

USAID/BRAZIL COUNTRY STRATEGIC PLAN (FY 2003-2008) ENVIRONMENTAL ANALYSIS

INTRODUCTION

Brazil, the largest country in South America, is distinguished by a high concentration of biodiversity and species endemism, a reflection of the richness and variety of its ecosystems over 8.5 million square kilometers of land area. Brazil's vast size, socioeconomic issues, and limited institutional capacity for environmental management have made the tasks of natural habitat protection and sustainable resources management extremely complex.

This environmental analysis presents an overview of biodiversity and tropical forestry in Brazil and assesses the threats and opportunities related to those resources to meet the environmental analysis requirement of the U.S. Agency for International Development (USAID)'s country strategic planning process, as specified in Automated Directive Systems 201.3.4.11.b. This requirement is derived from the 1986 amendments to the Foreign Assistance Act (FAA). Sections 118 "Tropical Forests" and 119 "Endangered Species" of the FAA require that all country strategic plans include: (a) an evaluation of the actions necessary in that country to conserve biological diversity (biodiversity) and tropical forests; and (b) the extent to which current or proposed USAID actions meet those needs.

This report is accordingly organized into five sections. **Section One** provides a summary of the characteristics of Brazil's biodiversity and tropical forests, including major ecosystems, species endemism and diversity, and key habitats. **Section Two** summarizes the threats to Brazil's biodiversity and tropical forests. **Section Three** analyzes the major obstacles to addressing those threats. **Section Four** describes the ongoing conservation efforts currently being undertaken by the Brazilian government, civil society, and international donors, including a description of current legislation, policies and strategies related to conservation and sustainable management. Finally, **Section Five** analyzes the extent to which USAID/Brazil's Country Strategic Plan (FY 2003-2008) addresses the major obstacles to conservation and sustainable management of biodiversity and tropical forest resources in Brazil.

The key documents that served as the basis for this analysis are USAID/Brazil's Strategic Plan (FY 2003-2008), USAID/Brazil's Environment Program Strategic Plan (FY 2003-2008), the World Bank's report on "Forests in the Balance: Challenges of Conservation in Development", and Brazil's "First National Report for the Convention on Biological Diversity." Other literature used for the development of this analysis is cited at the end of the document. This analysis was also developed in consultation with USAID/Brazil and U.S. Embassy staff. USAID/Peru's Country Strategic Plan (FY 2002-2006) Section 118/119 Environmental Assessment served as the model for the format of this analysis.

Status of Brazil's Biodiversity and Tropical Forests**1.1 COUNTRY OVERVIEW****1.1.1 Political**

Brazil is the only genuinely federal country in Latin America with substantial economic and political power invested in 26 state governments and 5,656 municipalities. The 1988 Brazilian Constitution provided for mandatory revenue allocation to states and municipalities and each entity is entitled to formulate and implement their own economic, social and environmental policy. The States and the Federal District of Brazil form five major regions--the North, Northeast, South, Southeast, and Center-West.

1.1.2 Economic

Brazil's gross domestic product (GDP) and per capita GDP in 2001 were estimated to be \$500 billion and \$2,245, respectively (USAID, 2002a). Natural resource-based materials and products such as metals, nonmetallic minerals, wood, crops, and livestock form the basis of Brazil's economy, which is primarily sustained by the industrial, agricultural, ranching, and mining sectors. The forestry sector accounts for 4% of the GDP, while fisheries accounts for 1% (Government of Brazil, 1997). Important agricultural exports include coffee, tobacco, sugar, soybeans, and orange juice. Brazil is also a major exporter of beef and chicken.

1.1.3 Demographics

Brazil has a large population exceeding 169 million people with an annual population growth rate of 1.4%. Brazil is one of the most least densely populated nations at 20 people per square kilometer, with 86% of the population highly concentrated in the Southeast (63 million), Northeast (45 million), and South (23.1 million), in an area that comprises approximately 30% of Brazil's total surface area (DFID *et al*, 2000a). An estimated 80% of Brazilians live in urban areas, making Brazil one of the most urbanized and industrialized countries in Latin America (Library of Congress). The most inhabited states in Brazil are those that lie along the Atlantic coast, including Sao Paulo, Minas Gerais, Rio de Janeiro, Bahia, Rio Grande do Sul, and Parana. Brazil's indigenous population, approximately 325,000 or 0.2% of the country's total population, inhabits 561 areas covering 972,450 square kilometers (about 11.38% of the national territory), primarily in the north and northeastern regions of the country (World Bank, 2000).

1.1.4 Geography

Brazil is the fifth largest country in the world at 8,511,965 square kilometers and covers approximately 50% of South America's land surface. In addition to its mainland holdings, Brazil possesses the archipelago of Fernando de Noronha, located 350 kilometers northeast of its "horn," and several small islands and atolls in the Atlantic. Geographically, Brazil is situated between 05°16'20" north and 33°44'32" south latitude and between 34°47'30" and 73°59'32" west longitude. Countries that border Brazil are French Guiana, Suriname, Guyana, Venezuela and Colombia to the north; Peru, Bolivia, and Paraguay to the west; and Argentina and Uruguay to the south. The Atlantic Ocean borders Brazil to the east.

1.1.5 Water Resources

Brazil has one of the world's most extensive river systems, with eight major drainage basins, all of which drain into the Atlantic Ocean. Two of these basins--the Amazon and the Tocantins-Araguaia--account for more than half the total drainage area. Brazil contains two-thirds of the world's largest system, the Amazon, through which flows one-fifth of the world's fresh water (Library of Congress). In addition, Brazil has extensive coastal resources with a coastline of 7,367 kilometers and 3.5 million square kilometers of coastal and marine waters under its jurisdiction. Brazil produces approximately 700,000 tons of fish per year, a relatively low quantity in relation to the expanse of its jurisdictional waters (Government of Brazil, 1997). Approximately 70% of this quantity is derived from the ocean, 20% from freshwater, and 10% from fish farms.

1.1.6 Climate

Although 90% of Brazil is located within the tropical zone, Brazil's climate varies considerably from the mostly tropical zone in the North to the temperate zones below the Tropic of Capricorn (in the vicinity of Sao Paulo). Precipitation levels vary widely across the country. Most of Brazil has moderate rainfall of 1,000-1,500 millimeters per year, while the majority of the Amazon region is humid and receives an average annual rainfall of 1,600-3,600 millimeters (Library of Congress). The northeastern region of Brazil, with scarce rainfall and severe droughts, is the driest and hottest part of the country.

1.1.6 Relevant Treaties

Brazil is a signatory to the 1992 Convention on Biodiversity (CBD), and has been a party to the Convention of International Trade in Endangered Species of Wild Fauna and Flora (CITES) treaty since 1975. Brazil is also a signatory to the United Nations Framework Convention on Climate Change. In June 2002, Brazil ratified the Kyoto Protocol.

1.2 MAJOR BIOMES

The enormous magnitude of Brazilian biodiversity is directly linked to the extraordinary wealth of the ecosystems in its biomes, summarized below. A map of Brazil's major biomes and a more detailed description of biome vegetation types are attached as Appendices A and B, respectively.

1.2.1 Brazilian Amazon

The Amazon rainforest is the world's largest remaining tropical forest and accounts for 40% of the world's tropical forests. The Brazilian Amazon (Amazonia) covers almost 3.7 square kilometers of primarily northern Brazilian territory and comprises more than 50% of the Amazon rainforest. Amazonia occupies nine states in the North, Northeast, and Center-west--Amazonas, Acre, Amapa, Para, Rondonia, Roraima, Tocantins, Mato Grosso, and Maranhao--and accounts for approximately 42% of the national territory. An estimated 75% of the Brazilian Amazon is under forest cover, 14% is comprised of savannas and grasslands, and 15% has been deforested for cattle pasture and agricultural activities. Approximately 85% of the Brazilian Amazon's original forest cover remains.

1.2.2 Atlantic Forest

The Atlantic Forest, or *Mata Atlantica*, is located along the Atlantic Coast over an area of one million square kilometers. The Atlantic Forest--consisting of high-altitude areas, montane ecosystems, *restingas* (coastal forests/scrub on sandy soils), sandbanks, mangroves, *Araucaria* forests and *campos sulinos* (grasslands in the south)--is one of the most highly endemic, important repositories of biodiversity in the world. Approximately 70% of Brazil's population and most of Brazil's industrial production is located in the Atlantic Forest biome (Government of Brazil, 1997). Urban and industrial development has severely depleted the Atlantic Forest, leaving only fragments of forested areas (7.5% of its original 1.2 million square kilometers).

1.2.3 Cerrado

The Cerrado primarily consists of scrub woodland, forest, and high-altitude moorlands in the drier areas of the central plateau. At two million square kilometers, the Cerrado is considered to be the largest savanna area in any single country. The Cerrado occupies approximately 20% of the national territory, primarily in the states of Mato Grosso and Goias, but also in Bahia, Minas Gerais and Sao Paulo. The climate of the Cerrado is diverse, with one dry and one humid season. Soils are relatively sandy and irrigation is accomplished primarily through extraction from the shallow water table via Artesian wells. Technological advances dealing with aridity and acidic soils have facilitated the expansion of ranching and soybean production. Extensive livestock management is the dominant land use in the Cerrado.

1.2.4 Caatinga

The Caatinga consists of one million square kilometers of vast semi-arid landscapes in northeastern Brazil and north of the state of Minas Gerais. This biome is comprised of thorn scrub and deciduous forest, as well as isolated rain forest patches (*brejos*). The climate is hot and dry with low rainfall ranging between 300 and 800 millimeters annually (Library of Congress). Cattle and goat ranching, irrigated farmlands, and firewood cutting for steel mills and brick factories are the primary land uses and have resulted in the desertification of 40,000 square kilometers of the biome (Government of Brazil, 1997).

1.2.5 Pantanal

The Pantanal, the world's most extensive wetland, is located primarily in mid-western Brazil in the basin of the Paraguay River and extends into the countries of Bolivia and Paraguay. The Brazilian Pantanal covers approximately 140,000 square kilometers in the state of Mato Grosso, is relatively flat, and is enclosed by mountains that hinder water drainage. The Pantanal performs essential flood-control functions by retaining the floodwaters of the Upper Paraguay River and protecting population centers located below the system's confluence in Paraguay. The Southern Pantanal is covered by flooded grass fields that are used for cattle feeding, small elevations and ciliary forests, while the Northern Pantanal shows a strong Amazon influence and is covered by denser forests.

1.2.6 Coastal biomes

Brazil's coastal and maritime biomes on the eastern side of the country occupy nearly 3.5 million square kilometers. The cold coastal waters off the south and southeastern coasts (Argentinean zone) and warm waters off the eastern, northeastern and northern coasts

(Caribbean zone) support a wide range of coastal and offshore ecosystems including coral reefs, dunes, wetlands, lagoons, estuaries, and mangrove swamps.

1.3 BIODIVERSITY AND ENDEMISM

Brazil is distinguished by a high concentration of biodiversity¹ and species endemism², a reflection of the richness and variety of its ecosystems. These high concentrations are a result of the wide variation that exists in climate and geomorphology over its large land area. A report by Conservation International, published in December 1997, ranks Brazil as the first of 17 megadiversity³ countries, due to the combination of its high species diversity and endemism (Mittermeier *et al*, 1997). A large number of distinct centers of endemism have been identified in the principal ecosystems of Brazil; for instance in the Amazon region alone, there are 13 for butterflies and six for terrestrial vertebrates.

Brazil is ranked first in the world in terms of the numbers of plant, freshwater fish, and mammal species, second for amphibians, third for birds, and fifth for reptiles (see Table 1). Brazil alone accounts for approximately 10-20% of the world's species and 22% of the world's total flora.⁴ However, due to the richness of the biomes and technical difficulty of identifying and categorizing species, the actual numbers of species are not definitive. In particular, only broad generalizations can be made about invertebrate species numbers and endemism in Brazil (Government of Brazil, 1997).

Table 1. Biodiversity and Endemism in Brazil

Species Category	Number of Species	Number of Endemic Species	% Endemism	% Total World Species	World Ranking
Freshwater Fish	>3,000	n/a	n/a	22	1
Marine Fish	750	n/a	n/a	n/a	n/a
Amphibians	517	294	57	12	2
Birds	1,622	191	>12	9	3
Mammals	524	131	25	9	1
Reptiles	468	172	37	7	5
Plants	50,000-56,000	16,500-18,500	7	22	1

n/a: information unavailable
Source: DFID *et al*, 2000a

Although Brazil is one of the few megadiverse countries that has an extensive system of academic and research institutions, scientific research and surveys on species diversity in the country are incomplete. One of the limitations regarding the accuracy and completeness of information on existing species and endemism is the varying concentration of researchers and specialists in certain regions of the country (Government of Brazil, 1997). For example, botanical collection is unevenly distributed in the Amazon, in the northeastern Atlantic Forest, and the state of Sao Paulo. Also, ornithological

¹ Biodiversity is defined as biological variability at the ecosystem, species, and gene level.

² Species endemism refers to those species that occur within a defined area.

³ Megadiversity indicates a high concentration of biodiversity and species endemism. The 17 megadiverse countries that contain 70% of the world's biodiversity are Australia, Brazil, China, Colombia, Ecuador, South Africa, Venezuela, Papua New Guinea, Malaysia, the Philippines, the United States, India, Indonesia, Madagascar, Mexico, Peru, and the Democratic Republic of the Congo.

⁴ International Union for Conservation of Nature and Natural Resources (IUCN), 1996

research is limited in the Amazon and the Cerrado, and countrywide distribution data for amphibians is scarce.

1.4 BRAZIL'S SPECIES DIVERSITY

Conservation International has ranked the Atlantic Forest and Cerrado biomes as fifth and twelfth, respectively, among the top global biodiversity hotspots⁵ in the world. The high biodiversity in the Atlantic Forest is a function of the extreme environmental variation of the biome in terms of latitude, altitude and occurrence of coastal and inland ecosystems. The Atlantic Forest also has a very high rate of species endemism with approximately 6,000 plant species (including 50% of its tree species), 199 bird species, 73 mammal species, and 260 reptile species.⁶ The savanna ecosystems of the Cerrado are believed to contain the largest diversity of all savanna floras in the world (UNEP, 2000). Other biomes highly ranked in terms of biodiversity and endemism include the Brazilian Amazon, which is believed to have an estimated 50% of the world's biodiversity.

1.4.1 Plants

Angiosperms (flowering plants) are the principal and economically most important group of terrestrial plants in Brazil, and include nearly all of the cultivated plants (Government of Brazil, 1997). Globally, there are approximately 250,000 angiosperm species, while estimates for Brazil are in the range of 50,000-56,000. By way of comparison, the species estimates for North America, Europe, and Africa are 17,000, 12,500 and 40,000-45,000, respectively. Other higher-plant species include gymnosperms (non-flowering plants), pteridophyta (herbaceous plants), and bryophytes (mosses). Brazil's 10 species of gymnosperms include important timber sources such as the native *Araucaria* in the south and the non-native *Pinus*. Of the 12,000 species of Pteridophyta known in the world, approximately 1,200-1,300 occur in Brazil, mostly in the Atlantic Forest and Amazonia. The total estimated number of bryophyte species occurring in Brazil is 3,100, which is approximately 20-25% of the world's total species. Bryophytes are also well-represented in the Atlantic forest and Amazonia.

1.4.2 Birds

There are 1,677 known bird species in Brazil out of a total of 9,050 known worldwide, making Brazil third in the world ranking. The Atlantic Forest contains at least 146 species of birds, of which 68 subspecies are endemic (World Bank, 2000).

1.4.3 Mammals

There are 524 known mammal species in Brazil, of a total of 4,500 worldwide. However, the number for Brazilian mammal species is believed to be low and is expected to increase as new identifications and classifications are made. For example, eight new species of monkeys (seven in Amazonia and one in the Atlantic Forest) have been identified as recently as the last decade. Brazil also has a high number of endemic mammalian species. Approximately 39% of the estimated 130 mammal species in the Atlantic Forest region are endemic, while an estimated 80% of the primates are endemic (Government of Brazil, 1997).

⁵ A biodiversity hotspot is an area characterized by high species richness that is under exceptional human-induced pressure.

⁶ United Nations Foundation Wire, 1999

1.4.4 Amphibians

Brazil is ranked second highest in the world for number of amphibian species (517 out of a worldwide total of 4,500). Amphibian species in Brazil primarily consist of frogs, toads, tree frogs, salamanders, and blind snakes. The number of known amphibian species in Brazil is expected to increase due to growing interest in frog collecting in Amazonia and the Atlantic Forest.

1.4.5 Reptiles

Brazil has 468 reptile species out of the 6,400 species known in the world and is ranked fifth for reptile diversity. Brazilian reptiles include tortoises, turtles, snakes, lizards, alligators and crocodiles. Snakes and lizards are the most diverse group, especially in Amazonia.

1.4.6 Fish

Brazil has the highest diversity of freshwater fish of any country in the world.⁷ Current estimates for Brazil marine and freshwater fish species are 750 and 3,000, respectively, of a world total of 24,000. Fish diversity is poorly documented in the Amazon basin, which is the center of origin and dispersal for a large number of freshwater fish; the real number of freshwater species may be as high as 3,000-5,000. Current estimates for river basins outside the Amazon include 150 species for the Sao Francisco river basin and 500 for the basins of Rios Parana, Paraguai and Uruguai.

1.4.7 Invertebrates

Invertebrates comprise 95% of known animal species. Species estimates for invertebrates in Brazil range from five million to ten million, but most have yet to be described and categorized.

1.5 THREATENED AND ENDANGERED SPECIES

Brazil has the second largest number of threatened bird species in the world, and the fourth highest number of threatened mammal species (see Table 2). IBAMA released an official list of 218 species of threatened fauna in December 1989.⁸ Revisions in 1992 and 1997 added 10 more endangered species to the list. In 1992, a list of endangered and vulnerable plants was published that listed 100 species.⁹ Both flora and fauna lists address status on a countrywide basis and are not classified according to biome. For example, a species that is widespread in Amazonia but highly threatened or even extinct in other parts of its geographic distribution will not be included on the IBAMA threatened species list. Brazil's endemic species are particularly susceptible to extinction from exploitation and habitat loss.

⁷ Compared, for example, to an average of 320 species in European rivers and lakes.

⁸ As a signatory to the Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES), the species on the official Brazilian list can be included in Annex 3 of the Convention.

⁹ The 2000 IUCN list indicates 338 endangered and vulnerable plants in Brazil.

Table 2. Endangered, Threatened, Vulnerable, and Extinct Species in Brazil

Species Category	Endangered, Threatened and Vulnerable Species	Extinct Species
Mammals	79	0
Birds	113	2
Reptiles	22	0
Amphibians	6	0
Fish	16	0
Invertebrates	34	5
Plants	338	15
Total	608	22

Source: IUCN, 2000

The uneven distribution of threats to Brazil's species has resulted in the development of several regional censuses and localized species lists by several states, including Parana, Minas Gerais and Sao Paulo. Each state list is based on the national listings but are specific to local conditions, reflecting geographic distributions and regional differences in threats such as hunting, extractivist activities and habitat destruction.

1.6 TROPICAL FORESTS

Tropical forests cover more than 65% (5.51 million square kilometers) of Brazil's total land area (World Bank, 2000). This forested area in Brazil accounts for 59.8% of the forests in tropical South America and 26.6% of the world's tropical forests. Approximately 90% of the country's remaining forest cover is located in the Amazon and the Cerrado. The rest of Brazil's forest resources are located in several areas--the Atlantic Forest, coastal *restingas*, the Caatinga, and deciduous seasonal forest that are located beyond the Atlantic Forest.

Tropical forests are characterized by high productivity and long cycles of change and growth that render a mosaic of gap, growth and mature forest patches favorable to a high diversity of species (DFID *et al*, 2000b). However, only 20% of the nutrients found in rainforests are in the soil; the rest reside within the living biomass. Therefore, although tropical rainforests can rapidly recover from low-impact changes, they do not readily recover from large-scale changes in structure or composition to the canopy.

1.6.1 Ecological Services

The tropical forests of Brazil are important for the ecosystem services they provide, including watershed protection, carbon sequestration¹⁰, and habitat for a diversity of plant and animal species. Although tropical forests only cover 7% of the world's land surface, they are inhabited by an estimated 80% of the world's tree species and 50% of the world's species as a whole (DFID *et al*, 2000a). The Amazon tropical rainforest is not only noted for high biodiversity, but also in terms of ecosystems and genetic diversity within the same species. It is believed that tropical forest loss and degradation will be the single greatest cause of all species extinctions in the next 50 years (DFID *et al*, 2000b).

Tropical forests also play an important role in global climate change by providing a reservoir of stored carbon in biomass and soil. Forests can either act as sinks through the

¹⁰ The total carbon sequestered in Brazilian forests is estimated to be 518 to 1,245 billion tons, or 140 to 350 tons per hectare.

uptake of atmospheric carbon dioxide, or as sources through the emitting of carbon dioxide from burning and decay of biomass and soil disturbances. Net carbon dioxide emissions from changes in land use (primarily deforestation occurring mainly in tropical areas) currently contribute approximately 20% of global anthropogenic carbon dioxide emissions (DFID *et al*, 2000b). In addition to being a significant carbon sink, Brazil is also a substantial producer of greenhouse gas emissions, with 6% of the global total. Brazil's emissions from land use sources--primarily caused by habitat conversion in the Amazon and Cerrado biomes--are greater than those of any other country (USAID, 2002b).

1.6.2 Economic and Social Services

In addition to ecosystem services, tropical forests also provide valuable commercial timber sources and a variety of non-timber forest products (NTFPs) including fuelwood, food, and medicine. It is estimated that in the world drug market, approximately 40% of medicines originate from natural sources (Fana and Hermann). In the United States, 25% of commonly prescribed pharmaceutical products contain active ingredients derived from plants and over 3,000 antibiotics are derived from microorganisms (Government of Brazil, 1997). Forests also support local community livelihoods by providing means of subsistence, supplies for barter, construction and clothing materials, medicines, and fuel (DFID *et al*, 2000b).

1.7 PROTECTED AREAS

Brazil has established a national system of protected areas, or conservation units (CUs) under the Law of National System of Conservation Units (SNUC). All CUs are classified into two groups: (1) "strictly protected" (consisting of national parks, biological reserves, ecological reserves, ecological stations, and areas of relevant ecological interest) in which exploitation or extractivism is prohibited but indirect use is permitted; and (2) "sustainable resource use" (consisting of Environmental Protection Areas, national forests, and extractivist reserves) which allow for resource exploitation but on a planned and regulated basis. There are currently 184 federal protected areas covering an area of 390,682 square kilometers, or 4.59% of the national territory (see Table 3). Of this, 1.87% of the national territory consists of Strictly Protected CUs and 2.72% consists of Sustainable Use CUs.

Table 3. Federal Protected Areas in Brazil

Category/Units	Number	Total Area (km ²)	% of Country Territory
<i>Strict Preservation</i>	103	158,895	1.87
National Parks	36		
Biological Reserves	23		
Ecological Stations	21		
Ecological Reserves	5		
Areas of Relevant Ecological Interest	18		
<i>Sustainable Use</i>	81	231,787	2.72
Environmental Protection Areas	24		
National Forests	46		
Extractive Reserves	11		
Total	184	390,682	4.59

Source: World Wildlife Fund, 1999

In addition to national protected areas, 11.38% of the national territory has been reserved for indigenous groups, although at present only 62% (63.1 million hectares) has been officially registered and demarcated (Government of Brazil, 1997). This "official" network of indigenous parks and reserves comprises 7.3% of the Brazil's surface area.

An estimated 451 state-administered conservation areas covering 29.8 million hectares have also been established. Other areas protected to some level include 341,000 hectares of Private Natural Heritage Reserves, and numerous, smaller, municipal protected areas. In addition, many universities and research institutes such as the National Institute for Amazon Research and the Brazilian Institute for Geography and Statistics maintain relatively small conservation areas reserved for scientific purposes.

The protected areas that have been established do not correspond to biome vulnerability or biodiversity levels. For instance, less than 1% of the Cerrado biome and 2% (33,084 square kilometers) of the Atlantic Forest have been designated as protected areas (Critical Ecosystem Partnership Fund). In addition, there is minimal protection of land in the Caatinga, or of the high-value endemic *araucaria* forests in southern Brazil. Of the seven principle biomes, Amazonia has the largest percentage of strictly protected areas, at 3.2%, or 12 million hectares (Global Environment Facility, 2002). This amount of strictly protected areas is significantly lower than other Amazon countries. For example, at least 15% of the Amazon territory in Venezuela, Colombia, and Ecuador is designated as strictly protected.¹¹

Deforestation and land occupancy in areas contiguous to protected areas from development and farming have transformed many protected areas into "green islands" that are under constant external pressure. Other problems central to the integrity of Brazil's protected areas include lack of financial resources to develop and implement management plans, insufficient technical personnel and equipment to police and manage areas, poaching and illegal harvesting, and inadequate sizes to ensure genetically viable populations of larger and wider-ranging species (World Wildlife Fund, 1999).

¹¹ Fifteen percent of the Amazon territory in Colombia and Ecuador is considered strictly protected while eighteen percent of Venezuela's Amazon territory is designated as strict protection.

Synopsis of Deforestation and Principle Threats

2.1 DEFORESTATION

2.1.1 Amazonia

Between 1978 and 1988, annual deforestation rates in the Brazilian Amazon were as high as 0.54% of the total forest cover area, or 21,130 square kilometers a year (Skole and Tucker). From 1978 to 1997, the total deforested area in Amazonia is estimated to have increased from 78,000 to 530,000 square kilometers (Government of Brazil, 1997). Deforestation in the Brazilian Amazon increased 30%, from 13,200 to 17,800 square kilometers between 1997 and 1998¹², while preliminary data from the National Space Research Institute (INPE) indicates a 15% increase (17,259 to 19,382 square kilometers) in Amazonian deforestation from 1999-2000 (Pool *et al*, 2002). Most of the deforestation in Amazonia has occurred in an arc on the southern basin, a reflection of the northward shift of the agricultural frontier.

2.1.2 Atlantic Forest

The Atlantic Forest once covered 1.1 million square kilometers in 17 Brazilian states along most of the coastal region and well inland. Agriculture and urban development has resulted in a drastic reduction of the native vegetation in this biome, which today is only sparsely distributed along the Brazilian coast, in the interior of the South and Southeast and some isolated areas in Goias, Mato Grosso, and in the northeastern interior. More than 5,000 square kilometers of Atlantic coastal forest was lost between 1990 and 1995 (see Table 3).¹³ The Atlantic Forest is now reduced to less than 7.5% of its original area, mainly due to the high human population densities and urban development along the eastern coast.

Table 3. Deforestation in the Atlantic Rainforest, 1990-95 (km²)

State	Area	Forested Area 1990	Forested Area 1995	Deforestation Area	
				km ²	%
Rio de Janeiro	44,081.11	10,692.30	9,288.58	1,403.72	13.13
Mato Grosso	357,424.10	437.52	395.55	41.97	9.59
Goias	340,165.90	71.19	64.71	6.48	9.10
Minas Gerais	587,172.00	12,140.59	11,251.08	8889.51	7.33
Espirito Santo	46,115.22	4,097.41	3,873.13	224.28	5.47
Rio Grande do Sul	278,946.64	5,352.55	5,064.62	287.93	5.38
Parana	198,086.03	18,151.37	17,305.28	846.09	4.66
Santa Catarina	95,716.47	17,291.60	16,662.41	629.19	3.64
Sao Paulo	241,752.11	18,589.59	17,915.59	674.00	3.63
TOTAL	2,189,459.58	86,824.12	81,829.95	5,003.17	5.76

Source: SOS Mata Atlantica, INPE and ISA, 1998

¹² United Nations Foundation Wire, 1999

¹³ World Bank, 2000

2.1.3 Caatinga and Cerrado

The total deforestation area of the Caatinga associated with the clearing of *caatinga* trees for firewood and charcoal production in semi-arid northeastern Brazil is estimated to be in the range of 5,300-11,200 square kilometers per year (Mishizawa and Uitto, 1995). Deforestation rates for the Cerrado are more difficult to establish due to the limited capacity of current satellite technology to detect land-use changes in savanna ecosystems as compared to the closed-canopy forests of Amazonia or the Atlantic Forest (Emery and Tucker, 1996).

2.2 PRINCIPLE THREATS

The four principle threats to the biodiversity and tropical forest resources of Brazil include unsustainable logging practices, habitat conversion driven by agricultural expansion, urban and industrial development, and poaching and animal trading. Other threats include increased flammability of forests, domestic and industrial energy demands and the introduction of exotic species.

2.2.1 Logging

Only 14% of the timber extracted from Brazil is exported; the remainder is used for the domestic market (World Bank, 2000). At present, Brazil contributes 8% to the world trade in tropical timber¹⁴, but is the world's largest consumer of tropical wood, accounting for 34% of global consumption (DFID *et al*, 2000a). Domestic uses for timber include civil construction, wood laminates, plywood, and improved wood products such as flooring, doors, and furniture. Sources of timber products include native forests and industrial eucalyptus and pine plantations in the southern region of the country (Westman, 2001).

The majority of commercial logging in Brazil has occurred in the forested areas of the Atlantic Forest, the Cerrado, and the Brazilian Amazon (World Bank, 2000). The Atlantic Forest historically provided the Brazilian timber sector most of its supplies until the 1980s when a depletion of resources led to increased logging pressure in Amazonia. Forest production in the Brazilian Amazon increased from 4.5 million cubic meters to 28 million cubic meters between 1976 and 1998. In 1997, the Amazonian states of Rondonia, Mato Grosso, and Para provided 93% of the total timber produced in Brazil (Government of Brazil, 1997). Growth is expected to continue at a rate of 5%-7% yearly, due to increases in market demand and the diminishment of traditional tropical timber sources in Southeast Asia (World Bank, 2000).

Conventional commercial logging in Brazil is generally poorly managed. The Brazilian Forestry Code requires that all natural forest harvesting activities must use sustainable forest management practices that maintain a healthy ecosystem (Government of Brazil, 1997). However, the majority of logging operations have inadequate management plans; for example, a 2001 evaluation survey by an independent expert committee found only 32 of 315 Amazonian management plans to be adequate (Critical Ecosystem Partnership Fund). It has been estimated that only 2% of harvested timber is derived from forests that are managed in accordance with sustainable management regulations (Pool *et al*, 2002). In addition to compromising the integrity of forested ecosystems, unsustainable practices negatively impact biodiversity—at least 41 Amazonian species are currently at risk of extinction due to poor management (World Bank, 2000).

¹⁴ First National Report on the Convention for Biodiversity Conservation, Government of Brazil (1997)

Recent investigations by IBAMA have also revealed that up to 80% of timber commerce in Amazonia is illegal (Government of Brazil, 1997). Illegal logging exacerbates conflict in Brazilian tropical forestry regions and leads to increased poverty among inhabitants and degradation of natural resources. Many indigenous lands are used illegally by non-landholders for logging, as well as for mining and agriculture. Protection of indigenous lands from illegal use has been inadequate, with indigenous people frequently having limited participation in decision-making regarding natural resource allocation on their lands (World Bank, 2000).

Because the Amazon forest is highly heterogeneous in terms of wood species per hectare, there is considerable distance between individual trees of high economic value (Library of Congress). Conventional selective logging is believed to damage 60-70% of the area harvested by causing the destruction of many other species through felling and transportation and increasing litter that becomes fodder for forest fires (Government of Brazil, 1997). The selective harvesting of higher-value species such as big-leaf mahogany (*Swietenia macrophylla*) and *cerejeira* threatens the integrity of forested systems and indigenous livelihoods. In Brazil, the "mahogany belt" comprises an area of approximately 800,000 square kilometers concentrated in Acre, southern Para, and parts of Rondonia, Amazonas, and Mato Grosso that coincide with numerous indigenous lands and areas of ecological conservation (World Bank, 2000).

2.2.2 Agricultural Expansion

Broader governmental development policies, tax incentives and subsidies have resulted in the expansion of agriculture-related activities in several of Brazil's biomes. The expansion of agriculture and pastureland has converted natural habitat into simpler pastures and cropland, with detrimental effects to forest resources and biodiversity. Natural habitat has been degraded through the outright destruction of large forested areas or through fragmentation.¹⁵ In addition to land clearing, cattle ranchers and small agricultural landholders also contribute to habitat degradation through constant and widespread timber extraction for fence stakes and subsistence agriculture (World Bank, 2000).

The conventional method of land clearing, slash-and-burn, is extensively used by smallholders in the Amazon due to its simplicity, minimal economic investment, and the short-term productive benefits it provides through the input of nutrient-rich ash into the infertile soil (Nepstad *et al*, 1999). The nutrients from the ash are quickly depleted, however, resulting in unproductive subsequent crops. Brazil's tropical soils are naturally poor in organic matter and nutrients, with little calcium, phosphorous and magnesium and high acidity and aluminum content (Library of Congress). Low soil fertility and abundant land has promoted a westward movement of the agricultural frontier that is associated with land degradation, abandonment of depleted cropping systems, and clearing of natural habitats (World Bank, 2000). The destruction of natural habitats through slash-and burn practices has resulted in biodiversity loss, increased soil erosion and pollution of waterways from agrochemical runoff.

The prime cause of deforestation in the Amazon region is the conversion of forests into pasture or agricultural land—the greatest activity being concentrated in the states of Mato Grosso, Para, Rondonia and Tocantins (Government of Brazil, 1997). Cattle ranching and

¹⁵ Fragmentation results when natural habitat is broken up into small, isolated patches that are too limited in size to maintain species stocks.

agricultural expansion have also resulted in the destruction of the natural habitat in the Atlantic Forest, the Cerrado, and the Caatinga. The most severely converted territory within the Atlantic Forest lies within the state of Espírito Santo, where pastures, coffee, and *Eucalyptus* plantations have replaced most of the original forest (Critical Ecosystem Partnership Fund). In the Cerrado, agricultural expansion has increased at an annual rate of 3%, leading to a loss of more than 40% of its original vegetation. Agricultural activities have also impacted the Caatinga, where the remaining area of forest in the northeastern states was reduced from 1,009,915 to 727,695 square kilometers in 1984 to 1990, a loss of 47% of the original area (Government of Brazil, 1997).

Slash-and-burn cycles are also used by the growing ranching sector to clear and maintain pastures. Between 1970 and 1991, the sizes of beef-cattle herds in Brazil increased at an annual rate of 3.1%, from 78.5 million head to 152.1 million head (Library of Congress). The beef-cattle industry in areas near Brazil's more developed states is considerably modernized and based on the agribusiness sector. In the frontier areas, however, the beef-cattle industry is substantially more traditional, and is characterized by low productivity and management problems. Grazing is presently one of the most intensive land uses in the state of Rio de Janeiro. More than 1.8 million head of cattle occupy the region, grazing on 19,300 square kilometers (44.5%) of the state (Critical Ecosystem Partnership Fund).

2.2.3 Urban and Industrial Development

High population concentration and economic development along the coastal cities of Brazil has greatly transformed natural habitats. The Atlantic Forest in particular has been directly impacted by urban development related to a substantial population increase over the last 30 years (Government of Brazil, 1997). The development of tourist accommodations and other real estate projects have also negatively impacted the forested areas in coastal regions, through the suppression of the understory forest, impoundment of streams and creeks, and transportation construction (Critical Ecosystem Partnership Fund).

Urban expansion in the coastal regions of Brazil has resulted in surface water pollution from untreated sewage outflow, the deforestation of mangroves and *restingas*, localized hazardous waste pollution, and air pollution. For example, on the Espírito Santo coastline, coastal development has caused the destruction of natural habitats, pollution of rivers and beaches, and deforestation. Air pollution from the Rio-Sao Paulo region, the most industrialized site in the country (accounting for 10% of the nation's exports), has resulted in acid rain damage to forest remnants (Critical Ecosystem Partnership Fund). Urban pollution also threatens the ecological health of the Brazilian Pantanal. Untreated domestic sewage and garbage from the rapidly-growing domestic centers in the highlands outside of the Pantanal (particularly from Cuiaba, the capital of Mato Grosso in the northern Pantanal) has resulted in organic loading, sedimentation and chemical contamination of the wetlands (Swarts, 2000).

Mining activity threatens the integrity of ecosystems through the removal of vegetation and production of pollution. The hillside extraction of materials in the Serra do Mar corridor in the Atlantic Forest has caused deforestation, erosion, flooding, and the silting of waterways. Mercury contamination of aquatic systems from gold mining operations is particularly prominent in the state of Mato Grosso; a 1998 federal government prohibition on the use of mercury has been ineffective due to lack of enforcement and the isolated location of most mining activities (Critical Ecosystem Partnership Fund).

2.2.4 Poaching and Animal Trading

Approximately one-tenth of the world \$10 billion/year wild animal trade is derived from Brazil and contributes to the threatened status of 171 Brazilian species (Critical Ecosystem Partnership Fund). Primary targets of the illegal animal trading business include threatened capuchin monkeys, golden lion tamarin, and exotic bird species such as macaws, parrots, and toucans. The economic incentives for animal trafficking are high; for example, a hyacinthine macaw is worth \$6,500-\$12,000 in the United States, while other Brazilian macaws can fetch between \$900-\$1,800 (Swarts, 2000).

Although the Wildlife Protection Act of 1967 banned sport hunting in Brazil in 1967, the substantial poaching of large fauna in the Pantanal still continues (Swarts, 2000). Subsistence hunting in protected areas also contributes to the decline of wildlife in Brazil-- a recent interview revealed that 42% of local residents in areas adjacent to the Una Biological Reserve admitted to meeting acute subsistence needs through hunting (Critical Ecosystem Partnership Fund).

2.2.5 Increased Forest Flammability

Fire is used by ranchers and farmers to clear virgin forest, remove secondary forest growth and burn pastures to encourage the growth of grass. Fires and drought increase the likelihood of fires in subsequent years by drying out the upper layers of soil, making it more difficult for forested areas to retain moisture that acts as a natural barrier against fires. Conventional logging practices also increases forest fire flammability by killing or damaging 10-40% of living biomass, reducing canopy coverage by 14-50%, and allowing sunlight to penetrate to the forest floor and dry out the organic debris left by logging (USAID, 2002b). Forest fires cause biodiversity loss, hinder potential income generation through the destruction of commercial timber supplies and NTFPs, release carbon into the atmosphere, and reduce carbon sequestration capacity (Nepstad *et al*, 1999).

The combination of drought, forest degradation from logging, and use of fire in agriculture and ranching has increased forest fire vulnerability in the Amazon forest and other regions, particularly during the dry seasons. During the 1998 dry season, large-scale wildfires burned approximately 40,000 square kilometers (20%) of the state of Roraima (World Bank, 2000). In the Caparao National Park in Espirito Santo, 485 fires were detected by satellite imaging in September 2001 (Critical Ecosystem Partnership Fund). Fires of human origin are also particularly prevalent in the Brazilian Pantanal and highlands during September and October (Swarts, 2000).

2.2.6 Energy Demands

Approximately 25 million rural people remain unconnected to Brazil's electricity grid (USAID, 2002a). In the northeast, approximately 70% of the rural population does not have access to electricity; firewood from the Caatinga accounts for 35% of the energy supply in this region (Government of Brazil, 2001). Plant biomass, including sugar-cane alcohol, firewood and charcoal, provides 26% of Brazil's energy demands for industry and domestic consumption (Government of Brazil, 1997). In the southeastern state of Minas Gerais, 60% of the domestic energy consumed comes from firewood, while 36% of industrial energy is derived from charcoal (DFID *et al*, 2000a). More than 80% of the charcoal used in the Brazilian steel industry is derived from native *cerrado* trees.

2.2.7 Exotic Species

Introduced exotic species typically replace native flora and fauna through competition, predation, or parasitism, and may change the dynamics of ecosystem functions. The development of tourism properties along the coastal regions of Brazil have resulted in the introduction of exotic ornamental tree and plant species to the region, threatening the viability of native flora (Critical Ecosystem Partnership Fund). For example, *Impatiens balsamica*, an exotic species that colonizes the banks of streams and creeks undermine the viability of native riparian species while the cultivation of exotic tree species such as almond trees, *casuarina* and *leucena* in lagoons compete with mangroves for sunlight and ultimately threaten their existence (Critical Ecosystem Partnership Fund).

The introduction of exotic animal species has also had detrimental effects on native Brazilian species. Apiculture with alien species, particularly *Apis mellifera*, interferes with the ecology of native bees. Riparian fish hatcheries threaten biodiversity in the Atlantic Forest region, since exotic species often compete with native species for food and habitat. At least 16 exotic fish species are believed to exist in the rivers of the Paraíba do Sul valley (Critical Ecosystem Partnership Fund). In highland areas, trout compete with native species as a result of escaping from trout farms, or being intentionally released into estuaries. Domestic animals are also known to prey upon or compete with local native species on the margins of human settlements.

2.3 SPECIFIC THREATS TO BIOMES

2.3.1 Amazonia

The Brazilian Amazon is currently the most well-preserved biome, with an estimated 4.59% allocated to protected areas and 85% still forested. Threats include fires and forest destruction that are associated with agriculture, cattle ranching and selective logging. Increased mining activities result in habitat degradation, soil erosion and the contamination of the Amazon's river systems.

2.3.2 Atlantic Forest

The main threat for the Atlantic forest is deforestation from agriculture and ranching, the creation of plantations, and housing development. Urban and industrial pollution is also a major threat to the air and water of Atlantic forest ecosystems.

2.3.3 Cerrado

In the past, the contamination and silting of rivers due to mining was the major threat to the Cerrado. Since the mid-20th century, however, intensive farming, cattle ranching and human settlement are the principle threats through deforestation, erosion, and pollution. Monocultural crops such as soybeans, rice, maize, and wheat have depleted soils and contaminated water and soils with agrochemicals. The extraction of wood for charcoal, which is used in iron and steel industry as well as for domestic purposes has also contributed to the degradation of natural vegetation in the Cerrado.

2.3.4 Caatinga

Extensive cattle ranching, agriculture, subsistence farming, and hunting during the dry season have had major impacts on the Caatinga. Vegetation is also affected by the

collection of fuelwood and charcoal for energy. The natural vegetation of the Caatinga covers less than 50% of its original area.

2.3.5 Pantanal

The principal threat to biodiversity in the Brazilian Pantanal is poaching; however, land clearing for agricultural development in the Brazilian highlands is also a substantial threat and has led to increased erosion, sedimentation and agrochemical pollution of the Pantanal waterways.

2.3.6 Coastal Zone

Specific threats to the Brazilian coastal ecosystems include real estate development, overfishing, and industrial and urban pollution of estuaries.

Obstacles to Mitigating Principle Threats

There are four primary obstacles to mitigating threats to Brazil's biodiversity and tropical forests: (1) ineffective government policies and programs; (2) capacity limits related to sustainable resource use; (3) poverty; and (4) migration.

3.1 INEFFECTIVE GOVERNMENT POLICIES AND PROGRAMS

In recent years, Brazil has made impressive gains in formulating the regulatory and policy framework associated with curbing forest destruction and environmental degradation. Environmental public policies and regulations in Brazil, though advanced, have historically been inadequately implemented and enforced (Government of Brazil, 1997). Despite a favorable policy and regulatory framework and substantial external funding, environmental protection efforts have generally not been effective. Resource exploitation and habitat degradation has been attributed to problems of governance, fiscal and resource issues, and ambiguity about appropriate tradeoffs between the environment and economic development (Library of Congress).

3.1.1 Government Pro-Settlement Initiatives

Some of the policies and programs implemented by the Brazilian government in the past have encouraged environmental degradation through settlement and development. Roads built in the 1970s as part of a national integration plan resulted in increased access to forested areas in Amazonia and subsequent land clearing for homesteads, crops and cattle ranching (World Bank, 2000). Until 1985, government settlement policies provided substantial incentives for mining and agricultural expansion in previously unoccupied areas of the Amazon and Cerrado, which resulted in the widespread degradation of natural habitats (Government of Brazil, 1997). Recognizing past errors, the Brazilian government now prohibits establishment of settlement projects in primary forest areas.

3.1.2 Integration of Economic Development and Resource Conservation Policies

Despite the establishment of several government environmental quality initiatives, there is little integration of economic development and resource conservation policies in Brazil. National economic development policies have often contradicted the objectives established by resource conservation programs. In addition, it is customary for economic development issues to be addressed with little involvement of the MMA. A recent example of Brazil's challenge to mainstream environmental issues into development policies and programs is evident with the recently developed Advance Brazil (*Avança Brasil*) program. The Advance Brazil program was developed with minimal involvement of the environment sector or civil society (World Bank, 2000).¹⁶

Under the \$40 billion Advance Brazil program, 6,245 kilometers of roads will be paved to facilitate better access to agricultural markets, expanding the length of paved highways in the Amazon from 12,000-18,000 kilometers (Pool *et al*, 2002). Critics of the program believe that paved roads will serve as an incentive to increase cultivation activities in the adjacent areas, as well as facilitate easier access to indigenous reserves and protected

¹⁶ However, the Brazilian government has engaged civil society in subsequent impact assessment and monitoring efforts.

areas for exploitation. Under the proposed program, an estimated 120,000-279,000 square kilometers of additional deforestation may occur over the next two to three decades (USAID, 2002b).

3.1.3 Enforcement and Monitoring

National environmental government agencies have been unable to effectively oversee programs and enforce regulations due to limited financial resources, personnel, and equipment (Government of Brazil, 1997).¹⁷ Consequently, agencies such as IBAMA are seeking partnerships with state and local governments and the civil sector to assist with environmental oversight and regulatory compliance. For example, forest regulatory enforcement is starting to be delegated to state and local governments, which may also have limited capacity to enforce regulations and monitor management practices.¹⁸ Other support has been secured from the military, police forces, and NGOs to administer and oversee some of the protected areas. In some of the extractivist and sustainable development reserves, IBAMA has been able to enlist the assistance of trained volunteers and community leaders (World Wildlife Fund, 1999).

3.2 CAPACITY LIMITS RELATED TO SUSTAINABLE RESOURCE USE

Capacity limits in the form of information gaps, system weaknesses and institutional barriers hinder the integration of natural resource sustainability principles into economic development strategies and land use management practices. Capacity is limited in several areas, including: (1) conservation corridors; (2) sustainable forest production systems; (3) appropriate land use management practices; and (4) training and extension opportunities for community forest and private sector practitioners.

3.2.1 Landscape and Conservation Corridor Research and Planning

The protected areas system established in Brazil has resulted in the establishment of fragmented conservation areas that are highly vulnerable to human impacts and ineffective at sustaining ecological processes (World Bank, 2000). The conventional focus on parks and reserves has recently shifted to include the development of biological corridors that connect fragments of natural forest across larger landscapes and incorporate the sustainable use of resources (Verissimo *et al*). Specifically, biological corridors would facilitate gene flow between species populations, ensure the sustainability of large-scale ecological and evolutionary processes¹⁹, and address the socioeconomic needs of human populations to better ensure the long-term viability of protected areas. The data acquired through landscape and conservation corridor research could be used to inform economic development and land use management options.

3.2.2 Sustainable Forest Production Systems

The current model of illegal logging, unplanned settlement, and forest degradation will lead to biodiversity losses and unsustainable timber extraction. Timber production in Amazonia is expected to increase in response to growing domestic and international demand (Government of Brazil, 1997). Given the anticipated expansion of the timber

¹⁷ Until recently, IBAMA has had 575 employees focused on protected areas administration (one employee for every 27,560 hectares).

¹⁸ In addition, some local entities have shown to be susceptible to local timber industry and development interests.

¹⁹ Conservation International, 2000

industry, the establishment of a coherent system of sustainably-managed production forests would more effectively address conservation and economic development concerns (Nepstad et al, 2002). Sustainable forest production systems could be enhanced through improved efficiency of production systems, strengthened marketing of sustainable production wood products and NTFPs, improved linkages between production and conservation through reduced-impact logging and regeneration techniques; and strengthened regulatory enforcement to favor legal forest production operations (Pool et al, 2002). Support for sustainable production systems could also assist with increasing the eligibility of forest units for certification.

3.2.3 Adoption of Sound Land-Use Management Practices

Current land-use practices in Brazil contribute to habitat degradation, marginal agricultural yields, and unstable income generation (USAID, 2002b). Improved interventions in forest management and fire prevention would promote natural resource sustainability, protect habitat and improve economic opportunities. Increased awareness of land-use options and associated consequences would better enable local communities and timber companies to make informed decisions regarding land use and management.

3.2.4 Training and Extension Opportunities for Forest Management Practitioners

Extension services in Brazil have historically focused on agricultural expansion with little reference to sustainable natural resource use principles or forest production management issues (World Bank, 2000). Forest management training that incorporates sustainability principles is essential to increased application of techniques that reduce habitat degradation and maintain long-term timber supply needs. The provision of training and technical assistance to industry and community forest managers in areas such as reduced-impact logging would facilitate increased awareness of sustainable management and promote the adoption of effective land-use management practices (USAID, 2002b).

3.3 POVERTY

3.3.1 Income Inequality

Brazil has the largest economy in South America, with a GDP of more than \$500 billion and average per capita GDP of \$2,245 (USAID, 2002a). However, Brazil has serious income distribution inequalities despite its efforts to control inflation and achieve economic stability. Nearly 53 million Brazilians, or 29.3% of the population, have an income of less than \$2 per day. Brazil's Gini index²⁰ is the third worst in the world at 0.549—lower only to the indices of Sierra Leone and the Central African Republic. The most severe income disparities are found in the North and Northeast, affecting 35 million people (USAID, 2002a). Per capita income in Amazonia is 60% of Brazil's average and has declined faster than any other region in Brazil since 1996 (USAID, 2002b). In the states of Para and Amazonas, for example, approximately 43% of the population live in extreme poverty.

A major consequence of income inequality in Brazil is exclusion of a large portion of the country's population from the economic and social mainstream, resulting in a high dependence on natural resources for subsistence. For instance, low income has been one of the major factors in the exploitation of forest resources for firewood and charcoal

²⁰ The Gini index of income and resource inequality is a measure of the degree to which a population shares that resource unequally. The index ranges from zero, indicating perfect equality (in which everyone receives an equal share), to one, indicating perfect inequality of resource distribution.

production in the state of Rio de Janeiro (Critical Ecosystem Partnership Fund). The livelihoods of the population of the Brazilian Amazon (approximately 13 million people) are tied to the forest, either directly through traditional activities such as rubber tapping and Brazil nut collection, or indirectly through dependence on water, energy, food in large urban areas (USAID, 2002b). Most of the population in the Northeast and North are engaged in agricultural or extractive activities (USAID, 2002a).

3.3.2 Land Distribution and Tenure Security

Land distribution in the Amazon is also highly skewed, with 1% of the population claiming 40% of Brazil's land area (Library of Congress). Land tenure security in Brazil is characterized by conflicting titles, undemarcated boundaries, and occupation by squatters (Global Environment Facility, 2002).²¹ The inadequacy of the land tenure system encourages resources exploitation over sustainable management since there is no assurance to landholders of continued access to those resources. Indigenous communities are legally entitled to harvest timber and engage in non-timber extractive uses based on an approved management plan, however, a substantial percentage of indigenous lands have yet to be demarcated. Consequently, a lack of awareness regarding property boundaries and land use rights has resulted in the resource exploitation of indigenous lands by outside interests (Pool *et al*, 2002).

3.4 MIGRATION

The enormous geopolitical differences between the regions of Brazil are reflected in the wide variations in socio-economic development, land use and occupancy. Regional differences in income have resulted in shifts in the human population to previously unoccupied areas, resulting in a loss of biodiversity and forest cover (Government of Brazil, 1997).

3.4.1 Urban Migration

During the 1950s through the 1970s, approximately 20 million people moved from rural to more industrialized urban areas in southeastern Brazil. Urban population grew at rates of about 5% per year (Library of Congress). Despite government settlement initiatives in the interior of the country, most social public policies continued to favor population concentration in the Southeast and large cities by promoting large-scale investments in industrialization and providing services and benefits primarily to urban residents.

Today, the South and Southeast regions are the most highly developed and industrialized parts of the country and continue to attract employment seekers, especially from the Northeast (DFID *et al*, 2000a). The Atlantic Forest region, from which an estimated 80% of Brazil's GDP is generated is home to approximately 70% of Brazil's 169 million people, mainly in the cities of Sao Paulo (population 11 million) and Rio de Janeiro (population 6 million) (Critical Ecosystem Partnership Fund).

²¹ A significant amount of the Brazilian Amazon (12%) is still categorized as "unclaimed government lands", creating favorable conditions for squatters and speculators.

3.4.2 Rural Migration

Migration to the interior of the country was initiated with the establishment of a new central capital, Brasilia, in the central-west, and by the military government policies in the 1960s through 1980s that promoted development projects in the Amazon such as roads, railroads, hydroelectric plants and mining operations and offered incentives for ranching and timber enterprises and planned settlement programs (Library of Congress). Many small landholdings were abandoned due to lack of adequate inputs, credit, markets, and social services, leading to a second urban migration.

Rural migration is currently impacting previously unoccupied areas of Amazonia, as well as other regions of the country. Desertification in the Northeast region of Brazil has resulted in the migration of Northeastern populations into the Amazon and the large urban areas in the South (Saunier *et al*, 2001). Major migrations have also accompanied the westward expansion of the agricultural and cattle ranching-frontiers, increase in mining, and the invasion of indigenous lands. The exhaustion of timber in older frontier areas is causing a chaotic migration of loggers to new frontier areas in western Para and southern Amazonas (Verissimo *et al*). Population in the Amazon states has increased from 5.7 million in 1960 to 18 million today and is expected to reach 27 million by 2010 (World Bank, 2000).

Conservation Efforts in Brazil**4.1 NATIONAL GOVERNMENT²²****4.1.1 Constitution**

Brazil's 1988 Constitution includes the basic provisions necessary for the protection of Brazil's biodiversity. The Constitution linked Brazil's 1981 National Environment Policy with a National System for the Environment that includes the National Environment Council (CONAMA), as well as municipal and state-level councils consisting of government authorities and representatives of civil society.

4.1.2 Governmental Environmental Institutions and Agencies

IBAMA was created in 1989 to implement environmental policy and execute environmental regulations. IBAMA is also responsible for managing federal protected areas and for coordinating state and municipal protected areas. The Ministry of Environment (MMA), established in 1992, is responsible for the planning, coordination and supervision of broader activities related to the National Environment Policy and the preservation of natural resources. The Secretariat for Biodiversity and Forests (SBF), created in 1999, is responsible for policy and regulatory development in biodiversity conservation, sustainable resource use, reforestation and control of forest fires (Government of Brazil, 2001). CONAMA is responsible for assessing of the environmental impacts of public and private projects, as well as the establishment of criteria and standards related to environmental quality. The National Council for the Amazon Region (CONAMAZ) was established to advise the President on Amazon policy.

4.1.3 Support for Biodiversity Conservation and Sustainable Forest Management

Brazil is a signatory to the Convention on Biological Diversity (CBD), which was signed in 1992 at the United Nations Conference on Environment and Development (UNCED). The CBD requires contracting parties to approve legislation that will advance national biodiversity protection. The MMA was assigned the responsibility of coordinating and implementing the CBD through the National Biodiversity Program (PRONABIO), a set of mechanisms developed to promote international cooperation, scientific research, demonstration projects and institutional support related to biodiversity conservation. CONAMA has also recently developed a National Biodiversity Policy in collaboration with non-governmental organizations (NGOs).

Financial and technical support for PRONABIO is derived from two complementary projects that are funded by the UNDP, the private sector, the Brazilian Government, and the Global Environmental Facility (through the International Bank for Reconstruction and Development). The Conservation and Sustainable Use of Brazilian Biological Diversity (PROBIO) project is implemented by MMA and supports the identification of priority actions and the development of demonstration studies and activities. The second project, the Brazilian Biodiversity Fund (FUNBIO), is a local biodiversity small grants program that is administered by the Getulio Vargas Foundation.

²² The majority of information on the national government's environmental protection efforts was obtained from Chapter 3 of the First National Report for the Convention for Biological Diversity.

Other research and management projects related to the conservation of biodiversity in Brazil are the National Environment Fund (NFMA) and the National Environment Program (PNMA). The NFMA, established in 1989 to finance environmental projects in Brazil, receives contributions from the Inter-American Development Bank (IDB), the Brazilian government, and a variety of individuals and companies. NFMA funds are used to support both government and NGO projects²³ in the areas of conservation, forestry extension, protected areas, sustainable natural resources management, environmental education, technological research and institutional development. The PNMA is financed by the World Bank and the German government and was established to improve the institutional capacity of Brazil's environmental agencies.

Most Brazilian government research programs are focused on agriculture and land husbandry rather than agroforestry, sustainable forest management, or reforestation (World Bank, 2000). EMBRAPA, Brazil's national agricultural research institute has historically emphasized agricultural development. Over the past decade, however, EMBRAPA research stations in the northern region have increased support of forest ecosystem research in collaboration with NGOs, universities, and other research institutions. For example, EMBRAPA and the Center for International Forestry Research (CIFOR) are currently working collaboratively on a forest sustainable management adoption system in the Brazilian Amazon (Pool *et al*, 2002). Brazilian extension services such as EMATER have historically focused on agricultural development and pasture management with little support for forest management.²⁴

4.1.4 Environmental Protection Regulations

Brazil has enacted several policies and regulations related to environmental protection; a more detailed synopsis of Brazil's environmental policy and regulatory framework is included in Appendix C. Examples of the foci addressed in Brazilian environmental regulations include land use and tenure, forestry management and concessions, wildlife and fisheries protection, bioprospecting, biosafety, and environmental crimes. The Law of Environmental Crimes, promulgated in 1998, authorizes environmental agencies to enforce environmental regulations and impose large financial penalties.

Brazil's forestry sector is extensively regulated, consisting of environmental impact assessment requirements, burning and clearing permits, cutting restrictions, forest management requirements, and export restrictions (World Bank, 2000). Recent regulatory forest protection measures include a 1996 presidential provisional measure increasing mandated intact forested areas on properties from 50-80%, and Decree No. 1963 which suspended all new authorizations and concessions for the commercial exploitation of mahogany and *Virola* trees.

4.1.5 Other Related Programs and Initiatives

Expansion of Protected Areas System. The management of protected areas in the Brazilian Amazon region is the primary responsibility of the MMA and IBAMA. Federal government investment in protected areas in the Amazon has been less than \$3.5 million in 30 years (Global Environment Facility, 2002), but the World Bank has channeled and additional \$6.5 million for Amazonian strictly protected areas through the NFMA.

²³From 1991 to 1997, non-governmental organizations received 51% of the NFMA resources, while municipalities, federal institutions and state agencies received 22%, 15%, and 9%, respectively.

²⁴An exception has been the World Bank-supported Minas Gerais Forest Service.

The Brazilian government's initiative to expand the protected areas system will be implemented through the Global Environment Facility (GEF)-funded Amazon Region Protected Areas (ARPA) project in partnership with Amazonian states and NGOs. ARPA's primary objective is to create 28 million hectares in new protected areas; other goals include the establishment of an endowment fund and a biodiversity monitoring and evaluation system. It is anticipated that the ARPA program will result in a total of 70 million hectares of protected areas and that 30% of the Amazon will be under some form of effective protection and sustainable use system within a decade (GEF, 2002).

Expansion of National Forest Program. The Brazilian Government has committed to increase the area of public lands designated for sound forest management, either as National Forests (FLONAs) or similar production forests under the control of state or municipal governments. There are currently 31 FLONAs in northern Brazil, covering an area of 16 million hectares. The National Forest Program plans for an increase in the number of National Forests to cover 50 million hectares by 2010, allowing for the sustainable exploitation of 1.3 million hectares per year (Government of Brazil, 2001).

FLONAs are sustainable use conservation units, whose purpose is to produce goods while ensuring the maintenance of ecological services (Verissimo *et al*). Under Brazilian law, FLONAs are required to prevent disturbance in areas of low timber potential, protect riparian areas and steep slopes, and engage in sustainable forest management practices (World Bank, 2000). It is believed that by expanding the FLONAs system and increasing sustainable timber management practices, timber from managed systems will dominate the domestic market. Research has shown that current levels of timber production could be sustainably produced with 700,000-800,000 square kilometers of FLONAs (Verissimo *et al*, 2002).

FLONAs will also play an important role in biodiversity conservation and the viability of natural habitat. FLONAs that are linked to strictly protected areas will serve as buffer zone around parks and reserves. In addition, corridors will be developed that allow movement between core protection areas. It is anticipated that the expanded system of production forests would eventually protect an additional 13% of Brazilian Amazon natural habitat from deforestation (Verissimo *et al*).

Forest Fire and Deforestation Monitoring. The Brazilian government coordinates the National System for the Prevention and Control of Forest Fires through INPE in collaboration with IBAMA, which is responsible for regulating the use of man-made fires. The Project for Monitoring of Deforested Areas in the Amazon Region (PROARCO) is working to prevent burning during the dry season through the use of satellite data and helicopters along the deforestation belt located in the states of Mato Grosso, Rondonia, and Para to enforce compliance. In November 2000, the MMA reported a 19% reduction in forest fires in the Amazonia region, attributed primarily to improved enforcement and increased adoption of low-cost fire prevention and management practices.

Land Reform. Brazil's land reform agency (INCRA) has nullified the titles of more than 20 million hectares of land illegally grabbed by speculators, loggers and ranchers (Nepstad *et al*, 2002). The Brazilian government plans to convert 10 million hectares of the returned land to national forests by 2002, and 10 million hectares to protected areas (nine million hectares for strict protection and one million hectares for sustainable use) by 2004 (Jungman, 2002).

Green Protocol. The green protocol requires lending institutions to incorporate environmental criteria into finance projects. The protocol also establishes that private and official funding agencies can release funds for agricultural property maintenance and investment only if legal conservation standards are met.

Changes to Rural Land Tax Provisions. Revisions to rural land tax laws introduced an exemption of Legal Forest Reserves and Areas of Permanent Preservation as well as other areas that the government may declare in interest of preservation.

Increase of Agency Oversight Resources. IBAMA has been allocated additional resources to increase its field presence in the Amazon as well as purchase of necessary field equipment.²⁵

4.2 STATE AND LOCAL GOVERNMENT

Brazilian states and municipalities have substantial authorities regarding environmental protection and enforcement as a result of decentralization efforts initially formalized in the 1988 Constitution. Capacity for environmental protection program implementation and regulatory enforcement has differed across states. In some cases decentralization has resulted in more effective environmental monitoring efforts for those state and municipal institutions that are stronger and environmentally more progressive (World Bank, 2000). For instance, all Amazonia states share responsibility with IBAMA for regulating forest-sector activities, with varying results.

Some of the most effective governmental action in the environmental area has occurred at the state and local levels. For instance, two Amazonian state governments, Acre and Amapa, are working to conserve forest resources and develop sustainable forest-based enterprises in their jurisdictions (World Bank, 2000). The state of Mato Grosso has also made effective use of remote sensing and geographic information systems technology to enforce forest policy and regulations (Nepstad *et al*, 2002). Various states offer increased value-added tax revenues to municipalities for conservation areas, and several states have developed regional flora and fauna censuses and localized species lists (World Bank, 2000; World Wildlife Fund, 1999). A large number of conservation areas totaling 29.8 million hectares are administered and protected by the states (Government of Brazil, 1997).

One of the most promising trends in frontier governance is the growing capacity of municipal governments for environmental and development planning (Nepstad *et al*, 2002). Through the support of international efforts, many municipal governments are strengthening local institutional capacity for environmental planning and regulation, while learning how to integrate local stakeholders into the planning process. Systems of protected areas at the municipal level have also been established and are generally administered and managed by the local Environment Secretariats.

4.3 CIVIL SOCIETY

Landscape degradation in the Amazon is a major issue in the international and Brazilian media, and nationwide polls have shown that Brazilians consider deforestation to be an important environmental issue, although public opinion regarding environmental quality

²⁵ IBAMA plans to hire 2,000 additional staff in 2002 to work primarily in the Amazon and Center-west regions of Brazil.

priorities differs between northern and southern parts of the country. For the majority of the population in the South and Southeast, the integrity of the Amazon is a high priority. However, those living in the Amazon (most of whom live in urban areas), desire more development, infrastructure and jobs (Saunier *et al*, 2001).

Local NGOs have become increasingly active in the 1990s, both in influencing policies and in implementing projects at the field level (World Bank, 2000). NGOs have also performed notable work in the development of practices that increase community participation and promote conflict resolution and the training of extension workers in forest management principles. The Working Group on Forest Policy and the Amazon Working Group (GTA) are two examples of NGO forums that have influenced forest policy issues.

The Amazon Environmental Research Institute (IPAM) is also working on forestry issues related to economic development. IPAM is currently engaging local officials and concerned citizens in democratic debate on a productive, sustained future for the Cuiaba-Santarem highway corridor. In June 2001, Advance Brazil officials requested IPAM's assistance with the monitoring of the strategic impact assessment that was commissioned by Brazil's Economic and Social Development Bank for this highway. One proposal put forward by IPAM was the reservation of a portion of the savings resulting from decreased transportation costs for sustainable agricultural and forestry projects.

A 1994 study showed that 57% of an estimated 5,000 NGOs in Brazil target environmental and social change issues (Library of Congress). Among the most visible Brazilian environmental NGOs are SOS Atlantic Forest, the Social-Environmental Institute, the Pro-Nature Foundation, and the Amazon Working Group. Important national NGO networks working on environmental issues include the Brazilian Forum of NGOs, Social Movements for the Environment and Development, and the Brazilian Association of NGOs. The principal international NGOs that have assisted with environmental research, technical expertise and policy analysis skills in Brazil are the World Wildlife Fund, Conservation International, the Wildlife Conservation Society, and the Nature Conservancy.

4.4 PRIVATE SECTOR

All but one of 103 Brazilian forest units certified by the Forest Stewardship Council (FSC) are privately owned.²⁶ Brazil currently has a total of 1,152,243 hectares of certified forests, of which 778,930 hectares are plantations, 353,313 are native Amazon forests, and 20,000 are native Atlantic forests. Brazilian FSC-certified products include timber logs, furniture, charcoal, musical instruments, and fiber hammocks (World Wildlife Fund, 2002).

4.5 INTERNATIONAL CONTRIBUTIONS²⁷

4.5.1 Pilot Program for the Conservation of the Brazilian Rain Forests (PPG-7)

The PPG-7 is supported by the G-7 and the European Community and has allocated approximately \$300 million for projects in the Amazon and Atlantic Forest biomes. The purpose of the PPG-7 is to reduce the rate of destruction to the Brazilian rain forests in the

²⁶ The first Brazilian community-based organization, Chico Mendes' Agroextractivist Project's Dwellers and Producers Association from the Xapuri municipality of Acre, was certified by the FSC on March 26, 2002.

²⁷ Much of the information on international contributions to conservation efforts in Brazil was obtained from the USAID/Brazil Environment Program Strategic Plan for 2003-2008.

Amazon and Atlantic Forest biomes and to encourage their ecologically sustainable use. The German Agency for Technical Cooperation (GTZ) is the main contributor to the PPG-7 at \$150 million, or 42% of total funding, while the European Community is the second largest donor. The Netherlands, under the PPG-7, contributes \$8 million for training, capacity building and institutional strengthening for environmental NGOs and government institutions. The Department of International Development (DFID) is an important partner of the PPG-7 and also supports several natural resources and sustainable rural income projects in the Amazon and the Northeast.

PPG-7 investments have focused on balancing livelihoods with environmental sustainability, concentrating on projects dealing with extractive and indigenous reserves, sustainable development projects, state and municipal development plans, ecological corridor development, improved surveillance and enforcement at the state level, and strengthening of key research centers. The PPG-7 has also contributed to the strengthened role of NGOs through the GTA network and has facilitated the linking of government and civil society. Relatively little attention has been given to “strict protection” protected areas under the PPG-7 program.

4.5.2 Global Environment Facility (GEF)

In addition to providing \$72 million for the ARPA program, GEF has reserved \$30 million for Brazil, part of which is managed by FUNBIO, and has also created an NGO small grants program for conservation-related projects in the Cerrado.

4.5.3 The World Bank

The World Bank provided loans for environmental/natural resource management in Rondonia and Mato Grosso, is a partner to the PPG-7 and Global Environment Fund and funds the PNMA. The World Bank is also currently discussing a \$500 million forest sector loan with the Brazilian government that would support the implementation of the National Forest Program through the testing of a framework for institutional, legislative, and fiscal policy reform. Activities supported under this loan would strengthen capacity for sustainable forest management, strengthen enforcement, establish protected areas of sustainable use, reforest degraded areas, and develop forest plantations (USAID, 2002b).

4.5.4 Inter-American Development Bank (IDB)

Major Inter-American Development Bank (IDB) projects are Sustainable Development in the Legal Amazon and Pantanal, Ecotourism Development (PROECOTUR), Conservation Areas in Tocantins and Serra de Capivara, Renewable Energy and the FNMA. The IDB is also developing an \$80 million sustainable forest project in the Amazonian state of Acre, in which state government and NGOs will coordinate efforts to implement innovative economic development activities based on sustainable forest use.

4.5.5 Private Donors

Private foundations currently providing financial support for environmental issues in Brazil include the Ford Foundation, the Hewlett Foundation and the Summit Foundation. The Ford Foundation’s three-year Amazon Basin Initiative focuses on university-based research, training and community extension, NGO policy analysis, public awareness of sustainable development concepts, community-based development projects and media coverage of Amazonia. The Ford Foundation has also committed \$1 million to FUNBIO.

The Hewlett Foundation supports institutions that conduct research on deforestation, road building impacts, and sustainable development. The Summit Foundation administers a donation program that has contributed to the conservation of the Atlantic Forest and the development of certified timber markets in Brazil.

4.5.6 Government Bilateral Donors

In addition to their contributions to the PPG-7, GTZ, DFID, the European Community, and the Netherlands support projects related to conservation and natural resources management on a bilateral basis. GTZ funds environmental management projects in the Atlantic Forest zones with the support of six states. DFID supports a group of sustainable rural livelihood projects in Amazonia and the Northeast. DFID is also currently developing a new strategy that shifts emphasis to poverty alleviation. The European Community program targets the reduction of income inequalities, administrative reform, research and small business incentives. The Netherlands supports Brazil's implementation of international treaties, as well as several community forest management, environmental legislation, climate change, and desertification projects.

Other bilateral donors that are working on environmental protection issues in Brazil include France, Japan, and Italy. France funds a series of small research projects in areas such as tropical soils, tropical agriculture and social geography. Japan has established a technical assistance program that focuses on agricultural development in the Cerrado, secondary forest management, and fisheries management. Italy supports a forest fire control project in Brazil, but does not have a formal program of cooperation on the environment with the government.

4.5.7 U.S. Government Agencies

USAID/Brazil. As a partner in the PPG-7, USAID/Brazil assists with the guidance of use of funds and promotes collaboration among governmental and private donors. The mission has also supported the reduction of deforestation through the development of protected area management plans, the increase of agroforestry systems in the state of Acre, improvement in fire research and monitoring, and reduced-impact logging research and training in collaboration with the United States Forest Service.

NASA. NASA is the major financier of the Large-Scale Biosphere-Atmosphere (LBA) project, which is designed to support a range of basic biological hydrological, geochemical and climatic studies in Amazonia in collaboration with several U.S., European, and Brazilian universities and research institutes.

USDA, Forest Service. In addition to collaborating on reduced-impact logging research and training with USAID/Brazil, the Tropical Forest Foundation, and IPAM, the Forest Service is also working with IBAMA to increase fire-control effectiveness by conducting fire-preparedness planning with communities, fire risk information analysis and dissemination, and training in fire-control techniques.

USAID/Brazil's Role in the Conservation of Brazil's Natural Resources

USAID/Brazil's FY 2003-2008 Country Strategic Plan has established four Strategic Objectives and one Special Objective:

- Strategic Objective 7--Transmission of Selected Communicable Diseases Reduced in Target Areas
- Strategic Objective 8--Natural Ecosystems Sustained
- Strategic Objective 9--Global Climate Change Mitigated through Market-Based Renewable Energy and Energy Conservation
- Strategic Objective 10--Economic Opportunities Enhanced for Disadvantaged Youth
- Special Objective 11--Integration and Targeting of Selected Brazilian Poverty Alleviation Policies and Programs Improved

The purpose of this section is to identify the actions necessary to overcome the obstacles discussed in Section 3 to achieve the conservation and sustainable management of biodiversity and tropical forest resources within Brazil, and the extent to which planned Mission activities will address the actions identified. A summary of the analysis is included at the end of this section.

5.1 Ineffective Government Policies and Programs

Action 5.1.1: Support the development and implementation of informed government natural resource policies

Activities implemented under Intermediate Result (IR) 8.3—*Integrated landscape mosaics that sustain environmental and socioeconomic benefits designed, tested and incorporated into government planning and policies*—will support the development and implementation of informed government natural resource policies through: (a) applied research on the future environmental and socioeconomic impacts of current and alternative land use trends in Amazonia; (b) the design of spatially defined conservation corridors within the Brazilian Amazon; and (c) incorporation of research findings into planning and policy development through the engagement of technical professionals, government representatives, and civil society. Through this IR, local NGOs will provide local governments, community members, and business leaders sustainable landscape information that can be used to inform decision making regarding land use options.

Action 5.1.2: Support the integration of environmental issues into the Brazilian government's development strategies

Activities under IR 8.3 will also complement in-country research in local flora, fauna and forest ecology by providing information on sustainable land use and management practices that can be integrated into the planning and implementation of development strategies. Knowledge of landscape mosaics will enable conservation organizations to work on a more informed basis with the key decision-makers responsible for major development initiatives such as the Advance Brazil program. Landscape mosaics would also enable policy makers to understand how development decisions could negatively alter regions and provide options for refining decisions accordingly.

Action 5.1.3: Support the National Forest Program

Activities implemented under IR 8.1—*Sound forest management practices improved*—will support research on the design and management of new national forests. This research will then be applied to develop sound forest management practices that will be disseminated to both forestry companies and low-income communities working both independently and within National Forests. USAID support under this IR will enable NGOs to work with the government to increase compliance of forest operations on National Forests through the streamlining of administrative procedures and provision of satellite-based monitoring information useful to enforcement. In addition, responsible harvesting of forest products in Amazonia will be increased by providing capacity building and outreach to practitioners in environmentally-sound forest management techniques through the establishment of an Amazon Forest Management Training Center.

Action 5.1.4: Support the strengthened administration and management of Brazil's protected areas system

Under IR 8.1, the mission will continue to engage NGOs to assist with the development of protected area management plans for national parks, extractive reserves and indigenous lands. Activities focused on fire research and prevention under the same IR will support the pilot monitoring of forest management, increase the engagement of communities in fire prevention, and ultimately reduce the incidents of accidental fires in protected areas. Landscape mosaic design activities under IR 8.3 will provide data that will be useful for formulating and refining major policy initiatives on protected areas. Sustainable landscape information could also provide a basis for reconciling socioeconomic and environmental needs and resolving debates regarding the productive use of protected areas.

5.2 Limited Capacity for Sustainable Resource Use

Action 5.2.1: Support the adoption of environmentally-sound forest management practices in the private sector and local communities

Under IR 8.1, the mission will continue to support research on the design and functioning of forested ecosystems. Activities under this IR will also support the identification and dissemination of environmentally-sound land use and forest management practices and the incorporation of such practices into forestry operations. Capacity will be built at the industrial and community-levels through field-based training provided through the establishment of an Amazon Forest Management Training Center, or by building the capacity of existing key regional technical schools to provide training in sound forest management. The mission will also expand upon the agroforestry activities established under the 1997-2002 strategy by promoting markets and production systems in Amazonian states related to sound forest management.

Action 5.2.2: Support the adoption of fire-free agricultural practices

Activities under IR 8.1 will also support the use of fire-free agricultural practices among agricultural smallholders. Through the promotion of slash-and-mulch technologies in place of conventional slash-and-burn practices for perennial crops, the mission aims to decrease the number of fire incidents and increase land that is devoted to fire-free production. The promotion of fire-free agricultural practices will also be linked to market-oriented activities implemented under IR 8.2—*Markets for environmental goods and*

services developed to provide tangible economic benefits for poor communities—in that market opportunities for fire-free NTFPs will be assessed and possibly developed.

Action 5.2.3: Support the development of conservation corridors

Islands of protected areas are susceptible to external human pressures and are insufficient to conserve biodiversity and sustain ecological processes. IR 8.3 of the mission's environment strategic objective directly addresses this action by implementing the design of spatially defined conservation corridors within the Brazilian Amazon. The protection of areas of high biological significance will require the creation of a conservation area mosaic that combines production forests and strictly protected areas to serve as biological corridors in species-rich biomes. The landscape mosaics that will be designed through the mission's program will identify land-use patterns that can be optimized for conservation and sustainable use while meeting the socioeconomic needs of local populations. The mosaics will then be used to inform national and state-level land use policies that include the creation and management of conservation corridors.

Action 5.2.4: Support the establishment of compliant and sustainable forest management practices and effective production forests

Independent certification of production forestry targeting Brazil's substantial domestic market could help mitigate deforestation and strengthen forest conservation through improved production systems. Support provided to the National Forest Program under IR 8.1 will also benefit independent forest operations by providing technical assistance on sustainable forest management practices, increasing awareness of compliance requirements, and developing documentation indicating full compliance with local, state, and federal laws. In addition, effective forest production operations established under IR 8.1 may be further advanced through linkages to capital access and market-oriented activities implemented under IR 8.2.

Action 5.2.5: Support the improvement and increased application of fire monitoring and prevention techniques

Under IR 8.1, USAID will continue to support research on the flammability of Amazonian ecosystems to build a regional model designed to predict flammability that will be used to guide fire prevention efforts and assist with predicting the environmental impacts of future development scenarios. USAID also provides support to the PPG-7's PROTEGER project in which the GTA provides training for grassroots organizations and communities in fire prevention and management. Under the new strategy, the mission could potentially expand the PPG-7's Promanejo project, which supports policy analysis and technologies for forest management monitoring in the states of Para and Amazonas, into the Amazonian state of Mato Grosso. Mission activities will also support strengthened coordination among key stakeholders by facilitating the establishment of a fire management working group that will focus on the exchange of information and best management practices.

Action 5.2.6: Support the involvement of civil society in environmental and economic development issues

The USAID/Brazil 2003-2008 Strategic Plan continues the mission's long-term interest and experience working with civil society on environmental, energy, health, poverty, and human capacity development issues. The mission will continue to provide funding to

research institutions, training centers, NGOs, and community groups for research and capacity building activities related to sustainable resource use and improved livelihoods. USAID/Brazil will also continue to support partnerships between civil society, the private sector and government authorities that focus on the creation and implementation of strategies that reconcile environmental protection, sustainable resource use, and economic development.

5.3 Poverty and Migration

Action 5.3.1: Increase rural income generation opportunities through sustainable natural resources management

Linking rural livelihoods through sustainable natural resource management in ecologically sensitive regions such as the Amazon will reduce pressure on resources. Mission activities under IR 8.2—*Markets for environmental goods and services developed to provide tangible economic benefits for poor communities*—will support environmentally sustainable community-based enterprises and link economic returns with the sustainable forest management initiatives in IR 8.1. Sub-IR 8.2.1—*Business skills in rural communities increased*—will support training and capacity building activities that provide rural communities the basic skills needed to establish and run business enterprises.

Sub-IR 8.2.2—*Private investment portfolios to increase access of communities to capital developed*—will involve the analysis, policy formulation and development of private investment portfolios to increase access of communities to capital needed for rural enterprises. Activities under this IR will support the development of an alternative approach to agricultural credit that offers more favorable, longer-term credit for environmentally-sound land use systems such as agroforestry. In addition, USAID support will focus on the policy analysis of rural credit programs and train technical staff in key credit agencies on environmental criteria so that such information will be incorporated into decision-making regarding credit applications.

The activities of other SOs will contribute to increased rural income generation. Micro-credit technical assistance provided under IR 11.2—*Stimulation of small and medium enterprise development*—will complement community-based enterprise capacity building activities under Sub-IRs 8.2.1 and 8.2.2 by targeting potential beneficiaries needing micro-credit and technical assistance in a variety of sectors, including environment. Micro-credit assistance provided under IR 11.2 will enable communities to obtain the initial investments that are necessary to finance sustainable resource production and generate future economic returns. SO 8—*Global Climate Change mitigated through market-based renewable energy and energy conservation*—will also support the increased income generation opportunities for rural communities by providing renewable energy services which could facilitate the value-added processing of food and fibers.

Action 5.3.2: Increase market opportunities for natural resource-based products produced from environmentally-sound land uses

Under IR 8.2, the mission plans to facilitate private sector-community partnerships in green marketing initiatives to increase local, national, and international market opportunities for certified timber and NTFPs derived from environmentally-sound land uses. Activities under Sub-IR 8.2.3—*Communication network for community access to market networks and trends improved*—will support the strengthening of community-based information clearinghouses that would disseminate local, national and international

market information to community-based rural enterprises in the Amazon. Information would be offered through networks of extension offices, community associations, local environmental NGOs as well as through radio programs.

Action 5.3.3: Improve energy sources and technologies available to rural populations

A reliable and cost-effective energy source can provide a basis for increased sustainable income generation and social benefits in rural communities. SO 9 addresses the energy provision needs of the rural poor through the delivery of rural energy services through IR 9.3—*Market development for renewable energy*. Activities under this IR will increase the number of renewable energy demonstration projects based on solar, wind, biomass, and hydropower in the Northeast, Center-west, and South. Examples of illustrative program activities under this IR include the promotion of home and community-based micro-enterprises based on renewable energy, using solar-powered energy for community wells and irrigation systems, development of renewable energy system microenterprises, and the strengthening of local energy cooperatives and support institutions. Activities under IR 10.1—*Increased marketable skills training for at-risk youth*--will support the training of rural and urban disadvantaged youth in northeastern Brazil in solar panel installation.

In addition to reducing Brazil's use of fossil fuels and associated carbon emissions, the establishment of renewable energy services in rural communities would mitigate environmental degradation due to a decrease in demand for firewood and charcoal and an increased capacity to engage in labor-intensive sustainable management practices. The establishment of local energy sources could also relieve pressure for the development of large hydropower plants in natural habitats in ecologically sensitive biomes.

Action 5.3.4: Support stability of land tenure in rural communities

The mission will not directly support the improvement of Brazil's land registration process under the 2003-2008 strategy. However, activities implemented under IR 8.1 and 8.2 will support the establishment of "pre-conditions" towards stabilizing land tenure by: (1) facilitating awareness of community rights regarding land use; and (2) promoting the continued use of existing landholdings through sustainable land use practices.

Action 5.3.5: Support environmental protection efforts through improved targeting and implementation of national poverty alleviation policies.

Under IR 11.1—*Improved targeting of selected Brazilian poverty alleviation policies and programs*—the mission will support the provision of technical assistance to the Brazilian government to improve the equality of income distribution in the poorest regions of the country, including the North and Northeast. Mission-funded evaluations, studies and assessments will provide the Brazilian government information useful to the development and improved targeting of national poverty alleviation policies and programs. IR 11.1 could potentially promote the integration of environmental protection efforts into poverty alleviation programs by supporting collaboration between the MMA and other Brazilian government ministries on poverty alleviation. Other potential activities related to environmental protection include: (1) technical assistance on policies that increase economic incentives for environmentally-friendly investments in high-poverty rural areas; (2) support for the creation of stronger rural-urban market linkages in the forestry and NTFP sectors; and (3) identification of opportunities in the area of ecotourism.

5.4 SUMMARY

Brazil has one of the world's high concentration of biodiversity and species endemism, and 26.6% of the world's tropical forests within its borders. Brazil's biodiversity and tropical forests are threatened by mismanagement and wasteful logging practices, land clearing related to the expansion of agricultural and ranching activities, urban and industrial development, and poaching and wildlife trafficking. The major obstacles to mitigating these principle threats include ineffective government environmental policies and programs, limited capacity for sustainable resource use, poverty and income equality, and migration of human populations.

The illustrative activities under Strategic Objectives 8 and 9 of USAID/Brazil's 2003-2008 Country Strategic Plan directly address 13 of the 15 actions proposed in Section 5 and will work to overcome the major obstacles to the conservation of Brazil's species and tropical forests. The practices, market opportunities and policies developed and promoted through these activities will mitigate environmental degradation, ensure the sustainability of natural resources and address the economic development concerns of communities and private enterprises that are highly dependent on natural resources for subsistence and income.

Two of the 15 actions are not directly addressed by the mission's strategy. The activities under Strategic Objective 8 indirectly supports Action 5.3.4--*Support land tenure support in rural communities*--by promoting "pre-conditions" that are useful to the establishment of an equitable and functional system of land tenure in Brazil. Several of the proposed activities under Special Objective 11 could support Action 5.3.5--*Support environmental protection efforts through improved targeting and implementation of national poverty alleviation policies*--but it is unclear to what extent environmental issues will be addressed. It is recommended that activities strengthening government ministry collaboration on poverty alleviation issues include the involvement of the Ministry of Environment. In addition, Special Objective 11 would more directly support Action 5.3.5 if mission-funded technical assistance addressed environmental protection issues and sustainable natural resource-based economic opportunities.

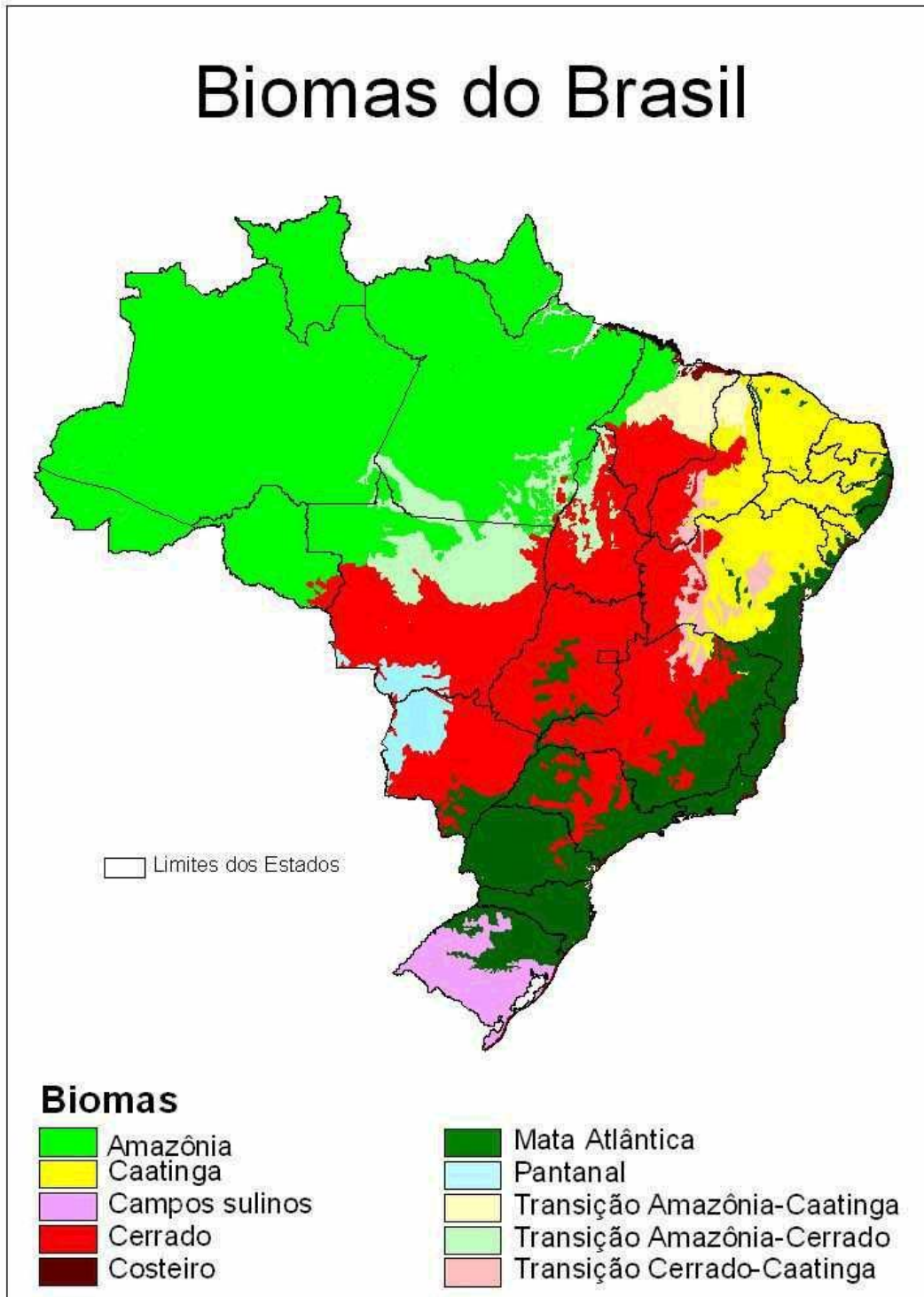
The activities implemented under Strategic Objectives 8 and 9 will support increased income generation and market opportunities for rural communities. Forest profitability through NTFP market development or increased timber extraction operations could be potentially damaging to Brazil's ecosystems if practitioners are not operating under a coherent system of sustainable resource use that includes appropriate training and monitoring. The environmental review of activities and demonstration projects established under the mission's strategy would ensure that related benefits such as increased productivity are balanced with appropriate environmental protection measures.

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**Appendix A:
Map of Biomes in Brazil**



Source: World Wildlife Fund Brazil

Appendix B: Biome Vegetation Types

Biome/Ecosystem	Vegetation Types	Original Area (km ²)	Country Area (%)
Amazonia	Lowland terra firme dense forest, undulating and submontane relief hill forest, white-water seasonally inundated forest (<i>varzea</i>), black-water seasonally inundated forest (<i>igapo</i>), permanently inundated forest (<i>igapo</i> , black-water or clear-water), floodplain open mixed fores, mixed forest with palms, semideciduous forest, white sand forest (<i>campinarana</i> or <i>caatinga amazonica</i>), white sand scrub (<i>campina</i>), sandstone rock outcrops (<i>campina rupestre</i>), cerrado enclaves, savannahs and savannah woodlands of Roraima, inundated savannahs (<i>campos de varzea</i>), tidal <i>varzea</i> , palm forest (<i>babassu</i> palm), liane forest (<i>floresta de cipo</i>), bamboo forest (<i>floresta de bambu</i>)	4,005,082	47.1
Cerrado	Central Brazilian savannah, savannah forest (<i>cerradao</i>), scrub savannah (<i>campo cerrado</i>), seasonal semideciduous and deciduous forest, gallery forest, open montane vegetation (subalpine moorland)	1,890,278	22.2
Pantanal	Savannah, parkland savannah (<i>campo limpo</i>), evergreen gallery forest, seasonal semideciduous forest, chaco	154,884	1.8
Caatinga	Tropical thorn scurb (<i>caatinga</i>), dry deciduous forest (<i>caatinga alta</i>), rocky outcrops (<i>lajeiros</i>), humid forest (<i>brejos</i>)	939,391	11.0
Transition	Transition between cerrado central Brazil, Amazonian forests, caatingas, and palm (<i>babassu</i>) forest (<i>zona de cocais</i>)	164,201	1.9
Seasonal semideciduous forests	Inland mesophytic (semideciduous) forests inland (Atlantic forest), gallery forest	518,834	6.1
Pine forest	Mixed forest dominated by Araucaria pine, parkland savannah.	220,363	2.6
Extreme south	Parkland savannah, seasonal semideciduous forest	203,875	2.4
Atlantic forest and coastal zone	Lowland moist forest, liana forest (<i>mata de cipo</i>), gallery forest, coastal scrub and forest on sandy soils (<i>restinga</i>), open montane (subalpine vegetation), dunes, mangrove swamps	415,088	4.9
Total for Brazil		8,511,996	100

Source: Government of Brazil, 1997

Appendix C: Synopsis of Brazilian Environmental Policies and Regulations²⁸

	Statutory or Policy Reference/Date	Summary
G E N E R A L	Decree No. 54/1975	Established Brazil's status as a signatory to CITES.
	Law No. 6.938-31/1981	Established National Environmental Policy, National Environmental System, and National Environmental Council.
	Law No. 7.347/1985	Establishes mechanism for civil public action for environmental damages.
	CONAMA Resolution No. 1-23/1986	Establishes requirements for environmental impact studies.
	Law No. 7.735/1989	Created Brazilian Institute of Environment and Natural Resources (IBAMA).
	Law No. 7.797/1989	Created National Fund for the Environment (NFMA).
	CONAMAZ Resolution No. 4/1995	Establishes a National Integrated Policy for the Amazon Region.
	Decree No. 1.541/1995	Regulates activities and powers of CONAMAZ.
F O R E S T R Y	Law No. 9.695/1998	<i>Law of Environmental Crimes</i> : Authorizes financial penalties for harming wildlife, damaging protected areas, setting fires, unlicensed timber production, pollution.
	First Forest Code/1934	<i>First Forest Code</i> : Establishes that forests are an "asset of common interest".
	Law No. 4.771/1965	<i>Current Forest Code</i> : Defines areas for permanent protection, habitats for threatened fauna and flora, and prohibits the use of fire in forests without authorization.
	Forest Code Amendment/1977	<i>Forest Code Amendment</i> : Mandates the creation of 500,000 km ² of national forests in the Amazon for managed timber concessions.
	Edict No. 122/1985	Establishes regulations for the exploitation of parana pine and Brazil nut tree.
	Decree No. 750/1993	Prohibits exploitation or suppression of Atlantic Forest regeneration.
	IBAMA Edict No. 71/1994	Required approval of management plans and clearances for logging of certain tree species (mahogany, parana pine and imbuia).
	Decree No. 1.282/1994	Mandates that timber exploitation is permitted only through sustainable forest management practices.
	IBAMA Normative Instruction No. 1/1994	Established guidelines for forestry management plans in the Caatinga.
	Prov. Measure 1511/1996	Increases forested cover requirement from 50% to 80% for properties.
P R O T A R E A S	Decree No. 1.963/1996	Establishes a two-year moratorium on new forest management plans for mahogany and virola exploitation.
	Decree No. 3,420/2000	<i>National Forest Program</i> : Establishes the National Forest Program which promotes market expansion and institutional development related to sustainable forestry.
	Law No. 4.71/1965	Creates national parks, biological reserves and legal forests.
	Law No. 6.513/1977	Defines ecological reserves and ecological stations.
	Law No. 6.902/1981	Establishes standards for ecological reserves and stations (at least 90% should be untouched). Defined environmental protection areas.
	Law No. 2.892/1992	Establishes unified national system for Protected Areas (SNUC).
	Decree No. 1.922/1996	Establishes and regulates private natural heritage reserve category.
	Law No. 9.985/2000	Mandates expansion of the National Protected Areas System.
W I L D I F E	Law No. 5.197/1967	Establishes norms for protecting Brazilian wildlife. Prohibited use, destruction, hunting, or capture of wild animals except for scientific research and subsistence hunting. Banned professional hunting and trade.
	Law No. 221/1967	Mandates the protection of aquatic wildlife (replaced Fishing Code of 1938).
	Resolution No. 001/1986	Establishes endangered species list and mandated that lists must be considered for all projects requiring an Environmental Impact Report or Statement.
	Law No. 7.643/1987	Prohibits the hunting of cetaceans.
M I S C	Draft Law 306/95	Mandates that surveys and collection of biodiversity resources requires prior authorization and reports on environmental impacts.
	Law No. 4.504/1964	Establishes rights and obligations concerning ararian reform.
	Decree No. 98.830/1990--	Legislates collection of scientific material by foreigners.
	IBAMA Edict No. 83/1996	Establishes regulations for exportation of Brazilian native flora products.
	Law No. 9.433/1997	Decentralized Water Resources Mgt. System; created River Basin Committees.

Sources: Government of Brazil (1997); World Bank (2000); JICA (1999)

²⁸ This synopsis does not provide an exhaustive list of existing environmental policies and regulations in Brazil.