Food and Agriculture Organization of the United Nations

Global Forest Resources Assessment 2015

How are the world's forests changing?

Second edition

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GLOBAL FOREST RESOURCES ASSESSMENT 2015

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Second edition

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
Rome, 2016

The Global Forest Resources Assessment

Sustainably managed forests provide essential goods and services and thus play a vital part in sustainable development. Reliable and up-to-date information on the state of forest resources is crucial to support decision-making for investment and policymaking in forestry and sustainable development.

The Food and Agriculture Organization of the United Nations (FAO), at the request of its member countries, regularly monitors the world´s forests and their management and uses through the Global Forest Resources Assessment (FRA). More information on the FRA 2015 process, other publications and the online database is available on the FRA website (www.fao.org/forest-resources-assessment).

The FRA process is coordinated by the Forestry Department at FAO headquarters in Rome together with partners in the Collaborative Forest Resources Questionnaire. The partners are: the Central African Forests Commission, FOREST EUROPE, the International Tropical Timber Organization, the Montréal Process and the United Nations Economic Commission for Europe.

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Global forest resource reporting is not possible without contributions from the nearly 300 FRA national correspondents and alternates who are appointed by their governments to prepare responses to the FRA Collaborative Forest Resources Questionnaire (CFRQ). National investments in data collection, workshops and report writing were substantial and were the foundation of the 155 Country Reports in FRA 2015. Regional and global workshops co-sponsored by FAO, the United Nations Economic Commission for Europe, and the Governments of Canada, Finland, India, Japan, Mexico, Thailand and the United States of America were an important part of the FRA 2015 process.

This report was written by K. MacDicken, Ö. Jonsson, L. Piña, L. Marklund, S. Maulo, V. Contessa, Y. Adikari, M. Garzuglia, E. Lindquist, G. Reams and R. D'Annunzio. Technical support was provided by P. Mundhenk and C. Boitani. Publications support services were provided by M. Palermo and L. Marinaro. D. Taylor and D. Miller edited the report and S. Lapstun provided editorial services and production coordination. Production of the second edition was coordinated by D. Miller. Design and layout were done by F. Dicarlo. The quality of the data and of the report was improved with reviews by CFRQ partners, FAO Forestry Department staff and peer reviewers, to whom we are grateful.

Foreword

The contributions of forests to the well-being of humankind are extraordinarily vast and far-reaching. Forests play a fundamental role in combating rural poverty, ensuring food security and providing decent livelihoods; they offer promising mid-term green growth opportunities; and they deliver vital long-term ecosystem services, such as clean air and water, conservation of biodiversity and mitigation of climate change.

Forestry has an important place in FAO's Strategic Framework, which strongly promotes an integrated approach to addressing the major problems that concern food production, rural development, land use and sustainable management of natural resources.

However, in order to manage our forests wisely for the benefit of current and future generations, it is vital to have a clear understanding of the situation of the world's forests and ongoing trends.

The *Global Forest Resources Assessment* (FRA) allows us to do exactly that. Since the first FRA was published in 1948, FAO has reported periodically on the situation of the world's forests, serving the international community with the best information and techniques available.

FRA 2015 arrives in a decisive period for forests and sustainable development. The development agenda towards 2030 has now been defined, including the new Sustainable Development Goals. Forests and their role in protecting and restoring terrestrial ecosystems and their services are essential for the post-2015 development agenda.

A global and inclusive climate change agreement – in which forests are a key part – was reached at the Conference of the Parties to the United Nations Framework Convention on Climate Change held in Paris in December 2015 and adopted by 195 countries.

The year 2015 also featured the XIV World Forestry Congress in Durban, South Africa. The largest international forest event of this decade, the Congress was held in Africa for the first time and this was where FRA 2015 was launched.

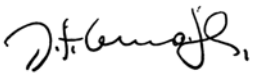
FRA 2015 shows an encouraging tendency towards a reduction in the rates of forest loss and carbon emissions from forests and increases in capacity for sustainable forest management. The reliability of the information collected has also improved enormously – national forest assessments apply to some 83 percent of global forest area, which is a substantial increase since 2010.

Two broad conclusions can be drawn: 1) we have a wealth of reliable information today on the situation of the world's forests; and 2) the direction of change is positive, with many impressive examples of progress in all regions of the world. However, this positive trend needs to be strengthened, especially in the countries that are lagging behind.

FRA 2015 is the result of countries' collective efforts, including those of some 300 national correspondents, partners and FAO. The Collaborative Forest Resources Questionnaire, implemented by six partners and processes, covers 88 percent of the world's forests. This ongoing collaborative effort is improving data consistency while reducing countries' reporting burdens. In addition, FRA 2015 has incorporated data quality indicators for the first time.

The results of the assessment are available in a range of formats, including the present synthesis document, a desk reference containing summary tables and a special issue of the journal *Forest Ecology and Management.*

FRA 2015 is a major step forward. I encourage you to take full advantage of the information included in this report.

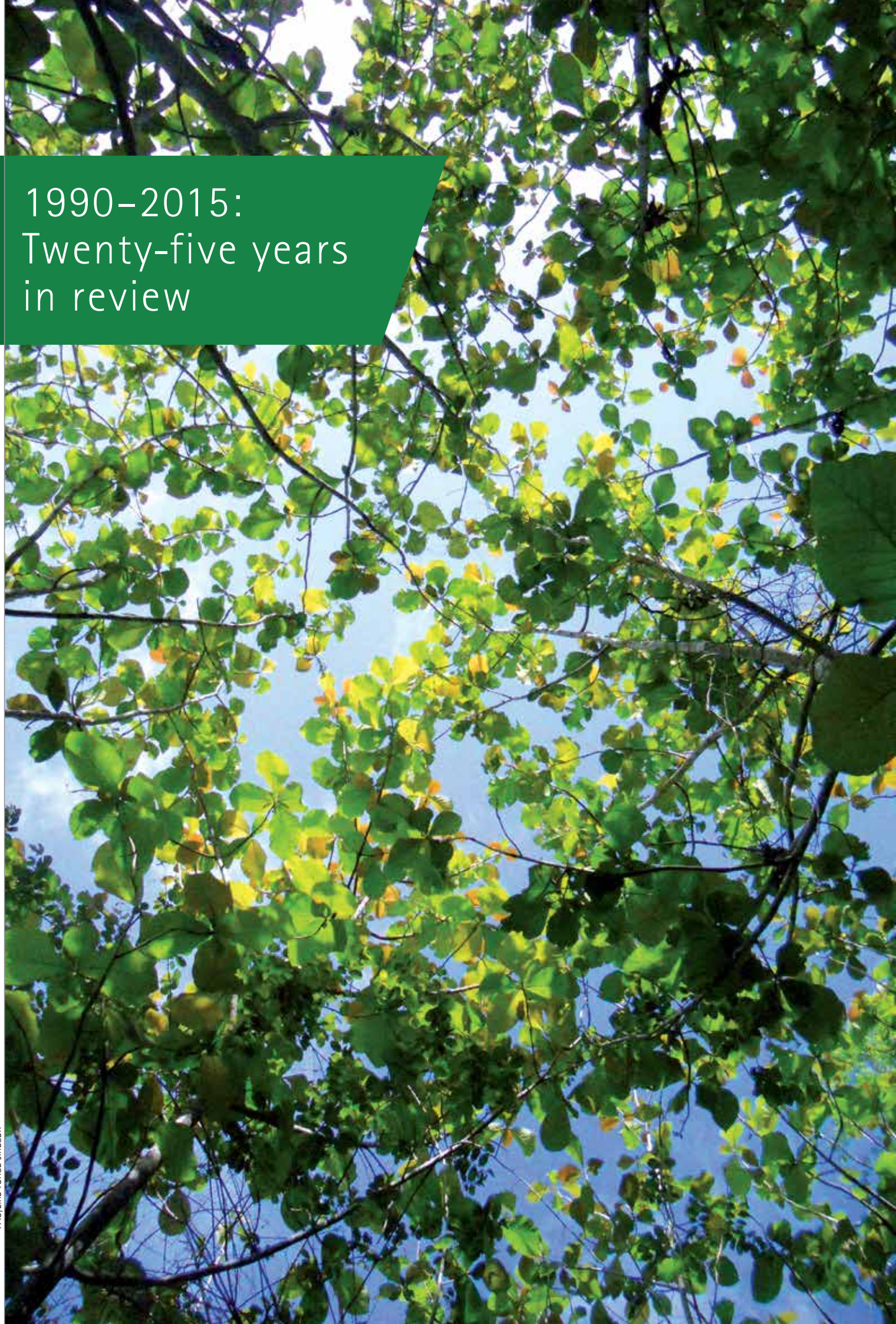


José Graziano da Silva
FAO Director-General

Acronyms

CFRQ	Collaborative Forest Resources Questionnaire
FAO	Food and Agriculture Organization of the United Nations
FMP	forest management plan
FRA	Global Forest Resources Assessment
FRIMS	Forest Resources Information Management System
FSC	Forest Stewardship Council
GDP	gross domestic product
Gt	gigatonne
ha	hectare
ISIC	International Standard Industrial Classification of All Economic Activities
NACE	Statistical Classification of Economic Activities in the European Community
NWFP	non-wood forest product
PCCL	partial canopy cover loss
PEFC	Programme for the Endorsement of Forest Certification
REDD+	Reducing Emissions from Deforestation and Forest Degradation
SDG	Sustainable Development Goal
SFM	sustainable forest management
SIDS	Small Island Developing States

1990–2015: Twenty-five years in review



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Forests and forest management have changed substantially over the past 25 years. Overall, this period has seen a series of positive developments. Even though, globally, the extent of the world's forests continues to decline as human populations continue to grow and demand for food and land increases, the rate of net forest loss has been cut by over 50 percent. At the same time, the attention paid to sustainable forest management (SFM) has never been higher: More land is designated as permanent forest, more assessment, monitoring, reporting, planning and stakeholder involvement is taking place, and the legal frameworks for SFM are being widely adopted. Larger areas are being designated for conservation of biodiversity while at the same time forests are meeting increasing demands for forest products and services.

In 1990 the world had 4 128 million ha of forest; by 2015 this area had decreased to 3 999 million ha. This is a change from 31.6 percent of global land area in 1990 to 30.6 percent[1] in 2015. Yet deforestation, or forest conversion to other land use, is more complicated than that. Forest gains and losses occur continuously, and forest gains are particularly difficult to monitor even with high-resolution satellite imagery. Natural forest and planted forest area change dynamics differ across national circumstances and forest types.

We can describe forest area change as a process of gain (forest expansion) and loss (deforestation). Change in total forest area provides a picture of how all forest resources combined are changing. Natural forest area change is perhaps a better indicator of natural habitat and biodiversity dynamics.

There was a net loss of some 129 million ha of forest between 1990 and 2015, about the size of South Africa, representing an annual net loss rate of 0.13 percent. Yet this should be understood in context: The rate of annual net loss of forest has slowed from 0.18 percent in the 1990s to 0.08 percent over the last five-year period. Between 2010 and 2015 there was an annual loss of 7.6 million ha and an annual gain of 4.3 million ha per year, resulting in a net annual decrease in forest area of 3.3 million ha.

The largest forest area loss occurred in the tropics, particularly in South America and Africa, although the rate of loss in those areas has decreased substantially in the past five years. Average per capita forest area declined from 0.8 ha to 0.6 ha per person from 1990 to 2015. While per capita forest area decline is greatest in the tropics and subtropics, it is occurring in every climatic domain (except in the temperate domain) as populations increase and forest land is converted to agriculture and other land uses.

The bulk of the world's forests is natural forest, with reported natural forest area amounting to 93 percent of global forest area, or 3.7 billion ha, in 2015. From 2010 to 2015, reported natural forest area decreased by a net 6.5 million ha per year. This is a reduction in net annual natural forest loss from 10.6 million ha per year for the period 1990 to 2000.

Most natural forest falls into the category of "other naturally regenerated forest" (74 percent); the remaining 26 percent is reported as primary forest. Since 1990, 31 million ha of primary forest have been reported by countries as modified or cleared. This does not necessarily mean that primary forest is converted to other land uses. Primary forest, when modified but not cleared, changes into other naturally regenerated forest and, in some cases, planted forest.

Planted forest area has increased by over 105 million ha since 1990. The average annual rate of increase between 1990 and 2000 was 3.6 million ha. The rate peaked at 5.9 million ha per year for the period 2000 to 2005 and slowed to 3.3 million ha per year between 2010 and 2015, as planting decreased in East Asia, Europe, North America, and South and Southeast Asia.

Wood removals increased slightly from 1990 to 2011, while reliance on woodfuel has remained large, particularly in low-income countries. In 2011 annual wood removals amounted to 3.0 billion m^3 globally, of which 49 percent were for woodfuel.

In 2015 about 31 percent of the world's forests were primarily designated as production forest, a slight decrease of 13.4 million ha since 1990. In addition, close to 28 percent of the reported forest area was designated for multiple use and decreased by 37.5 million ha between 1990 and 2015. Multiple-use forests are managed to provide a wide range of products and services simultaneously.

The conservation of biodiversity represents the primary management objective for 13 percent of the world's forests and, since 1990, 150 million ha of forest have been added to the area primarily managed for conservation. The area of forests designated for protection of soil and water has also increased and now represents 31 percent of the forest area of the reporting countries.

[1] Calculated on the basis of 2015 total land area.

©FAO/Jim Ball

Over the past 25 years global carbon stocks in forest biomass have decreased by almost 11 gigatonnes (Gt). This reduction has been mainly driven by conversion to other land uses and to a lesser extent by forest degradation.

Several indicators show progress towards SFM over the last 25 years. Ninety-six percent of the world's forests are covered by both policies and legislation supporting SFM. Most countries offer opportunities for stakeholders to provide input to national policy processes.

Forest resource data have improved in recent years. As of 2014, 112 countries representing about 83 percent of the global forest area reported that they had carried out or had an ongoing national forest assessment (based on either a field inventory, remote sensing or a combination of the two), of which most had been done or had been updated during the last five years.

The area of forest under a management plan has also increased. By 2010 the area under a management plan was more than half of the total forest area, split almost equally between production and conservation purposes. The majority of these plans require social and community involvement specifications and the delineation of high conservation value forests. Aspects of soil and water protection are included in the forest management plans for more than half of the areas covered by the plans. However, the challenge remains to increase the forest area under a management plan.

The area under international forest management certification schemes[2] increased from 14 million ha in 2000 to 438 million ha in 2014, of which 58 percent was under the Programme for the Endorsement of Forest Certification (PEFC) scheme and 42 percent was under the Forest Stewardship Council (FSC) certification scheme.

Most forests remain publicly owned, but the proportion of privately owned forests increased from 15 percent in 1990 to 18 percent in 2010. Most of this increase took place in upper-middle-income countries. Management rights of public forests held by private companies have increased substantially – the percentage of public forest area increased from 6 percent in 1990 to 14 percent in 2010.

[2] Reported figures include only those areas covered by the FSC and PEFC schemes.

Over the past 25 years the world's forests have changed in dynamic and diverse ways. Countries now have more and better information about their forest resources than ever before and as a result we have a better picture of global forest trends. The rate of forest area loss is declining and the indicators for SFM reveal positive progress. At the same time, important challenges remain. The existence of sound policies, legislation and regulation is not always coupled with effective incentives or enforcement. Unsustainable forest practices and forest conversion clearly persist – despite increased efforts – and the benefits from forest utilization in some countries do not effectively reach local communities. FAO's *Global Forest Resources Assessment 2015* (FRA 2015) documents both progress in forest management and a need for continued efforts towards SFM for the benefit of current and future generations.

Introducing the Global Forest Resources Assessment 2015

Working together

The first FRA was published in 1948 and its main focus was to assess the availability of timber. Since then, global assessments have evolved to respond to increasing information needs and have included many descriptors of forest resources and SFM. FRA 2015 is the result of contributions from 155 countries and the hard work of national correspondents who prepared Country Reports that present government forest statistics in a common format.

When FRA began in 1948, FAO was the only organization collecting and reporting global forest resource information. Today there are many international and regional organizations involved in measuring, monitoring and reporting forest resource data, mostly using remote sensing with little or no information other than tree cover area estimates. In 2011, six international organizations and processes[3] came together to create the Collaborative Forest Resources Questionnaire (CFRQ), representing some 100 countries and 88 percent of the world's forest area. These organizations now jointly collect data on over 60 percent of the total number of variables collected through the FRA process. These data are then shared among the CFRQ partners; as a result, data are collected once and used many times. This both reduces the reporting burden and increases data consistency across organizations. The CFRQ partnership has also helped to standardize definitions and timing of data collection.

Partnership was also crucial in the area of remote sensing. A global remote sensing survey was conducted with over 200 specialists from about 100 countries. In addition, a close working relationship with the European Commission Joint Research Centre has resulted in the sharing of both technical advances and the workload of global forest change analysis of Landsat data.

A quick guide to the data

The FRA 2015 dataset and the analyses have some unique attributes that should be considered when using this document. For more information on where the data have come from, see the data sources section on page 42 or visit the FRA website (www.fao.org/forest-resources-assessment).

[3] Central African Forests Commission, FAO, FOREST EUROPE, International Tropical Timber Organization, Montréal Process, United Nations Economic Commission for Europe.

The main categories used for the analyses are:

1. *Region and subregion.* These are the same geographic region and subregion groupings used in FRA 2010.

2. *Climatic domain.* FRA country data are classified by dominant climatic domains (tropical, subtropical, temperate and boreal) for each country (Figure 1). For example, the United States of America has boreal, temperate and subtropical forest, but as the largest forest area is found in the temperate climatic domain, country data have been assigned to that category.

3. *Income categories.* These analyses use World Bank income categories as of July 2013 (Figure 2).

FRA 2015 provides indicators of data quality, introducing a tier system in which most variables are labelled by countries according to a pre-established set of definitions. The main purpose of the tiers is to indicate data quality, primarily age of the data and nature of the original data source. Tier 3 is the most recent and most robust data source, Tier 2 older and less complete, and Tier 1 an expert estimate (see page 43).

FIGURE 1 **Countries by dominant climatic domain**

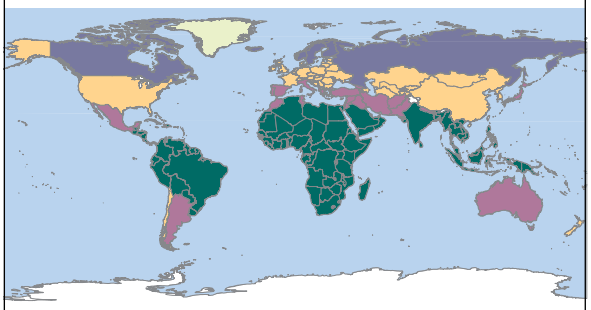
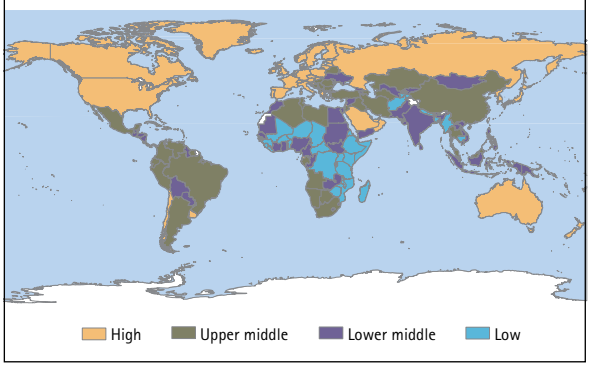


FIGURE 2 **Countries by income category**



Statistical profiles

WORLD (234 countries and territories)				
Variable (unit, year)[a]	**Total**	**Direction of change[b]**	**Annual change[b] (%)**	**Data availability[c] (status/trend)**
FOREST AREA AND CHARACTERISTICS				
Forest area (million ha, 2015)	3 999	↓	-0.13	H/H
Area of other wooded land (million ha, 2015)	1 204	↓	-0.10	H/H
Area of other land with tree cover (million ha, 2015)	284	↑	0.52	M/M
Average annual reforestation (million ha, 2015)	27	↑	1.57	H/M
Natural forest (million ha, 2015)[d]	3 695	↓	-0.24	H/H
Planted forest (million ha, 2015)	291	↑	1.84	H/H
Net annual forest change (million ha, 2010–2015)	-3.3			H/*
Net annual natural forest change (million ha, 2010–2015)[d]	-6.5			H/*
Net annual planted forest change (million ha, 2010–2015)	3.3			H/*
PRODUCTION				
Forest growing stock (billion m^3, 2015)[e]	531	~	0.03	H/H
Forest growing stock (m^3 per ha, 2015)[e]	129	↑	0.16	H/H
Carbon in above- and below-ground biomass (Gt, 2015)[e]	296	↓	-0.15	H/H
Carbon in above- and below-ground biomass (tonnes per ha, 2015)[e]	73	~	-0.02	H/H
Production forest (million ha, 2015)	1 187	~	-0.05	H/H
Multiple-use forest (million ha, 2015)	1 049	↓	-0.16	H/H
Total wood removals (million m^3, 2011)	2 997	↑	0.41	H/H
PROTECTIVE FUNCTIONS AND SELECTIVE ECOSYSTEM SERVICES				
Protection of soil and water (million ha, 2015)	1 015	↑	0.53	H/M
Ecosystem services, cultural or spiritual values (million ha, 2015)	1 163	↑	0.59	M/M
BIODIVERSITY AND CONSERVATION				
Conservation of biodiversity (million ha, 2015)	524	↑	1.75	H/H
Primary forest (million ha, 2015)	1 277	↓	-0.10	H/H
Forest area within protected areas (million ha, 2015)	651	↑	1.98	H/H

[a] Variables may be overlapping.
[b] Unless otherwise specified, change refers to the period 1990 to latest reporting year. The symbol "~" indicates a change rate ≤ 0.05%.
[c] Data availability categories:
H = high (reporting countries represent 75–100% of total forest area)
M = medium (reporting countries represent 50–74% of total forest area)
L = low (reporting countries represent 25–49% of total forest area)
– = very low (reporting countries represent < 25% of total forest area)
* = trend data not available
Blank = not applicable
[d] Not all countries reported on natural and planted area; thus the sum does not equal total forest area.
[e] Growing stock and carbon stock figures include FAO estimates for non-reporting countries.

WORLD (234 countries and territories)				
Variable (unit, year)[a]	**Total**	**Direction of change[b]**	**Annual change[b] (%)**	**Data availability[c] (status/trend)**
DISTURBANCES				
Area with invasive woody species (million ha, 2010)	79	↑	11.33	L/L
Forest area burned (million ha, 2010)	65			H/*
Forest area with reduction in canopy cover (million ha, 2000–2010)	185			M/*
MEASURING PROGRESS TOWARDS SUSTAINABLE FOREST MANAGEMENT (SFM)				
Countries with policies supporting SFM (latest available year)	146			H/*
Countries with legislation and regulation supporting SFM (latest available year)	144			H/*
Forest area in permanent forest land use (million ha, 2010)	2 166			H/*
Forest area under a management plan (million ha, 2010)	2 100			H/*
Forest area certified under an international scheme (million ha, 2014)	438	↑		H/H
Countries with a national stakeholder platform (latest available year)	126			H/*
Forest area with national forest assessment since 2010 (million ha, 2014)	3 126			H/*
Forest area covered by Criteria and Indicator reporting (million ha, latest available year)	3 078			H/*
Forest area reported through periodic national state of forest reports (million ha, latest available year)	3 530			H/*
OWNERSHIP				
Public (million ha, 2010)	2 969	↓	-0.24	H/H
Private (million ha, 2010)	774	↑	1.00	H/H
Unknown (million ha, 2010)	141	↓	-1.19	H/H
ECONOMICS/LIVELIHOOD				
In-forest employment (million persons, 2010)	12.7	↓	-0.45	H/L
Gross value added from in-forest activities (billion USD, latest year)	116			H/*
Gross value added from the forest sector (billion USD, 2011)[f]	606			

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Blank = not applicable
[d] Not all countries reported on natural and planted area; thus the sum does not equal total forest area.
[e] Growing stock and carbon stock figures include FAO estimates for non-reporting countries.
[f] FAO, 2014.

AFRICA (58 countries and territories)				
Variable (unit, year)[a]	Total	Direction of change[b]	Annual change[b] (%)	Data availability[c] (status/ trend)
Forest area (million ha, 2015)	624	↓	-0.49	H/H
Natural forest (million ha, 2015)[d]	600	↓	-0.54	H/H
Planted forest (million ha, 2015)	16	↑	1.34	H/H
Net annual forest change (million ha, 2010–2015)	-2.8			H/*
Net annual natural forest change (million ha, 2010–2015)[d]	-3.1			H/*
Net annual planted forest change (million ha, 2010–2015)	0.2			H/*
Forest growing stock (billion m^3, 2015)[e]	79	↓	-0.37	H/H
Forest growing stock (m^3 per ha, 2015)[e]	128	↑	0.13	H/H
Carbon in above- and below-ground biomass (Gt, 2015)[e]	60	↓	-0.43	H/H
Carbon in above- and below-ground biomass (tonnes per ha, 2015)[e]	96	↑	0.07	H/H
Production forest (million ha, 2015)	165	↓	-0.77	H/M
Multiple-use forest (million ha, 2015)	133	↓	-0.46	H/M
Total wood removals (million m^3, 2011)	614	↑	2.12	H/H
Protection of soil and water (million ha, 2015)	50	↓	-0.15	M/L
Ecosystem services, cultural or spiritual values (million ha, 2015)	67	↓	-0.30	L/L
Conservation of biodiversity (million ha, 2015)	92	↑	0.75	H/M
Primary forest (million ha, 2015)	135	↓	-0.45	H/H
Forest area within protected areas (million ha, 2015)	101	↑	0.66	H/M
Forest area burned (million ha, 2010)	19			H/*
Forest area with reduction in canopy cover (million ha, 2000–2010)	50			H/*
Forest area under a management plan (million ha, 2010)	140			H/*
Forest area certified under an international scheme (million ha, 2014)	6.4	↑		H/*
Public ownership (million ha, 2010)	535	↓	-0.49	H/H
Private ownership (million ha, 2010)	71	↓	-0.16	H/H
Unknown ownership (million ha, 2010)	2.0	↓	-13.39	H/H
Employment in forestry (thousand persons, 2010)	1 109	↑	2.48	M/L

ASIA (48 countries and territories)				
Variable (unit, year)[a]	Total	Direction of change[b]	Annual change[b] (%)	Data availability[c] (status/ trend)
Forest area (million ha, 2015)	593	↑	0.17	H/H
Natural forest (million ha, 2015)[d]	462	↓	-0.24	H/H
Planted forest (million ha, 2015)	129	↑	2.17	H/H
Net annual forest change (million ha, 2010–2015)	0.8			H/*
Net annual natural forest change (million ha, 2010–2015)[d]	-1.0			H/*
Net annual planted forest change (million ha, 2010–2015)	1.8			H/*
Forest growing stock (billion m^3, 2015)[e]	55	↑	0.28	H/H
Forest growing stock (m^3 per ha, 2015)[e]	93	↑	0.11	H/H
Carbon in above- and below-ground biomass (Gt, 2015)[e]	36	↓	-0.23	H/H
Carbon in above- and below-ground biomass (tonnes per ha, 2015)[e]	61	↓	-0.41	H/H
Production forest (million ha, 2015)	247	~	-0.03	H/H
Multiple-use forest (million ha, 2015)	129	↓	-1.19	H/H
Total wood removals (million m^3, 2011)	780	↑	1.62	H/H
Protection of soil and water (million ha, 2015)	195	↑	1.74	H/H
Ecosystem services, cultural or spiritual values (million ha, 2015)	43	↑	1.55	M/M
Conservation of biodiversity (million ha, 2015)	86	↑	1.28	H/H
Primary forest (million ha, 2015)	117	~	0.03	H/H
Forest area within protected areas (million ha, 2015)	115	↑	1.71	H/H
Forest area burned (million ha, 2010)	1.4			H/*
Forest area with reduction in canopy cover (million ha, 2000–2010)	54			M/*
Forest area under a management plan (million ha, 2010)	410			H/*
Forest area certified under an international scheme (million ha, 2014)	14	↑		H/*
Public ownership (million ha, 2010)	453	↓	-0.65	H/H
Private ownership (million ha, 2010)	134	↑	5.32	H/H
Unknown ownership (million ha, 2010)	1.0	↓	-6.27	H/H
Employment in forestry (thousand persons, 2010)	9 939	↓	-0.51	H/M

[a] Variables may be overlapping.
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M = medium (reporting countries represent 50–74% of total forest area)
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Blank = not applicable
[d] Not all countries reported on natural and planted area; thus the sum does not equal total forest area.
[e] Growing stock and carbon stock figures include FAO estimates for non-reporting countries.

EUROPE (50 countries and territories)

Variable (unit, year)[a]	Total	Direction of change[b]	Annual change[b] (%)	Data availability[c] (status/ trend)
Forest area (million ha, 2015)	1 015	↑	0.08	H/H
Natural forest (million ha, 2015)[d]	929	~	0.01	H/H
Planted forest (million ha, 2015)	83	↑	1.11	H/H
Net annual forest change (million ha, 2010–2015)	0.4			H/*
Net annual natural forest change (million ha, 2010–2015)[d]	0.01			H/*
Net annual planted forest change (million ha, 2010–2015)	0.4			H/*
Forest growing stock (billion m^3, 2015)[e]	115	↑	0.40	H/H
Forest growing stock (m^3 per ha, 2015)[e]	113	↑	0.32	H/H
Carbon in above- and below-ground biomass (Gt, 2015)[e]	45	↑	0.37	H/H
Carbon in above- and below-ground biomass (tonnes per ha, 2015)[e]	45	↑	0.29	H/H
Production forest (million ha, 2015)	511	↓	-0.27	H/H
Multiple-use forest (million ha, 2015)	238	↓	-0.49	H/H
Total wood removals (million m^3, 2011)	681	↓	-0.29	H/H
Protection of soil and water (million ha, 2015)	123	↑	1.37	H/H
Ecosystem services, cultural or spiritual values (million ha, 2015)	122	↑	1.51	H/H
Conservation of biodiversity (million ha, 2015)	53	↑	2.31	H/H
Primary forest (million ha, 2015)	277	↑	0.48	H/H
Forest area within protected areas (million ha, 2015)	46	↑	2.92	H/H
Forest area burned (million ha, 2010)	2.6			H/*
Forest area with reduction in canopy cover (million ha, 2000–2010)	18			H/*
Forest area under a management plan (million ha, 2010)	950			H/*
Forest area certified under an international scheme (million ha, 2014)	167	↑		H/*
Public ownership (million ha, 2010)	897	~	-0.02	H/H
Private ownership (million ha, 2010)	108	↑	0.94	H/H
Unknown ownership (million ha, 2010)	8.1	↑	12.13	H/H
Employment in forestry (thousand persons, 2010)	671	↓	-2.00	H/-

NORTH AND CENTRAL AMERICA (39 countries and territories)

Variable (unit, year)[a]	Total	Direction of change[b]	Annual change[b] (%)	Data availability[c] (status/ trend)
Forest area (million ha, 2015)	751	~	-0.01	H/H
Natural forest (million ha, 2015)[d]	707	↓	-0.11	H/H
Planted forest (million ha, 2015)	43	↑	2.51	H/H
Net annual forest change (million ha, 2010–2015)	0.1			H/*
Net annual natural forest change (million ha, 2010–2015)[d]	-0.4			H/*
Net annual planted forest change (million ha, 2010–2015)	0.5			H/*
Forest growing stock (billion m^3, 2015)[e]	96	↑	0.29	H/H
Forest growing stock (m^3 per ha, 2015)[e]	129	↑	0.30	H/H
Carbon in above- and below-ground biomass (Gt, 2015)[e]	36	↑	0.23	H/H
Carbon in above- and below-ground biomass (tonnes per ha, 2015)[e]	58	↑	0.24	H/H
Production forest (million ha, 2015)	124	↑	0.82	H/H
Multiple-use forest (million ha, 2015)	391	↓	-0.20	H/H
Total wood removals (million m^3, 2011)	513	↓	-1.48	H/H
Protection of soil and water (million ha, 2015)	534	↑	0.19	H/H
Ecosystem services, cultural or spiritual values (million ha, 2015)	642	~	0.04	H/H
Conservation of biodiversity (million ha, 2015)	127	↑	1.08	H/H
Primary forest (million ha, 2015)	320	~	-0.04	H/H
Forest area within protected areas (million ha, 2015)	75	↑	0.98	H/H
Forest area burned (million ha, 2010)	3.9			H/*
Forest area with reduction in canopy cover (million ha, 2000–2010)	10			M/*
Forest area under a management plan (million ha, 2010)	430			H/*
Forest area certified under an international scheme (million ha, 2014)	222	↑		H/*
Public ownership (million ha, 2010)	458	↑	0.10	H/H
Private ownership (million ha, 2010)	244	↓	-0.10	H/H
Unknown ownership (million ha, 2010)	34	↓	-0.62	H/H
Employment in forestry (thousand persons, 2010)	186	↓	-0.92	H/L

[a] Variables may be overlapping.

[b] Unless otherwise specified, change refers to the period 1990 to latest reporting year. The symbol "~" indicates a change rate ≤ 0.05%.

[c] Data availability categories:

H = high (reporting countries represent 75–100% of total forest area)

M = medium (reporting countries represent 50–74% of total forest area)

L = low (reporting countries represent 25–49% of total forest area)

– = very low (reporting countries represent < 25% of total forest area)

* = trend data not available

Blank = not applicable

[d] Not all countries reported on natural and planted area; thus the sum does not equal total forest area.

[e] Growing stock and carbon stock figures include FAO estimates for non-reporting countries.

OCEANIA (25 countries and territories)				
Variable (unit, year)[a]	Total	Direction of change[b]	Annual change[b] (%)	Data availability[c] (status/ trend)
Forest area (million ha, 2015)	174	↓	-0.08	H/H
Natural forest (million ha, 2015)[d]	169	↓	-0.12	H/H
Planted forest (million ha, 2015)	4.4	↑	1.82	H/H
Net annual forest change (million ha, 2010–2015)	0.3			H/*
Net annual natural forest change (million ha, 2010–2015)[d]	0.3			H/*
Net annual planted forest change (million ha, 2010–2015)	0.03			H/*
Forest growing stock (billion m^3, 2015)[e]	35	↑	0.08	H/H
Forest growing stock (m^3 per ha, 2015)[e]	202	↑	0.15	L/L
Carbon in above- and below-ground biomass (Gt, 2015)[e]	16	~	0.05	H/H
Carbon in above- and below-ground biomass (tonnes per ha, 2015)[e]	92	↑	0.13	H/H
Production forest (million ha, 2015)	13	↑	2.38	H/H
Multiple-use forest (million ha, 2015)	54	↑	4.06	H/L
Total wood removals (million m^3, 2011)	63	↑	2.53	H/H
Protection of soil and water (million ha, 2015)	37	↑	0.09	H/-
Ecosystem services, cultural or spiritual values (million ha, 2015)	123	↓	-0.15	H/M
Conservation of biodiversity (million ha, 2015)	36	↑	0.84	H/L
Primary forest (million ha, 2015)	27	↓	-2.11	H/-
Forest area within protected areas (million ha, 2015)	27	↑	4.49	H/-
Forest area burned (million ha, 2010)	2.6			H/*
Forest area with reduction in canopy cover (million ha, 2000–2010)	5			L/*
Forest area under a management plan (million ha, 2010)	46			H/*
Forest area certified under an international scheme (million ha, 2014)	13	↑		H/*
Public ownership (million ha, 2010)	97	↓	-0.16	H/L
Private ownership (million ha, 2010)	72	↑	0.09	H/L
Unknown ownership (million ha, 2010)	1.4			H/L
Employment in forestry (thousand persons, 2010)	16	↑	0.55	H/-

SOUTH AMERICA (14 countries and territories)				
Variable (unit, year)[a]	Total	Direction of change[b]	Annual change[b] (%)	Data availability[c] (status/ trend)
Forest area (million ha, 2015)	842	↓	-0.40	H/H
Natural forest (million ha, 2015)[d]	827	↓	-0.43	H/H
Planted forest (million ha, 2015)	15	↑	2.38	H/H
Net annual forest change (million ha, 2010–2015)	-2.0			H/*
Net annual natural forest change (million ha, 2010–2015)[d]	-2.2			H/*
Net annual planted forest change (million ha, 2010–2015)	0.4			H/*
Forest growing stock (billion m^3, 2015)[e]	150	↓	-0.28	H/H
Forest growing stock (m^3 per ha, 2015)[e]	178	↑	0.12	H/H
Carbon in above- and below-ground biomass (Gt, 2015)[e]	103	↓	-0.31	H/H
Carbon in above- and below-ground biomass (tonnes per ha, 2015)[e]	122	↑	0.09	H/H
Production forest (million ha, 2015)	127	↑	1.21	H/H
Multiple-use forest (million ha, 2015)	104	↑	6.44	H/H
Total wood removals (million m^3, 2011)	346	↑	0.17	H/H
Protection of soil and water (million ha, 2015)	76	↓	-0.3	M/M
Ecosystem services, cultural or spiritual values (million ha, 2015)	167	↑	6.60	M/M
Conservation of biodiversity (million ha, 2015)	130	↑	3.92	H/H
Primary forest (million ha, 2015)	400	↓	-0.32	H/H
Forest area within protected areas (million ha, 2015)	287	↑	2.89	H/M
Forest area burned (million ha, 2010)	36			H/*
Forest area with reduction in canopy cover (million ha, 2000–2010)	47			H/*
Forest area under a management plan (million ha, 2010)	125			H/*
Forest area certified under an international scheme (million ha, 2014)	15	↑		H/*
Public ownership (million ha, 2010)	528	↓	-0.38	H/-
Private ownership (million ha, 2010)	145	↑	0.70	H/H
Unknown ownership (million ha, 2010)	95	↓	-1.90	H/-
Employment in forestry (thousand persons, 2010)	734	↑	10.59	H/-

[a] Variables may be overlapping.

[b] Unless otherwise specified, change refers to the period 1990 to latest reporting year. The symbol "~" indicates a change rate ≤ 0.05%.

[c] Data availability categories:

H = high (reporting countries represent 75–100% of total forest area)

M = medium (reporting countries represent 50–74% of total forest area)

L = low (reporting countries represent 25–49% of total forest area)

– = very low (reporting countries represent < 25% of total forest area)

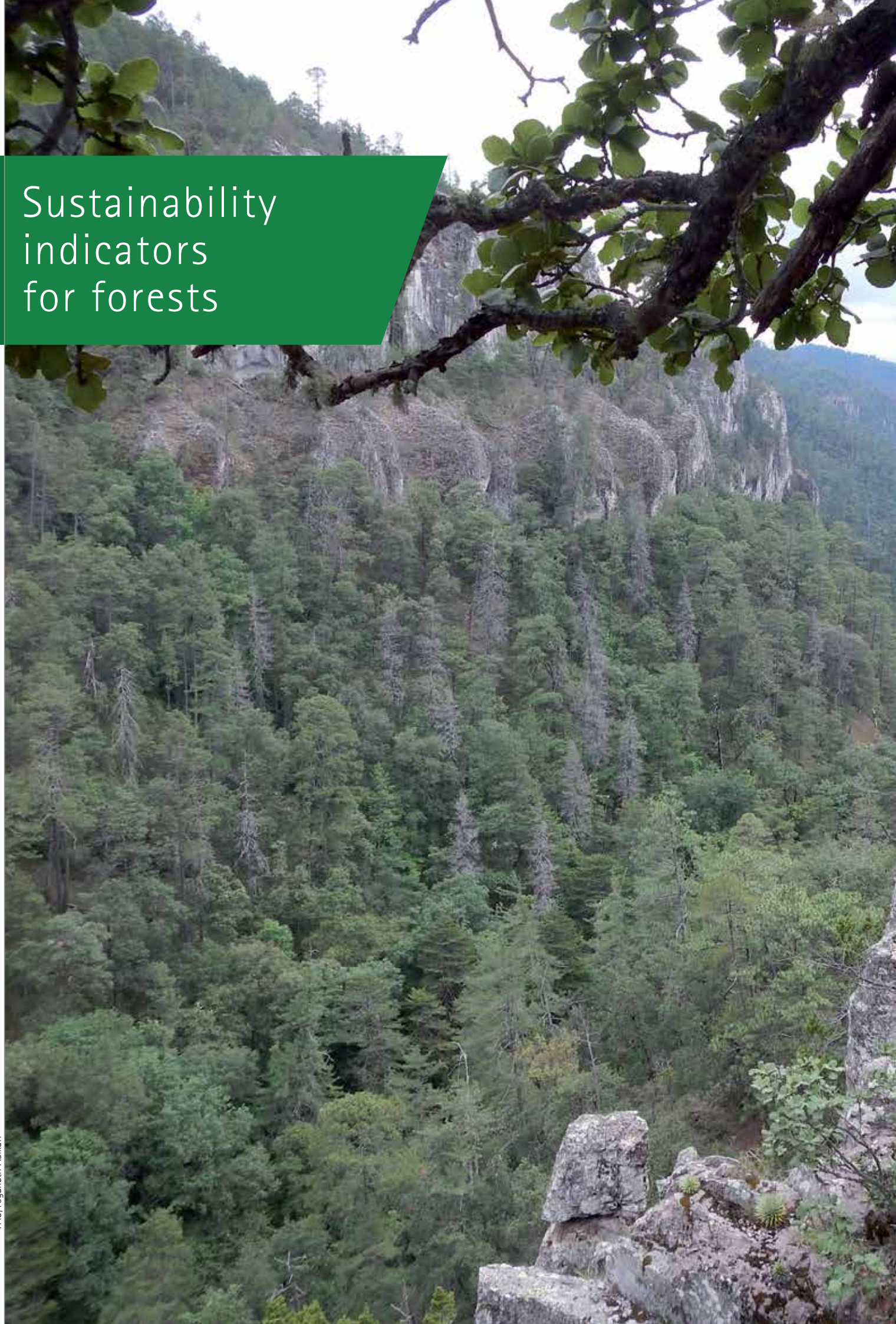
* = trend data not available

Blank = not applicable

[d] Not all countries reported on natural and planted area; thus the sum does not equal total forest area.

[e] Growing stock and carbon stock figures include FAO estimates for non-reporting countries.

Sustainability indicators for forests



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Managing forests responsibly and sustainably requires a balanced approach encompassing the three pillars of sustainability – economic, social and environmental. Measuring progress in each of these broad areas in a meaningful way is complex and in many cases not fully achievable, even in countries that have the resources to collect the relevant data. However, indicators that measure progress provide a guide to how management and investment decisions can be adapted to meet the needs and expectations of current and future generations.

What are they?

Sustainability indicators are science-based measures that provide a consistent approach to assess, monitor and report progress on SFM to a wide range of stakeholders and institutions, including governments, the private sector, non-governmental organizations, donor organizations, researchers and the public. Sustainability indicators can be useful to identify the changes in forest management practices required to maintain and improve healthy forests.

Why are they important?

FRA 2015 indicators provide a picture of the current state of the world's forest resources and, most importantly, of the changes over the last 25-year period. All of this information, made available by countries to FRA and the global community, constitutes a basis for the development of policies, practices and investments affecting forests and forestry.

Given the complexity of the world's forests and the societal benefits from forests, no single indicator can adequately assess progress towards SFM. The whole range of indicators must be considered to obtain a comprehensive picture.

Information provided by FRA will also contribute to some of the forest-related indicators identified to monitor progress towards the Sustainable Development Goals (SDGs) adopted by the United Nations General Assembly in 2015. More specifically, FRA will contribute to SDG indicator 15.1.1 (forest area as a proportion of total land area) and to providing relevant information for indicator 15.2.1 (progress towards SFM).

The wealth of data made available through the FRA reporting process is provided directly by the countries through a well-established, consolidated, transparent and traceable reporting process. Furthermore, the application of a standardized reporting methodology and harmonized variables means that national statistics can be aggregated at the regional and global level as well as monitored over time, thus meeting the requirements of SDG monitoring and reporting. To further engage in the monitoring of the SDG, FRA will continue to strengthen countries' capacity to report in accordance with SDG monitoring requirements.

EXTENT OF FOREST RESOURCES

The extent of forest resources is an important indicator of sustainable forest management. Understanding changes in forest resources is necessary for policy and management actions, as well as for guiding public and private investments. Ensuring adequate forest resources to provide social, economic and environmental functions for future generations is essential for sustainable development.

Changes in forest area

WHY IS THIS INDICATOR IMPORTANT?

Knowing how and why forest area changes over time is important for managing forests sustainably because such changes may result in long-term losses (e.g. forest conversion to agriculture) or gains (e.g. afforestation). Because forests provide the bulk of the world's forest products and a number of ecological and environmental services, such as water purification, erosion control and carbon sequestration, it is vital to understand current forest resources and the many paths by which forests are changing. Forests also act as sinks and sources of carbon, so monitoring forest gains and losses through land-use change helps scientists and decision-makers to gauge the forests' ability to reduce net greenhouse gas emissions.

Changes in forest area often relate to changes in the ability of forests to provide globally important goods and services. These can include employment, wood products, non-wood forest products and services. An understanding of these changes provides a sound basis for policy, investment and management decision-making at the national, regional and global levels.

WHAT HAS CHANGED AND WHY?

Over the past 25 years the world's forest area has declined from 4.1 billion ha to just under 4 billion ha, a decrease of 3.1 percent. The rate of global forest area net loss has slowed by more than 50 percent between the periods 1990–2000 and 2010–2015 (Table 1). This is a result of a combination of reduced forest area loss in some countries and increased gains in others. It appears that net forest area change has stabilized over the past decade.

Figure 3 shows forest area as a proportion of land area as of 2015. The top ten countries in terms of forest area account for some 67 percent of global forest area (Table 2).

The largest proportion of the world's forests is found in high-income countries, followed by upper-middle, lower-middle and low-income countries. This is also true for the area of natural and planted forest (Figure 4).

The ways in which the forest area has changed are important, particularly given the continued growth in human populations and demand for forest products. Tables 3 and 4 show where the greatest forest area losses and gains occurred between 2010–2015, while countries with a stable forest area, and forest area gains and losses from 1990 to 2015 are shown in Figure 5.

Most of the forest converted to other land uses between 1990 and 2015 was in the tropical domain, which has shown losses in every measurement period since 1990 (Figure 6). In the temperate domain, forest area has increased in every measurement period, while there has been relatively little change in the boreal and subtropical domains.

While forest area has declined, human populations have increased, which means that per capita forest area is declining – a trend that has existed for many millennia. Changes in per capita forest area are, like other measures of forest area change, uneven across climatic domains and subregions (Figure 7). Change in the boreal and temperate domains has been gradual, while decline in the tropics has not – per capita forest area has nearly halved over the last 25 years. In the subtropics it has declined by over 35 percent.

TABLE 1 **Global forest area change, 1990–2015**

		Annual net change		
Year	Forest (thousand ha)	Period	Area (thousand ha)	Rate[a] (%)
1990	4 128 269			
2000	4 055 602	1990–2000	-7 267	-0.18
2005	4 032 743	2000–2005	-4 572	-0.11
2010	4 015 673	2005–2010	-3 414	-0.08
2015	3 999 134	2010–2015	-3 308	-0.08

[a] Calculated as the compound annual growth rate.

FIGURE 3 **Forest area as a percentage of total land area in 2015**

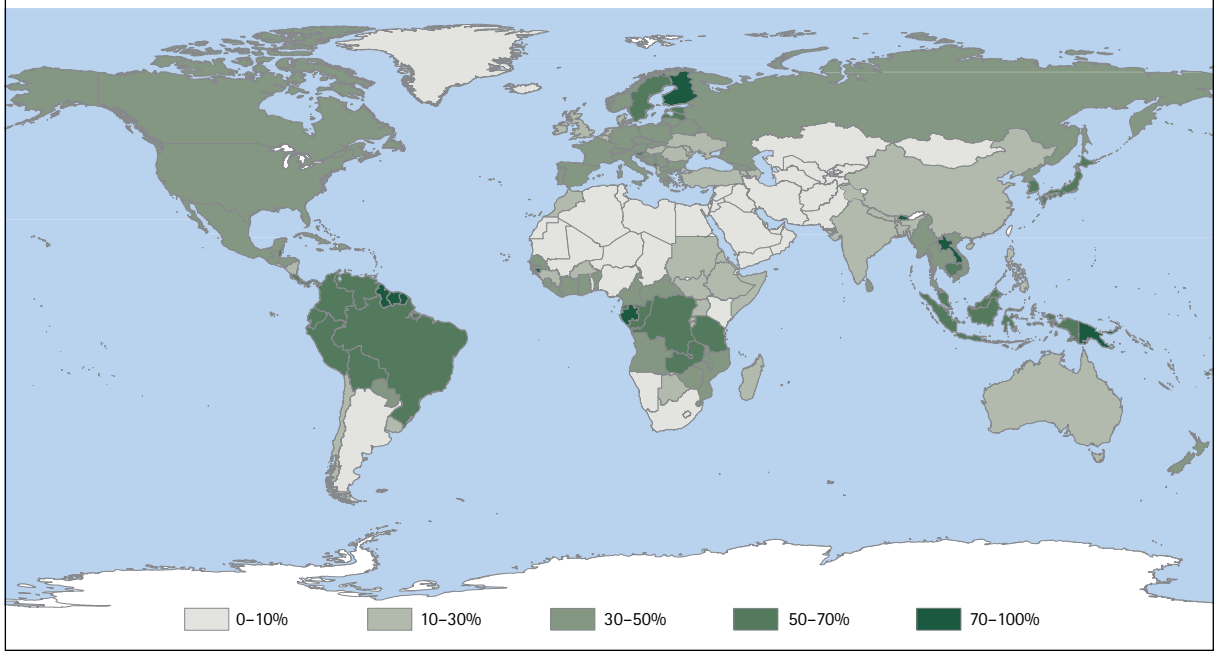


TABLE 2 **Top ten countries by reported forest area in 2015**

	Country	Forest area (thousand ha)	% of land area	% of global forest area
1	Russian Federation	814 931	50	20
2	Brazil	493 538	59	12
3	Canada	347 069	38	9
4	United States of America	310 095	34	8
5	China	208 321	22	5
6	Democratic Republic of the Congo	152 578	67	4
7	Australia	124 751	16	3
8	Indonesia	91 010	53	2
9	Peru	73 973	58	2
10	India	70 682	24	2
	Total	**2 686 948**		**67**

TABLE 3 **Top ten countries reporting the greatest annual net loss of forest area, 2010–2015**

	Country	Annual forest area net loss	
		Area (thousand ha)	Rate (%)
1	Brazil	984	0.2
2	Indonesia	684	0.7
3	Myanmar	546	1.8
4	Nigeria	410	5.0
5	United Republic of Tanzania	372	0.8
6	Paraguay	325	2.0
7	Zimbabwe	312	2.1
8	Democratic Republic of the Congo	311	0.2
9	Argentina	297	1.1
10	Bolivia (Plurinational State of)	289	0.5

TABLE 4 **Top ten countries reporting the greatest annual net gain in forest area, 2010–2015**

	Country	Annual forest area net gain	
		Area (thousand ha)	Rate (%)
1	China	1 542	0.8
2	Australia	308	0.2
3	Chile	301	1.8
4	United States of America	275	0.1
5	Philippines	240	3.3
6	Gabon	200	0.9
7	Lao People's Democratic Republic	189	1.0
8	India	178	0.3
9	Viet Nam	129	0.9
10	France	113	0.7

FIGURE 4 **Reported natural and planted forest area by income category in 2015**

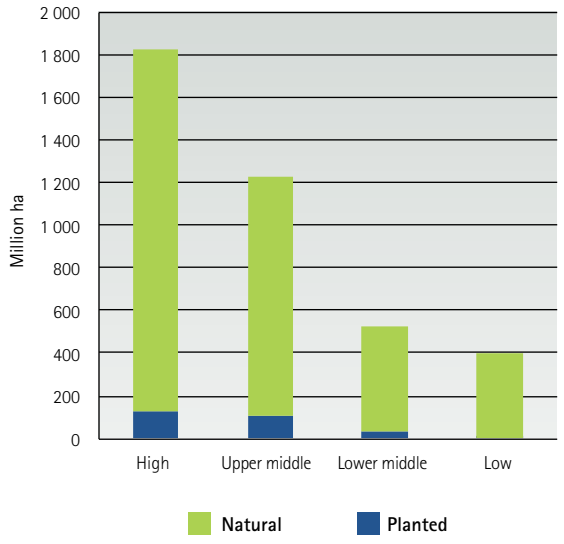


FIGURE 6 **Annual forest area net change by climatic domain, 1990–2015**

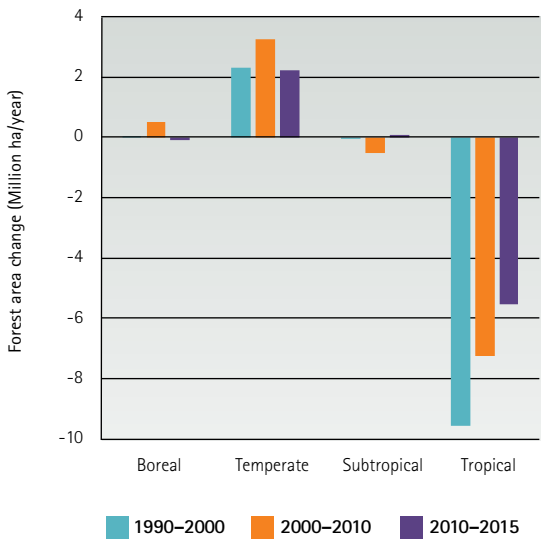
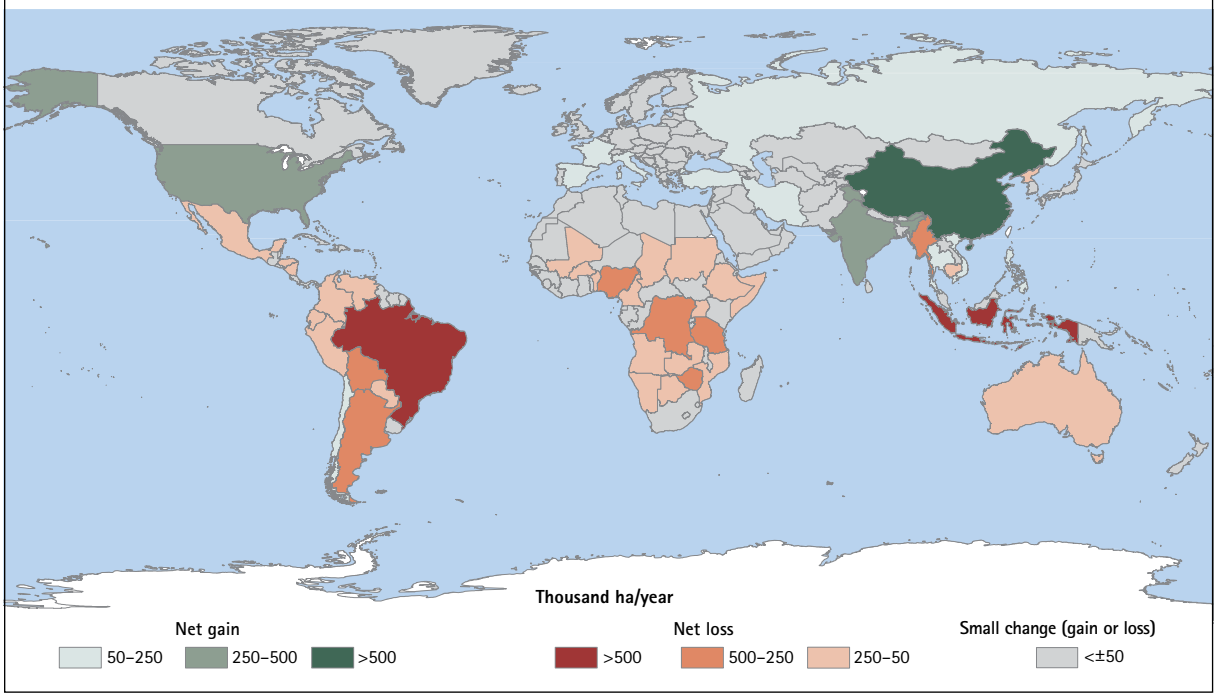


FIGURE 5 **Annual net forest gain/loss by country, 1990–2015**



Forest area change among high-income countries has been positive over the last 25 years, with a slight increase in the period 2010–2015 (Figure 8). Upper-middle-income countries have managed to reduce annual net loss of forest from about 1.8 million ha per year in 1990–2000 to a slight gain for the period 2010–2015. Annual net loss of forest in lower-middle-income countries has gone from 3.4 million ha in the 1990s to 1.9 million ha between 2010 and 2015, while for low-income countries, there was a decrease from 2.9 million ha in 1990–2000 to 2.4 million ha in 2010–2015.

WHAT IS THE FUTURE OUTLOOK?

The decrease in net forest loss rates in the tropics and subtropics, combined with stable or moderate increases in the temperate and boreal zones, suggests that the global rate of forest loss will probably continue to decrease in coming years and gradually level out. As human populations continue to increase, it is likely that there will be a continued demand for conversion of more forest land to agriculture, particularly in the tropics (unless agricultural

productivity increases substantially on existing agricultural lands). The decline in per capita forest area, coupled with steady increases in wood removals, indicates that more wood will be needed from less land in coming years.

Natural and planted forest area change

WHY IS THIS INDICATOR IMPORTANT?

The similarities and differences between natural and planted forests is a topic of debate among many stakeholders interested in forest change. Natural forests contribute to conserving the diversity of genotypes and to maintaining the natural tree species composition, structure and ecological dynamics. Planted forests are often established for the purpose of production and/or protection of soil and water. Well-managed planted forests can provide various forest goods and services and help to reduce the pressure on natural forests.

WHAT HAS CHANGED AND WHY?

Globally, natural forest area is decreasing and planted forest area is increasing. As of 2015 reported natural forest accounts for 93 percent of total forest area. The global annual net loss of natural forests decreased from some 10.6 million ha in the 1990s to 6.5 million ha between 2010 and 2015.

Forest vs tree cover: What is the difference?

Differences between global data on forest area reported by FAO and those reported by other organizations are mainly due to two factors: the different methods employed to derive the information and the different definitions of forest. FRA results show a steady decrease in the rate of forest loss globally. Other sources have reported that the rate of forest loss is increasing. The discrepancy in the findings is explained mainly by the fact that FAO defines forest as a combination of tree cover and land use, while some define forest only in terms of tree cover.
Datasets based solely on remote sensing sources such as Landsat imagery cannot differentiate between tree cover in agricultural production systems (oil palm plantations, coffee plantations, etc.), and tree cover on land that is not predominantly under agricultural or urban land use. In addition, areas with tree cover that has been temporarily removed as part of a forest management scheme or temporarily lost through natural disturbances are still considered forest according to the FAO definition, while a remote sensing analysis of tree cover will interpret these areas as forest loss. Moreover, newly established forest cannot easily be detected by remote sensing.

FIGURE 7 **Forest area per capita by climatic domain, 1990–2015**

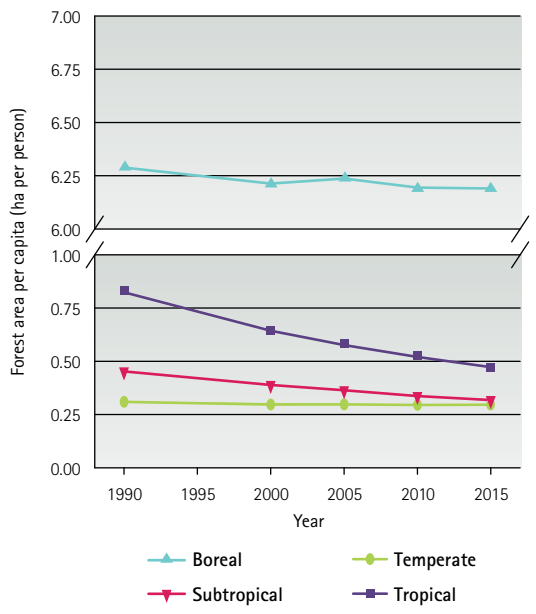


FIGURE 8 **Annual forest area change by income category, 1990–2015**

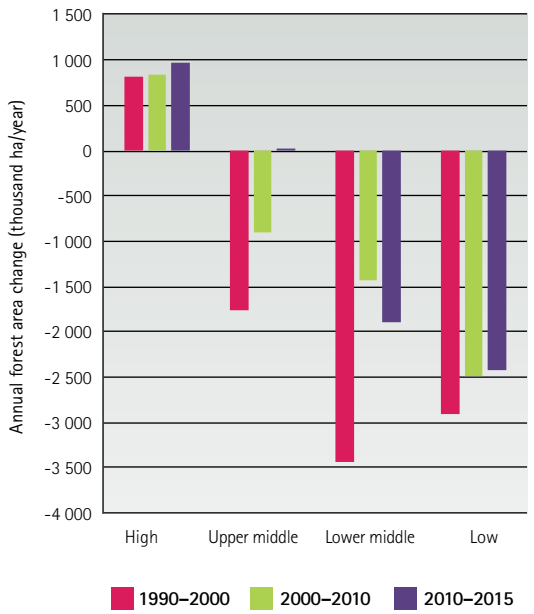


FIGURE 9 **Natural forest area by region, 1990–2015**

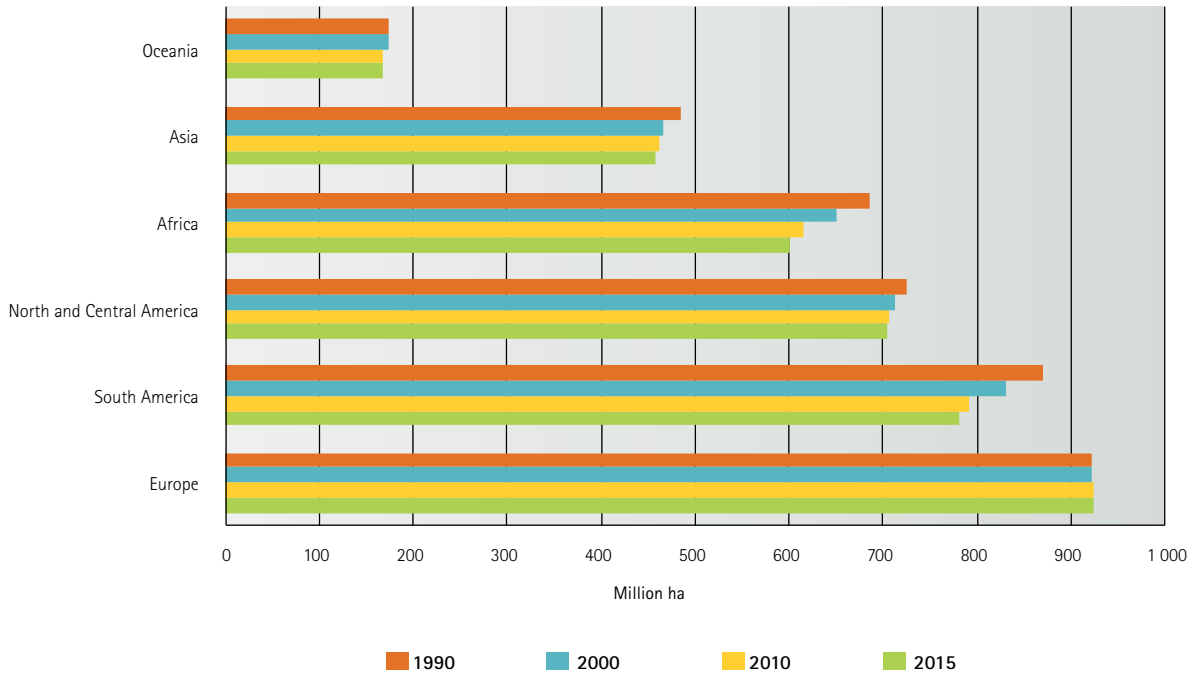
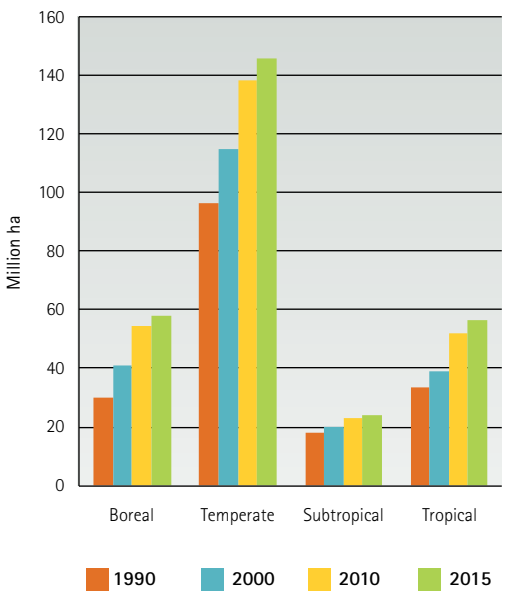


FIGURE 10 **Planted forest area by climatic domain, 1990–2015**



The largest area of natural forests is found in Europe, with about 925 million ha (Figure 9), of which about 85 percent is in the Russian Federation. South America and Africa account for the largest loss of natural forests, followed by Asia and North and Central America. In Europe and Oceania the trend is relatively stable.

Planted forest area has increased by over 105 million ha since 1990 and accounts for 7 percent of the world's forest area. The average annual rate of increase between 1990 and 2000 was 3.6 million ha. The rate peaked at 5.3 million ha per year for the period 2000–2010 and slowed to 3.2 million ha between 2010 and 2015, as planting decreased in East Asia, Europe, North America, South Asia and Southeast Asia.

The largest area of planted forests is found in the temperate domain, accounting for 150 million ha, followed by the tropical and boreal domains with almost 60 million ha each. Over the last 25 years the area of planted forest has increased in all climatic domains, most notably in the boreal domain, where it has almost doubled. In the tropical and temperate zones, it increased by 67 percent and 51 percent, respectively (Figure 10).

WHAT IS THE FUTURE OUTLOOK?

Although the loss of natural forests has slowed, natural forest area will likely continue to decline, particularly in the tropics, primarily due to conversion of forest to agriculture. On the other hand, due to a growing demand for forest products and environmental services, the area of planted forests is likely to continue to increase in coming years.

Partial canopy cover loss – a proxy for forest degradation?

WHY IS THIS INDICATOR IMPORTANT?

Forest degradation affects biodiversity and atmospheric carbon flux and can be a precursor to forest conversion. Measuring forest degradation is problematic, however, for several reasons. First, forest degradation is notoriously difficult to define. Second, forest degradation by any definition is difficult to detect with most forms of measurement as it is a subtle form of forest change. Detecting degradation from remotely sensed data, especially with the most commonly used forms of medium spatial resolution data, is difficult because the scale at which the degradation takes place is often at sub-pixel resolution. This means that the nature of the degradation affects areas smaller than the detection capability of the remotely sensed pixel.

HOW WAS THIS DONE?

Partial canopy cover loss (PCCL) was totalled for all years between 2000 and 2012; thus there is no time series of estimates to determine what has changed in terms of its rates or locations. The total area of PCCL was 185 million ha for 2000–2012, but this was spread unevenly across climatic domains (Figure 11). The tropical climatic domain had the most PCCL detected, with over 156 million ha, or 9 percent of the forest area. The boreal and subtropical climatic domains indicate a PCCL of 1.3 percent and 2.1 percent, respectively.

WHAT HAS CHANGED AND WHY?

Figure 12 presents results for PCCL by subregion. Forest loss was greater than the area of PCCL in Eastern and Southern Africa (almost four times

Trees outside forests

While not technically considered as forest according to the standard forest definition used by FAO and many other international organizations, trees outside forests are a valuable source of many products and services found in forests. In some countries they provide critical supplies of wood, fruits and other non-wood forest products. For FRA 2015 the area of trees outside forests was reported to be 280 million ha in 2015, which is an increase from the 246 million ha reported for 1990; however, only 84 countries representing 51 percent of global forest area reported on this variable. While substantially more difficult and costly to measure than forest at a national level, trees outside forests are clearly an important natural resource in many countries.

greater), South America (almost double) and Central America. South and Southeast Asia exhibited the largest amount of PCCL, with over 50 million ha detected. Results for South America indicate approximately 47 million ha of PCCL. Western and Central Africa was third with approximately 35 million ha. Expressed as a proportion of total forest area in 2010, the subregion with the largest amount of PCCL was Central America with approximately 18 percent of the forest area indicated as PCCL.

WHAT IS THE FUTURE OUTLOOK?

Causes of canopy cover loss include not only those anthropogenic actions that may be considered harmful to the functioning of intact forests, but also human management activity and natural causes that are part of properly functioning forest ecosystems or could be considered enhancements to forest systems. Thus, large areas of PCCL are probably caused by fire, whereas others are considered to be under SFM regimes. Additional PCCL will certainly occur as a result of selective harvesting, maintenance of lower stocking densities, fire, pests, disease and/or livestock grazing. However, it is likely that these changes will occur in amounts similar to those of the current day. The Reducing Emissions from Deforestation and Forest Degradation (REDD+) mechanism may work to slow rates of forest degradation where national-level efforts are successful.

FIGURE 11 **Estimated area with PCCL by climatic domain, 2000–2012**

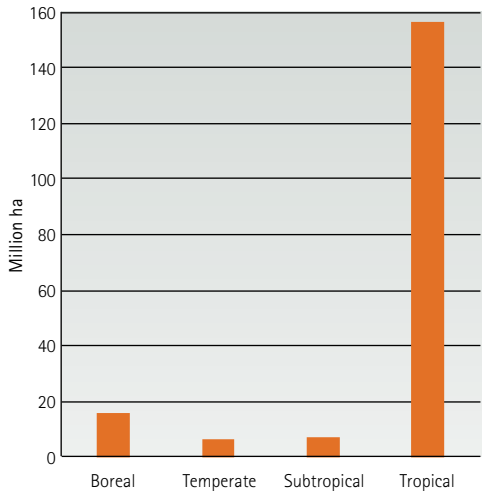
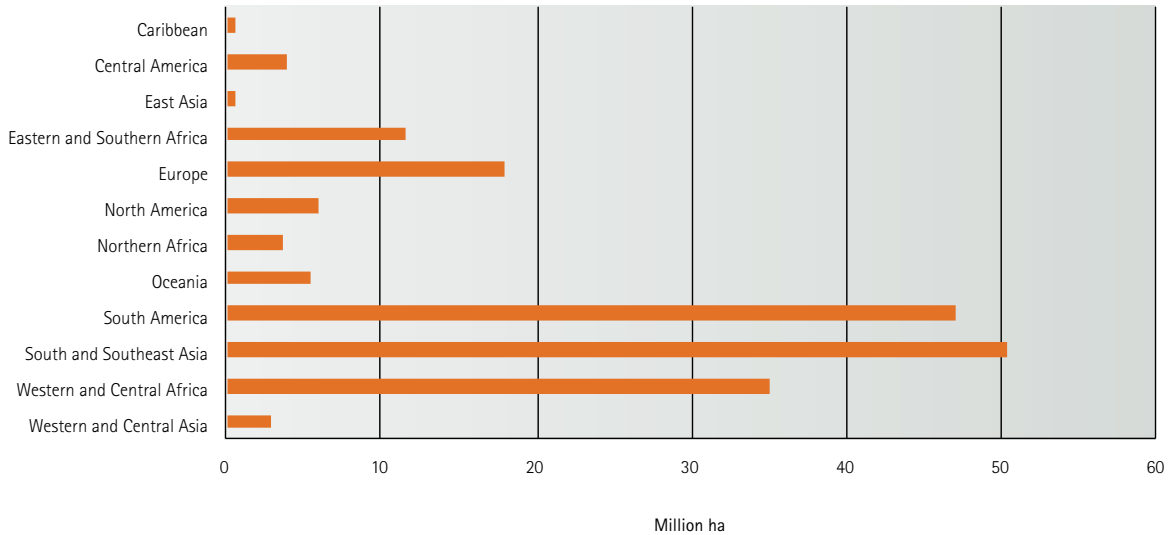


FIGURE 12 **Estimated area with PCCL by subregion, 2000–2012**



SUSTAINABLE FOREST MANAGEMENT

Sustainable forest management (SFM) means different things to different people, but there is general agreement that it should involve a balance between social, environmental and economic aspects. The United Nations describes SFM as "a dynamic and evolving concept, [that] is intended to maintain and enhance the economic, social and environmental value of all types of forests, for the benefit of present and future generations".[4]

WHY IS THIS SET OF INDICATORS IMPORTANT?

Indicators for SFM have been developed by different international processes during the last decades and have recently become part of the monitoring and reporting framework for the SDGs. In an attempt to harmonize the indicators from different Criteria and Indicator processes, the following seven thematic areas have emerged:

- extent of forest resources
- biodiversity
- forest health and vitality
- productive functions of forest resources
- protective functions of forest resources
- socioeconomic functions
- policy, legal and institutional framework.

In addition to data related to status and trends in forest area, carbon stocks, and forest designation and use presented elsewhere in this report, specific information related to the enabling framework and operational aspects of implementing SFM was also collected for FRA 2015.

WHAT HAS CHANGED AND WHY?

A number of key indicators suggest progress towards SFM in recent years. These changes can be summarized as follows:

- The rate of annual net loss of forest area has decreased from 0.18 percent in the period 1990–2000 to 0.08 percent in the period 2010–2015.
- Forest area in protected areas has increased, with a particularly strong increase in the tropics.
- About 2.2 billion ha are under permanent forest land use.
- The area of forests designated for protection of soil and water and other ecological, cultural and spiritual values has increased.
- Forest area under a management plan has increased to 2.1 billion ha (2010) and the area is distributed equally between production and conservation purposes.
- International certification of forest management was introduced in the late 1990s, and certified forests now cover 438 million ha, or 11 percent of global forest area.

For FRA 2015, information was also collected on the current status of some key indicators related to the enabling framework for SFM (Table 5). In total, 140 countries and territories reported that they had policy and legal frameworks in place to support SFM, while 126 reported having a national platform to involve stakeholders in the policy dialogue. Periodic reports on the state of their forests are produced by 116 countries and territories, and 86 report periodically to the international Criteria and Indicator processes.

How much forest is intended to be kept in the long term?

WHY IS THIS INDICATOR IMPORTANT?

Not all forests that exist today will exist in the future. Having an indication of how much forest is intended to be kept in the long term provides insights into accumulated government and private

[4] United Nations General Assembly resolution A/RES/62/98 of 31 January 2008 (www.un.org/en/ga/search/view_doc.asp?symbol=A/RES/62/98).

TABLE 5 **Specific indicators for SFM reported for FRA 2015**

SFM indicator	Number of countries reporting	Data availability (%)
Policy and legal framework supporting SFM	140	96
National platform for stakeholder involvement	126	94
Forest area under permanent forest land use	163	93
National reporting to SFM Criteria and Indicator process	86	77
Forest area under a management plan (FMP)	167	97
FMP subdivided by production and conservation	109	72
FMP should include soil and water protection	121	67
FMP should include delineation of high conservation value forests	118	88
FMP should include social considerations	116	88

Note: Data availability is the forest area of countries that reported on a specific indicator expressed as a proportion of the total global forest area.

FIGURE 13 **Forest area under permanent forest land use by climatic domain in 2010**

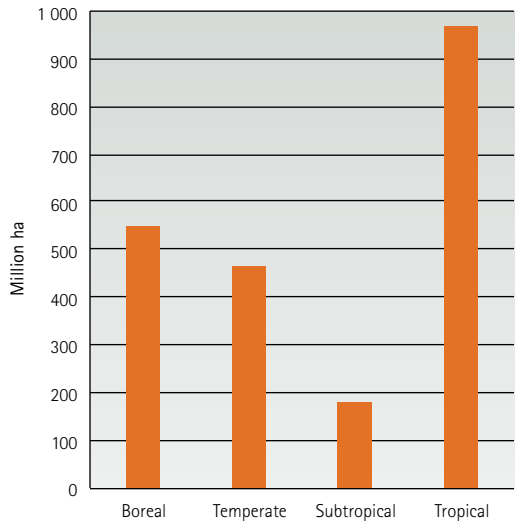
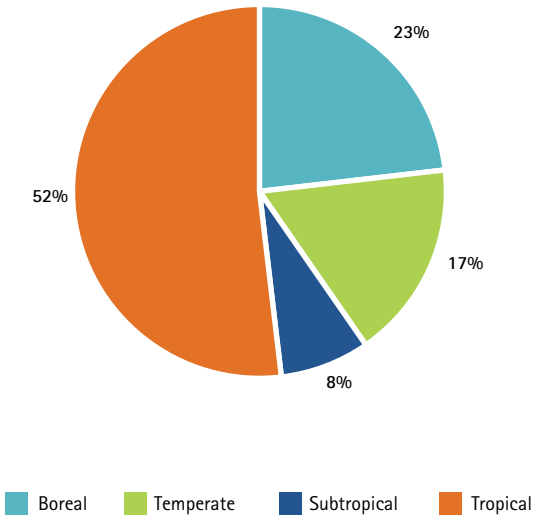


FIGURE 14 **Permanent forest estate by climatic domain in 2010**



plans for retaining forest in permanent use. Some countries have forests that by law or regulation are mandated to remain as forest; these are called the "permanent forest estate". In other countries there is no legally established permanent forest estate, but there are intentions to maintain forests permanently. This indicator captures both the permanent forest estate and other forest areas expected to be retained as permanent forest land use.

WHAT HAS CHANGED?

One hundred and sixty-three countries and territories with a total forest area of 3.7 billion ha reported that about 2.2 billion ha are intended to be kept under permanent forest land use. Of these, close to 1 billion ha are found in the tropics (Figure 13).

Of the area under permanent forest land use, slightly less than 1.5 billion ha have been legally assigned as permanent forest estate. More than half of the permanent forest estate is found in the tropics (Figure 14).

Forest management plans

WHY IS THIS INDICATOR IMPORTANT?

Forest management plans are important instruments used to ensure that forests are managed so that they are able to sustain provision of goods and services in the long term. Forest management plans are established for different or multiple purposes, such as production, conservation and provision of environmental services.

WHAT HAS CHANGED?

It is notable that the vast majority of countries have a forest management plan (167 countries representing 98 percent of global forest area), and these plans cover more than half of their forest area, equivalent to about 2.1 billion ha. More than half of the area under a forest management plan is found in the boreal zone (Figure 15). Fewer countries (109) reported on the focus of the management plan; they indicated that about half of the area under a management plan is focused on production while the other half is focused on conservation.

Regarding the content of the forest management plans, 121 countries and territories indicated that the plans should include soil and water protection, while 118 indicated that they should include the delineation of high conservation value forests and 116 indicated that they should include social considerations.

FIGURE 15 **Forest area under a management plan by climatic domain in 2010**

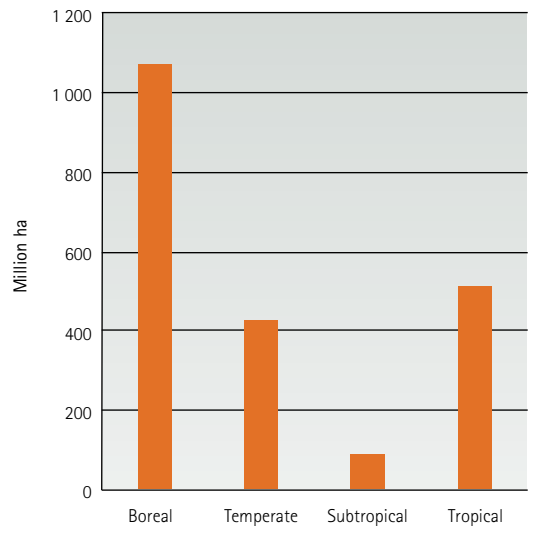
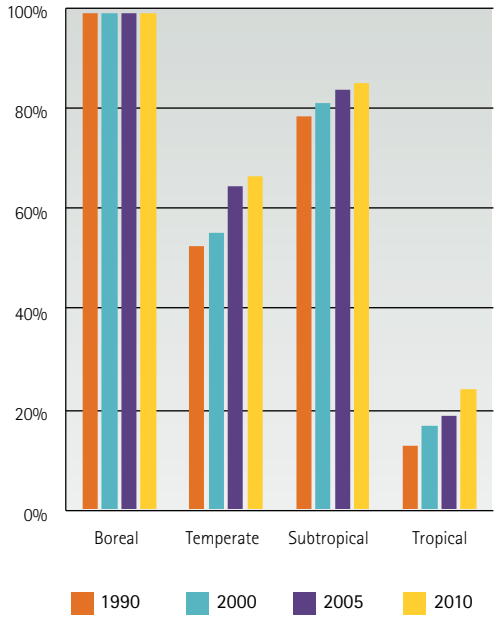


FIGURE 16 **Proportion of forest area under a forest management plan by climatic domain, 1990–2010**



Source: FAO, 2010.

The proportion of forest area under a management plan has increased since 1990 in all climatic domains except the boreal domain, where it remains stable at a high level (Figure 16).

WHAT IS THE FUTURE OUTLOOK?

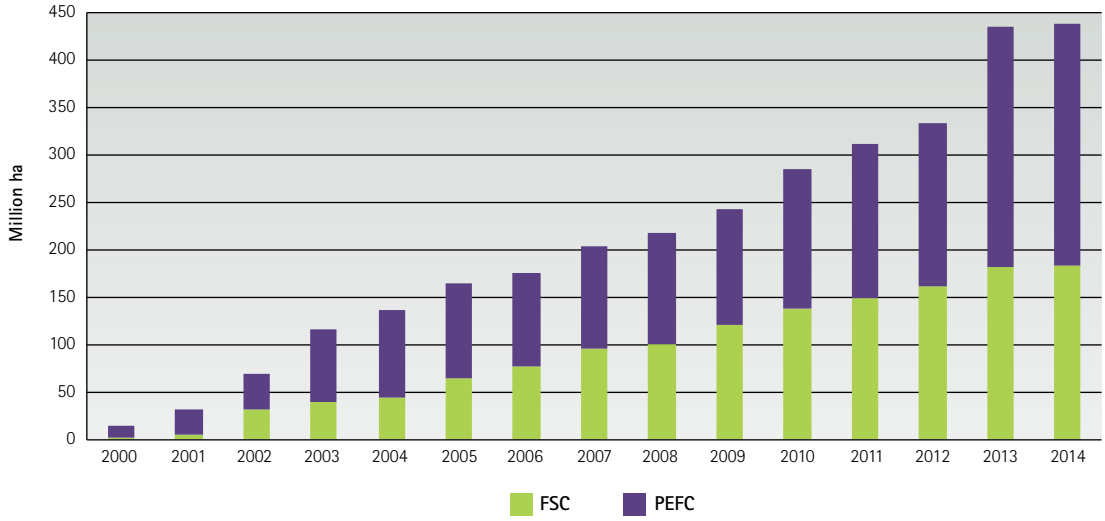
It seems likely that the proportion of forest area covered by a management plan will continue to increase, considering current trends and increased attention to SFM. However, the challenge remains to increase the forest area under a management plan, particularly in tropical countries.

Forest management certification

WHY IS THIS INDICATOR IMPORTANT?

Independent certification of forest management was introduced in the late 1990s as a voluntary tool to promote SFM and trade of products coming from sustainably managed forests. Two major international certification schemes prevail: the Forest Stewardship Council (FSC) and the Programme for the Endorsement

FIGURE 17 **Area of international forest management certification by FSC and PEFC, 2000–2014**



of Forest Certification (PEFC). Both schemes include criteria for best practices in forest management, covering environmental, social and economic aspects.

Forest management certification is not a perfect tool for SFM. However, it is an important proxy that can be monitored. Certification with third-party verification provides a good indication that the forest manager is investing in continuing improvement to ensure the use of best management practices that will result in stable provision of forest goods and services.

WHAT HAS CHANGED AND WHY?

The area covered by these two forest management certification schemes increased from 14 million ha in 2000 to over 438 million ha in 2014, of which 58 percent is under PEFC and 42 percent is under FSC (Figure 17). These figures contain some double accounting (approximately 2 percent[5]) as there are some forest management units that are certified by both schemes. The most rapid, sustained growth in international certification continues to be found in the temperate and boreal zones.

WHAT IS THE FUTURE OUTLOOK?

The area of forest certified by international certification schemes can be expected to continue to increase. However, other alternatives, such as Voluntary Partnership Agreements, are also available to ensure that forest products come from sustainably managed forests. Furthermore, as certification is a voluntary and market-driven instrument, it is affected by the demand for certified products which in turn is related to general economic indicators.

[5] Estimate of double accounting is from Fernholz and Kraxner, 2012, pp. 107–116.

Forest monitoring and reporting

WHY IS THIS INDICATOR IMPORTANT?

Forest monitoring and reporting are important tools to measure and disseminate information on status and trends related to SFM. Reliable and up-to-date information is the foundation of forest management and investment in forests and forestry by governments, private companies, international donors, individuals and civil society.

WHAT HAS CHANGED AND WHY?

In recent years there has been a remarkable increase in the forest area covered by forest monitoring and assessment activities. International negotiations on a financial instrument for reducing emissions from deforestation and forest degradation in developing countries (REDD+) have made financing available to support the development of national forest monitoring systems.

A total of 112 countries, representing about 83 percent of global forest area, reported that they had carried out or had an ongoing national forest assessment based on either a field inventory or remote sensing, or a combination of the two. Of these, 81 countries, representing 77 percent of global forest area, reported that they had either finalized or initiated their national forest assessment after 2010.

cc0/World Bank/Curt Carnemark

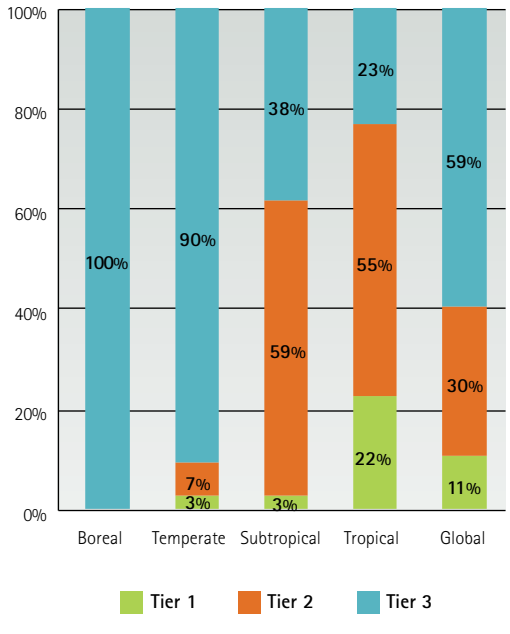
Another way to illustrate countries' capacity to report on their forest resources is by examining their assessment of reliability of the forest area estimates based on a tier system[6] in which Tier 3 is based on the most recent and reliable data sources while Tier 1 and Tier 2 are based on older data sources, partial inventories or expert estimates. Globally, close to 60 percent of the estimated forest area was derived from Tier 3 data sources (Figure 18). Countries in the boreal and temperate domains have reported using predominantly Tier 3 data quality for their forest area, while countries in subtropical and tropical domains have predominantly Tier 1 and Tier 2.

Countries have made significant commitments to report on their forests. A total of 116 countries, representing 88 percent of global forest area, reported that they periodically produced a national report on the state of their forests. Eighty-six countries representing 77 percent of global forest area reported that they produced reports on Criteria and Indicators for SFM. These kinds of national reports are helpful in assessing changes over time and providing insight on progress towards SFM, in particular when they provide comprehensive information on social, economic and environmental aspects of SFM.

WHAT IS THE FUTURE OUTLOOK?

The increased coverage of forest monitoring and reporting in recent years indicates a growing interest in countries to improve information on their forests. This trend is expected to continue, in particular considering the potential for REDD+ performance-based payments, which may provide additional incentives to conduct national forest monitoring and assessment for many countries in the tropics.

FIGURE 18 **Proportion of forest area by climatic domain in 2015 reported at different tiers**



[6] Tier 3: Data sources are either recent (less than ten years old), or national forest inventories, or remote sensing, with ground truthing or a programme for repeated compatible national forest inventories.
Tier 2: Data sources are full cover mapping/remote sensing or a national forest inventory more than ten years old.
Tier 1: Other data sources.

MAINTAINING ECOLOGICAL INTEGRITY AND BIODIVERSITY

Forests play an important role in supporting and maintaining ecological systems and cycles. Forests both depend on and contribute to the many complex processes that are responsible for recycling carbon and water. They also regulate water flows and protect soils. How forests are managed can affect their future roles in maintaining genetic and taxonomic variation, ecosystem functions and environmental services.

Conservation of biodiversity

WHY IS THIS INDICATOR IMPORTANT?

Conservation of biodiversity allows species to survive, evolve and dynamically adapt to changing environmental conditions. It also enhances plant and animal gene pools and provides genetic reservoirs for tree breeding. Maintaining biodiversity is thus crucial for the long-term health and productivity of the world's forests. Reliable data on forest biodiversity provide an indication of countries in which biodiversity may be increasing or decreasing. In FRA 2015, biodiversity conservation is addressed through three indicators: area of primary forest, forest area primarily designated for conservation of biodiversity and forest area within protected areas.

WHAT HAS CHANGED AND WHY?

In 2015 primary forests accounted for 33 percent of the world's forests, or about 1.3 billion ha, half of which are located in the tropics. At the regional level the largest extent of primary forests is found in South America, followed by North and Central America. Over half of the world's primary forests are found in only three countries: Brazil, Canada and the Russian Federation. Information on the state of primary forests in 2015 was available for 203 countries and territories, representing 97 percent of global forest area. However, many of these countries relied on proxies, such as the extent of forest within national parks and conservation areas, to estimate the extent of primary forests.

The area of primary forest decreased in the tropical climatic domain, while the boreal and temperate domains show a slight increase (Figure 19). Reported increases are generally a result of reclassifications at the national level – for example, the designation of new wilderness or protected areas – rather than a real increase.

Primary forest area change should be viewed with some caution, particularly for the tropics. Only 33 percent of the primary forest area reported was classified as Tier 3 (the highest quality category) and 57 percent was Tier 1 (the least reliable category), which indicates that it is difficult for most countries to assess primary forest area.

Information is still lacking on what proportion of the decrease in primary forest area is due to deforestation and what is due to conversion to other forest types as a result of forest management operations or other human interventions. A comparison of annual change over time of primary and other naturally regenerated forest highlighted that, among the countries that reported a decrease in primary forest over the last 25 years, about 15 countries (representing 55 percent of total primary forest loss) reported an increase in the area of naturally regenerated forest. For some of these countries the correspondence between losses of primary forest and gains in other naturally regenerated forest is particularly evident, suggesting that the loss of primary forest could be mainly due to conversion to other natural forests (Figure 20).

FIGURE 19 **Primary forest area by climatic domain, 1990–2015**

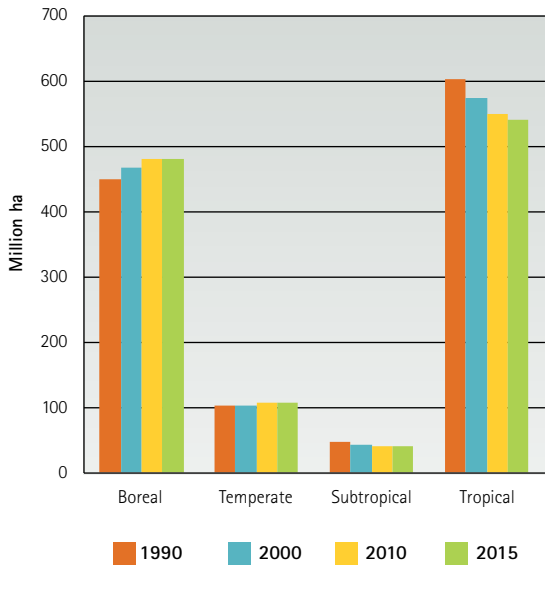


FIGURE 20 **Selected countries that reported a negative annual change in primary forest area and a positive annual change in other naturally regenerated forest area, 1990–2015**

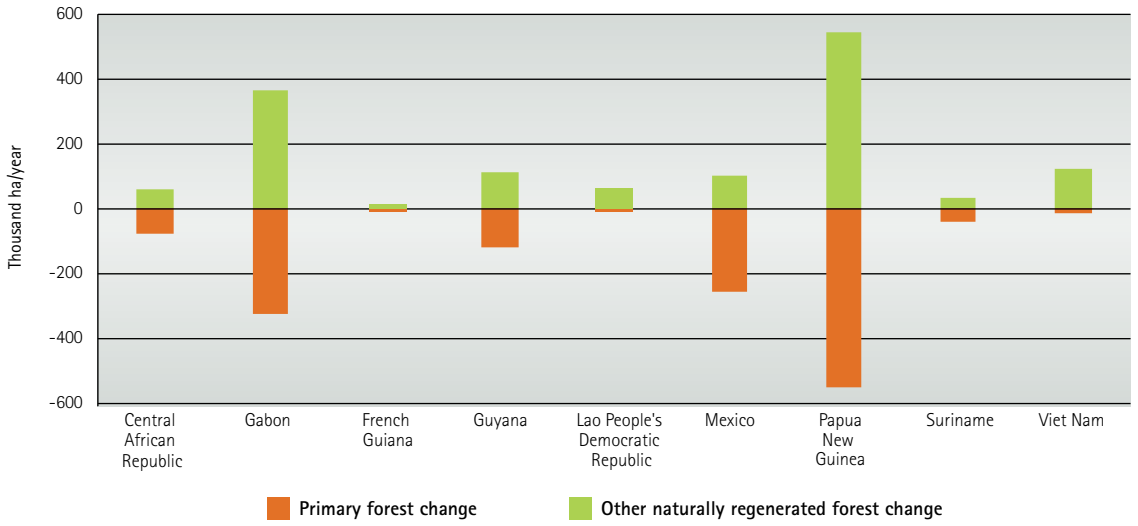


TABLE 6 **Top ten countries with forest area designated primarily for conservation of biodiversity in 2015**

	Country	Forest area designated primarily for conservation of biodiversity (thousand ha)	% of forest area reported
1	United States of America	64 763	21
2	Brazil	46 969	10
3	Mexico	28 049	42
4	Russian Federation	26 511	3
5	Australia	26 397	21
6	Democratic Republic of the Congo	26 314	17
7	Venezuela (Bolivarian Republic of)	24 313	52
8	Canada	23 924	7
9	Indonesia	21 233	23
10	Peru	19 674	27
	Total	**308 147**	

In other countries (for example, Brazil) that show decreases in both "other naturally regenerated forest" and primary forest and a slight increase in planted forest, it is more difficult to assess the change dynamics.

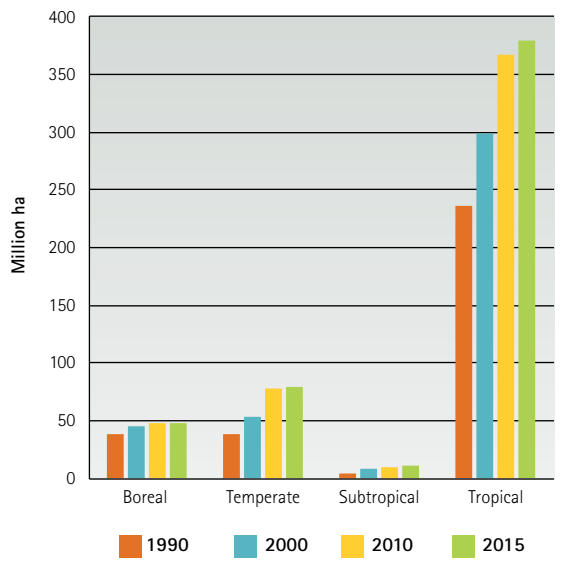
Forest area designated primarily for biodiversity conservation accounts for 13 percent of the world's forest, or 524 million ha, with the largest areas reported in the United States of America and Brazil (Table 6). The area of forest designated for that purpose has increased by 150 million ha since 1990, but the rate of annual increase has slowed during the last five years. Over the last five-year period, Africa, Asia and South America have each reported an increase of about 1 million ha per year of the area designated for conservation of biodiversity, while Europe, North and Central America and Oceania together have reported an increase of about 600 000 ha.

Seventeen percent of the world's forests are located within legally established protected areas, accounting for 651 million ha. South America recorded the highest proportion (34 percent) of protected forest, largely because of Brazil, where 42 percent of the forests are located within the protected areas network (Table 7). The area of forest within protected areas has increased by 200 million ha since 1990, but the rate of increase slowed during the period 2010–2015. The increase in the area of forest within protected areas was particularly evident in the tropics, where an additional 143 million ha of new forests have been put under protection since 1990 (Figure 21).

TABLE 7 **Top ten countries with forest area within protected areas in 2015**

	Country	Forest area within protected areas (thousand ha)	% of country forest area
1	Brazil	206 227	42
2	United States of America	32 863	11
3	Indonesia	32 211	35
4	China	28 097	13
5	Democratic Republic of the Congo	24 297	16
6	Venezuela (Bolivarian Republic of)	24 046	52
7	Canada	23 924	7
8	Australia	21 422	17
9	Peru	18 844	25
10	Russian Federation	17 667	2
	Total	**429 598**	

FIGURE 21 **Forest in protected areas by climatic domain, 1990–2015**



WHAT IS THE FUTURE OUTLOOK?

Deforestation, forest degradation and fragmentation, pollution and climate change are all having negative impacts on forest biodiversity. The analysis of the Country Reports confirmed that, despite mounting conservation efforts over the past 25 years, the threat of biodiversity loss, reflected in the degradation or loss of primary forests, persists and is likely to continue. Possible future trends are not easily assessed due to weaknesses in reported data and a lack of more detailed information on primary forest change dynamics. Although more areas of forest will likely be designated for biodiversity conservation, tangible results in reducing biodiversity loss will be achieved only through integration of conservation policies into broader national and local development programmes and through more systematic consideration of trade-offs between biodiversity conservation and other needs of society. The expansion of SFM practices will also enhance biodiversity conservation.

Biomass and carbon stock changes

WHY IS THIS INDICATOR IMPORTANT?

The biomass and carbon stocks in forests are important indicators of forests' productive capacities, energy potential and capacity to sequester carbon. The role of forests as terrestrial sinks and sources of carbon dioxide has received increasing attention since the adoption of the 1997 Kyoto Protocol to the United Nations Framework Convention on Climate Change.

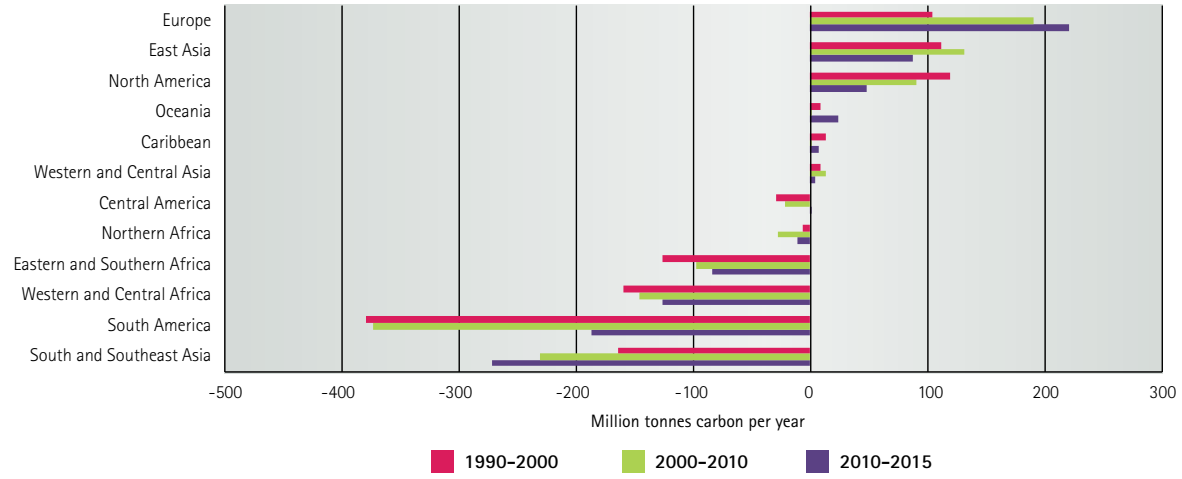
WHAT HAS CHANGED AND WHY?

The world's forests store an estimated 296 Gt of carbon[7] in both above- and below-ground biomass, which contains almost half of the total carbon stored in forests. The highest densities of carbon are found in forests of South America and Western and Central Africa, storing about 120 tonnes of carbon per hectare in the living biomass alone. The global average is 74 tonnes per hectare.

Over the past 25 years the carbon stocks in forest biomass have decreased by almost 11.1 Gt, equivalent to a reduction of 442 million tonnes per year or about 1.6 Gt of carbon dioxide. The reduction is mainly driven by carbon stock changes as a result of converting forest

[7] The reported figures on carbon include both country reported values and FAO estimates for missing data.

FIGURE 22 **Changes in carbon stock in forest biomass, 1990–2015**



lands to agriculture and settlements and degradation of forest land. Africa, South America, and South and Southeast Asia account for most of the losses (Figure 22). Carbon stocks increased the most in Europe, East Asia and North America. Oceania, the Caribbean, and Western and Central Asia reported only a slight increase.

Over the 25-year period net losses decreased from 0.5 Gt per year in the 1990s to 0.3 Gt per year between 2010 and 2015. One reason for the change is that countries in South and Central America and in Asia have managed to significantly slow the rate of forest loss. Brazil alone reported that the annual loss of carbon in above- and below-ground biomass was reduced from 240 million tonnes of carbon per year in the 1990s to about 80 million tonnes per year for 2010–2015.

WHAT IS THE FUTURE OUTLOOK?

The current global trend of decreasing carbon stocks is likely to continue but losses can eventually be expected to level out. The application of REDD+ and other initiatives has contributed to increased awareness of the role that forests have as terrestrial sinks and sources of carbon dioxide. New data will probably continue to show changes in the quantities of greenhouse gas emissions from forests. The use of woody biomass is likely to increase, as is the recognition that forests and forestry may reduce carbon dioxide emissions in other ways, such as through increased use of wood-based biofuels as a substitute for fossil fuels. Improved use of less energy-intensive construction materials, such as wood and bamboo, will continue to contribute to reductions in greenhouse gas emissions when they substitute for energy-intensive materials, such as iron and concrete. Harvested wood products can also play a role in carbon storage, providing greenhouse gas sequestration benefits.

Protection of soil, water and environmental services

WHY IS THIS INDICATOR IMPORTANT?

Forests deliver protection or conservation of natural resources, including soil and water, and other environmental services. They slow water dispersion and favour infiltration and percolation of rainwater, which recharge soil and underground water storage. This is crucial in supplying clean water for drinking, agriculture and other uses. Forests protect soils from wind and water erosion, avalanches and landslides.

Forests also provide habitats that support biodiversity and ecological processes and have cultural, religious and recreational values that are important to many forest users. Knowing whether or not these functions exist or are threatened helps governments to identify priorities and needs for restoration.

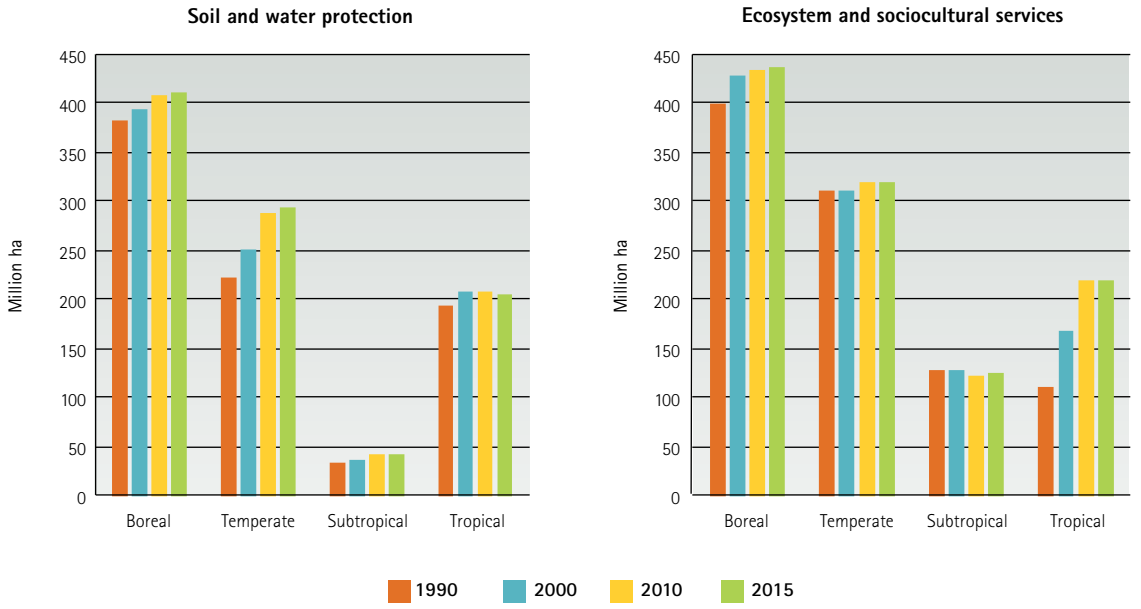
WHAT HAS CHANGED?

Globally, close to one-third of forest area is designated for soil and water protection, and about 40 percent for other ecosystem and sociocultural services; however, there are considerable variations between climatic domains (Figure 23). Countries reported increases of 117 million ha for soil and water conservation and 150 million ha for other ecosystem and sociocultural services from 1990 to 2015, corresponding to an average annual increase of 4.7 million ha and 6.0 million ha, respectively.

WHAT IS THE FUTURE OUTLOOK?

Forest area designated for protective functions has increased slightly and this trend is likely to continue. There is increasing awareness of the importance of retaining these functions for both production and conservation of forest lands, and the number of countries reporting is likely to increase. Given the current interest in forest land restoration, it is highly probable that more countries will also evaluate more forest area for the presence or absence of these functions and take steps to ameliorate forest degradation.

FIGURE 23 **Change in forest area allocated for soil and water protection and provision of other ecosystem and sociocultural services by climatic domain, 1990–2015**



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ECONOMIC AND SOCIAL BENEFITS

One aim of sustainable forest management is to ensure that forests provide a broad range of goods and services over the long term, including significant economic and social benefits.

Trends in production, multiple-use forests and wood removals

WHY ARE THESE INDICATORS IMPORTANT?

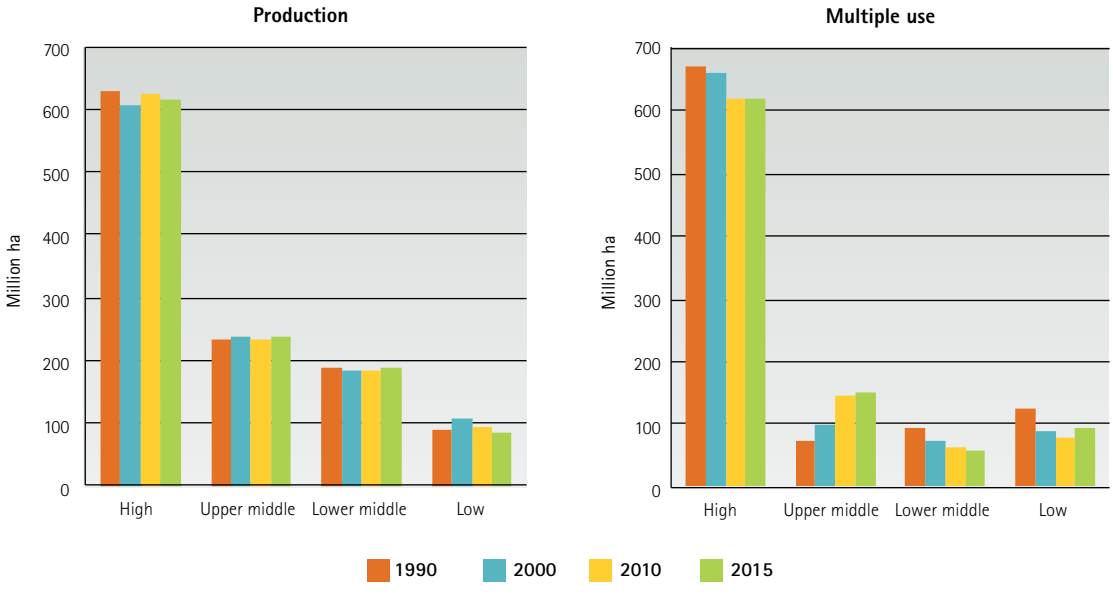
Wood is part of almost everyone's life, whether as construction wood, furniture, woodfuel, paper or other wood products. The tracking of reported industrial roundwood and woodfuel removals provides an approximation of how much wood from the forest goes to meet these needs and how this demand changes. Most of the world's wood comes from production and multiple-use forest areas. For some countries this tracking also shows where wood removals are not significant in production or multiple-use forest and where trees outside forests or from other wooded land are more important. Analyses of trends in wood demand and the types of forest that supply timber and woodfuel help to highlight the importance of these forest classifications for long-term security of wood supplies.

WHAT HAS CHANGED AND WHY?

Close to 1.2 billion ha of forest are designated primarily for production, with more than half of this area found in high-income countries and only 8 percent in low-income countries (Figure 24). There has been a slight decrease of about 13 million ha since 1990. In addition, about 1 billion ha of forests are designated for multiple use, in most cases including the production of wood and non-wood forest products (NWFPs) (Figure 24). About two-thirds of the total forest area designated for multiple use is found in high-income countries and only one-tenth in low-income countries. In the last 25-year period the area designated for multiple use has decreased by some 38 million ha; only countries in the upper-middle-income category have reported an increase.

In 2011 approximately 3 billion m^3 of wood were removed globally, equivalent to about 0.6 percent of the total growing stock. Between 1990 and 2011 annual reported wood removals remained stable but with considerable annual variation. In the early 1990s a sharp drop in wood

FIGURE 24 **Forest area designated for production and multiple use by income category, 1990–2015**



removals was reported for Europe, mainly due to the decrease in removals reported by the Russian Federation. This was followed by a period of increase with a peak in 2005. Following the financial crisis of 2007–2008, Europe and North America together reported a sharp decrease in wood removals from 1.3 billion m^3 in 2007 to 1 billion m^3 in 2009. This was followed by an increase to 1.1 billion m^3 in 2011 (Figure 25). Other regions did not indicate a significant reduction in total wood removals caused by the financial crisis. Countries with the highest wood removals are noted in Table 8.

Globally about half of total removals are woodfuel, but the share of woodfuel varies significantly by income category (Figure 26). In high-income countries the share of woodfuel is about 17 percent, in upper-middle-income countries it is 40 percent, while in lower-middle-income and low-income countries it is 86 percent and 93 percent, respectively.

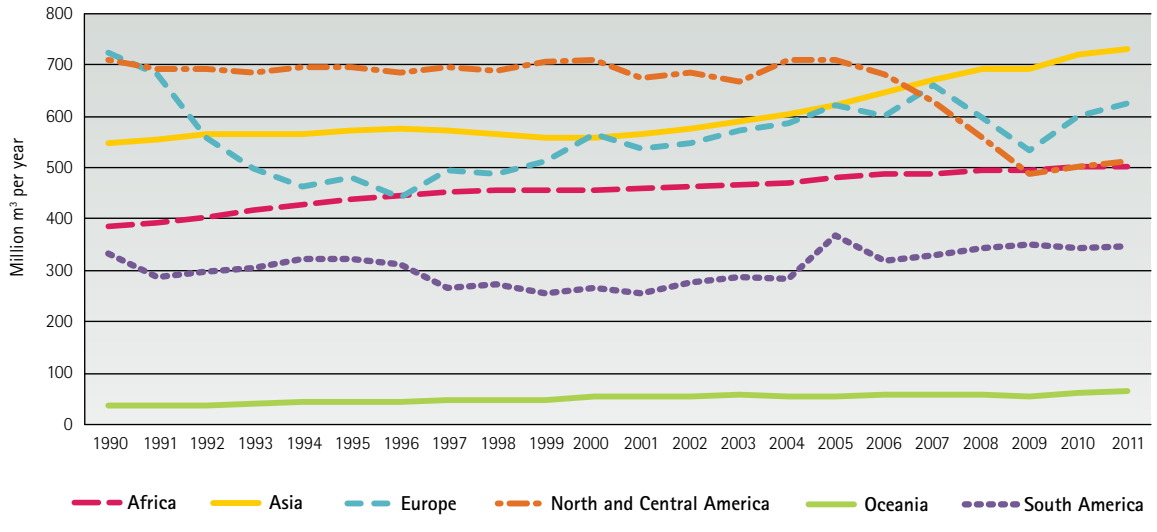
WHAT IS THE FUTURE OUTLOOK?

Demand for wood products is likely to continue to increase globally. In high-income countries the share of woodfuel will probably increase as wood is a climate-friendly, renewable energy source. Part of the woodfuel will come from lower-quality wood. In low-income countries the share will most likely remain stable or decrease. Production and multiple-use forest area will

TABLE 8 **Top ten countries by wood removals in 2011**

	Country	Wood removals (thousand m^3)	Woodfuel as % of total wood removals
1	India	434 766	88.6
2	United States of America	324 433	12.5
3	Brazil	228 929	50.7
4	Russian Federation	197 000	22.2
5	Canada	149 855	2.5
6	Ethiopia	104 209	97.2
7	Democratic Republic of the Congo	81 184	94.4
8	China	74 496	9.3
9	Nigeria	72 633	87.0
10	Sweden	72 103	8.2
	Total	**1 739 608**	

FIGURE 25 **Annual wood removals by region, 1990–2011**



probably remain stable, although it is also clear that a large proportion of wood removals will come from other wooded land, trees outside forests and forests designated for other purposes.

Contribution of forestry to gross domestic product

FRA has worked to harmonize procedures with the International Standard Industrial Classification of All Economic Activities, ISIC (United Nations, 2008), since 2010. Following ISIC, the boundaries of the forest sector can be summarized as the addition of three categories: *forestry and logging* (ISIC Rev. 4 Division 02), *wood industry* (ISIC Rev. 4 Division 16) and *pulp and paper industry* (ISIC Rev. 4 Division 17). FRA 2015 is restricted to the primary production in the sector, that is, the category of *forestry and logging*. Therefore, the statistics on gross value added from forestry and the statistics on employment denote only activities under the category of *forestry and logging* (FAO, 2013).

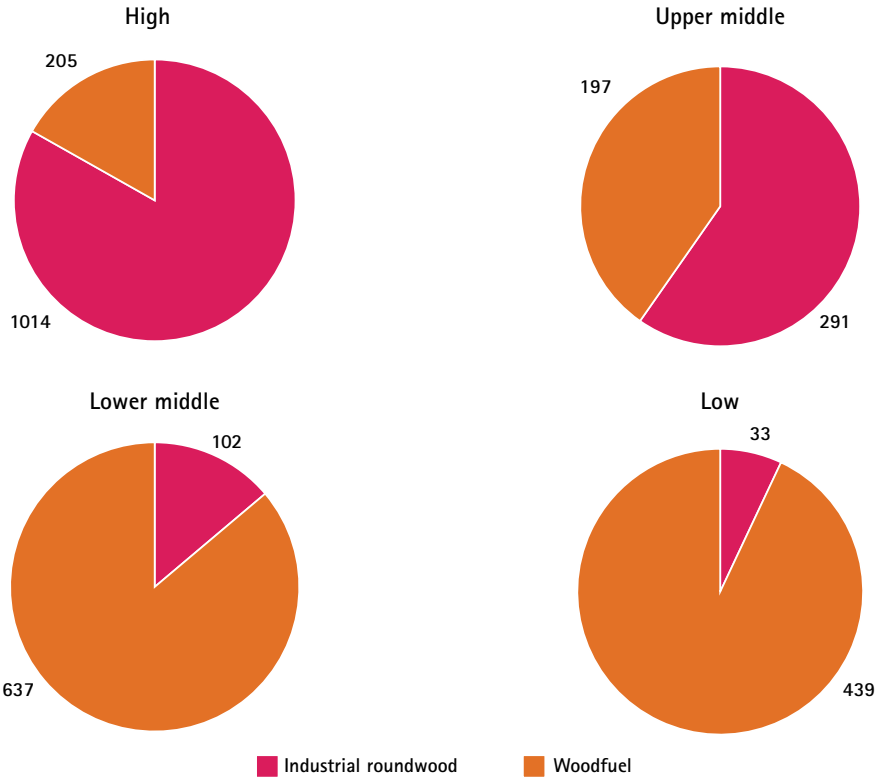
WHY IS THIS INDICATOR IMPORTANT?

Forestry contributes to a country's gross domestic product (GDP) in both formal and informal economic sectors. In many countries with rapidly expanding economies, the relative share of forestry and logging is decreasing at the national level. Yet the economic impact of revenue from forestry and logging is often felt most at the local level. Changes in the contributions of the within-forest activities reported in FRA 2015 reflect its economic importance at the national level. The value added is weighted by the total size of the economy; therefore this indicator reflects the performance of forestry and logging and GDP.

WHAT HAS CHANGED AND WHY?

According to the *State of the World's Forests* (FAO, 2014), the forest sector in 2011 contributed an estimated total amount of USD600 billion to global GDP, or about 0.9 percent of global GDP. Data reported to FRA by 148 countries indicate that forestry and logging contributed about USD117 billion. Of this amount, high-income countries accounted for 41 percent, while low-income countries accounted for only 5 percent (Figure 27). However, the proportion

FIGURE 26 **Industrial roundwood and woodfuel removals by income category in 2011**



Note: The figures represent annual removals in million m^3.

of this contribution to total GDP is much higher in low-income countries, where it amounts to almost 1.4 percent compared with only 0.1 percent in high-income countries (Figure 28).

WHAT IS THE FUTURE OUTLOOK?

As national incomes increase, dependence on woodfuel for domestic use is likely to continue to decrease as a proportion of GDP. For low-income and lower-middle-income countries, woodfuel contributions to GDP will remain important for the foreseeable future. For high-income countries, the relative contribution of forestry to GDP is decreasing as a result of faster growth in the non-forest sector. However, in all cases value added from forestry is less important at the national level than it is in local economies, where communities and regions can be highly dependent upon forest-related income.

Employment in forestry

FRA 2015 includes data on full-time equivalent labour in forestry and logging. This is labour only in forests, not in the whole forest sector (which includes manufacturing and related employment). These values include both formal and informal employment estimates (ISIC/NACE Rev. 4 activity A02). These data complement those published in *State of the World's Forests 2014*, which was compiled using a broad range of data sources.

WHY IS THIS INDICATOR IMPORTANT?

Employment in forestry and logging (mainly harvesting and silvicultural operations, including the collection of woodfuel and NWFPs) contributes to society's economic, environmental and social welfare. Forestry activities are carried out in rural areas, where there are often few alternative sources of employment, which makes such employment in these communities exceptionally important. Measuring and reporting employment provides an indication of how many rural jobs exist in forested areas.

WHAT HAS CHANGED AND WHY?

In 2010 about 12.7 million people were employed in forestry and logging (full-time equivalent), 79 percent of whom were in Asia (mainly Bangladesh, China and India). Employment in forestry and logging remained relatively stable in the tropical, subtropical and boreal climatic domains and decreased in the temperate zone (Figure 29). Employment in forests is considered heavily under-reported due to a lack of data, particularly for informal or part-time employment.

Only 29 countries representing 17 percent of global forest area reported total employment and female employment for all years, showing that most countries do not have data disaggregated by gender. For these countries, the percentage of female employment increased from 20 percent in 1990 to 32 percent in 2010.

Countries with the highest number of women working in forests were Bangladesh (600 000), China (301 000) and Mali (180 000). Countries with the greatest share of female employment were Mali (90 percent), Mongolia and

FIGURE 27 **Value added by forestry and logging by income category**

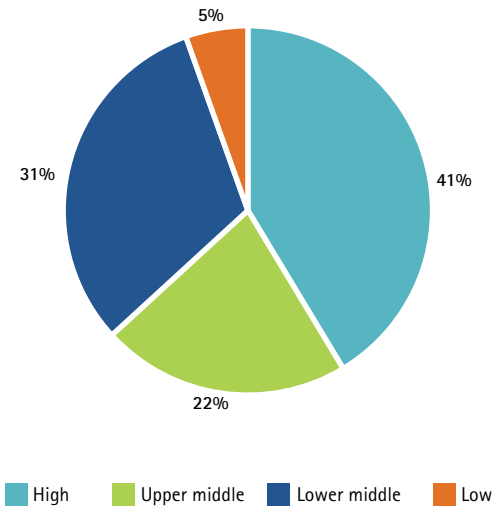


FIGURE 28 **Contribution of forestry and logging to GDP**

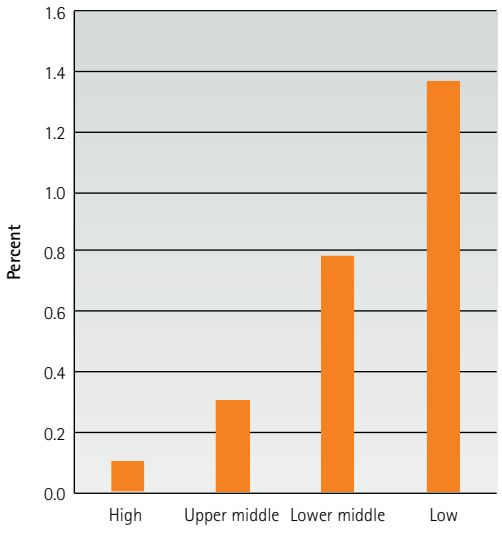


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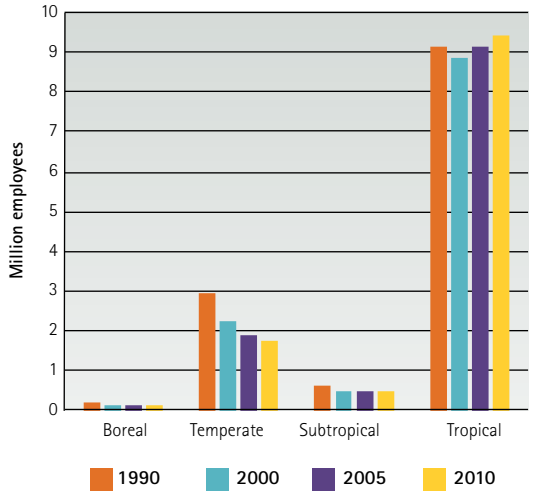
FIGURE 29 **Employment in forestry and logging, 1990–2010**



Non-wood forest products

NWFPs are an important source of livelihood for many rural dwellers and of income for industries that process or use these products. Despite their importance, it is difficult to obtain reliable and consistent data on NWFPs, because most NWFPs do not enter the commercial marketplace, and data on non-commercial values are generally unreliable or absent. Only 74 countries reported data on the value of NWFP removals and for the majority of them, data were either partial or incomplete. However, some countries provided detailed information, and the values of NWFP removals per hectare reported by them were quite substantial (Table 9).

TABLE 9 **Top ten countries by value of NWFP removals per hectare in 2010**

Country	Value of NWFP removals (USD/ha)
1. Republic of Korea	169
2. Portugal	124
3. Czech Republic	101
4. Tunisia	98
5. China	50
6. Latvia	44
7. Austria	43
8. Poland	42
9. India	35
10. Spain	34

Namibia (45 percent) and Bangladesh (40 percent). Bangladesh has updated its forest policy and legislation to enhance women's participation in social forestry development. In Mongolia, women have historically been responsible for such forestry activities as woodfuel collecting, reforestation and education, while in Mali women are actively involved in woodfuel and NWFP collection.

WHAT IS THE FUTURE OUTLOOK?

Globally, employment in forestry and logging seems likely to decline as productivity increases in most parts of the world. However, this decline is unlikely to occur in countries with high woodfuel use, where labour-use efficiency is unlikely to change in the foreseeable future.

Forest ownership and management rights

WHY IS THIS INDICATOR IMPORTANT?

Information on who owns the forest and who has forest management rights is critical in tracking environmental, social and economic development. Clear ownership and management rights are vital for good governance and sustainable management of forests. Information about forest ownership helps us to better understand who controls forest management and use, and who benefits or loses from the variety of products and services provided by forests. When forest tenure is secure, it promotes capital investment by government and the private sector and has a role in the arrangement of incentives that motivate the sustainable use of forest resources.

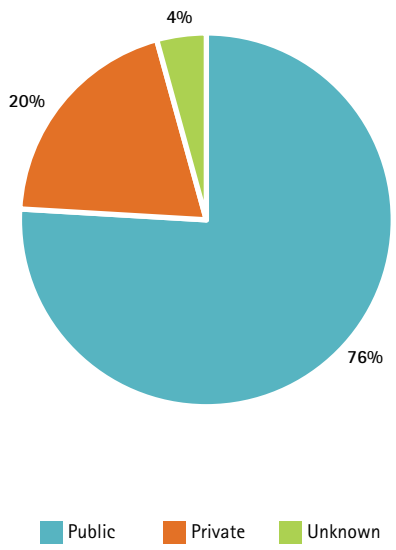
WHAT HAS CHANGED AND WHY?

Reporting on ownership has improved, with more countries reporting for the year 2010 than for 1990. In 2010, 76 percent of global forest area was publicly owned, 20 percent was private and 4 percent was of unknown ownership (Figure 30). Western and Central Africa is the region with the highest proportion of public ownership (99 percent), followed by Western and Central Asia (98 percent) and South and Southeast Asia (90 percent). The highest proportion of private forest is found in East Asia and Oceania (42 percent), followed by North America (33 percent).

During the period 1990 to 2010, forest area under public ownership decreased by about 120 million ha, while privately owned forests showed an increase of 115 million ha. The largest increase in private ownership was observed in the upper-middle-income category, where the area of private ownership nearly doubled. China accounted for an increase of 85 million ha, mainly as a result of the implementation of the 2008 reform of collective forest ownership.

Between 1990 and 2010 the share of individual ownership of private forests increased from 42 percent to 56 percent and at the same time the proportion of

FIGURE 30 **Forest ownership in 2010**



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private forest area owned by private business entities, institutions, and local, tribal and indigenous communities decreased (Figure 31). Even though the relative proportion of forest owned by communities decreased from 19 percent in 1990 to 15 percent in 2010, in real terms the forest area owned by communities increased from 60 million ha to 64 million ha.

At the global level, the management rights of publicly owned forests are dominated by public administration. Between 1990 and 2010 the proportion of public forests managed by private companies increased from 3 percent to 15 percent, while the area managed by public administration decreased from 95 percent to 82 percent (Figure 32).

The countries with the largest public forest area under community management in 2010 were Brazil and Colombia with 152 million ha and 30 million ha, respectively. Timor-Leste and Saint Pierre and Miquelon reported having 100 percent of their publicly owned forests under community management rights.

WHAT IS THE FUTURE OUTLOOK?

The current trend in forest tenure towards increased private ownership, and private companies having increased management responsibilities for public forests, is likely to continue. Decentralization of forests from national to subnational levels is also expected to continue in many countries. Privatization of forests in upper-middle-income countries appears likely to continue, particularly as national incomes increase.

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FIGURE 31 **Distribution of private ownership of forest, 1990–2010**

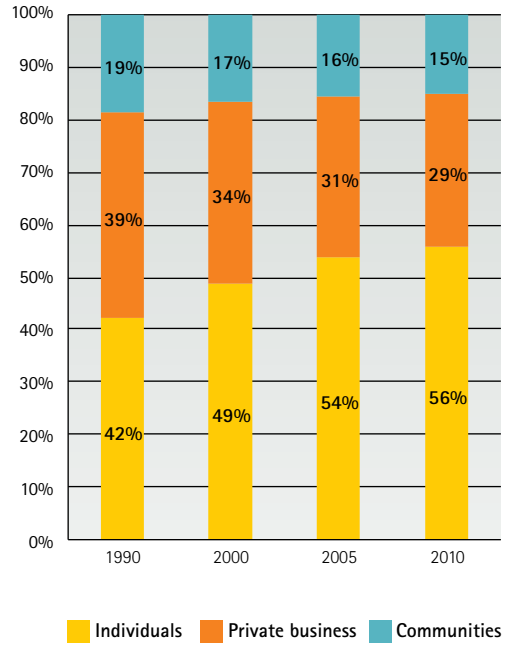
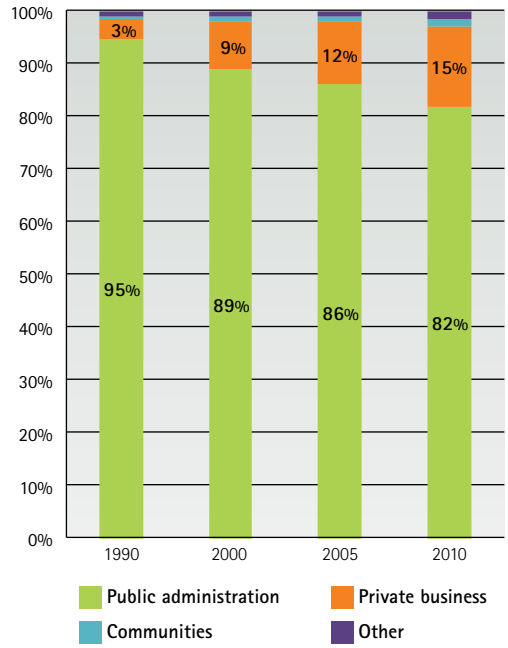


FIGURE 32 **Management rights of publicly owned forests, 1990–2010**



Importance of forests in Small Island Developing States

WHY ARE THESE FORESTS IMPORTANT?

Forest cover in Small Island Developing States (SIDS)[8] represents about 2 percent of the world's forest area, which is insignificant in global terms. However, in many SIDS, forests and trees play a more crucial role in social and economic development than they do in many larger countries. Many island habitats also have global significance for conservation of biodiversity and particular endemic species.

Forest management is important in SIDS because of the vital role of forests in soil and water protection and for building resilience against potential risks and disasters. In addition, coastal forests and mangrove forests are important for marine habitat and for protection from coastal erosion.

WHAT HAS CHANGED AND WHY?

SIDS have some of the world's highest forest cover in percentage of land area covered by forests. In fact, six of the top ten countries in proportion of forest to land area are SIDS. The total forest area in SIDS increased from 80.6 million ha in 1990 to 81.8 million ha in 2015.

Among SIDS, the five largest countries in terms of forest area represent 87 percent of the total forest area, while the 34 smallest countries represent only 1 percent of the total forest area (Table 10). While forest area in SIDS with the least forest increased between 1990 and 2010, the rate of increase declined from 10 000 ha per year in the 1990s to 2 600 ha per year in the period 2000–2010. This changed to a forest area net loss of 900 ha per year between 2010 and 2015.

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[8] American Samoa, Anguilla, Antigua and Barbuda, Aruba, Bahamas, Barbados, Belize, British Virgin Islands, Cabo Verde, Comoros, Cook Islands, Cuba, Dominica, Dominican Republic, Fiji, French Polynesia, Grenada, Guam, Guinea-Bissau, Guyana, Haiti, Jamaica, Kiribati, Maldives, Marshall Islands, Mauritius, Micronesia (Federated States of), Montserrat, Nauru, New Caledonia, Niue, Northern Mariana Islands, Palau, Papua New Guinea, Puerto Rico, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Samoa, Sao Tome and Principe, Seychelles, Singapore, Solomon Islands, Suriname, Timor-Leste, Tonga, Trinidad and Tobago, Tuvalu, United States Virgin Islands, Vanuatu.

TABLE 10 **Small Island Developing States forest area by forest area size class in 2015**

Country forest area class	Number of countries	Forest area (million ha)	% of SIDS forest area
Large (>2 million ha)	5	70.8	87
Medium (200 000 ha to 2 million ha)	11	9.9	12
Small (<200 000 ha)	34	1.1	1
Total	**50**	**81.8**	

FIGURE 33 **Annual change in forest area by income category, 1990–2015 (SIDS)**

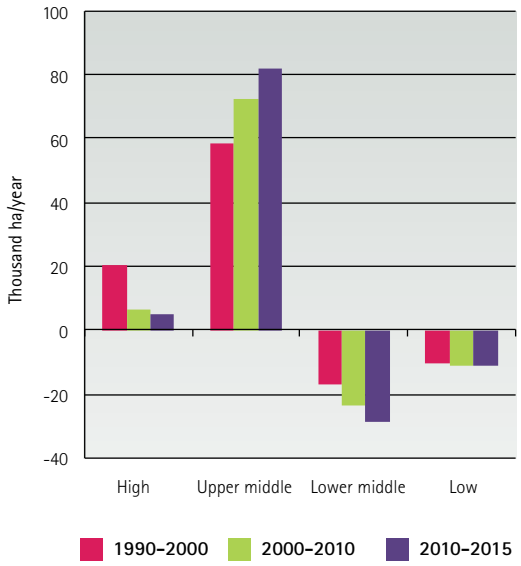
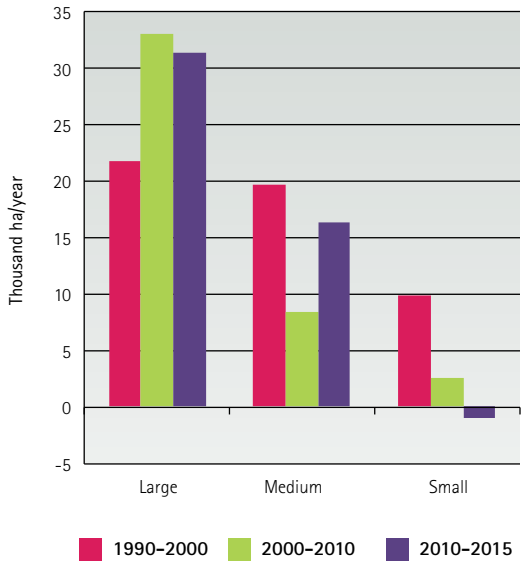


FIGURE 34 **Annual change in forest area by forest area size class, 1990–2015 (SIDS)**



Forest area increased in SIDS with large and medium forest areas, and in SIDS in the high-income and upper-middle-income categories, while lower-middle-income and low-income category SIDS (Figure 33) and small forest area countries (Figure 34) showed decreases in forest area.

Mangroves play an important role in SIDS. Thanks to a wide variety of plant species providing habitats for a wealth of animal species, mangrove ecosystems are not only rich in biodiversity but they also serve as protection areas from natural disasters such as cyclones, erosion from sea level rise and tsunamis. They also provide landscapes that are highly valued for residential and tourism uses. Globally, there are almost 15 million ha of mangroves, of which about 15 percent (2.2 million ha) are found in SIDS.

WHAT IS THE FUTURE OUTLOOK?

Forests in SIDS will remain important for biodiversity and socioeconomic values. Forest area change is difficult to predict given the volatility in change rates, but it is unlikely that large changes in area will occur in the near future. The only exception appears to be in the small SIDS, where forest area decreased over the period 2010–2015.

Data sources and quality

Most of the data reported in this and other FRA 2015 publications come from Country Reports. FRA 2015 provides reports on 234 countries and territories, of which 155 are Country Reports prepared by national correspondents nominated by government agencies responsible for forestry. The remainder come from desk studies, which since FRA 2000 have been used to provide estimated values for forest statistics in countries or territories that have not nominated a national correspondent or that have not provided a Country Report. While the number of desk studies is high, in total they report on only 1.3 percent of global forest area.

Data collection and reporting leading up to 2015 was guided by a series of workshops and training sessions designed to maximize consistency between reports. For FRA 2015, data were also acquired through the Forest Resources Information Management System (FRIMS), the online data collection portal of FAO. Countries were given templates with data they had submitted for FRA 2010.

Countries were requested to revise and update the former figures when new data were available and then estimate the figures for 2015. In addition to providing the data reported by countries, FAO has worked with national correspondents to provide data assembled from other sources. Most of these are sources previously provided by national governments to the United Nations, including data on population, land area and wood removals.

It is important to note that all Country Reports were independently peer-reviewed by FAO staff, partners in the Collaborative Forest Resources Questionnaire and external experts. Peer-review comments were provided to national

correspondents for inclusion in the Country Reports and, where necessary, corrections of individual Country Reports were made before the data were included in the final FRA 2015 database.

The reporting format for countries encourages them to provide data for references and calculations. In some cases, countries have provided excellent documentation that allows the reader to examine and recalculate values submitted for FRA 2015. Readers may refer to the Country Reports for details, references and descriptions.[9] Publications and documents describing terms and definitions, as well as the guide to FRA 2015, can also be found on the FAO website.[10]

FRA 2015 employed a set of tier categories similar to those used by the Intergovernmental Panel on Climate Change. Tiers were requested for all variables that potentially had more than one source of data. Tiers were defined by countries for each of the included variables for both status (i.e. the most recent report) and trend (i.e. for two or more reporting periods). Countries were asked to assign a tier value to each qualifying variable: Tier 1 (expert estimate), Tier 2 (low intensity or incomplete surveys, older data) or Tier 3 (high reliability, recent sources with national scope). Specific definitions for each tier were provided in FRIMS following this general pattern and are available in the Country Reports.

[9] See www.fao.org/forest-resources-assessment/current-assessment/country-reports/en/.
[10] See www.fao.org/forestry/fra2015.

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Global Forest Resources Assessment 2015

The contributions of forests to the well-being of humankind are far-reaching. Forests provide vital wood supplies, help to combat rural poverty, and ensure food security and decent livelihoods; they offer promising mid-term green growth opportunities; and they deliver vital long-term environmental services, such as clean air and water, biodiversity and mitigation of climate change.

Building on data that are more comprehensive and reliable than ever before and covering 234 countries and territories, the *Global Forest Resources Assessment 2015* (FRA 2015) shows encouraging signs of improved forest management and a global slowdown in deforestation. However, these trends need to be strengthened, especially in countries that are lagging behind.

Joint data collection, analysis and reporting on the world's forests: the Collaborative Forest Resources Questionnaire partnership

There has been widespread interest in consistent forest information with common definitions and shared effort. The Collaborative Forest Resources Questionnaire (CFRQ) is an initiative developed by FAO together with regional data collection partners to collect, analyse and report forest data jointly. Linked directly to the FRA that FAO has conducted since 1948, the CFRQ covers 104 countries that represent some 88 percent of the world's forests. Data collected through the CFRQ were collected once and used many times, which reduces the workload for national correspondents and provides more consistent numbers. This approach increases the use of common definitions and provides a basis for enhanced sharing of forest statistics.

There are six partners working to implement the CFRQ for reporting in 2015: the Central African Forests Commission, FAO Forestry (FRA), FOREST EUROPE, the International Tropical Timber Organization, the Montréal Process and the United Nations Economic Commission for Europe. The CFRQ is the successful result of the joint commitment of these organizations to simplify and harmonize forest-related data collection while reducing the reporting burden that countries face.

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