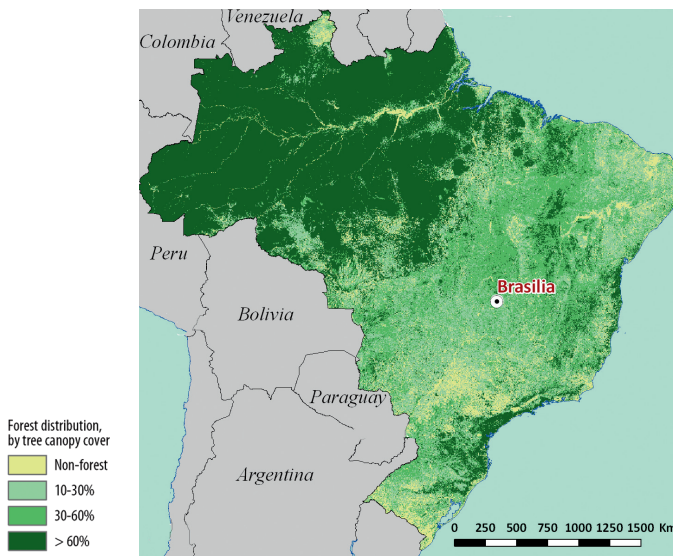


# BRAZIL



## Forest resources

Brazil has a land area of 846 million hectares and an estimated population in 2010 of 195 million people (United Nations Population Division 2010); the country is ranked 75th out of 182 countries in UNDP's Human Development Index (UNDP 2009). Ninety-three per cent of the country is below 800 m in altitude. The highest peaks, at about 2500 m, are found on the northern border with Venezuela and in the southeast on the Atlantic coast. The vast Amazon Basin contains the world's largest area of tropical rainforest; the majority of it is Brazilian territory. FAO (2010a) and Government of Brazil (2010) both estimated Brazil's total forest cover in 2010 at 519 million hectares, including both tropical and non-tropical natural and planted forests; an estimated 354 million hectares of the total was in the Amazon.<sup>a</sup>

**Forest types.** Brazilian forests can be classified broadly as Amazon rainforest, Atlantic rainforest (*Mata Atlântica*) (28.8 million hectares), central *cerrado* savanna (70 million hectares), arid *caatinga* (46.8 million hectares) and the wetlands of the Pantanal (8.55 million hectares; Government of Brazil 2010).

The two main forest types in the Amazon are dense and open ombrophilous (humid) forests. The dense humid forests are characterized by large and medium-sized trees (with canopy up to 50 m and emergent trees up to 40 m) and abundant lianas

and epiphytes. In the open humid forests the trees are more widely spaced and palm creepers and bamboos are more common.

The predominant vegetation in the *cerrado* is savanna (forested, arborized and steppe). Savanna formations also predominate in the Pantanal biome, which also contains savanna as well as small areas of semi-deciduous and deciduous forest. The *caatinga* comprises predominantly steppe savanna, interrupted by clusters of deciduous and semideciduous forest and savanna. To the north, pioneer formations occur, represented by marshes and swamps on the coast. The *Mata Atlântica* biome consists of humid (dense, open and mixed) and seasonal (deciduous and semi-deciduous) forests. Pioneer formations occur, represented by marshes and swamps along the coast, and savanna occurs in small areas in the northeast near the coast.<sup>a</sup>

Brazil has more mangrove forests than any country other than Indonesia, with about 1.3 million hectares, which is 8.5% of all mangroves. Mangroves occur on the northern coastline, intermittently in estuaries and coastal lagoons in the northeast, and south beyond the Tropic of Capricorn (Spalding et al. 2010).

**Permanent forest estate.** Brazil's tropical-forest PFE may be considered to comprise 117 million hectares of federal and state conservation units (*Sistema Nacional de Unidades de Conservação da Natureza* – SNUC – and *Sistema Estados Unidos de Conservação da Natureza*, respectively), 106 million hectares of Indigenous lands, 50.2 million hectares of legal reserves and permanent preservation areas on rural properties, and 36.1 million hectares of 'other public forest' protected by law.<sup>1</sup> This area includes the Amazon, *caatinga*, *cerrado* and *Mata Atlântica* biomes and may include some non-forest and some non-tropical forest. Box 1 shows the areas in each specific conservation unit category.

<sup>1</sup> Federal and state conservation units and Indigenous lands include forest and other kinds of vegetation. For some categories the area may be under-estimated because of a lack of data on land under state responsibility (e.g. federal conservation units). 'Other public forests protected by law' refers to public forests listed in the National Register of Public Forests. They are not yet assigned to any function; however, according to Law 11 284/2006, public forest should be maintained as forests indefinitely.

Table 1 Permanent forest estate

Reporting year	Estimated total forest area, range (million ha)	Total closed natural forest ('000 ha)	PFE ('000 hectares)			
			Production		Protection	Total
			Natural	Planted		
2005*	444–515	489 515	98 100	3810	217 000	372 910
<b>2010</b>	<b>519</b>	<b>264 700</b>	<b>135 000</b>	<b>6650**</b>	<b>175 000</b>	<b>316 650</b>

\* As reported in ITTO (2006).

\*\* Being mostly privately owned and not required by law to be maintained as forest, strictly speaking this area is not part of the PFE but is included here to minimize confusion. Includes some non-tropical planted forest.

Source: Government of Brazil (2010), CNUC (2011), and personal communications – see endnote b.

The SNUC, which was established by Law 9985/00, is divided into two groups:

- Units of integral protection, whose purpose is to preserve nature – use does not involve the consumption, collection, damage or destruction of natural resources. Categories in this group are ecological stations, biological reserves, national parks, national monuments and wildlife refuges.
- Sustainable use units, which aim to reconcile nature conservation with sustainable use, involving the collection and use, commercial or otherwise, of a portion of a unit's natural resources. Categories in this group include national (and state) forests (*florestas nacionais* – FLONAs), extractive reserves and sustainable development reserves.

There are 69.4 million hectares of units of integral protection, 25.5 million hectares of FLONAs, 10.2 million hectares of sustainable development reserves and 12.3 million hectares of extractive reserves in the tropical PFE (J. Lorensi do Canto, pers. comm., 2011; CNUC 2011).<sup>2</sup> The estimate of protection PFE in Table 1 comprises the total area of forest in 'units of integral protection' plus the total area of Indigenous lands.

Under the Brazilian Forest Code (Law 4771/65), the following percentages (at least) of private land must be maintained under native vegetation (called 'legal reserves'), in addition to permanent protection areas (areas to be preserved along rivers, hills and others):

- 80% of rural properties located in forest areas in the Legal Amazon.<sup>3</sup>

- 35% of rural properties located in savanna areas in the Legal Amazon.
- 20% of rural properties located in forest or other vegetation in other (i.e. non-Legal Amazon) regions.
- 20% of rural properties in native grasslands in any region.

Legal reserves are forest areas that may be harvested for timber and other products on the basis of sustainable forest management plans (*planos de manejo florestal sustentável* – PMFSs – see below). The extent to which these restrictions are adhered to is unclear.

The total PFE reported here is considerably less than that reported for 2005, most likely due to differences in definition of what constitutes PFE rather than to a significant change in legal status or forest area. The Government of Brazil did not make an official submission for the 2005 survey; therefore, the data presented here for 2010 are likely to be more accurate than those given in ITTO (2006).

## Forest ecosystem health

**Deforestation and forest degradation.** Brazil lost an estimated 2.19 million hectares of forest per year in the period 2005–10. This is an annual rate of deforestation of 0.42%, which is lower than the estimated annual rate of deforestation in the period 2000–2005 (0.57%) (FAO 2010b). In the period 2005–09 about 1.07 million hectares of forest was lost per year in the Amazon<sup>a</sup> and 929 000 hectares were lost per year in the *cerrado* (FAO 2010a). Brazil has an estimated 477 million hectares of primary forests (Table 2).

The Brazilian government's National Institute for Space Research (*Instituto Nacional de Pesquisas*

<sup>2</sup> Data are for both federal and state lands.

<sup>3</sup> The Legal Amazon was set by law for economic planning reasons. It comprises the states of northern Brazil (Acre, Amazonas, Amapá, Pará, Rondônia, Roraima and Tocantins), part of the states of Mato Grosso and Maranhão, and a small portion of the state of Goiás. It covers an area of more than five million km<sup>2</sup>, which is about 61% of the Brazilian territory.

Box 1 Brazil's PFE, by tenure type and government jurisdiction

		Production PFE	Protection PFE	Total
		million ha		
Conservation units				
FLONAs/state forests	Federal	16.1	-	16.1
	State	9.40	-	9.40
Extractive reserves	Federal	12.3	-	12.3
	State	0.67	-	0.67
Sustainable development reserves	Federal	0.64	-	0.64
	State	9.53	-	9.53
Units of integral protection	Federal	-	35.8	35.8
	State	-	33.6	33.6
Subtotal		48.64	69.4	118.04
Indigenous lands			106	106
Legal reserves and permanent preservation areas on private land		50.2		50.2
Other public land		36.1		36.1
<b>Total</b>		<b>134.94</b>	<b>175.4</b>	<b>310.34</b>

Note: Includes the Amazon, caatinga, cerrado and Mata Atlântica biomes; may include some non-forest and some non-tropical forest.

Source: CNUC (2011) and personal communications – seen endnote b.

*Espaciais*) monitors forest cover in the Amazon by satellite using four operating systems: PRODES, DETER, DEGRAD and DETEX. These systems are complementary and are designed to meet different goals. PRODES (Program for the Calculation of Deforestation in the Amazon – *Monitoramento da Floresta Amazônica Brasileira por Satélite*) has measured the annual rate of clearcutting since 1988. Using Landsat satellite images, it can account for deforestation that takes place on areas greater than 6.25 hectares. DEGRAD (System for Mapping Forest Degradation – *Sistema de Mapeamento de Degradação Florestal*), which was developed in 2007, uses images from the Landsat and CBERS (China–Brazil Earth Resources Satellite) satellites to map areas in the process of deforestation where forest cover is not completely removed and therefore not counted by PRODES. DETER (System of Deforestation Detection in Real Time – *Deteção de Desmatamento em Tempo Real*) uses MODIS (Moderate Resolution Imaging Spectroradiometer) and CBERS satellite data to publish, on a monthly basis, maps of areas greater than 25 hectares which have either been completely deforested or are in the process of deforestation.

DETEX (Detection of Selective Logging Activities), developed with the support of the Brazilian Forest Service (*Serviço Florestal Brasileiro*), generates information for monitoring management plans

in forest concessions (created by Law 11 284/06) and in public forests in general. Using images from Landsat and CBERS, multi-temporal DETEX studies have been conducted in national forests and forest concessions, especially in the vicinity of the BR-163 and BR-319 roads to identify instances of exploratory timber activity. All public forests in the Amazon have been monitored by this system since 2008.

An estimated 244 000 hectares of FLONAs were affected by fires in 2008, and a similar area was burned in 2007.<sup>a</sup>

**Vulnerability of forests to climate change.** Brazil is vulnerable to climate change, not least because of its fragile, biologically diverse ecosystems (Lèbre La Rovere & Pereira 2007). The Amazon forests and Pantanal wetlands are of particular concern. A number of studies suggest a drying trend in Amazon forests, such as an increased frequency of years with reduced precipitation, as was particularly the case in 1997, 1998, 2005 and 2010 (Perez 2011). Such dry years make spontaneous fires more frequent. These droughts have started to change the general view that Amazon forests can resist fire because of the moisture stored beneath the dense tree canopy. It has been suggested that extreme droughts could breach the flammability threshold of Amazon forests, triggering a feedback loop that leads to increasingly frequent wildfires (ibid.) and

Table 2 Forest condition\*

	PFE	Non-PFE	Total
	'000 ha		
Area of primary forest	-	-	477 000
Area of degraded primary forest	-	-	-
Area of secondary forest	-	-	36 500**
Area of degraded forest land	-	-	-

\* All forests.

\*\* 'Other naturally regenerated forest'.

Source: FAO (2010a).

affecting vast areas of previously unburnt Amazon forests. Changing rainfall patterns, especially in the drought-affected northeast region of the country, could reduce the quality and quantity of water resources available for agriculture. The hydrological services of Amazon forests require further study to facilitate adaptation. The monitoring of climate variability and its effects on the Amazon forests is also important because of the crucial role that those forests play as the world's largest storage of terrestrial carbon.

### SFM policy framework

**Forest tenure.** Even though much production forest is privately owned, under the 1988 Federal Constitution (Article 225) forests are considered to be a common asset for all inhabitants, and ownership and tenure disputes are a major problem. Private owners are only able to exercise their rights within the limits imposed by the 1965 Forest Code, which regulates the harvesting of timber resources. There are legal stipulations to set aside 'legal reserves' and 'permanent preservation areas' in private forest areas (Article 2). More than one-third of the tropical PFE is owned by Indigenous communities (Table 3).

Extractive reserves are state-owned areas in which use rights are granted to traditional extractive populations whose subsistence is based on the

harvesting of naturally growing products such as latex, nuts, fruits and oils as well as on agriculture and animal-raising. The purpose of extractive reserves is to protect the livelihoods and cultures of those traditional extractive populations and to ensure the sustainable use of natural resources in the reserves. There are 62 extractive reserves in Brazil (mostly in the Amazon), comprising a total area of 12.96 million hectares – 12.3 million hectares of which are on federal lands and 667 000 hectares of which are on state lands (Box 2). Although timber harvesting is generally not permitted, these areas are counted as part of the production PFE (in total, 12.3 million hectares in the Amazon). All extractive reserves have a management plan prepared by the managing agency (the Chico Mendes Institute of Biodiversity Conservation).

Under the Federal Constitution, Indigenous lands (lands traditionally occupied by Amerindians) are defined as: "those where they live on a permanent basis, those used for their productive activities, those essential to the preservation of environmental resources necessary for their well-being and for their physical and cultural reproduction, according to their habits, customs and traditions". Amerindians have the permanent possession and "exclusive use of the riches of the soil, rivers and lakes" existing on their lands. Nevertheless, such lands constitute the property of the state and, as public goods of special

Box 2 Area of federal and state extractive reserves, by biome (ha)

Biome	Area of federal extractive reserves	Area of state extractive reserves
Amazon	11 597 193	667 438
Cerrado	107 249	-
Coastal	587 676	-
Mata Atlântica	1178	-
<b>Total</b>	<b>12 293 296</b>	<b>667 438</b>

Source: CNUC (2011).

Table 3 Forest area, by tenure\*

Ownership category	Total area	Of which PFE	Notes
	'000 ha		
State ownership (national, state or provincial government)	-	113 000	Includes federal conservation units, which comprise forest and other kinds of vegetation (and therefore may overestimate PFE in this category); in some cases the area may be an underestimate because of a lack of data for forests under state responsibility. Also includes 'Other public forests protected by law', which refers to public forests registered in the National Register of Public Forests. Such forests are not yet assigned to any function; according to Law 11284 (2006), however, public forest should be maintained as forests indefinitely.
Other public entities (e.g. municipalities, villages)	-		
<b>Total public</b>	-	<b>113 000</b>	
Owned by local communities and/or Indigenous groups	-	106 000	Includes forest and other kinds of vegetation. These forests remain the property of the state.
Privately owned by individuals, firms, other corporate	-	54 100	Includes 'legal reserves' and 'permanent preservation areas' on rural properties and forests under PMFSs in the Amazon and caatinga biomes.

\* Tropical forests only.

Source: Government of Brazil (2010).

use, besides being inalienable and unavailable (can not be disposed of or alienated), they cannot be the object of use of any kind by anyone other than the Amerindians themselves.<sup>3</sup> Of the 106 million hectares of forest in the Amazon allocated to Indigenous communities, 1.75 million hectares have been 'bounded', 8.1 million hectares have been 'declared', 3.6 million hectares have been 'approved' and 92.2 million hectares have been 'regularized' (i.e. full rights have been secured).<sup>3</sup>

According to FAO (2010a), communities in Brazil have management rights in 160 million hectares of publicly owned forest (including indigenous lands outside the Amazon region).

In 2009 President Luiz Inacio Lula da Silva approved Law 11952, which provides for the legalization of occupied federal land in the Legal Amazon through the sale and grant of right of use of real estate. The aim of the law is to reduce legal uncertainty, which promotes the illegal appropriation of land, the intensification of agrarian conflicts and deforestation. Under the law, certain unallocated federal land will be transferred to municipalities in order to expedite its privatization. The law establishes size limits for areas to be privatized, the terms of payment and other legal and financial aspects.

Under the new law, squatters occupying up to 100 hectares of land will be given title to the land free of cost. Lots measuring between 100 and 400 hectares

will be sold at a 'symbolic cost', and holdings of 400–1500 hectares will be sold at market prices. Larger lots of up to 2500 hectares will be auctioned to the highest bidder. Anything larger can only be sold with congressional approval.<sup>4</sup>

**Criteria and indicators.** The Government of Brazil participates in the Tarapoto C&I process coordinated by the Amazon Cooperation Treaty Organization and used the ITTO C&I in its submission to ITTO for this report.<sup>3</sup>

**Forest policy and legislation.** Brazil is a federation of 26 states, a federal district and more than 5500 local governments (municipalities – *municípios*). The adoption of a new constitution in 1988 prompted decentralization in the management of natural resources and the implementation of development programs. Considerable political and tax power and fiscal revenue shifted from the central government to states and municipalities, and privatization and economic liberalization policies were also pursued.

Forest-related legislation includes:

- Law 4771 (1965) – Forest Code (as amended).
- Law 5197 (1967) – Protection of Fauna.
- Law 6938 (1981) – National Environmental Policy.

4 [www.illegal-logging.info/item\\_single.php?it\\_id=3493&it=news](http://www.illegal-logging.info/item_single.php?it_id=3493&it=news).

- Law 9433 (1997) – Water Resources Policy.
- Law 9605 (1998) – Environmental Crimes.
- Decree 3179 (1999), which establishes penalties for forest crimes.
- Decree 3420 (2000), creating the National Forest Programme.
- Decree 4340 (2002), which regulates articles of Law 4771 and various other laws. It also provides regulations for the exploitation, suppression and clear-cutting of forests and succeeding formations; PMFSs; forest replanting; and licences to transport forest by-products.
- Law 11 284 (2006) (the Public Forest Management Law), which provides for public forest management for sustainable production, creates the Brazilian Forest Service within the structure of the Brazilian Ministry of the Environment, establishes the National Forest Development Fund (*Fundo Nacional de Desenvolvimento Florestal* – FNDF), and makes other provisions.
- Resolution 378 (2006), which defines undertakings that may potentially cause national or regional environmental impact and makes other provisions; and subjects forest exploitation to permits issued by the Brazilian Institute of Environment and Renewable Resources (*Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis* – IBAMA).
- Resolution 379 (2006), which creates and regulates the database on forest management at the National Environmental System (*Sistema Nacional do Meio Ambiente*) level.
- Decree 6063 (2007), which regulates, at the federal level, provisions of Law 11 284.
- Resolution 406 (2009), which establishes technical standards to be adopted in the formulation, presentation, technical evaluation and implementation of PMFSs for logging purposes in native forests and their succeeding formations in the Amazon biome.
- A number of normative instructions relating to forest use.<sup>a</sup>

The enactment of the Public Forest Management Law in 2006 was a significant achievement. Previously, although large areas of forest are located

on public land in Brazil, there was no regulatory framework to deal with their management. This made it difficult for the government to establish policies that could ensure the maintenance of those forests as an asset belonging to all Brazilians. In the case of the Amazon the situation was even more worrisome because for decades the advance of agriculture had led to large losses of forest cover and land-grabbing. In 2004, the federal government initiated the formulation of a legal framework to allow for the management of public land in a way that would halt land-grabbing, introduce a forest concessions system to maintain the capacity of the forests to provide goods and services in perpetuity, and serve as a socioeconomic development alternative. The 2006 law and subsequent resolutions, decrees and instructions were the result.

In 2004 the Government of Brazil announced its Action Plan to Prevent and Control Deforestation in the Amazon involving eleven ministries led by the President's Cabinet. The action plan comprises 144 actions under three main strategies: land-tenure and territory planning; environmental monitoring and control; and incentives for sustainable production. Under the action plan, by 2008 ten million hectares of Indigenous territories, 20 million hectares of protected areas and 3.9 million hectares of 'sustainable settlement' projects had been created and 66 000 illegal land titles had been cancelled.<sup>b</sup>

**Institutions involved in forests.** The Ministry of Environment (*Ministério do Meio Ambiente* – MMA) is responsible for forestry as well as for planning, coordinating and controlling activities related to the national environment policy and policies for developing the Amazon. It supervises the activities of IBAMA and the Brazilian Forest Service, chairs the National Council for the Environment (*Conselho Nacional do Meio Ambiente*) and takes part in the President's Chamber for Natural Resources Policies, which coordinates various aspects related to forests. Other agencies with responsibilities related to forest resources include the National Colonization and Agrarian Reform Institute (*Instituto Nacional de Colonização e Reforma Agrária*), and the Indian National Foundation (*Fundação Nacional do Índio*), which is responsible for the preservation of Amerindian culture. In 1999, a Secretariat for Biodiversity and Forests was created in MMA. Among other functions, IBAMA, which was established in 1985,

implements and coordinates the National Forest Program. In some states in the Legal Amazon and the Northeast Region, state-government institutions issue forest management permits and conduct state forest inspections.

The National Forest Commission (*Comissão Nacional de Florestas* – CONAFLO), which was established by Decree 3420/00, is composed of 39 representatives distributed between the government (20 representatives) and civil society (19 representatives), including federal government agencies and entities, state environmental agencies, civil-society groups, forest industry, NGOs and educational and research institutions. CONAFLO provides guidelines for the implementation of procedures in national forests and enables the participation of various interest groups in developing public policies for the forest sector.<sup>a</sup>

The Public Forest Management Law (2006) established the Brazilian Forest Service as an agency of the federal government under the MMA, with responsibility over public forest management for sustainable production; thus, it is responsible for concessions (i.e. timber harvesting and the extraction of NTFPs) in FLONAs and other public forests. The Brazilian Forest Service is also responsible for managing the FNDF and the National Register of Public Forests (*Cadastro Nacional de Florestas Públicas*). The goal of the National Register is to set up a database of geo-referenced data for the identification of public forests in order to provide public managers and the population in general with a reliable database on forest management.<sup>a</sup>

The main instruments used by the Brazilian Forest Service for the sustainable production and management of federal public forests are forest concessions and allotment to local communities. A forest concession is a chargeable warrant for the right to practise SFM for the exploitation of a forest's products and services. The allotment of public forests to local communities is carried out through the identification of areas occupied by traditional populations, such as Indigenous communities, slave-descendant communities (known as *quilombolas*) and settlements. The Brazilian Forest Service assists in the identification of those populations and encourages and promotes community forest management by providing technical support and capacity-building.<sup>a</sup>

A draft Bill before the Brazilian Congress would, if passed, transform the Brazilian Forest Service into an autonomous institution. As part of the Federal Government administration under the MMA, the Service currently lacks the necessary institutional conditions to efficiently carry out the tasks allocated to it under the law, thus hindering, for example, the speed at which concessions are assessed and approved (or otherwise). Currently, the Service has 240 employees, of whom only 56 are career public servants. As the Service consolidates itself, increasing institutional demands – such as the increasing number of concession applications – will require a speedy, dynamic process to build up and enlarge its workforce. According to an internal study, an additional 760 new positions of 'environment' career specialists and 62 new director-level positions will be needed by 2012.<sup>a</sup>

The Commission on Public Forest Management (*Comissão de Gestão de Florestas Públicas* – CGFLOP) is an advisory body of the Brazilian Forest Service which aims to advise, evaluate and propose guidelines for the management of public forests in Brazil, especially regarding the Annual Forest Concessions Plan (*Plano Anual de Outorga Florestal*). The CGFLOP, which was established by Law 11 284/06 and regulated by Decree 5795/06, is composed of 24 representatives appointed by the holders of the respective agencies, groups, organizations and sectors involved in the process and designated by the Minister of State for the Environment. The Commission meets at least twice a year or as requested by its chairman or at least one-third of its members.

Average total annual direct investment by the federal government in forest management, administration, research and human resource development in the period 2005–09 was about 141 million reais (R\$), including R\$56.1 million through the MMA, R\$9.72 million through the Brazilian Forest Service and R\$25.8 million through IBAMA. Some R\$26.1 million was allocated to the Chico Mendes Institute of Biodiversity Conservation<sup>a</sup>, which is responsible for the management of all federal conservation units.

The aim of the FNDF is to foster the development of forest-based sustainable activities in Brazil and promote technological innovation in the sector. Its main source of funds is revenue generated by forest concessions in compliance with the percentages

outlined in the Public Forest Management Law (2006). Moreover, the FNDF may receive donations from national and international public and private entities.

It was estimated that R\$2.2 million would be allocated in 2010 for measures to bolster forest management. Based on estimated future revenue from forest concessions, the FNDF will have an allocation of R\$4 million in 2012 and R\$29 million in 2015.

FNDF resources are to be allocated primarily to projects in the following areas:

- technological research and development in forest management
- technical assistance and forest extension
- recovery of degraded areas with native species
- rational and sustainable economic use of forest resources
- control and monitoring of forest activities and deforestation
- capacity-building in forest management
- environmental education
- environmental protection and natural resources conservation.<sup>a</sup>

The Amazon Fund, which was established in 2008 by Decree No 6527, aims to attract donations for non-refundable investments in deforestation prevention, monitoring and combat, and also to promote the conservation and sustainable use of forests in the Amazon biome. Specifically it is designed to support projects in the following areas:

- public forests and protected areas management
- environmental control, monitoring and enforcement
- SFM
- economic activities developed as a result of forest sustainable use
- ecological–economic zoning, land-use planning and land regulation
- biodiversity conservation and sustainable use
- recovery of degraded areas.

In 2010 the Brazilian Development Bank established the ‘Support to Reforestation, Recovery

and Sustainable Use of Forest’ program, the aim of which is to support the reforestation, conservation and forest recovery of degraded or converted areas and the sustainable use of native areas through SFM.

The Brazilian Agricultural Research Corporation (*Empresa Brasileira de Pesquisa Agropecuária – EMBRAPA*) spent an average R\$2.37 million on forest-related research per year in 2005–09. In the same period the total annual research expenditure by the Ministry of Science and Technology, through such institutions as the National Institute of Amazonian Research (*Instituto Nacional de Pesquisas da Amazonia*), based in Manaus, the Mamirauá Institute of Sustainable Development and the Emílio Goeldi Museum, was R\$21.3 million.<sup>a</sup>

Universities, large forestry enterprises, and NGOs such as the Amazon Institute of People and the Environment (*Instituto do Homem e Meio Ambiente da Amazônia*) also engage in forestry research. University education in forestry started in 1960; currently, 51 universities offer teaching and research in forest management.<sup>a</sup> There are about 7000 forest engineers working in Brazil, 1600 with master’s degrees and 300 with PhDs.

## Status of forest management

### Forest for production

The forest management system adopted for Amazonian dense tropical rainforest is a polycyclic system involving the selective logging of commercial forest species in cutting cycles of 25–35 years. FMUs are usually divided into annual production units according to the cutting cycle adopted.

By law the use of natural forest resources on both private and public land requires the presentation of a PMFS to IBAMA and its approval by that body and/or the relevant state environment agency.

Since 2006 forest management (i.e. timber harvesting) has been permitted in Brazil’s public forests through forest concession contracts that can span up to 40 years. Concessions are granted through a transparent tendering and/or bidding process for the production of timber and/or non-timber products or services. Each year the Brazilian Forest Service prepares an Annual Forest Concessions Plan, which is a major instrument of policy planning for forest concessions in public forests. A national policy to support community



forest management has also been implemented (Decree 6874/2009) with the aim of encouraging and organizing the country's forest management activities, and it also establishes minimum prices for NTFPs.

MMA Normative Instruction 5 (2006) introduced important changes to the parameters of forest management on both public and private land. The main features were:

- The maximum allowable harvest is 30 m<sup>3</sup> per hectare when harvesting is mechanized and 10 m<sup>3</sup> per hectare when the operation does not use heavy machinery, with harvesting cycles of 35 years and ten years, respectively.
- For those forest species whose minimum cutting diameter had not previously been determined, the minimum cutting diameter is set at 50 cm.
- At least 10% of each exploited tree species which could be harvested are to be left standing as seed bearers, selected in each 100-hectare working unit.
- A tracking system (chain of custody) is required for harvested trees.
- The use of waste wood is allowed.

Since September 2006, forest product transportation has been controlled through a national information system, IBAMA's Forest Origin Document system. Under it, forest products are tracked from their harvest to the final stage of marketing. The entire supply and transportation chain must be updated online in real time. The system has significantly improved the control of illegal logging in Brazil.<sup>a</sup>

A forest planning process called *Modeflora* (Digital Model of Forest Exploitation), hailed as a technological breakthrough in forest management, has been tested successfully by EMBRAPA researchers. It consists of the georeferencing and geomonitoring of all phases of forest management, from the preparation of a forest management plan to its implementation, combining the use of forest inventory techniques, operational research and a range of technologies such as global positioning systems (GPS), GIS, radar and satellite images (Figure 1). *Modeflora* enables a reduction of at least 30% in the cost of preparing and implementing forest management plans. It also reduces field error and increases the accuracy of tree-tracking and

micro-zoning by enabling the production of maps at a scale of 1:15.<sup>a</sup>

In public forests under forest concession, the Brazilian Forest Service subsidizes the price of wood for those concessionaires who promote value-adding near the forest concession, the installation of permanent plots, and biodiversity monitoring. Nevertheless, despite the existence of pilot projects in SFM and technical standards for the adoption of best forest management practices in the Amazon, the level of adoption of these practices is still incipient.<sup>a</sup>

Control and law enforcement in the Amazon are extremely difficult because of the vastness of the area, poor infrastructure, a lack of capacity and the large number of actors contributing to deforestation and illegal logging. Other problems facing forestry in Brazil are the remoteness of many forests from centres of commerce and control; the weak economic competitiveness of SFM as a land use; the lack of competitiveness of the tropical timber industry, for various reasons; extensive degraded forests; lack of full-cost pricing and the abundant availability of low-cost timber; and a serious shortage of management skills (ITTO 2006).

The scarcity of information on forest management for business people and a lack of technical capacity are other barriers to the widespread adoption of SFM. Most employers still do not know the meaning of SFM and are unaware of the potential financial benefits of good forest management. The technologies adopted by these timber companies generally correspond to the practices used for decades in conventional exploitation.<sup>a</sup>

The enlargement of the agricultural frontier, which causes deforestation and is associated with illegal wood supply, continues to be a limiting factor to the promotion of forest management in the Amazon.<sup>a</sup>

Box 3 shows the planning process before the commencement of logging in the Amazon.

**Silviculture and species selection.** The main silvicultural process proposed for the Brazilian Amazon is as follows:

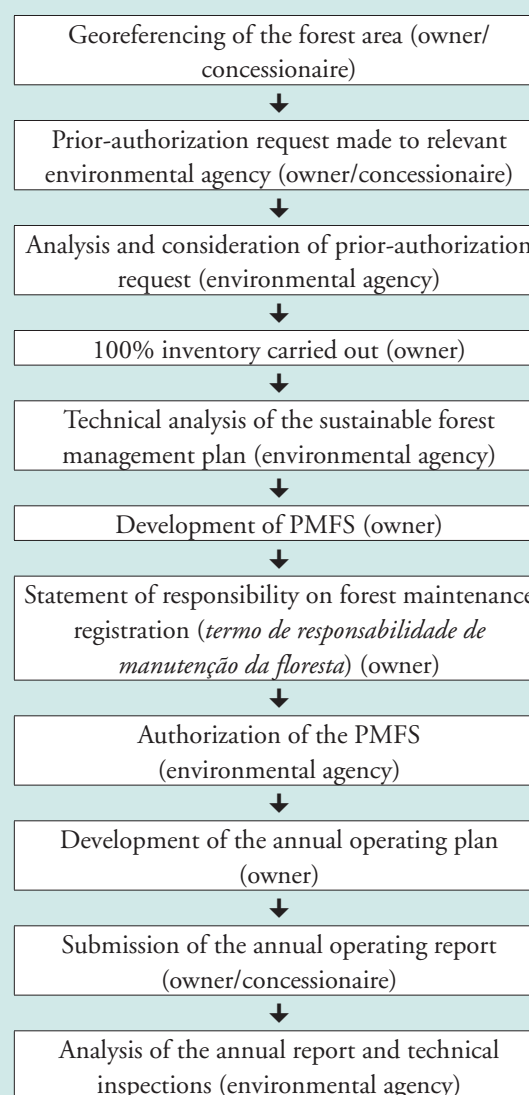
- *E minus 2 years* (where E = forest harvesting event) – delimitation and subdivision of the annual production unit (external delimitation and internal subdivision to facilitate the mapping of trees).

- *E minus 1 year* – forest inventory at 100% (i.e. the measurement of all commercial trees with dbh  $\geq$  40 cm).
- *E minus 1 year* – liana cutting (for commercial species above the minimum cutting diameter).
- *E minus 1 year* – installation and measurement of permanent plots.
- *E minus 1 year* – exploration planning (primary and secondary roads; pre-selection of trees based on inventory; preparation of map of annual production unit).
- *E minus 1 year* – opening of roads, sidings and marshalling yards (forest roads, bridges, drainage system, and 25x25 m marshalling yards).
- *E* – forest harvesting (reduced impact).
- *E plus 1 year* – assessment of damage caused by harvesting (evaluation of remaining trees, skid trails and cutting quality).
- *E plus 1 year, E plus 3 years*, and henceforth every five years – re-measurement of permanent plots.
- *E plus 4 years* – silvicultural treatments (e.g. girdling of non-commercial trees to make room for commercially promising trees).

As reported above, the maximum allowable harvest is 30 m<sup>3</sup> per hectare when harvesting is mechanized and 10 m<sup>3</sup> per hectare when the operation does not use heavy machinery, with harvesting cycles of 35 years and ten years, respectively.

Table 4 lists some commonly harvested tropical timber species.

*Box 3 Flow-chart of Amazon logging planning process*



*Table 4 Commonly harvested tropical species for industrial roundwood*

Species	Volume (m <sup>3</sup> ) transported in 2007
<i>Manilkara huberi</i> (maçaranduba)	592 395
<i>Dinizia excelsa</i> (angelim)	390 330
<i>Goupia glabra</i> (cupiúba)	361 628
<i>Hymenaea courbaril</i> (jatobá)*	336 662
<i>Erismia uncinatum</i> (cedrinho)*	293 922

\* Also listed in ITTO (2006).

Source: Personal communications – see endnote b.

**Planted forest and trees outside the forest.**

Brazil's plantation estate comprises about 4.52 million hectares of *Eucalyptus* species, 1.79 million hectares of *Pinus* species, and 344 000 of other species (including *Acacia mearnsii*, *A. mangium*, *Schizolobium amazonicum*, *Tectona grandis*, *Araucaria angustifolia* and *Populus* spp), for an estimated total plantation area of 6.65 million hectares.<sup>a</sup> Significant areas of plantations (especially *Pinus* spp) are outside the tropics. There are also about 128 000 hectares of rubber (*Hevea brasiliensis*) plantation. Even though planted forests account for little more than 1% of the total forest area in Brazil, they make a substantial contribution to industrial wood production.

**Forest certification.** As of October 2010, a total of 6.16 million hectares of natural and planted forests had been certified under the FSC umbrella in Brazil. Of this, about 2.70 million hectares were natural tropical forest and 2.13 million hectares were planted tropical forest (FSC 2010); most of the remainder were non-tropical plantations. The certified natural forest includes 47 000 hectares in the Antimary State Forest in the state of Acre, which is being managed according to a management plan developed under an ITTO project.

The Brazilian forest certification system (*Certificação Florestal* – CERFLOR), was initiated in the 1990s and became operational for planted forests in 2003. As of 16 September 2010, a total of 1.25 million hectares of forest plantations were certified under CERFLOR, but the only CERFLOR-certified native-forest operation (73 000 hectares in the Amazonian state of Rondônia) was under suspension.<sup>5</sup> CERFLOR is endorsed by the PEFC.

**Estimate of the area of forest sustainably managed for production.** Brazil's native-forest concession system for public forests is still in an early stage of implementation, with only one concession (covering an area of 96 300 hectares) approved in the Amazon. In total, 2.94 million hectares of Amazonian forest and (295 000 hectares of *caatinga*) are subject to approved PMFSSs; all extractive reserves are also subject to management plans. An estimated 2.70 million hectares of natural tropical forest are certified by the FSC (FSC 2010). On the available information, therefore, the total



A rubber-tapper community in the Antimary State Forest, Acre, Brazil.

area of natural tropical production PFE considered to be under SFM is at least 2.70 million hectares (Table 5).

**Timber production and trade.** On average, an estimated 247 million m<sup>3</sup> of logs were produced annually in Brazil in the period 2005–08, comprising 81 million m<sup>3</sup> of logs from natural forests and 166 million m<sup>3</sup> of logs from plantations. FAO (2010a) estimated that over half of this is fuelwood.

Brazil produced an estimated 23.7 million m<sup>3</sup> of (non-coniferous) tropical logs for industrial purposes in 2009, down from a peak of 29.7 million m<sup>3</sup> in 2003. About 15.5 million m<sup>3</sup> of tropical sawnwood were produced in 2009 (up slightly from the 14.4 million m<sup>3</sup> produced in 2003), of which 1.06 million m<sup>3</sup> were exported. In the same year, Brazil produced about 600 000 m<sup>3</sup> of tropical plywood, down from a peak of 1.38 million m<sup>3</sup> in 2003 (ITTO 2010).

Brazil's production of tropical logs is less than one-quarter of total industrial roundwood production, which was 105 million m<sup>3</sup> in 2009. Log-processing capacity in the Legal Amazon declined from 10.4 million m<sup>3</sup> per year in 2004 to 5.8 million m<sup>3</sup> per year in 2009 (ibid.).

**Non-timber forest products.** Brazil owes its name to *brazilin*, a red dye from *Caesalpinia echinata*, and to the dye extractors, *brasileiros*. A very large number of NTFPs (e.g. food, medicinal plants, perfumes, dyes and tannins, natural rubber, Brazil nut, handicraft and construction materials, exudates, honey and wax) are used locally. About 45 700 tonnes of Brazil nut were harvested in 2009, and the export of this product was worth US\$20.3 million.<sup>a</sup> About 121 000 tonnes of açai berries, 7890 tonnes of latex, 3790 tonnes of copaiba oil

<sup>5</sup> [www.inmetro.gov.br/qualidade/cerflor.asp](http://www.inmetro.gov.br/qualidade/cerflor.asp).

Table 5 Management of the production PFE ('000 hectares)

Reporting year	Natural					Planted		
	Total	Available for harvesting	With management plans	Certified	Sustainably managed	Total	With management plans	Certified
2005*	98 100	-	5250	1160	1360	3810	1350	1350
<b>2010</b>	<b>135 000</b>	<b>15 340</b>	<b>15 340**</b>	<b>2700</b>	<b>2700</b>	<b>6650‡</b>	<b>3380†</b>	<b>3380†</b>

\* As reported in ITTO (2006).

\*\* Comprises 3.04 million hectares under PMFSs in the Legal Amazon and 12.3 million hectares of extractive reserves, all of which are subject to management plans.

‡ Tropical and non-tropical.

† Tropical certified plantations (other tropical plantations may have management plans, but data were unavailable).

and 644 tonnes of cumaru almonds were harvested in the Amazon in 2009.<sup>a</sup>

**Forest carbon.** Brazil has the world's largest forest carbon stock. Gibbs et al. (2007) estimated the total forest biomass carbon stock at 54 700–82 700 MtC and FAO (2010a) estimated it at 62 000 MtC. An estimated 54% of Brazil's GHG emissions come from land use and deforestation and 25% come from the agricultural sector (Lèbre La Rovere & Pereira 2007). In 2008 Brazil created the Amazon Fund (see above) as a tool to combat deforestation and promote sustainable development in the Amazon. The goal is a 70% reduction in deforestation by 2018 (compared with the average between 1996 and 2006). REDD+ is considered to be a major opportunity in efforts to achieve this target. Any project funded through the Amazon Fund must comply with Brazil's National Plan on Climate Change. Through international arrangements, for example with the Government of Norway, considerable funding is being provided to initiate the Amazon Fund and for the development of an effective forest monitoring system.

Brazil is closely engaged in the international REDD+ Partnership and is co-chairing this process in 2011. The country has been a participant in the Forest Carbon Partnership Facility since 2008 and is a recipient country of the Forest Investment Program. Significant investments in forest carbon

are also being made at the state level. In Acre, for example, a US\$100 million investment made through the Inter-American Development Bank was used to initiate, in the period 2007–10, a major investment promotion with the aim of creating a sustainable financing scheme for REDD+ in that western Amazonian state. Through REDDES, Brazil participates in and benefits from an ITTO project implemented by the Amazon Cooperation Treaty Organization for capacity-building on monitoring land use, land-use change and forests in the Amazon region. Table 6 summarizes Brazil's current forest carbon potential.

### Forest for protection

**Soil and water.** 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.<sup>a</sup>

**Biological diversity.** Brazil's forests contain a significant share of the world's biodiversity, including an estimated 56 000–62 000 higher plant (not including mosses, lichens and fungi) and mammal species. The Amazon is home to about 20% of the world's plant species, 20% of bird species and 10% of mammal species. Sixty-four mammals, 78 birds, five reptiles, 24 amphibians, eight arthropods and 14 plants found

Table 6 Forest carbon potential

Biomass forest carbon (MtC)	% forest with canopy cover >60%	Deforestation/ degradation potential to 2030	Enhancement of carbon sink capacity to 2030	Forest area change monitoring capacity	Forest/ GHG inventory capacity	Importance of forest fire/ biomass burning	Engagement in international REDD+ processes
54 700–82 700	51	+++	+++	+++	+++	++	+++

+++ high; ++ medium; + low; estimate of national forest carbon based on Gibbs et al. (2007); estimate of % total forest with canopy cover >60% based on UNEP-WCMC (2010).

in Brazil's forests are listed as critically endangered, endangered or vulnerable on the IUCN red list of threatened species (IUCN 2010). Wood species in the Amazon considered endangered or threatened with extinction are *Amburana cearensis* var. *accreana* (cerejeira), *Peltogyne maranhensis* (pau-roxo), *Bertholletia excelsa* (castanha), *Swietenia macrophylla* (mogno – also known as mahogany) and *Euxylophora paraensis* (pau-amarelo). There are also seven such species in the *Mata Atlântica* biome and two in the *cerrado/caatinga*.<sup>a</sup>

Brazil has 28 plant species listed in CITES Appendix I, 429 in Appendix II and 3 in Appendix III (UNEP-WCMC 2011), including mogno, cedro and a few other tree species for which production and trade is minimal. The Brazilian National Policy and Strategy for Biodiversity and the National Biodiversity Programme are designed to address the situation through *in situ* and *ex situ* measures and the management of biotechnology.

#### Protective measures in production forests.

Measures taken to protect the production forests as part of the country's forest conservation strategy include a moratorium on the harvesting and sale of over-harvested species such as mogno and virola; the introduction and implementation of measures to control illegal logging through sophisticated devices for timber-tracking and satellite data transfer; limiting the area allowed for farming in forest properties in the Amazon; yield regulation in natural selection forests; forest restoration; the establishment of ecological corridors; incentives for municipalities that have environmental conservation areas through the transfer of a 'products and services tax'; and broadening the scope of eligible activities for CDM support.<sup>a</sup>

**Extent of protected areas.** There is uncertainty about the extent of protected areas in Brazil; partly this stems from differences in the definition of 'protected' and the extent to which extractive uses are permitted. The estimate of protection PFE given

in Table 1 and Table 7 comprises conservation units of integral protection and Indigenous reserves. The estimate is considerably less than that reported in ITTO (2006), most likely due differences in definition of what constitutes PFE rather than to a significant change in legal status or forest area.

All conservation units of integral protection (i.e. federal and state lands in the categories national parks, biological reserves, ecological reserves, national monuments and wildlife refuge areas) must have management plans. These are technical documents which, depending on the purposes of the conservation unit, establish the limits of the unit and the rules for its management and use, including the installation of infrastructure. However, the status of these management plans is unclear: some of them are under preparation but, for others, the preparation process has not yet begun. Management plans for conservation units of integral protection require, among other things, studies on vegetation, wildlife and soils and socioeconomic surveys in order to support zoning and the identification of appropriate management practices.<sup>b</sup>

#### Estimate of the area of forest sustainably managed for protection.

Data on the status of management of the protection PFE were unavailable for the purposes of this report (Table 7). However, vast areas of the Amazon are currently under no threat of deforestation or other significant human-induced disturbance due to their remoteness.

### Socioeconomic aspects

**Economic aspects.** Forest-based industries contributed an estimated 3.4% to Brazil's GDP in 2007, down from 4.5% in 2003. An estimated 580 000 people were directly employed in the formal forest and wood products sector in Brazil in 2010<sup>a</sup>, although data on the number of people employed in that part of the sector specifically based on natural tropical forests were unavailable for this report.

Table 7 Management of the protection PFE ('000 hectares)

Reporting year	Protection PFE	Attributed to IUCN categories I-IV	Allocated for soil and water	With management plans	Sustainably managed
2005*	271 000	19 000	-	-	-
<b>2010</b>	<b>175 000</b>	<b>40 200**</b>	<b>243 000</b>	-	-

\* As reported in ITTO (2006).

\*\* Amazon biome only. An additional 643 000 hectares in the caatinga biome, 5.23 million hectares in the cerrado biome and 2.21 million hectares in the Mata Atlântica biome are in IUCN categories I-IV.

Source: CNUC (2011) and personal communications – see endnote b.

**Livelihood values.** The Indigenous communities in the Amazon, dwellers in extractive reserves, and *caatinga* forest users in the northeast depend in large measure on forests for subsistence. However, no data on the extent of this dependence were available for this report.

**Social relations.** There are 227 Indigenous societies in Brazil, with a total population of about 600 000 people. These people have rights to 106 million hectares of land in the Amazon, which is 13% of the national land area. Demarcation of the land is very slow, however, which leads to encroachment and conflict, and there is insufficient support for economic development (Sobral 2009).

The slow process of recognition and approval of tenure causes dissatisfaction on the part of Indigenous communities. Nevertheless, the situation has improved in some areas; Indigenous peoples' organizations are now both stronger and more numerous and Indigenous communities have started to grow, thus reducing fears of their extinction. On the other hand, the majority of Indigenous people still suffer from economic marginalization, malnutrition and inadequate assistance and protection (as they remain under the guardianship of the federal government). The *quilombolas* are another marginalized group with land rights: the government recognizes their right to the land where they live but, again, the process of formal recognition is slow (*ibid.*). The majority of the Amazon's inhabitants are recent settlers and differences in their backgrounds lead to frequent friction.

## Summary

Significant advances have been made towards sustainable management in the Brazilian Amazon; for example, the area of certified natural forest has doubled since 2005. Despite continuing deforestation, clearance rates have declined dramatically in the last five years. Moreover, funds are being made available to improve forest management and protection, forest law enforcement is being strengthened, and new laws and regulations provide for improvements in forest management. A number of data-gathering services are greatly improving the availability and timeliness of forest-related information, although data on the management of forested protected areas were unavailable for this report. Efforts are also under way to clarify land tenure and to put

FLONAs under management plans, and large areas of forest are managed by Indigenous and other local communities (although the process of recognition and approval of tenure is slow). Nevertheless, significant problems remain in the application of SFM in the tropical PFE. They include poor infrastructure; the remoteness of many forests from centres of commerce and control; the weak competitiveness of SFM as a land use; declining wood-processing capacity in the Amazon; and a lack of awareness about SFM – and its potential benefits – among timber operators. Given that development will continue in the region, probably at an accelerated rate, the Government of Brazil is pursuing several models to improve the competitiveness of natural forest management as a land use. It is also working to address institutional barriers to SFM and recent initiatives offer hope that the area of tropical PFE under SFM will expand significantly in the future.

## Key points

- Brazil has a tropical-forest PFE of 310 million hectares, the largest in the tropics. Despite continuing deforestation, there are still huge forest resources in the Amazon.
- There has been a significant increase in the area of certified natural forest in the Amazon.
- At least 2.70 million hectares of natural tropical-forest production PFE are being sustainably managed; insufficient information was available to estimate the area of protection PFE so managed.
- Vast areas of the Amazon are currently under no threat of deforestation or other significant human-induced disturbance due to their remoteness.
- Since 2006, timber harvesting has been permitted in Brazil's public forests through forest concession contracts that can span up to 40 years; this system is in the early stages of implementation.
- A wide range of policies, strategies, laws and regulations have been developed to facilitate forest administration, improve timber legality and achieve SFM. Law enforcement has been strengthened, but the vastness of the resource and the spread of colonization make it difficult to control forest illegality.

- New laws have been enacted in an effort to improve the clarity of forest tenure in the Amazon and the management of public lands. Large areas of forest are allocated to Indigenous and *quilombola* communities, and a new law will increase opportunities for squatters to own land. Nevertheless, disputes over tenure remain a significant problem.

## Endnotes

- a Government of Brazil (2010).
- b Personal communications with officials in the Brazilian Forest Service, 2008, 2010, 2011.

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