

2.2 Monitoring and Mitigation of Impacts on Biological Diversity

2.2.1 Socio-economic Pressures and Their Impacts

Reducing or eliminating the current impacts on Brazilian diversity is a complex task. Brazilian Amazonia covers more than 3.7 million km², and the Cerrado biome, which has suffered worst from the expansion of agriculture and cattle-ranching in recent years, covers some 2 million km². The Atlantic forest extending from the north-east to the far south of Brazil has been reduced to a mere strip of remnants. The Brazilian coast extends for 7,408 km, and Brazilian oceanic waters cover 2 million km².

Brazilian biomes continue to suffer from the consequences of social and economic structures developed over the centuries and well before the advent of environmental awareness. The coastal area was where colonisation first took place and still has the highest population densities (Figures 2-9, 2-9a) and is where altered environments predominate (Figure 2-10).

Until 1985, government policy provided substantial incentives for mining and the expansion of the agricultural and cattle-ranching frontiers, with little regard to the environment. Tax incentives and subsidies were created to stimulate the occupation of enormous areas in the Amazon and the Cerrado, resulting in widespread deforestation and the degradation of the natural environments. Between 1970 and 1985, financial incentives and subsidised credits totalled US\$700 million, including 950 projects in the Amazon. Of these, 631 involved deforestation for cattle ranching.

The situation is similar in other regions of the country and with equally serious consequences. The destruction of the Atlantic forest is a tragic part of Brazil's history.

Apart from this, regional differences in income and social infrastructure have resulted in shifts in the human population, the occupation of new areas and the loss of biological diversity. According to the Report on Human Development in Brazil published by the United Nations Development Program - UNDP in 1996, the per capita GNP in the south and south-east is slightly over US\$5,000 per annum, whereas in the north-east it is US\$2,559, and US\$3,747 in the north. However, there are states in the

Table 2-12. Diversity of freshwater invertebrates in Brazil.

Phylum	Subphylum	Class	Subgroup	No. of genera	No. of species
Protozoa	Sarcodina	Sarcodina	Tecamebas	20	150
Porifera				21	44
Coelenterata				5	5
Platyhelminthes		Turbellaria		20	96
Nematomorpha				3	9
Annelida					73
Rotifera					457
Arthropoda	Crustacea	Branchiopoda	Cladocera		86
Arthropoda	Crustacea	Maxillopoda	Copepoda		273
Arthropoda	Crustacea	Malacostraca			75

Source: Rocha (1997).

north-east such as Piauí where the per capita GNP is only US\$1,339 per annum, and similar disparities occur when comparing municipalities within each of the Federal States.

Disparity of income and poor living standards, together with population increases, have resulted in a marked migration from rural to urban environments, as well as from poor areas to those offering employment and a better social infrastructure. Major migrations have also accompanied the expansion of the agricultural and cattle-ranching frontiers and the increase in mining, both industrial and open cast, placer-mining. It also resulted in the invasion of hitherto preserved Indigenous lands.

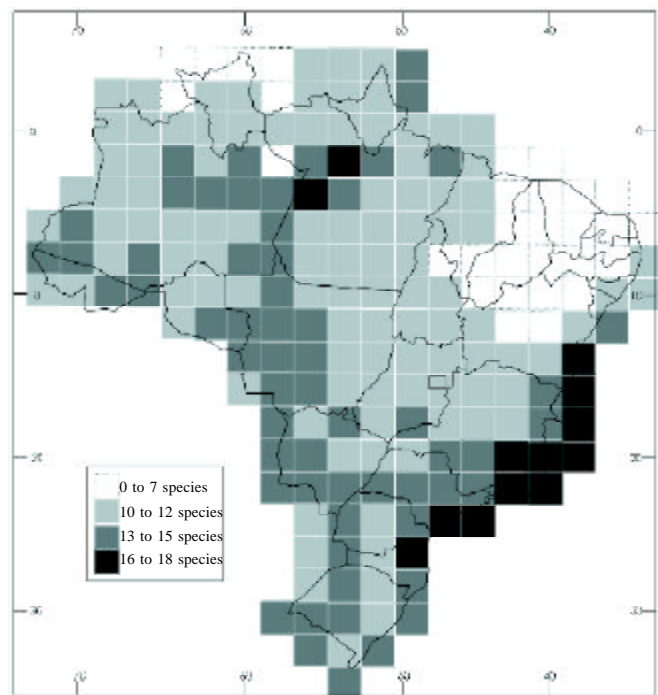


Figure 2-8. Distribution of threatened mammals in Brazil.

Source: Fonseca, Rylands, Costa, Machado, Leite (1994).

Table 2-13. The number of animal species threatened or presumed threatened in the states of Minas Gerais (MG) and São Paulo (SP).

Taxa	Threatened species								Species presumed threatened			
	Extinct		Critically endangered		Endangered		Vulnerable		Total			
	MG	SP	MG	SP	MG	SP	MG	SP	MG	SP	MG	SP
Mammals	5	1	13	9	12	8	10	22	40	40	25	25
Birds	4	21	12	47	27	37	40	59	83	164	64	25
Reptiles	0	1	3	0	2	10	5	13	10	24	15	40
Amphibians	0	0	-	0	1	3	10	1	11	4	17	26
Fish	0	0	1	3	0	2	2	29	3	34	32	29
Terrestrial invertebrates	3	1	4	8	13	12	11	22	31	43	12	40
Marines invertebrates	-	0	-	0	-	1	-	0	-	1		18
Total	12	24	33	67	55	73	78	146	178	310	165	203

Sources:

Minas Gerais State Government. COPAM Deliberation No. 041, 20th January 1995;
 São Paulo State Government. PROBIO-SP, State Decree No. 42,838, 4th February 1998.

As a result, the population of the nine states of the Northern region (Amazonia) has increased from 2 million inhabitants in 1950, to 4 million in 1970, 5.8 million in 1980 and 12 million in 1991. It now stands at about 18 million. The state of Rondônia has seen an increase in population from 36 thousand inhabitants in 1970 to 30 times this number in 1996. In Roraima, the population trebled between 1970 and 1991, and in Pará it has quadrupled in 50 years. The population of Manaus, the capital of the state of Amazonas, went from 633,000 inhabitants in 1980 to over 1 million in 1991.

Overall, the north of Brazil has increased its population from 7.8% of the country's total population in 1970 to 11.3% in 1991. Between 1980 and 1991, the population of the Amazon region increased at the rate of 1.8% a year for rural areas, compared to 5.4% a year for urban areas (Figures 2-11 and 2-12).

Population growth rates, however, have been declining over the last two decades. Health care and the use of contraceptives and voluntary sterilisation have been instrumental in causing a reduction in population growth from 3% a year in the 1950s, to 2.9% in the 1960s, and to 1.9% a year by the census of 1991. It is still decreasing. The birth rate has gone down by 37% over the last 15 years in the country as a whole, and by 20% in the north. Current statistics point to a growth rate of around 1.3% a year (Figure 2-13).

The 1996 Report on Human Development in Brazil by the UNDP concluded that the decline in the birth rate in Brazil is not a circumstantial phenomenon but an irreversible process within what, in demographic terminology, could be called a demographic transition. The report predicts that the population will stabilise at about 211 million inhabitants around the year 2020.

Over the past decades, social and economic expansion in the Central West and the Amazon has been stimulated by the opening up and paving of a major road network. The 'Polonoroeste' colonisation and development programme was begun in the 1970s, in parallel with the construction of BR 364 highway, linking central Brazil to the state of Rondônia.

The current situation in each of the biomes is as follows:

Amazonia. This is most well-preserved biome, with about 10% allocated to protected areas, and about 85% of the Brazilian Amazon still forested. Fires and forest destruction are generally associated with agriculture, cattle-ranching, and selective logging. Amazonia now provides 70% of the national and 2% of the international demand for timber, figures which will increase in the future. Mining is a serious

Table 2-14. Numbers and categories of threatened plant species in the states of Minas Gerais (MG) and Paraná (PR).

State	Category	No. of species
Minas Gerais ¹	Probably extinct	79
	Critically endangered	108
	Endangered	128
	Vulnerable	221
Paraná ²	Endangered	236
	Vulnerable	106
	Rare	251

Sources:

¹ Fundação Biodiversitas, Minas Gerais.
² Paraná State Government. State Secretariat for the Environment (SEMA) and the German Technical Co-operation Agency - GTZ. *Lista Vermelha de Plantas Ameaçadas de Extinção no Estado do Paraná*. Curitiba (1995).

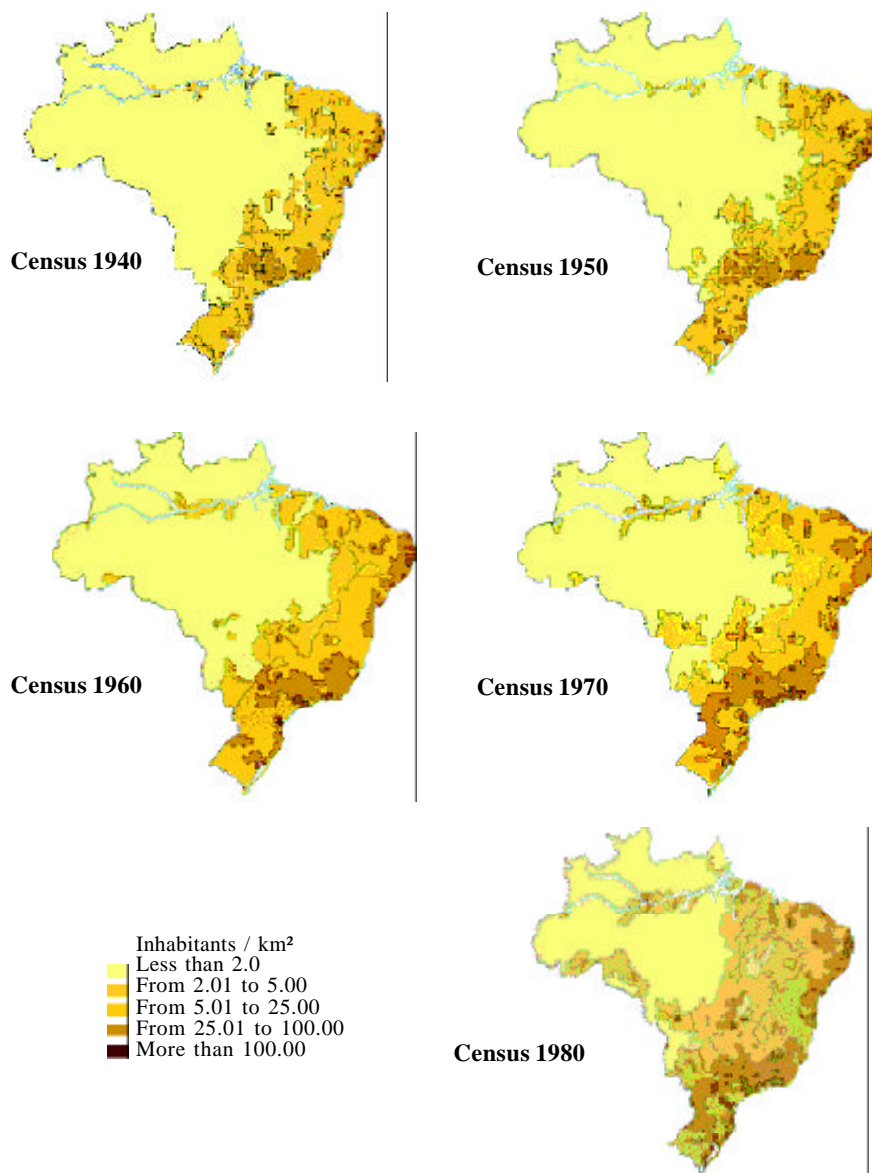


Figure 2-9. Evolution of human occupation of Brazilian territory - population density.
Source: IBGE (1992).

threat to many river systems, and overfishing has become a problem in some.

Cerrado. In terms of area, agriculture and cattle-ranching is increasing by 3% a year. Conversion of the Cerrado ecosystems for economic use involving the total loss of the original vegetation now totals 40% of the area, and more than 50% of the remaining natural ecosystems have been degraded. Burning, both for the maintenance and the creation of cattle pasture and for plantations is a common practice, and results in soil erosion as well as the loss of biological diversity.

Caatinga. The natural vegetation of this biome now covers less than 50% of the original area, and only less than 1% has

been designated as protected areas. Desertification is widespread. Extensive cattle-ranching, agriculture, extractivism, and subsistence farming have all had major impacts on this biome. Hunting for food is an important additional factor, especially in the dry season.

Atlantic forest. This is the most threatened of the Brazilian forest biomes, with less than 9% of the original area remaining. Around 80% of the forest is in private hands. Protected areas account for 2% of the original area. Deforestation is the main threat, for agriculture, for monocultural reforestation and for housing. Subsistence and commercial extractivism is also an important factor in the south of the state of Bahia as well as the southern states. The Araucaria Forest and the so-called Campos Sulinos (grasslands in the south), distinct ecosystems but considered part of the domain of the Atlantic forest, have been very severely affected by logging agriculture and cattle-ranching. Weakening of the soil is an ever-increasing problem. Only about 1% of the original area has been designated as protected areas.

Coastal Zone. Chief threats to the Brazilian coastal ecosystems include real estate speculation, and uncontrolled tourism, overfishing (industrial and subsistence), destruction and subsistence exploitation of mangrove swamps, and the pollution of estuaries (erosion inland, and industrial and urban pollution).

2.2.2 Monitoring Deforestation

From 1978 to 1996, the deforested area in the Amazon region is estimated to have increased from 78 to 501 thousand km²; 12.5% of the original forest area (Table 2-15). The yearly deforestation rates increased in the 1970s and 1980s. Between 1978 and 1988 they were as high as 0.54% of the total area, or 21,130 km² a year (Table 2-16).

Government measures in 1998, which included the suspension of tax incentives along with an economic recession, reduced the rate of deforestation. It dropped from

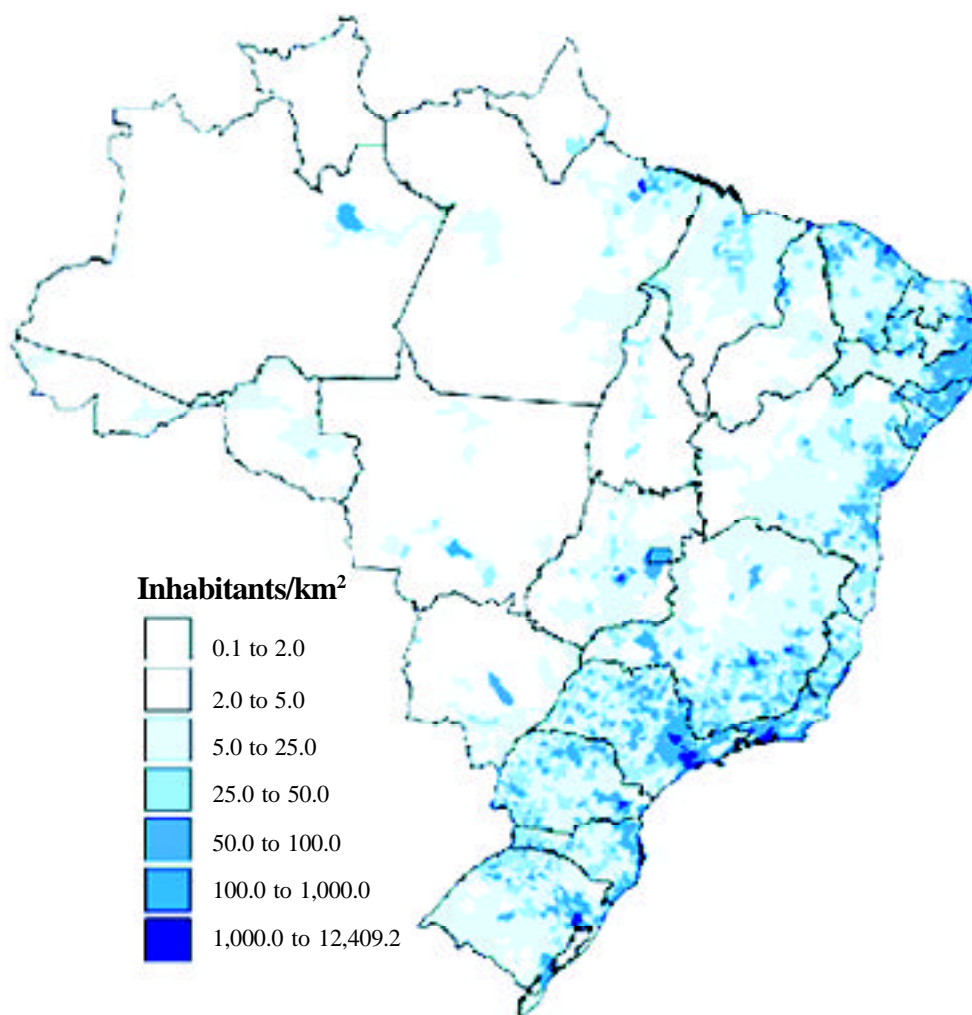


Figure 2-9a. Demographic densities - Brazil 1996.
Source: IBGE (1988).

0.48% in 1988/89, to 0.37% in 1989/90, and to 0.30% in 1990/91. As of 1991, however, deforestation increased again due to a more favourable economic climate, immigration, and the advance the agricultural and cattle-ranching frontier, going from 0.37% in 1991/92, to 0.40% for 1992/94, and peaking at 0.81% in 1994/1995. In 1995/1996, the deforestation rate dropped to 0.51% (Figure 2-14).

The Brazilian Government co-ordinates the world's biggest programme for routine monitoring of forest cover, through the National Institute for Space Research (Instituto Nacional de Pesquisas Espaciais - INPE). The Project for Monitoring of Deforested Areas in the Amazon Region (Projeto de Monitoramento de Áreas Deflorestadas na Amazônia Legal - PRODES) has carried out routine yearly surveys since 1988. Different from those of a number of international agencies, this project does not involve merely sampling, but a complete annual census over the entire region, an area the size of Europe.

A report recently published by IBAMA and by INPE on deforestation shows that the prime cause in the region is the

conversion of forest into temporary pasture or land for agriculture. The greatest expansion in agricultural land has been concentrated in the states of Mato Grosso, Pará, Rondônia and Tocantins. According to this report, land holdings (less than 50 ha) having little access to technology or other resources account for 41% of the deforestation in the region (Figure 2-15). The worst hit vegetation types are the closed and open ombrophilous forests and their contact zones (Figure 2-16).

The impacts of logging are considerable, and indirectly lead to complete deforestation. The IBAMA/INPE report shows that the profits from selective logging (not registered in PRODES) revert eventually to projects involving clear-cutting, facilitated by the roads opened up for timber exploitation. Timber sales have grown in recent years, and now 90% of the internal market is supplied from the Amazon. Investigations by IBAMA have demonstrated that up to 80% of timber commerce in the Amazonia is illegal and predatory. Selective logging of just a few tree species is highly wasteful; up to 60%-70% of the trees felled are not marketed.

In December 1997, an External Commission of the Chamber of Deputies produced a report which reviewed the acquisition of timber companies, sawmills and large tracts of land in the Brazilian Amazon by Asian consortiums. It concluded that the presence of Asian timber businesses exposes the Amazon forest to a potentially high risk. Of the 13 transnational companies investigated, 12 had committed offences in terms of forest management, illegal purchase of timber; and the negotiation of timber from Indigenous Lands. Ten of them were deficient or illegal in their forest management plans, five had been fined for malpractice and four had been accused of violating the rights of indigenous people.

The Report made six recommendations: 1) A 10-year moratorium on deforestation; 2) An immediate stop to all man-made fires as from 1998; 3) That 10% of the entire Brazilian Amazon be given over to protected areas by the year 2000; 4) All Federal public land be converted into protected areas; 5) That approval of the law defining environmental crimes, already sanctioned by the Senate, be given priority in the Chamber of Deputies and; 6) The declaration of areas prohibited for logging. The Report went on to suggest a policy of incentives for forest conservation and for forestry exploitation under management, the establishment of an International Forestry Convention in the ambit of the United Nations, environmental auditing of all transnational enterprises, and the exclusion of

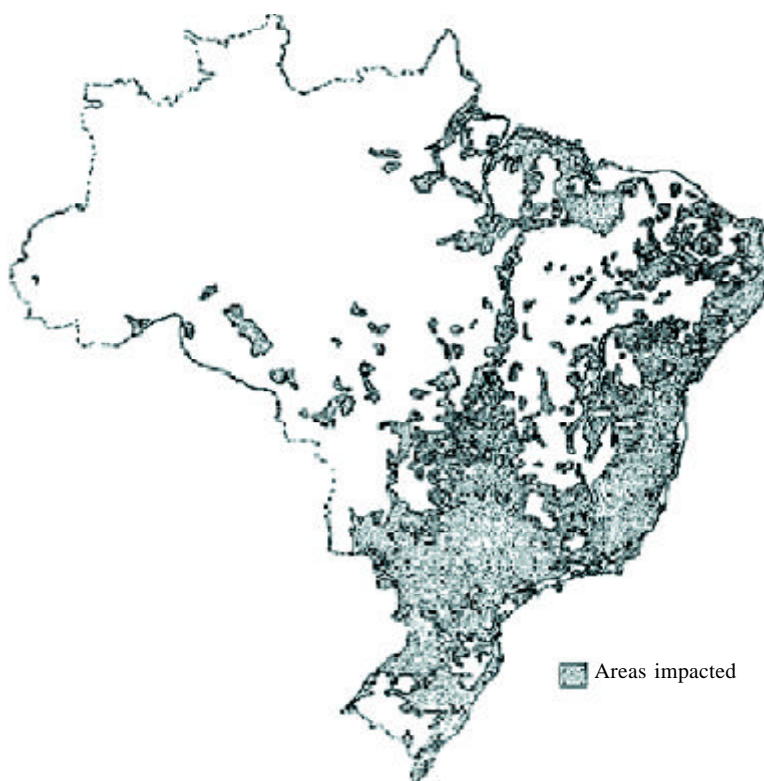


Figure 2-10. Areas suffering significant human impacts in Brazil.

Source: Brazão, Santos and Silva, IBGE (1993).

all areas of primary Amazon forest in any project for traditional agrarian reform.

The situation in the Cerrado and Caatinga regions is of even more concern insofar as 40% of the original vegetation in the Cerrado has been destroyed by human activities. As for the Caatinga, the remaining area of dry forest in the states of the North-East was reduced from 1,009,915 km² in 1984 to 727,695 km² in 1990, representing a loss of 47% over the original area (Table 2-17), the land having been cleared and put to other uses.

In the past, the Atlantic forest and its associated ecosystems covered some 1,130,000 km² in 17 Brazilian states. Human occupation of the region has resulted in a drastic reduction of the native vegetation in this biome, which is today only sparsely distributed along the Brazilian coast, in the interior of the south and south-east, and with some important isolated areas in Goiás, Mato Grosso do Sul and in the interior of the north-east.

In 1990, the INPE and an NGO, the SOS Atlantic Forest Foundation (Fundação SOS Mata Atlântica) concluded an 'Atlas of the Remnant Forests in the Atlantic Forest Domain,' on a scale of 1:1,000,000. It was published in 1993. A second

Tabela 2-15. Original and remaining (km²) forested areas of the Brazilian Amazon.

State	Area of State ¹	Original forested area ²	Remaining forested area in 1996 ³	% remaining in 1996
Acre	153,149	153,697	139,955	91.1
Amapá	143,453	137,532	135,570	98.7
Amazonas	1,577,820	1,481,902	1,454,468	98.1
Maranhão	333,365	165,848	66,510	40.1
Mato Grosso	906,806	481,442	362,301	75.3
Pará	1,253,164	1,144,858	984,503	86.0
Rondônia	238,512	215,245	166,597	77.4
Roraima	225,116	162,567	157,206	96.7
Tocantins	278,420	84,250	58,767	69.8
Brazilian Amazon	5,109,805	4,027,341	3,525,877	87.5

Sources: ¹ IBGE (1977). ² FAO. Brazil - Country Brief for Interim Forest Cover Assessment. São José dos Campos: INPE (1996); ³ INPE. *Desflorestamento 1995-1997 - Amazônia*. MCT/INPE. Brasília: MMA/IBAMA (1997).

edition, on a scale of 1:250,000, will cover 10 states (Bahia, Espírito Santo, Minas Gerais, Goiás, Mato Grosso do Sul, São Paulo, Rio de Janeiro, Paraná, Santa Catarina and Rio Grande do Sul), updating the information to 1995. In 1990 (Table 2-18), the remaining forest covered 9.02% of its original area, and the yearly rate of deforestation between 1990 and 1995 ranged from 3.62% to 13.13% in the different states, with an overall rate of 6.88% (Table 2-19).

The data for the state of Santa Catarina have already been analysed for the second edition of the atlas (period 1990-1995). Originally, forest covered 7,768,440 ha or 81.5% of the state, the rest being restinga (coastal vegetation on sand), mangroves and savannah. In 1995, the remaining forest covers 1,654,179 ha, 17.35% of the state, and 21.29% of the area of the forest that existed five hundred years ago (Tables 2-20 and 2-21). From 1990 to 1995, Santa Catarina lost 70,065 ha of forest, mostly Araucaria forest, which was 4.06% of the forest remaining in 1990. From 1990 to 1995, there was also a considerable loss of the restinga vegetation, with 10,013 ha being cleared, or 10.46% of the restinga present in 1990. Only 85,640 ha of restinga remain. A total of 155 ha of mangroves were also cleared during this period: 2.28% of the are remaining in 1990. There are now 6,621 ha of mangrove swamps in the state.

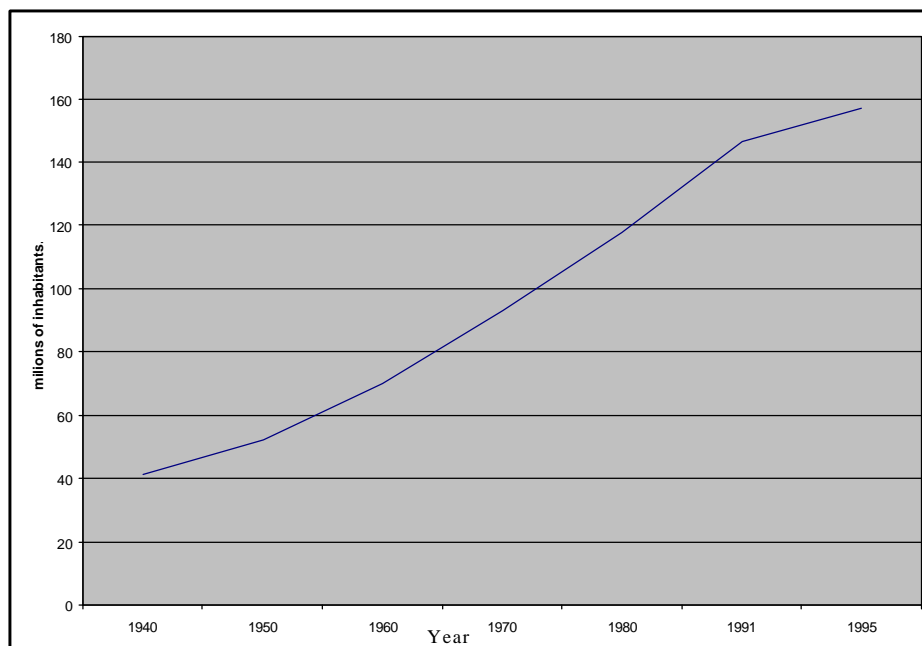


Figure 2-11. Population growth in Brazil, 1940-1996.

Source: IBGE (1997).

In the 10 years from 1985 to 1995, the state of Santa Catarina lost 167,851 ha (9.21%), of its remaining forest, and 11,802 ha (12.11%) of the remaining restinga vegetation. Summing the Atlantic forest, restinga and mangroves, the total loss of natural vegetation was 9.33%.

2.2.3 Combating Deforestation

The enormous problems and difficulties in combating deforestation in a country the size of Brazil require a major and complex infrastructure for planning, execution, monitoring

Table 2-16. Average annual deforestation in the Brazilian Amazon Region

State	78/89		87-88/89		89/90		90/91		91/92		92/94		94/95		95/96	
	km ² /year	%/year	km ² /year	%/year	km ² /year	%/year	km ² /year	%/year	km ² /year	%/year	km ² /year	%/year	km ² /year	%/year	km ² /year	%/year
Acre	620	0.42	540	0.39	550	0.39	380	0.28	400	0.29	482	0.35	1,208	0.86	433	0.31
Amapá	60	0.06	130	0.12	250	0.23	410	0.37	36	0.03			9	0.01		
Amazonas	1,510	0.10	1,180	0.08	520	0.04	980	0.07	799	0.06	370	0.03	2,114	0.14	1,023	0.07
Maranhão	2,450	1.79	1,420	1.30	1,100	1.03	670	0.63	1,135	1.07	372	0.35	1,745	3.21	1,061	2.01
Mato Grosso	5,140	1.01	5,960	1.31	4,020	0.90	2,840	0.64	4,674	1.05	6,220	1.40	10,391	2.43	6,543	1.56
Pará	6,990	0.62	5,750	0.55	4,890	0.47	3,780	0.37	3,787	0.37	4,284	0.42	7,845	0.78	6,135	0.62
Rondônia	2,340	1.11	1,430	0.78	1,670	0.91	1,110	0.62	2,265	1.27	2,595	1.46	4,730	2.75	2,432	1.45
Roraima	290	0.18	630	0.39	150	0.10	420	0.27	281	0.18	240	0.15	220	0.14	214	0.14
Tocantins	1,650	2.67	730	2.00	580	1.61	440	1.26	409	1.17	333	0.95	797	2.29	320	0.94
Brazilian Amazon Region	211,300	0.54	17,860	0.48	13,810	0.37	11,130	0.30	13,786	0.37	14,896	0.40	29,059	0.81	18,161	0.51

Obs.: The absence of data for the state of Amapá in 1994 is due to the incidence of clouds.

Sources: INPE, IBAMA and MMA. *Desflorestamento* 1995-997.