flows. Public procurement policies and corporate decisions are likely to have similar effects. With a large proportion of higher value-added products destined for these markets being manufactured in a few key countries, with wood sourced in low-income resource-rich countries, the leverage of such measures on regional trade is immense. Both producer nations and intermediate processing countries are likely to be significantly affected where capability does not exist along the market chain to meet legality and sustainability requirements. Under such circumstances, producers and manufacturers will need to find new markets either within or outside the region. Even where manufacturing is sustained, margins are likely to fall as a result of movement to lower paying markets.

Providing ecosystem services will be challenging

In almost all countries, demand for ecosystem services will increase considerably. However, the nature of demands – and the ability to fulfill them – will differ considerably. In most agrarian societies, watershed values and arresting land degradation will be primary concerns. In situations of high population density and low incomes, establishing trade-offs between competing objectives will remain a challenge. In many countries, maintaining levels of biodiversity will pose almost insurmountable problems and some losses are inevitable. As well as deforestation and forest degradation, the porosity of national borders and park boundaries, and huge demands for wildlife and plants for food, medicine

and other uses will mean a constant drain on populations of desired species regardless of protection efforts. Increased accessibility of previously more isolated areas as roads are constructed is likely to exacerbate rates of depletion. Improved financing for protected area management and restoration efforts may provide some respite although institutional weaknesses in the most biologically diverse countries could mean slow progress at best. Prospects for maintenance of watersheds and arresting land degradation may be more promising, especially because the consequences of continuing degradation are readily apparent to local populations. Ecotourism prospects will increase in line with economic growth, but will mainly offer forest conservation potential in small areas with exceptional scenic values.

Where climate change goes, forestry will follow

For a significant part of the last decade, some aspects of forestry have been largely in abeyance; awaiting the settlement and clarification of new climate change rules. Climate change undoubtedly offers enormous potential for forestry in Asia and the Pacific; in terms of both prospects for vast new resources to improve forest management, and prospects for enormous disappointment if such financing, and workable mechanisms to mobilize it, are not forthcoming. In the meantime, the forestry sector will continue to avidly watch climate change discussions. Governments will continue to defer policy development and implementation; the private sector will continue to defer investment decisions; and the forestry sector will continue to operate in a climate of hope, skepticism and uncertainty.

The policy focus will shift from formulation to implementation and enforcement

Over past decades, forest and forestry policies have been formulated to encompass the principles of sustainable forest management in almost all countries in the region. Implementation has, however, been lacking in all but a few. This has largely resulted from a disjuncture between identified goals and capacities to achieve these. Despite all the credentials of 'good' forest policy, many examples in the region are largely textbook models of forest policy; sometimes inappropriate for the circumstances into which they were born, and with enormous shortfalls in capacities for implementation. Recognition of these deficiencies and refocusing on grass roots forestry and what can realistically be achieved will become inevitable in many countries. Capabilities in terms of human resources, available knowledge, political will and financial support will have to be taken into account much more seriously if widespread adoption of policy aims is to come about.

New roles and opportunities will emerge for all sector participants

The current global focus on forest and forestry constitutes a unique opportunity in recent times for the forestry sector to deliver on society's priorities. Financing and trade-related stimuli to promote sustainable forest management offer prospects for new growth and directions in forestry in which many new participants will be involved. Decentralization, new trade instruments, carbon sequestration, conservation and watershed protection will involve a host of new actors and changed roles for existing forestry sector participants.

Gradual shifts towards local participation and individual and household ownership of forests mean that many more stakeholders will play deciding roles in the future of forestry by 2020. Facilitating and regulating the many, as opposed to the few, will be a very different task for forestry agencies in much of the region. Movement away from direct management of forests will also mean that high level integration and intersectoral coordination will be of much greater importance for forestry agencies to retain a raison d'être. Such a transition it likely to consolidate the role of forestry agencies even if the role is considerably altered. Roles of civil society organizations and the private sector will also continue to evolve. Where relationships between these groups (and often with governments) have been adversarial, there is a marked trend towards more collaborative approaches. Cooperation rather than confrontation is likely to be increasingly the norm.

SPECIFIC DEVELOPMENTS IN COUNTRY CLUSTERS

Developed economies

Most developed economies have relatively stable forest situations and no major changes are expected if past trends continue. Climate change impacts and especially prolonged drought may, however, impact forests in Australia and elsewhere, with increased incidence of forest fire a particular challenge. Continued efforts to improve fire-related forest management and reduce incidence of arson will be necessary to maintain conservation values of forests and inhibit land degradation. Otherwise, dependency on land for income and employment has declined and economic fluctuations are unlikely to bring about major changes as regards the extent of forests and how they are managed. Service functions of forests will continue to gain pre-eminence. Many developed countries are evolving as post-industrial knowledge societies, with reduced emphasis on manufacturing and increased emphasis on knowledge-intensive services. This accelerates the process of evolution into 'green economies', although 'off-shoring' production may have negative environmental effects elsewhere.

While most developed economies are in a strong position to deal with the adverse impacts of a prolonged economic downturn, their forest sectors will not be immune to changing market conditions. Wood production and processing by the private sector will be particularly affected, as declining demand drives down investments in forest management and wood processing. In many cases this may encourage changes in ownership and consequent land-use changes. Long-term economic stagnation will also affect public spending on forestry which could increase damage from pest outbreaks and fires.

Emerging economies

Under the economic growth and recovery scenario, the forest sector in most emerging and middleincome economies will change rapidly, especially in view of increasing demand for wood and wood products and renewed efforts to protect forest resources. Structural changes in economies, along with increased investments in afforestation and reforestation (and expansion of trees outside forests), will bring some stability to total areas under forests. However, in some cases, demand for wood and other raw materials may exceed domestic production, resulting in increased dependence on other countries. Under such circumstances, 'exported forest degradation' will continue to pose a threat to regional environmental security unless consuming countries move strongly towards preferential procurement of legally and sustainably produced products.

A slow growth scenario will have a number of direct and indirect implications on forests and forestry at national and regional levels. Within countries, reductions in growth imply a slowing of forest transitions, as manufacturing and services sectors contract and dependence on agriculture increases. At the same time, a prolonged downturn will affect governments' abilities to invest in management of forests; including afforestation and reforestation.

Low-income, forest-rich countries

Rapid economic growth will put enormous pressure on low-income, forest-rich countries on account of overall increases in external demands for food, wood, fibre and fuel. Under a rapid economic growth scenario, these countries will likely witness significant reductions in forest area or significant forest degradation as pressures for resource exploitation mount in the face of dwindling natural forests elsewhere. While these countries can expect to benefit economically from new opportunities, there will be a need to ensure that forest conversion is effectively regulated through policy and institutional reforms, and that incomes from forests are utilized for effective socio-economic development. With better husbandry of natural resources, these countries have tremendous scope to leapfrog onto green economy pathways.

Conversely, a prolonged economic recession should generate a slowing of forest conversion in forest-rich developing countries, on account of reduced demands for food, wood, fibre and fuel. However, this would also curtail opportunities to use resources for better social and economic development and a return to growth without reform would also signal a return to forest conversion and unsustainable management.

Low-income, resource-poor countries

Irrespective of economic growth rates, low-income, resource-poor countries face enormous constraints on account of the paucity of 'natural capital' on which to build strong economic foundations. High population densities, low levels of human and natural resources, and high incidences of poverty contribute to unsustainable use of forests and other resources. Degradation remains a major problem. Even if economies grow rapidly, absolute increases in incomes are likely to be inadequate to reduce dependence on forests. Challenges are compounded by poorly developed policy and institutional frameworks and a dearth of skilled human resources to manage resources sustainably at industrialized levels. Some improvements can be anticipated in the context of rapid growth, under which the pressure on resources diminishes on account of remittances and international assistance. However, continued low growth of economies is likely to exacerbate problems of resource degradation.

Small island countries

Forests and forestry usually play a very limited role in the economies of small island countries, which tend to rely largely on tourism and fishing as the main sources of income. While provision of subsistence supplies of wood for construction, fuel and cultural purposes are important, provision of ecosystem services is the primary function of forests in most small island countries. These include protection of coastal zones, improvement of watershed values, shelter and, as an important component, contributing to ecotourism. Continued rapid economic growth implies expansion of tourism with both positive and negative impacts on forests and trees. Establishing trade-offs between development and conservation will continue to pose challenges. An economic downturn could, on the other hand, significantly reduce tourism income, presenting a different set of land-use challenges. Improvement of the forestry situation in small island nations depends on the specific situation in each country and the opportunities and challenges faced in pursuing available options.

The Asia-Pacific region's forest situation will continue to change during the next decade and beyond, in response to the collective impacts of various drivers of change. Demand for forest products and services is expected to increase considerably, but many countries will be challenged to reconcile conflicting demands and to establish acceptable trade-offs among competing needs. While there will be a number of positive changes in some countries (for example, enhanced afforestation and reforestation efforts and expansion of farm tree-planting), other countries will have to deal with increased forest clearance and degradation. An understanding of the drivers of change and how different scenarios may unfold helps to identify how the sector may deal with the various challenges.

Forestry priorities and strategies will have to be country-based and will depend on national visions of how societies will change and how forests and forestry should respond at different stages of societal evolution. As discussed earlier, a range of development pathways are likely within Asia-Pacific countries, with key bounds determined by high or low growth rates of economies, and varying levels of social and economic sustainability. Achieving high growth rates remains the primary thrust in most countries and it is assumed that social and environmental dimensions will be taken care of through trickle-down processes. However, increasing social and ecological vulnerability are encouraging countries to shift towards green pathways encompassing greater sustainability. Efforts towards climate change adaptation and mitigation are encouraging such shifts; for example, by reducing dependence on fossil fuels and increasing the share of renewable energy. The pursuit of green paths has received increased national and international attention in the context of the recent economic crisis.

The discussion below – on priorities and strategies – assumes that most countries, irrespective of their divergent conditions, are interested in pursuing a 'green economy' scenario and would prefer to take measures aimed at enhancing social and ecological sustainability, though not necessarily at the expense of economic growth. While details will have to be worked out to account for specific conditions in each country, this chapter provides a broad outline of priorities and strategies that could enable countries to shift towards green paths by focusing on enhancing social and ecological sustainability.

OVERALL PRIORITIES

The focus of international discussions on forestry reflect only a small portion of overall forestry issues and activities but often consume a disproportionate amount of attention and energy, especially from government forestry officials. For example, the present enthusiasm for climate change and forest law enforcement and governance, although inspiring, often seemingly denies the importance of the vast majority of on-the-ground forestry-related activities – growing timber, collecting fuelwood and NWFPs, logging, manufacturing products, trade, etc. Of course, the international focus could turn towards some of these issues and have major implications for forestry but, in the meantime, the practical aspects of forestry should not give way completely to more distant goals.
In summary, the following broad priorities should garner considerable focus in the Asia-Pacific region.

Rebuilding natural resource bases and conservation of existing resources

Although the Asia-Pacific region is unlikely to face large-scale wood shortages in the near future, rebuilding the forest resource base and conservation of remaining resources will remain an utmost priority. Already, there is considerable dependence on wood and wood product imports and indications are that such dependence will increase in future years. However, factors such as increases in transport costs or increased emphasis on reducing carbon footprints in transport could significantly affect wood supplies to the region. At the same time, rebuilding natural capital bases offers significant opportunities for economic development, particularly through new job creation. Forestry's potential for employment generation stems from several factors, including the labour-intensive nature of many forestry sector activities and low capital requirements (with the exception of some forest industries such as pulp and paper and panel products).

In the meantime, escalating demands for food, fibre and fuel from natural resource-deficit countries are putting enormous pressure on resource-rich countries – within and outside the region. As demands increase, land conversion becomes increasingly attractive as a means of income generation. Consequently, more forests are likely to be cleared, as is already happening in several countries in Southeast Asia and Oceania (especially Melanesia) and outside the region. Concerted efforts will have to be made to sustainably manage resources and to ensure the removal of perverse incentives that encourage land conversion and 'exporting of forest degradation'.

Most importantly, many ecosystem services are non-tradable and will have to be provided *in situ*. As populations continue to increase and become more wealthy, demand for some ecosystem services – especially clean water, forest recreation, arresting land degradation and desertification, and carbon sequestration – will increase significantly. Without effort at mitigation, natural resource deficits – particularly severe in densely populated countries – will lead to further overexploitation and continued degradation. Major efforts are also required to slow the loss of irreplaceable biodiversity through species extinctions. Undoubtedly, the forest stewardship of current generations will be judged harshly by our successors, in terms of irresponsible and reckless loss of biodiversity.

Upstream forestry activities – afforestation, reforestation, improved management of natural forests, conservation, watershed protection, agroforestry, urban forestry, etc. – also directly contribute to climate change mitigation and adaptation. Better management of forests to reduce fuel loads will also reduce the intensity of forest fires and consequent carbon emissions.

Rural development, employment generation and poverty alleviation

While urbanization is a major demographic trend in Asia and the Pacific, the majority of the region's population will remain rurally-based. With the low incomes attendant to semi-subsistence agriculture, poverty will remain a major issue for several countries in the region, especially in South Asia. At the same time, rapid economic growth is enhancing rural-urban divides.

Absence of opportunities for productive employment is one of the major problems facing communities living in forested regions. With significant reductions in forestry activities, especially harvesting and silvicultural operations, employment opportunities for many forest-dwelling communities have declined. Increased focus on afforestation and reforestation, management of natural forests and plantations, silviculture, fire protection, and so forth, could significantly enhance employment opportunities, increase rural incomes and, at the same time, help to rebuild natural resource bases. A number of countries have already initiated rural employment generation

programmes that include afforestation and reforestation as important components.

Increased reliance on industrial and services sectors for income and employment has to some extent reduced investments in primary production including forestry. However, conditions of low economic growth may provide opportunities for forest rehabilitation and afforestation as part of government fiscal stimulus and employment generation packages (Nair and Rutt 2009). Private forest owners (individuals, families, enterprises and communities) are likely to have scaled down their investments in forestry and forest management in response to the economic downturn and associated declining wood demand. This suggests that governments should consider including forestry in stimulus packages to ensure that future supplies of products and services are sustained.

Targeted public investments could generate a significant number of new jobs in the forestry sector. Most of this employment would be in rural areas, where it would positively impact on rural poverty. Unemployment and subsistence needs have been major factors contributing to deforestation and especially forest degradation in most countries. Employment in sustainable forest management thus has a double benefit: while it builds the natural asset base, it also reduces the deforestation and degradation that often occur when other income-earning opportunities are absent (Nair and Rutt 2009). Such employment could also strengthen the management of protected areas, improve watersheds, create new urban and peri-urban green zones and reduce the incidence of fire.

Sources of revenue to fund job creation could be derived from climate change-related mechanisms, or supported by national budgets where constraints are less severe. Failure to invest in the natural resource base will, for some countries, herald an end to the 'development subsidy' provided by natural resource abundance. The implications, not only for future employment, but also for national economic growth and environmental security are likely to be highly negative and investments made now will avert spiraling costs in the future.

In all cases, forestry agencies should make maximum use of newly available funding for environmental protection and rehabilitation, especially in relation to climate change adaptation and mitigation. There is unlikely to be another period when investors are so receptive to financing forestry for many years to come.

Enhancing efficiency of raw material/energy use

With the burgeoning demand for various products, it is imperative that the Asia-Pacific region pays greater attention to enhancing efficiency of raw material and energy use. One area that particularly requires attention is improvement in the efficiency of wood energy use. A wide array of technologies is already available and, with greater attention to policies and other incentives, it is possible to significantly improve the output of products and energy. Increased use of wood residues for local processing and energy generation is another area that warrants attention. With increasing markets for wood chips and wood pellets and with small-scale energy generation equipment becoming increasingly affordable, wood energy could not only improve rural livelihoods but, where wood is sustainably produced, reduce carbon emissions.

Further increases in recycling would contribute to meeting growing demand for paper and paper products while reducing the need for expansion of monocultural plantations and harvesting of fibre from natural forests. Some gains in carbon efficiency could also be expected where non-fossil fuel energy supplies are used in paper production.

Governance

There is an overarching need to strengthen governance – in general terms as well as specifically within the forestry sector. Poor governance increases the risks attached to investments; with the term 'investments' being used in a very broad sense to encompass the plethora of contributions to forestry development – financial or otherwise. These cover such diverse spheres as overseas development assistance, plantation development, education programmes, carbon sequestration, research facilities, wood processing, forest management, etc. Although transitions in Asia-Pacific economies have taken place with astonishing speed in the past, they have largely been driven by economic imperatives that have sometimes run ahead of capacities for effective governance. Attention to reducing or eradicating corruption including endemic bribery and extortion will be important in improving investor confidence and creating efficient industries.

Increased global attention to governance and moves to block illegally harvested products from entering high paying markets should provide an incentive for greater attention to sustainable and legal production of timber and forest products. If forestry export opportunities are to be maximized, Asia-Pacific governments will need to implement administrative mechanisms that facilitate provision of proof to importers that timber exports comply with national laws and statutes. Governance will also be a critical prerequisite to attracting REDD- and other carbon-financing. Countries with poor governance will be severely disadvantaged in competing for funds, with money gravitating to where investors have confidence.

Table 7.1 lists priorities for the various country clusters in the Asia-Pacific region. Considering the divergence of situations among countries in the same clusters, it is important that these priorities are refined to take into account specific country situations.

Cluster	Priorities
Developed economies	 Provision of ecosystem services, especially recreation and carbon sequestration in the context of emission reduction commitments. Improved processing technologies to produce a wide array of new products (e.g. through biorefineries) and to enhance efficiency in the use of raw materials and energy. Maintaining competitiveness: (1) of forest industries in the face of high labour costs and reduced natural advantages; and (2) of forestry as an attractive employment option.
Emerging economies	 Large-scale afforestation and reforestation to meet growing demands for wood and wood products and ecosystem services. Increase investments in wood and wood product industries to enhance production and improve efficiency in the use of raw materials and energy. Improving governance and strengthening investor confidence. Attracting carbon financing. Bridge widening rural-urban divides by promoting small and medium forestry enterprises.
Low-income, forest-rich countries	 Improve conservation and management of existing forests. Streamline land-use planning to minimize adverse environmental impacts from unavoidable forest clearance. Increase investments in value addition. Policy and institutional reform, especially to ensure that resources are sustainably managed. Strengthening forest law enforcement and governance. Attracting carbon financing to the forestry sector.

Table	7.1.	Forestry	priorities
-------	------	----------	------------

Low-income, forest-poor countries	 Strengthen afforestation and reforestation efforts to enhance natural asset bases. Integrate tree growing and forest conservation into larger land-use contexts. Emphasis on forestry to support rural development, including employment generation. Policy, institutional and governance reform to enhance the involvement of local communities and farmers in improved land management. Attracting carbon financing.
Small island economies	 Improve forest management for the provision of ecosystem services (especially in support of tourism and fisheries). Integrate forests and trees with other land uses to enhance landscape values. Identify and develop niche markets for forest products. Enhance the protection of coastal areas.

STRATEGIES

Most countries have a range of approaches and strategies to accomplish the priorities indicated above. Broadly the key areas that require greatest attention are:

- (a) improvements in policy, legal and institutional frameworks;
- (b) building capacities for grassroots forestry;
- (c) strengthening science and technology capacities;
- (d) improving education and awareness;
- (e) developing societal consensus; and
- (f) strengthening leadership and communication.

Policies and institutional improvements

Policies, legislation and institutional arrangements should empower people to undertake individual and collective actions, helping to resolve conflicts and establish acceptable trade-offs between competing and conflicting objectives. Many sector-focused approaches to policy formulation and institutional development will need to be replaced by more integrated approaches. Issues that will require immediate attention include:

- Tenure reform. Tenure will remain one of the core issues in empowerment of local communities and in enabling them to undertake activities that could help address poverty. Many existing policies and pieces of legislation still adopt narrow sectoral approaches that make clear distinctions between forestry and agriculture, and how these are administered and regulated. With the increasing role of land outside forests in producing wood, as well as ecosystem services, traditional approaches and related policies and legislation become less tenable. It is important to visualize situations where most land is owned and managed by smallholders producing most goods and services efficiently. This also entails recognition of the role of informal sectors and creation of enabling conditions within tenure arrangements to shift much of the informal sector into the formal domain.
- Reform of public sector agencies with emphasis on facilitation and regulation while shifting managerial functions to the private sector, including farmers and communities. To be successful and remain relevant, institutions need to ensure flexibility, strategic management capabilities, strong 'sensory' capacities and an institutional culture that responds to change (FAO 2008b). Significant effort needs to be focused on strengthening local level institutions (including cooperatives, farmers' associations and community organizations) to manage resources sustainably.

- Improved land-use planning and careful management of land conversion programmes. Without political agreement over the position of forestry in national economies and firm plans for designation of areas according to needs and land capabilities, a foundation for investment in a sustainable future will remain underdeveloped. This will have significant repercussions on long-term economic growth. At the same time, enforcement of decisions will need to accompany improved planning. Institutional frameworks will need to correspond to ground-level jurisdictions without leakage and associated inefficiencies becoming endemic. Clear demarcation of permanent forest areas will be an important step for some countries. However, there will be situations where some forest clearance is inevitable. In these cases, it is important that forest land-use changes are carefully planned to minimize adverse environmental impacts and to ensure that land conversion has a net positive welfare impact in the long term. With improved GIS technologies, more systematic planning is feasible, which should lead to reduced adverse consequences.
- Creating enabling environments. Forestry in many countries is still too prescriptive and paternal; failing to give people sufficient encouragement to succeed. Policies and legislation need to be structured to ensure they create enabling environments in which incentives reward 'good' behaviours and penalize the 'bad'. Policies that empower people to make decisions to help themselves, through innovation and entrepreneurship, are necessary; while government emphasis should be on regulation to ensure activities are not exploitative or destructive.

Grassroots forestry

The enthusiasm for various topical issues in forestry – poverty alleviation, devolution, climate change, FLEG – can overwhelm the importance of on-the-ground forestry activities. Often the reality in the field is that forest management cannot keep pace with developments in national and international dialogues; at times this may be ignored or go seemingly unnoticed. While theory, science and policy may advance; at the grassroots local levels – where the trees are and where demand for livelihoods, wood and ecosystem services are increasing – lack of capacity and knowledge are often highly constraining.

Consequently, international agreements and policy development need to be accompanied by practical steps towards improvements in forest management. Guidelines and codes of practice are often insufficiently disseminated or adhered to and science and technologies, although developed, often do not make it to the field level. For example, local level fire management is rarely supported despite education and rapid response being the only efficient way to control forest fires. Similarly, lack of forest rangers and guards means that biodiversity losses will continue to occur and carbon stocks will be at greater risk. Reduced impact logging is rarely practiced despite its ecological, economic and social benefits. As such forestry extension and major attention to training, capacity development and enforcement of regulations are sorely needed if hopes are to become realities.

Investments to improve science and technology

Enhancing social and ecological sustainability requires major improvements in science and technology capacities. Resource misuse often stems from absence of knowledge and deficiencies in science and technology capability. To change the current pattern of resource use, stronger inputs from science are necessary. The focus is, however, not so much towards research, but in translating existing knowledge into technologies that use energy and materials more efficiently. Capacity development in the past has largely been focused on economic profitability, while social

and ecological dimensions have largely been ignored. In the context of mounting social and ecological problems, science and technology developments should focus on enhancing resource and energy efficiency, including increased use of renewables. Some of the specific areas that require attention are:

- Improved and affordable techniques for soil and water conservation.
- Improved techniques for afforestation and reforestation and to enhance productivity of existing plantations.
- Greater uptake of reduced impact logging and remote sensing technologies.
- Efficiency in the use of raw materials and energy, especially enhancing efficiency in the use of wood as a source of energy.
- Alternative energy sources (for example solar, wind and fossil fuels) for pockets with acute wood scarcity, where wood energy options are economically and ecologically unviable.
- Reduced disincentives that inhibit (or provision of incentives that stimulate) the development and adaptation of more environmentally- and socially-acceptable technologies.
- Improvements in access to information and linking of farmers and communities with markets.

Investment in human resources

The time scales over which changes in forestry occur and the current lack of skilled human resources in many countries in the region point to a clear need to improve education in a general sense and also to increase awareness in relation to forests and natural resources. The region's growing population and the skew towards younger generations in many countries place greater emphasis on the need for improved education and awareness. Without an 'environmentally smarter' next generation of consumers and decision-makers, it is likely that resources will be irretrievably eroded through population pressure and environmentally sustainable practices will fail.

More immediately, the current lack of human resource capacity in forestry and increasing complexity of forest management, imply that high quality education and training need to be made available to those working in forestry and related disciplines at local, provincial and national levels.

Societal consensus

Continuation and acceleration of efforts towards achieving societal consensus in how forests should be managed, and for which purposes, will be a key element in effective forest management in the coming decade. The core elements of these strategies are well understood including attention to livelihoods, participation, consultation, democratic decision-making and principles of equity. These sit at the core of effective forest management (**Box 7.1**).

Box 7.1 Towards a model of good forest management

An APFC initiative In search of excellence: exemplary forest management in Asia and the Pacific concluded that social and community consensus on how forests should be managed, and for which purposes, underlied and overlay the core components of good forest management:

"...various elements of excellence in forest management can be drawn together in a simple model (that)... stresses the importance of inter-relationships between and among a range of components – commitment, resource security, attention to improving livelihoods for local people and/or profitability, sound institutional and management frameworks, attention to silviculture and ecosystem management, and application of sensible management philosophies. The core of the model is anchored on reaching societal consensus with regard to how forests should be managed and what we want from forestry. Overarching the model is a holistic approach to management that recognizes the roles of the forest within broader ecological, economic and socio-cultural systems."

Source: Durst et al. (2005).

The challenges that confront forestry – with respect to climate change and otherwise – and difficulties in implementing more complex forest policy through centralized mechanisms suggest that much greater inclusion of forestry stakeholders at various levels is necessary.

Traditional forms of forest governance that focus on hierarchical, top-down policy formulation and implementation by the nation state and the use of regulatory policy instruments are insufficiently flexible to meet the challenges posed by climate change (Seppälä et al. 2009).

In support of this goal, greater efforts are required to integrate public opinion into decision-making and build levels of awareness in relation to forests and forestry such that policies are appropriate, widely supported and can be easily implemented with broad community support. Increased attention to national forest programmes can contribute to these aspects.

Leadership and communication

An unfortunate fact in many countries is that forestry, regardless of its economic importance, is accorded relatively low priority within government. The forestry portfolio is often held by relatively junior ministers or as a minor portfolio and forestry departments are usually subsumed within broader ministries for natural resources, environment or rural industries. The forestry environment is also being fragmented by increasing diversity of specialist agendas, which further dilutes the prospects for forestry agencies to provide leadership. In such circumstances, the development of strong advocates and champions for forestry advocates may arise outside the government, often they are perceived to be pursuing their own interests or narrow agendas. In the Asia-Pacific region, where many cultures promote humility and maintaining consensus, this lack of advocacy and leadership to drive change often appears particularly acute. Even in some of the most 'successful' forestry countries, for example China, a lack of sectoral authority is perceived as a significant constraint to forestry programmes (**Box 7.2**).

Box 7.2 Forestry administration in China

An APFC/FAO study on reinventing forestry agencies examined the impacts of institutional restructuring in forestry agencies in Asia and the Pacific. A key finding in China was that:

"Powerful forestry administrative organizations are necessary for the revival and development of forestry in China. In the State Council reform of 1998, however, the Ministry of Forestry was downgraded and re-organized as the State Forestry Administration (SFA) and although the state has constantly increased input into forestry to accelerate the pace of development, the SFA seems to lack authority. In addition, the re-organization and lowering of the forestry authority negatively influenced local forestry organizations. Some local governments abolished or incorporated their forestry organizations into other institutions and this resulted in numerous difficulties in forestry development."

Source: Zhang (2008).

Communication is very much at the heart of this issue and it is ironic that foresters may often be more inclined to retreat from the hue and cry and make for the woods. Nonetheless, it is of great importance that foresters learn how to better communicate to politicians and the public the importance of forests and related goals. Globally, and within the region, governments and larger organizations have employed communication specialists to bring key messages to wider audiences. With the current high profile of forestry, greater investment in communications may be warranted.

In all, a major challenge for forestry is to strengthen its sectoral profile and to develop more powerful champions, advocates and leaders. While some of this development undoubtedly comes through intangible factors, it could be promoted through provision of specialized training opportunities, greater encouragement and empowerment of staff, and significant institutional culture changes. This is important at all levels of forestry, but the emergence of more eloquent and powerful leaders and advocates at national and international levels could be a major driving force to shift forestry onto 'greener', better and more sustainable pathways.

SELECTED REFERENCES

- Aalbersberg, B. 2008. Bioprospecting and live rock harvesting for coral conservation in Fiji. In The Nature Conservancy, Conservation International, and Conservation and Community Investment Forum. 2008. workshop proceedings for a private sector approach – conservation agreements in support of marine protection, pp.26-29. Washington State, USA. (available at www.mcatoolkit. org/pdf/PMCA_Workshop/1_MCAWorkshop_FullProceddings.pdf).
- Adhikari, B. 2009. Market-based approaches to environmental management: A review of lessons from payment for environmental services in Asia. ADBI Working Paper 134. Tokyo, ADB.
- Arancon, R.N. 2009. The situation and prospects for the utilization of coconut wood in Asia and the Pacific. Asia-Pacific Forestry Sector Outlook Study II. Working paper series. Working Paper No. APFSOS II/WP/2009/15. Bangkok, FAO. 45 pp.
- Asia Business Council. 2008. Building Energy efficiency: why green buildings are key to Asia's future (also available at: www.asiabusinesscouncil.org/docs/BEE/BEE2008Overview.pdf).
- Asia Forest Network. 2009. Where is the future for cultures and forests? Indigenous peoples and Forest Management in 2020. Asia-Pacific Forestry Sector Outlook Study II. Working paper series. Working Paper No. APFSOS II/WP/2009/23. Bangkok, FAO. 83 pp.
- Asian Development Bank (ADB). 2005. *Mongolia: country environmental analysis.* 165 pp. Manila. Asian Development Bank (ADB) (available at www.adb.org/Documents/Studies/Ctry-Environmental-Analysis/2005/MON/mon-cea.pdf).
- ADB. 2007. Key indicators: inequality in Asia. ADB.
- **ADB.** 2008. *Basic statistics.* Economics and Research Department, Development Indicators and Policy Research Division, ADB (available at: www.adb.org/statistics/pdf/Basic-Statistics-2009. pdf).
- Asia-Pacific Forestry Commission (APFC). 2000. Regional strategy for implementing code of practice for forest harvesting. Bangkok, Asia Pacific Forestry Commission and FAO (available at: ftp://ftp.fao.org/docrep/fao/009/ag312e/ag312e00.pdf).
- Atalla, R., Beecher, J., Caron, R., Catchmark, J., Deng, Y., Glasser, W., Gray, D., Haigler, C., Jones, P., Joyce, M., Kohlman, J., Koukoulas, A., Lancaster, P., Perine, L., Rodriguez, A., Ragauskas, A., Wegner, T. & Zhu, J. 2005. Nanotechnology for the forest products industry: vision and technology roadmap. USDA Forest Service (available at http://www.fpl.fs.fed.us/ documnts/pdf2005/fpl_2005_tappi001.pdf).
- Balmford, A., Gaston, K.J., Blyth, S., James, A. & Kapos, V. 2003. Global variation in terrestrial conservation costs, conservation benefits, and unmet conservation needs. *In Proceedings of the National Academy of Sciences of the United States of America.* Vol. 100 (3): 1046-1050 (available at : http://www.pnas.org/content/100/3/1046.full.pdf).
- **Banerjee**, **A.** 2007. Chapter 8: Joint forest management in West Bengal. *In* O. Springate-Baginski & P. Blaikie, eds. *Forests, people and power: The political ecology of reform in South Asia*. UK & USA, Earthscan.
- Barr, C., Resosudarmo, I.A., Dermawan, A., McCarthy, J.F., Moeliono, M. & Setiono, B. 2006. Decentralization of forest administration in Indonesia: implications for forest sustainability, economic development and community livelihoods. CIFOR, Bogor. 178 pp.
- **Basnyat, B.** 2008. Impacts of demographic changes on forests and forestry in Asia and the *Pacific*. Asia-Pacific Forestry Sector Outlook Study II. Working paper series. Working Paper No. APFSOS II/WP/2009/08. Bangkok, FAO. 82 pp.

- Baudin, A., Eliasson, L., Gustafsson, A., Hagström, L., Helstad, K., Nyrud, A.Q., Sande, J.B., Haartveit, E.Y. & Ziethén, R. 2005. ICT and the wood industry. In L. Hetemäki & S. Nilsson, eds. Information technology and the forest sector, pp. 129-149. Vienna, International Union of Forest Research Organizations (IUFRO).
- Beinhocker, E., Farrell, D. & Zainulbhai, Z. 2007. Tackling the growth of India's middle class. The McKinsey Quarterly 2007 (3).
- Bhojvaid, P.P. 2009. Role of agroforests and small-scale production forestry in employment generation and environmental conservation. In The future of forests, proceedings of an international conference on the outlook for Asia-Pacific forests to 2020. Asia Pacific Forestry Commission, RAP Publication 2009/03. Bangkok, FAO.
- Bird, N. & Thiel, H. 2007. New technologies for forest governance: factors. influencing success. VERIFOR Briefing Paper No. 7. London: ODI.
- Block, B. 2009. Illegal pangolin trade threatens rare species., Washington DC, Eyes on Earth, Worldwatch Institute (available at www.worldwatch.org/node/6198).
- Boulay, A. 2010. Contract tree farming and smallholders: drivers of adoption in Thailand. Australian National University, Australia. (PhD thesis)
- Bowe, S.A., Smith, R.L., Kline, D.E. & Araman, P.A. 2002. A segmental analysis of current and future scanning and optimizing technology in the hardwood sawmill industry. Forest Products Journal, 52(3): 68-76.
- Brown, R.P. & Leeves, G. 2007. Impacts of international migration and remittances on source country household incomes in small island states: Fiji and Tonga. ESA Working Paper No. 07-13. Rome, FAO, Agricultural Development Economics Division.
- Cañares, M.P. 2009. Macro-economic trends and their impacts on forests and forestry in Asia and the Pacific to 2020. Asia-Pacific Forestry Sector Outlook Study II. Working paper series. Working Paper No. APFSOS II/WP/2009/27. Bangkok, FAO. 91 pp.
- Centre for Forestry Planning and Statistics, Ministry of Forestry. 2009. Indonesia forestry outlook study. Asia-Pacific Forestry Sector Outlook Study II. Working paper series. Working Paper No. APFSOS II/WP/2009/13. Bangkok, FAO. 74 pp.
- Chaudhury, M. 2009a. Assessing the protection of forest-based environmental services in the Greater Mekong subregion. Asia-Pacific Forestry Sector Outlook Study II. Working paper series. Working Paper No. APFSOS II/WP/2009/14. Bangkok, FAO. 67 pp.
- Chaudhury, M. 2009b. Valuing services: an analysis of the ability and willingness to protect forest-based environmental services in the Asia-Pacific Region. Asia-Pacific Forestry Sector Outlook Study II. Working paper series. Working Paper No. APFSOS II/WP/2009/16. Bangkok, FAO. 76 pp.
- Chiew, T.H. 2009. Malaysia forestry outlook. Asia-Pacific Forestry Sector Outlook Study II. Working paper series. Working Paper No. APFSOS II/WP/2009/02. Bangkok, FAO. 69 pp.
- Conservation International. 2007. Biodiversity hotspots. Arlington, USA (available at www. biodiversityhotspots.org/xp/Hotspots/hotspots by region/).
- Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). 2009. Rhinoceroses. In Interpretation and implementation of the convention on species trade and conservation. Fifty-eighth meeting of the Standing Committee
 - Geneva, Switzerland (available at www.cites.org/eng/com/SC/58/E58-37.pdf).
- Dalfelt, A., Næss, L.O., Sutamihardja, R.T.M. & Gintings, N. 1996. Feasibility study on: reforestation of degraded grasslands in Indonesia as a climate change mitigation option. Center for International Climate and Environmental Research – Oslo (CICERO). 128 pp. (available at: www.cicero.uio.no/media/88.pdf).
- Damodaran, A. & Engel, S. 2003. Joint forest management in India: assessment of performance and evaluation of impacts. ZEF-Discussion Papers on Development Policy 77.
- Dhital, D.B. 2009. Bhutan forestry outlook study. Asia-Pacific Forestry Sector Outlook Study II. Working paper series. Working Paper No. APFSOS II/WP/2009/04. Bangkok, FAO. 73 pp.
- Dillaha, T., Ferraro, P., Huang, M., Southgate, D., Upadhyaya, S. & Wunder, S. 2007. Payments

for watershed services regional syntheses. *In USAID PES brief* 7. United States Agency for International Development.

- **Dolidon, N., Hofer, T., Jansky, L. & Sidle, R.** 2009. Watershed and forest management for landslide risk reduction. In *Landslides disaster risk reduction,* pp. 633-649. Berlin, Springer-Verlag.
- **Dreher, A.** 2006. Does globalization affect growth? Evidence from a new index of globalization. *Applied Economics, 38*(10): 1091-1110. Updated in Dreher, A., Gaston, N. & Martens, P. 2008. *Measuring globalisation gauging its consequences.* New York, Springer.
- Durst, P., Waggener T., Enters, T. & Tan, L., eds. 2001. Forests out of bounds: impacts and effectiveness of logging bans in natural forests in Asia-Pacific. FAO, Bangkok.
- **Durst, P., Brown, C., Tacio, H. & Ishikawa, M., eds.** 2005. *In search of excellence: exemplary forest management in Asia and the Pacific.* Bangkok, FAO.
- Economist. 2009. Crouching tigers and stirring dragons. The Economist, 391(8631): 77-79.
- Economic Intelligence Unit. 2008. Available at www.eiu.com
- Edmunds, D. & Wollenberg, E. 2003. Local forest management: the impacts of devolution policies. UK & USA, Earthscan.
- **Environmental Investigation Agency (EIA).** 2009a. *European parliament votes to strengthen illegal timber regulation.* London, Environmental Investigation Agency (available at: www.illegal-logging.info/item_single.php?item=news&item_id=3275&approach_id=26).
- **EIA.** 2009b. *What is the Lacey Act*? Washington DC, EIA. (available at www.eia-global.org/ forests_for_the_world/Lacey_Act_Background.html).
- **Elges, Lisa Ann.** 2009. Mitigating the corruption factor in the Asia-Pacific region. *In The future of forests, proceedings of an international conference on the outlook for Asia-Pacific forests to 2020.* Asia Pacific Forestry Commission, RAP Publication 2009/03. Bangkok, FAO.
- Enters, T. & Durst, P, eds. 2004. What does it take? The role of incentives in forest plantation development. RAP 2004/27, Bangkok, FAO.
- **Environmental News Service (ENS).** 2009. Asian demand for rhino horn fuels poaching crisis. Environmental News Service (available at: www.ens-newswire.com/ens/jul2009/2009-07-16-02.asp).
- **Eurekalert.** 2009. Available at http://www.eurekalert.org/pub_releases/2009-07/e-ths071309. php
- **European Forest Institute.** 2009. *EU to conclude deal to stop illegal timber extraction from Republic of Congo*. Washington, DC, EurekAlert. (available at www.eurekalert.org/pub_releases/2009-05/bc-etc050609.php).
- Federation of Community Forest Users Nepal (FECOFUN). 2009. *About us.* Kathmandu, FECOFUN (available at www.fecofun.org/about.php).
- **Food and Agriculture Organization of the United Nations (FAO).** 1997. *Regional study on wood energy today and tomorrow.* Field Document No. 50. Regional Wood Energy Development Programme in Asia. Bangkok, FAO (available at: http://www.fao.org/DOCREP/006/AD538E/AD538E00.HTM).
- **FAO.** 2001a. *Global forest resources assessment 2000. Main report.* FAO Forestry Paper No. 140. Rome, FAO (also available at www.fao.org/docrep/004/y1997e/y1997e00.htm).
- **FAO**. 2001b. Forest out of bounds: Impacts and effectiveness of logging bans in natural forests in Asia-Pacific. RAP Publication 2001/08, Bangkok, FAO.
- FAO. 2003. Terrastat database (available at www.fao.org/ag/agl/agll/terrastat/#terrastatdb).
- **FAO.** 2004. *Global forest resources assessment update 2005: Terms and definitions.* Working Paper 83, Forest Resources Assessment Programme, Rome, FAO (available at: www.fao.org/ forestry/media/7797/1/0/).
- **FAO**. 2005. *Forests and floods: Drowning in fiction or thriving on facts?* RAP publication 2005/3. FAO Regional Office for Asia and the Pacific Available at:
 - ftp://ftp.fao.org/docrep/fao/008/ae929e/ae929e00.pdf
- FAO. 2006a. Global forest resources assessment 2005 progress towards sustainable forest

management. FAO Forestry Paper No. 147. Rome, FAO (available at www.fao. org/docrep/008/ a0400e/a0400e00.htm).

- **FAO.** 2006b. Understanding forest tenure in South and Southeast Asia. Forestry Policy and Institutions Working Paper No. 14. Rome.
- **FAO.** 2006c. Global planted forests thematic study: results and analysis. By A. Del Lungo, J. Ball & J. Carle. In *Planted forests and trees.* Working Paper No. 38. Rome, FAO (available at www. fao.org/forestry/site/10368/en).
- **FAO.** 2006d. *Payment for environmental services*. Secretariat Note, 21st Session of the Asia-Pacific Forestry Commission, FO/APFC/02, Dehra Dun, India, 17-21.
- FAO. 2008a. The state of food insecurity in the world 2008. Rome, FAO.
- **FAO.** 2008b. *Re-inventing forestry agencies experiences of institutional restructuring in Asia and the Pacific,* by P. Durst, C. Brown, J. Broadhead, R. Suzuki, R. Leslie & A. Inoguchi, eds. RAP Publication 2008/05. Bangkok, FAO Regional Office for Asia and the Pacific.
- **FAO.** 2009a. *Forest insects as food: humans bite back.* Proceedings of a workshop focused on Asia-Pacific resources and their potential for development. Bangkok, FAO.
- FAO. 2009b. ForesSTAT statistical database (available at faostat.fao.org).
- FAO. 2010a. FAOSTAT database (available at http://faostat.fao.org/default.aspx).
- **FAO.** 2010b. *Global forest resources assessment 2010.* FAO, Rome (also available at www.fao. org/forestry/fra2010).
- FAO. 2010c. Subregional report for the Pacific. Asia-Pacific Outlook Study. Bangkok, FAO.
- FAO. 2010d. Subregional study for East Asia. Asia-Pacific Outlook Study. Bangkok, FAO.
- FAO. 2010e. Subregional report for Southeast Asia. Asia-Pacific Outlook Study. Bangkok, FAO.
- **FAO & ASEAN.** 2006. Taking stock: Assessing progress in developing and implementing codes of practice for forest harvesting in ASEAN member countries. RAP Publication 2006/10. Bangkok, FAO.
- Forbes, K. & Broadhead, J.S. 2007. The role of coastal forests in the mitigation of tsunami impacts. Bangkok, FAO (available at http://www.fao.org/forestry/media/14561/1/0/).
- **Forest Department.** 2009. *Sri Lanka forestry outlook study*. Asia-Pacific Forestry Sector Outlook Study II. Working paper series. Working Paper No. APFSOS II/WP/2009/29. Bangkok, FAO. 66 pp.
- **Forest Management Bureau.** 2009. *Philippines forestry outlook study*. Asia-Pacific Forestry Sector Outlook Study II. Working paper series. Working Paper No. APFSOS II/WP/2009/10. Bangkok, FAO. 97 pp.
- Forest Science Institute of Viet Nam (FSIV). 2009. Vietnam forestry outlook study. Asia-Pacific Forestry Sector Outlook Study II. Working paper series. Working Paper No. APFSOS II/ WP/2009/09. Bangkok, FAO. 72 pp.
- **Ganguly**, I. & Eastin, I. 2007. Overview of the Indian market for US wood products. Cintrafor Working Paper 105 (available at http://www.softwood.org/reports/WP105-INDIA.pdf).
- **Guiang, E.S. & Castillo, G.** 2006. Trends in forest ownership, forest resources tenure and institutional arrangements in the Philippines: are they contributing to better forest management and poverty reduction? *In Understanding forest tenure in South and Southeast Asia.* FAO, Forest Policy and Institutions Working Paper 14. Rome, FAO.
- **Gumartini, T.** 2009. *Biomass energy in the Asia-Pacific Region: current status, trends and future setting*. Asia-Pacific Forestry Sector Outlook Study II. Working paper series. Working Paper No. APFSOS II/WP/2009/26. 106 pp. Bangkok, FAO.
- Hamilton, L.S. 2008 *Forests and water.* A thematic study prepared in the framework of the Global Forest Resources Assessment 2005. FAO Forestry Paper 155. Rome, FAO.
- Hanbar R.D. & Karve, P. 2002. National Programme on Improved Chulha (NPIC) of the Government of India: an overview. *In Energy for sustainable development 6(2): 46-45.* (available at: www.sciencedirect.com/science?_ob=ArticleURL&_udi=B94T4-4V9PDFV-9&_user=6718006&_rdoc=1&_fmt=&_orig=search&_sort=d&_docanchor=&view=c&_searchStrId=958215010&_rerunOrigin=google&_acct=C000055286&_version=1&_urlVersion=0&_userid=6718006&md5

=997a8768847aa855ca7d68c63d2daab7).

- Hansda, R. 2009. The outlook for non-wood forest products in Asia and the Pacific. Asia-Pacific Forestry Sector Outlook Study II. Working paper series. Working Paper No. APFSOS II/ WP/2009/18. 91 pp. Bangkok, FAO.
- Hetemäki, L. & Nilsson, S. 2005. Information technology and the forest sector. IUFRO World Series Vol. 18. Vienna, IUFRO.
- Hoang, M. van Noordwijk, H. & Thuy, P.T. 2008. *Payment for environmental services: experiences and lessons from Vietnam*. Hanoi, World Agroforestry Center (available at: www.adbi.org/files/2009.03.26.wp134.market.based.approaches.environmental.mngt.pdfhttp://www.adbi.org/files/2009.03.26.wp134.market.based.approaches.environmental.mngt.pdf).
- **Htun, K.** 2009. *Myanmar forestry outlook study*. Asia-Pacific Forestry Sector Outlook Study II. Working paper series. Working Paper No. APFSOS II/WP/2009/07. Bangkok, FAO. 55 pp.
- Huang, M. & Upadhyaya, S.K. 2007. Watershed-based payment for environmental services in Asia. Working paper No 06-07. OIRED. 28 pp. (available at www.oired.vt.edu/sanremcrsp/ documents/PES.Sourcebook.Oct.2007/Sept.2007.PESAsia.pdf).
- Hurahura, F. 2008. Country outlook paper PNG: An analysis of key trends in forest policies, legislation and institutional arrangement. Draft country report. Unpublished.
- International Centre for Environmental Management (ICEM). 2003. Regional report on protected areas and development. Review of Protected Areas and Development in the Lower Mekong River Region, Indooroopilly, Queensland, Australia. 197 pp.
- **International Council on Management of Population Programmes (ICOMP).** 2009. *ICPD at 15: priority challenges for Asia and the Pacific: a regional review of ICPD implementation.* Bangkok, UNFP.
- International Energy Agency (IEA). 2007. World energy outlook 2007. Paris, IEA.
- International Labour Organization (ILO). 2009a. *Global employment trends*, *May 2009*. Geneva, ILO.
- ILO. 2009b. Global employment trends, January 2009. Geneva, ILO.
- International Monetary Fund (IMF). 2008. World economic outlook update rapidly weakening prospects call for new policy stimulus. Press Release: 6 November 2008. Washington DC, IMF.
- **IMF.** 2009. *World economic outlook global economy contracts, with slow recovery next year.* IMF Survey Magazine: IMF Research. Release: 22 April 2009. Washington DC, IMF.
- **Inoguchi, A.** 2010. *Outlook of globalization in the Asia-Pacific forestry sector*. Asia-Pacific Outlook Study. Bangkok, FAO.
- International Tropical Timber Organization (ITTO). 2006. *Status of tropical forest management 2005.* Yokohama, ITTO.
- **ITTO.** 2008. Developing forest certification Towards increasing the comparability and acceptance of forest certification systems worldwide. ITTO Technical Series #29. Yokohama, ITTO.
- **Jimenez, Fidel.** 2008. *Korte Suprema nagtalaga ng 117 'green courts'*. New York, GMA News TV. (available at http://www.gmanews.tv/print/76634).
- Jonsson, R. & Whiteman, A. 2008. Global forest product projections. Rome, FAO.
- **Keong, C.H.** 2009. Key challenges for the NGO community to 2020. *In The future of forests, proceedings of an international conference on the outlook for Asia-Pacific forests to 2020.* Asia Pacific Forestry Commission, RAP Publication 2009/03. Bangkok, FAO.
- **KOF.** 2008. 2008 KOF index of globalization. (available at www.globalization.kof.ethz.ch/static/ pdf/rankings_2008.pdf).
- **Kugelman, M. & Levenstein, S.L., eds.** 2009. *Land grab: the race for the world's farmland.* Washington, DC, Woodrow Wilson International Center for Scholars.
- **Lebedys, A.** 2008. Contribution of the forestry sector to national economies, 1990–2006. FAO, Rome.
- Linlin, M. 2009. The relevance and impact of gender issues on the outlook for forestry to 2020 in

north Asia. Asia-Pacific Forestry Sector Outlook Study II. Working paper series. Working Paper No. APFSOS II/WP/2009/12. Bangkok, FAO. 74 pp.

- Løyche-Wilkie, M. 2009. Whither the forests of Asia and the Pacific? In The future of forests, proceedings of an international conference on the outlook for Asia-Pacific forests to 2020. Asia Pacific Forestry Commission, RAP Publication 2009/03. Bangkok, FAO.
- **Mee-young**, **C.** 2009. South Korea's polluters invest in green for profit (available at http://www.cfdspros.com/news/commodities---futures-news/analysis-s.korea's-polluters-invest-in-green-for-profit-70328).
- Megahan, W.F. & King, P.N. 1985. Identification of critical areas on forest land for control of nonpoint sources of pollution. *Environmental Management*, 9(1):7-18.
- **Millennium Ecosystem Assessment (MEA).** 2005. *Ecosystems and human well-being: Synthesis.* Washington, DC, Island Press.
- **Ministry of Agriculture, Forestry and Fisheries of Japan (MAFF)**. 2008. Annual report on trends in forest and forestry fiscal year 2008. Tokyo.
- Ministry of Agriculture and Rural Development (MARD). 2007. Decision on the declaration of forest status of the country in 2006. Decision No 2503/QD-BNN-LN, Hanoi, 7 August 2006.
- Ministry of Environment and Forests Government, of India. 2009. India forestry outlook study. Asia-Pacific Forestry Sector Outlook Study II. Working paper series. Working Paper No. APFSOS II/WP/2009/06. Bangkok, FAO. 78 pp.
- Ministry of Forests and Soil Conservation, Singha Durbar, Kathmandu, Nepal. 2009. *Nepal forestry outlook study*. Asia-Pacific Forestry Sector Outlook Study II. Working paper series. Working Paper No. APFSOS II/WP/2009/05. Bangkok, FAO. 83 pp.
- Ministry of Forestry, Japan. 2009. *Japan forestry outlook study*. Asia-Pacific Forestry Sector Outlook Study II. Working paper series. Working Paper No. APFSOS II/WP/2009/30. Bangkok, FAO. 52 pp.
- Nair, C.T.S. & Rutt, R. 2009. Creating forestry jobs to boost the economy and build a green future. *Unasylva*, 233. Rome, FAO.
- National Association of Forest Industries (NAFI) & A3P. 2006. *Industry skills shortage audit*. Deakin West, NAFI (available at: www.nafi.com.au/skills/Skills_Audit_Full_Version.pdf).
- Nawir, A.A. & Murniati, Lukas, R. 2007. Forest rehabilitation in Indonesia: where to after three decades? Bogor, Indonesia, CIFOR. 269 pp. (available at: www.cifor.cgiar.org/publications/pdf_files/Books/BNawir0701.pdf).
- **Neilson, D.A.** 2009. Corporate private sector dimensions in planted forest investments. *In The future of forests, proceedings of an international conference on the outlook for Asia-Pacific forests to 2020.* Asia Pacific Forestry Commission, RAP Publication 2009/03. Bangkok, FAO.
- **NEPCON.** 2009. *European parliament votes to crack down on illegal timber trade*. Nature, Ecology & People Consult. (available at www.nepcon.net/index.php?id=2633).
- **New Zealand Ministry of Agriculture and Forestry (NZMAF).** 2009. *Carbon forestry options for landowners* http://www.maf.govt.nz/sustainable-forestry/ets/options-for-landowners.pdf]
- Nguyen, Q.T., Nguten, B.N. Tran, N.T, Sunderlin, W. & Yasmi, Y. 2008. Forest tenure reform in Vietnam: case studies from the northern upland and central highlands regions. RECOFTC and RRI.
- Nyrud, A.Q. & Devine, Å. 2005. E-Commerce. In L. Hetemäki & S. Nilsson, eds. Information technology and the forest sector, pp. 49-64. Vienna, IUFRO.
- NZ Wood. Available at http://www.nzwood.co.nz
- **O'Brien.** 2007. Abalone poachers in New Zealand threaten China's banquet treat. London, Illegal-fishing.info. (available at: www.illegal-fishing.info/item_single.php?item=news&item_ id=1577&approach_id=13).
- Office of the Inspector General of Forestry, Ministry of Environment, Government of Pakistan. 2009. *Pakistan forestry outlook study*. Asia-Pacific Forestry Sector Outlook Study II. Working paper series. Working Paper No. APFSOS II/WP/2009/28. Bangkok, FAO. 64 pp.
- Office of the United Nations High Commissioner for Refugees (UNHCR). 2004. Chronology

for Dayaks in Malaysia. Minorities at risk project (available at http://www.unhcr.org/refworld/top ic,463af2212,469f2e7114a,469f38b91c,0.html).

- **Oi, M.** 2009. Tree DNA to fight illegal logging. BBC news. (available at http://news.bbc.co.uk/2/hi/ business/8209645.stm).
- **Pacific Asia Travel Association (PATA).** 2008. Asia Pacific tourism revenues set to soar to US 4.6 trillion by 2010. PATA (available at www.forimmediaterelease.net/pm/1244.html).
- Pandey, C.N. & Rangaraju, T.S. 2008. India's industrial wood balance. International Forestry *Review*, 10(2):173-189. 2008.
- Papua New Guinea Forest Authority. 2009. Papua New Guinea forestry outlook study. Asia-Pacific Forestry Sector Outlook Study II. Working paper series. Working Paper No. APFSOS II/ WP/2009/19. 43 pp. Bangkok, FAO.
- Papua New Guinea Investment Promotion Authority. Available at

http://www.ipa.gov.pg/index.php?option=com_content&task=blogcategory&id=111&Itemid=137 (website visited April 2010)

- Pauku, R.L. 2009. Solomon Islands forestry outlook study. Asia-Pacific Forestry Sector Outlook Study II. Working paper series. Working Paper No. APFSOS II/WP/2009/31. Bangkok, FAO. 48 pp.
- **Perley, C.** 2008. The status and prospects for forestry as a source of bioenergy in Asia and the Pacific. Bangkok, FAO.
- Perera, K.K.C.K. & Sugathapala, A.G.T. 2002. Fuelwood-fired cookstoves in Sri Lanka and related issues. *Energy for Sustainable Development*, 6(1): 85-94, Elsevier Inc (available at: www. sciencedirect.com/science?_ob=ArticleURL&_udi=B94T4-4V9PDGY-C&_user=6718006&_rdoc=1&_fmt=&_orig=search&_sort=d&_docanchor=&view=c&_acct=C000055286&_version=1&_urlVersion=0&_userid=6718006&md5=335d637d8b9bbba3dd47d3f2f58fa493).
- **Poschen, P.** 1997. Forests and employment much more than meets the eye. Proceedings XI. WFC. Vol. 4. (updated 2001).
- Rainforest-Alliance Newsletter. 2007. Improving village life in Nepal, (rainforest matters). March 2007. Available at: http://www.rainforest-alliance.org/news/rainforest-matters/march_07.html
- **Rao, J.** 2008. Analysis of key trends in forest policies, legislation and institutional arrangements in India. Draft country report. Unpublished.
- Ratha, D., Mohapatra, S. & Silwal, A. 2009. *Outlook for remittance flows 2009-2011: Remittances expected to fall by 7-10 percent in 2009.* Migration and Development Brief 10, World Bank (available at http://siteresources.worldbank.org/INTPROSPECTS/Resources/334934-1110315015165/Migration&DevelopmentBrief10.pdf).
- **Regional Community Forestry Training Center (RECOFTC, aka The Center for People and Forests).** 2008. *Is there a future role for forests and forestry in reducing poverty?* Bangkok, RECOFT.
- **RECOFTC.** 2009a. Is there a future role for forests and forestry in reducing poverty? Asia-Pacific Forestry Sector Outlook Study II. Working paper series. Working Paper No. APFSOS II/ WP/2009/24. Bangkok, FAO. 60 pp.
- **RECOFTC.** 2009b. *Decoding REDD: Addressing and assessing the second "D"*. Bangkok, RECOFTC.
- **Renner, M.** 2002. *The anatomy of resource wars.* Worldwatch Paper 162. Washington DC, Worldwatch Institute.
- Rin Won Joo, Byung Heon Jung, Seong Youn Lee, Jae Soo Bae, Kyongha Kim, Sang-Yoel Han, Jong-Hwan Lim, Kyeong-hak Lee & Rheehwa Yoo. 2009. *Republic of Korea forestry outlook study*. Asia-Pacific Forestry Sector Outlook Study II. Working paper series. Working Paper No. APFSOS II/WP/2009/32. Bangkok, FAO. 88 pp.
- **Royal Forest Department (RFD) & Department of Wildlife and National Parks (DWNP).** 2009. *Thailand forestry outlook study*. Asia-Pacific Forestry Sector Outlook Study II. Working paper series. Working Paper No. APFSOS II/WP/2009/22. Bangkok, FAO. 106 pp.

Ruiz-Pérez, M., Belcher, B., Achdiawan, R., Alexiades, M., Aubertin, C., Caballero, J.,

Campbell, B., Clement, C., Cunningham, T., Fantini, A., de Foresta, H., García Fernández, C., Gautam, K.H., Hersch Martínez, P., de Jong, W., Kusters, K., Kutty, M.G., López, C., Fu, M., Martínez Alfaro, M.A., Nair, T.R., Ndoye, O., Ocampo, R., Rai, N., Ricker, M., Schreckenberg, K., Shackleton, S., Shanley, P., Sunderland, T. & Youn, Y. 2004. Markets drive the specialization strategies of forest peoples. *Ecology and Society*, 9(2): 4.

- Sasatani, D. 2009. National competitiveness index of the forest products industry in the Asia-Pacific region. Asia-Pacific Forestry Sector Outlook Study II. Working paper series. Working Paper No. APFSOS II/WP/2009/25. Bangkok, FAO. 114 pp.
- Seppälä, R., Buck, A. & Katila, P. eds. 2009. Adaptation of forests and people to climate change. a global assessment report. IUFRO World Series Volume 22. Helsinki. 224 pp.
- **Sesega, S.** 2009. *Samoa forestry outlook study*. Asia-Pacific Forestry Sector Outlook Study II. Working paper series. Working Paper No. APFSOS II/WP/2009/01.Bangkok, FAO. 48 pp.
- Shahabuddin, G. 2009. Emerging trends in protected area management. In The future of forests, proceedings of an international conference on the outlook for Asia-Pacific forests to 2020. Asia Pacific Forestry Commission, RAP Publication 2009/03. Bangkok, FAO.
- Sharma, R. 2008. Green courts in India: strengthening environmental governance? *Law, Environment and Development Journal*, 4/1: 50 (available at http://www.lead-journal.org/ content/08050.pdf).
- Sidle, R.C., Ziegler, A.D., Negishi, J.N., Nik, A.R., Siew, R. & Turkelboom, F. 2006. Erosion processes in steep terrain truths, myths, and uncertainties related to forest management in Southeast Asia. *Forest Ecology and Management*, 224 (1-2): 199-225.
- **Siwatibau, S.** 2009. Emerging issues in Pacific Island countries and their implications on sustainable forest management. *In The future of forests, proceedings of an international conference on the outlook for Asia-Pacific forests to 2020.* Asia Pacific Forestry Commission, RAP Publication 2009/03. Bangkok, FAO.
- State Forestry Administration (SFA). 2009. *People's Republic of China forestry outlook study*. Asia-Pacific Forestry Sector Outlook Study II. Working paper series. Working Paper No. APFSOS II/WP/2009/11. Bangkok, FAO. 85 pp.
- **Thaindian**. 2009. South Korea to produce wood pellet fuel in Indonesia. *Thaindian News*. (available at www.thaindian.com/newsportal/business/south-korea-to-produce-wood-pellet-fuel-in-indonesia_100164171.html).
- **Thaung, T.L.** 2008. Key trends in forest policies, legislation and institutional arrangements in Myanmar. Draft country report. Unpublished.
- **Thupalli, R.** 2009. *Maldives forestry outlook study*. Asia-Pacific Forestry Sector Outlook Study II. Working paper series. Working Paper No. APFSOS II/WP/2009/03. Bangkok, FAO. 29 pp.
- **TIES.** 2007. *Resources: ecotourism in Asia Pacific*. Washington DC, The International Ecotourism Society.
- **Tong, P.S.** 2009. *Lao People's Democratic Republic forestry outlook study*. Asia-Pacific Forestry Sector Outlook Study II. Working paper series. Working Paper No. APFSOS II/WP/2009/17. Bangkok, FAO. 62 pp.
- **TRAFFIC.** 2008a. What's driving the wildlife trade? A review of expert opinion on economic and social drivers of the wildlife trade and trade control efforts in Cambodia, Indonesia, Lao PDR and Viet Nam. World Bank/TRAFFIC.
- **TRAFFIC.** 2008b. *India's wild medicinal plants threatened through over-exploitation* (available at www.traffic.org/home/2008/11/24/indias-wild-medicinal-plants-threatened-through-over-exploit. html).
- **United Nations (UN).** 2008a. Common database (available at http://unstats.un.org/ unsd/cdb/ cdb_help/cdb_quick_start.asp).
- **UN.** 2008b. *Millennium Development Goals Indicators database series: terrestrial areas protected* (available at http://mdgs.un.org/unsd/mdg/SeriesDetail.aspx?srid=783&crid).
- **UN.** 2009. *World population prospects: the 2008 revision*. Population Division, UN. (available at http://esa.un.org/unpp).

- **United Nations Convention to Combat Desertification (UNCCD).** 2007. Mountain desert at the roof of the world Pakistan. *In Women pastoralists preserving traditional knowledge, facing modern challenges.* Secretariat of the UNCCD, Bonn, Germany, UN.
- **United Nations Development Programme (UNDP).** 2008. *Promotion of energy efficient cooking, heating and housing technologies.* Pakistan, UNDP (available at www.undp.org.pk/promotion-of-energy-efficient-cooking-heating-and-housing-technologies.html).
- United Nations Economic Commission for Europe (UNECE) & FAO. 2005. European forestry sector outlook study. 1960-2000-2020: main report. Geneva, Switzerland.
- **UNECE & FAO.** 2008. *Forest products annual market review 2007-2008.* New York, USA and Geneva, Switzerland, UN.
- **UNECE Timber Committee.** 2001. Secondary processed wood products markets, including engineered wood products. Secretariat presentation to the 59th Session (available at www.unece.org/timber/docs/tc-59/presentations/2-pepke.ppt)
- **United Nations Environment Programme (UNEP).** 2003. *Global environment outlook 3: Past, present and future perspectives.* Nairobi, UNEP.
- **United Nations Framework Convention on Climate Change (UNFCCC).** 2009. Draft decision -/ CP.15 Proposal by the President, Copenhagen Accord. FCCC/CP/2009/L.7. From: Conference of the Parties, Fifteenth session, Copenhagen, Denmark: 7-18 December 2009.

UNFCCC. 2010. CDM: project activities. Registered projects. Bonn, Germany.

- **UNEP, FAO & United Nations Forum on Forests (UNFF).** 2009. *Vital forest graphics*. UNEP/ GRID-Arendal.
- **UNEP, SEFI & New Energy Finance.** 2009. *Global trends in sustainable energy investment 2009 report.* (available at http://sefi.unep.org/english/globaltrends2009.html).
- **United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP).** 2007. *Regional study on the role of tourism in socio-economic development.* Study prepared for UNESCAP Sixty-third session, 17-23 May 2007, Almaty, Kazakhstan.
- **UNESCAP**. 2010. *Statistical yearbook for Asia and the Pacific 2009*. Thailand.
- **UN World Tourism Organization (UNWTO).** 2008. *Asia Pacific Newsletter*, 11(1) (also available at www.unwto.org/asia/news/en/newsle.php?op=2&subop=2).
- UNWTO. 2009. Tourism highlights. 2009 edition. Madrid, UNWTO.
- Van Deusen, C. 2008. Fiji Pine Limited: a case study of long term privatization and stakeholder conflict. OJICA: Online Journal Of International Case Analysis, 1, (1).
- Vedeld, P., Angelsen, A., Bojø, J., Sjaastad, E. & Kobugabe, G.K. 2007. Forest environmental incomes and the rural poor. *Elsevier*, 9: 869-879.
- Westoby, J. 1989. Introduction to world forestry. Basil Blackwell Ltd. 228 pp.
- World Bank. 2007a. World development indicators. Washington DC, USA.
- **World Bank.** 2007b. *Global economic prospects 2007: managing the wave of globalization.* Washington DC, USA (available at http://go.worldbank.org/027LYJI4F1).
- World Bank. 2008a.CDM afforestation and reforestation projects in the Asia-Pacific region.
- **World Bank.** 2008b. *New data show 1.4 billion live on less than \$1.25 a day, but progress against poverty remains strong.* Washington DC, USA (available at http://go.worldbank.org/DQKD6WV4T0).
- **World Bank.** 2009a. As global economy deteriorates, World Bank predicts sharply slower growth in developing world in 2009; weak recovery in 2010. Washington DC, USA.
- World Bank. 2009b. 2009 world development indicators. Washington, DC.
- **World Bank.** 2010. *Global economic prospects 2010: crisis, finance, and growth.* Washington DC, World Bank.
- **World Conservation Union (IUCN).** 2003. *United Nations list of protected areas.* IUCN, Gland, Switzerland and Cambridge, UK, IUCN and Cambridge, UK, UNEP-WCMC. ix + 44pp.
- **World Economic Forum.** 2009. *Scenario planning* (available at http://www.weforum.org/en/ initiatives/Scenarios/index.htm).
- World Wildlife Foundation International (WWF). 2001. Capacity building for ecotourism in

Sabah, Malaysia. *In Guidelines for community-based ecotourism development.* Ledbury, UK, WWF.

- **Wunder, S.** 2005. *Payments for environmental services: some nuts and bolts.* Occasional Paper No.42. CIFOR.
- Xiaoqian, X. 2008. Country profile: China. Draft country report. Unpublished.
- **Yasmi, Y., Enters, T. & Broadhead, J.S.** 2010. *Forest policies, legislation and institutions in Asia-Pacific (trends and emerging needs for 2020)*. Bangkok, FAO, The Nature Conservancy and RECOFTC.
- **Ykhanbai. H.** 2009. *Mongolia forestry outlook study.* Asia-Pacific Forestry Sector Outlook Study II. Working paper series. Working Paper No. APFSOS II/WP/2009/21. Bangkok, FAO. 49 pp.
- Zhang, K., Lu, W. & Osamu, H. 2007. *Demand and supply of wood products in China*. Forest Products Working Paper 1. Rome, FAO.
- **Zhang, L.** 2008. Reform of the forest sector in China. *In* P. Durst, C. Brown, J. Broadhead, R. Suzuki, R. Leslie & A. Inoguchi, eds. *Re-inventing forestry agencies experiences of institutional restructuring in Asia and the Pacific.* RAP Publication 2008/05. Bangkok, FAO Regional Office for Asia and the Pacific.

In the twelve years since the first Asia-Pacific Forestry Sector Outlook Study was completed in 1998, the region has experienced tremendous changes in nearly every aspect. These changes have been particularly profound in the forestry sector, where society has dramatically increased its demands and expanded its expectations of forests and forestry. This publication summarizes the key findings and results of the second Asia-Pacific Forestry Sector Outlook Study — a comprehensive effort spanning nearly four years and involving all member countries of the Asia-Pacific Forestry Commission. The current report synthesizes observations and findings from almost 50 country and thematic reports in providing analyses of the status and trends of all aspects of Asia-Pacific forestry. The publication also analyzes key factors driving changes in forestry in the region and sets out three scenarios for 2020: "Boom", "Bust" and "Green Economy". The report concludes by outlining priorities and strategies to move the regionis forestry sector onto a more sustainable footing and to provide continued benefits to future generations.