

Figure 2-17g. Monthly variation in the incidence of fires (heat spots) - 1997.

Source: INPE/Núcleo de Monitoramento Ambiental da EMBRAPA/Ecoforça/Agência Estado (1992/1997).

Table 2-22. Number of fires (heat spots) in Brazil, 1992 to 1997.

Year	June	July	August	September	October	November	Total	Satellite
1992	5,363	13,100	71,643	92,357	107,993	-	290,733	NOAA14
1993	6,635	19,771	83,032	110,431	95,397	-	314,490	NOAA14
1994	1,856	8,528	60,988	33,699	12,119	-	117,190 ¹	NOAA14
1995	10,358	38,889	73,319					
			(1st fortnight)			-	-	NOAA14
			13,526					
			(2nd fortnight)	15,069	-	-	32,215	NOAA12
1996	6,419	52,182					58,601	NOAA14
			11,688	17,601	4,420	2,056	35,765	NOAA12
1997	7,951	28,363					36,314	NOAA14
			13,226	27,677	11,350	4,150	56,403	NOAA12

¹ From 2nd fortnight of August onwards, data from satellite NOAA12.

Source: INPE/Núcleo de Monitoramento Ambiental da EMBRAPA/Ecoforça/Agência Estado. *Relatórios sobre queimadas 1992/97.*

b) Fire Management

Fire damage in federal protected areas has put at risk the preservation of their biodiversity and ecosystems. Minimising the damage will be made possible through Fire Management Plans (Planos de Manejo de Fogo) which, by using techniques for the suppression of and controlled use of fire, will reduce their direct and indirect effects on the ecosystem and the community in general. This objective will give priority to the elaboration of Fire Management Plans for the protected areas annually affected by fires, especially those in the Cerrado ecosystem.

c) Monitoring

The Satellite System for Monitoring Heat Spots (Sistema de Monitoramento dos Focos de Calor por Satélite - SMS) will be set up at the state level, with the establishment of Fire

Monitoring Centres (Centros de Monitoramento de Incêndios), which will receive detailed information of the location of fires detected in each municipality. Through these state monitoring centres, PREVFOGO will be decentralised in the monitoring, prevention and combat of forest fires.

d) Training

This objective provides continuity for training in fire-prevention and fire-fighting (formation of fire brigades), aerial combating (training of pilots) and the training of experts in the detection of the causes of forest fires.

e) Prevention and Combat

This objective aims to facilitate the prevention and combat of fires in IBAMA's protected areas. Hiring support staff in the form of voluntary and temporary fire brigades, as well as

Table 2-23. Federal protected areas administered by IBAMA.

Category		Nº	Total Area (ha)	% of country
Indirect use	National Parks	36		
	Biological Reserves	23		
	Ecological Stations	21		
	Ecological Reserves	5		
	Areas of Significant Ecological Interest	18		
Subtotal	Indirect use	103	15,889,543	1.87
Direct use	Environmental Protection Areas	24		
	National Forests	46		
	Extractivist Reserves	11		
Subtotal	Sustainable use	81	23,178,668	2.72
Total	Federal Protected Areas	184	39,068,211	4.59

Source: Modified from IBAMA. *Relatório Nacional do Brasil, 2ª versão.* In: Congresso Latino-Americano de Parques Nacionais e Outras Áreas Protegidas, 1. Brasília (1997).

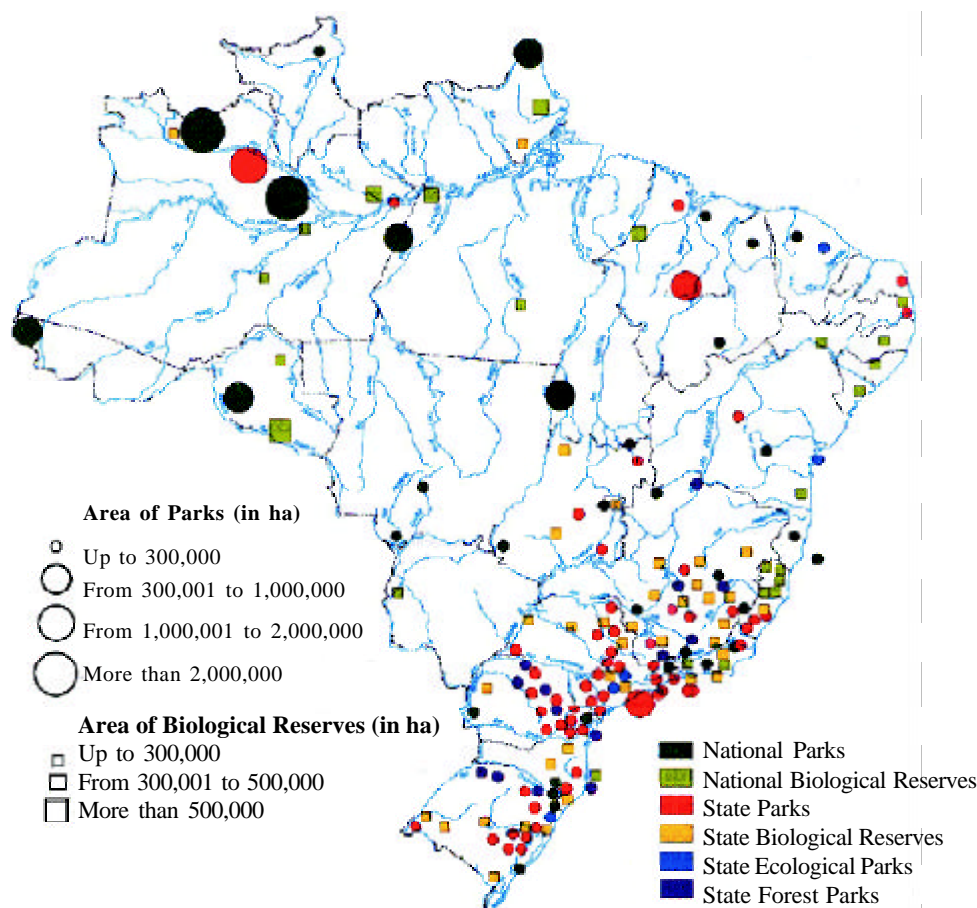


Figure 2-18. Federal and state protected areas. distribution and size classes. The Ilha Grande National Park is not included.

Source: IBGE.

re-equipping permanent fire brigades, will improve the prevention and control of forest fires in the protected areas administered by IBAMA. The UNDP support, through the Project BRA/95/028 - Environmental Macro-monitoring and the accompanying technical co-operation agreements, are also expected to continue. IBAMA also plans to step up its activities through PREVFOGO in environmental education, as well as the prevention and monitoring (with the Departamento de Fiscalização - DEFIS) of man-made fires and forest fires.

2.2.6 Evaluation of Impacts Caused by Man-made Fires

A World Wide Fund for Nature - WWF report, published in December 1997, pointed to a vicious circle in forest fires: 'The propagation of fire is both a result of climate change and a contributing factor towards it'. The report also states that burning of pasture in the Amazon region increased in 1997, a factor which, along with the phenomenon of El Niño which prolonged the dry season until November instead of

late September/early October, contributed significantly to the increase in forest fires.

Another report, published by the Environmental Defence Fund, also in December 1997, concluded that, in spite of the fact that 70% of the fires were in deforested areas, burns along with deforestation, presented a serious threat to biodiversity, since the fires affect primary forest, pasture and secondary forest.

An appraisal by the Amazon Environmental Research Institute (Instituto de Pesquisas Ambientais da Amazônia - IPAM) and The Woods Hole Research Center - WHRC, published in an IPAM bulletin in December 1997, stated that the increase in the number of man-made fires in the Amazon region in 1997 did not necessarily mean an increase in the rate of deforestation. Extensive fieldwork, involving 370 rural properties (about 1 million ha) in four Amazonian states (Acre, Mato Grosso, Pará and Rondônia), showed that the area burnt did in fact increase from 1994 to 1995. Although fires in pasture and young secondary forest (capoeira) rather than in primary forest were the cause of this increase, this does not mean that the rate of deforestation did not increase

in 1997 as well. In 1988, the number of fires spotted by the satellite NOAA reflected a considerable increase in the rate of deforestation.

“The results of our study”, the IPAM report went on, “show that the average area per property burnt each year varied from 5% (properties over 5,000 ha) to 19% (properties under 100 ha). One fifth of the burnt area was, on average, the result of deforestation; cutting down and burning primary or selectively logged forest. We can say that some 70% of what is burnt today is in areas which have been deforested. These areas are generally comprised of pasture, forests in regeneration or other areas of non-forest vegetation. One tenth of the total area burnt is primary forest or exploited forest. Fires in these forests are difficult to detect by satellite, since they are limited to the understorey, affecting the forest structure and its biodiversity, but not destroying the canopy.”

The IPAM report foresees some risks. “The virgin forests of the Amazon region acts as huge firebreaks, preventing accidental or intentional fires spreading from farmland and pasture. If these forests lose their protective function, it is likely that large areas of the Amazon landscape will burn periodically; seriously impacting biodiversity, and reducing the forest biomass and the amount of water released into the atmosphere (essential to maintain the water and rain cycles). Whenever the forest burns, it becomes more susceptible to new fires due to the large amount of combustible material (leaves and dead branches) which accumulate on the forest floor. Increasing the frequency of forest fires increases the risk of turning enormous areas of dense Amazon forest into savannah.

Tabela 2-24. National Parks (PARNAs) in Brazil.

Name	State	Region	Area (ha)
Caparaó	MG/ES	South-east	26,000
Grande Sertão Veredas	MG	South-east	84,000
Ilha Grande	MS, PR	Central-west, south	78,875
Itatiaia	RJ/MG	South-east	30,000
Serra da Bocaina	RJ	South-east	100,000
Serra da Canastra	MG	South-east	200,000
Serra do Cipó	MG	South-east	33,800
Serra dos Órgãos	RJ	South-east	11,800
Tijuca	RJ	South-east	3,200
Aparados Da Serra	RS/SC	South	10,250
Iguaçu	PR	South	185,262
Lagoa do Peixe	RS	South	34,400
São Joaquim	SC	South	49,300
Serra Geral	RS/SC	South	17,300
Superagui	PR	South	21,400
Brasília	DF	Central-west	30,000
Chapada dos Guimarães	MT	Central-west	33,000
Chapada dos Veadeiros	GO	Central-west	60,000
Emas	GO	Central-west	131,868
Pantanal Mato-grossense	MT	Central-west	135,000
Chapada Diamantina	BA	North-east	152,000
Lençóis Maranhenses	MA	North-east	155,000
Marinho de Abrolhos	BA	North-east	91,235
Marinho de Fernando de Noronha	PE	North-east	11,270
Monte Pascoal	BA	North-east	22,500
Serra da Capivara	PI	North-east	100,000
Sete Cidades	PI	North-east	7,700
Ubajara	CE	North-east	563
Amazônia	PA/AM	North	994,000
Araguaia	TO	North	562,312
Cabo Orange	AP	North	619,000
Jaú	AM	North	2,272,000
Monte Roraima	RR	North	116,000
Pacaás Novos	RO	North	764,801
Pico da Neblina	AM	North	2,200,000
Serra do Divisor	AC	North	605,000
TOTAL: 36 PARNAs			9,948,836

See Figure 1-1 for Brazilian regions and states.

Source: Modified from IBAMA. *Relatório Nacional do Brasil, 2ª versão. In: Congresso Latino-Americano de Parques Nacionais e Outras Áreas Protegidas, 1.* Brasília (1997).

With regard to the causes for the increase of fires, IPAM and WHRC argued that “the two main factors making the Amazon forest combustible are logging and drought. Each year now the area affected by logging (over 11,000 km²/year in 1996) is close to that deforested between 1992 and 1994 (15,000 km²/year according to INPE). Logging makes the forests inflammable: due to gap in the forest canopy (up to 50%) allowing the sun to dry the forest floor, rapidly drying

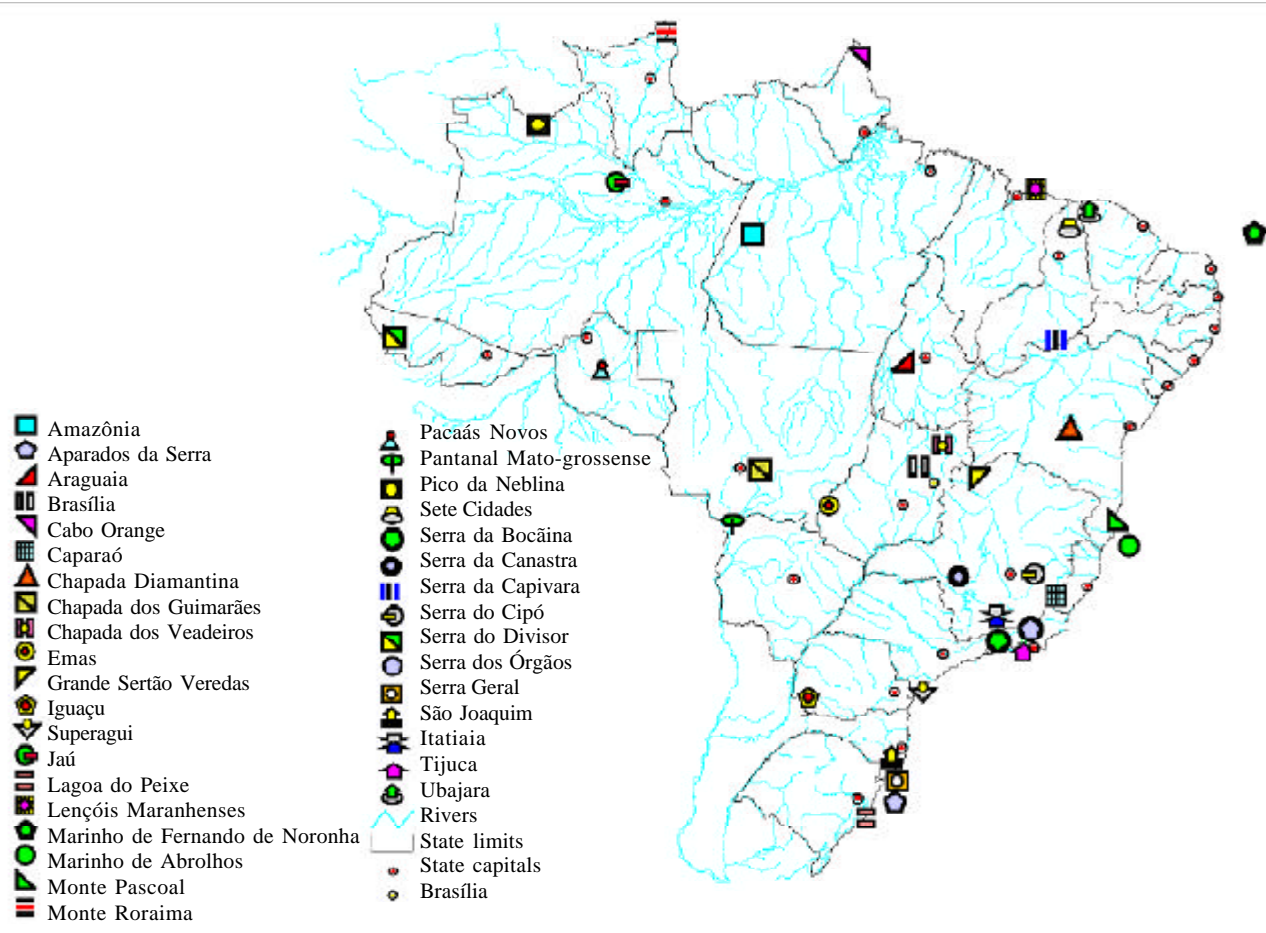


Figure 2-19. Location of Brazilian National Parks.

Source: Brazil, MMA (1997).

the organic material there. Our studies show that understory fires can kill-off up to one half of the fully-grown trees left in exploited forests and this in turn makes the forest more susceptible to future fires. Fire and the removal of trees affect transpiration by plants and the soil and a loss of water to the atmosphere. It results in more water draining to the streams and rivers and a greater risk of flood. Periods of severe drought can also make large areas of tropical forest prone to fires. One half of the four million km² of Brazilian Amazon forest may well be susceptible to small changes in rainfall.”

The factors, according to IPAM, can also lead to an underestimation of the rate of deforestation. Changes caused by selective logging and fires are difficult to detect through satellite images.

This report also concluded that the dry season in the Amazon region is more prolonged and severe when suffering such climatic phenomena such as El Niño (as in 1997). It recommends that local populations should be supported in

their efforts to prevent accidental fires; the cause of half the area burnt in 1994 and 1995. Such measures have proved promising. For example, the Del Rei Agricultural Community in eastern Amazonia has set up regulations for burning which demand that community members make firebreaks before using fire to clear their land and must warn their neighbours when they plan to burn. Indemnity for damages caused by fire are paid by the person responsible.

Studies by the World Bank and other agencies have shown that since 1994 the majority of fires occur when clearing and/or re-using areas already deforested, and not newly cleared areas (6% of the total), and as such do not affect primary forest directly.

Other studies, including those by INPE, have shown that clearing and burning in the Amazon region is concentrated in about 100 municipalities in the states of Pará, Mato Grosso, Rondônia, Acre and Maranhão (this last owing to the increase in soybean plantations).

2.3 Biodiversity Conservation *in situ*

2.3.1 The National Protected Areas System - SNUC

Today, Brazil has an extensive system of Protected Areas. In general terms, the National Council for Protected Areas (Conselho Nacional de Unidades de Conservação – CNUC) determines the policies for their creation, establishment and use. They form part of the National Protected Areas System (Sistema Nacional de Unidades de Conservação - SNUC), linked to the MMA and co-ordinated by IBAMA, the main executive agency for Brazilian environmental policy at the federal level.

There have been significant efforts in Brazil to expand the protected areas system, even though strictly protected areas cover only 2.61%, and protected areas for direct use cover 5.52%, to give a total of 8.13% of the area of the country. This is somewhat over-estimated because many Environmental Protection Areas (APAs) overlap with other categories. Even so, this demonstrates a considerable effort on behalf of *in situ* conservation of Brazilian biodiversity. Besides these protected areas is a large network of Indigenous Parks and Reserves, which represent 7.3% of the country and maintain their biodiversity largely intact. This 7.3% represents land officially registered and demarcated to date, and covers 61.3 million ha.

Excluding the Indigenous Reserves, there are 184 federal protected areas number covering an area of 39,068,211 ha (390.7 thousand km²) or 4.59% of the country (Table 2-23 and Figure 2-18).

Strictly Protected Areas (Áreas de Uso Indireto) are those in which exploitation or extractivism is strictly forbidden but where indirect use is permitted (Figure 2-18). They include National Parks (PARNAs) (Table 2-24 and Figure 2-19), Biological Reserves (REBIOs) (Table 2-25 and Figure 2-20), Ecological Reserves (RESECs) (Table 2-26 and Figure 2-21), Ecological Stations (ESECs) (Table 2-27 and Figure 2-22) and Areas of Relevant Ecological Interest (ARIEs) (Table 2-28).

Protected Areas of direct use (Áreas de Uso Direto) are those which allow for exploitation, but on a planned and regulated basis. They are seen as areas of sustainable use, and include the Areas of Environmental Protection Areas (APAs) (Table 2-29), National Forests (FLONAs) (Table 2-30 and Figure 2-23) and Extractivist Reserves - (RESEXs) (Table 2-31 and Figure 2-24).

Also important is the large number of conservation areas administered and protected by the states (Table 2-32), which number 451 and cover an area of 29.8 million ha. Some of

Table 2-25. Federal Biological Reserves (REBIOs) in Brazil.

Name	State	Region	Area (ha)
Augusto Ruschi	ES	South-east	4,000
Comboios	ES	South-east	833
Córrego do Veado	ES	South-east	1,854
Córrego Grande	ES	South-east	1,504
Poço das Antas	RJ	South-east	5,000
Sooretama	ES	South-east	24,000
Tinguá	RJ	South-east	26,000
Marinha do Arvoredo	SC	South	17,600
Atol das Rocas	RN	North-east	36,242
Guaribas	PB	North-east	4,321
Pedra Talhada	PE/AL	North-east	4,469
Saltinho	PE	North-east	548
Santa Isabel	SE	North-east	2,766
Serra Negra	PE	North-east	1,100
Una	BA	North-east	11,400
Abufari	A M	North	288,000
Guaporé	RO	North	600,000
Gurupi	MA	North	341,650
Jaru	RO	North	268,150
Lago Piratuba	AP	North	357,000
Rio Trombetas	PA	North	385,000
Tapirapé	PA	North	103,000
Uatumã	A M	North	560,000
Total 23 REBIOs			3,044,438

See Figure 1-1 for Brazilian regions and states.

Source: Modified from IBAMA. *Relatório Nacional do Brasil, 2ª versão. In: Congresso Latino-Americano de Parques Nacionais e Outras Áreas Protegidas, 1.* Brasília (1997).

these areas, such as the Sustainable Development Reserve of Amanã of 2.35 million ha, are very large. This reserve, along with the Sustainable Development Reserve of Mamirauá, the Jaú National Park, the Anavilhanas Ecological Station, the Rio Negro State Park and the Environmental Protection Areas of the Right Bank and the Left Bank of the Rio Negro, makes a continuous total protected area of 8.567.908 ha. This is larger than Austria, and the largest area of protected tropical forest in the world.

The largest state protected areas are in the north (Table 2-32), 49% in terms of area, although only 12% in terms of numbers. Seven of these state protected areas are over 1 million ha in size, and one, the Island of Marajó Environmental Protection Area, Pará, is nearly 6 million ha. In the south, state protected areas are more numerous but on the whole considerably smaller.

A study of the National Environment Program (Programa Nacional do Meio Ambiente - PNMA) inventoried all fede-

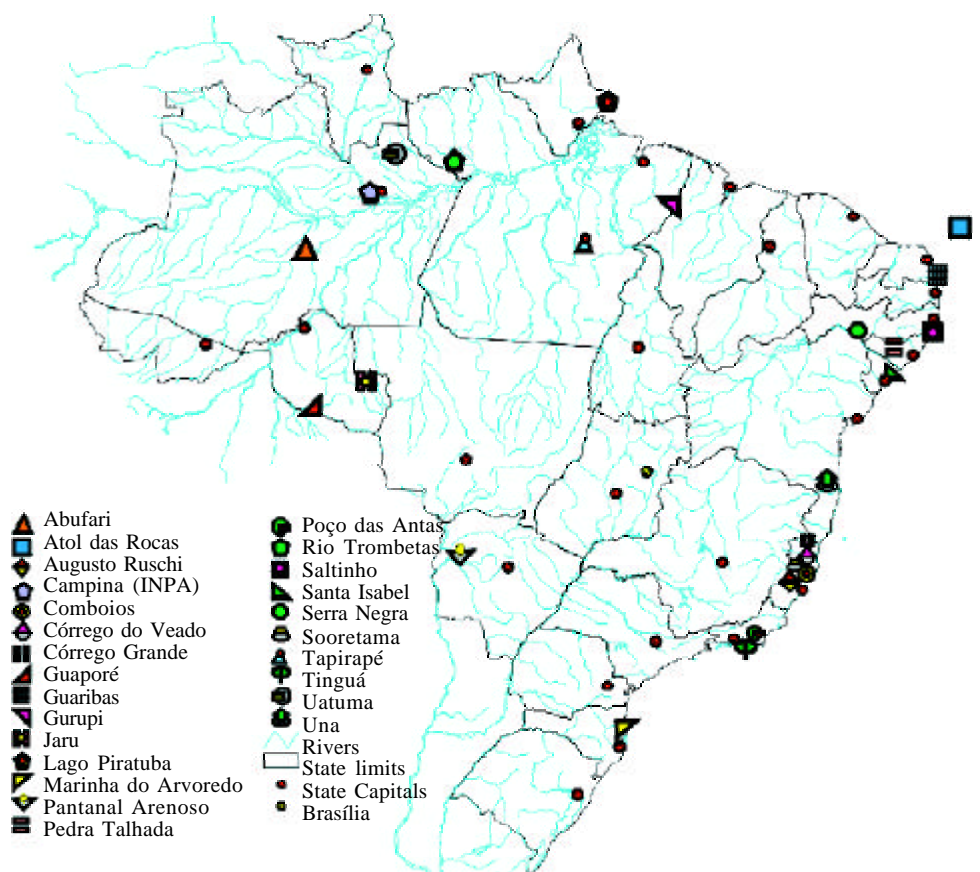


Figure 2-20. Location of Brazilian Federal Biological Reserves.

Source: Brazil, MMA (1997).

ral, state and some municipal protected areas. In terms of biomes (Figure 2-25 and Table 2-33), Amazonia has the largest area of protected areas (Figures 2-26 and 2-27 and Tables 2-34 and 2-35). In percentage terms, however, protected areas in the Coastal Zone and the Atlantic forest have comprise the highest proportion.

There are also some systems of protected areas at the

municipal level which are, in general, under the local Environment Secretariats and maintained by them. Many universities and research institutes also maintain areas reserved for scientific and experimental purposes as well as for conservation. Two examples are the Adolfo Ducke Forest Reserve (10,000 ha) in Manaus, which is administered by the National Institute for Amazon Research (Instituto Nacional de Pesquisas da Amazônia - INPA), and the IBGE Ecological Reserve (1,260 ha), in Brasília.

Table 2-26. Federal Ecological Reserves (RESECs) In Brazil.

Name	State	Region	Area (ha)
Ilha dos Lobos	RS	South	1.69
Raso da Catarina	BA	North-east	99,772
Juami-Japurá	A M	North	265,000
Jutaí-Solimões	A M	North	284,285
Sauim-Castanheiras	A M	North	109
TOTAL: 5 RESECs			649,167

See Figure 1-1 for Brazilian regions and states.

Source: Modified from IBAMA. *Relatório Nacional do Brasil, 2ª versão*. In: *Congresso Latino-Americano de Parques Nacionais e Outras Áreas Protegidas, 1*. Brasília (1997).

Some private organizations, many of them involved in ecotourism, administer protected areas specifically for conservation. Many companies such as those involved in cellulose, mining, energy and forestry, also hold important reserves: either for environmental reasons to counterbalance their exploited areas or for management purposes. Paper and pulp companies reserve more than 1 million ha in the Atlantic Forest alone. The Linhares Forest Reserve of the Vale do Rio Doce mining company, with 21,787 ha, for example, is one of the most important protected areas in the Atlantic forest.

Some non governmental conservation organizations also own and administer reserves and sanctuaries. The Biological Station of Caratinga (880 ha) in the east of the state of Minas Gerais, is administered by the Biodiversitas Foundation (Fundação Biodiversitas). Likewise, the Salto Morato Natural