



Chapter I

Brazilian Biodiversity

The nation with the richest biodiversity in the world, Brazil was the first signatory of the Convention on

Biological Diversity - CBD, and has been endeavouring to fulfil the commitments involved, after playing a decisive part in its negotiation, adoption, and approval during and after the Conference on Environment and Development - UNCED, held in Rio de Janeiro in June 1992. Fulfilling this objective requires vision and action on numerous fronts to tackle the complex biodiversity issues covered by the CBD:

- I. Considering biodiversity in all its different forms;
- II. Planning for conservation of biological diversity, the sustainable use of its components and a fair and equitable sharing of the benefits derived from the use of genetic resources;
- III. Considering options for the management of biological diversity; and

- IV. Considering the principal means to promote the rational use and management of biological diversity.

It is important to remember, however, that different levels of responsibilities and interests exist between the countries which are sources of, and conserve, biological diversity (Brazil and other tropical countries) and the nations that are principally users of such biodiversity (the industrialised countries, consumers of the products of biodiversity and of genetic resources for their biotechnological development). The latter are concerned with high rates of extinction and the erosion of biodiversity, and are proposing measures according to their specific interests. The source countries, on the other hand, have legitimate concerns in increasing their economic returns from the use of their biological heritage in order to improve the quality of life for their people as well as to offset the costs involved in its conservation.

It was precisely this divergence of interests that, for the first time in the history of diplomatic negotiations, led the

CBD to establish differentiated responsibilities and, in consequence, a fair and equitable sharing of the commercial and scientific benefits arising from the development of biotechnological products between the countries providing the genetic resources and those using them. Moreover, the CBD established the principle of sharing the costs of conservation and of sustainable use of biodiversity, both *in situ* and *ex situ*, with the richer countries having the incremental expense of being responsible for a significant portion. An asymmetry exists, therefore, between responsibilities and interests.

Biodiversity, as a whole and by its dimensions, represents an incalculable guarantee, an insurance for the future against the unexpected, providing alternatives and opportunities under adverse conditions.

The Commission for Genetic Resources of the United Nations' Food and Agriculture Organisation - FAO has pointed out that more than half of the varieties of the world's twenty most-important foods have been lost since the beginning of the century, including those of such as rice, wheat, maize, oats, barley, beans and peas: each with their unique, specific and irreplaceable genes allowing for adaptation to different soils, climates, diseases and pests. We will become more and more dependent on hybrid strains to create new varieties with increased vigour and resistance if we are to ensure food supplies for the ever-increasing world population.

Biological diversity also holds the key to substituting increasingly scarce materials, especially true for those of mineral origin.

Biodiversity is of decisive importance in economic development. The agribusiness sector, for example, accounts for about 40% of Brazil's GNP (US\$ 774 billion in 1997). That of forestry accounts for 4% of the GNP, while fisheries are responsible for 1%. Products of biodiversity, especially coffee, soybeans and oranges, represent 31% of Brazilian exports. More than 3 million people are employed in plant extractivism and fisheries. Plant biomass, here including sugar-cane alcohol, firewood and charcoal from native and from planted forests, provides 26% of the country's energy demands (in some regions, the North-east, for example, this figure is more than 50% for domestic consumption and industry). Demand for the use of medicinal plants is increasing, be it in therapeutic medicine or alternative medicine based on popular traditions.

Recent studies by Costanza *et al.* (1997, see Box 1.1) have provided a conservative estimate of between US\$ 16 trillion and US\$ 54 trillion a year, and a mean of US\$ 33 trillion, as the value for ecological services provided by 16 world ecosystems. Given that Brazil has between 10% and 20% of the world's biodiversity, 12.7% of the world's river

water (5,190 km³ a year), a vast territorial extension and 3.5 million km² of coastal and marine waters under its jurisdiction, it would hardly be an exaggeration to put the value of Brazilian biodiversity and the services of its ecosystems at billions of dollars yearly; several times higher than the GNP. It is clear that such a heritage represents enormous scientific, economic and cultural possibilities, depending only on the availability of the appropriate technology since the raw materials and the markets are evidently guaranteed.

It should be remembered that in the USA alone 25% of commonly prescribed pharmaceutical products contain active ingredients derived from plants, and that there are over 3,000 antibiotics derived from micro-organisms. The environmental scientist Thomas Lovejoy estimated the turnover in the chemical-pharmaceutical industry to be US\$ 200 billion a year for products based on biodiversity.

Despite Brazil's natural riches, however, most of its economy is based on non-native species. Sugar-cane comes from New Guinea, coffee from Ethiopia, rice from the Philippines, and soybeans and oranges from China. Forestry depends on Eucalyptus from Australia and pines from Central America. Cattle-ranches use African grasses for pasture, Indian cattle, and horses from central Asia. Fish-farms depend on carp from China and *Tilapia* from East Africa. The bee-keeping industry depends on bees from Europe and Africa.

For these and other reasons, Brazil must secure ways to protect its biodiversity and genetic resources, while still retaining access to non-native genetic resources, essential for improving agriculture, cattle ranching, forestry and fish-farming.

Brazil is the richest of the world's megadiversity countries (Mittermeier *et al.*, 1997), with its fauna and flora comprising at least 10% to 20% of the world's species described to date. It has the most diverse flora, with 50,000 to 56,000 described species of higher plants, or 20% to 22% of the world's total.

Many of the species important for the world economy originated in Brazil. Examples include, ground nuts, Brazil nuts, Carnaúba wax palm, rubber trees, guaraná (providing soft drinks), pineapple and cashew nuts, in addition to countless other species important for fodder, fruit, oil, medicine and timber.

At least 10% of the world's amphibians and mammals and 17% of all bird species occur in Brazil. Brazil has the world's richest diversity in three major groups of organisms. 1) Mammals. There are 524 species of mammals, of which 77 are primates - 27% of the world's total. Since 1990, eight new species of monkeys (seven in the Amazon and

one in the Atlantic Forest) have been described. 2) Freshwater fish. There are more than 3,000 species of freshwater fish: over twice the number in any other country. 3) Vascular plants, with over 50,000 species. Brazil is second-ranking in terms of amphibians, with 517 species, as well as for non-fish vertebrates as a whole, with 3,131 species. It is the third richest country in terms of birds, with 1,677 species, over 191 of them endemic. Of the 3,131 species of non-fish vertebrates, 259 are endangered or vulnerable. It is estimated that there are at least 5 to 10 million insect species, but most of them have yet to be described.

The dimensions and complexity of Brazil's biodiversity, both marine and terrestrial, may mean that it will never be completely described. It is distributed through biomes such as the Amazon, the world's largest remaining rain forest (40% of the world's tropical forest), 3.7 million km² of which lies within Brazil; the Cerrado of about 2 million km², including high altitude moorlands, the largest extent of savannah in any single country; the Atlantic forest, extending from the south to the north-east of Brazil over an area of more than 1 million km², including montane ecosystems, restingas (coastal forests and scrub on sandy soils), mangroves and the Araucaria forests and grasslands in the south, and one of the most important repositories of biodiversity in the country and in the world; the Caatinga, of about 1 million km², a vast semi-arid area in the north-east of Brazil, comprising thorn scrub and deciduous forest, as well as isolated rain forest patches (brejos); the Pantanal of Mato Grosso with about 140 thousand km² in Brazil, and one of the world's most significant wetlands; and the coastal and marine biomes, some 3.5 million km² under Brazilian jurisdiction, with cold waters off the south and south-eastern coasts (Argentinian zone) and warm waters off the eastern, north-eastern and northern coasts (Caribbean zone), supporting a wide range of coastal and offshore ecosystems which include coral reefs, dunes, wetlands, lagoons, estuaries and mangroves. There are numerous subsystems and ecosystems within these biomes, each with unique characteristics, and the conservation of ecotones between them is vital for the preservation of their biodiversity.

Brazil harbours a truly remarkable biological diversity in terms of genes, species, and ecosystems: the result of the wide variation in climate and geomorphology of a country with continental dimensions, more than 8.5 million km² in land area.

There is also a considerable cultural diversity (Box 1-2). Besides the descendants of numerous European, Asian and African colonists, there are more than 200 indigenous groups, each with their unique customs, languages and cultures, and a broad, profound and largely untapped knowledge of Brazil's fauna and flora, which comprise

another significant and threatened heritage of the country.

Among the Europeans, the Portuguese, the first to colonise Brazil, have been the most influential in shaping the cultural patterns of today, but as of the 19th century there have been many immigrants from Europe, principally Italy, Spain, Germany, Poland and Ukraine, as well as from Asia, mainly Japan, Syria and the Lebanon.

The large majority of the slaves brought to the New World came from African ethnic groups. They included the Bantu from southern Africa (the Congo, Angola and Mozambique), as well as Samba, Moxicongo and Anjico, and ethnic groups from the north-western coast of Africa such as Nago, Jeje, Fanti, Achanti, Haussa, Mandinga, Tapa and Fula, originating from regions from Senegal to Nigeria.

More than 170 different languages and dialects are currently spoken among the indigenous peoples of Brazil. Of these, only 10% have been completely described, a fact which underlines our lack of knowledge of the country's remarkable cultural diversity. Many of these languages belong to the Tupi-Guarani tribes (40 languages); the Macro-Jê (21 languages and 16 dialects); the Karib (21 languages); and the Aruak (24 languages). In 1500, when the European colonisers first arrived in Brazil, there were some 340 languages spoken by over 1,400 groups of these four main linguistic classes, as well as many other isolated branches. At this time, the indigenous population was estimated at 5 million, but between 1900 and 1957 alone, 87 ethnic groups disappeared. Only in the last few decades, and for the first time since colonisation, have the indigenous populations of Brazil increased in number.

These factors resulted in Brazilian Congressmen dedicating an entire chapter of the Federal Constitution of 1988 to Indians (Chapter VIII, articles 231 and 232). The Federal Constitution begins by recognising the Indians and their "social organisation, customs, languages, beliefs and traditions, and their original rights over the lands traditionally occupied by them, and the duty of the State to delimit these lands and to protect and enforce respect for all their assets." These lands "are theirs forever, and they have exclusive rights to exploit the riches of the soil, the rivers and the lakes within them." This patrimony is inalienable and cannot be disposed of, and the indigenous rights to the territory are not subject to statutes of limitation. The exploitation of any resources on Indian land requires authorisation from Congress, following consultation of the parties involved.

Indigenous matters apart, in the last few decades economic growth has been accompanied by a significant loss of biological diversity resulting from the occupation and destruction of previously untouched natural ecosystems,

the extent of which varies from biome to biome. About 15% of the Amazon forest has now been destroyed, with the opening up of highways, through mining, colonisation, and timber exploitation, and with the advance of the agricultural frontier. The loss of the native vegetation of the Cerrado has been estimated at over 40%, likewise through the expansion of agriculture and cattle-ranching, and the dramatic increase in human populations. They have increased six-fold in the past 40 years and now number around 20 million people. Suffering from prolonged droughts, desertification, and soil erosion and salinisation, the Caatinga has lost 50% of its native vegetation. The Atlantic Forest, originally extending along most of the coastal region and well inland in the past, suffers from the highest concentrations of human populations in Brazil. Its widespread destruction over the centuries, and especially over the past decades, now means that only about 8.75% of the original forest cover remains.

Despite the varied and numerous problems, obstacles and complexities faced over the past five years following the UNCED in Rio de Janeiro, Brazil has achieved considerable progress in the implementation of the CBD.

Considering its magnitude, the management and conservation of Brazil's biological diversity is no easy task. The formulation of a National Strategy for Biological Diversity is a vital first step to provide the necessary framework for implementing the CBD and to ensure that financing, whether national or international, provided by the Government for conservation and the sustainable use of natural resources is used in a consistent and integrated manner throughout the country.

As a megadiversity country, Brazil fully assumes its responsibilities in the conservation and wise use of its natural resources. The Ministry of Environment - MMA was given the task of co-ordinating and implementing the CBD, ratified by the National Congress in February 1994. In 1996, the MMA outlined a proposal for the elaboration of a National Strategy, which included ample nation-wide consultation. This project is sponsored by the United Nations Development Program - UNDP, and has also secured financial support from the GEF, and a matching contribution from the Federal Government.

A number of mechanisms have been set up to co-ordinate the implementation of the Convention in Brazil.

The General Co-ordination for Biological Diversity (Co-ordenação Geral de Diversidade Biológica - COBIO) linked to the Secretariat for Co-ordination of Environmental Affairs (Secretaria de Coordenação de Assuntos do Meio Ambiente - SMA), was established in 1994 within the Department

for Policy and Environmental Programmes (Departamento de Formulação de Políticas e Programas Ambientais - DEPAM) of the Ministry of Environment - MMA, in order to plan, co-ordinate, monitor and evaluate measures relating to the conservation and sustainable use of Brazilian biodiversity, especially those in the ambit of the National Biodiversity Programme (Programa Nacional de Diversidade Biológica - PRONABIO).

PRONABIO was created on 29th December 1994 to promote partnerships between Government and society in the conservation of biodiversity, the sustainable use of its resources, and the sharing of the benefits derived. Funding comes from the Treasury and overseas, meeting the priorities defined by a Co-ordinating Commission with parity between Government and society.

PRONABIO's specific tasks include: the definition of methodologies, mechanisms and processes; the promotion of international co-operation; the encouragement of research; the production and dissemination of information; training of personnel; institutional support; raising public awareness; and the development of concrete, demonstrative actions for the conservation of biodiversity and its sustainable use.

The United Nations Development Programme - UNDP has provided technical and administrative support to PRONABIO through its project 'Brazilian Biodiversity Management'. Financial and technical support for the implementation of PRONABIO has come also from two complementary projects funded by the Brazilian Government, the private sector and by the GEF (through International Bank for Reconstruction and Development - IBRD). Conditions concerning partnerships in conservation and the sustainable use of biodiversity have been established between the Government, nongovernmental organisations, academic institutions and the private sector. All are represented in the Co-ordinating Commission of PRONABIO.

The first of these complementary projects is that for the Conservation and Sustainable Use of Brazilian Biological Diversity (Projeto de Conservação e Utilização Sustentável da Diversidade Biológica Brasileira - PROBIO), which has US\$ 20 million available, half of which is funded by the Brazilian Government and the remainder by the GEF. Implemented by MMA and with COBIO as its technical secretariat, PROBIO allows the Government and society to organise and disseminate information for decision-making in the area of conservation and sustainable use of biodiversity, as well as to support initiatives which identify priority action and stimulate the development of demonstrative studies and subprojects.

The identification and evaluation of priority action, involves, amongst other things, a series of biodiversity surveys in each of the major Brazilian biomes and the establishment of an Information Network on Brazilian Biodiversity. Five initial subprojects are under way with the participation of members of the scientific community, conservationists and environmentalists, as well as the suppliers and users of biological resources and representatives of governmental agencies at federal, state and local levels. Workshops will bring together and evaluate information on the Amazon forest, the Atlantic forest, the Cerrado, the Pantanal, the Caatinga, and the coastal areas and the sea, and will result in the proposal of priorities for conservation activities and the sustainable use of Brazilian biodiversity in each. The project is being carried out in collaboration with the Brazilian National Research Council (Conselho Nacional de Desenvolvimento Científico e Tecnológico - CNPq) of the Ministry of Science and Technology. With funding from the MMA (US\$ 2 million), CNPq (US\$ 2 million) and the GEF (US\$ 2 million), PROBIO published a public tender in December 1997 which invited subprojects concerning research on ecosystem fragmentation.

The second project is the Brazilian Biodiversity Fund (Fundo Brasileiro para a Biodiversidade - FUNBIO). The initial capital was US\$ 20 million provided by the GEF, but with contributions from the private sector as well as interest arising from its investment. It is administered by the Getúlio Vargas Foundation (*Fundação Getúlio Vargas - FGV*), and will provide long-term support for projects on the conservation and sustainable use of biodiversity.

Support for biodiversity research and conservation has also been available through other government programmes, including the National Environment Fund (Fundo Nacional do Meio Ambiente - FNMA), the National Environment Programme (Programa Nacional do Meio Ambiente - PNMA), and the Pilot Program for the Conservation of Tropical Rain Forests (Programa Piloto para a Proteção das Florestas Tropicais do Brasil - PPG-7). As a result, considerable progress has been achieved in such areas as the establishment of information networks and data bases, administrative infrastructure, in the implantation and consolidation of protected areas, in geographic and diagnostic research for the principal biomes, in setting up germplasm banks, in testing new models, and in increasing incentives for the sustainable use of biodiversity.

The last ten years have seen a major government-financed project concerning the monitoring of fires and deforestation in the Amazon. This programme has now been consolidated into the Surveillance System for the Amazon (Sistema de Vigilância da Amazônia - SIVAM), with the major participation of the National Institute for Space Research (Instituto Nacional de Pesquisas Espaciais - INPE), São José

dos Campos, São Paulo, Brazil.

Another important mechanism for biodiversity conservation is what is known as the 'Green Protocol' (*Protocolo Verde*). It is co-ordinated directly by the Presidency of Brazilian Government, and a Working Group for the Green Protocol was created on May 29th 1995. The aim is establish conditions whereby private and official funding agencies will release funds for maintenance and/or investment in agricultural properties and projects only if legal conservation standards are met.

With regard to legislation, the Public Attorney Office has been an important ally, with its powers to open inquiries and take legal action for the enforcement of environmental laws. The Brazilian programme for conservation of biodiversity and its sustainable use, and the commitments undertaken by Brazil in relation to the CBD, are legally underpinned by the Federal Constitution of the Republic of 1988, which devotes an entire chapter (article 225) to the environment.

Brazilian legislation makes provision for a National Environmental Policy, a National Council for the Environment (Conselho Nacional do Meio Ambiente - CONAMA), a National Policy for Water Resources (Política Nacional de Recursos Hídricos), a Land Statute (Estatuto da Terra), a Forest Code (Código Florestal), a Law for the Protection of the Fauna (Lei de Proteção à Fauna), a Decree-Law for the Protection and Promotion of Fisheries (Decreto-Lei de Proteção e Estímulo à Pesca), a Law of Biosafety (Lei de Biossegurança), a Law for the Protection of Cultivars (Lei de Proteção de Cultivares), a Law of Industrial Property (Lei de Propriedade Industrial), and a Law of Environmental Crime (Lei de Crimes Ambientais) which defines liability and civic-public action to be taken in the event of damage caused to the environment.

Concerned about the widespread forest destruction arising from the rapidly expanding agricultural and cattle-ranching frontiers and the increasing demand for logging concessions in the Amazon, in 1996 the Federal government issued a presidential provisional measure (Medida Provisória Presidencial, which has the force of a law) which increased the obligatory area for the conservation of native on each property from 50% to 80%. It also suspended the felling of mahogany and *Virola* trees, and further determined that all the management plans, which comprise part of the legal requirements for licensing timber extraction, be reviewed and revised.

With these and other measures, the annual rate of deforestation in the Amazon region during the period 1977 to 1994 has shown some tendency to stabilise. In 1977/1978, the annual rate was estimated at 0.54% a year of 3.7 million km². It dropped to 0.3% in 1990/1991, then rose to

0.37% in 1991/1992 and 0.4% between 1992/1994. It peaked at 0.81% in 1994/95, but fell once again to 0.51% in 1995/96, representing at this time 18,161 km² a year (the most recent statistics available from the National Institute for Space Research - INPE).

Brazil has also made significant progress regarding conservation areas *in situ*. The National System of Protected Areas now covers 4.59% of the country, including a number of different categories administered by the Brazilian Institute for the Environment and Renewable Natural Resources - IBAMA. These areas total more than 39.07 million ha. There are also 26.31 million ha of state-administered protected areas (3.50% of the country) and 341,000 ha of Private Natural Heritage Reserves (*Reservas Particulares do Patrimônio Natural - RPPN*), as well as numerous, if smaller, municipal protected areas (not included in these totals).

Efforts to establish the system of protected areas have resulted in significant qualitative advances, most especially through the National Environment Programme - PNMA which has supported the training of IBAMA personnel, and the National Environment Fund - FNMA which has allowed for considerable investment in the elaboration of management plans and in the reserves themselves, and has also financed research, training and the implementation of environmental educational programmes in and around protected areas. In addition to formal protected areas, indigenous lands which have been reserved, sanctioned, or registered now cover more than 61.37 million ha, or 7.18% of the country. These include some of the most important and best conserved areas for Brazilian biodiversity, principally in the Amazon region. This means that 130.55 million ha, or 15.37% of Brazil are legally declared as protected areas.

This is equivalent to the combined areas of France, Germany and Sweden. Forty-seven million ha (the majority) of the indigenous lands have been sanctioned since 1992, and 15.6 million ha just in the past three years. Likewise, 27 federal protected areas were sanctioned between 1992 and 1998, along with 131 RPPNs (80% of the total), giving a total of 8,030,816 ha.

A large number of private landowners have voluntarily created RPPNs, which involve the permanent and irrevocable registration of conservation areas on their properties. Besides this, the Forest Code also determines Areas of Permanent Preservation on private lands. These include, for example, forests along watercourses (gallery forests), springs, and forest on steep slopes. A conservative estimate would put these areas at 5% of the country. As explained above, the Forest Code also demands that natural forests be maintained over 80% of private properties in

the Amazon and 20% of private rural properties elsewhere, and determines measures for the recovery of areas in these 'forest reserves' which are degraded. Their exploitation or use is allowed only in the form of sustainable management.

In addition, an ambitious programme on the verge of being implemented is that of the 'biological corridors' in both the Amazon and the Atlantic forests, comprising mosaics of landscapes managed for sustainable use and protected areas, which due to their extent and diversity, will favour the conservation of the integrity of reproductive cycles and food webs, besides allowing for links between ecosystems and faunal corridors. The key challenge is to consolidate and administer these protected areas for the benefit of society

Considerable advances have been made in *ex situ* conservation, particularly in relation to genetic resources for agriculture by the Brazilian Company for Research in Agriculture and Cattle-breeding (Empresa Brasileira de Pesquisa Agropecuária - EMBRAPA), which co-ordinates a major network of 107 germplasm banks with more than 200,000 contributors.

Notwithstanding the disposition of the Brazilian Government to carry out the determinations of the CBD, ratified by the National Congress nearly four years ago, the difficulties involved in a country the size of Brazil are enormous. With its 8.5 million km² and 3.5 million km² of coastal and marine waters, decision-making for concrete action in biomes such as the Amazon or the Pantanal requires the evaluation of innumerable variables, including such as local physical conditions, limitations in the infrastructure available, and local involvement of the community. Likewise, environmental monitoring and control of the coastal areas and territorial waters is complicated by the lack of adequate infrastructure and the sheer vastness of the area to be covered.

The Republic of Brazil is comprised of the Federal District, 26 states, and more than 5,000 municipalities, each constitutionally entitled to formulate and carry out their own economic, social and environmental policy, the articulation of which, along with the sharing of responsibilities, and joint implementation, results in considerable additional demands. The Federal Policy Commission for Sustainable Development and for Agenda 21 (Comissão de Políticas de Desenvolvimento Sustentável e da Agenda 21) is responsible for the co-ordination of environmental planning at the three government levels. It was set up in 1994, and is linked to the Chamber of Policy for Natural Resources (Câmara de Política dos Recursos Naturais) of the Government Council (Conselho do Governo), and involves various ministries, government representatives and members of a number of segments of

society.

The National Council for the Environment - CONAMA formulates and regulates environmental policy at the national level.

No less complex is the articulation of environmental action carried out independently by society, bringing it into line with the measures and strategies of the government. There are now thousands of governmental and nongovernmental organisations at work, at national and international levels, in the environmental area alone.

Despite these difficulties, funds for biodiversity conservation have been made available, principally through the PPG-7, the PNMA, the FNMA and the PRONABIO, as is detailed later in the Report. Recruitment and the training of personnel for surveys and for conservation of biodiversity and its sustainable use have involved co-operation with private and public universities, public organisations and the state foundations supporting research.

The lack of any real tradition of scientific and technological research in Brazilian private enterprise is an important aspect in this complex equation. Although there has been some progress in recent years, investment in scientific and technological research in 1994 was only US\$ 3.85 billion, or 0.7% of the GNP. This included 0.11% from the state and 0.40% from the federal public sectors. The exact participation of the private sector is difficult to estimate, but investment in scientific and technological

research arising directly from the Government or from research foundations can be assumed to amount to some 80% of the total.

Since the 1980s, Brazil, like many other countries, has been going through successive phases of harsh policies for fiscal adjustment which are not conducive to the allocation of funds for research or the establishment of programmes for environmental issues. Brazil is also a country that still has serious inequalities in its income distribution despite its efforts to control inflation and achieve economic stability. Poverty is a factor seriously damaging to natural resources and biodiversity. One example of this lies in the frequent internal migrations of people engaged in placer-mining or predatory logging, principally in the Amazon; activities carried out even within indigenous areas. Action has been taken by the Government to prohibit invasion of indigenous lands, as witnessed by the recent removal of goldminers from the Yanomami reserve. Nonetheless, this is one of the main causes of the loss of biodiversity, along with the advance of the agricultural frontiers in both the Cerrado and the Amazon.

In short, a realistic view of the conservation and sustainable use of biodiversity must take into account numerous biological, physical, social and economic factors, as well as the relative lack of funding. The problems are many, complex, delicate and difficult to separate. Overall, however, the commitment of the Brazilian Government, working in close co-operation with society, has resulted in definite progress regarding the implementation of the resolutions of the CBD, ratified in the National Congress on 3rd February 1994, Legislative Decree 2/94 (see Box 6-1, on international agreements signed by Brazil).

It is felt that Brazil, despite the major challenges it is still facing, has made a positive response to the CBD. The number of biodiversity-related projects has doubled, and the funding available has increased four-fold (although still only one-fifth of that desired).

Much further action is expected and planned. Brazil's determination in this area is proportional to its responsibilities as the holder of the richest biodiversity in the world. The Brazilian Government will continue in its efforts to meet the obligations undertaken in June 1992 and ratified in 1994, and we hope that international co-operation will increase accordingly to meet the challenges, the collective responsibility of every individual and all of humanity.



Figure 1-1. The states and regions of Brazil.

South: Paraná (PR), Santa Catarina (SC), and Rio Grande do Sul (RS)

South-east: Espírito Santo (ES), Minas Gerais (MG), Rio de Janeiro (RJ), São Paulo (SP)

Central-west: Federal District (DF); Mato Grosso (MT), Mato Grosso do Sul (MS), and Goiás (GO)

North-east: Alagoas (AL), Bahia (BA), Ceará (CE), Maranhão (MA), Paraíba (PB), Pernambuco (PE),

Piauí (PI), Sergipe (SE), and Rio Grande do Norte (RG)

North: Rondônia (RO), Acre (AC), Amazonas (AM), Tocantins (TO), Roraima (RR), Amapá (AP), and Pará (PA).

Source: IBGE (1996).

Box 1-1

The value of the ecosystem-related services and of Brazil's natural capital

In 1997, Robert Costanza, co-ordinating a team of North-American, Dutch and Argentinian scientists, together with a Brazilian, Monica Regina Grasso (M.A. in Oceanography at the University of São Paulo and a Ph.D. student at the University of Maryland), published a paper (Nature, volume 387, number 6230, pp.253-260, 1997) in which they estimated the economic value of 17 ecosystem-related-services (and the stock of natural capital which generates them) in 16 biomes. For the entire biosphere, the value is estimated to be in the range of US\$16 trillion to US\$54 trillion (1012) per year, with an average of US\$33 trillion per year. By comparison, the global gross national product is around US\$18 trillion per year.

The paper was the result of 18 months of research, and included a workshop at the National Center for Ecological Analysis and Synthesis of the University of California in Santa Barbara.

In this study, the value of the services identified have no price in world markets, and the values given correspond to those which would be required in terms of the human costs in substituting them if it were possible.

The ecosystem services include the flow of materials, energy and information of the stocks of the natural capital, which combine with the services of human and manufactured capital to produce human well-being.

The world's habitats were divided into 16 major categories or biomes, including coastal and oceanic waters. A mean value per ha was estimated for each, taking into account 17 different services including: regulation of the chemical composition of the atmosphere; regulation of the climate; control of soil erosion and retention of sediment; food production; supplies of raw materials; absorption and recycling of human waste; regulation of water flow; supply, storage and retention of water; regulation of natural disturbances (protection against storms, flood control and drought, for example); soil formation; nutrient cycles; pollination; biological control of animal populations; refuge for migrant and resident populations; genetic resources; leisure and culture.

The highest value per hectare was attributed to wetland and flood plains at US\$14,785 a year. The open ocean was valued at US\$252, and tropical rain forest at US\$2,007 a year.

Some 63% of the total (US\$20.9 trillion) was ascribed to the marine systems, one half of this from the coastal areas. Of the terrestrial systems, the main contributors were forests (at US\$4.7 trillion) and wetlands (at US\$4.9 trillion).

Nutrient cycles alone were estimated at US\$17 trillion a year. The services provided by deserts, tundra, ice-caps and mountain ranges were not included due to the lack of consistent information. Had they been, and had the other services been estimated at their maximum values, the total would have reached US\$54 trillion a year.

The authors argued that "ecosystem services provide an important portion of the total contribution to human welfare on this planet. We must begin to give the natural capital stock that produces these services adequate weight in the decision-making process, otherwise current and continued future human welfare may drastically suffer." (p.259).

The scientists also concluded that "If ecosystem services were actually paid for, in terms of their value contribution to the global economy, the global price system would be very different from what it is today. The price of commodities using ecosystem services directly or indirectly would be much greater. The structure of factor payments, including wages, interest rates and profits would change dramatically. World GNP would be very different in both magnitude and composition if it adequately incorporated the value of ecosystem services." (p.259).

It was also emphasised that the value of natural capital and of the services provided by ecosystems would go up as and when impacts reduced their availability.

The team involved in this study included Robert Costanza, Ralph d'Arge, Rudolf de Groot, Stephen Farber, Monica Grasso, Bruce Hannon, Karin Limburg, Shahid Nacem, Robert V. O'Neill, Jose Paruelo, Robert G. Raskin, Paul Sutton and Marjan van den Belt.

Box 1-2

Brazilian cultural diversity

Brazil has a rich ethnic and cultural diversity, including not only indigenous groups but also the descendants of African Negroes, brought to the country during the period of slavery, including members of such tribes as the Nagô, Jêje, Fanti, Achanti, Haussá, Mandinga Tapa and Fulá, from the north-eastern coast of Africa, from Senegal to Nigeria. Other Bantu groups came from the south-western and south-eastern coast of Africa (Congo, Angola and Mozambique) and included Samba, Moxicongo, Macua and Anjico. Dahomeyans (Jêjes, Nagôs and Yorubas) came from the Gold Coast and the Bight of Benin. Mixed with white, yellow and Indian ethnic groups, these Negro groups today represent an important component of Brazil's human population.

A truly extraordinary cultural diversity is represented by some 330,000 Indians, of 215 distinct social groups and with more than 170 languages, of which only 10% are fully described. Many of these languages stem from Tupi-Guarani (40 languages), Macro-jê (21 languages and 16 dialects), Karib (21 languages) and Aruak (24 languages), while others are isolated and have no distinct affinities. Many have been lost. When European colonists first arrived in Brazil in 1500, there were more than 340 languages among 1400 groups, with an indigenous population estimated at 5 million. Between 1900 and 1957 alone, 87 ethnic groups were wiped out, and only in the past few decades has the indigenous population begun to recover.

Indigenous societies can be found in all of the Brazilian states except for the Federal District. Many now live in cities, especially in the north and central-west. Their existence in these urban environments is invariably precarious. Some 1,500 Pankararu Indians from Pernambuco now live in the city of São Paulo, for example. The National Indian Foundation (Fundação Nacional do Índio - FUNAI) has estimated a population of 30,000 to 50,000 Indians today living in urban areas.

Brazil is one of the few countries where there are still indigenous groups which have never been contacted. They are isolated, autonomous, and reclusive, resisting contact and generally resorting to remote areas. There are references to 55 of them, nearly all in the Amazon region. The National Indian Foundation (FUNAI) has established contact with 20 of them and established means for their protection, even though they remain isolated and little is known about them. No information is available for the other 35 groups.

The 1988 Constitution includes an entire chapter determining the rights of the Indians (Chapter VIII, Articles 231 and 232). It begins recognising the Indians and their "social organization, customs, languages, beliefs and traditions and their traditional rights over the territories they occupy, the Union being responsible for their demarcation, for their protection, and for guaranteeing respect for their land and property.."

The lands they occupy "are for their permanent possession, and they have exclusive rights to the riches of the soil, the rivers and the lakes within them." Their patrimony is inalienable and cannot be disposed of and the indigenous rights to their lands are not subject to statute of limitation. Use of resources found on Indian lands requires authorisation from the National Congress, after full consultation of the interested parties.