Tropical Forest Resources: Facts and Tables

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L. Pancel, M. Köhl (eds.), *Tropical Forestry Handbook*,
DOI 10.1007/978-3-642-54601-3_7

Abstract

More than 40 % of the world's 4 billion hectares forests are located in tropical regions and cover 1.73 billion hectares which corresponds to nearly half of the tropical land area. Deforestation – mainly the conversion of tropical forests to agricultural land – shows signs of decreasing in several countries but continues at a high rate in others. Around 8 million hectares of tropical forest were converted to other uses or lost through natural causes each year in the last decade compared to more than 10 million hectares per year in the 1990s. Fifteen tropical countries loose more than 1 % of their forests per year, in five countries forest area is stable, and in nine countries forest area is slightly increasing by a total of 0.3 million hectares per year.

Half of the world's growing stock is located in tropical forests. In terms of carbon content, they have a share of about 60 %. On average, tropical forests in Africa and Latin America/Caribbean store 100 t carbon per ha, in Asia/Pacific 75 t carbon per ha.

Primary forest, i.e., forest of native species where there are no clearly visible indications of human activities and the ecological processes have not been significantly disturbed, includes the most species-rich, diverse terrestrial ecosystems. In Africa and Asia/Pacific, the share of primary forests on total tropical forest area is 42 %, while in Latin America/Caribbean still 74 % are primary. Overall, the area of primary forests is decreasing in all tropical regions with about 3.7 million hectares per year, but the situation seems to be improving especially in Asia/Pacific, while the rates of conversion show an increasing trend in Latin America/Caribbean.

About 15 % of tropical forests are designated as primary function for the conservation of biodiversity.

National parks, game reserves, wilderness areas, and other legally established protected areas also cover about 15 % of the total tropical forest area. The primary function of these forests may be the conservation of biological diversity, the protection of soil and water resources, or the conservation of cultural heritage.

Half of all tropical countries declare forest fires as severe problem. Severe storms, flooding, and earthquakes have also damaged areas of forests. Nearly all countries in the tropics face at least forest degradation as result of the impact of human interventions in production forests, protected areas and parks. In many tropical countries, the climate appears to be changing. Recent data provide evidence of, for example, increasing temperatures and prolonged dry periods

in some regions and increased rainfall and more frequent tropical storms in others.

Half of the tropical forest is designated as permanent forest estate (PFE). Again half of these, about 400 million hectares, serve production purposes. Due to accessibility problems, only parts of the production forests are available for harvest. About 3 % of the permanent forest estate is planted forest. Reported wood removals amount to 1.3 billion cubic meters annually and equivalent to 0.5 % of the total growing stock. By far the most important product is fuelwood, although the statistics on this product are neither complete nor precise. Only few tropical countries are able to report on amount and value of non-timber forest products.

Keywords

Biodiversity • Carbon content • Climate change • Conversion of tropical forests • Deforestation • Primary tropical forests • Tropical forests • Tropical forest resources

Introduction

During the last decade, the information on tropical forests improved considerably. Though still many information gaps exist, an attempt is made to summarize current knowledge on state of the forests and forestry in tropical countries. The following analysis is based on data (see Annex) compiled from:

1. Global Forest Resources Assessment 2010 and associated remote sensing analyses (FAO 2010)
2. ITTO (Blaser et al. 2011): ITTO producer countries (33 countries representing more than 80 % of the total tropical forest area)
3. FCPF (Country Readiness Preparation Proposals: http://www.forestcarbonpartnership.org): all participating countries as supplement
4. Country data presented at official websites: all countries with low information status as supplement.

Considered are all countries situated in the tropical regions as listed by ITTO and FAO (65 countries) as well as Nepal which is listed by FAO only. The descriptions follow the structure of the Forest Resources Assessment (FAO 2010).

A fundamental difficulty in reporting tropical forest area is that many countries have more than one climatic domain. For example, China and the United States both have tropical forest but they are a fraction of forest area. Likewise, while Peru has substantial tropical forest and is an ITTO producer country, they also have significant forest that is not tropical. Thus, one must take care in interpreting forest area based on country alone unless the country has reported forest area by forest type. Of the analyses presented in this chapter, only the remote sensing work of the Global Forest Resources Assessment (FRA) reports forest area and change based on climatic ecozones (Table 1).

Table 1 Forest area (million hectares, ± *95 % confidence interval*) by region and climatic domain. Forest area figures are presented rounded to the nearest significant digit

FRA region	Climatic domain	Samples	1990	2000	2010
Africa	Subtropical	122	**4** ± *51 %*	**5** ± *51 %*	**4** ± *52 %*
	Tropical	2,415	**590** ± *6 %*	**580** ± *7 %*	**560** ± *7 %*
Asia	Boreal	31	**16** ± *16 %*	**17** ± *15 %*	**18** ± *16 %*
	Subtropical	769	**130** ± *12 %*	**150** ± *11 %*	**160** ± *11 %*
	Temperate	1,273	**70** ± *16 %*	**80** ± *15 %*	**90** ± *15 %*
	Tropical	911	**310** ± *8 %*	**290** ± *8 %*	**280** ± *9 %*
Europe	Boreal	294	**800** ± *5 %*	**800** ± *5 %*	**790** ± *5 %*
	Subtropical	94	**18** ± *26 %*	**18** ± *25 %*	**18** ± *25 %*
	Temperate	531	**270** ± *9 %*	**270** ± *9 %*	**260** ± *9 %*
North and Central America	Boreal	2,777	**380** ± *2 %*	**390** ± *2 %*	**380** ± *2 %*
	Subtropical	368	**90** ± *13 %*	**90** ± *13 %*	**90** ± *12 %*
	Temperate	1,593	**260** ± *6 %*	**260** ± *6 %*	**250** ± *6 %*
	Tropical	127	**70** ± *12 %*	**70** ± *12 %*	**70** ± *12 %*
Oceania	Subtropical	429	**30** ± *25 %*	**30** ± *25 %*	**30** ± *25 %*
	Temperate	51	**21** ± *20 %*	**21** ± *20 %*	**20** ± *20 %*
	Tropical	300	**70** ± *19 %*	**70** ± *19 %*	**70** ± *19 %*
South America	Subtropical	177	**20** ± *26 %*	**20** ± *25 %*	**20** ± *25 %*
	Temperate	96	**13** ± *33 %*	**13** ± *33 %*	**13** ± *33 %*
	Tropical	1,217	**820** ± *4 %*	**790** ± *4 %*	**760** ± *4 %*
World	Boreal	3,102	**1,200** ± *3 %*	**1,200** ± *3 %*	**1,190** ± *3 %*
	Subtropical	1,959	**300** ± *7 %*	**320** ± *7 %*	**330** ± *7 %*
	Temperate	3,544	**630** ± *5 %*	**640** ± *5 %*	**630** ± *5 %*
	Tropical	4,970	**1,860** ± *3 %*	**1,790** ± *3 %*	**1,730** ± *3 %*
World		13,575	**4,000** ± *3 %*	**3,950** ± *3 %*	**3,890** ± *3 %*

Source: FAO Global Forest Resources Assessment remote sensing analysis (2014)

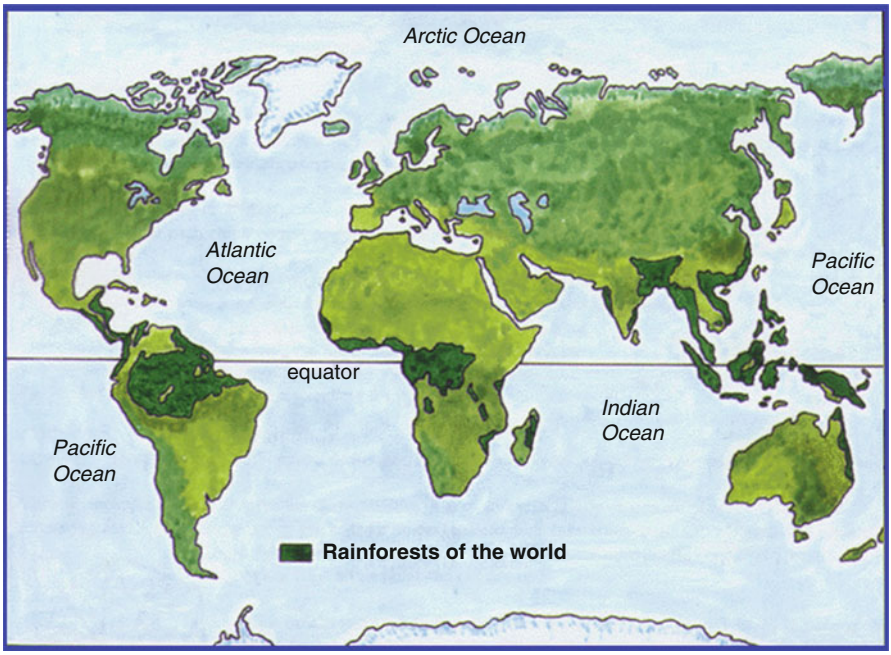
Extent of the Tropical Forest Resource

Extent, Naturalness, and Designation

Tropical forests form a variety of unique ecosystems leading to the rich diversity of the tropics. Tropical rainforests merge into other types of forest depending on the altitude, latitude, and various soil, flooding, and climate conditions. They occur in the equatorial zone, within the area bounded by latitudes 23.5° N (Tropic of Cancer) and 23.5° S (Tropic of Capricorn). One of the major characteristics of tropical forests is their distinct seasonality: winter is absent, and only two seasons may occur. The

length of daylight is 12 h and varies little. The seasonal distribution of rainfalls determines the subdivision in:

- *Evergreen rainforest*: no dry season.
- *Seasonal rainforest*: short dry period in a very wet tropical region (the forest exhibits definite seasonal changes as trees undergo developmental changes simultaneously, but the general character of vegetation remains the same as in evergreen rainforests).
- *Semievergreen forest*: longer dry season (the upper tree story consists of deciduous trees, while the lower story is still evergreen).
- *Moist/dry deciduous forest (monsoon)*: the length of the dry season increases further as rainfall decreases (all trees are deciduous).
- http://www.srl.caltech.edu/personnel/krubal/rainforest/Edit560s6/www/where.html



The bulk of the world's tropical rainforest occurs in the Amazon Basin in South America. The Congo Basin and Southeast Asia, respectively, have the second and third largest areas of tropical rainforest. Rainforests also exist on some the Caribbean islands, in Central America, in India, on scattered islands in the South Pacific, in Madagascar, in West and East Africa outside the Congo Basin, in Central America and Mexico, and in parts of South America outside the Amazon. Brazil has the largest extent of rainforest of any country on Earth.

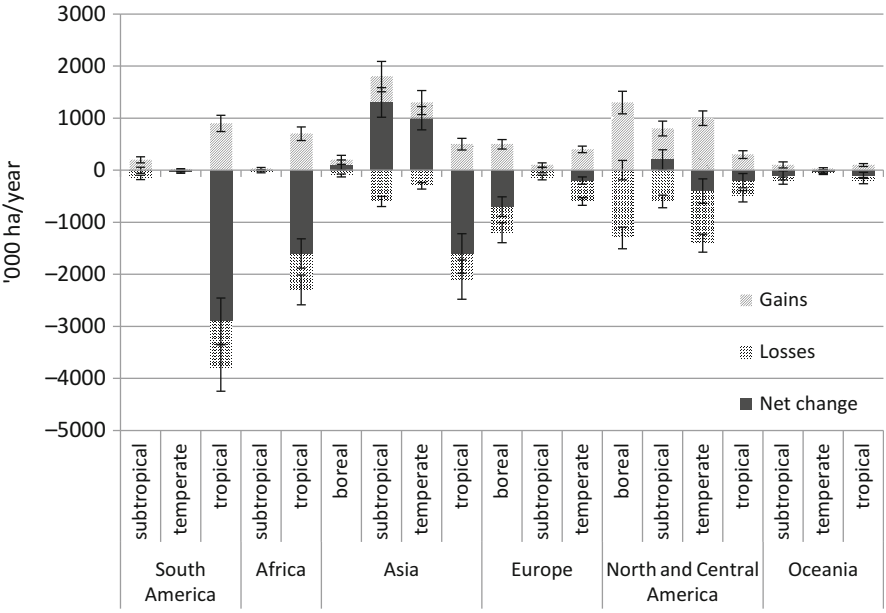


Fig. 1 Annual change in forest land-use area (1990–2010) by region and climatic domain

According to FAO, tropical forests extend on 1.70 billion hectares in 2010 based on Landsat image analysis (Table 5, Table 1).

The world's forests are distributed unevenly with just under half the world's forests in the tropical domain (45 % of total area), about one third in boreal (31 %) and smaller amounts in temperate (16 %) and subtropical (8 %) domains. Figure 1 shows regional differences in the rate of change in forest area. The highest rate of forest conversion to other land uses was in South America, followed by Africa and Asia. Net forest loss in the tropical domain was reasonably constant from 1990 to 2010, going from 6 million hectares per year in the 1990s to 7 million hectares per year in the 2000s.

About half of the land area in the tropics is covered by forests. Forest coverage is highest in Latin America/Caribbean (56 %), followed by Africa (48 %) and Asia/Pacific (39 %). On country level, the highest coverage (85–98 %) is found in Gabon, Suriname, and French Guyana. Only few forests (4–7 % coverage) exist in Togo, Burundi, Kenya, and Haiti.

ITTO producer countries are covered by 1.42 billion hectares tropical forests following FAO, but ITTO estimates the extent in a range between 1.30 and 1.39 billion hectares. While FAO includes the total forest area of India and Mexico (133 million hectares), ITTO estimates the area of tropical forests only (69 million hectares). Only ten of the 33 ITTO producer countries correspond to FAO figures. Seven countries conduct no forest inventory, 2 countries prepare for their first inventory, 10 countries request inventories only within the forest management units (FMUs), 5 countries rely on inventories conducted before 2000 and 8 countries accomplished their last inventory during the previous decade (Table 5, Annex 2).

Table 2 Forest area and permanent forest estate in tropical countries and subdivision of the PFE in ITTO producer countries (Blaser et al. 2011) complemented by FAO 2010

Region	Forest area '000 ha	Permanent forest estate (PFE) '000 ha (% of total forest area)	PFE for production natural '000 ha (% of PFE)	PFE for production planted '000 ha (% of PFE)	PFE for protection '000 ha (% of PFE)
Total tropical	1,730,831	881,081 (51)			
Total ITTO	1,420,513	783,101 (55)	403,196 (52)	22,371 (3)	357,755 (45)
Africa	270,067	112,751 (42)	68,244 (62)	950 (1)	43,210 (38)
Asia/Pacific	282,006	178,627 (63)	108,219 (61)	12,038 (7)	58,370 (33)
Latin America/ Caribbean	868,440	491,723 (57)	226,706 (46)	9,383 (2)	255,687 (52)

The Permanent Forest Estate in Tropical Countries

ITTO reported that some 910 million hectares are primary forests, of these 870 million hectare are in ITTO producer countries. Half of the forest area serves no designated purpose. In tropical Africa 60 % of the forest area has no defined status, in Asia/Pacific its 44 % like in Latin America/Caribbean (45 %). 880 million hectares are designated as permanent forest estate (PFE), of these 780 million hectares are in ITTO producer countries. Nearly 3 % of the PFE are planted forests, i.e., 0.4 % in Africa, 7 % in Asia/Pacific, and 2 % in Latin America/Caribbean. The PFE serves production purposes (55 % of the area) as well as protection services (45 %). In Latin America/Caribbean, the area of forests for protection exceeds that of production forests (Table 2).

More than half of the tropical forest is closed forest whose tree canopy covers 60 % or more of the ground surface, when viewed from above. In Africa, on average 60 % of the forest area is closed. The highest ranking is found in Liberia and Gabon, but the canopy covers less than 20 % in Ghana, Côte d'Ivoire, Nigeria, and Togo. In Asia/Pacific, on average 51 % of the forests are closed namely in Vanuatu, Papua New Guinea, and Malaysia. In contrast, India has a low proportion of closed forests. In Latin America/Caribbean, more than half of the forests (55 %) are closed in all countries except Mexico. Suriname and Guyana show the highest ranking of all ITTO producer countries in terms of closed forests.

Annual Change Rates

Annual change rates in tropical forest area vary slightly between FAO and ITTO estimates (Table 4, Annex 1). Greatest discrepancies exist in Nigeria, Cameroon, Mexico, and Peru.

Annual change rates range from −5, to 75 % in Togo to +1.1 % in Viet Nam. The total gross annually deforested area in the tropics between 2005 and 2010 is 8.2 million hectares, when considering new plantations, the annually affected net area is reduced to 7.9 million hectares.

The highest annual losses are observed in Brazil (−2.2 million hectares), Indonesia (−0.7 million hectares), Nigeria and Tanzania (−0.4 million hectares), and Cameroon, Democratic Republic of Congo Zimbabwe, Bolivia, and Venezuela (about −0.3 million hectares).

In all tropical regions, deforestation is driven primarily by conversion to agricultural land use. Additionally, in Africa fuelwood gathering and charcoal production play an important role – but one that is not well quantified. The Asia/Pacific regions suffer periodically from destruction by fires. In Latin America/Caribbean, mining and infrastructure development are also important drivers.

In some tropical countries, the forest area is extending namely in India and Viet Nam as well as, though on lower level, in Costa Rica and Cuba. Still, reafforestation in tropical regions reduces tropical forest losses only by about 0.3 million hectares per year.

Growing Stock and Carbon Stocks

Half of the world's growing stock is located in tropical forests. The majority is stocking in Latin America/Caribbean (62 % with 48 % in Brazil) followed by Africa (27 %) and Asia/Pacific (11 %) (Table 5, Annex 2).

FRA 2010 estimates that the world's forests store 289 gigatonnes (Gt) of carbon in their biomass alone. Tropical forests have a share of about 60 %. Carbon in tropical forests is again concentrated in Latin America/Caribbean (55 % with 37 % in Brazil) followed by Africa (29 %) and Asia/Pacific (16 %). On average. tropical forests in Africa and Latin America/Caribbean store 100 t carbon per ha, in Asia/Pacific 75 t carbon per ha. While sustainable management, planting, and rehabilitation of forests can conserve or increase forest carbon stocks, deforestation, degradation, and poor forest management reduce them. Information on changes in carbon stocks is scarce. For reporting period 2005–2010, most countries report not significant changes, only Indonesia (−1.7 t/ha/year) and Malaysia (−0.8 t/ha/year) provided data.

Biodiversity in Tropical Forests

Area of Primary Forests

Forests of native species where there are no clearly visible indications of human activities and the ecological processes have not been significantly disturbed are considered as primary forests. They include the most species-rich, diverse terrestrial ecosystems. More than half of the tropical forests worldwide, i.e. 0.91 billion hectares, are primary forests (Table 6, Annex 3). In Africa and Asia/Pacific, the share of primary forests on total tropical forest area is 42 %, while in Latin America/

Caribbean still 74 % are primary. The decrease of primary forests during the last decades is largely due to reclassification of primary forest to "other naturally regenerated forest" because of selective logging, shifting cultivation, and other human interventions. Overall, the area of primary forests is decreasing in all tropical regions at a rate of about 3.7 million hectares per year, but the situation seems to be improving especially in Asia/Pacific, while the rates of conversion show an increasing trend in Latin America/Caribbean. More than 70 % of all losses of primary tropical forests occur in Brazil although this seems to be slowing in recent years. Relatively high conversion rates are also observed in Papua New Guinea and Gabon.

Forest Area Designated for Conservation of Biological Diversity

About 15 % of tropical forests are designated as primary function for the conservation of biodiversity (Table 6, Annex 3). This is more than the global average of about 13 %. Only five countries in the tropics were not able to report on biodiversity conservation areas though for instants countries like Kenya and the Dominican Republic are known for their nature reserves. The highest share of biological diversity conservation areas which are tropical forests is found in the Asia/Pacific region. Most, but by far not all of these areas are legally established protected areas. This is especially true for Latin America/Caribbean.

Tropical Forests in Protected Areas

National parks, game reserves, wilderness areas, and other legally established protected areas also cover about 15 % of the total tropical forest area (Table 6, Annex 3). The primary function of these forests may be the conservation of biological diversity, the protection of soil and water resources, or the conservation of cultural heritage.

In Africa and Latin America/Caribbean, the share of legally protected area is about 12 % of the total tropical forest area, while in Asia/Pacific the share amounts to 28 %. The situation varies widely between countries. The highest shares with more than half of the total forest area in a legally protected status are found in Thailand, Nicaragua, and Panama.

Health and Vitality of Tropical Forests

Forest Fires

While some forest ecosystems depend on fire for their regeneration, forest fires can be devastating to others and also frequently cause loss of property and human life. In tropical forests, less than 1 % of all forests were reported to be significantly affected each year by forest fires. However, the area of forest affected by fires was severely

underreported, with information missing from many countries. Still, half of all tropical countries declare forest fires as severe problem. The greatest damaged areas are reported from India, Ghana, Cameroon, and Myanmar (Table 7, Annex 4). Less than 10 % of all forest fires are prescribed burning; most are classified as wildfires.

Pests and Diseases, Natural Disasters, and Invasive Species

Information availability and quality continues to be poor for most of these disturbances. Outbreaks of forest insect pests are reported from India, Mexico, El Salvador, Guatemala, Honduras, and Peru. Severe storms, flooding, and earthquakes have also damaged large areas of forests. During the last 15 years, hurricanes hit especially Myanmar, Guatemala, Honduras, Cuba, Haiti, Nicaragua, and Jamaica. Mozambique, Indonesia, Myanmar, and Thailand suffered from severe flooding. Earthquakes destroyed parts of Indonesia, Papua New Guinea, El Salvador, and Haiti.

Woody invasive species are of particular concern in small island developing states, where they can threaten the habitat of endemic species.

Human-Induced Disturbances

Healthy biological functioning of forest ecosystems can be affected by a variety of human actions such as encroachment, illegal harvesting, human-induced fire and pollution, grazing, mining, poaching, etc. Nearly all countries in the tropics face at least forest degradation as result of the impact of human interventions in production forests, protected areas, as well as in parks.

Climate Change

ITTO producer countries were asked to specify their expectations concerning the vulnerability of their forests to climate change (Table 7, Annex 4). Blaser et al. (2011) concluded: "Climate change and climate variability could be among the most serious threats to sustainable development, with potential adverse impacts on natural resources, physical infrastructure, human health, food security and economic activity. Forests and rural landscapes in the tropics may be particularly vulnerable to the effects of climate variability, for example extreme weather events such as droughts (and associated wildfires), flooding and storms. At the same time, forests have the capability to reduce both environmental and social vulnerability.

In many tropical countries the climate appears to be changing. Recent data provide evidence of, for example, increasing temperatures and prolonged dry periods in some regions, and increased rainfall and more frequent tropical storms in others. In Mexico, there has been an increase in mean annual temperature

of 0.6 °C in the past four decades. In Peru, average annual temperature has increased by 0.3 °C in the last 50 years. In Ghana, average annual temperature has increased by 1.0 °C since 1960, thus damaging the integrity of forest ecosystems. Adaptive approaches to forest management will become increasingly important in the face of climate change. Regardless of the pace of such change, healthy forests maintained under SFM will be better able to cope than those weakened and/or degraded by over-exploitation."

Productive Functions of Tropical Forests

Areas Designated for Productive Functions

Half of the tropical forest is designated as permanent forest estate (PFE). Again half of these, about 400 million hectares, serve production purposes. In Asia/Pacific, production forests have a share of more than one third of the total forests.

ITTO producer countries report on their production forests in more detail (Table 3). Due to accessibility problems, only parts of the production forests are available for harvest. In Latin America/Caribbean, only one fourth of these forests can be exploited, while in Africa nearly two thirds are accessible. In Asia/Pacific, half of the production forests are covered by management plans. This share is with 20 % lowest in Latin America/Caribbean. Certification also plays a minor role in Latin America/Caribbean. Still, up to now the area of certified forests is slightly increasing throughout the tropics but especially some countries in Latin America/Caribbean observe nonrenewals of certificates because demand for certified timber is lacking.

Planted Forests

About 3 % of the permanent forest estate is planted forest. During the decade 2000–2010, there is a decreasing trend in forest plantations in Angola, Burundi, Papua New Guinea, and Sri Lanka. In half of the tropical countries, the plantation area did not change significantly, but 28 countries show an increasing trend, especially Brazil, Viet Nam, Malaysia, Peru, Myanmar, Ghana, Colombia, and Ecuador.

Removals of Wood Products

Reported wood removals amount to 1.3 billion cubic meters annually and equivalent to 0.5 % of the total growing stock (Table 8, Annex 5). Most countries have a stable timber production level. By far the most important product is fuelwood. Since some countries regard fuelwood as non-timber forest product (NTFP) and do not include this wood in their statistics, the actual amount of wood removals is undoubtedly

Table 3 Status of the PFE for production in ITTO producer countries (Blaser et al. 2011)

	PFE for production	PFE available for harvest		Forest area with management plans		Certified forest area			
Region	'000 ha	'000 ha	% PFE prod.	'000 ha	% PFE prod.	'000 ha 2010	% PFE total	'000 ha 7/2012	% PFE total
Total ITTO	403,169	165,332	41	129,062	32	17,617	2	24,179	3
Africa	68,244	45,714	67	26,359	39	4,628	4	5,699	5
Asia/Pacific	108,219	62,766	58	58,013	54	6,367	4	7,170	4
Latin America/ Caribbean	226,706	56,852	25	44,690	20	6,622	1	11,310	2

higher than reported. There is also no estimate on informally and illegally removed wood. About 1.5 % of the harvested wood is exported.

Forest Management for Production

More than half of all tropical countries developed forestry guidelines, six of them have none (Table 5, Annex 2). Twenty out of 65 countries conducted a national forest inventory, 16 countries conduct inventories in their forest management units (FMUs), 7 countries definitely have no inventory information, the situation in the remaining counties is unknown. The monitoring capacity is low in most countries; high capacities are reported by Côte d'Ivoire, India, Malaysia, Brazil, Guyana, and Mexico.

Seventeen countries contract out concessions which differ considerably in size and duration between countries (Table 8, Annex 6). Thirteen countries offer short-term harvest permits. Usually, standards for harvest are set and minimum diameter rules for species or species groups are prescribed. Ten countries are committed to reduced impact logging systems (RIL), but chainsaw logging and high grading are still widespread. Most countries rely on successful natural regeneration, but 12 countries also use enrichment planting.

Removals of Non-wood Forest Products

Only few tropical countries are able to report on amount and value of non-timber forest products (NTFPs) such as Brazil, Colombia, India, Malaysia, Mexico, Costa Rica, El Salvador, Tanzania, and The Philippines. The major categories of NWFP removals about which countries provided the most information are (in descending order of importance):

1. Food
2. Exudates
3. Other plant products
4. Wild honey and beeswax
5. Ornamental plants
6. Raw materials for medicine and aromatic products
7. Wild meat
8. Raw materials for utensils, handicrafts and construction
9. Living animals
10. Hides, skins, and trophies

Some countries, especially in Latin America/Caribbean, introduced or are introducing markets to facilitate payments for environmental services (PES) such as water catchment protection, biodiversity conservation, and carbon sequestration. At the international level, the volume and value of payments is still low, but it is expected that there is substantial potential for an increase, especially for carbon sequestration.

Protective Functions of Tropical Forests

Forest Area Designated for Soil and Water Conservation

One of the most important protective function of forests is related to soil and water resources. Forests conserve water by increasing infiltration, reducing runoff velocity and surface erosion, and decreasing sedimentation. Forests play a role in filtering water pollutants, regulating water yield and flow, moderating floods, enhancing precipitation, and mitigating salinity. The forest area with "protection of soil and water as the primary designated function" refers specifically to the area of forests that have been set aside for the purposes of soil and water conservation, either by legal prescription or by decision of the landowner or manager. More specifically, the variable refers to soil and water conservation, avalanche control, sand dune stabilization, desertification control, and coastal protection. It does not include forests that have a protective function in terms of biodiversity conservation or those in protected areas, unless the main purpose is soil and water conservation.

Following FAO, about 133 million hectares or nearly 8 % of the tropical forests have soil and water conservation as their primary objective (Table 6, Annex 3). The quantification of the protection forest area remains difficult. ITTO producer countries report much greater areas especially in Latin America. Brazil reported 43 million hectares forest designated for soil and water protection to FAO. The ITTO report states: "The Amazon Basin produces 20 % of the world's freshwater; it is therefore vital that its soil and water resources are properly protected. An estimated 243 million hectares of forest in Brazil are managed primarily for soil and water protection."

In Africa, the greatest protective forests are located in Mozambique, Central African Republic, and the Republic of Congo. In Asia Pacific, Indonesia, Myanmar, Lao PDR, and Vietnam have the greatest protective forests. In Latin America/Caribbean, they are found in Brazil, Venezuela, and Colombia.

Socioeconomic Functions of Tropical Forests

Ownership and Management Rights

In African tropical countries, most of the forests are in public ownership. Significant private ownership exists in Sierra Leone (86 % belong communities), Togo (73 % belong individuals), Uganda (68 %), Kenya (61 % belong mainly communities), Zimbabwe (32 %), and Central African Republic (9 %). The holder of management rights in public forests is usually public administrations or in few cases communities. In those countries where concessions for timber harvest are granted, business entities hold management rights for a given period.

In Asia/Pacific as well as in Latin America/Caribbean, private forest ownership is much more spread especially in Papua New Guinea (97 %), Fiji (95 %), Timor Leste (67 % belong communities), El Salvador (69 %), Colombia (67 %), Jamaica (65 %), Paraguay (61 %), and Guatemala (52 %). Still, the holder of management rights are mainly public administrations.

Public Expenditure and Revenue Collection

Thirty-one of 65 tropical countries reported on revenues from forestry and public expenditure for forestry measures in 2005 (FAO 2010). On average, total forest revenue collection was about US$4.4 per hectare, ranging from US$0.3 per hectare in tropical Africa to US$6.6 per hectare in tropical Asia/Pacific. Public expenditures range from US$0.7 per hectare in tropical Africa to US$2.5 per hectare in Asia/Pacific. In Latin America/Caribbean, the situation is dominated by Brazil. Here, revenue collection is relatively high with more than US$5 per hectare, and public expenditures are low. Without Brazil, the relation of revenues (US$0.7 per hectare) and expenditures (US$1.9 per hectare) are similar to the African situation. Only in Asia/Pacific, namely, Malaysia and Papua New Guinea, and Brazil revenues are higher than expenditures.

Value of Wood and Non-wood Forest Product Removals

Forty-four tropical countries report on values of wood and non-wood forest removals in 2005 (FAO 2010). Wood removals valued just over US$25.7 billion annually in the period 2003–2007, accounted for by industrial roundwood (60 %) and woodfuel (40 %). In Liberia, Burundi, Madagascar, Rwanda, Tanzania, India, and Myanmar, the value of woodfuel trade exceeds that of industrial roundwood.

The reported value of non-wood forest product removals amounts to about US$0.8 billion for 2005. Food products account for the greatest share. However, information is still missing from many countries in which non-wood forest products are highly important, and the true value of subsistence use is rarely captured. As a result, the reported statistics probably cover only a fraction of the true total value of harvested non-wood forest products. High values are reported by Brazil, Colombia, and India. Millions of people depend on food, medicine, and products from the forest in their daily life. Some ITTO producer countries estimated the number of depending people such as 45 million in the Democratic Republic of Congo, 48 million in Nigeria, 115.5 million in Cambodia, 38 million in Myanmar, more than 200 million in India, more than 5 million in Papua New Guinea, 25 million in the Philippines as well as in Thailand, and 12 million in Mexico.

Payment for environmental services (PES) may generate additional income, but are not fully established yet. PES mainly for the management of water catchments is practiced in Kenya, Fiji, Brazil, Colombia, Ecuador, Guatemala, Guyana, Mexico, Costa Rica, Dominican Republic, and Paraguay. Regional initiatives or pilot projects are conducted in Madagascar, Indonesia, Vietnam, Panama, and El Salvador.

Employment

During the last decade, reported employment in forest establishment, management, and use employment increased in 14 countries especially in Malaysia, Vietnam, and Paraguay – probably because roundwood production has increased faster than gains

in labor productivity. Employment decreased in 9 countries, especially in Indonesia and Jamaica. Some countries reported increased employment in management of protected areas such as Nigeria, Zimbabwe, and Vietnam. Given that much forestry employment is outside the formal sector, forest work is surely much more important for rural livelihoods and national economies than the reported figures suggest.

Area of Forest Designated for Social Services

The forest area designated for recreation, tourism, education, or conservation of cultural and spiritual heritage is expanding in the tropics. Roughly about 0.17 million hectares or about 10 % of the tropical forest are designated for the provision of social services. Brazil has designated more than one fifth of its forest area for the protection of the culture and way of life of forest-dependent people.

Annex

Annex 1

See Table 4

Annex 2

See Table 5

Annex 3

See Table 6

Annex 4

See Table 7

Annex 5

See Table 8

Annex 6

See Table 9

Table 4 Tropical forest area, change in area

Country	Total forest 000 ha FAO	% of total area %	Change 05–10 %/a FAO	Total forest 000 ha ITTO	Change 05–10 %/a ITTO	Deforestation 000 ha/a	Primary forest % (000 ha)	Permanent F. Estate 000 ha	Canopy cover > 60 % %
Cameroon	19,916	42	−1.07	19,700–21,200	−0.14	−270	18	12,800	54
Central African Republic	22,605	36	−0.13	22,700–>30,000	−0.19	−43	10	5,763	38
Congo, Democratic Republic	154,135	68	−0.2	112,000–154,000	−0.2	−311	51	48,300	66
Congo, Republic of	22,411	66	−0.05	22,400	−0.03	−67	33	18,900	68
Côte d'Ivoire	10,403	33	–	10,400	n.s.	<−15	6	4,220	17
Gabon	22,000	85	0	21,700–24,600	−0.12	−10	90	13,525	87
Ghana	4,940	22	−2.19	4,680	−2.2	−135	5	1,334	18
Liberia	4,329	45	−0.68	3,330–4,390	−0.35–1.0	−15–43	4 (FAO)–56	1,904	88
Nigeria	9,041	10	−4.0	9,000	n.a.	−410	0	5,622	11
Togo	287	5	−5.75	500–1,700	−5.75	−20	0	383	2
Subtotal Africa	**270,067**	**48**		**226,140–282,370**		**−1,310**	**42 (113,730)**	**112,751**	**60**
Angola	58,480	47	−0.21			−125	0	58,480	
Benin	4,561	41	−1.06			−50	0	2,700	
Burundi	172	7	−1.01			−2	23	80	
Equatorial Guinea	1,626	58	−0.71			−10	0	1,630	
Gambia	480	48	+0.38			+2	n.s.	30	

(*continued*)

Table 4 (continued)

Country	Total forest 000 ha FAO	% of total area %	Change 05–10 %/a FAO	Total forest 000 ha ITTO	Change 05–10 %/a ITTO	Deforestation 000 ha/a	Primary forest % (000 ha)	Permanent F. Estate 000 ha	Canopy cover > 60 % %
Guinea	6,544	27	−0.54			−40	1	1,190	
Guinea Bissau	2,022	72	−0.49			−10	0	–	
Kenya	3,467	6	−0.31			−10	19	1,260	
Madagascar	12,553	22	−0.45			−60	24	3,260	
Mozambique	39,022	50	−0.53			−210	0	–	
Rwanda	435	18	+2.47			+10	0	–	
Sierra Leone	2,726	38	−0.7			−20	4	290	
Tanzania, United Rep. of	33,428	38	−1.16			−400	0	13,000	
Uganda	2,988	15	−2.27			−90	0	1,900	
Zambia	49,468	67	−0.33			−170	0	3,240	
Zimbabwe	15,624	40	−1.97			−330	5	910	
Total Africa	**503,663**	**44**				**−2,825**	**27 (118,410)**	**200,721**	
Cambodia	10,094	57	−1.22	10,000–10,700	−1.2	−127	3	8,300	39
Fiji	1,014	56	+0.34	1,000	+0.34	0	48	219	n.a.
India	68,434	23	+0.21	37,800[a]	±0.21	−30–40	42	36,300	13
Indonesia	94,432	52	−0.71	94,400–98,500	−0.7	−684	50	68,400	69
Malaysia	20,456	63	−0.42	18,400–18,600	−0.42	−90	21	14,400	79
Myanmar	31,773	48	−0.95	30,800–35,400	−0.95	−310	10	22,000	58
Papua New Guinea	28,726	63	−0.49	28,600–33,000	−0.47–0.9	−140–300	91	10,500	79

Philippines	7,665	26	+0.73	7,100–7,700	+0.7	+30	11	6,350	42
Thailand	18,972	37	+0.08	15,900–19,000	+0.08	+15	35	12,160	32
Vanuatu	440	36	0	440	−0.3	−2	–	0	89
Subtotal Asia/ Pacific	**282,006**	**39**		**244,440–262,140**		**−1,353**	**42 (117,840)**	**178,629**	**51**
Brunei Darussalam	380	72	−0.47			−2	69	320	
Lao People's Democratic Republic	15,751	68	−0.49			−80	9	–	
Nepal	3,636	25	0			−84	14	–	
Solomon Islands	2,213	79	−0.25			−5	50	0	
Sri Lanka	1,860	29	−0.77			−15	9	–	
Timor-Leste	742	50	−1.44			−10	0	–	
Vietnam, Socialist Republic of	13,797	44	+1.08			+144	1	–	
Total Asia/Pacific	**320,385**	**40**				**−1,325**	**38 (120,940)**	**178,949**	
Bolivia, Plurinational State of	57,196	53	−0.53	52,400–57,200	−0.5	−270	67	38,300	64
Brazil	519,522	62	−0.42	519,000	−0.42	−2,200	92	316,650	51
Colombia	60,499	55	−0.17	56,900–61,500	−0.17	−101	14	15,240	60
Ecuador	9,865	36	−1.89	9,900–11,200	−1.89	−198	40	8,700	59
Guatemala	3,657	34	−1.47	3,700–4,600	−1.47	−56	43	2,500	51
Guyana	15,205	77	0	15,200	−0.6–0	−9–0	45	12,200	89
Honduras	5,192	46	−2.16	5,800	−2.16	−120	8	3,600	51
Mexico	64,802	33	−0.24	31,400[a]	−0.49	−155	53	12,200	35[a]

(*continued*)

Table 4 (continued)

Country	Total forest 000 ha FAO	% of total area %	Change 05–10 %/a FAO	Total forest 000 ha ITTO	Change 05–10 %/a ITTO	Deforestation 000 ha/a	Primary forest % (000 ha)	Permanent F. Estate 000 ha	Canopy cover > 60 % %
Panama	3,251	44	−0.36	3,000–4,300	−0.36	−12	22	2,300	49
Peru	67,992	53	−0.22	68,000–71,000	−0.1	−150	60	38,900	81
Suriname	14,758	95	−0.02	14,800	−0.1	−4	93	7,500	96
Trinidad & Tobago	226	44	−0.32	226	−0.32	−1	28	200	66
Venezuela, Bolivarian Republic of	46,275	52	−0.61	46,700	−0.6	−288	45	33,400	55
Subtotal LAC	**868,440**	**56**		**827,026–842,926**		**−3,559**	**74 (648,000)**	**491,690**	**55**
Belize	1,393	61	−0.68			−10	43	–	
Costa Rica	2,605	51	+0.9			+23	24	–	
Cuba	2,870	26	+1.25			+35	0	2,870	
Dominican Republic	1,972	41	0			0	–	–	
El Salvador	287	14	−1.47			−4	2	–	
French Guiana	8,082	98	−0.04			−4	95	6,600	
Haiti	101	4	−0.77			−1	0	–	
Jamaica	337	31	−0.12			n.s.	26	120	
Nicaragua	3,114	26	−2.11			−70	38	–	
Paraguay	17,582	44	−0.99			−180	11	–	

Total LAC	**906,783**	**55**				**−3,770**	**73 (660,110)**	**501,280**	
Total ITTO countries	142,0513	50		1,297,876–1,387,436	−0.43	−6,222	61 (873,570)	783,070	56
Total	1,730,831	48			−0.45	−7,920	53 (909,460)	880,950	
Africa ITTO	270,067	48		226,410–282,370	−0.48	−1,310	42 (113,730)	112,751	60
A/P ITTO	282,006	39		244,440–262,140	−0.48	−1,325	42 (117,840)	178,629	51
LAC ITTO	868,449	56		827,026–842,926	−0.39	−3,559	74 (648,000)	491,690	55
					Total gross	−8,214			

Bold: ITTO producer countries
[a]Tropical forest only

Table 5 Stocks, carbon

	Growing stock	Carbon	Carbon/ ha	Institutional framework				
Country	Million m^3	Million t	Tonnes	Forest law	Law enforcement capacity	Forestry guidelines	Inventory	Monitoring capacity
Cameroon	6,141	2,969	135	1994	Low	1998	2004	Low
Central African Republic	3,776	2,861	127	2008	Low	None	1991–93	Insufficient
Congo, Democratic Republic of	35,473	19,639	127	2002	Low		In FMUs	Low
Congo, Republic of	4,539	3,438	153	2000	Low	2005	In FMUs	Low
Côte d'Ivoire	2,632	1,842	177	65, in prep.	Low	2010	None, ghg	High
Gabon	4,895	2,710	123	2001	Medium		In FMUs	Improved
Ghana	291	381	77	1998	Partly strong	1998	1985–92	Medium
Liberia	684	585	135	2006	Low	2006	None	Low
Nigeria	1,161	1,085	120	1937 in prep	Low	1996	None	Low
Togo	–	–	–	2008	Low	None	None	Low
Subtotal Africa	59,592							
Angola	2,266	4,385	75	1955				
Benin	161	263	58	1993	Low			
Burundi	20	17	96	1985	Low		1992	
Equatorial Guinea	268	203	125	1997	Low	Yes	Partly, FMUs	
Gambia	18	32	66	1998			2008–10	
Guinea	506	96	47	1989				
Guinea Bissau	61	96	47	1991				
Kenya	629	525	137	2005	Low	In work		Low

Madagascar	2,146	1,626	130	1997	Low	2000		Medium
Mozambique	1,420	1,692	43	1999/12	Low		2005	Low
Rwanda	79	39	91	1988				Low
Sierra Leone	109	216	79	1988	Low	No		Inadequate
Tanzania, United Republic of	1,237	2,019	60	2002	Low	Yes	In progress	
Uganda	131	109	36	2003	Low	Yes	In FMUs	
Zambia	2,755	2,416	49	1973	Low			
Zimbabwe	596	492	49	1996				
Total Africa	71,994	49,736	99					
Cambodia	956	464	46	2002	Weak	1999	In FMUs	Low
Fiji	–	–	–	1992		1990 in work	2006–08	None
India	5,489	2,800	41	1927	Inadequate	Several	Yes	High
Indonesia	11,343	13,017	138	1999	Low	2009, 10	Yes	Medium
Malaysia	4,239	3,212	157	1984		Several	2007	High
Myanmar	1,430	1,654	52	1992	Low	2000	None	Low
Papua New Guinea	2,726	2,306	80	1991	Low	1993	None	Low
Philippines	1,278	663	87	1975	Low	Several	2003–05	Medium
Thailand	783	880	46	2007	Low		None	Low
Vanuatu	–	–	–	2001	Low	None	1989–92	Low
Subtotal A/P	Min 28,244							
Brunei Darussalam	72	72	188	1984		Yes		
Lao People's Democratic Republic	–	1,074	68	2007	Improving	Yes		Low
Nepal	–	485	133	1993	Weak	1995	1999	
Solomon Islands	208	182	82	2004	Low	1996	In FMUs	

(*continued*)

Table 5 (continued)

Country	Growing stock	Carbon	Carbon/ ha	Institutional framework				
	Million m^3	Million t	Tonnes	Forest law	Law enforcement capacity	Forestry guidelines	Inventory	Monitoring capacity
Sri Lanka	–	61	33	1995	Low			
Timor-Leste	–	–	–	2000	Low		2008–10	
Vietnam, Socialist Republic of	870	992	72	1992	Low		2000–05	
Total A/P	Min 29,394	24,116	75					
Bolivia, Plurinational State of	4,242	4,442	78	In work	Weak	1997, 2006	in FMUs	low
Brazil	126,221	62,607	121	1965	Strengthened	2006	1980, fmus	High
Colombia	8,982	6,805	112	1974		None	In prep.	Medium
Ecuador	–	–	–	In work	Partially	2004	In fmus	Medium
Guatemala	596	281	77	1996	Improving	Yes	2002–03	Low
Guyana	2,206	1,629	107	2009	High	Yes	In fmus	High
Honduras	629	330	64	2008	Low	1996	2006	Low
Mexico	2,870	2,043	32	2003	Improving		2004–07	High
Panama	664	367	113	1994	Low	2003	In fmus	Medium
Peru	8,159	8,560	126	2001	Improving	Yes	In fmus	Medium
Suriname	3,389	3,165	214	1992	Medium	Yes	In fmus	Medium
Trinidad and Tobago	24	19	85	In work		None	1969	None
Venezuela, Bolivarian Republic of	–	–	–	2008	Partially	Yes	In work	Medium

Subtotal LAC	Min 157,982							
Belize	226	171	123	2000		Yes		Low
Costa Rica	272	238	91	1996	Low	Yes	Pilot study	
Cuba	258	226	79	1998				
Dominican Republic	122	114	58	1999				
El Salvador	–	–	–	2002	Low			Low
French Guiana	2,829	1,651	204	2001			In fmus	
Haiti	7	5	54	1926				
Jamaica	52	48	141	1996	Low	Yes	2003	
Nicaragua	461	349	112	2003	Improving		2007–08	Low
Paraguay	–	–	–	1973/04	Improving		In fmus	Low
Total LAC	Min 162,209	Min 93,050	103					
Total	Min 263,597			527 billion m^3 worldwide = 50 %				
Total		170,648	289 Gt	Estimate for f r a total biomass carbon				

FAO 2010

Table 6 Biodiversity: primary forest

Country	Total forest	Primary forest	Change 90–10	Protected areas FAO		Soil/water primary function	Biol.div. prim. func
	000 ha (FAO)	% (‘000 ha)	% / trend	000 ha	% total forest	000 ha	000 ha
Cameroon	19,916	18	–	9,100	46	(600)	884
Central African Republic	22,605	10	−2.9/+	250	1	5,700	226
Congo, Democratic Republic of	154,135	51	–	16,300	11	(0)	26,203
Congo, Republic of	22,411	33	−0.08 /=	990	4	(0)3,660	896
Côte d’Ivoire	10,403	6	0	810	8	374	832
Gabon	22,000	90	−2.1 / +	3,430	16	(0)	3,960
Ghana	4,940	5	0	43	1	350	49
Liberia	4,329	4(FAO)–56	0	190	4	(0)	173
Nigeria	9,041	0	n.s / ++	2,510	28	(0)57	2,531
Togo	287	0	–	–	–	(45)6	46
Subtotal Africa	**270,067**	**42(113,730)**		**33,623**	**12**	**(7,070)10,145**	**35,800**
Angola	58,480	0	–	1,860	3	0	1,754
Benin	4,561	0	–	1,260	28	0	1,277
Burundi	172	23	0	40	23	0	0
Equatorial Guinea	1,626	0	–	590	37	0	585
Gambia	480	n.s.	n.s.	40	8	60	43
Guinea	6,544	1	0	240	4	590	3,010
Guinea Bissau	2,022	0	–	–		240	1,112
Kenya	3,467	19	−0.3 / =	–		3,260	0
Madagascar	12,553	24	−0.65 /+	4,750	38	1,250	4,770
Mozambique	39,022	0	–	4,140	11	8,580	4,292

Rwanda	435	2	0	60	14	50	0
Sierra Leone	2,726	4	−3.3 / =	190	7	0	191
Tanzania, United Republic of	33,428	0	–	2,000	6	0	2,006
Uganda	2,988	0	–	730	24	0	1,076
Zambia	49,468	0	–	10,680	22	0	10,883
Zimbabwe	15,624	5	0	800	5	470	781
Total Africa	503,663	27(118,410)		61,003	14	21,570	67,580
Cambodia	10,094	3	0/++	3,090	31	550	3,937
Fiji	1,014	48	n.s./++	90	9	304	91
India	68,434	42	0	19,770	29	(10,700)4,540	19,820
Indonesia	94,432	50	−0.2/+	37,810	40	(22,660)26,400	15,109
Malaysia	20,456	21	0	4,640	23	(2,660)5,200	2,046
Myanmar	31,773	10	0	2,080	7	(1,270)21,100	2,224
Papua New Guinea	28,726	91	−1.5/–	310	1	0	1,436
Philippines	7,665	11	0	1,800	24	(613)1,500	1,226
Thailand	18,972	35	0	9,430	50	1,330	8,917
Vanuatu	440		–	–	–	–	–
Subtotal A/P	282,006	42(117,840)		79,020	28	(39,870)60,920	54,806
Brunei Darussalam	380	69	−0.9/=	20	5	20	80
Lao People's Democratic Republic	15,751	9	0	–		9,140	2,993
Nepal *	3,636	14	0/+	526	14	436	509
Solomon Islands	2,213	50	0	0	0	620	487
Sri Lanka	1,860	9	0/++	–		190	558
Timor-Leste	742	0	–	495		310	185
Vietnam, Socialist Republic of	13,797	1	−1.2/+	–		5,100	2,237
Total A/P	320,385	38(120,940)		80,061	19	55,690	61,855

(*continued*)

Table 6 (continued)

Country	Total forest 000 ha (FAO)	Primary forest % (‘000 ha)	Change 90–10 % / trend	Protected areas FAO 000 ha	Protected areas FAO % total forest	Soil/water primary function 000 ha	Biol.div. prim. func 000 ha
Bolivia, Plurinational State of	57,196	67	−0.5/−	10,680	19	0	10,867
Brazil	519,522	92	−0.48/+	89,540	17	(43,000)243,000	46,757
Colombia	60,499	14	−0.17/=	–	–	(605)3,800	8,470
Ecuador	9,865	40	0.26/=	–	–	2,300	4,834
Guatemala	3,657	43	−3.7/–	–	–	(0)950	2,304
Guyana	15,205	45	0	–	–	0	152
Honduras	5,192	8	0	2,340	45	(1,140)1,000	2,285
Mexico	64,802	53	−0.1/++	8,490	13	0	8,424
Panama	3,251	22	–	2,120	65	(65)406	1,333
Peru	67,992	60	−0.3 =	–	–	(n.s.)756	18,358
Suriname	14,758	93	−0.1−	2,015	14	0	2,214
Trinidad & Tobago	226	28	0	–	–	(60)37	20
Venezuela, Bolivarian Republic of	46,275	45	–	–	–	(7,870)14,500	15,734
Subtotal LAC	868,440	74(648,000)		115,185	13	(55,040)266,750	121,752
Belize	1,393	43	0	–		0	599

Costa Rica	2,605	24	0	–		290	625
Cuba	2,870	0	–	630	22	1,350	603
Dominican Republic	1,972	–	–	–		–	–
El Salvador	287	2	0	30	10	10	32
French Guiana	8,082	95	−0.1/+	2,420	30	0	2,425
Haiti	101	0	–	5	5	0	4
Jamaica	337	26	−0.07/=	120	36	10	71
Nicaragua	3,114	38	−2.1−	2,020	65	190	2,024
Paraguay	17,582	11	0	–		n.s.	1,934
Total LAC	906,783	73(660,110)		120,410	29	55,450	130,069

Countries in bold: 1. Blaser et al.(ITTO) 2011 all: 2. FAO 2010 (in brackets)

Table 7 Forest fires/climate change

Country	Burned 2003–07		Fire reported as problem	Expected trend	Mean temperature	Mean rainfall
	000 ha/year	% Wild fire			Expected trend	Expected trend
Cameroon	497	93	x	Partly increased	Increased of 0.15 °C/ decade	Decreased of 2.2 %/ decade
Central African Republic			x	Increased	Increased	Decreased of 2.2 %/ decade
Congo, Democratic Rep. of						
Congo, Republic of				Increased	–	–
Côte d'Ivoire			x	Increased	Increased	
Gabon					Increased of 0.14 °C/ decade	Decreased of 2.6 %/ decade
Ghana	500	80	x		Increased of 0.21 °C/ decade	Decreased of
Liberia					Increased of 0.18 °C/ decade	Decreased
Nigeria					Increased of 0.03 °C/ decade	Decreased
Togo			x	Incr.	Increased	
Angola						
Benin	47	40	x			
Burundi			x			
Equatorial Guinea						
Gambia		100				
Guinea		100				
Guinea Bissau						
Kenya	2	100				
Madagascar	16	100	x			

Mozambique		100	x			
Rwanda						
Sierra Leone		90	x			
Tanzania, United Republic of	15	100	x			
Uganda						
Zambia						
Zimbabwe	20		x			
Cambodia			x		Increased of 0.18 °C/ decade	No change
Fiji			x		Increased	
India	1,605	100	x		Increased	
Indonesia	5	100	xx	Increased	Increased	Increased
Malaysia	2	100			Increased	No long-term trend
Myanmar	218					
Papua New Guinea		100	xx		Increased	
Philippines	2	100	x	Increased	Increased	Decreased
Thailand	21		x		Increased	Decreased
Vanuatu					incr.	
Brunei Darussalam			x			
Lao People's D R			x			
Nepal			x			
Solomon Islands						
Sri Lanka			x			
Timor-Leste			x			
Vietnam, Socialist Republic			x			
Bolivia, Plurinational State of			x			
Brazil		100		Increased		Decreased

(*continued*)

Table 7 (continued)

Country	Burned 2003–07		Fire reported as problem	Expected trend	Mean temperature	Mean rainfall
	000 ha/year	% Wild fire			Expected trend	Expected trend
Colombia			x	Increased		Changing patterns
Ecuador				Increased		
Guatemala			x			
Guyana			x		Increased	
Honduras	23	95	x			
Mexico	38	92	x	Increased	Increased of 0.13 °C/ decade	No trend
Panama	3		x			
Peru	12				Increased	Changing patterns
Suriname				Increased	Increased	Changing patterns
Trinidad & Tobago	3	100	x		Increased	
Venezuela, Bolivarian Republic			x	Increased		
Belize						
Costa Rica	7					
Cuba	9	100				
Dominican Republic	3		x			
El Salvador			x			
French Guiana	0					
Haiti						
Jamaica						
Nicaragua	63	100	x			
Paraguay						

Countries in bold: 1. Blaser et al.(ITTO) 2011 all: 2. FAO 2010

Table 8 Timber production

Country	PES Fee	PFE production nat. 000 ha	 % Total forest	Production Mio m^3/ trend	Fuelwood %	Export Mio m^3	
Cameroon		7,600	38	14.00 =	67–85	1.00	
Central African Republic		5,200	23	3.00 =	85	0.08	High transport costs, no port; artisanal timber
Congo, Democratic Republic		22,500	15	80.00 +	85	0,22	Low-quality timber, forests are difficult to assess
Congo, Republic of		15,200	68	2.60 =	NTFP	0.80	High transport costs, no port
Côte d'Ivoire		1,950	19	21.50 =	90	0.50	Policy revision 2010, low political will
Gabon		10,600	48	3.40 =	45	1.90	Ban on unprocessed timber 2010
Ghana		774	16	1.32 +	NTFP	0,25	Log export banned since 1997, chainsaw lumber is illegal, but traded
Liberia		1,700	39	0.36 +	NTFP	few	2 of 4 ports work again
Nigeria		2,720	30	77.00 =	90	0.22	>1/2 of log volume harvested by chainsaw
Togo		0	0	6.00 =	50	0.10	No commercially exploitable forests left
Subtotal Africa*		68,244	25				
Angola		2,340	4	5.10 =	75	n.s.	
Benin		1,410	31	6.70 =	90	n.s.	
Burundi		15	9	10.70 +	95	n.s.	
Equatorial Guinea		80	5	1.00 =	45	no logs2008	
Gambia		n.s.		0.80 =	80	n.s.	
Guinea		130	2	12.60 =	95	0.17	
Guinea Bissau		590	29	2.70 =	85	0.01	
Kenya	x	210	6	27.60 =	95	n.s.	
Madagascar	in prep.	3,260	26	13.30 =	90	n.s.	

(*continued*)

Table 8 (continued)

Country	PES Fee	PFE production nat. 000 ha	 % Total forest	Production Mio m^3/ trend	Fuelwood %	Export Mio m^3	
Mozambique		26,170	67	18.10 =	95	0,01	
Rwanda		320	74	6.20 =	95	–	
Sierra Leone		240	9	5.70 =	95	0.02	
Tanzania, United Republic		23,730	71	25.00 =	90	0.01	
Uganda		360	12	43.70 =	90	no logs 1,999	
Zambia		11,870	24	10.40 =	90	n.s.	
Zimbabwe		1,560	10	9.50 =	90	n.s.	
Total Africa		140,529	28				
Cambodia		3,710	37	0.10 –	20	0.02	Logging in natural forest banned since 1988
Fiji	x	0	0	0.47 =	NTFP	0.01	Remaining forest difficult to access
India		26,160	38	307.00 =	85	0.00	50 % of wood supply from non-forest resources
Indonesia	Regionally	38,600	41	101.00 =	86	3.00	Illegal logging equals official harvest
Malaysia		10,298	50	18.00 –	NTFP	4.40	FSC + PEFC certified, harvest from plantations
Myanmar		15,800	50	43.10 =	91	1.40	Government controls teak, limited profit for others
Papua New Guinea		8,700	30	2.90 +	NTFP	1.90	1,8 Mio m3/a by clearance authorities for agriculture, difficult access
Philippines		4,700	61	0.85 =	30	0.00	1988 ban on old-growth logging
Thailand		251	1	45.00 =	90	1.60	Logging ban in natural forests since 1988
Vanuatu		0	0	0.14 =	75	few	All land is owned by individuals or clans
Subtotal A/P*		108,219	38				
Brunei Darussalam		220	58	0.10 =	n.s.	banned	

Lao People' Democratic Republic		3,620	23	6.20 =	95	no logs	
Nepal				0.20 =	25	banned	
Solomon Islands		380	17	1.60 =	NTFP	1.4	Resource exhausted by 2014
Sri Lanka		170	9	5.80 −	90	n.s.	Logging ban
Timor-Leste		247	33	0.10 =	100	n.s.	
Vietnam, Socialist Republic	pilot p.	6,480	47	27.80 =	90	no logs	
Total A/P		119,587	37				
Bolivia, Plurinational State of		25,100	44	2.70 +	NTFP	0.40	No demand for certified timber
Brazil	x	135,000	26	247.00 =	50	1.10	FSC + PEFC certified, 166 Mio m3 from plantations
Colombia	x	5,500	9	13.00 =	85	n.s.	Wood is abundant, prices are low, no incentives for management
Ecuador	x	1,964	20	4.80 +	80	0.20	Harvest in planted forests is greater
Guatemala	x	1,140	31	16.00 +	40	0.01	30–50 % of official production is illegal
Guyana	x	11,090	73	0.30 =	5	0.15	Overmature stands, industry sector underdeveloped
Honduras		1,096	21	10.80 −	90	0.07	Illegal production is three to four times higher
Mexico	x	8,400	13	2.40 =	NTFP	0.00	Nonrenewals of certificates, lack of price premium
Panama	(x)	350	11	1.50 −	90	n.s.	Forests are considered as common goods, no political priority
Peru		18,700	28	2.40 =	NTFP	0.50	Log export not permitted
Suriname		5,319	36	0.20 =	1	0.05	Lack of interest, gold-mining has priority
Trinidad & Tobago		127	56	0.05 =	NTFP	0.00	Needs imports
Venezuela, Bolivarian Republic		12,920	28	2.40 =	NTFP	n.s.	No demand for certified timber

(*continued*)

Table 8 (continued)

Country	PES	PFE production nat.		Production	Fuelwood	Export	
	Fee	000 ha	% Total forest	Mio m^3/ trend	%	Mio m^3	
Subtotal LAC[a]		226,706	26				
Belize		0	0	0.20 =	–	n.s.	
Costa Rica	x	360	14	4.70 =	30	0.20	
Cuba		890	31	1.90 –	70	–	
Dominican Republic	x	–		0.90 =	–	n.s.	
El Salvador	pilot p	70	24	4.90 =	85	0.02	
French Guiana		0	0	0.20 =	0	n.s.	
Haiti		50	50	2.20 =	–	–	
Jamaica		10	3	0.70 –	–	–	
Nicaragua	none	620	20	6.10 =	15	n.s.	
Paraguay	x	0	0	10.60 +	0	0.02	
Total LAC		2,000	25				

[a]Subtotals contain estimates; thus cross totals do not match exactly

Table 9 Management in production forests

Country	Concessions		Harvest permits		Min dia/sp	Standards	Harvest system		Enrichment planting	Timber tracking system
	Size (ha)	Years	Size (ha)	Years			RIL	Other		
Cameroon	>200,000	15			Yes	Yes			Yes	
Central African Rep.	42,000–475,000	30	<10	1	Yes	Yes				
Congo, Democratic Repblic	Max 500,000	25			Yes	Partly, seed trees				
Congo, Republic of	Mean 400,000	15–25			60–80	Yes			Yes	
Côte d'Ivoire	>25,000	15–20				Partly		High grading		
Gabon	50,000–600,000		Small	1	Yes	Yes				
Ghana	Abolished	40	Small	1	Yes	Yes, seed trees	Planned	Chainsaw		In pilot phase
Liberia	50,000–400,000	25						Chainsaw		Yes
Nigeria	Small	1–3			60–90			Chainsaw		
Togo	None		Small	1	No	No				
Subtotal Africa										
Angola										
Benin										
Burundi										
Equatorial Guinea	Cancelled		Yes		Yes	Yes			No	
Gambia										
Guinea						No		High grading		
Guinea Bissau										

(*continued*)

Table 9 (continued)

Country	Concessions		Harvest permits		Min dia/sp	Standards	Harvest system		Enrichment planting	Timber tracking system
	Size (ha)	Years	Size (ha)	Years			RIL	Other		
Kenya										
Madagascar	<200	3–5								
Mozambique		50						High grading		
Rwanda			>2							
Sierra Leone						No				
Tanzania, United Republic						Yes				Yes
Uganda		25			Yes	Yes	Partly	Pit sawing	Yes	
Zambia					Yes					
Zimbabwe						Yes				
Cambodia	Suspended	20–30	5,000	1	Yes	Yes				Yes
Fiji		10–30		1	35	Yes				
India	None				Yes	Yes	No			
Indonesia	In revision	35			Yes	Yes, seed trees			Yes	
Malaysia		30–100	<1,000	1–2	55–65	Yes	Yes	Helicopter	Yes	
Myanmar	None	30			Yes	Yes	Elefants	High grading		
Papua New Guinea	Up to 2,555,000	Min 35			Yes	Yes	Yes			In pilot phase
Philippines	Max 5,000	25			Yes	Yes				Yes, pilot phase

Thailand	Suspended									
Vanuatu		5–10			Yes	Yes	Promoted	High grading		
Brunei Darussalam					Yes	Yes	Yes		Yes	
Lao People's Democratic Republic										
Nepal										
Solomon Islands					Yes	Yes	Yes	High grading	Occas.	
Sri Lanka	Logging ban									
Timor-Leste	Logging ban									
Vietnam, Socialist Republic		30–50			Yes	Yes				
Bolivia, Plurinational State of	Mean 65,000	40			Yes	Yes				
Brazil		−40			Yes	Yes, seed trees				Yes
Colombia	None			1		No				
Ecuador	Abandoned			1	Yes					
Guatemala		30–40			45–60	Yes, seed trees	Yes	FSC requi. in fmus	Yes	
Guyana	>24,000	>20	<8,000	1	No	Yes	Yes			Yes
Honduras						Yes		High grading		
Mexico	>250		<20		Yes	Yes			Yes	
Panama	1,000– > 5,000	5–20	Small	1		No		High grading		

(*continued*)

Table 9 (continued)

Country	Concessions		Harvest permits		Min dia/sp	Standards	Harvest system		Enrichment planting	Timber tracking system
	Size (ha)	Years	Size (ha)	Years			RIL	Other		
Peru	Mean 12,900	Min 20			Yes	Yes, seed trees	Yes		Yes	
Suriname	<5,000–150,000				No	Yes				Partly
Trinidad &Tobago	None				Yes				Yes	
Venezuela, Bolivarian Republic	>5,000	20–40	<5,000	1	Yes			High grading	Yes	
Belize						Yes				
Costa Rica						Yes				
Cuba										
Dominican Republic										
El Salvador										
French Guiana					Yes					
Haiti										
Jamaica						Yes				
Nicaragua										
Paraguay								High grading		

Countries in bold: 1. Blaser et al.(ITTO) 2011 all: 2. FAO 2010 3. FCPF country reports

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