THE CHALLENGE OF SUSTAINABLE DEVELOPMENT

The Brazilian Report
For the United Nations Conference on Environment and Development

1992

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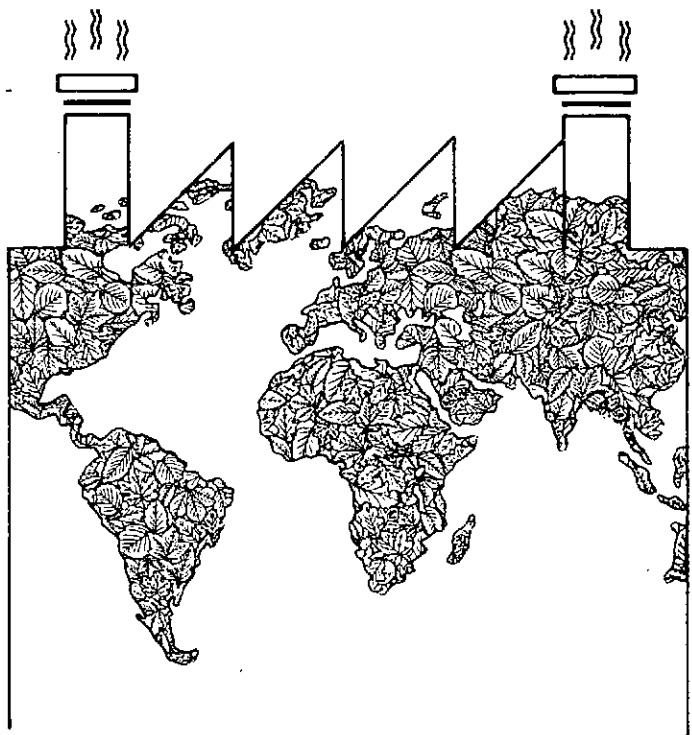

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For the United Nations Conference on
Environment and Development

CIMA
Interministerial Commission for the
Preparation of the United Nations Conference on
Environment and Development

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of the Presidency
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Presentation

Brazil hereby fulfills its commitment to the international community by presenting an evaluation of the development process of the environmental situation of the country over the last two decades. The National Report for the United Nations Conference on Environment and Development represents a critical appraisal of our experience, through an objective description of Brazilian reality as it is. From past experience we have learned the necessary lessons for sustainable development.

We have chosen the path of ample participation by all segments of our society in the preparation of this Report. The mobilization of efforts brought about by the debate of themes presented in this report, is proof of Brazilian awareness regarding the need for development in harmonious co-existence with Nature. The interest which is present in public opinion, the media, government agencies and non-governmental organizations, is evidence of the importance attributed to an authentic, faithful depiction of Brazil, worthy of presentation to the participants of the Conference on Environment and Development.

As the host of one of the most relevant international conferences of our times, Brazil firmly believes that the Rio de Janeiro meeting will provide the opportunity to reconsider the basis upon which the international economic alliances rest and to build foundations for new models of sustainable economic development on a global scale. Heads of State and Governments representing countries from all continents will be discussing the future of the Earth in the next millennium. We have repeated that poverty and its extreme conditions, which impose upon millions of people a quality of life incompatible with human dignity, are obstacles that must be surmounted in the construction of a more equitable, healthy and balanced worldwide environmental order.

Brazil's contribution to the United Nations Conference does not end with this National Report, as this document is a preliminary product of our reflection on environmental and development issues.

President Fernando Collor

Introduction

Brazil and the Challenge of Sustainable Development

1. Development trends, ecological transition and environmental crisis

The world context in which Brazil is presenting and discussing its environmental situation is one of drastic changes in the frames of reference that govern the organization of human society. Tensions created by the arms race are giving way to a detente in international relations, together with a certain perplexity, as well as new forms of knowledge brought about by geo-political transformations.

The notion of an exhaustion of traditional modes of development seems to be the key idea that explains current challenges. These range from the traditional obstacles of poverty, inequality and distribution to those arising with unusual strength with regard to foreign debt and in the expected worldwide reshuffling of political forces.

If a synthetic definition for the turn of the century were to be attempted, it could be expressed as the end of a development trend that has proved to be ecologically predatory, socially perverse and politically unjust. In this sense, the signs of vulnerability of the earth's ecosystem have served as a sounding board announcing the various "exhaustions of modes" that lead with unquestionable logic to a calling for profound changes.

This concept of change requires a more precise definition, in order to establish its direction, premises, commitments and limits.

The presentation of the Brazilian Report cannot be dissociated from this definition and from the fact that the crisis - with the worsening and globalization of problems faced by humanity - will only be adequately confronted if nations take the initiative of formulating proposals that reflect the urgent need for change.

The abandonment of defensive and diversionary postures would be consistent with a willingness to change, moving towards a clear recognition of: the real internal signs, in each country, of the crisis of the traditional models of economic development; the exact extent of responsibilities of nations in the configuration of worldwide problems; the need to reverse the stalemates in international relations; and the imperative need for a new distribution of the benefits of development.

The most evident manifestation of the crisis is undoubtedly the fact that we live in an era of scarcity of resources, of difficulties in expanding the economic base of national societies, of saturation of sites for storing or eliminating society's industrial wastes and above all, of the fragility of local, regional and international institutions in facing the challenges arising from this crisis. Indeed, it is an ecological crisis (characterized by a progressive depletion of our natural resource base), and an environmental crisis (characterized by a decrease in the capacity for recovering our ecosystems). But it is also a political crisis directly related to the authority structures in the distribution and use of society's resources which, in a last analysis, determine a situation of absolute scarcity (exhaustion of the stock of resources) or relative scarcity (unsustainable standards of consumption or inequities regarding access to them).

The incorporation of an ecological dimension into the process of government decision making - so as to consider the implications of public policy regarding the network of interrelations that operate in ecosystems - is more than an aspiration. It is a biological necessity for the very maintenance of the natural systems that make life possible. This facet of the present moment calls for the recognition that humanity is undergoing a period of authentic ecological transition.

It is not surprising that the ecological argument has for so long been absent from economic, political and social considerations. The crisis of development, via ecological transition, is characteristic of contemporary society, just as the anthropocentric standpoint regards progress and evolution as an indiscriminate capacity to generate technology, without admitting any limits.

It should come as no surprise, therefore, that given the primacy of the economic dogmas of abundance and of material progress, a majority of contemporary institutions appear to be incapable of adequately facing the challenges of transition.

The crisis is also perceivable through precise indicators of the vulnerability of our natural systems. The outlooks for the planetary ecosystem presented by the majority of reports and simulation models published in recent decades are, from all points of view, disheartening.

It is estimated that since the middle of this century the world has lost one fifth of its arable surface and one fifth of its tropical forests. Each year 20 million hectares of forests are lost, along with 25 billion tons of humus through the effects of erosion, desertification, salinization and other processes of soil degradation.

The availability of water for human consumption and for agriculture, which in the seventies revealed problems of serious shortage in many countries of Africa, Southeast Asia, the Middle East and Latin America, has become one of the most pressing problems of the planet. One-fourth of the irrigated surface of the world has been damaged by salinization alone, which leads us to anticipate the reappearance of famine in Africa, and its possible expansion to other regions of the planet.

Equally distressing are the forecasts regarding the destruction of the flora and fauna. Every day approximately one hundred species of animals and plants disappear, many of which have never been studied, in terms of their properties or potential for human welfare. The implications of this unprecedented ecological disaster for scientific knowledge, medicine, genetic engineering and other productive activities, cannot be disregarded. The impact of such a trend on science can be considered equivalent to trying to advance in astronomy without having studied the stars. Regarding productive activities, it is sufficient to recall that genetic improvement does not "create" new genes; it simply rearranges the existing ones.

Better than center a debate on numerical estimates of the multiplicity of ecosystems, the implications suggested by such projections should be the object of our concern.

Whether we are discussing the disappearance of 20% or 40% of a resource is less relevant than the question of how we are to avoid this, since what is at stake is the very survival of the species.

2. The environmental crisis through the prism of North-South relations

The current crisis highlights two basic elements of modern civilization: technology and growth. This situation raises questions concerning the internationalized style of development, which is evidenced mainly through the processes of modernization of agriculture, urbanization, appropriation of natural resource bases and use of non-renewable sources of energy. Such a style has been determined mostly by the adaptation of the technological model by transnational companies, as a homogenizing tendency of the world economy.

At the time of the 1972 Stockholm Conference, the idea that the world would be entering the era of the "astronaut economy" was disseminated. Over the centuries, humanity

grew accustomed to the idea of a virtually limitless world. When the environment deteriorated to the point where it did not offer the same former sustainability, there was always a new frontier for expanding economic activities. Given that the flow of human activities effectively occurs within a closed economy, without unlimited reserves of resources or deposits for absorbing its waste, the concept of an "economy of the frontier" has been unavoidably replaced by one of an "astronaut economy."

The metaphor of the "astronaut economy" emphasizes the global and interdependent character of societies or nations at the twilight of this century, so clearly synthesized in the very title of the report prepared by Barbara Ward and Rene Dubos for the 1972 Stockholm Conference: "One Earth."

Twenty years after the Stockholm Conference, we are forced to admit, however, that all people do not occupy the same place in this "spaceship". Less than a fifth of the population on our planet occupies the first class section of the spaceship and consumes 80% of available resources. The immense majority of passengers, about 80% of the world's population, are in the cargo compartment. More than a third of these suffer from hunger or malnutrition and three-fourths do not have adequate access to water and decent housing. Each first class passenger, who usually comes from a developed country, has an impact on resource reserves that is 25 times higher than that of the occupants of the cargo compartment.

The contrast between North and South in Spaceship Earth makes the metaphor more tangible. In highly industrialized economies, environmental problems are generally associated with pollution. Their environmental policies are, for this reason, directed towards avoiding an intensification of this degradation, or restoring the standards of quality of the water, air and soil to their original state before the crisis. In underdeveloped countries however, the environmental crisis is clearly associated with an exhaustion of natural resources. Thus, their policies must give priority to a rational management of these resources.

This distinction has lost much of its validity, mainly in Southern countries, which are faced with situations of environmental degradation due to the depletion of their natural resource heritage, because of their underdevelopment, but they also face situations normally associated with "excessive development". The ecological concepts of interdependence and diversity can certainly be applied to the situation just described. One example of interdependence between the center and the periphery was undoubtedly the momentary disarray of the international economic system provoked by a group of countries that decided to increase the price of oil during the 1970's.

However, when considering the flow of resources throughout the world, we observe that: highly industrialized countries account for about 80%, two thirds of all exports from developing countries are primary products, while the advanced industrialized countries are responsible for about 90% of exported capital goods. These figures reinforce the idea that underdeveloped countries are importing a lifestyle that is characteristic of the developed world, and reflects its ecological relationships (potential and limitations) as well as its environmental problems.

In sum, in recent decades, not only has the economic gap widened between North and South, but the environmental and ecological gaps have also widened between the two worlds. It is a well-known fact that countries of the South find themselves in the most vulnerable position, suffering the consequences of global degradation. Let us consider, for example, the progressive depletion of the biogenetic substratum of human activities, with its impact on the maintenance of diversity in the planetary ecosystem. The most significant part of humanity's biogenetic heritage is found in the tropical rain forests, now seriously affected by anthropic activities.

Let us consider still the environmental problems associated with industrialization and urbanization. At the beginning of the last decade, 22 cities in the developing world had a population of over 4 million inhabitants; by the year 2000 this number is expected to reach 60 million. On the other hand, the corresponding figures for the developed world should reveal an increase from 16 to 25 million. Finally, in the year 2000 ten out of the 12 most populated cities in the world, with more than 13 million inhabitants, will be found in the South, half of them in Latin America, with Mexico City and São Paulo at the top of the list. About 40% of the Latin American population will be living in cities with over 1 million inhabitants. The problems of atmospheric pollution that result from such urban concentration has led the United Nations Environment Programme (UNEP) to state that the five largest Latin American cities are being converted into veritable gas chambers.

The realization that both countries of the Northern and Southern countries are affected by the impact of the environmental crisis does not imply the existence of common responsibilities for possible solutions. Most of the global problems, such as acid rain, the "greenhouse effect" and the destruction of the ozone layer are almost exclusively the responsibility of developed countries. Besides suffering the adverse effects of these problems, without sharing the benefits of development, the countries of the South are called upon to share both the responsibility and the cost of measures aimed at overcoming the crisis.

3. Brazil and the changes in the international agenda from the 1972 Stockholm Conference to the United Nations Conference on Environment and Development (Rio, 1992)

At present, almost two decades after the Stockholm Conference, the world's perception of environmental problems has changed considerably, as attested by the creation of the World Commission on Environment and Development through the United Nations Assembly Resolution 38/161. Chaired by the Prime Minister of Norway, Gro Brundtland, this commission published, in 1987, a report entitled "Our Common Future," which clearly reflects this change of perspective.

From the outset, the commission refused to limit itself to environmental problems in a narrow sense. Reflecting what was considered at the time a position reflecting the interests of developing countries, the debates centered on styles of development trends and their repercussions on the functioning of natural systems. For no other reason are the commission's proposals all oriented towards the notion of sustained development. Equally interesting is the fact that it has called the attention of the world to the importance of cooperation and multilateralism in facing the challenges of the turn of the century.

Finally, the report emphasizes that environmental problems and the chances of reaching a form of sustainable development are directly related to the problems of poverty, to meeting the basic needs for food, health and housing, to a new energy matrix favouring renewable energy sources and to the process of technological innovation.

In response to a request from the Brundtland Commission, the Latin American Commission on Development and Environment was created in October 1989, and published a document in the latter half of 1990 entitled "Our Own Agenda," which clearly demonstrated the links between wealth, poverty, population and environment. The document "Sustainable development: productive transformation, equity and the environment," prepared by ECLAC for the Preparatory Meeting for the United Nations Conference on Environment and Development, held in Mexico City in March 1991, generally follows the same line of argument, underlining, however, the need to find a balance between making Latin American economies more competitive, the need to promote greater social equity and to provide for the preservation of the environment and the conservation of natural resources. As a result of the meeting, the Tlatelolco Platform on Environment and Development contains the positions of the countries of the region for the United Nations Conference on Environment and Development to be held in Rio de Janeiro.

There is no doubt that the changes that have occurred in the international agenda between the time of "One Earth" and the current "Sustainable Development" entail modifications in the way we meet socio-ecological challenges. It is no longer possible to reduce the environmental crisis to a question of keeping clean the air we breathe, the water we drink and the soil that produces our food.

The technocratic vision is outdated, at least as regards the definition of problems. It makes no sense to oppose environment and development, since the quality of the former is the result of the dynamics of the latter. Problems of environmental preservation are those of development itself: a development that is unequal for human societies and harmful to natural systems.

This situation does not reflect a technical problem, but rather a social and political one. The key issue, today, is not that of accommodating our numbers, our aspirations and our needs to the planet's sustaining capacity. More than the human capacity for adaptation, the possibility for substantial change in the forms of social organization and interaction with the laws of nature is at stake.

Preparations for the United Nations Conference on Environment and Development show that the underdeveloped countries, and those of Latin America in particular, gather all the necessary conditions to transform the present crisis into new opportunities for development, as in 1929, at the outset of the international economic depression. Whereas the 1972 Stockholm Conference sought to find technical solutions to the problems of pollution, this new round of discussions, according to the UN, aims at examining development strategies through "specific agreements and commitments by governments and intergovernmental organizations, setting up time limits and financial resources for implementing such strategies."

Resolution 44/228, which convened the Conference, clearly states that "poverty and environmental degradation are intimately related," and that environmental protection cannot be isolated from this context. It also points out that most pollution related problems are caused by developed countries, consequently being theirs "the main responsibility for combatting them"; that resources and technology must be allocated to developing countries so that they may reverse their process of degradation; and that an "efficient and urgent" solution is needed to the problem of the foreign debt, a fundamental requirement for a sustainable development strategy.

Resolution 44/228 is equally mandatory in other aspects. It reaffirms, for example, that the importance of introducing the environmental dimension into the policies and programmes of governments must not lead to "a new form of conditioning aid for development, nor constitute a pretext for trade barriers." It also emphasizes that sustainable development

"requires changes in current standards of production and consumption, particularly in the industrialized countries."

The position of the developing countries regarding environmental problems, and particularly that of Brazil, show that fundamental postulates persist. There are two basic components to this standpoint. The first argues that economic growth and improvement of the quality of life of the Brazilian population cannot be subordinated, acritically, to the preservation of a healthy world environment and to a better management of the planet's natural resources. Although both the Brazilian government and its society recognize the existence of serious environmental problems, there is consensus as to the fact that industrialized countries are mainly responsible for the gravity of the worldwide situation. It is natural, then, to suppose that the developed world will promote and finance the elimination of pollution from the planet.

Secondly, Brazil shares in the consensus that the globalization of environmental problems calls for a responsible interpretation of the traditional concept of national sovereignty and strategic security. This must not give way, however, to a naive perception of the realities of power that still hold sway in international relations, at the risk of submitting ourselves to the "interests of humanity," as defined both ambiguously and geo-politically.

The great challenge, therefore, lies in the search for new forms of cooperation which, without ignoring the current imbalance between North and South, permits the appearance of a new world order in which national interests contribute to the strengthening of world interests, in perfect harmony with the sovereign rights of each country.

It is also justifiable to question the notion that natural resources constitute a heritage for humanity. It would be unrealistic to suppose that certain resources pertain to humanity as a whole, while in fact they are located within national borders. If it were accepted that they be shared in a kind of "world fund," it would be no less correct to expect that economic, political and technological authority also be shared by all nations. Since the central countries do not appear to be willing to accept this latter idea, the peripheral countries are to an even lesser degree willing to renounce their right to decide how to use their natural resources.

A third element of the position of the developing countries has to do with the interrelations between population growth and the use of natural resources. Since the first models of the Club of Rome, proposals for demographic control continue in vogue, based on the confirmation that the planet's resources are finite. The position of the developing countries has always been that of justified reticence, and it should be emphasized that indiscriminate prescription of birth control, without due consideration of the relationship at the national level

between population, demographic pressures and availability of resources, amount to being not only irresponsible but morally censurable.

The relations between population, resources and the environment still lack rigorous scientific foundation, as there are multiple interfering variables. The levels of environmental pollution in major industrialized countries have grown at rates infinitely higher than the growth of their populations. It is also commonly emphasized that even scientific truths have a temporal limit.

In sum, the developed world has a greater and more specific form of responsibility in the search for solutions to the most pressing problems of the planet, since until now the contribution of our ecological disorder to the global disorder has been limited. One cannot escape the fact, nonetheless, that a form of development that is environmentally sustainable will be impossible to attain if all countries are not also willing to modify their current standards of growth and the exploitation of their natural heritage.

4. Poverty, environmental degradation and sustainable development

The general consensus that poverty and environmental degradation are intimately related usually disappears when rhetoric is abandoned and one attempts to specify, empirically, the causal relationships between the two. Indeed such relationships occur indirectly, through other intervening variables. Among these variables, are the inequalities that characterize the present form of development, with its resulting social marginalization and disintegration, the institutional fragmentation of contemporary society, as well as the structural imperfections of the market and even of the regulatory function of the state.

Self-perpetuating social and environmental degradation stems neither from independent nor causally related processes, but rather as a result of a development trend that has an influence over human relations as well as over those between humanity and nature. According to the UNEP, the two basic causes of the environmental crisis are poverty and misuse of wealth; the poor majority is forced to destroy, in the short term, the very resources they will need for their long term subsistence, while the rich minority makes demands on resources that are unsustainable in the long run, thus transferring the costs to the poor.

Using the ECLAC studies as reference, the poor are defined as those families with an income below twice the cost of the basic food basket; the population living in poverty in Latin America at the beginning of the eighties represented 41% of the total population (135.9

million people), which reached 43% of the total population (170.2 million) in 1986. This increase in the number of the poor, was almost entirely concentrated in urban areas, where proportions rose from 30% to 36%. These figures indirectly reflect the depth of the crisis of the first-half of the decade when one considers that the poor increased by 34.3 million, and that 55% (19 million) of these are under the poverty line - in other words, those whose income is insufficient to buy the basic food basket - in both the urban and the rural areas. The seventies were marked by a considerable increase in urban poverty (from 26% to 31%) and also a significant drop in rural poverty (from 62% to 54%).

The figures for Brazil, in the last decades, speak for themselves. By far the most dynamic economy in the post-war period, following a level of development in the 1940-1950 period barely superior to that of the region's poorest countries, Brazil transformed itself into the eleventh largest industrial economy in the world, but did not succeed in reducing its levels of inequality. On the contrary, during the period of highest growth, between 1960 and 1980, the wealthiest 10% of the labor force succeeded in increasing its share of the general income from 40% to 50%, while the poorest 50% saw its share dwindle from a modest 17% to only 12% in 1980.

When rates for urban and rural areas are compared, the spatial concentration of poverty in the urban areas is evident. In rural Brazil, poverty levels followed a declining trend in the 1970 to 1980 period, and then remained stable until 1986. In the urban areas, poverty declined from 35% to 30% between 1970 and 1980, only to return to a level of 34% in 1986.

This analysis allows one to conclude that ecological problems are deeply rooted in those of a social and political nature (in other words, the patterns of relationship between human beings and the organization of a society), as well as linked to structural distortions in the economy (patterns of consumption and the way that society is organized to satisfy them). Brazil not only faces situations of environmental degradation associated with an "excess" of development (pollution and waste of resources), but also conditions that can be defined as resulting from an "absence" of development, or of perverse development (poverty and social and economic inequality).

It is worth mentioning that in situations of extreme poverty, an individual that is marginalized from society and from the national economy, will lack the commitment to avoid degrading the environment, insofar his own degradation as a person has not been avoided by society.

Post-industrial societies have managed to extend the limits of life-supporting systems. But, parallel to this, the globalization of the economy has exacerbated the challenges

presented by environmental problems, by despoiling human society of its ecological foundations. Absolute and relative scarcity - the actual lack of resources and the lack of access to them - equally affect the developed and underdeveloped nations.

The time has come for social and political institutions to pave the way to a better future, in a way that such societies may learn to adequately confront the unequal distribution of the planet's resources and defy a form of development that is decidedly unsustainable.

Chapter I

Brazilian Development and its Socio-Environmental Implications

Until the mid-1960's, growth was based on import substitution, and protectionism was the basic instrument of industrial policy. The major funding mechanisms were then direct foreign investments and expansion of the money supply, generating "forced savings" of the non-business sector. This style of financing ended with the acceleration of the inflationary process and an accumulation of deficits in the balance of payments, which culminated in a recession and political crisis at the beginning of the sixties.

After 1964, fiscal and financial reforms succeeded in overcoming the fiscal crisis and in reducing inflation, thus creating conditions for a second phase of growth, during the 1970's, when import substitution was complemented with the expansion of industrial exports.

The oil crisis of 1973 created an impasse for this mode of development. The economic policy's response was to sustain growth through a process of external endebtment, avoiding any major alterations in the basic economic indicators such as currency exchange rates, interest rates and real wages and salaries.

By adapting the territorial structure to a proposal for industrialization, strategies aimed at removing any material, political and ideological obstacles to modern capitalistic expansion were consolidated. A network of technical and political control was set up through government planning.

The adopted industrial strategy, backed by state owned companies, Brazilian private companies and transnational firms, was that of integrating the domestic productive sector by substituting imports of basic materials and capital goods. Investment programmes were adopted for the production of oil, fuel and alcohol and the generation of hydroelectric and nuclear power. The vigorous expansion of mineral extraction that marked the seventies also reflected government incentives.

This ambitious programme was largely accomplished through external loans at fluctuating interest rates, coupled with an expansion of the domestic debt. The country's net foreign debt jumped from US$ 6.2 billion in December of 1973 to US$ 31.6 billion in December of 1978. This debt was to continue growing consequent to, among other factors, the adjustment policies of the United States Government, which substantially raised international interest rates and made them highly unstable. However, on the eve of the second oil shock and the explosion of international interest rates, the foreign debt did not yet appear to be an unbearable burden for the Brazilian economy.

With regard to the performance of the economy, it may be affirmed today that the investment programme launched in 1974 was partly successful. The metallurgical and chemical industrial sectors grew considerably, as did the production of machines and equipment. Exports increased and diversified. Technological upgrading received a boost. As a result, the productive structure underwent important changes, which became evident as larger projects progressed.

The second oil crisis, the increase in interest rates and the reduction in foreign capital entering the country signified a twofold crisis for the Brazilian economy, and substantially affected its financing capacity. Deprived of funds coming from external loans, the country found itself faced with a need to generate trade surpluses to pay for servicing the debt. Domestically, the problem of transferring funds from the private to the public sector, became the main factor responsible for the foreign debt, but did not generate revenues in hard currency to cope with interest rate payments.

The external adjustment was impressive. After 1984, the trade deficits that had existed at the beginning of the decade were transformed into surpluses. For the public sector, the changes in relative prices in favor of exports implied, on the one hand, an increase in financial costs, and on the other, a lowering of the real price of public utilities offered in the domestic market (energy, transports and communications) and of import-substituting goods (oil, petrochemicals and steel).

The federal policy of giving priority to industry and infrastructure was maintained by channeling funds from agriculture, which guaranteed the supply of food and raw materials required by rapid urban industrial growth. The options chosen for solving agrarian problems, to guarantee the continuity of agricultural modernization, kept the land ownership structure almost unchanged.

A dynamic territorial complex was consolidated, with the focal point being the large urban centers of the Mid-Southern region of the country, notably São Paulo, which

absorbed large amounts of state and multinational investments. The most advanced centers for science and technology were also established there.

The metropolitan axis connected the cities of São Paulo and Rio de Janeiro, forming a large, almost contiguous industrial area, which also included part of the state of Minas Gerais and sent out vectors in the direction of Brasilia, essentially a government city, and towards the state of Espírito Santo, an important port, agro-industrial and steel center. Around this axis a constellation of metropolises was formed, made up of Belo Horizonte, Curitiba and Porto Alegre, outstanding for their industrial growth. A hierarchy of functions and authority, linked to productive, distributive and management activities, emerged.

The maintenance of an extremely concentrated land ownership structure resulted in the migration of large contingents of the population to small cities, where they served as reserve labor force for seasonal work in the fields, or swelled the lines of the underemployed and unemployed in the medium-size and large cities. In certain regions migrants became prospectors in the many mines that spread throughout the country.

In the agrarian social and economic context, dramatic rural and urban poverty levels persisted, as did the privileges in land, markets, and sharing in public funds. In the Northeast, the fragility of the regional economy, due to periodic droughts, was used as an instrument to gain special privileges for the region. This led to an intricate network of subsidies and state protection that resists the forces of modern capitalist competition.

Table I.1 summarizes the expansion of the Brazilian economy in the 1970-1990 period, by sector and region and in per capita figures.

The proposal for regional industrialization put forth by the Northeast Development Superintendency (SUDENE) made possible the integration of the Northeast with the Mid-Southern region, although in a subordinate position. Being capital-intensive and spatially concentrated, this process gave rise to the creation of modern frontiers in isolated areas, like the Camaçari Petrochemical Complex, near Salvador (state of Bahia), and to farming enclaves such as the large irrigation projects along the São Francisco Valley.

Regional policy reproduced the SUDENE experience by creating regional superintendencies for the Amazon Region (SUDAM), the Mid-West (SUDECO) and the South (SUDESUL). The concession of fiscal and credit incentives, guaranteed the collaboration of the regional elites to modernization. The federal government thus created new forms of management, superimposed in practice upon the political and administrative structure of the states and territories.

Table I.1,A - Sectorial Evolution of the Brazilian Gross Domestic Product
(Cr$ 1,000.00 at 1980 prices)

Specification	1970	1975	1980	1985	1990	Growth Rates (% p.a.)			
Gross Domestic Product						70-75	75-80	80-85	85-90
Total	5,419	8,756	12,382	13,069	14,430	10,07	7,21	1,09	2,00
Per Capita (Cr$ 1,00)	0,056	0,081	0,102	0,096	0,096	7,47	4,75	-1,21	0,00
Sectorial Composition of GDP									
Agriculture	561	895	1,232	1,373	1,288	4,36	5,09	3,96	1,09
Industry	1,742	3,364	4,902	5,390	4,874	11,20	7,44	-0,18	0,94
Mining	38	69	125	386	208	8,13	6,16	11,88	1,99
Manufacturing	1,333	2,611	3,746	4,014	3,314	10,70	7,24	-0,63	0,39
Engineering & Construction	262	518	813	714	988	13,59	6,85	-3,27	1,92
Public Utilities	108	166	218	276	364	12,27	12,31	7,94	4,14
Services	2,557	4,072	5,945	6,639	8,067	10,92	7,89	1,87	3,37
Commerce	797	1,212	1,328	1,081	899	10,02	6,46	0,18	0,82
Transportation	180	270	462	507	510	13,31	8,96	1,71	4,12
Communication	30	66	111	128	166	18,55	23,52	14,33	13,40
Financial Institutions	293	545	955	1,480	1,573	-	-	6,82	-1,61
Public Administration	449	625	781	907	1,514	-	-	2,22	2,07
Other Services	357	797	1,482	1,394	1,547	-	-	1,09	4,46
Rents	451	557	826	1,142	1,858	-	-	-	-
Total (b)	4,860	8,331	12,079	13,402	14,229	-	-	-	-

Source: IBGE - Indicators - Dec., 1989 and July, 1991
Notes: (a) Values computed using the implicit monthly GDP deflator. Rates calculated by the real product indices of each sector.
(b) Includes imputation of financial intermediation services.

Table I.1.B - Regional Evolution of Brazil's Gross Domestic Product
(Cr$ 1,000.00 at 1980 prices)

Specification	1970	1975	1980	1985	Regional Distribution			
					1970	1975	1980	1985
Regional Composition of GDP								
North	93	149	368	509	2,3	2,2	3,3	4,3
Northeast	501	772	1,349	1,612	12,0	11,5	12,1	13,5
Southeast	2,711	4,262	6,903	6,924	65,0	63,7	62,1	58,2
South	711	1,223	1,918	2,105	17,0	18,3	17,3	17,7
Mid-West	155	287	577	751	3,7	4,3	5,2	6,3
Total (c)	4,171	6,693	11,115	11,901	100,0	100,0	100,0	100,0
Per Capita Prod. (Cr$ 1.00)								
North	0,0252	0,0316	0,0614	0,0665	57,9	51,0	67,0	75,5
Northeast	0,0173	0,0240	0,0380	0,0413	39,8	38,7	41,5	47,0
Southeast	0,0661	0,0913	0,1309	0,1171	152,0	147,3	142,9	133,4
South	0,0419	0,0673	0,0989	0,1017	96,3	108,5	108,0	115,8
Center West	0,0297	0,0449	0,0750	0,0826	68,3	72,4	81,9	94,1
Total (c)	0,0435	0,0620	0,0916	0,0878	100,0	100,0	100,0	100,0

Source: IBGE - Indicators

(c) Does not include Engineering and Construction and Public Utilities in 1970 and 1975, and Air and Highway Transportation from 1970 to 1985.

In the early seventies, governmental strategy became more selective, no longer acting on a macro-regional scale but rather on a sub-regional one, by establishing development poles. In the Amazon region, subsidies for national and transnational investments favored land appropriation by farming, livestock and mining companies. The setting up of giant highways, and urban, telecommunication and hydroelectric networks for the purpose of spatial integration, cut through the forest exposing the fabulous wealth of its subsoil. Migration was encouraged, thus complementing the policy for a mobile labor market in the region.

The territorial management which combined large scale production with important mobilization of natural resources, intensive use of energy and accelerated mobility of the labor force, intensified the prevailing technological pattern of the post-war period. The apogee of this development strategy, during the 1970's, coincided with a downturn of the world's economy. The financial crisis and the oil crisis forced a restructuring of the industrialized economies, it being necessary to reduce dependency on energy and raw materials, to introduce more technology-intensive procedures and increase the flexibility of production and management processes.

In Brazil, given its territorial dimensions and the size of its population, the extension and diversity of its ecosystems, the complexity of its productive structure and the unequal distribution of wealth, this dilemma is expressed in the challenge of accelerating material development with social justice and environmental protection. The uniform logic, characteristic of economies of scale superimposed itself on natural and cultural differences, which were viewed as obstacles to progress. Large parts of the nation's heritage of biodiversity and forms of life were sacrificed in the name of modernization, to the detriment of the quality of life of the population as a whole.

The expansion of the economy on its two fronts will be analyzed. Important recent issues will also be addressed, such as health, demographic growth and urbanization, and indian communities.

1. The expansion of agriculture and its impact

The expansion of agriculture resulted from the continual advance of the agricultural frontier and the introduction of more capital-intensive production techniques. The area covered by farmland practically doubled between 1950 and 1980, increasing by 1.67 million square kilometers.

Concentration of land ownership, social disparities and the absence of social mobility in the rural sector are phenomena that lie at the root of economic, social and environmental problems in Brazil.

The modernization process was unequally distributed, both regionally and by types of produce and rural strata, reflecting its partiality and its link with the internationalization of the economy. Modernization took place intensely in the Southeastern and Southern regions, especially in São Paulo, Paraná and Rio Grande do Sul and, in general, in the export crop farming regions, such as the areas of the Center-West and the "Zona da Mata" in the Northeast.

This modernization strategy gradually led to the affirmation of agro-industrial complexes, a combination of science applied to agriculture with profound changes in the organization of production, reducing the gap formerly existing between agriculture and industry. Research on tropical conditions was consolidated, allowing significant increases in productivity.

A comparison of the average growth rate of crops both for domestic consumption and export with population growth rates over the past three decades provides a clear view of the prevailing general trend. The production of rice, beans, corn and manioc either stagnated or declined dramatically, while coffee, soybeans, oranges and sugar cane remained at high levels. The evolution of the main structural data for Brazilian agriculture, from 1970 to 1985, broken down by macro-region, is shown in Table I.2. Indicators of appropriation, concentration and extensive use of land predominate and remain high. Indicators of technification reiterate the wide regional disparities in the sector.

The use of the tractor in agriculture is an example of the marked imbalance in the modernization process: although the number of farm tractors grew 7800% from 1950 to 1985, they existed in only 7.2% of farms in 1985. The Southern region, where 16.3% of the farms used tractors, concentrated 43.2% of the tractors used in Brazilian agriculture. In 1980, three fourths of the farms in Brazil used manual farming methods, such as the hoe, machete, scythe and axe. Only 23% used draught plows.

With regard to chemical fertilizers, figures for 1980 reflect a similar form of imbalance. Only 26% of Brazilian farms used chemical fertilizers; 70.4% of the farms using fertilizers were located in the states of São Paulo, Paraná, Minas Gerais and Rio Grande do Sul, although the farms in those states represent only 18.4% of all Brazilian farms. In terms of region and types of crops, available data clearly show that chemical fertilizing was used mostly on crops destined for export. In the Northern and Northeastern regions, sugar cane, which occupied 6.2% of the harvest area, consumed 85% of the fertilizers used, with cacao in second place, occupying only 2.9% of the crop area and consuming 10% of the total amount of fertilizers

Table I.2.A - Evolution of Land Utilization and Brazilian Agricultural Indicators

SPECIFICATION	1970	1975	1980	1985	Five Year Rates (% p.a.)		
					70-75	75-80	80-85
Land Utilization In (1,000,000)							
A- Area of Settlements	294.2	323.9	364.8	376.8	1.95	2.41	0.64
B- Area Utilized	189.8	208.5	228.6	239.0	1.90	1.86	0.89
1- Permanent Crops	8.0	8.4	10.5	9.9	0.99	4.54	-1.21
2- Temporary Crops	26.0	31.6	38.6	42.4	3.99	4.09	1.89
3- Natural Pastures	124.4	125.9	113.9	105.5	0.25	-1.99	-1.53
4- Planted Pastures	29.7	39.7	60.6	74.5	5.95	8.83	4.22
5- Planted Forests	1.7	2.9	5.0	6.7	11.55	11.86	5.93
C- Other Areas	104.4	115.4	136.2	137.8	2.03	3.38	0.23
1- Natural Forests	56.2	67.9	83.1	83.0	3.83	4.15	-0.04
2- Fallow Areas	-	2.2	8.6	11.2	-	31.33	5.46
3- Non-cultivated Area	33.4	30.6	24.8	24.0	-1.72	-4.14	-0.64
4- Unusable Area	14.8	14.7	19.7	19.6	-0.07	6.03	-0.12
General Data on the Sector							
D- Total Settlements (1,000)	4.924.0	4.993.3	5.159.9	5.832.6	0.28	0.66	2.48
E- Settlements Using Fertilizers (1,000)	915.8	1.111.8	1.657.8	1.751.1	3.96	8.32	1.10
F- Personnel (1,000,000)	17.6	20.3	21.2	23.5	2.96	0.79	2.15
G- Tractors (no.)	165.9	323.1	545.2	666.3	1.14	11.03	4.09
H- Cattle herd (1,000,000)	78.6	101.7	118.1	128.2	5.29	3.04	1.65

Source: IBGE - Agricultural Censuses

used. In the Southeastern and Center-West regions, coffee, sugar cane, soybeans and cotton consumed 75% of the fertilizers in use, while occupying only 27.2% of the cultivated area. In the South, soybeans and wheat predominated, employing 90% of the chemical fertilizers used in that region.

The development of capital-intensive agricultural areas did not provide enough jobs to absorb the labor supply in rural areas, thus causing a migratory flow to the cities or to the agricultural frontier regions, notably to the Amazon region. Modernization brought about marked changes in labor relations. Former partners, homesteaders and sharecroppers became partial and underpaid wage laborers. The advance of the one-crop system and the resulting increase of seasonal work turned many into temporary and migratory workers. Monocultures suppressed subsistence crops for the rural worker, who became a wage laborer searching for employment in cities or in the country.

An increase in the demand for food supplies that ceased to be produced on the former subsistence farms, together with low wages, caused a drastic reduction in food consumption, increasing malnutrition among the migrant population.

Furthermore, modernization had the effect of further favoring the concentration of land ownership and the incorporation of small properties into medium-sized and large farms. Another manifestation of the process was the proliferation of "micro-farms", the average size of which has been diminishing steadily. In 1960, there were 1.5 million farms with an average area of 4 hectares. In 1980, this number had climbed to 2.6 million with an average area of 3.5 hectares. In 1985; these small establishments totalled 3.1 million, with an average area of 3.1 hectares. Data from 1980 indicate that 80% of the farming and livestock land belonged to 10% of the agricultural properties.

In the eighties, the contradictions of the expansionist phase were exacerbated by external factors such as the oil crisis, the increase in international interest rates and the fall in the international prices of farm products, which, in conjunction with the acceleration of inflation and the problem of the balance of payments, led the farming sector into a crisis. To overcome this crisis, several measures favoring the export sector were taken. Farm and livestock products began to be increasingly processed prior to being consumed or exported.

Table I.2.B

Because of the external and fiscal crises, most programmes for fostering settlement on frontier land were gradually reduced until they were totally eliminated by the end of the decade. A minimum price policy still helped during difficult market periods, but it gradually ceased to be effective.

Table I.2.B - Evolution and Regional Profile of Brazilian Agricultural Indicators

SPECIFICATION	EVOLUT BRAZIL				BY REGION 1985				
	1970	1975	1980	1985	N	NE	SE	S	MW
Appropriation (% of territory)	34.8	38.3	43.1	44.6	17.6	60.1	80.3	85.6	53.0
Utilization (% of B/A)	64.4	64.5	62.6	63.4	38.3	54.5	80.4	79.0	67.4
Animal Husbandry (%B-3, 4/B)	81.2	79.4	76.3	75.3	87.4	70.3	72.0	56.5	88.4
Support capacity (H/B-3, 4)	0.51	0.61	0.68	0.71	0.43	0.63	0.84	1.16	0.61
Land concentration (GINI)	0.838	0.850	0.853	0.854	0.79	0.86	0.76	0.74	0.83
Fertilizer utilization (% E/D)	18.60	22.27	32.13	30.02	3.29	11.77	58.36	60.39	34.72
Manpower peoductivity (B-1, 2/F)	1.93	1.97	2.32	2.22	1.08	1.37	2.85	3.23	5.61
Man: Machine ratio (F/G)	106.00	62.97	38.82	35.33	207.23	249.50	19.97	15.68	14.52
Mechanization (B-1, 2/G)	204.88	123.80	90.06	78.46	223.85	342.31	56.86	50.64	81.47

Source: IBGE - Agricultural Censuses

Ecological and environmental problems that had not yet been perceived in their full dimension began to emerge with the rapid growth of agriculture, and the aggravation of the social crisis. Among the causes, were the growing use of chemical fertilizers and pesticides, intensive and concentrated use of mechanization and extensive single crop farming aimed at the export market which led to the erosion and degradation of farmland, and had serious impacts on forest resources, rivers and lakes, and on the biological balance of pests and diseases.

Moreover, in some public irrigation programme sites, inadequate use of technology caused serious environmental problems, such as the particulary damaging effects of the leaching of chemical products and the salinization of arable soil.

But the most negative effect of this expansion was the felling of trees and the elimination of native vegetation, both of which occurred over large areas throughout the country. Before the coffee boom, the forest covered 82% of the area of the state of São Paulo. By 1973, this percentage had been reduced to 8.2%. In the late forties, almost 90% of the land in the northern part of Paraná was covered with native forests. Currently, these forests cover only 17% of the region. The impact on other states has been similar.

2. Development of energy systems and their impact on the environment

From 1950 to 1960, two large nation-wide centralized energy systems were inaugurated in Brazil, both predominantly state-owned: electricity and oil. Setting up and expanding these systems, which involved substantial investments, would ensure an energy base for the development process, providing adequate power at reduced cost. New standards of technical and managerial efficiency were introduced. The growth of heavy industry and the infrastructure of engineering and heavy construction services were encouraged.

After the two oil shocks, problems derived from deficits in the balance of payments and the need to in guarantee the supply of energy led to the formulation of an energy policy, the main objectives of which were energy conservation, increase in domestic oil and electric power production, and the substitution of alternative domestic sources (hydroelectric power, biomass, coal, etc:) for oil by-products. To these ends, policies were adopted in the following areas: energy prices, technology and incentives and subsidies. Measures restricting consumption by setting quotas for companies in the industrial sector were also adopted.

The results of these policies became evident as from 1979, when traditional and innovative source of energy were combined in new ways: the use of oil by-products decreased,

while the use of electric power accelerated; that of coal also increased and new expectations emerged regarding the industrial use of fuels derived from biomass (alcohol, charcoal, wood), though the traditional uses for these fuels, mainly firewood for cooking, continued to diminish.

In the power supply field, large hydroelectric projects were launched and the integration of national power systems was consolidated. Domestic oil production increased substantially, especially in off-shore wells. The National Alcohol Fuel Programme (PROÁLCOOL) and the steel industry (using charcoal fuel) proved, on an unprecedented scale, the potential for biomass production. The foundations were established for the development of other renewable and decentralized energy sources such as small hydroelectric plants and solar energy.

Table I.3 illustrates the development, from 1970 to 1990, of the primary production of energy and the final consumption, by source and sector.

The objective of ensuring a reliable energy supply continued to prevail over economic concerns, that is, over the objective of reducing costs. Many of the strategic decisions taken during that period were not based on criteria of economic rationality, and could be made possible only through subsidies to the private sector, which increased the financial imbalances in the public sector.

In the early eighties, plunging international prices and increasing oil production combined to reduce, in government and public opinion, any strategic interest in the development of other sources of energy. Simultaneously, the gap between energy prices and utility rates in the state-owned sector and a declining energy demand, negatively affected the expected return on new investments.

In the mid-1980's, structural changes in the national energy matrix that had started in the seventies, seemed to have come to an end. A return to earlier trends became apparent: consumption of oil by-products again increased, the use of electrical energy persisted despite reduced industrial activity, and the contribution of other energy sources, especially biomass, stabilized or diminished.

In general terms, consumption is now divided into approximately equal parts, among electricity, oil by-products and others, mainly biomass. On the supply side, electric power and oil have remained organized as nationwide centralized and predominantly state-owned systems; biomass, on the other hand, is managed through a decentralized and predominantly private system. It should be emphasized that from the viewpoint of global climatic alterations, the adoption, to a high degree, of renewable forms of energy (hydropower and biomass) was

Table I.3 A - Production Evolution and Final Consumption of Energy in Brazil

SPECIFICATION	AMOUNT IN 1,000 TEP					QUINQUEN. TAXES (%p.a.)			
	1970	1975	1980	1985	1990	70/75	75/80	80/85	85/90
Composition of Primary Production 1st									
Non-renewable total	10,256	11,323	13,530	36,930	40,111	2.00	3.63	22.24	1.67
Oil	8,009	8,565	9,083	27,493	31,612	1.35	1.18	24.80	2.83
Natural gas	1,153	1,482	2,011	4,986	5,726	5.15	6.29	19.91	2.81
Coal vapor	599	729	1,463	2,572	2,142	4.01	14.95	11.95	-3.59
Metallurgy coal	495	547	973	887	631	2.02	12.21	-1.83	-6.58
Uranium	0	-	-	992	0	-	-	-	-
Renewable total	47,088	58,165	78,064	103,954	107,171	4.32	6.06	5.90	3.09
Hydraulic energy	11,542	20,963	37,383	51,729	60,097	12.68	12.26	6.71	3.04
Firewood	31,789	32,739	30,607	32,138	27,446	0.59	-1.34	0.98	-3.11
Sugar-cane	3,536	4,105	9,081	18,589	17,893	3.03	17.21	15.40	-0.76
Other	221	358	993	1,498	1,735	10.01	22.63	8.57	2.98
Total of Primary Production 1st	57,334	69,488	91,594	140,884	147,282	3.92	5.68	8.99	0.89
Complementary factors to the Primary Production of total Consumptium 1st									
Exchange (M-X)	18,902	35,670	47,245	27,339	41,809	13.54	5.78	-10.4	8.87
Loss and Deduction(a)	-7,902	-8,270	-10,756	-18,272	-20,397	2.70	5.40	11.18	2.22
Non-energetic consumptiun	-1,441	-3,391	-6,122	-9,234	-9,917	18.67	12.54	8.57	1.44

SOURCES: MINFRA - Balanço Energético Nacional - 1990 e Boletim - 1991

NOTES: (a) Non-renewable, Reinjections, Trasf. Losses-Distrib., Var. Stocks and Adjustments

(b) Major participation of Road transport (80 to 87%)

(c) Energy sector (increasing from 15 to 40%) Commercial, Public and Agrarian

Table I.3 B - Production Evolution and Final Consumption of Energy in Brazil

SPECIFICATION	AMOUNT IN 1,000 TEP					QUINQUEN. TAXES (%p.a.)			
	1970	1975	1980	1985	1990	70/75	75/80	80/85	85/90
Composition of Energy Consumption (1st and 2nd)									
By sources									
Oil by-products	21.658	37,934	46,728	38,873	46,264	11.86	4.26	-3.61	3.54
Electricity	11.064	20,257	35,614	50,058	62,821	12.86	11.95	7.05	4.65
Biomass by-products	33.203	32,757	34,545	42,338	39,340	-0.27	1.07	4.15	-1.65
Other sources	1.642	2,549	5,074	9,448	10,352	9.19	13.24	13.24	1.84
By Sectors									
Homes	23,496	24,455	25,464	24,950	27,590	0.80	0.81	-0.41	2.03
Transports (b)	12,994	21,758	25,311	27,320	32,768	10.86	2.32	1.54	3.70
Industry	21,182	32,964	50,561	59,338	64,979	9.25	-3.19	3.25	1.83
Other sectors (c)	9.895	14,320	20,625	29,109	33,440	7.67	7.57	7.13	2.81
Consumption p/inhabitant	725	890	1,025	1,052	1,056	4.19	2.86	0.52	0.08
Total consumption	67,567	93,497	121,961	140,717	158,777	6.17	5.46	2.90	2.44

SOURCES: MINFRA - Balanço Energético Nacional - 1990 e Boletim - 1991

NOTES: (a) Non-renewable, Reinjections, Trasf. Losses-Distrib., Var. Stocks and Adjustments

(b) Major participation of Road transport (80 to 87%)

(c) Energy sector (increasing from 15 to 40%) Commercial, Public and Agrarian

highly beneficial. This participation, is due mostly to typical industrial usages, involving modern technologies.

Different perspectives may be envisioned for the country in terms of energy, depending on the assumptions regarding decisions to be made by the various agents involved, both in the government and the private sector. One of these scenarios has the energy supply adapted to the evolution of demand, in the event that the current structure of energy prices in the external market is maintained and without direct interference from the State. The outlook for production, consumption and environmental impact of each source of energy is briefly described as follows.

The oil and natural gas sector is government managed, as regards exploration, production, processing, foreign trade, and maritime and pipeline transport for oil and its by-products, while distribution and retail sale of by-products are predominantly private.

The processing industry has the capacity to process 1.4 million barrels/day, enough to meet the current demand. It has adjusted to alterations in demand and in the type of crude oil that is processed. However, the need to import GLP and export the petrol surplus still exists. Crude oil production in 1990 reached 11.6 thousand tons (57% of consumption) yielded by off-shore platforms at an escalating pace. According to the National Energy Balance - 1990, oil reserves total 180 million tons.

The role of natural gas in the Brazilian energy context is still somewhat modest, despite its evident advantages from an environmental point of view. A large potential market for natural gas exists, but its development has been made difficult by indefinitions at institutional level regarding distribution, and lack of financial resources for investment.

The natural gas industry must also run the risk of fires and leaks during exploration, production, storage and distribution which can cause considerable damage to the environment and severe consequences for the population's safety and quality of life. Accidents and environmental disasters associated with these activities have raised justifiable concern from public opinion and government authorities, confirming the need to strengthen prevention methods that will minimize the risks of such hazards.

The coal mining sector is essentially private. For many years, its development was state-regulated through price control, mandatory minimum quotas for the use of national metallurgical coal in the iron and steel industry, and through contracts for purchase and sale of coal gas for thermoelectric power generation.

It is estimated that mineral coal production, at a level of less than 6 million tons in 1989, will rise to about 26 million tons by year 2010, 80% of which will be used for electric

power generation. Present known and estimated reserves amount to 32 billion tons, and the industry's current production capacity can reach 12 million tons per year in on a short term basis, with additional but relatively small investments. The remaining question is that of the compatibility of this scenario with environmental protection, which would require the use of technologies not yet tested on a commercial scale in Brazilian conditions.

In 1990, Brazil adopted norms regulating the emission of particulate and sulfur, for permanent new installations such as thermoelectric and industrial plants.

The importance of coal fuel for the planning of thermoelectric plants, is evident in the planning of the electric power sector in general, due to its high degree of ash (25% in Paraná, 40 to 45% in Santa Catarina and over 50% in Rio Grande do Sul). The sulfur level varies from 1-2.5% in Rio Grande do Sul to 6.5% in Paraná, which is enough to require controls.

Hydroelectric power has shown the highest rate of annual growth in the Brazilian energy system, (7.8%/year from 1975 to 1989) despite its moderate growth in recent years, as compared to the 1970's (7.4%/year versus 12.3%/year). Thus, electric power, when calculated on the basis of thermal energy (3.132 kcal) necessary to produce 1 kwh or 860 kcal, accounts for 26% of the total energy consumed in the country.

Until recently, questions of a social and environmental order were low priority issues in the electric power planning sector. Plants designed in the late seventies and early eighties are being criticized today because of their impact. The persistent and multiple effects on the environmental, economic and social levels have given rise to strong reactions and pressures against the sector, causing it to adopt minimal preventive measures, such as those discussed in the "Handbook of Studies on Environmental Effects of Electrical Power Systems," published in 1986 by a group of operating companies.

Although results from this model may be positive, there is an evident need to update it, in terms of decentralizing the decision mechanism and making it more agile and efficient. In the future, the trend will be towards the predominance of water power sources, although the generation of thermoelectric power is also increasing.

Among the energy policies for biomass products, the most prominent is the National Alcohol Fuel Programme. The Programme was launched in 1975, and consisted, initially, in the mixing of anhydrous alcohol with petrol, and subsequently, in 1979, in the use of hydrated alcohol. Its main strategic objective was to overcome increasing difficulties related to oil supply on the international market and the continuous rise in oil prices.

Despite technological and organizational difficulties, 4.2 million vehicles are currently running on hydrated alcohol and all other Otto cycle vehicles should have a standard fuel combination of petrol containing 22% anhydrous alcohol. Present consumption of alcohol fuel (200 thousand barrels per day) is equivalent to almost 25% of the total consumption of liquid fuels in Brazil.

Sales of alcohol-propelled cars reached over 90% of the total number of sales by the end of the 1980's. However, the drop in supply in 1989-1990 caused the sale of alcohol-propelled cars to decrease considerably. Hydrated alcohol consumption has stabilized. On the other hand, petrol consumption is growing and, in consequence, that of anhydrous alcohol.

The advantages of alcohol over gasoline include the: improvement of antiknock power, which avoids the use of polluting additives in petrol, and less discharge of carbon monoxide and other polluting gases. Thus, its use has the environmental benefit of improving the quality of air in metropolitan regions. The solution is therefore to standardize a single Otto cycle fuel, composed of petrol and 22% alcohol, allowing the use of natural gas in controlled fleets of vehicles.

In Brazil, in the general energy supply context, alcohol has brought an alternative of great strategic importance, since it has reduced the vulnerability of supply and has given added value to domestic energy resources. As regards standards for energy consumption, however, the contribution has been nil, since it has intensified the use of the automobile, which was being threatened by the oil crisis.

Sugar cane production and processing to obtain sugar and alcohol for fuel, created environment polluting residues, that are technically manageable. The processes of cane burning and washing, filter residue, vinasse and bagasse burning are the main sources of pollution.

When PROÁLCOOL was started, the discharging of vinasse (13 liters per liter of alcohol produced) into waterways caused serious environmental problems, chiefly in the regions of concentrated production in São Paulo, Pernambuco and Alagoas. Once the problem was identified, alternative uses of vinasse were developed, such as the production of biogas, and principally the use of vinasse as a biofertilizer for the sugar cane crop itself, especially in the state of São Paulo. However, the discharging of vinasse continues in large areas of the Northeast, causing enormous harm to the water environment.

In recent years, firewood consumption has remained relatively stable, varying between 100 and 110 million tons annually: the decrease in home consumption has been counterbalanced by the growth of industrial consumption, for the production of charcoal. This

situation is expected to continue for the next ten years. Afterwards, consumption should grow slowly, reaching about 140 million tons by the year 2010. The use of firewood in the overall energy picture, however, will continue to drop, maintaining the traditional trend.

About 30% of the national territory is made up of land unsuitable for agriculture, but suitable for forestry exploitation. The use of half this area, about 1.2 million square kilometers, under sustainable management, could produce about 300 million tons per year, over twice the production expected for the year 2010. Furthermore, the use of part of this area for high yield forestation would mean increasing this potential significantly.

It is estimated that predominantly rural homes account for about 30% of firewood consumption. Contrary to the situation in many developing countries, this consumption does not represent a major factor in deforestation, but may have local impact. Home consumption is declining rapidly, and is presently estimated at less than half the absolute level of 1973.

The supply to industries poses one of the most serious problems, as it is responsible for over 60% of total consumption - ranging from furnaces using primitive technology, that depend on cheap firewood, to averagely sophisticated pulp factories and steel foundries.

The use of nuclear energy in the country is the object of ample rejection by society, which is explainable, among other factors, by the very conditions under which the first nuclear plant was set up in 1970, in a region of exceptional scenic beauty (Angra dos Reis), and in the corridor between the two major metropolitan regions of the country; moreover, technical problems were encountred in the equipment installation phase.

In 1975, the Brazilian Government signed an ambitious cooperation agreement with Germany, calling for the installation of eight nuclear centers of 1.3 million KW over 15 years, and complete technology transfer of the project, including manufacturing of equipment and nuclear fuel cycle. Currently, only the Almirante Alvaro Alberto plant (Angra I) is functioning, generating about 1% of the electric power used in Brazil. The Angra II and Angra III nuclear plants are under construction, and only parts of the other industrial installations provided for in the agreement are in operation, with low rates of use.

Aside from the general impact caused by nuclear energy use, Brazil is vulnerable with regard to uranium extraction, nuclear waste disposal, and external security mechanisms for the plant in operation, in the event of an accident.

The process of institutional control over decisions regarding the use of nuclear energy is also deficient. Although the Federal Constitution has given the National Congress new

authority in this area, Congress still lacks a specific monitoring system that would permit its effective use.

3. Mining and its impacts

The mineral potential of Brazil, a country of wide geological diversity and extensive territory, is far from being assessed with precision. This is true even with regard to the Carajás mineral reserve, which has the world's largest reserves of iron and important concentrations of manganese, copper, tin, nickel, bauxite and gold. Nevertheless, from 1950 to 1989, Brazilian mineral production rose from 230 million dollars to 9 billion dollars in terms of the real value of the 1989 dollar.

Mineral deposits are generally located in regions devoid of infrastructure for mining operations and transportation of mineral production. Therefore, mining serves the purpose of relocating investments, insofar as it spurs the expansion of the transport and electric power networks. Mining activities, when poorly conducted, can cause serious environmental impacts.

In the case of projects in the state of Amazonas, the fragile tropical ecosystem makes the region even more vulnerable, requiring additional precautions. In this regard, the obligation to protect Indigenous reserves should condition the installation of mines, roads and dams. Mining near urban areas, also frequent in Brazil, causes problems resulting from dust, noise and vibrations.

Measures for environmental protection are necessary in the planning or operation of mining projects, such as the recomposition of the mining area, the elimination of atmospheric pollution caused by the spread of dust during the transportation of ore, the improvement of decanting tanks for storing waste from ore processing, and the replacement of the searing process by more modern and cleaner methods.

Mining in Brazil still involves a broad informal segment of prospecting. This is an activity that is manual labor-intensive and requires a low volume of investment.

In the first half of the century, prospecting activities did not expand. Only in the fifties and sixties, however, did two important areas open up:-Rondônia and Tapajós-(in the state of Pará) marking the beginning of large scale activities in the Amazon region.

Until the sixties, semi-mechanized prospecting prevailed. Since then, its characteristics have changed, due to the discovery of gold in the Amazon and the incorporation

of new equipment, bringing about social and technological changes that profoundly modified traditional prospection.

The rapid expansion and accelerated mechanization of prospection mines brought about consequences that have come to stigmatize this activity: degradation of the environment, conflicts with Indigenous tribes and organized mining, precarious working conditions, gold contraband and depredation of deposits. The environmental impacts consequent to this form of mining derive mostly from disordered prospecting, lack of prior knowledge of regional geology, indiscriminate disposal of waste, discharge of metallic mercury used in amalgamation and failure to recuperate degraded areas.

It is estimated, according to official figures, that there are about 1,854 gold, precious stone and other mines scattered throughout the country, employing approximately 300.000 people.

4. Evolution of the manufacturing industry and its impact on the environment

From the post-war period until the 1970's, the capitalist economies underwent one of the phases of greatest economic expansion and transformation of their productive structure, under the aegis of the industrial sector. This expansion was led by two of the larger subsectors: the metal-mechanical industry (automobile, capital goods and durable goods industries) and the chemical industry (especially petrochemicals).

In the first stage, North American patterns of consumption spread to Europe and to Japan, changing the energy picture in replacing coal by oil. This pattern of consumption was accompanied by technological, organizational and business patterns aimed at industrial production and sustained by large companies, which strongly influenced the entire world economy, and the countries in the capitalist sphere in particular.

In the 1970's, and especially during the first half of the decade, the first signs of exhaustion of this model began to appear. From the second-half onwards, the capitalist economies have been undergoing short periods of recession with equally short growth periods.

The rapid establishment of the international industrial matrix in Brazil internalized the production guidelines of industries involved in chemicals, petrochemicals, metal mechanics, the materials and transport industries and the paper and pulp and non-metallic mineral sectors, all causing heavy impacts on the environment.

In a general way, and regardless of each ecosystem's features, the environmental impact of the industrial sector is determined by three major factors: the type of industrial structure and its diverse relations with the natural environment; the intensity and spatial

concentration of industrial types and sectors; and the technological level of the production process - technologies for filtering and reprocessing effluent, in addition to economic reutilization of by-products.

Massive and delayed industrialization incorporated advanced technologies into the national infrastructure, but they are obsolete in environmental terms, considering that processing, recycling and reprocessing technologies are scarce.

To assess the actual impact of industry on the environment, one must analyze how the spatial concentration of industrial types enhances or reduces its potential impact. The concentration profile is presented in Table I.4 by industrial type, broken down into six large groups.

The spatial concentration of Brazilian industrial types has given rise to a certain number of corresponding environmental impacts. In some cases, industrial complexes with a low share in the Industrial Transformation Value (ITV) will present a high percentage of the total ITV of a certain type, with a particular environmental effect. On the other hand, subregions such as the São Paulo metropolitan region have a substantial effect on total ITV, and higher still on certain types that put particular pressure on the environment.

In several cases, the spatial density of economic activities may be even greater, causing specific varieties of large scale environmental degradation in microregions, that are masked by the geographic aggregation by subregion. Among these industrial superconcentrations, three areas of environmental degradation merit attention. They differ as to level of specificity and period of establishment, with varying results in terms of degradation: the Cubatão and Camaçari chemical complexes, and the Carajás mining-metallurgy complex.

Environmental aspects were practically unknown or ignored in the decision making process for setting up industrial activities in the municipality of Cubatão. The total absence of land use planning (a factor favorable to the dispersion of polluting substances), and the concentration of industries with high polluting potential, resulted in a rapid process of environmental deterioration.

In Camaçari, despite technological advances, problems of an environmental nature are still significant, mainly due to the soil's great absorption properties and insufficient instruments for the control of water pollution. Storage of raw materials and solid and liquid products, as well as solid waste disposal, merits constant attention in terms of protection and safety, as do the risks of contamination of surface and water tables.

The Greater Carajás Programme, under way since 1980 in the South of the state of Pará, is the third concentration of industrial activities to require special measures for impact

TABLE I.4 - BRAZIL: Degree of Industrial Concentration - 1980

Rank	Degree of Concentration	Industry	Industry % of VTI		
			1 center	3 centers	4 centers
1	Highly Concentrated	Pharmaceutical	50	84	89
		Perfumes, Soaps and Candles	52	80	87
		Publishing and Printing	46	80	85
2	Very Concentrated	Communications and Electric	50	70	80
		Plastic	50	70	77
		Rubber	56	66	75
3	Quite Concentrated	Metal-Mechanics	44	58	65
		Tobacco	22	58	72
4	Average Concentration	Clothing and Footwear	28	50	60
		Chemicals	21	44	60
		Paper and Cardboard	32	43	52
		Textiles	32	42	48
		Furniture	28	40	50
5	Dispersed	Non-metallic Minerals	20	34	41
		Leathers and Hides	17	37	43
		Foodstuffs	15	23	27
		Beverages	13	27	35
6	Very Dispersed	Mining	8	21	30
		Lumber	8	27	22
		Total	33	45	51

Source: IBGE, Brasil: Uma Visão Geográfica dos Anos 80.

minimizing. Concentrated chiefly in the pig iron industry in the municipality of Marabá, this mining and metallurgy complex is contributing to accelerating the deforestation process in the region, first started by farming and livestock enterprises.

As Brazil begins to make adjustments in its national industrial profile, the world economy is entering a new cycle and technological paradigm. Contrary to the post-war period of industrialization, marked by high consumption of natural resources - raw materials, commodities and energy - the new pattern of growth is directed towards a high demand for information and knowledge, with a relative decrease in the "consumption" of environmental resources and "production" of polluting effluents.

Cubatão

The Cubatão region, during the period of its most intensive industrialization (1950 to 1960), gathered all the favorable features for attracting industry: proximity to consumer centers, large seaports, a highway network and available labor, water and electric power.

The environmental aspect was practically ignored during the analysis and decision processes regarding the setting up of industrial activities in the municipality, and this brought about an intense environmental degradation.

Moreover, the assaults on the Serra do Mar vegetation, caused by human activities and particularly by the phytotoxic effects of industrial emissions, destabilized its slopes, making the industrial complex prone to landslides.

Beginning in 1983, the Programme for the Recovery of Environmental Quality in Cubatão was launched, as a response to increasing pressure from public opinion. In 1984, the programme adopted several individual plans for environmental control in the factories.

The existence of residential zones over pipeline passage ways, carrying hazardous products and exposing thousands of persons to serious large-scale accidents, resulted in the tragedy of vila Socó, also in 1984. The explosion and blazing of 700 thousand liters of petroleum, killed over 100 people.

Because of the magnitude of its pollution levels and risks to the population, Cubatão became a symbol, inducing intense public reaction. In 1986, the Public Ministry of the state of São Paulo and a non-governmental environment organization brought a civil law suit against 24 polluting firms for damages caused to the Serra do Mar.

Nowadays, the results of the programme reflect a significant reduction of polluting emission levels and a decrease in the number of emergency alert warnings in the region, the incidence of which was formerly 17 times per year.

Environmental control, however, still depends on a sequence of actions, especially regarding rivers that receive industrial effluent. Important tasks remain, such as finding solutions for treatment and disposal of old industrial waste deposits and an assessment of the effectiveness of replanting and the potential for recovering degraded areas.

5. Expansion of the transport infrastructure and the environment

The expansion of the highway transportation network in Brazil has played an important part in the expansion of the economic frontier and in development plan feasibility.

From the post-war period to the crisis of the early sixties, the automobile industry and a large highway network were constructed in the country. From a period when railroads leading to export ports prevailed, there was a change to one in which priority was placed on highways connecting the main Brazilian cities in all directions. As of 1964, government planning became particularly attentive to the Brazilian economy's adjustment, as well as to the establishment of new routes for national integration and security.

By the end of the 1968-1970 period, government plans had taken on a different profile: as economic growth was given top-priority, the transport sector gained an important role in the attainment of high growth rates of Gross Domestic Product (GDP). Once the initial phase of restrictions and adjustments was over, investments in transport and large public works proceeded. With resources obtained from special programmes, about 12 thousand kilometers of roads were built or paved.

While in the 1945-1963 period the expansion of industries of durable and nondurable goods generated non-specific freight, therefore suitable for highway transportation, Brazilian industrialization entered a new phase emphasizing basic industries, generating bulk cargo, more adequately transported by train, cabotage, river vessels and waterways. However, the highway option was preserved.

The rapid implementation of highways, set up without an effective large-scale territorial organization policy, further promoted social phenomena such as rural-urban and inter-regional migration, and caused large population contingents to abandon cities and regions, causing economic and population concentration, and declining standards of living in large centers, aside from creating greater dependence on gasoline.

The opening of highways in the Amazon region led to the misuse of natural resources and to the devastation of areas where settlement projects, as well as lumber and agricultural activities were implemented. In other areas, the transport network allowed for the access of goods from the Mid-Southern region, which competed with locally-produced goods. The absence of ecological-economic zoning contributed to increasing the negative effects of this situation.

In the late eighties, the considerable shortage of financial resources in this sector aggravated the deterioration of highways, increasing the rate of fatal accidents and the loss of

cargo, besides significantly increasing the rate of pollution caused by accidents. Moreover, it drove up transportation costs, because of the wear and tear on vehicles and their higher fuel consumption. Consequently, the flow of people and goods was reduced.

Considering the negative impacts on this sector, actions must be undertaken to strike a balance between the development of transport activities, the needs of the community, and the preservation of the environment.

The attention given by the government to multimodal transport alternatives seeked to remedy the anachronism of the highway policy, as the development of basic industry required heavier transport modes. Rising oil prices, the exhaustion of the economic model, and decreasing growth rates led to a rechannelling of investments.

The Export Corridor Program proposed to concentrate investments where there was a significant demand for transport and aimed at rationalizing integration among different forms of transport. The Railroad Development Program (1975-1979) was aimed at supporting the National Steel Production Plan, integrating the export corridors of Rio Grande, Paranaguá and Santos, at renewing railroads and purchasing cars. The Naval Construction Programme's (1975-1979) objective was to build ships in national shipyards totalling 5 million tons of gross loading capacity, which were to be used primarily by the fleets of state-owned companies. Finally, the Port Development Programme was aimed at improving the operational conditions of ports and new facilities to assist the export corridors, particularly Vitória, Santos, Paranaguá and Rio Grande. Also of relevance were the ports of Itaqui (state of Maranhão), linked to the Carajás Iron Ore Project, and that of Aratu (state of Bahia), which was to be used by the Petrochemical Complex of Bahia. The programme has paved the way for higher energy efficiency and increased the competitiveness of export products by reducing transport costs.

Table I.5 shows the evolution of cargo and passenger transport in Brazil.

Regarding urban passenger transport, a growth in individual transport has been noted in relation to collective transport, as a result of the development of the automobile industry and of low oil prices.

The concentration of population in large cities has led to a greater demand for collective transport. The priority thus placed on setting up a system of electricity-run vehicles on rails led to the construction of the subway networks of São Paulo and Rio de Janeiro and the surface metros of Porto Alegre, Belo Horizonte and Recife.

Nevertheless, problems persist in urban passenger transport, and conditions are particularly difficult for populations living in distant (low income) suburbs. The highway sector

Table I.5 - Trends in Passenger and Cargo Traffic in Brazil, by Mode

Specification	Traffic Volume				Rate (% p.a.)		
	1977	1980	1985	1988	77-80	80-85	85-88
Cargo (1,000,000 t.km.)							
Air (a)	686	1,020	1,339	1,523	14.14	5.59	4.39
Water Transport (b)	37,283	47,701	78,054	90,617	8.56	10.35	5.10
Pipeline	8,489	11,929	17,767	19,734	12.01	8.29	3.56
Railway	60,603	86,302	100,226	120,036	12.51	3.04	6.20
Highway (c)	168,200	208,500	235,100	301,000	7.42	2.43	8.59
Total	275,261	355,452	432,486	532,910	8.90	4.00	7.21
Passengers (1,000,000 Pass.km.)							
Airway (a)	6,591	9,559	11,006	13,491	13.19	2.86	7.02
Waterway (b)	3	...	...	...	...	...	...
Railway	11,700	12,376	16,306	13,891	1.89	5.67	-5.20
Subway	-	1,519	2,778	3,764	-	12.83	10.66
Highway (c)	275,454	410,357	499,200	561,532	14.21	4.00	4.00
Total	293,748	433,811	529,290	592,678	13.88	4.06	3.84

Source: GEIPOT

Notes: (a) Does not include international flights,
(b) Coastal shipping and domestic routes only.
(c) Estimates.

was privileged to the detriment of railroad and boat transport, which have higher productivity rates from the social point of view. Automobiles have prevailed over collective transport, and buses over rail cars.

The bus fleet is made up of about 50 thousand vehicles, 57% of which are in state capitals. They carry between 60% and 70% of the population, or 619 million passengers/month. The number of passengers who use the subway system is negligible, because of the small size of the underground network. Total diesel consumption by the country's bus service is about 3 million petroleum-equivalent tons, while the consumption of fuel alcohol and petrol, which are mainly used by cars, amounts to 12.5 million petroleum-equivalent tons in 1989.

Because of the accelerated of the urbanization process and population concentration in large cities, positive results in the urban transportation challenge have been attained only when integrated in urban planning arrangements, as in Curitiba and Campo Grande.

6. Population, urbanization and environmental impact

The population aspect can be analyzed from two environmental points of view, both of which are related to the use of space. The first is the progressive urban concentration of the Brazilian population, a phenomenon occurring in all regions of the country, which results in environmental problems, the nature, consequences and solutions of which are similar in all regions. The second is unequal spatial distribution, with regard to both natural resources and economic activities. The extent of environmental problems in specific regional contexts will vary according to these two considerations.

The 1990 Census was delayed until 1991. For this reason, the only available figures are the results of the annual household sample surveys - with limited compatibility - to compare with figures from the seventies. With the purpose of assessing structural features and recent trends, Table I.6 presents data from both sources.

From a dynamic point of view, the pattern of population growth in Brazil, which had been rapid, began to drop in the late sixties. This decline, which was initially slow, soon became sharp and generalized. An abrupt drop in fertility rates was confirmed in all regions, although this phenomenon is more noticeable in urban areas and in the higher educational and social levels. The total fertility rate dropped from 5.8% in 1960-70 to 3.2% in 1980-90. This change also led to a drop in the natural growth rate from 2.9% a year during the sixties to 2.1% in the eighties.

Table I.6 - Evolution of Brazilian Demographic Indicators

	SPECIFICATION	Evolution of NATIONAL TOTALS				Ten Year Rates (%)	
		1960	1970	1980	1989	60-70	70-80
1	A- General Data						
0	1- Land Area (1,000 km²)	8,456.5	-	-	-	-	-
0	2- Total population	70,191.4	93,139.0	119,002.7	144,293.1	2.87	2.48
0	3- Urban population	31,303.0	52,085.0	80,436.4	107,239.8	5.22	4.44
	4- Rural population	38,767.4	41,051.1	38,566.3	37,053.3	0.57	-0.62
D I	5- Men	35,059.6	46,331.3	59,123.4	70,811.9	2.83	2.47
A N	6- Women	35,131.8	46,807.7	59,879.3	73,481.2	2.91	2.49
T H	B- Age Structure						
A A	1- Under 15 years old	29,912.8	39,130.4	45,460.8	50,642.5	2.72	1.51
B	2- Adults (15-60 years old)	36,848.6	49,108.4	66,197.9	82,904.7	2.91	3.03
I	3- More than 60 years old	3,331.0	4,716.2	7,216.0	10,737.8	3.54	4.34
T	4- Unknown age	99.0	184.0	128.0	8.1	-	-
A	C-Literacy (over 15)						
N	1- Can read and write	24,259.3	35,586.8	54,793.3	76,058.2	3.91	4.41
T	2- Cannot read and write	15,946.8	18,147.0	18,716.8	17,588.2	1.29	0.31
S	3- Not declared	54.5	274.9	31.8	4.2	-	-
	Calculated Indicators						
I	Demographic density (A2/A1)	8.30	11.01	14.07	17.43	-	-
N	Urbanization rate(%A3/A2)	44.60	55.92	67.59	74.32	-	-
D	Rel, masculinity (A5/A6)	0.998	0.990	0.987	0.964	-	-
I	Rel, dependance (B-1,3/B2)	0.90	0.89	0.80	0.78	-	-
C	Literacy rate (%C1/C1,2)	60.31	66.23	74.54	81.22	-	-
A	Other Indicators					-	-
T	Life expectancy - Eo	52.37	52.67	60.08	-	-	-
O	Infant mortality rate (a)	118.13	116.94	87.88	-	-	-
R	Income concentration (GINI)	0.518	0.562	0.573	0.618	-	-
S	Net Emigration rate (b)	12.56	14.34	15.46	-	-	-
	Net Immigration rate (c)	12.23	14.15	15.29	-	-	-

Source: IBGE - Anuário Estatístico do Brasil - 1990
IBGE - PNAD - 1989 (escluding North-rural non comparable, but shows trends.
IPEA/CPS - Income Concentration Indicators

NOTES: (a) Deaths of children under 1 per 1,000 live births
(b) % Native non-residents of the state/natives of the state
(c) % Non-natives of the state/residents
(c) % Non-natives of the state/residents of the state.

If the Brazilian population had continued to grow as it did in the sixties, Brazil's total population would equal 213 million by the year 2000. Because of the fertility rate decline, it is expected that, by the end of the century, Brazil will have a population of the order of 170 million, based on the estimate of a growth rate of 1.55% a year in the nineties. It is further estimated that population growth will stabilize at a level of 265.5 million, by the year 2075, corresponding to an average growth rate of 0.59% a year.

The analysis of patterns of growth for the Brazilian population shows that Brazil is already at an advanced stage of demographic transition.

Furthermore, it is estimated that the annual rate of job supply will have increased by 2.4% in 1990, equivalent to 1.7 million persons per year. Even during periods of intense economic growth, high levels of marginality, unemployment, and underemployment have been recorded, due to the extremely unequal structure of income distribution and the adoption of low labor-intensive technologies in industries and rural areas, among other reasons. Therefore, an aggravation of existing social problems can be anticipated.

Table I.7 is descriptive of the economically active population, as regards recent activity, occupation and formal job rates in Brazil, covering all macro-regions.

Regarding patterns of spatial distribution of the employed population, the rise in number of industrial jobs, with significantly higher wages and salaries as compared to rural areas added to better access to public goods and services in the urban centers, attracted large numbers of migrants. Because of the limited capacity of the urban infrastructure in absorbing them, they have settled, in often precarious conditions, in the peripheries of large cities. The geographic concentration of the population can be strongly felt in the urban areas of the Mid-Southern region, particularly in the metropolitan region of São Paulo.

In 1950, the industrial census had registered 1.3 million persons employed by the manufacturing industry. For the same category, the 1980 Census detected the presence of 5 million persons, and that of 1985, approximately 5.6 million. This means that between 1950 and 1980 the industrial job rate grew by 4.6% per year, dropping to 2.3% during the first five years of the eighties.

The job growth rate became progressively higher until the end of the seventies, as a result of the expanding manufacturing industry: between 1950 and 1960, the manufacturing industry accounted for only 6.1% of the direct new jobs created in the Brazilian economy. In the following decade, it accounted for almost 18.9%, and in 1970-80, it reached a rate of 25.4%; a little over one-fourth of all new jobs created during that decade.

Table I.7 - Evolution of Indicators broken down by Occupation and Sex

SPECIFICATION		NATIONWIDE EVOLUTION (a)				RATE (% p.a.)		
		1976	1979	1986	1989	76-79	79-86	86-89
	A- Pop. over 10 Years Old							
	1- Men	38,408.2	41,517.4	49,696.9	53,493.6	2.63	2.60	2.48
	2- Women	39,738.9	42,876.0	52,173.8	56,756.6	2.57	2.84	2.85
1	3- Total	78,147.1	84,393.3	101,870.7	110,250.2	2.60	2.73	2.67
0	B-Economically Active Pop							
D 0	1- Men	28,283.7	30,998.9	37,596.6	40,523.6	3.10	2.79	2.53
A 0	2- Women	11,434.2	14,412.6	19,219.6	21,989.6	8.02	4.20	4.59
T	3- Total	39,717.9	45,411.6	56,816.2	62,513.2	4.55	3.25	3.24
A I	C- Active Population							
N	1- Men	27,766.6	30,148.5	36,742.5	39,279.1	2.78	2.87	2.25
H	2- Women	11,229.6	14,015.9	18,693.5	21,342.8	7.67	4.20	4.52
A	3- Total	38,996.2	44,164.4	53,436.0	60,621.9	4.24	2.76	4.30
B	D- Employees							
I	1- Men	17,072.7	18,643.5	23,821.4	25,396.3	2.98	3.56	2.16
T	2- Women	7,401.3	8,907.4	12,829.3	14,595.0	6.37	5.35	4.39
A	3- Total	24,474.0	27,550.9	36,650.7	39,991.2	4.03	4.16	2.95
N	E- Registered Employees							
T	1- Men	10,514.9	11,630.4	14,357.0	15,583.0	3.42	3.05	2.99
S	2- Women	3,804.1	4,861.7	6,842.5	8,035.0	8.52	5.00	5.50
	3- Total (b)	14,319.0	16,492.2	21,199.5	27,718.0	4.82	3.65	3.81
I	Proportional Rates (Men)							
N	1- Activity rate (B/A)	73.64	74.66	75.65	75.75	-	-	-
D	2- Occupation rate(C/B)	98.17	97.26	97.73	96.93	-	-	-
I	3- Employment rate(D/C)	61.49	61.84	64.83	64.66	-	-	-
C	4- Formaliz. rate (E/D)	61.59	62.38	60.27	61.75	-	-	-
A	5- Product of rates(E/A)	(c)27.38	28.01	28.89	29.32	-	-	-
T	Proportional rates(Women)							
O	1- Activity rate (B/A)	28.77	33.61	36.84	38.74	-	-	-
R	2- Occupation rate(C/B)	98.21	97.25	97.26	97.06	-	-	-
S	3- Employment rate(D/C)	65.91	63.55	68.63	68.38	-	-	-
	4- Formaliz. rate (E/D)	51.40	54.58	53.33	55.05	-	-	-
(%)	5- Product of rates(E/A)	(c) 9.57	11.34	13.11	14.16	-	-	-

Source: IBGE - National Household Sample Survey (PNAD)
Notes : (a) Domiciles in the rural area of the northern region excluded every year and those in the Mid-West in 1976 and 1979.
(b) On the average, only 83 with wages higher than the MINIMUM
(c) The complement is not integrated into the market, and even without the inactive, contains a majority

Historically, the occupation of the various Brazilian regions is marked by gaps and interruptions, as a result of the geographical isolation of its various economic cycles. This fact led to the proliferation of disconnected communities with high population density in many parts of the national territory. However, during this century, the region around the capital of São Paulo has had an integrative influence through the progressive unification of the national market, in spite of the regional development policies of recent decades, which have systematically attempted to branch out economic activity, including industrial activity, to more distant regions.

The transfer of the capital from Rio de Janeiro to Brasilia attracted significant migratory flows to the Central-Western region of the country as from the sixties, interiorizing the population. In the following decade, the geographic decentralization process continued to take place, a fact that can be explained by the expansion of the highway network, the implementation of regional and urban policies, and the industrial boost caused by the growing number of subsidiary plants and factories connected to the metropolitan region of São Paulo, particularly in the area of intermediate goods. From this perspective, this movement did not slow down the concentration process, but expanded the perimeter of influence of the dominant center. Most of the programmes for the developement of secondary centers, which were aimed at alleviating the population pressure on large cities, particularly São Paulo and Rio de Janeiro, lacked continuity.

In 1940, Brazil had only 51 cities with more than 20,000 inhabitants. By 1990, these figures had increased to 685. The population living in cities of that size had grown from 8.03 million in 1940 to 51.8 million in 1980 (Table I.8).

At present, 60% of the population lives in nine metropolitan areas (São Paulo, Rio de Janeiro, Belo Horizonte, Porto Alegre, Curitiba, Salvador, Recife, Fortaleza and Belém). If the present demographic growth trend continues, about 80% of the population will be living in cities, by the year 2000.

Table I.8 - Urban Expansion in localities with over 20,000 inhabitants

YEAR	N° of localities > 20,000 inhabitants	Population in localities > 20,000 inhabitants	Population in other localities
1940	50	8,035,661	33,200,654
1950	82	12,597,266	39,347,131
1960	148	22,852,865	46,835,459
1970	246	37,253,718	55,885,359
1980	393	62,852,180	57,150,526

Source: IBGE (Brazilian Institute of Geography and Statistics) - Demographic Census

In the past, urban growth was, for the most part, seen as a consequence of the rural exodus, even during periods of higher natural growth. Today, migrations of a rural origin are decreasing. The magnitude of the urban population itself is such that cities are more affected by their natural growth, in spite of lower fertility rates, than by migratory flows.

Over the past 60 years, more intense migration toward agricultural frontier areas has been observed. Three large migratory waves have been identified: in the state of Paraná, of rural origin and destination; in the states of Mato Grosso do Sul, Goiás, Tocantins and Maranhão; and in the Amazon region.

However, the Amazon frontier has not played a very significant role, on a nationwide basis, as an alternative destination for migration from traditional agricultural areas. The number of migrants who were absorbed by rural areas in the Amazon region in the seventies, about 400 thousand, was small when compared to migration towards urban centers. During that same period, about 16 million people moved from rural areas to cities. In certain areas of the Amazon region, such as Rondônia, migration was relatively intense and had considerable negative effects on the environment. In general terms, urban growth has been far more important than rural growth, even in the frontier regions.

Urban environmental problems in Brazil are basically caused by two determining factors. On the one hand, poverty in the cities, particularly the large ones, affects a large portion of the Brazilian population and is closely linked to the consequences of environmental degradation. On the other hand, there are problems caused by the concentration of economic activities, particularly those of the industrial sector, in urban locations.

The rapid urbanization process has generated a deficiency in the infrastructure of urban services, its most serious manifestation being the shortage of basic sanitation facilities. Considering that about 33 million persons live in the outskirts of the major cities, it is obvious that the basic sanitation issue is - and will continue to be - one of the major urban environmental problems in our country in coming decades. According to official data, 35% of urban homes, most of which are located in slums, are regarded as "inadequate" health-wise. The available statistical data on housing adequacy raises the issue of healt in the urban environment.

Another basic urbanization problem is related to waste disposal and to keeping urban areas clean. Waste disposal problems are comparable to those of basic sanitation. Among the almost 12,000 locations used by Brazilian municipalities to dispose of their solid waste, open-air disposal sites prevail, causing problems of air, water, and soil contamination, and favouring the proliferation of conditions that are harmful to the human health. Only a few municipalities have been selectively collecting their waste to recycle materials such as paper,

cardboard, glass, plastic containers and metals and reintroducing them into the production cycle. Some municipalities, such as Curitiba, São Paulo and Florianópolis, are already carrying out pilot experiences of this type, which offer obvious ecological advantages. Garbage collection services cover less than 50% of the urban population.

Medium-sized cities are at a stage where it is still possible to preserve relative environmental quality at lower costs than in the metropolises. Environmental problems are concentrated in urban areas and are linked to the pollution of rivers and springs, soil contamination by pesticides, and loss of fertile land due to erosion.

The smaller urban areas and their population frequently have more favourable environmental conditions, but are facing problems caused by the use of pesticides, soil erosion, and deforestation.

The geographical distribution of the urban network is also very uneven. In Amazônia, the approximately 500 municipalities are usually distant from each other. They are isolated and depend on river transport for their basic supplies. Most coastal capitals in the Brazilian Northeast are overpopulated as a result of migration. In the southern part of the state of Minas Gerais and in the states of São Paulo, Paraná, Santa Catarina and Rio Grande do Sul, a network of small and medium-sized cities has been established with widespread industrialization.

Air pollution is among the most serious urban environmental problems in Brazil, the main source of which is carbon monoxide (CO) released by vehicles. Sound pollution is another problem, which is mainly caused by nocturnal industrial and commercial activities, as well as by collective and individual transportation.

The risk of ecological disasters increases geometrically in urban agglomerations. The accident caused by cesium in Goiânia, capital of the state of Goiás, is a shocking example of this risk.

Radioactive Contamination

A single and important case of radioactive contamination took place in Goiânia in September 1987, when a cesium-137 artefact that had been left in a semi-destroyed hospital was stolen and broken open. The artefact released 19 grams of cesium-137 in the urban area of Goiânia, directly contaminating a 15 hectare area, killing four people and contaminating many others. To decontaminate the area, 3 thousand cubic meters of radioactive waste had to be removed and transferred to a provisional disposal site in the city of Abadia de Goiás, from where it will be transferred to a final disposal site, to be kept there for 130 years.

7. Sanitation infrastructure and the environment

The poor conditions of basic urban sanitation, in spite of the several attempts to overcome this problem, reveal serious institutional and financial shortcomings. The results attained in more than two decades of efforts are uneven.

Over 60% of financial resources for the improvement of water supply systems were applied in the Southeast region, which also received more than 65% of the resources invested in sewage systems.

In general terms, there was a remarkable advance in water supply services. The percentage of the urban population benefitting from this service jumped from 4.5% in 1970 to the present 88%. The results for sewage systems are far more modest: these grew from 22% to 35% during the same period, reflecting severely deficient services.

Only 10% of sewage has adequate final treatment, which means that about 10 billion liters of sewage a day are disposed of in natura directly on the soil or in waterways.

Table I.9 shows the situation of water supply and basic sanitation in Brazil in 1988, by region.

Another aspect of the environmental crisis is the increasing rate and intensity of natural catastrophes, particularly those caused by rain, consequent to the intense erosion caused by the destruction of green areas, the inadequate occupation of urban and rural areas, and deficiencies in the urban drainage systems.

The lack of sanitation facilities mainly affects the low-income population. Of the 5.9 million urban homes that were not connected to water supply systems and lacked sewage facilities in 1980, 72% (over 21 million persons) were homes with a family income equivalent to less than three minimum wages.

Treated water supply rates have even declined slightly in recent years. Water supply systems in some major Brazilian cities are showing clear signs of saturation, a fact that, considering the effects on public health, standard of living and well being, has a direct impact on economic activities, particularly in the secondary sector. Similar trends afflict the other sanitation services (garbage disposal and drainage), which have traditionally received less priority.

Regarding rural sanitation, its evolution since the post-war period confirms that institutional obstacles represent the main challenge, considering that technical questions have largely been resolved.

Table I.9 - Situation of Basic Sanitation in Brazil by Macroregion

SPECIFICATION		REGION					
		NO	NE	MW	SE	SO	BRAZIL
GDE A NT . A	Urban Population(1000 inhab)	5,817	26,955	8,614	58,191	16,596	116.17
	County Seat	201	1,459	449	1,427	761	4,297
	County (Municipality), except for County Seat	220	1,806	297	1,495	1,151	4,969
	Total Urban Centers	421	3,265	746	2,922	1,912	9,266
WATER SUPPLY	Localities with Systems						
	County Seats	194	1,315	379	1,427	758	4,073
	Districts	105	911	63	1,098	728	2,905
	Total	299	2,226	442	2,525	1,486	6,978
	Localities with Systems						
	County Seats (%)	96.52	90.13	84.41	100.00	99.61	94.79
	Districts (%)	47.73	50.44	21.21	73.44	63.25	58.46
	Total (%)	71.02	68.18	59,25	86,41	77.72	75.31
	Population Served						
	Absolute (1,000 inhab.)	4,027	18,546	6,541	50,019	14,520	93,653
	(%)	69.23	68.80	75.93	85.96	87.49	80.62
SANITARY SYSTEM	Localities with Systems						
	County Seats	12	49	41	1,053	77	1,232
	Districts	1	2	3	184	0	190
	Total	13	51	44	1,237	77	1,422
	Localities with Systems						
	County Seats (%)	5.97	3.36	9.13	73.79	10.12	28.67
	Districts (%)	0.45	.11	1.01	12.31	0.00	3.82
	Total (%)	3.09	1.56	5.90	42.33	4.03	15.35
	Population Served						
	Absolute (1,000 Inhab.)	201	3,166	2,632	32,312	2,987	41,298
	(%)	3.46	11.75	30.55	55.53	18.00	35.55

Source: Catálogo Brasileiro de Engenharia Sanitária e Ambiental, CABES, 86-89

During the past decade, advances in rural sanitation were insignificant: water supply increased from 2.6% to 4.3% and sewage systems from 1.9% to 7.3%. About 6.8% of the rural population is served by public drinkable water supplies and is equipped with sewage systems or sanitary cesspits. Of the 38 million Brazilians who live in rural areas, 24 million drink and use water from wells, rivers or other rudimentary water sources; 14 million use rudimentary septic tanks.

In sum, plans in the sanitation sector have prevented the expected improvements in rural areas because they have mainly concentrated on denser urban areas, particularly the capitals and larger cities. They have also reduced the support to municipal administrations by transferring responsibility for providing water supply and sewage services to state companies.

With few exceptions, municipal companies are technically and administratively fragile and their rates are seldom adequate. The main problems faced by these companies are the high investments required to expand their services, and meet the needs of a growing urban population. In this context of financial difficulties, most of these companies pay little attention to rural sanitation.

The Federal Constitution, in 1988, enabled municipal administrations to provide better local services by increasing their share of public resources; efforts must now be made to improve administrative mechanisms for the municipalities.

8. The impacts of development on health standards

In the past three decades, mortality rates due to infectious diseases, in children under one year of age, have declined because of intensive vaccination campaigns, improvements in sanitary conditions and greater use of urban services by the population.

On the other hand, diarrheal diseases still represent one of the major health problems, particularly in the Northeast of Brazil, mostly affecting children under the age of five. The overall infant mortality rate dropped from 121 per thousand to 83 per thousand in the 1960-1990 period.

Malnutrition is still a problem and represents another challenge. This situation is caused by socioeconomic differences and affects the low-income population in particular, which is still afflicted by the malnutrition-infection syndrome.

The health crisis is evidenced by recurring diseases that had been eliminated in the past, such as dengue (breakbone fever) and cholera. Diseases caused by parasites, which

used to be limited to certain focal points, have spread to other areas. The rate of incidence of Hansen's disease, tuberculosis, hepatitis and sexually transmitted diseases is increasing.

Malaria killed 1,480 persons in 1988, and 63.2 million persons were exposed to it. The rate of schistosomiasis-infected individuals was above 40 million, causing 7 million victims. Dengue afflicted several urban centers, reaching a contamination rate of 800 thousand. Chagas' disease, concentrated in high-incidence areas, has 5 million carriers, and 30 million people are exposed to it.

These endemic-epidemic processes cannot be explained solely by the persistence of poverty pockets, as they are also a direct consequence of environmental degradation and the development model adopted by the country.

It is generally admitted nowadays that environmental pollution is an influencing factor in the development of acute pathological situations, such as intoxication of rural workers by pesticides, and chronic-degenerative diseases such as cancer and cardiovascular illnesses in large cities. The waste produced by hospitals, industries, phytosanitary activities or homes represent a major additional problem because of the lack of adequate collection and final disposal systems. This waste ends up being discharged directly into waterways or inadequate disposal sites.

The occupational health situation of workers is somber. In ten years, over 10.5 million individuals covered by the social security system had accidents. More than 41 thousand died and about 250 thousand became permanently disabled. Studies carried out on this issue show the following diseases as those with the highest incidence: hearing loss caused by excessive noise, occupational dermatosis, intoxication by metals (particularly lead), health problems caused by exposure to solvents and pneumoconiosis.

Beginning in 1980, a special situation began to be experienced in Amazônia, as the use of mercury in prospecting activities became intensive and widespread. The major nonoccupational exposure to mercury in human beings is the consumption of contaminated fish and its by-products. Estimates based on the actual gold production suggest that approximately 900 tons of mercury were thrown into the Amazon ecosystem in the eighties.

The health issue in Brazil calls above all for solutions to the current institutional deadlock, insofar as the assistance provided to the population today is hampered by conflicting interests which transcend the limits of this sector. The importance of redistributing the national income must be stressed, as well as of concurrently expanding the infrastructure of urban services, particularly basic sanitation, as a sure way to raise the health level of the Brazilian people and correct environmental imbalances.

9. The Indigenous issue: evolution, problems and prospects

The Indigenous issue has been present throughout the history of the origins and development of Brazilian society. Nevertheless, it has not been included as an important topic when considering and debating national problems. This is partly due to the unawareness of the extent to which cultural differences can enrich and stimulate social dynamics, but mainly to the resistance towards coexistence with different societies. The almost 190 Indigenous groups in Brazil live under different conditions and have different levels of socio-cultural autonomy. They can be classified according to their contact with the surrounding society. They may be autonomous or isolated groups, groups that have sporadic contact or regular contact with the outside world.

The discovery of economic wealth in areas that had not been exploited in the past provoked ecological disturbances caused by deforestation activities, extinction of species of flora and fauna and environmental pollution. In Indigenous communities, these problems are conducive to the transmission of infectious diseases and cause conflicts and invasion of territories. For this reason, communities located in areas where such movements are scarse, are safeguarded from these problems. However, when such situations occur, Indigenous people have limited options: they may move to more isolated regions, running the risk of invading the territories of other Indigenous communities, or they may try to reorganize their life-style by adapting to the new environmental conditions. The disparity of forces makes self-defence almost impossible by their means.

After the initial contact, which may be friendly or hostile, a gradual process of deterioration is established because of the growing dependence on external sources, deprivation and loss of territories. Missionary actions, when characterized by ethnocentrism, stimulate this process of community disorganization.

An important change adopted for the Indigenous strategy was introduced in the constitutional texts of 1967 and 1969, which incorporated Indigenous land into federal assets and pronounced them inalienable. Laws regulating Indigenous issues formed the Indian Charter (Law 6,001/73), which established a five-year deadline to demarcate Indigenous land. Later, the 1988 Federal Constitution reaffirmed that all Indigenous land belongs to the Federal Government, and that their demarcation must be concluded by 1993.

Recent estimates point to the existence of 240,000 indians in Brazil, not including groups without direct contact with national society. In October 1990, the official figures on

Indigenous land were as follows: 279 demarcated areas (35,982,553 hectares) and 265 areas to be demarcated (46,517,447 hectares).

About 65% of the Indigenous population lives in Amazônia. This is also the region where the last isolated groups, which have little contact with the national economy, live. Because it lacked an effective plan to defend Indigenous land or provide basic economic and medical assistance, the occupation of the Amazon region had a strong effect on the Indigenous world. The Indigenous policy adopted in the sixties aimed at speeding up integration of the indians into the market economy, to prevent them from becoming obstacles to the occupation of Amazônia.

The various planning strategies adopted in the region had tremendous negative impact on the Indigenous population. In the Northwest region, for example, two million hectares of forests were destroyed, land conflicts were intensified, and the opening and paving of roads multiplied the entry of clandestine prospectors and miners in Indigenous territories.

In the northern region of the state of Pará, a series of activities was carried out which totally disrupted the social, economic and cultural organization of the Indians, creating an open conflict between them and settlers who moved to the region to engage in mining activities, integrated to railroad and port facilities, or who were attracted by the expansion of agriculture and cattle-raising.

In the occupation of the frontier strip, the most noticeable effect was the reduction in size of Indigenous territories. The division of Indigenous reserves into disconnected areas, the creation of national forests overlapping Indigenous territories and the slow response of the government to the predatory advance of economic agents, created a critical situation that jeopardized the basic survival conditions of the Indigenous communities.

The very serious Indigenous situation highlights the importance of global and integrated planning in the establishment of large works and productive activities, considering their potential impact on the population. Technical and economic objectives should necessarily be adapted to the values of local communities and ethnic minorities. If it may be said that the Indigenous condition in Brazil has improved, it is due less to the preventive actions of the state than to the increased capacity for action and advocacy of tribal leaders and their allies.

The traditional lifestyle of the Indians is based on their full acquaintance with the land in which they live. This integration is necessary to preserve the characteristics of the environment, making room for carrying out productive activities that may be reproduced over time. The Indians carry out permanent observation and control actions in all areas of activity,

correcting imbalances caused both by man and nature, through deliberate interventions. The traditional mechanisms used for this purpose are part of the knowledge slowly elaborated by tradition, is renewed in accordance with the community's dynamics.

Analyses of Indigenous society provide us with information and knowledge on nature's processes, which may help us to obtain a deeper understanding of many aspects of the environmental issue. No precise limit can be drawn between natural and rearranged ecosystems. A large part of what has been called "natural" forests and savannah areas in Amazônia is possibly the result of thousands of years of rearrangement carried out by Indigenous communities. Indigenous knowledge is therefore an alternative to be considered for the sustainable use of Amazon ecosystems ard another reason why the preservation of Indigenous lands is so important to the environment.

Chapter II

The Evolution of Environmental Policy

After the 1972 United Nations Conference on the Human Environment, the national debate on environmental issues grew in scope. Consequently, legislation, which had been limited to preserving the flora and fauna and to the use of water and mineral resources, became more complex. The Government became thus concerned not only with the environmental impact of the ongoing accelerated development process, but also with addressing the environmental issues in a manner, consistent with the recommendations adopted by the Stockholm Conference.

Decree 73,030, of October 30, 1973, created the Special Office for the Environment (SEMA), subordinated to the Ministry of the Interior, with responsibility for examining the implications of national development and technological progress on the environment; for helping agencies and organizations in charge of the preservation of the environment; for preparing rules and standards; and for ensuring that legal provisions are complied with either directly or in a coordinated action with other agencies.

The environment as an issue was first addressed by government planning in the late seventies. The Government's concerns were also broadened to include urban industrial activities, giving rise to the regulation of such activities.

In 1981, Law 6,938, establishing objectives and tools for the National Environmental Policy, incorporated for the first time in a text of its kind the concept of reconciling economic development with the preservation of the environment. An additional innovation introduced by that legal instrument was the creation of the National Environmental System (SISNAMA), made up by the National Enviromental Council (CONAMA) and by federal and state-level executive agencies. This system includes not only the ministries and sectorial

organizations of the federal administration directly responsible for the environment, but also state and municipal-level agencies, professional associations and non-governmental organizations.

As the consulting and deliberating agency of SISNAMA, the National Environmental Council (CONAMA) is designed to advise, study and propose government policy guidelines for the environment and natural resources, as well as to consider rules and standards compatible with environmental protection.

Once duly regulated, the tools of the National Environmental Policy produced a licensing system for activities capable of altering ecosystems. CONAMA was commissioned to define the criteria to be adopted by Environmental Impact Assessments (EIA) for issuing those licenses, thereby ensuring public access to information on damages caused to the environment and environmental protection actions.

After the resumption of direct elections for state governments in 1982, there came about a new wave of institutionalization of state environmental agencies, in accordance with Law 6,938/81. Pressed, on one hand, by their institutional and political fragility, and on the other by growing social demands, federal and state environmental agencies jointly set up the Brazilian Association of Environmental Organizations (ABEMA). This association is a national forum that aims at strengthening the National Environmental System, and consequently the executive agencies. Federal legislation also encourages states and municipalities to set up environmental councils supported by the executive branch. In 1981, Complementary Law 40 assigned the Office of the Attorney General with the authority for bringing public penal and civil suits against those responsible for damaging the environment.

Law 7,347/85 regulated the reinforcement of public civil suits for damages caused to the environment as well as to property of an artistic, landscape, aesthetic or historical value; the Office of the Attorney General began to organize environmental protection organizations in the more crowded cities. Also, organizations engaged in environment-protecting activities were given a right to judicial action by that law.

As the Constitution of 1988 was being drafted, non-governmental organizations, the scientific community and other civil society representatives created an informal mechanism for debating and forwarding proposals which succeeded, more than in any other area, to safeguard their objectives in the constitutional text. As a result of this action, a chapter fully dedicated to environmental issues came into being, which guarantees the right of Brazilians to an ecologically balanced environment for the common use of the people, as essential to a healthy quality of life.

The Constitution also includes, in other chapters, several provisions dealing with people's rights in connection with the environment, emphasizing the citizen's role; the division of legislative jurisdiction among federal, state and municipal administrations, granting states and municipalities unprecedented autonomy; congressional jurisdiction in the field of nuclear activities; environmental protection as an area of competence ascribed to the Office of the Attorney General; the protection of the environment as an economic issue; and the preservation of the environment as a factor bearing upon property rights.

Immediately after the promulgation of the Constitution, while the spirit of mobilization in defense of the environment still prevailed, the program, "Our Nature" was launched, consisting of a set of proposals for legislative and institutional improvements, with special emphasis on Amazônia.

The ensuing debate changed substantially the Government's original proposal and made room for legal and programmatic innovations, among which the following deserve special mention: the setting up of a Government agency with broad responsibilities for conducting environmental policy, namely the Brazilian Institute for the Environment and Renewable Natural Resources (IBAMA), which incorporated the Special Office for the Environment (SEMA) and the federal agencies that were responsible for fishery, rubber and forest development; further restrictions included in the Forest Code were expanded, with special emphasis on the prohibition of deforestation activities; suspension of official credits and tax incentives to projects involving deforestation activities or that may affect primary ecosystems; linking of mining concessions to environmental licensing; registration of producers, exporters, and importers of metallic mercury; drafting of laws for controlling all phases of pesticide use in the country; creation of the National Fund for the Environmental (FNMA) and the establishment of legal status for the extractive reserve concept.

After the promulgation of Law 8,028/90, a new institutional framework was created , with the establishment of the Office for the Environment of the Presidency (SEMAM-PR), which aims at "planning, coordinating, supervising and controlling activities related to the National Environment Policy and is responsible for the preservation, conservation and rational use of renewable natural resources."

This new institutional framework, however, refers only to the environment in the narrower sense of the term. It does not exempt other associated segments from playing their role in areas which may include an environmental dimension in the broader sense of the term. The distinction between sector and dimension is very important for carrying out the Brazilian

environmental policy correctly. To reach a truly sustainable development one must be aware of economic, social and environmental dimensions, among others. In the final analysis, all fields of activity interact positively or negatively, with those three dimensions.

1. Environmental control: norms and standards

The setting up of SEMA lent a fresh impetus to actions aimed at controlling pollution. The country's water resources were classified, for the purpose of controlling pollution of national water systems. Water use was classified into four categories and standards of minimum quality were adopted as a guarantee for that utilization, while States were left free to establish additional and more restrictive standards.

By comparing these standards with previous ones, it can be verified that the environmental control authorities were further empowered to intervene in the use of space in order to protect water quality, producing a shift in the approach from one of source control to one of promoting an integrated management of basins.

Two comprehensive programs are being developed to provide greater effectiveness to actions aimed at enforcing the laws on aspects related to water quality: the National Water Quality Program (PROÁGUA) and the Maritime Environment Management Program.

Within the scope of PROÁGUA, special emphasis is placed on recovering and maintaining river basins in critical or degraded areas, monitoring the quality of the water, implementing a national data base on water quality and regulation or regulation of federal rivers.

The Maritime Environment Management Program seeks to manage the coastal strip and adjacent zones, identifying areas of industrial and urban concentration, locations and terminals that may be sources of aggression and ecologically sensitive areas, and to develop specific plans to be used in case of oil spills or spills of other hazardous substances.

It should be emphasized that from 1984 onwards many attempts were made to establish a management system for water resources as a means to organize the decision-making process among the various jurisdictions involved before this system was included in the Federal Constitution as of 1988 in article 22, XIX. Although it has not yet been implemented, it is a fundamental provision for a harmonious evolution of the sector.

Air quality control is based on legally-established standards and specific programs, the basic strategy of which is to limit polluting emissions at the national level. Of the main action guidelines of the Air Quality Control Program (PRONAR), the following deserve special mention: air monitoring; management of the licensing of pollution sources; national inventory of pollution.

With regard to emissions from automotive vehicles, the National Program for Controlling the Pollution Caused by Vehicles (PROCONVE) is currently being implemented. It is aimed at controlling, in several steps, pollution levels, the use of fuels, and the production of vehicles according to adequate standards. PROCONVE's timetable sets 1997 as the deadline for compliance with maximum limits established for polluting emissions from engines and new motor-propelled vehicles.

2. Licensing system for environment polluting activities

The environmental licensing system implemented in a few states during the seventies was only set up on a nation-wide basis in 1981 through Law 6,938, which regulates the construction, installation, expansion and operation of facilities and activities considered as potential or actual sources of pollution.

This law was partly modified by Law 7,804/89, due to the need to harmonize its contents with the establishment of IBAMA; but the foundations and mechanisms provided for in the original law were preserved.

The licensing process is carried out in three compulsory steps: preliminary licensing, license to install the facilities, and license to operate. The system functions as a mechanism for following up environmental consequences of certain economic activities, starting with their initial planning stages. The frequency of monitoring actions varies according to the nature of the activities and their planning, implementation and operation timetable.

According to Law 6,938/81, only the federal executive branch had authority to grant environmental licenses for petrochemical or chlorochemical facilities, provide the interested states and municipalities were consulted. Nuclear facilities were subject to the approval of the National Nuclear Energy Commission (CNEN). After the changes introduced by Law 7,804/89, the competence for granting licenses to activities with a significant impact on the environment at the national or regional level was fully transferred to IBAMA. More recently, some municipalities have established licensing authority for themselves within their jurisdiction through organic laws (municipal constitutions), which include requirements for preliminary studies and submission of Environmental Impact Reports (RIMA). In some states, environmental control over local impact activities is being assigned to the municipalities.

Licensing processes for forest exploitation activities have been revised as of 1989, after IBAMA was created. Elements of provisions which used to apply only to urban and industrial environmental licenses were made applicable to licenses for forest-related activities.

Under the umbrella of environmental management, society can respond to the claims of different sectors interested in defending the environment. Community participation is still evolving, and in the licensing context it is not very effective right now. Although the publication of license requirements is provided for in the licensing system, there are no mechanisms for interventions by interested parties in the decision-making process for approving the licenses, except in cases where Environmental Impact Reports (RIMA)have been required. For this reason, one of the most important steps to improve the licensing system would be to expand its democratic character, by including mechanisms that will allow the participation of society in all phases involved in the granting of licenses.

Regarding Environmental Impact Assessment (EIA), it should be mentioned that its procedures may represent an important component in decision-taking related to sectorial energy use or transport programs. Thus, the conflicts that frequently occur during consideration of specific infrastructure projects could be settled in the formulation stage of such programs. For this reason, the appraisal of environmental impact is an important instrument for the implementation of environmental policy and management.

In accordance with the National Environmental Policy, CONAMA is responsible for setting basic criteria for requiring environmental impact studies in licensing processes. Decree 88,351/83 established the connection between the EIA and licensing systems. In 1986, CONAMA laid down the general guidelines for using and implementing the appraisal of environmental impact, and determined procedures to be complied with by both governmental agencies and private enterprise, as well as rules for participation by the public in this process. The need for appraisal of environmental impact applies to a long list of undertakings, ranging from sanitary earthfills to the building of airports, agricultural complexes and urban projects, the licensing of which depends on the presentation of the relevant Environment Impact Assessment and respective RIMA. In most states, the law on EIA and RIMA has not yet been regulated.

3. Conservation of renewable natural resources

The world strategy for the conservation of nature, which Brazil seeks to implement, is composed of three specific objectives: to maintain the essential ecological processes and life systems, preserve genetic diversity and permit perennial utilization of species in specific ecosystems. The main strategies to conserve nature may be classified as ex situ

conservation, in situ conservation, and planning of human activities that involve the use of natural resources, to make them compatible with the bearing capacity of the environment.

Conservation units are the best mechanism for in situ preservation of genetic resources. Brazil, endowed with the greatest biological diversity in the world - about 15-20% of all living species, is increasingly aware of the need to preserve its genetic patrimony.

The Constitution determines that each state of the Federation define areas to be particularly protected, the status of which can only be altered by law, and where activities liable to harm the integrity and the special features that justify the protection of the area are forbidden.

The establishment of National parks, forests and biological reserves fall under the competence of the Government, and aim at reconciling the protection of flora, fauna and natural attractions with scientific, educational and recreational purposes, any form of exploitation of natural resources being strictly prohibited. Ecological stations and environmental protection areas have been created as examples of the different Brazilian ecosystems, for the purpose of basic research applied to the ecology, to the protection of the natural environment and to the development of environmental education. The establishment of extractive reserves also falls under the Government's responsibility. These are areas set aside for self-sustainable exploitation and conservation of profitable natural resources by people engaged in extraction.

A bill has been referred to the National Congress by CONAMA, which proposes a system for the establishment of conservation units in the country and creates new management categories that are not foreseen in present laws, such as wildlife refuges, natural monuments, and resource and fauna reserves. Today, Brazil possesses 34 national parks, 23 federal biological reserves, 30 ecological stations, 38 nationals forests, 16 environmental protection areas and five extractive reserves, as well as six ecological reserves, comprising a total area of 32 million hectares. Table II.1 indicates the distribution of federal conservation units throughout the country, by region and state.

To sum up, Brazil has 1.8% of its territory protected by conservation units where resources are indirectly used (national parks, biological reserves and ecological stations), which are the most important for preserving biodiversity. The total percentage of protected area is 3.7% of the country's surface.

Current laws empower the three levels of Government, Federal, State and Municipal, to establish conservation units. In 1988, State systems comprised about 3,560,000 hectares, although official statistic records show figures considerably under those estimates (Table II.2). Regarding private systems, some non-governmental organizations have set up a

Table II.1 - Size of Federal Conservation Units in Brazil (Areas in hectares)

REGIONS & STATES	PARNA		REBIO		ESENA		REENA		FLONA		RESEX		APA		TOTAL	
	Nº	Area	Nº	Area	Nº	Area	Nº	Area	Nº	Area	Nº	Area	Nº	Area	Nº	Area
Northern Region	8	8134113	7	2617150	11	2126266	3	553296	24	12527986	4	2162989	1	21600	58	28143400
Acre	1	605000			1	77500			1	173475	2	1476756			5	2332731
Amazonas	2	4472000	2	848000	3	1140168	3	553296	15	7363226					25	14376690
Amapá	1	619000	1	395000	1	72000			1	412000	1	481650	1	21600	5	1979650
Pará	1	994000	1	488000	1	227126			4	1419600					9	3150326
Rondônia	1	765801	2	886150	1	104000			2	495000	1	204583			7	2455534
Roraima	1	116000			3	468472			1	2664685					5	3449157
Tocantins	1	562312			1	37000									2	599321
Northeast Region	8	536787	8	403503	6	163905	1	99772	1	38262			3	76400	27	1318629
Alagoas			1	4469	1	5322							1	8600	3	18391
Bahia	3	265800	1	11400											5	376972
Ceará	1	563			1	11596	1	99772	1	38262			1	6800	4	56921
Maranhão	1	155000	1	342650									1	61000	3	558650
Paraíba			1	4321	1	9721									2	14042
Pernambuco	1	11270	2	1648											3	12918
Piauí	2	104154			1	135000									3	239154
R.G. do Norte			1	36249	1	1166										
Sergipe			1	2766	1	1100										
Southeast Region	8	359525	7	64229	5	29295	1	200	4	8005			8	922289	33	1383543
Espírito Santo			5	33229					1	2830					6	36059
Minas Gerais	4	215325			1	1090			1	335			4	654317	10	871067
Rio de Janeiro	3	44200	2	31100	1	4070	1	200	1	493			3	65140	11	145103
São Paulo	1	100000			3	24135			1	4347			1	202832	6	331314
Southern Region	5	285436	1	17800	5	56332	1	2	9	15235			1	291500	22	666305
Paraná	2	191486			1	13700			2	4288			1	291500	6	500974
R.G. do Sul	2	44650			2	34087	1	2	3	3383					8	82122
Santa Catarina	1	49300	1	17800	2	8548			4	7564					8	83209
Mid-West Region	5	387868			3	243025							2	116200	10	747093
Federal District	1	28000											2	116200	3	144200
Goiás	2	191868													2	191868
Mato Grosso	2	168000			3	243025									8	411025
M.G. do Sul																
Total	34	9703729	23	3102682	30	2618823	6	653270	38	12589488	4	2162989	15	1427989	150	32258970
% of Brazil's Total Area	1.14%		0.36%		0.31%		0.08%		1.48%		0.25%		0.27%			

Table II,2 - Other Conservation Units with Official Registration (a)

Macro-Region	Total of UF	State (UF)		Municipal		Private (e)		TOTAL		
		Nº	ha	Nº	ha	Nº	ha	Nº de UF	Nº	ha
N	7	1	111	-	-	-	-	1	1	111
NE	9	68	(b)738,984	3	212	1	53,000	7	72	792,196
SE	4	59	(c)845,557	18	4,148	2	22,850	4	79	872,555
S	3	35	189,217	17	13,321	-	-	3	52	202,538
CW	4	5	(d) 39,528	1	48	-	-	3	6	39,576
TOTAL	27	168	1,813,397	39	17,729	3	e)75,850	18	210	(a)1,906,976

Source:IBGE - Anuário Estatístico do Brasil - 1990
Notes: The statistically registered area represents about 60% of the estimated total
(a) (c) (d) plus 2,3 and 2 U,C,, respectively, without specification of area,
(e) All 3 U,C, are the property of Companhia Vale do Rio Doce (CVRD).
(UF) Unit of the Federation (state, territory or Federal District)

network protected areas parallel to the one implemented by the Government. Private systems may make a remarkable contribution to promoting the preservation of biodiversity in the country, while promoting at the private level the conservation cause. They are officially recognized as Private Natural Heritage Reserves.

4. Policies adopted for the use of renewable natural resources

The Forestry Code is a tool to regulate and discipline land occupation, aiming at protecting forests.

In practical terms, in addition to setting conditions for the formulation of a forestry policy, the Constitution provides for the establishment of natural or sylvan areas in all states of the Federation. Both the Forestry Code and Law 5,197/76 encourage the establishment of national, state and municipal public sylvan units (parks, reserves and forests), though they do not stipulate that such areas be created in all states of the Federation, nor do they define quantitative requirements.

Two private groups are mentioned in the Forestry Code: rural landowners and industries that use forestry raw material.

As a conservation factor, each rural estate must preserve at least 50% of its forest areas. For properties in the Southern region estates, the meridional East and the southern part of the Central-Western region, which already existed before the Forestry Code, it is required that they keep intact 20% of the area covered by forests. Estates located in savannah regions also must preserve 20% of their forest covered areas.

Rural estates located in the state of São Paulo and in the Southern region of the country, a habitat of the typical pine tree of the state of Paraná, cannot be deforested and must be handled in a way that ensures the permanent maintenance of the forest.

To protect the hillsides of private or public estates, areas with a slope between 24 and 45 degrees cannot be deforested. Only the silvicultural handling of the native forest, or extractive activities carried out without the cutting of trees, are allowed in these areas.

With the purpose of protecting water sources, forests located alongside waterways, near springs, at the top of topographic elevations, on hillsides with a declivity over 45 degrees, around lagoons and at heights above 1,800 meters are regarded as untouchable, and are set aside for the preservation of certain minimum percentages of forest areas in each rural estate, as mentioned above.

Industries which use or consume forest raw material have been classified into two distinct types. Those industries that depend on forest raw materials, such as sawmills, paper and pulp factories, rolling-mills, fall into one category. Metallurgical plants, transport companies and other charcoal or lumber-consuming industries that can replace the use of forest raw materials by other materials, fall into the other. Both types of industry should invest in forests that can meet their demands, establishing a link between the primary and secondary sector, that is, between the production of raw materials and the industries that consume them.

The provisions of the Forestry Code, if complied with, will ensure the existence of a network of forests of considerable dimension, regularly distributed and located, especially, in the more sensitive areas.

According to the Code, forests should alternate with agricultural activities in such a way as to form barriers against winds, protecting biological diversity and controlling pests.

The financial incentives provided for in the code to stimulate forest activities, such as special funds, interest rates and terms have not been institutionalized; tax exemption for planted forest products was revoked; exemption from territorial taxes on forest areas indicated by law was also revoked and dealt with according to agricultural interests; tax exemption on income derived from cultivated forests was vetoed and never became law; and the full deduction from income tax of sums invested in the formation of forests was substantially changed. Tax incentives for reforestation activities remained, for a long time, the main policy absorbing most of the forestry administration's attention.

Lastly, with the aim of integrating the primary and secondary sectors, as provided for in the Forestry Code, forest recovery guidelines were setup. As time went by, these guidelines underwent modifications and evolved from the obligation to plant four trees 2 meters apart, for every cubic meter of lumber used, to present plans or mechanisms to keep managed natural forests under control in accordance with specific company demands.

Regarding the protection of flora and fauna, the legal provisions in force prohibit trade in wild animal products or byproducts, except for those produced in animal nurseries. The official list of endangered species includes 14 species of plants and 207 animal species.

Among the various wild animal species whose habitats have suffered anthropic changes, and are threatened by extinction, mention may be made, for example, of the Amazon caiman, the manatee and the jaguar in the Brazilian Amazon region, as well as the deer, the Brazilian river otter, the blue macaw and the great anteater of the Pantanal of the state of Mato Grosso.

The Convention on International Trade in Endangered Species of Wild Flora and Fauna, of 1975, of which Brazil is a signatory, has proven its efficiency in reducing smuggling activities worldwide and in Brazil.

Noncompliance with the laws is due to many reasons, among which are the lack of adequate inspection, the shortage and inadequacy of human resources, the lack of vehicles and facilities, the lack of environmental awareness and education, the pressures on poor communities that rely on natural resources for their survival, and the high prices obtained by tropical plants and animals in the international market.

It should be stressed, nonetheless, that wildlife conservation projects are being developed by research and teaching institutions, Government agencies and non-governmental organizations.

The fishery development policy was subject to the strongest Government intervention between 1962 and the early eighties, during the so-called industrialization phase of the fishing sector. Various institutional, economic and financial measures were taken during that period, among which the following stand out: the setting up of a specialized federal agency, the classification of the sector as a basic industry and the policy of tax incentives aimed at modernizing fishing. These measures brought technological improvements to certain fishing sectors, made room for the establishment of a modern fishing fleet at that time, promoted trade in fillet-cut products and stimulated exports of fine fish.

However, it cannot be denied that the sector is still lagging behind technologically in various aspects and that the above-mentioned process of technological improvement entailed high social and environmental costs. Tending to marginalize small scale production, which was regarded as doomed to disappear in the modernization boom, the policy denied them access to economic-financial mechanisms, on the assumption that small scale operations were an obstacle to attracting capital, and an inadequate investment.

This model was implemented without prior knowledge of fishing resources and without taking into consideration that the fishery development process should be combined with modifications in the productive sector, due to socioeconomic factors and bearing in mind the need to promote its technological evolution without harming the environment.

The easy availability of financial resources and incentives stimulated entrepreneurial experiments, most of which originating in other sectors. Because of the lack of an adequate governmental framework to conceptualize and implement development plans, these experiments produced an oversized industry characterized by poor distribution of species and imbalances among the fishing, processing and trade activities.

In addition, the model clearly led to a concentration of efforts on a few species, mostly for export on the international market, such as shrimp, lobster, porgy and piramutaba. The high prices obtained by these products in the foreign market and government incentives distorted production costs and led to an over-exploitation of such species, almost exhausting their supply.

With regard to aquiculture, shrimp cultures prevailed, based on methods that repeated the "industrialism" of extractive fishing activities, applied this time to large undertakings. Given the lack of adequate technical knowledge, these projects were not successful.

Actions aimed at helping cottage industry activities not only disposed of limited funds but also circumscribed themselves to the problem of increasing production. Because the Government focused on assistance to small-scale fishing that did not address the fundamental problems of small producers, its strategy did not succeed in promoting production as expected, nor did it improve the living conditions of fishing communities.

Hesitant policies aimed at organizing the use of fishing resources further compounded the problems of small-scale fishing activities. In addition, new factors arose, which exacerbated the permanent conflict between this type of activity and industrial undertakings. Thus, small-scale fishing zones were also exploited by large industrial fishing boats, depleting fish stocks that were meant to be manually exploited and also young stocks that would be fished later in a sustainable way by the industry itself.

When these negative effects were observed in the exploitation of the main fishing resources, various measures had to be taken which harmed small producers, particularly as the exploitation of resources shared with the industry began to be more effectively regulated.

As market economy mechanisms were introduced, small-scale fishing activities themselves became a factor of environmental impact, as in the case of concentrated fishing in breeding areas.

It is also important to point out that the fishing policy adopted to date, has not adequately assessed exogenous factors that also produce environmental impact, such as the disorderly coastline occupation by tourist ventures and the establishment of industrial complexes at inappropriate sites.

In brief, the management of fishing resources conducted by the State has been extremely unsatisfactory. Profound changes in Government policy are required to improve this situation, particularly as regards the clarity and technical-scientific background for the decision-making process and the actual enforcement of measures. There is a need to strengthen

institutions, while doing away with political and economic pressures that are prejudicial to an adequate management of our common heritage, and to continue to carry out studies and research aimed at defining new alternatives, as well as to make substantial investments in environmental education.

5. Territorial zoning and organization

The ecological-economic zoning of the Brazilian territory is legally determined (Law 6,938), and is one of the main features of the National Environmental Policy. Its function is to provide technical-scientific grounds for the development of plans aimed at territorial organization. It is characterized by the division of certain areas into subareas or intervention zones with certain similarities and contrasts as regards their ecological and socioeconomic profiles.

Studies on the structure and dynamics of these areas provide the inputs for the precise definition of objectives and selection of criteria, rules and standards to be used in the planning of interventions. In addition, the process of ecological-economic zoning requires a methodology compatible with the complexity and comprehensiveness of the topics involved in the definition of sustainability, which must be understood as a basic requirement in this context.

The current concept of ecological-economic zoning is based on the need to identify and to establish the limits for at least three areas, according to their intervention category: production areas, capable of ensuring productivity at a commercial or survival level by appropriate use of natural resources, with due account given to improvements in the standard of living of the local population and the conservation of the environment; areas that are inappropriate for productive use in the short term, due to serious limitations posed by the lack of sufficiently complex management techniques which require investments that are not compatible with the intended returns or that could cause serious environmental damage; and special areas, including conservation units of indirect use, permanent preservation areas, Indigenous areas and sites of relevant historical, landscape and cultural interest.

To honor priorities established by law, the Government took measures, in March 1990, to speed up the ecological-economic zoning of the Legal Amazon region. Based on an analysis of the work that had been carried out, three levels of examination were proposed for more in-depth studies: environmental diagnosis covering all the Legal Amazon region on a macro-regional level; ecological-economic zoning at a regional scale of areas identified and defined as priority areas by the diagnosis; and specific studies on critical and especially significant areas.

6. Environmental education

Environmental education figures in the Constitution as a responsibility of the Government, together with the promotion of social awareness to defend the environment. Federal laws, decrees, state-level constitutions, municipal laws, rules and administrative decrees provide for compulsory environmental education at various levels. However, the effectiveness of these provisions is compromised by structural problems and the lack of adequate formal education facilities in the country.

Environmental education experiences were carried out initially at the primary and secondary levels, and only later at the undergraduate and postgraduate university level. The initial slowness of the process can be blamed on the poor qualification of the teachers and professors involved. Therefore, the inclusion of environmental studies in school curricula has required the creation of training programs on a scale that is still far from having been satisfied.

As of 1975, the first environmental education projects made their appearance in Brazilian municipal and state-level schools and private teaching institutions, stimulating a large production of didactic material in this area, such as books, games and audiovisual material.

Universities with a greater academic tradition have been publishing works about ecology since the forties. In 1977, the environmental studies were included as a discipline in the minimum curriculum of undergraduate engineering programs. Now, several public universities offer postgraduate ecology courses, with an approach that is basically naturalistic. In the teaching of human sciences, the inclusion of environmental education is incipient.

During the eighties, environmental education went through a period of significant growth in the country. Environmental problems became an important political issue, and the development strategy itself included explicit consideration of environmental degradation. The resumption of democracy enabled communities to express their claims in this field, and the popularity of environmentalism made room for a proliferation of environmentalist associations and a variety of social groups.

In 1985, the Federal Council of Education determined that ecology should not be treated as a specific discipline, because of the overload of disciplines in school curricula and the multidisciplinary nature of the subject. Today, environmental education in primary and secondary schools is a subject included in teacher education programmes in most states. However, the results attained to date in the environmental education area, as a result of public initiatives, are mostly derived from the actions undertaken by the National Environmental System, rather than from the official involvement of the educational sector.

At any rate, the greatest contribution to the process of promoting public awareness on environmental issues has come from social movements, non-governmental organizations, the media and political and cultural movements.

Until 1970, attention given to environmental problems in the Brazilian press was insignificant, a fact for which the censorship associated with the authoritarian regime of the time is not totally to blame. The environment didn't make the news because the social awareness of the issue lacked political expression. As of that year, environmental themes have been conquering more and more space in the media through the launching of campaigns, publications, debates, seminars, lectures and opinion polls, and thanks to the publicity given to problems related to environmental degradation.

The same phenomenon has occurred in the technical-scientific press and technological journals dealing with rural matters. Twenty years ago, TV and radio dealt with environmental problems only circumstantially. As of the eighties, coverage of these problems has grown considerably.

7. The environmental movement

In approaching society's initiatives with relation to environmental issues, the environmentalist movement concept is adopted here in its broadest sense. From the organizational point of view, it includes both non-governmental organizations and grassroots and community groups with a minimum of formal organization. Most of the associations are just now being legally established. They are usually set up with specific aims that represent the focus of activity in each association, besides being permanent recipients of a multitude of complaints from isolated citizens, informal groups or other associations, particularly of residents. The most common targets of the struggles of these associations, in their initial phase, are particular environmental problems that affect the local community.

The evolution of the environmentalist movement is divided into two phases. The initial phase (1958-1986) was characterized by denunciation and promotion of public awareness, and the present phase is a transition towards greater institutionalization of the movement inspired by the goal of sustainable development.

The environmentalist movement began with actions aimed at defending the fauna and flora threatened by extinction, and then moved on to exert pressure against the inappropriate

use of mechanical and chemical means in agricultural activities, attention being given as well to water pollution and the destruction of the landscape. The promotion of an ecological and planetary awareness is also an important aspect of the actions of the movement.

In the later seventies, small, intensely active groups were formed in the main cities of the country devoted to denouncing urban degradation problems and to protecting the remnants of the country's native vegetation, such as the Atlantic Forest, which covers certain areas of the coastal states. Environmentalist groups of the South-Southeast region became increasingly interested in the Amazon region, transforming it into a symbol the struggle against a lifestyle that entails the destruction of nature.

At the end of the decade, the movement acquired greater strength in its fight against nuclear plants, with an active participation by the scientific community, particularly as regards the Brazil-Germany Nuclear Agreement.

The eighties were a period marked by the emergence of many environmentalist groups. In the Southern region, environmentalist organizations played an important role in winning support for laws aimed at restricting the building of nuclear plants and at regulating the use of pesticides in agriculture. In spite of the intrinsic value of those results, their effectiveness was shortlived, as they were nullfied by federal legislation.

The emergence of environmentalism in the Southern and Southeastern regions of Brazil is similar in many ways to the equivalent process that took place in Western Europe, North America, Australia and Japan. However, although the environmentalist movement in Brazil originated mostly in the middle- and upper-middle classes, it includes a significant minority from social sectors with a limited consumption capacity and educational level. Participation by such sectors is proportionally of higher importance for Brazilian environmentalism than in its counterpart in the First World. Therefore, the movement's agenda includes topics where the environmental issue blends in with the need to overcome problems that are typically found in underdeveloped societies.

The ability of the environmentalist movement to press its claims at a political level faced its greatest test during the drafting of the 1988 Constitution. The inclusion of a very relevant set of provisions proposed by the movement, and the election of one of its members to the Constituent Assembly, demonstrated the movement's emerging clout particularly as regards its power to establish alliances with important sectors of society not directly involved with environmentalism.

At the state and municipal level, the political power of the movement had already ensured the election of a few militants. Although ecological issues have been playing a significant role in electoral campaigns, it is interesting to note that this has not ensured their inclusion in party programs and platforms, in which they still play a superficial part and are not clearly linked to long-term proposals of a philosophical, ideological, economic, or social character.

Two interrelated issues are crucial for the evolution of the environmentalist movement in developing countries: social justice and economic development. For most of the low-income population, these are fundamental problems. Therefore, the potential impact and the expansion of environmentalism in Brazil are directly associated to the way these issues are addressed in the world context.

The connection between environmentalism and economics was underestimated at first. However, the relationship with social justice became more evident from the mid-eighties onwards. Several environmentalist groups realized that the mobilization of other sectors around environmental issues directly affecting them was extremely important. This is how discussions on common problems were engaged with union activists, the landless workers movement, low-income outskirts community movements, rubber tappers and Indigenous groups in Amazônia.

The main change that has recently taken place in the environmentalist movement is not related to the emergence of groups at a slower pace. Instead, it is related to an internal differentiation process produced by a widespread movement of institutionalization. New organizations have been set up with a professional, technical and administrative staff and with systematic fund-raising ability. These organizations have defined their areas of activity with precision, with concrete goals and mechanisms to assess their performance in the pursuance of these goals.

In the second-half of the eighties, there was a slight change in the regional distribution of environmentalist groups, due to their growth in the Central-Western region. However, the South-Southeast region continues to concentrate approximately 90% of these groups.

The environmentalists have influenced several social movements which, in spite of not centering their action on environmental issues and of not calling themselves environmentalist, have included the protection of the environment in their regular activities.

Warning Operation

An example of a joint Government-society mobilization happened in São Paulo on Friday, July 13, 1988. On that day, the city almost stopped; 180,000 vehicles were withdrawn from circulation, cutting by half the air pollution of the most critical region of the city.

Up to that year, factories were blamed for the pollution in the city of São Paulo. Through an action that involved information, inspection and fines over the preceding 10-year period, the factories were brought under control. However, the 4.5 million cars that circulate every working day in the capital had become the leading factor in environmental degradation, responsible for 90% of the air pollution.

The general idea behind the Warning Operation, which was carried out during the winter of 1988, was to persuade regular citizens to leave their cars at home at least once a week. On that specific day, July 13th, no car owner should take his or her car out to the streets in the area defined as the control zone.

There is no doubt that the most important result from the operation referred to participation. On the previous day, an opinion poll showed that 98.9% of the interviewees in the area in question approved the operation. Commercial and banking activities were carried out normally, and on the following day another poll revealed that the rate of approval was the same.

8. Environmentalist actions in the productive sector

The relationship between the private sector and environmental protection must be considered in light of the historical political-institutional process of the country, and particularly in light of the role played by the State as a mediator among different social forces and enforcer of democratic rights. These features, added to the country's income distribution profile, explain how, in general, the axis of the decision-making process in society tilts towards the side where the income is already concentrated, in detriment to basic citizenship rights, among which, the right to a fair standard of living.

For this reason, economic power has traditionally meant the right to pollute, despite laws. It may be said that the country has adequate environmental laws, which nevertheless have not been complied with satisfactorily.

Recently, the business community has started to feel the evils of economic development devoid of environmental considerations, in particular because of the risks it poses to the existence of certain activities and their acceptance by society.

Such a reaction, added to the improvements being introduced into legal and institutional mechanisms aimed at defending social rights, and to the growing participation of the environmental sector in planning and inspection agencies, and to the consolidation of environmental claims arising from the communities, provides indications that the relationship between the productive sector and environmental concerns is undergoing a transition.

In 1974, the International Chamber of Commerce adopted the Environmental Guidelines for World Industry, which are periodically revised and updated and represent an important commitment, assigning economic and social responsibilities to industry, with regard to the environment. These guidelines were adopted in Brazil by the National Committee of the International Chamber of Commerce.

In recent years, environmental management has been included in industrial planning and operation, alongside with community relations. The legal requirement to undertake environmental impact studies and to hold public audiences to discuss projects before carrying out industrial projects has also played a role in ensuring that environmental issues are considered by the productive sector.

In this transition process, the adoption of clean technologies, which minimize negative impacts on the environment, has varied among the many sectors involved, although it is now recognized that when measures for protecting the environment and managing or controlling risks are considered in the initial phase of any industrial project, pollution control costs are lower and greater effectiveness is attained .

Some sectors, such as the aluminiun, chemical, petrochemical, paper and pulp industries have advanced more in including environmental measures in their activities, by adopting technologies and carrying out experiences to control and recycle residues, among others. In this context, special mention should be made of risk analyses in industrial projects, prevention of environmental accidents, environmental auditing and control of waste disposal in the air or in waterways, and the adherence to programs being implemented at an international level.

In the public sector, environmental control experiences are being carried out in connection with major undertakings in the electricity and mining sectors. Positive results have been attained in research geared towards technological solutions to environmental problems in the agricultural area.

Chapter III

The Situation of the Main Brazilian Ecosystems

Brazil has a surface area of 8,511,996.3 square kilometers. Within its continental extension, encompassing from equatorial regions in the North to extra-tropical regions in the South, differentiated climatically and geomorphologically, the country is endowed with a remarkable ecological diversity. Although such vast areas may contain various natural regions and topographic compartments, they do have a set of distinctive geomorphic features, soil associations, characteristic vegetal formations and hydrological conditions.

Some of the main ecosystems will now be described, with special emphasis on the six morphoclimatic domains (Figure III.1), including the anthropic pressures that differentiate them. Situations of greater vulnerability are located in the Semi-Arid and Campos do Sul domains, where localized decertification processes are beginning to occur (Figure III.2, which also indicates the macroregional division of the country). Because of its relevance and with the same approach, this chapter includes an analysis of fishing resources in the country, as well as of the large Brazilian hydrographic basins (Figure III.3), indicating the frequent correlation among the three mapped physiographic differentiations: the phytoecological, the regional and the hydrographic.

FIGURE III.1

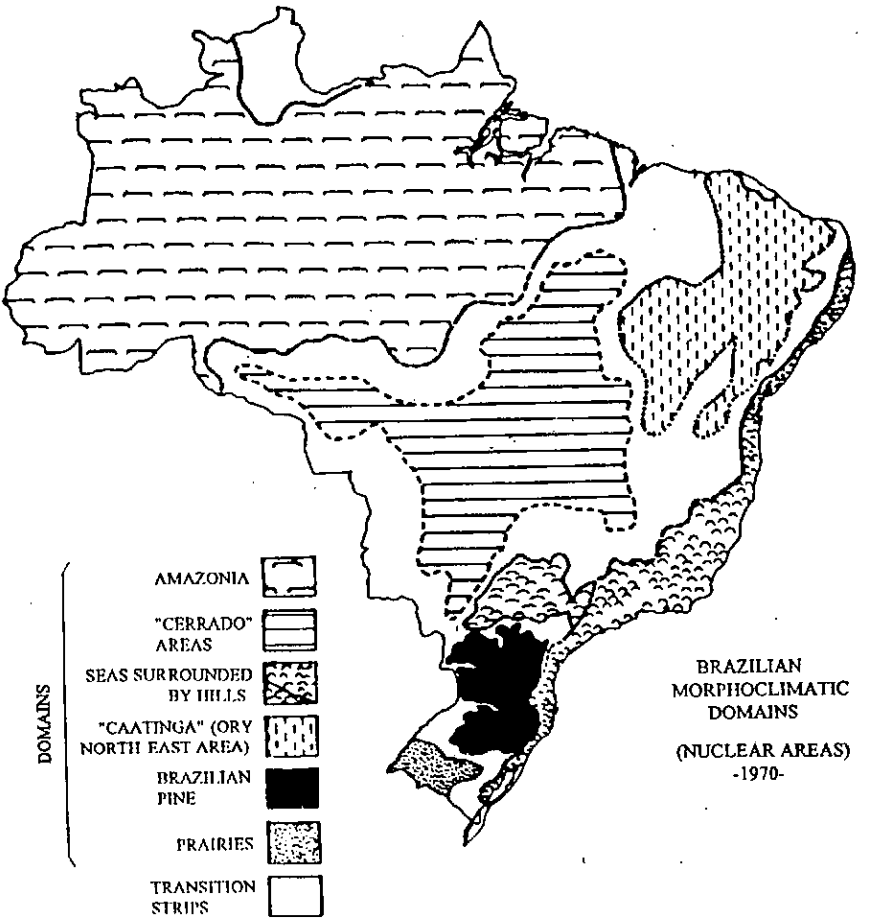
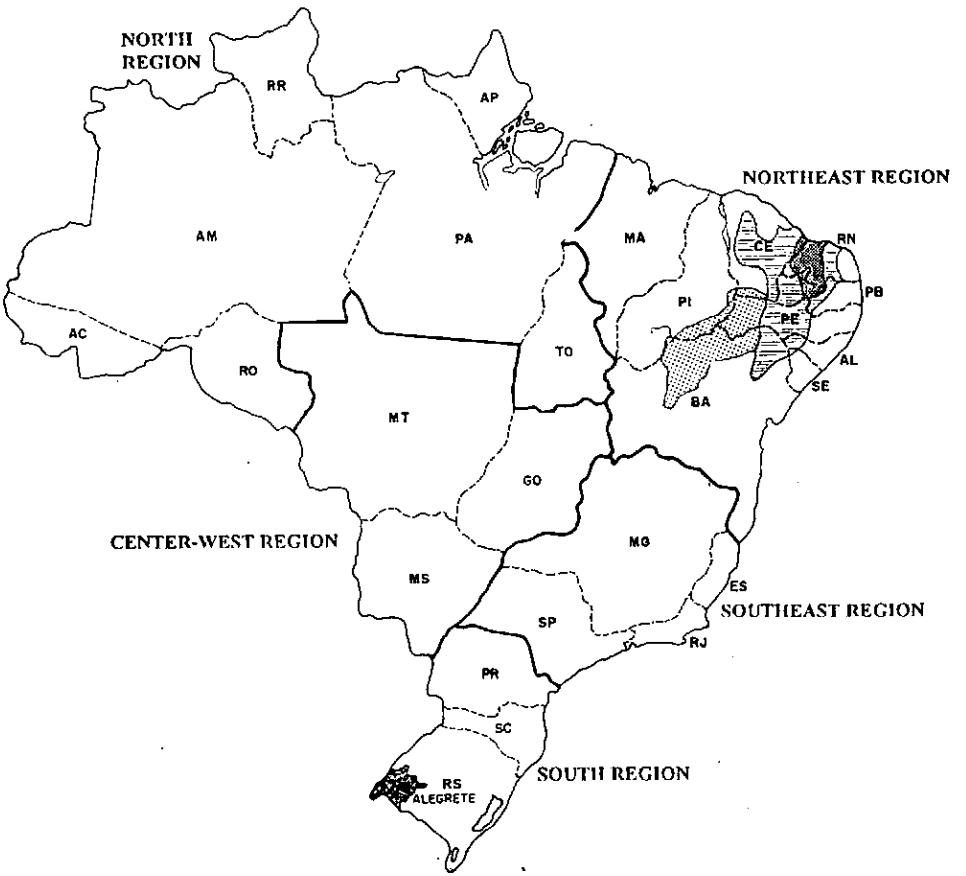

DOMAINS
AMAZONIA
"CERRADO" AREAS
SEAS SURROUNDED BY HILLS
"CAATINGA" (ORY NORTH EAST AREA)
BRAZILIAN PINE
PRAIRIES
TRANSITION STRIPS
BRAZILIAN MORPHOCLIMATIC DOMAINS
(NUCLEAR AREAS)
-1970-

FIGURE III.2

AREAS UNDER RISK OF DESERTIFICATION



LEGEND:

—— Regional division

----- State division

Areas under risk of desertification

Very high

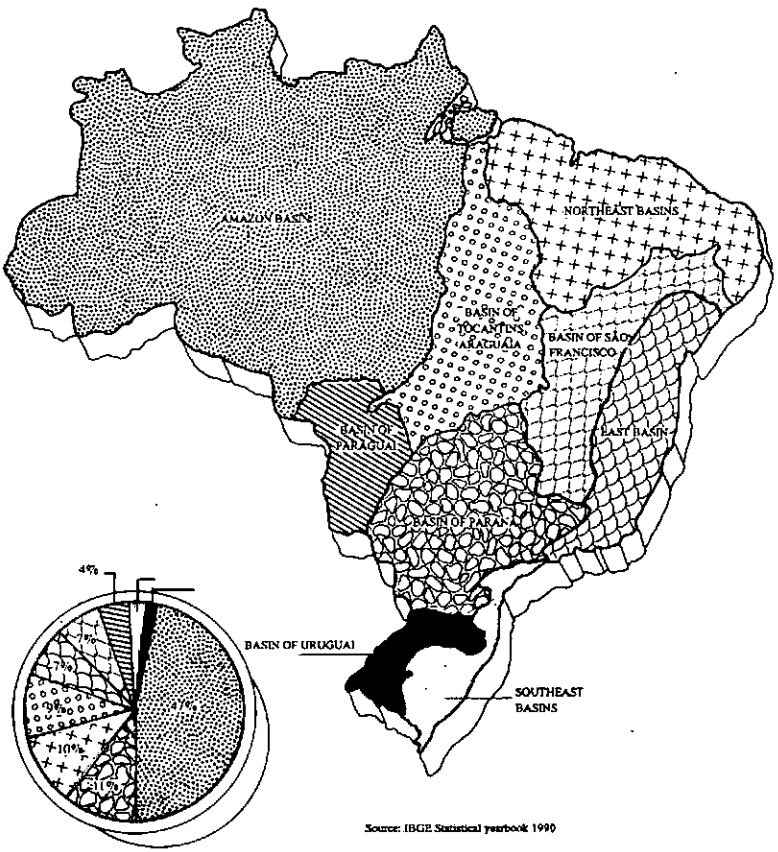
High

Moderate

Area where desertification occurs in some points according to SOUTO, 1985

Rio Grande do Sul

FIGURE III - 3



Source: IBGE Statistical yearbook 1990

1. The Amazon

The Amazon River Basin covers about 7 million square kilometers, including the Tocantins and Araguaia River Basins. The Amazon jungle or rain forest, with an area of approximately 5.5 million square kilometers, covers a large part of the hydrographic basin, going beyond its limits to the north, but not covering a large part of the headwaters of the Araguaia or Tocantins rivers in the Brazilian Planalto Central (highlands). About 60% of the rain forest (3.3 million square kilometers) is found in Brazil, with the rest distributed among Bolivia, Colombia, Ecuador, Guiana, French Guiana, Peru, Surinam and Venezuela. Brazilian "Legal Amazônia" includes the states of Amazonas, Amapá, Acre, Mato Grosso, western Maranhão, Pará, Rondônia, Roraima and Tocantins, comprising an area of approximately 5 million square kilometers, or 60% of the national territory. Included in this area are 1.9 million square kilometers of dense forest growth (38% of the region), 1.8 million square kilometers of non-dense forest (36% of the region) and 700 thousand square kilometers of "open" vegetation, such as savannahs and natural fields (14% of the region). The remaining 600 thousand square kilometers (12% of the regional area) are occupied by human activities, secondary vegetation and farming and livestock activities.

The world's tropical rain forests, which are found in South and Central America, Africa and Asia, are today reduced to 60% of the 14 million square kilometers that made up their original extension. The Brazilian Amazon contains about 40% of the planet's remaining tropical forests.

The Amazon rain forests are characterized by their wide biodiversity, which embraces both the wealth of ecosystems and species as the genetic diversity within the same species. A high degree of endemicity has been observed among species of birds, lizards, butterflies and plants of different families. While in the Amazon forest there are more than 2,500 known species of trees, in all temperate forests in France there are only about 50 species. This comparison becomes more impressive when it is observed that in 1 hectare of the Amazon forest one may find 100 to 300 species of trees, depending on the site and the minimum trunk-diameter chosen as the inferior limit for the sample.

Despite the high natural primary productivity of the tropical rain forests, these ecosystems are fragile, since their productivity and stability over time depend on the recycling processes of nutrients, the effectiveness of which is related to the biodiversity and structural complexity of the forest itself.

Different types of rivers are found in the Amazon, both in terms of the water quality and geomorphology. The major ones are the rivers with black water, the Rio Negro for example, the rivers with clear water, such as the Rio Tapajós, and the rivers with turbid water (called "white water" in the region), which have the Solimões and Amazon River systems as their main examples.

The population of the Amazon region is 16.7 million, including 170 thousand indians, whose natural and cultural heritage must be respected and valued, as well as that of the traditional populations of the region.

The decades of the sixties and seventies marked the beginning of the so-called large projects, backed by the establishment of regional development agencies. A broad survey of the natural resources of Legal Amazon, with particular attention to minerals and timber (the RADAM Project), was undertaken, with the use of radar images. Large infrastructural works such as the Belém-Brasilia and the Cuiabá-Porto Velho highway, as well as the general improvement in air transport and telecommunications throughout the country, brought the region into closer contact with the centers of political decision making.

All large scale projects, and many smaller or medium-sized ones, such as gold mining, have proved to cause strong impact. However, it is important to differentiate these projects as to their scale and spatial extension. Railroads or highways permit the linear progression of deforestation over long distances. The destruction of the forest by farming and livestock enterprises, are not only set up along the highway network, but also often spread over extensive areas along connecting roads.

Some environmental impacts, however, recur with each step of the settlement process, the most important being burnings and deforestation, which accompany the building of dams for hydroelectric plants, the expansion of mining, farming and livestock enterprises, highways and inadequate colonization. Other important impacts are the extinction of species and genetic biodiversity, misuse of timber resources and other forest products, compacting and erosion of the soil, modifications in the microclimate and the local hydrological cycle, with the degradation of the hydric network (by mining), and the contribution to the increase of the "greenhouse effect."

The immediate economic value of the forest is mistakenly presented as inferior to that of alternate uses of the soil. This difference is even artificially increased by inadequate fiscal mechanisms, such as the Rural Territorial Tax, which is greater for forest areas, since forest clearing is considered land improvement; or the example of tax incentives granted until recently for farming and livestock activities in areas of dense forests.

In 1990, intensive work was undertaken to review the published data concerning areas and rates of deforestation in the Amazon. With the use of satellite photography, calculations were revised, and the following declining figures were evidenced:

- Deforestation rates averaged 21 thousand square kilometers annually, from 1978 to 1986.
- For 1989, the deforestation rate was 18 thousand square kilometers.
- For 1990, the rate was 14 thousand square kilometers.

Comparing the extent of the deforested areas with that of the original forest cover, the spread of deforestation becomes evident in the states of Maranhão and Tocantins, and the concentration of deforestation in specific areas of the states of Pará and Mato Grosso is also observed, where the impact on the forest is much greater than the percentage for these states would indicate.

Policies applied to the Amazon region were determined by an attempt to find solutions to problems that were external to the region. For the settlement projects, the Amazon was seen as an empty space and a means of avoiding agrarian reform in the Mid-Southern region of the country. For farming and livestock and mining enterprises, the region was looked upon as a frontier of resources for economic sectors established outside the region. The activities set in place during this period tended to disrupt the environment without reducing the regional social and economic inequalities.

There are many alternatives for sustained use of the renewable natural resources in the Amazon. One of them, the creation of extractive reserves, attempts to reconcile conservation interests with those of social development. Despite the precarious conditions for survival that always accompany extractive activities in the Amazon, the movement of the rubber tappers, which was organized in the region in 1970, has since its inception, revindicated the right to remain in the forest.

According to present law, extractive reserves are territories under the protection of the government, destined for self-sustaining exploitation and for the conservation of renewable natural resources, by a population that has a tradition of using extractive resources, and regulated by a contract that provides for legal concession of use, through a plan of use approved by IBAMA. Table III.I shows the dimensions of these reserves (REX's) with the projects for extractive settlements (PAEs) established within the scope of the National Agrarian Reform Program.

Table III.1
Extractive Settlement Projects (PAEs) and Extractive Reserves (REXs)

STATE	NUMBER	AREA (ha)	FAMILIES
Acre	5	166,586	563
Amapá	3	323,500	1,068
Amazonas	2	339,462	1,293
Subtotal of PAEs	10	889,548	2,924
Acre	2	1,476,756	4,600
Amapá	1	481,650	1,000
Rondônia	1	204,583	650
Subtotal of REXs	4	2,162,989	6,250
Grand Total	14	3,052,527	9,174

Source: Institute of Amazon Studies, 19916

Tapping of the native rubber trees cannot be analyzed exclusively in economic terms. This activity has a social function in the Amazon, since it provides jobs and income, as well as environmental functions, as it is not predatory and allows for vigilance of the forest by the rubber tappers.

Within the context of ecological and economic zoning, those areas identified as potentially extractive can be designated to serve as nuclei for ecological development, by creating incentives to economic activities that will add value to products of the traditional economy. Regardless of their regional coverage, extractive reserves can be established as model units for projects involving tropical forest management.

The Amazon region research agencies possess technical capability to transform this potential into marketable products. Adding value to forest products considered as "minor" (resins, oils, fruits, gums, nuts and medicinal plants), while bearing in mind the existing rights regarding their exploitation by the Indigenous and regional populations, can represent an important stimulus to the regional economy.

2. The Semi-Arid Region

The Semi-Arid region, which includes the states of the Brazilian Northeast besides northern Minas Gerais, is characterized by the caatinga (a region covered with brushwood), which makes up the northeastern Sertão (bushland). The Atlantic Forest, nowadays reduced to a few pockets, originally extended along a narrow coastal belt from Bahia to the state of Rio Grande do Norte, and is known as the Zona da Mata (forest zone). Between the latter and the bushland is the Agreste (dry rocky area of scarce vegetation). In the states of Maranhão and part

of Piauí, there is a large transition area between the sertão and the Amazon ecosystem, known as the Zone of the Coconut Palm Groves or the Mid-North.

A little over 40 million people, almost one third of the Brazilian population, live in the Northeast, 30% living in poverty or extreme poverty. The rainy season is relatively short in the Sertão - two to three months in the Agreste and approximately five months in the Zona da Mata. Droughts, which cannot always be anticipated because of their intermittent character, represent a limiting factor, aggravated by an extremely concentrated structure of land ownership.

Farming in the Northeast, basically sugar cane, with the settlement of the Agreste and the bushland, and is an example of extensive exploitation of the soil and manual labor force. Population growth extended food crops into new areas. Land use was expanded to include large scale cotton plantations, together with corn and beans. This strategy increased the number of herds and new expansion of land occupation.

In the late-fifties, a development agency was set up for the Northeast that adopted a strategy for combatting the drought, whereby prevailing water reservoir programmes were replaced by irrigation projects. Irrigated farming, aimed at single crop production of produce such as tomatoes and corn, became the link between small farmers and the agroindustries, thus inaugurating a new phase in the agriculture of the Semi-Arid region, although confined to small enclaves.

The intensification of the economy in the Semi-Arid Zone, led to a diversity of anthropic effects. The natural vegetation was largely replaced by a farming and pasture system. The soil is progressively losing its organic matter, and an accentuated process of erosion is occurring. The latifundia are being consolidated, reinforcing the economic and political power of landlords, and worsening the poverty situation of a large part of the population. Direct use has considerably increased the pressure on the flora and fauna.

Significant portions of land have been abandoned, due to the exhaustion of soil nutrients resulting from intensive land use, as well as the incipient erosion resulting from the devastation of the plant cover. There is also an intense process of salinization, affecting some 25 to 30% of the soils.

Another serious problem in the irrigated areas is that of soil contamination by pesticides, aggravated by the planting of crops on the borders of reservoirs. The excess water pumped for irrigation is drained, carrying chemical products, and resulting in water contamination, and over the long-term, the obstruction of the reservoir.

Commercial agriculture in the Semi-Arid region is an activity subordinated to industry, whether as a consumer of products or as a supplier of raw materials. In this particular

domain, public policies have been insufficient to provide adequate protection and conservation of the natural resources in the region.

Table III.2 shows the area affected by man in the Northeast region, by state. In a comparative study of satellite data between 1984 and 1990, it was possible to assess the considerable modifications under way. The data show that there was a reduction of native plant cover from 1,002,915 square kilometers to 725,965 square kilometers. Due to climatic conditions, and to the nature of the soils and the plant cover, the Northeast region, and specifically the Polygon of Drought, is the Brazilian region most exposed to desertification. On the World Desertification Map (1977), it was considered a risk area, with degrees of risk ranging from very high to moderate (Figure III.2).

Table III.2 - Expansion of Settlement in the Northeast and Distribution by Sate

SPECIFICATION	TOTAL AREA	SETTLED AREA		REMAINING NATIVE VEG.	
		Km²	%	Km²	%
Expansion of the Northeast	1,548,672	545,754	34	1,002,915	65
Situation - 1984	1,548,672	820,707	53	727,965	47
Situation - 1990					
Distribution by state in 1990					
Alagoas	27,731	22,462	81	5,269	19
Bahia	561,026	294,370	52	266,656	48
Ceará	148,016	124,333	84	23,683	16
Maranhão	328,663	136,460	42	192,203	58
Paraíba	56,372	37,769	67	18,603	33
Pernambuco	98,281	51,106	52	47,175	48
Piauí	250,934	109,116	43	141,818	57
Rio Grande do Norte	53,015	30,059	57	22,956	43
Sergipe	21,994	13,636	62	8,358	38
In litigation: Piauí & Ceará	2,640	1,396	53	1,244	47

Several studies have confirmed the existence of nuclei of desertification, where the degradation of plant cover and soils are irreversible, appearing as small "deserts" within the primitive ecosystem. These nuclei have their own dynamics, and tend to become more accentuated and to spread to adjacent areas.

In Bahia, an area of 52.5 thousand square kilometers has been recorded, where the vegetation is thinning out and the unprotected soil is showing indications of rapid erosion. In the state of Pernambuco, the identified area corresponds to a polygon of approximately 25 thousand square kilometers, that is, 28% of the state. In Rio Grande do Norte, the unfavorable climatic conditions of low rainfall (400 mm/year), combined with prospecting activities, make the region one of the most ominous examples of desertification. In the state of Piauí, devastation

of the plant cover, consequent to large farming and livestock projects, started in the 1970's, has caused an intense process of erosion, which in turn causes a reduction in soil productivity, and sedimentation of the main bodies of water.

3. The Cerrado

The cerrado, or woodland savannah, is a continuous area occupying approximately 25% of the entire area of Brazil, as shown in Figure III.1. Its most important agrometeorological feature is the temporal distribution of rainfall, which has two well defined seasons: one rainy, lasting five to seven months during which 90% of the rainfall occurs; the other a dry season, with sparse rainfalls. During the rainy season the occurrence of dry periods, popularly named "short summers," is frequent.

Almost 90% of the region's soils have extremely low fertility and high acid content and toxicity, due to the high concentration of aluminum. Most are deep and well drained. There is no uniformity in the composition of the flora and fauna in the savannahs.

The low population density of this region prior to 1950 meant that the impact of hunting, extractive and farming activities was in a way localized, and restricted to certain products. Gold and diamond prospecting are probably the most environment-impacting activities over the past two centuries. Hundreds of mines were spread about the hydrographic basins in the savannah, resulting in the destruction of the riparian vegetation, destabilization of river banks, sedimentation of river beds and water contamination by mercury. The level of river sedimentation was intense to the extent that it made mining impracticable in the downstream areas of the first mines and exacerbated the problem of periodic flooding.

Human settlement during the past 40 years has sped up the process of impact in the region, due to population growth. The population of the Mid-West region increased six-fold between 1950 and 1990, growing to about 10 million inhabitants, with an average density of 6.4 persons per square kilometer. This increase was not only due to natural growth but was also the result of intense migration, doubling the region's relative participation in the national population (from 3.3 to 6.9%). However, the population of the savannah regions is highly concentrated, with 80% living in urban areas.

The expansion of urban areas has caused great impact on the environment: the opening of gravel pits; soil banks diggings; scraped areas; sand extraction areas; roads; cuttings through hills, embankments and drains; cave-ins; further deforestation for firewood and clearings

for construction and furnaces; increase of water consumption and the construction of dams for water supply and power; increase in number of vehicles and the resulting sound pollution and atmospheric pollution; and the gradually disfigured landscape and native biota resulting from the expansion of areas occupied by exotic plants and animals.

The establishment of urban settlements in areas unsuitable for construction (with deficient drainage, outcropping rocks and soils susceptible to erosion, among other aspects) has caused many urban sanitation and environmental problems, especially cave-ins with large loss of soil and damage to buildings. Nonexistent or inadequate rainwater drainage in the region's cities has accelerated erosion caused by the intensity of rainfall in the summer. This damage has taken place even where technical information was available to avoid such occurrences, as it did in the Federal District. About two-thirds of the 52 large cave-ins mapped in the Federal District are in urban areas or their vicinity, or along paved roads.

The damming of the main rivers of the highland region for the construction of large reservoirs and hydroelectric plants is also part of this process of urbanization and industrialization. Among the environmental impacts of these dams, the most noteworthy are the destruction of embankment forests, bottom land, and falls and rapids, as well as the disruption of the continuity of river systems resulting in the interruption of the piracema ("fish shoal": the period when the shoals of fish go upstream to deposit their eggs).

In the industrial sector, the industries principally responsible for atmospheric pollution in the savannah region are those involved in the transformation of non-metallic minerals (especially cement and asbestos). Extensive areas of the savannah have been destroyed in the production of charcoal for the pig iron industry in Minas Gerais (and more recently in Maranhão): most of the woodland savannahs and dense woodlands of Minas Gerais have already disappeared, and the process is now spreading to the south of Piauí. In some municipalities in the northeast of Minas Gerais there were more than 20 thousand charcoal furnaces operating in 1970. Finally, many lime caverns have been destroyed for cement production and for the obtention of agricultural lime in Minas Gerais and Goiás.

Although land occupation associated with urbanization has caused environmental impacts, the activities that have caused most changes in the region's environment are those of farming and livestock, both as results of the extent of planted areas and of productivity increase, through mechanization, fertilizing and the use of selected crops. The loss of fertilized soil has been high, due to the lack of conservationist practices or the inadequate use of equipment.

This process is aggravated by a lack of knowledge of the potential and the limits of the region by the populations originating from other regions of the country, the low

proportion of conservation areas under government control, the lack of an efficient forest expansion or regulation system, the lack of territorial organization based on the ecological potential and limitations, and the existence of policies and incentives conflicting with the preservation of the sustainability of economic use of resources.

The region has undergone a large influx of mechanization, but in some situations decreasing productivity and increasing production costs have been noted, as a result of environmental degradation. Often, the origin of these problems is easy to detect, such as inadequate management, with practices that cause excessive compacting of the soil or the reduction of organic material content. Single crop cultivation or crop rotation that favors higher incidence of disease, pests and weeds may also be cited, in addition to indiscriminate forest clearing, inadequate location of dams, and use of soil that is improper for cultivation, among other factors.

By 1985, the savannah region was intensely affected by human occupation, with pasture land, annual crops, permanent crops, dammed areas, urban areas and seriously degraded areas. A recent study based on remote sensing reveals that 33.6% of the Central-Western region has been strongly altered by human activity. Table III.3 presents an estimate of the settled areas of the Savannah, by type of land use.

Table III.3 - Estimation of Occupation Patterns of Savannahs. in 1985

TYPE OF USE	Basis of Estimation (Source/Year X Rate of Growth)	Area (1,000,000 ha)	% BIOMA
1 Anthropic Landscapes:			
Planted Pastures	IBGE / 1980 X 1.12	35.0	17.3
Annual Cultures	IBGE / 1980 X 1.44	13.5	6.7
Reforestation	IBDF / 1981 X 1.44	2.0	1.0
Perennial Crops	IBGE / 1980 X 1.44	1.3	0.6
Damming	Eletrobrás	1.5	0.7
Urban Areas		1.0	0.5
Cleared Areas		1.0	0.5
Deforested Areas	Difference among areas	20.0	9.9
Subtotal	Total of other uses	75.3	37.3
2.Managed Native Landscapes:			
Natural landscape	IBGE / 1980 X 1.12	83.5	41.4
Native forests		...	...
Indigenous reserves	CIMI / 1993. 85. 87	10.8	5.3
APAs	SEMA / 1987	1.4	0.7
Military Training Fields		1.0	0.5
National Forests	IBDF / 1987	0.04	0.02
Subtotal		113.24	56.1
3.Natural Preserved Landscapes:			
Ecological Reserves	5% do Bioma	10.1	5.0
Parks	SEMA / 1988	2.3	1.2
Scientific Reserves	SEMA / 1988	0.8	0.4
Monuments and Sanctuaries	SEMA / 1988	0.02	0.01
Subtotal		13.22	6.6
Total		201.76	100.0

4. The Atlantic Forest

The Atlantic Forest, covering about 1 million square kilometers, extends almost along the entire Brazilian coast. The tropical rain forests that covered this immense belt are now reduced to 4% of the primary cover.

Of the original continuous forest mass there is practically no remaining forest above the Baía de Todos os Santos in the state of Bahia. The remaining small forest groups in the area are repositories of a genetic bank of inestimable value. In the south of Bahia some larger masses of primary forest are still visible. Besides these areas, the existence of about 500 thousand hectares of forests sheltering cacao plantations, in the cacao producing region, is of great significance. Although predominantly despoiled of the jacaranda trees and other more valuable species, this original plant cover, which provides natural shade for the cacao plantations, is a forest system of major importance that, besides producing wealth through cacao production, offers a peculiar situation in Brazilian agriculture from the environmental point of view.

Between Porto Seguro and the mouth of the Doce River in the state of Espírito Santo, slightly removed from the coast, rock formations appear and in some places provide some of the country's most beautiful scenery. The series of sugar loaf mountains that are features of this region, have given protection to some remaining forests because of their steepness. There is also a remaining section of considerable size along the coastal belt, which continues to be attacked by charcoal producers, lumber interests and other destructive agents. The lower, more fertile soils that make up the greater part of this area have been almost completely cleared, even along the streams.

To the south of the Rio Doce, the Mantiqueira mountain chain, starts on the border between Espírito Santo and Minas Gerais. A sequence of coastal ridges also begins here; these include the Serra do Mar (Ocean Range) and the Serra Geral (General Range), reaching to the north of the state of Rio Grande do Sul. These coastal ranges, on account of their steepness, are essential to the preservation of the largest part of what remains of the Atlantic Forest.

The Mantiqueira Range areas nearest to the coast in Espírito Santo, have a reasonable amount of remaining forest, both primary and secondary, interlaced with small farms. This model repeats itself in various sections along the range, extending beyond the dense growth of Itatiaia, situated on the border between Rio de Janeiro, Minas Gerais and São Paulo. This dense forest still preserves a fair amount of continuous high forest growth.

To the north of the state of Rio de Janeiro, near the mouth of the Paraíba do Sul River, the Serra do Mar begins, marking the origin of a continuous stretch of primary and secondary woods that extend to its end, in the north of the state of Santa Catarina, interrupted only in some places by older settlements or crossed by roads.

The Serra do Mar is followed by the Serra Geral. The forest mass continues on this range without interruption to the north of the state of Rio Grande do Sul. This large stretch of forest, about 1,500 kilometers long, represents the most important forest mass in this ecosystem.

To the interior of the Southeastern region, almost nothing remains of the forest, which once reached up to the banks of the Paraná River, except for a few examples on the slopes of small ranges or in a few official reserves.

The current state of devastation of the rain forests within the Atlantic Forest is the result of almost five centuries of colonization and agricultural expansion and of the Brazilian network of cities. Throughout its history, the region has undergone the effects of various cycles of the country's economic development, such as that of sugar cane, gold, coffee, and now the modernization of agriculture and industrialization.

The example of Pau-brasil wood, which lent its name to the country, and was exploited until its near extinction by the Portuguese, Spanish, French and Dutch, reflects the firmly rooted predatory nature of the relationship between man and the Atlantic Forest.

More recently, the destruction of the plant cover is a consequence of the incentives for introducing the paper industry. Valuable timber has been exported to the country's industrial complexes, to Europe and to North America. In addition, charcoal has become an important source of energy for the steel industry.

The destruction of the forest threatens innumerable species of plants and animals, among which the most significant are indicated in Table III.4.

Table III.4 - Endangered Species

Primates

Brachyteles arachnoides	Spider monkey
Callicebus personatus	Marmoset or titi monkey
Callithrix flaviceps	Saki
Leontopithecus rosalia	Mico Leão Dourado (a)
Leontopithecus chysometas	Mico Leão da Cara Dourada (b)
Leontopithecus chrysopygus	Mico Leão Preto (c)
Leontopithecus caissara	Mico Leão da Cara Preta (d)
Cebus appela xanthosthernus	Macaco Prego (e)

NOTES: (a)(b)(c)(d) - types of Capuchin Monkeys
(e) Capuchin Monkey

Birds

Tinamus solitaris pernambuceusis	Macuco do Nordeste (a)
Mitu m. mitu	Mutum do Nordeste (b)
Crax Blumenbachü	Mutum do Sudeste (c)
Neomorphus geoffrogi dulcis	Jacu Estalo or Jacutaquara(d
Pipile jacutinga	Jacutinga (e)
Amazona brasiliensis	Papagaio da cara roxa (f)
Amazona petrei	Papagaio charão (g)
Amazona rhodo corytha	Papagaio chaua (h)
Amazona vinacea	Papagaio curraleiro (i)

NOTES: (a) Northeastern Tinamous
(b) Northeastern Curassow
(c) Southeastern Curassow
(d) a kind of Motmot
(e) the Black Fronted Piping Guam
(f)(h)(i) - types of Brazilian parrots
(g) Pretre's Parrot

5. The Southern Plains

The plains in the Southern region of Brazil are generally called pampas, a term of Indigenous origin meaning "plain region." Strictly speaking, however, this term applies to only one type of terrain, mostly found in the south of the state of Rio Grande do Sul, on the borders with Uruguay and Argentina.

Other types, known as the high plains, are found in transition areas where Brazilian pines predominate. In still other areas, rough terrain similar to the savannah is found.

The plains, in general, appear to be edaphic and non-climatic formations. Pasture land and burning practices do not permit the flourishing of bush vegetation, as is observed in various sections of the Southern Plain.

The geomorphological region of the Campanha highlands, the largest extension of plains in Rio Grande do Sul, is the western and southernmost portion of the morphostructural predominance of basins and sedimentary covers. In the areas of contact with the Botucatu arenite, dark red podzolic soil is present, mainly in the southwest of Quarai and the south and southeast of Alegrete, where the process of decertification has been observed. In general, these soils have low natural fertility and are very susceptible to erosion.

At first sight, the field vegetation shows apparent uniformity, with a low herbaceous cover on the more levelled heights, although sparse and poor in species, becoming more dense and rich on the slopes. Grasses and leguminous plants generally predominate.

The Campanha is a beef-cattle breeding region. The techniques used, however, are not adequate to the conditions presented by this type of terrain, considering that the consequences of burning practices are not yet fully understood. Most of the pasture land is used without regard to recovery and maintenance of vegetation. The natural fields in Rio Grande do Sul are generally exploited through a system of continuous and extensive pasture feeding, alternating between periods of low pasture use at times that are most favorable for grass growth, and high use during unfavorable periods. The use of burning is common, to eliminate unwanted growth and to avoid what is known as "thickening" of the fields after winter, common on the high plains.

Fertilizer is rarely used on the low fertility soils, where a notable reduction of good quality forage species may be observed; this process is aggravated by excessive trampling by cattle.

Other important economic activities are the cultivation of rice, corn, wheat and soybeans, often in association with cattle and sheep raising. In the Uruguay highlands and in the

middle highlands the expansion of soybean and wheat crops has contributed to the disappearance of the plains and the clearing of forests. Currently, these two crops occupy almost the entire area, causing a gradual reduction of soil fertility, a process which gives way to erosion, soil compacting and the loss of organic material.

The deterioration and exposure of sandy soils following the destruction of field vegetation through overuse of pasture land, and/or by inadequate farming practices, favor the spread of erosion by rain, and the formation of ravines. The continuous deposit of sediments carried by flash floods in these depressions causes cave-ins in the pastures, and leads to the appearance of sandy patches, called decertification nuclei. Available data indicate areas of decertification covering almost 3.600 hectares.

6. The Brazilian Pine Forest

The Mata de Araucárias (Brazilian Pine Forest) spreads over the basalt highlands originating from the lava flow in the Southern Brazilian highlands, and is characterized by the presence of the Brazilian pine - Araucaria angustifolia. This dense forest is found in the Southern states, with scattered enclaves in other areas of the Southeastern region. Its western limit is a small marginal strip at the extreme northeast of Argentina.

The Mata de Araucárias extends over approximately 400 thousand square kilometers. However, only about one-fourth was originally covered by dense pine forests. The rest of this space is occupied by transitions between forests and open plains, and plain enclaves with pine trees and Atlantic Forest trees forming vegetation ecotones.

The intense and uncontrolled exploitation of timber, which began in the Brazilian Pine highlands with German and Italian colonization, brought about a gradual expansion of agriculture. The Brazilian pine was used for building houses and furniture. With the advance of colonization and farming, giant pines were cut down and burned to clear the way for corn and wheat crops, and vineyards. Later, pine lumber was exported in a veritable "exploitation race" that reached its culminating point between 1920 and 1960 in the three southern states of Brazil, and led to the large scarcity of natural reserves.

Around 1900, native forests were estimated at 16.07 million hectares, corresponding to 83.4% of the total area of the states of Santa Catarina and Paraná. In 1950, the total was no more than 7.8 million hectares, less than half the original surface. By 1970, the native cover had fallen below 20%.

Protection of the Brazilian Pine Forest is now supported through four indirect use conservation units (230 thousand hectares), eight national forests (14 thousand hectares) and five state conservation units. More than half the species are confined to these units.

In Rio Grande do Sul, especially between 1960 and 1970, exotic arboreal species were introduced in areas already degraded, or simply to replace the native forest or other original formations, resulting in single crops that totally transformed the areas, altering the flora and fauna.

Temperate climate fruit orchards are taking over the native fields and forests. In the vicinity of farms, stretches of forests suffering from selective extractivism are common, now directed towards pine and other remaining valuable timber of lesser hight. These are regeneration-potential areas and merit special attention.

7. The Pantanal of Mato Grosso

The Pantanal (lowlands) of Mato Grosso constitutes the largest continuous extension of wetlands on the planet. Its geographical location is of particular relevance since it is the link between the Central Brazilian savannah, the Chaco of Bolivia and the Amazon region to the north, being approximately coterminous with the Upper Paraguay Basin.

The Pantanal functions as a large reservoir, with a difference of up to five months between the outflow and inflow. In the summer, floods last from November to March in the north and from May to August in the south, in the latter case under the regulating influence of the Pantanal.

The soil, in general, has its limitations for crop raising. In the low areas, hydromorphic laterites and plain soils predominate, as well as several other classes, all flood-prone to a greater or lesser degree and of low fertility. There do exist some favorable situations in the highlands, though soils with various limitations for agriculture predominate there as well, mostly due to poor fertility, topography and lack of water.

As a transitional area, the Pantanal region displays a mosaic of ecosystems, a resemblance to the savannahs, and to a certain degree to the Amazon forest, aside from aquatic and semi-aquatic ecosystems, which are interdependent to a greater or lesser extent. The highlands of the upper basin are formed by escarpments and eroded highlands locally known as ranges. They are covered by predominantly open vegetation, such as clear fields, partially covered fields, grass savannahs and woodland savannahs, mainly dominated by edaphic and climatic factors, and also by rain forests, an extension of the Amazon ecosystem.

The swampland, which is the Pantanal strictly speaking, is one of the most important humid areas of South America. Here there are low, medium and high swampland with generalized and prolonged flooding. This environment, which is periodically flooded, has high biological productivity, and great density and diversity of fauna.

According to archeological research, the area was settled approximately ten thousand years ago by Indigenous groups. Economic activities in the Pantanal started with the conquest and annihilation of the Guato and Guaicuru Indians by explorers. Livestock was introduced on the swampland, and is still the single stable economic activity. From a macroeconomic point of view, the swamplands played an important part in supplying meat to other states in the past. However, this activity is now in decline.

The process of frontier expansion, which occurred mostly after 1970, was the primary cause of demographic growth in the Brazilian Central-West region. The region of the Pantanal plain, with its landholding structure of extensive cattle raising properties in flood areas, did not accompany the process of population growth characteristic of Pantanal towns. In the highlands, however, urban growth accelerated. As with all the cities that expanded or appeared at that time, those of Mato Grosso and Mato Grosso do Sul did not have, or have yet, adequate infrastructure that would minimize the environmental impact of accelerated growth, caused mainly by the discharging of residential or industrial sewage into the waterways of the basin. This type of pollution has direct repercussions on the Pantanal plain, which receives the sediments and residues from the high regions.

The same frontier expansion process was responsible for the use of savannahs for livestock, which caused the clearing of vast areas of the highlands and the introduction of soybean and rice crops, aside from pasture land. The inadequate management of these crops has caused, among other things, soil erosion, thus significantly adding to the sedimentation of several rivers. Moreover, it has exacerbated the problems of contamination of various rivers with biocides and fertilizers.

The presence of gold and diamonds in the lowlands of Cuiabá and near the sources of the Paraguay and São Lourenço Rivers has attracted thousands of prospectors. Their activity causes washouts and is detrimental to the biological productivity of rivers and streams, besides contaminating them with mercury.

8. Coastal and insular ecosystems

The Brazilian coastline extends for 7,367 kilometers, between the Oiapoque River (4 52'45"N) and the Chuí stream (33 45'10"S). The variety of ecosystems is immense. There are dunes, coral reefs, rocky shores, bays, estuaries, swampland, coastal mountains and shoals. Although constantly recurring and apparently homogeneous, many of them, such as the beaches, shoals, lagoons and mangroves, have specific flora and fauna features associated with the different origins of the environments along the coastline.

The diversity of Brazilian coastal areas, cover the entire range of coastal ecosystem substrata, can be subdivided into oceanographic, climatic and continental elements. Figure III.4 provides a synthesis of the five major groups of shorelines, according to these physical elements. The biotic features associated with these types of substrata may be seen in Figure III.5.

The Amazon or equatorial shoreline is characterized by the occurrence of mangroves. Along the northeast or barrier section there is a predominance of mangrove, sand bank vegetation and marshlands ecosystems. Along the eastern section of the coastline there are mangroves in a state of degradation, aside from coral reefs and arenite barriers that have good biological productivity. Along the southeastern or crystalline escarpment coastal area, the mangrove, shoals, lagoons and rocky coastline ecosystems predominate. The southern or subtropical Brazilian coastline is marked by the occurrence of marshes that are important wetlands abounding in avifauna.

There are three basic types of islands along the Brazilian coastline. Most of them are the result of coastal washout, therefore an extension of the shore relief. Islands that are basically crystal formations of washed out parts of the Serra do Mar are found by the hundreds along the crystalline escarpment shore. Sedimentary islands of low altitude are found along the Amazon shore and are the result of deposits of eroded material carried away by the strong current.

A third type is made up of the oceanic islands, resulting from volcanic actions and rising from the depths of the Atlantic, such as Fernando de Noronha island and the Rocas Atoll, that are entirely separated from the Brazilian continental relief. Along the southern shore of Bahia are found coral reefs and volcanic islands that form the Abrolhos Archipelago, part of which includes the Abrolhos National Park.

The insular ecosystems are replicas, on a smaller scale, of what occurs along the shoreline. There is an immense and varied Brazilian mesographic complex, which plays an

FIGURE III.4

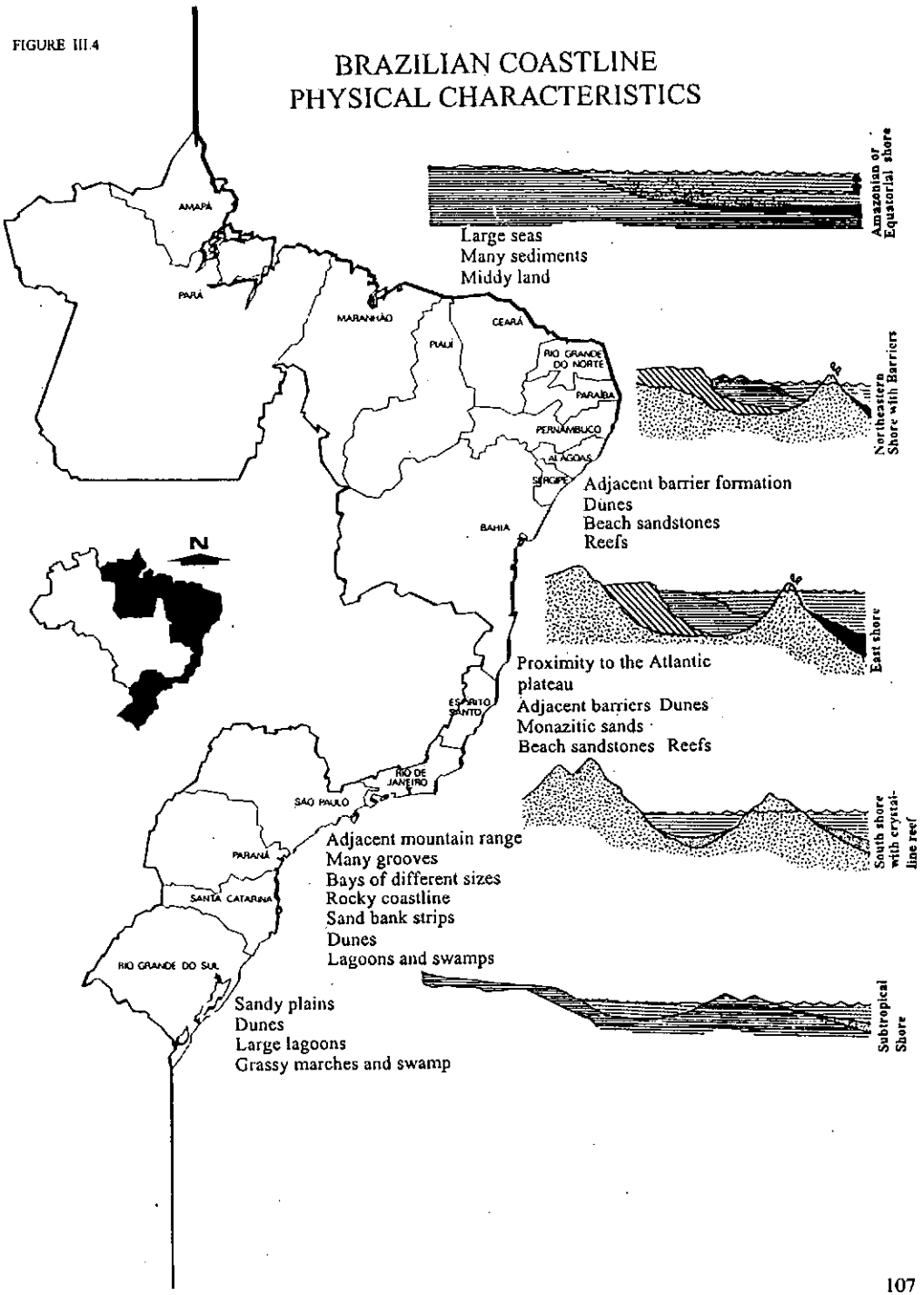
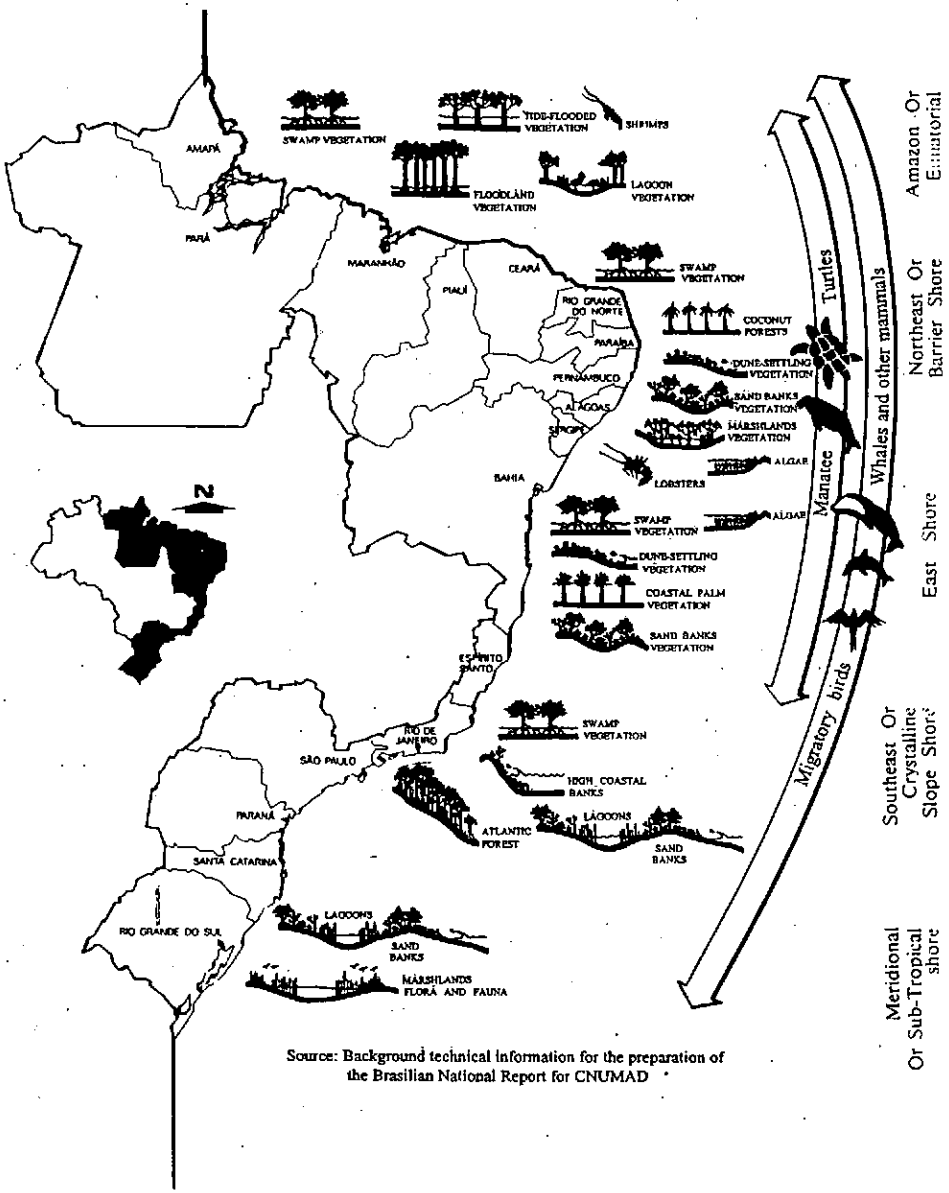

BRAZILIAN COASTLINE
PHYSICAL CHARACTERISTICS
AMAPÁ
PARÁ
MARANHÃO
PIAUÍ
CEARÁ
RIO GRANDE DO NORTE
PARAÍBA
PERNAMBUCO
ALAGOAS
SERGIPE
BAHIA
ESPÍRITO SANTO
RIO DE JANEIRO
SÃO PAULO
PARANÁ
SANTA CATARINA
RIO GRANDE DO SUL
N
Large seas
Many sediments
Middy land
Amazonian or Equatorial shore
Adjacent barrier formation
Dunes
Beach sandstones
Reefs
Northeastern Shore with Barriers
Proximity to the Atlantic plateau
Adjacent barriers Dunes
Monazitic sands
Beach sandstones Reefs
East shore
Adjacent mountain range
Many grooves
Bays of different sizes
Rocky coastline
Sand bank strips
Dunes
Lagoons and swamps
South shore with crystalline reef
Sandy plains
Dunes
Large lagoons
Grassy marches and swamp
Subtropical Shore

FIGURE III.5

BRAZILIAN SHORE
BIOTIC CHARACTERISTICS



Source: Background technical information for the preparation of the Brasilian National Report for CNUMAD

important role in the maintenance of marine bird populations, serving as they do as nesting and reproduction sites.

In waters within Brazilian jurisdiction, it is estimated that there are presently about 50 species of whales. The whaling industry in Brazil, which brought few economic benefits and threatened the extinction of notable species that were little known to scientists, has been vigorously attacked by civil groups since the 1970's, in a movement that by then had become worldwide.

In 1985, Brazil adhered to the moratorium on whaling, and this is still in force today, as determined by the International Whaling Commission. In 1987, the killing, capture or molesting of any whale was prohibited within Brazilian waters. This prohibition consolidated the view that whales are a resource to be indirectly exploited, and that they have ecological, scientific and even touristic value that surpasses their use as a source of animal by-products. Currently, Brazil is faced with the problem of the accidental capture of small cetaceous species (dolphins) in fishing nets.

The coastline concentrates more than half the Brazilian population and a large portion of the country's economic activity. The coastal ecosystems thus find themselves submitted to violent pressures. Among the 17 Brazilian states that have a coastline, 14 have coastal capital cities. São Paulo, one of the few exceptions, has intensive exchanges with the coast, where a network of different industrial (Cubatão) and port related (Santos) activities take place, as well as tourism.

The main vectors of use/occupation of the Brazilian coast may be summarized as follows:

Growing level of uncontrolled urban expansion and real estate development, privatizing of beaches, disposal of effluent and waste - factors that increase as the population and economic activity expand;

- Salt production, fishing and agriculture - the oldest economic activities;
- The improvement/expansion of coastal transportation corridors, linking major urban centers with small towns and beaches where tourism predominates;
- Industrial activity, notably due to the impact of industrial districts and specialized complexes (petrochemical and chlorochemical);
- Port activity and the proliferation of specialized maritime terminals;
- Mining, whether on dry land or in the ocean, for offshore oil, natural gas drilling, rock salt and coal mining.

The sites where these activities are located are as follows:

- Bays, promontories, beaches, inlets, islands and other rocky formations, which provide shelter for installations involved in typical coastal activities;
- Coastal lowlands, which house most of the Brazilian coastal population;
- The continental platform, which during the last quarter of this century has supported not only fishing but exploration and drilling for oil and natural gas.

As a result of the process of use/settlement of these areas, the following ecosystem components may be highlighted as the object of direct and indirect environmental impact:

- Coral reefs and islands where there has been degradation of important genetic banks;
- Coastal plant cover (mangroves, Atlantic forest, coconut groves, cove forests, etc.), which suffered loss of inherent ecological and economic potential, and a reduction in the capacity to replace the stock of various species;
- Coastal bodies of water, which are sedimented and contaminated as a result of erosion and the discharging of toxic substances and high amounts of organic waste, to the detriment of their use for bathing and of the food balance cycle for fish, due to the bioaccumulation of heavy metals.

The cultural heritage and traditional lifestyles are also affected by the elimination of historical, artistic and scenic features, with the impoverishment of many different manifestations of Brazilian coastal culture.

A large part of the problems involving degradation of coastal resources is associated with the large metropolitan concentrations of industries and ports. The specialized maritime terminals and their movement of high risk and toxic cargos have an important impact. The occurrence of accidents involving oil spills, for example, has been recorded in several states.

The use of firewood as fuel on the outskirts of the large urban areas, mostly by small industries such as ceramic factories, bakeries and tanneries, accounts for a good part of the pressure brought to bear on the remaining coastal plant cover.

The process of urban conglomeration along kilometers of beaches has been detected, with a growing development of beachfront lots and real estate speculation. Many of these developments include ponds and marshes.

The elimination of plant growth that held together sand dunes, the clearing of extensive mangroves and the discharging of sewage and solid waste into bodies of water have given rise to innumerable environmental problems, which not only tend to neutralize the dynamics of ecosystems, but threaten the very survival of the tourist trade.

Although not as widespread as urban expansion, coal mining and oil drilling are mainly responsible for the appearance of environmental deterioration and accidental pollution. To a lesser degree, but by no means neglectable, is the extraction of monazitic sand and rock salt, which are also responsible for causing considerable damage to the quality of surrounding areas.

Due to the gravity of the physical-chemical alterations in the bodies of water caused by mining effluents, and to scenic and cultural degradation, coal mining along the southern coast has been the object of special attention. The coal reserves in the state of Santa Catarina will sustain mining for many years, which makes the known impacts today a small part of the long-term problem. It must be considered, furthermore, that the region contains almost the entire coal reserves of Brazil.

Guanabara Bay

The Guanabara Bay, with a surface area of approximately 4 thousand square kilometers, encloses a large part of the Rio de Janeiro metropolitan region, about 35 rivers of major importance and 44 square kilometers of islands, with a perimeter of 131 kilometers and a volume of water of 2 billion cubic meters. Of the original plant cover, which was characterized by a sand bar barrier and by a strip of mangroves surrounding practically the entire bay, there remains today only a 40 kilometer stretch of mangroves of irregular width.

The pressure brought to bear by uncontrolled urban growth, by high population density and by industrial complexes without the needed support of investment in infrastructure seriously interferes with the potential uses of the bay's water resources, besides causing damage to the economy and to the health of the population.

The basin of Guanabara Bay contains the second largest industrial complex in the country, with about six thousand industrial plants, which are responsible for about 25% of the organic water pollution and almost the entire amount of heavy metal pollution. There are, moreover, two commercial ports (Rio and Niterói), oil terminals and about 2 thousand service posts, besides 32 shipyards, which contribute with 33% of the total discharge of oil.

The population, estimated at 8.7 million in 1989, pours 406 metric tons a day of untreated sewage into the waters of the bay. There are also several refuse dumps, prominent among which is the Duque de Caxias metropolitan landfill, in the Fluminense sector, built on top of a mangrove area, which takes in a daily amount of 5,500 metric tons of waste.

Direct consequences of this set of pressures include the following: a 90% decline in commercial fishing over the past twenty years; increasing sedimentation of the water, reaching rates of about 81 cm/100 years; the progressive destruction of the mangroves; degradation of the quality of the bay water; and the aggravation of erosion and flooding resulting from the forest clearing activities in the basin, mainly in its steeper areas.

9. Fish resources

At the beginning of 1980, fish production totalled about 900 thousand metric tons, providing the third largest source of animal protein. Now, production is stabilized at this figure and has even shown some significant decline.

Along the coastline, Brazil has a vast amount of fish resources from tropical, semitropical and semi-temperate waters, although, for the most part, biomass potential is limited. The economic value on international markets and for domestic supply is significant, however.

The major resources of economic and food importance now being exploited along the coast are shrimp, lobster, sardines, piramutaba, porgy, tuna and deep water fish. The levels of fishery potential of the coastal macro-regions are shown in Table III.5.

Studies carried out in the late sixties have shown estimates of the sustainable fishery potential of the Brazilian coast to be of the order of 1.4 to 1.7 million metric tons. This, however, is preliminary information, and applies to areas up to a depth of 200 meters. Of this estimate of potential in the maritime and estuary waters, about 900 thousand tons would correspond to pelagic resources and between 500 and 800 thousand to deep water fish.

Pollution and degradation of important ecosystems along the coast, and of nationwide estuaries, responsible for food production and for the larval and juvenile growth of fish resources, indicate a marked reduction in stocks.

The country's fishery management lacks reliable statistics and scientific procedures, besides being strongly pressured by the productive sector. Research is isolated and disorganized, conducted independently at the initiative of various institutions in the country, with scattered efforts, and often purely academic. The nonexistence of training courses or fishery schools at the high school level, and the low quality of manual labor, are inhibiting factors for the development of fishing.

The stage of Brazilian aquaculture is still underdeveloped compared to that of Asian countries, which are responsible for 80% of world production. Brazil accounts for only 3% of the world's annual fishing production.

Table III.5 - Sustainable Potential and Level of Exploitation of Principal Fishery Resources

Region	Fishery Potential (thousand tons)	Fishery Resources	
		Exploited	Underexploited
North	390 -480	Shrimp Piramutaba Other demersals	Jellyfish in general Sharks Deep shrimps
Northeast	215 - 295	Lobster	Tuna and Sharks Cangulo and Flying Fish
Southeast	275 - 390	Sardine Shrimp Demersals in general	Squids, Anchovies Tuna and Related Fishes Mesopelagie Species
South	555 - 665	Demersals in general Shrimp	Tuna & related fishes, squids Anchovies, mesopelagic species

Source: "Subsídios técnicos para elaboração do Relatório do Brasil para CNUMAD"

10. Water resources

Brazil has six major watersheds and five sets of minor basins flowing to the sea. Within this context there is a wide diversity of situations, with an abundance of water in the Northern and Central-Western regions and a scarcity in the Northeast, as well as in some developed states such as Rio de Janeiro and São Paulo.

The demographic and economic growth of the country over the past 30 years has led to the use of water resources beyond their support capacity, both in quantity and quality. It may be stated that serious water management problems are caused mainly by the uncontrolled expansion of urban centers and the limited availability of water resources. Table III.6 shows a variety of situations, with abundance of water resources in the North and Center-West and scarcity in the Northeast and Southeast, where the greater concentration of demand is found, as well as in the Southern region.

Although punctual water pollution associated with the lack of basic sanitation is significant, it acts in conjunction with diffuse pollution caused by problems of pesticide contamination, heavy metals, toxic wastes and fertilizers, especially in the Southern and Southeastern states.

Paradoxically, however, the emerging problem of heavy metal pollution occurs at a great distance from the more developed sections of the country. In the mines of the Amazon region, thousands of miners use mercury for the extraction of fine gold deposited in the river beds. About 55% of the mercury used during amalgamation goes into the atmosphere, with the rest being thrown into the water in metal form. The presence of this metal in the muscle tissue of fish in the regions near the mines shows concentrations of 10 to 20 times that of fish in locations where gold mining is not practiced.

Water depollution is not merely a technical problem, as there are methods for purifying effluents of almost any kind. The problem is also an economic and social one, since available funds are insufficient for the introduction of purification systems for liquid effluents using available technology. The alternative solution has been the development of socio-economically appropriate technologies such as ascending flow biodigestors, biological filters, oxidation ponds and the utilization of filtering soils for rice cultivation.

With respect to underground water, Brazilian aquifer formations correspond to the sedimentary deposits that cover about 3.2 million square kilometers of the country. In Figure III.6 the average potential of underground water is indicated, and Table III.7 shows the water reserves for the major underground aquifers in the country.

Table III.6 - Average Flow, Relative Availability, Sectorial Demanf and Hydric Balance in Brazil

SPECIFICATION	BRAZIL	NORTH	NORTHEAST	SOUTHEAST	SOUTH	MID-WEST
A- Average flow (m^3/s)	177,757,0	121,847,0	5,900,0	10,589,0	11,578,0	27,842,0
B- Overall dimension						
1- Land area (1,000 km^2)	8,512,0	3,574,2	1,556,0	924,3	575,3	1,882,2
2- Irrigated area '85 (1,000 ha)	2,030,0	16,9	381,0	636,3	898,8	96,9
3- Total population '90 (1,000)	150,367,8	8,892,9	42,882,1	65,558,9	22,762,3	10,331,6
4- Urban population '88 (1,000)	93,[illegible],7	4,024,7	18,544,0	50,019,0	14,519,0	6,540,0
C- Relative availability						
1- Specific flow (l/s/km^2) A/B-1	20,9	34,1	3,8	11,5	20,1	14,8
2- Flow p/capita (m^3/d/inhab) '86.4A/B-3	102,1	1,183,8	11,9	14,0	43,9	232,8
D- Sectorial demand (m^3/s)						
1- Urban supply	255,1	9,3	42,9	144,7	42,0	16,1
2- Sugar-alcohol plants (b)	85,0	0,1	20,5	56,3	4,1	4,0
3- Other industries (c)	130,0	3,8	11,1	92,0	21,3	1,8
4- Irrigation	686,3	2,7	173,2	201,6	284,2	24,6
5- Total demand	1,156,4	16,0	247,7	494,6	351,6	46,5
E- Coefficients of consumption						
1- Urban supply (l/d/inhab) D-1/B-4	236,4	199,6	199,9	250,0	250,0	212,7 0,25
2- Irrigation (l/sec/ha) D-4/B-2	0,43	0,16	0,45	0,32	0,32	0,17
F- Hydric balance (% D-5/A)	0,65	0,01	4,20	4,67	3,04	
	20,9					

SOURCES: IBGE - Anuário Estatístico do Brasil - 1990
DNAEE - Carta de Disponibilidade Hídrica no Brasil
CABES - Catálogo Brasileiro de Engenharia Sanitária

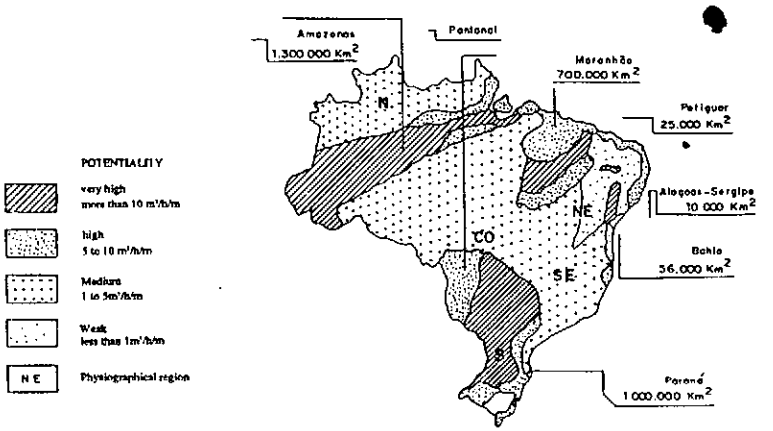
NOTES: (a) The State of Tocantins is still included in the Mid-West region
(b) Regionalized by the % of tons of ground cane
(c) Regionalized by the % of VTI of the sector

Deep wells supply important cities such as state capitals in the Northeast and several cities and industries in the South and Southeast. In the urban centers and more important industrial centers, such as São Paulo, underground water is an important complement to the public water systems supplied by surface water.

The reasons for using underground water for fresh water supply are its excellent quality, which makes it possible to dispense with the conventional treatment given to surface water, and the lower cost for obtaining it as compared again to surface water. However, the lack of specific legislation regulating the drilling of wells and the extraction of water in regions where demand is high, as in large urban and industrial centers, has caused a lowering of the water level and pollution, consequent to the lack of sanitary protection of the wells and the inadequate disposal of urban and industrial solid residues.

Because of the features of its soil and its climate, Brazil presents a high potential for water erosion. Added to this feature is the action of man in the rural areas, where intensive agriculture has not yet adopted suitable methods, and in urban areas, where settlements are established without soil protection. The current loss estimate is 1 billion tons per year. This runoff material, when deposited in the waterways, causes difficulties in water supply systems and loss of storage capacity in reservoirs. Besides, the most fertile soil is lost. Adopting a territorial division by macro-region, Tables III.8 to III.12 summarize the set of anthropic pressures on the hydric ecosystems and basins, by agent, location and extent of degradation.

FIGURE III.6



Mean potentiality of underground water in Brazil according to Rebouças, 1978

Table III.7 - Brazilian Reserves of Subterranean Water

Aquiferous Domain	Area (1,000Km²)	Main Aquiferous System	Volume In Stock (Km³)
Faulted Pre-Cambrian Rocks	600	Faulted zones	80
Alterated Pre-Cambrian Rocks	4,000	Bad Water and Faults	10,000
Sedimentary Basin of Amazonas	1,300	Tertiary Deposits	32,500
Sedimentary Basin of Maranhao	700	Fm Corda-Grajaú Fm Sambaiba Fm Poti-Piauí Fm Cabeças Fm Serra Grande	17,500
Potiguar Sedimentary Basin	23	Gr Barreiras Fm Jandaira Gr Açu-Beberibe	230
Sedimentary Basin of Alagoas-Sergipe	10	Gr Barreiras Fm Marituba	100
Sedimentary Basin of Bahia	56	Fm Marinzal Fm São Sebastião	840
Sedimentary Basin of Paraná	1,000	Gr Baurú Fm Serra Geral Fm Botucatú Fm Piramboia	50,000
Surface Deposits	823	Alluvions and Dunes	411
TOTAL	8,512	TOTAL	111,661

Source: Rebouças, 1988

Table III.8

General Table of Main Environmental Impacts - Northern Region

Activities of Greatest Potential Environmental Impact	Area of Occurence	Type of Degradation
Gold prospecting	Rondônia Pará Amapá Amazonas Several sub-basins of the Amazon, Tapajós and Madeira rivers	- Silting and erosion of watercourses - Water pollution, turbidity and heavy metals increase - Formation of population centers with serious social problems - Landscape degradation - Aquatic life degradation with serious direct consequences for fishing and population
Industrial mining: manganese, cassiterite, copper, bauxite, etc.	Amapá Amazonas Pará - Carajás Rondônia	- Landscape degradation - Water pollution and silting - Sterilization of large areas - Social and economic impacts
Extensive agricultural and cattle raising (large agricultural and livestock projects)	The entire Amazon region near highways and big cities	- Forest burning, destruction of flora and fauna (fire seen by astronauts) - Contamination of river courses by toxic pesticides - Erosion and silting of watercourses - Destruction of native productive areas: extrative reserves
Large hidroelectic plants	Balbina (Amazonas)	- Cultural impacts: native population - Socio-economic impact - Flooding of forest and agricultural areas, settlements, etc. - Impact on flora, fauna and adjacent ecosystems
Pig iron industries	Pará Great Carajás Programme	- Demand for charcoal from native forests: deforestation of the Amazon forest - Energy export at low price and high environmental cost - Water, air and soil pollution
Industrial centers and large industries	Industrial Center in Manaus (AM): Free zone	- Air, water and soil pollution - Formation of toxic residues - Conflict with urban centers
Construction of the Transamazon Highway	Axis of the highway and interconnections	- Large migrations and exodus - Destruction of native culture - Large farming and cattle raising projects - Large burnings - Expanding mining activities (garimpo) - Propagation of endemic diseases - Demographic boom and its consequences
Predatory hunting and fishing	The entire Amazon are, near highways and big cities	- Extinction of aquatic mammals and decrease of turtle and fish population in the Amazon Basin - Drastic reduction of animal population of economic and ecological value
Aluminum industry	Belém (Pará)	- Atmosphere pollution - Marine pollution - Indirect impacts due to enormous demand for electric power
Vertiginous population growth (domestic migration)	Rondônia Manaus (Amazonas) Belém (Pará) Amapá	- Serious social problems, population increasing sometimes up to 40% between 1970 and 1980 - Disordered land occupation, with serious consequences for natural resources

Table III.9

General Table of Main Environmental Impacts - Northeast Region

Activities of Greatest Potential Environmental Impact	Area of Occurrence	Type of Degradation
Sugar and alcohol agro-industries	Pernambuco Paraíba Rio Grande do Norte Alagoas	- Usually they are in the most fertile agrarian areas - Zona da Mata, competing with food crops causing rural exodus - Extensive monoculture areas of sugar cane - destroys the native vegetation - Pollution of interior and coastal waters problems - Soil exhaustion and groundwater contamination - Landholding concentration - large groups
Industry centers and/or large industries	Bahia: Camaçari Petrochemical Center, Aratu Industrial Center Sergipe: Nitro Fertil and Petromisa Alagoas: Maceió Cholochemical Center, Sagema Complex Maranhão: Aluminum Industry	- Air, water and soil pollution - Threatens coast ecosysterns - mangroves and swamps - Conflict Industry x Tourism x Fishing x Leisure
Disordered urban expansion in natural coastline areas and real-state speculation	The entire Northeast, mainly the regions located near the coastal capitals, at the Parnaíba Beach resort and in Piauí	- Degradation of coastal ecosystems, beaches, dunes and mangroves - Landscape degradation - Negative impacts in economic activities such as tourism and fishing
Port Activities	Porto de Suape, Capibaribe-PE Natal-RN Luiz Correia and Parnaíba - Piauí ALCOA fishing terminal, Itaqui port - São Luis do Maranhão Macuripe-CE Salvador, Aratú, Ilheus-BA	- Pollution of coastal waters - Impact on urban areas - Risk of accidents - Atmosphere pollution
Excessive fishing	The entire coast, mainly in the states of Ceará	- Exhaustion of fishery stocks, mainly in lagoons, and better priced fishes - Ecologic imbalance of marine biota - Negative impacts: socioeconomic and cultural (PB whale fishing (Prohibited)
Large landholding	Maranhão Piauí Rio Grande do Norte Paraíba Bahia	- Deforestation of native vegetation - Pesticides pulverization by airplanes - intensive use - Control of natural resources by large economic groups, such as water resources, dams, fertile soil (Zona da Mata)
Carcini culture, fish breeding and salt mines	Rio Grande do Norte Paraíba Maranhão Pernambuco	- Destruction of marshlands (landfilling, road construction, draining) - Concentration of great areas under the ownership of few companies (coastal landholding) - Impact on marine life and fishing
Steel industries, brick factories and other industries that use charcoal as fuel and exploit native vegetation raw-material	Rio Grande do Norte: Serra das Formigas	- Feeling of native vegetation for firewood and charcoal - Desertification of the Semi-Arid - Rural exodus for capitals of coast cities in the Northeast, Southeast and currently to the North, increasing social, economic and ecologic conflicts
Prospecting and exploitation of fossil, oil and natural gas fuels	Rio Grande do Norte: in terra firma, Mossoró and Alto Rodrigues	- Contamination of groundwater - Contamination of landwater - Deforestation of natural areas power

Table III.10 - General Table of Main Environmental Impacts - Southeast Region

Activities of Greatest Potential Environmental Impacts	Area of Occurence	Type of Degradation
Large urban concentrations (metropolitan areas)	- Greater São Paulo - Greater Rio de Janeiro - Greater Belo Horizonte - Greater Vitória	- Landscape degradation - Pollution air, inland and coastal water - Soil contamination - Scarcity of space - Socio-economic problems - Noise pollution
Large industrial concentrations and industrial centers	- MetropoEtan regions of the four above mentioned states	- Air, water and soil pollution - Landscape degradation - Generation of hazardous solid waste
Concentration of automotives vehicles in metropolitan areas	- Metropolitan regions uf: - São Paulo (São Paulo) - Rio de Janeiro (Rio de Janeiro) - Belo Horizonte (Minas Gerais)	- Pollution of the atmosphere - Noise pollution
Port activity, transport and storage of naval cargo and shipyards	- São Paulo: S. Sebastião and Santos - Rio de Janeiro: Baía da Guanabara and Sepetiba - Espírito Santo: Vitória, Tubarão and Ubú	- Coastal water pollution - Pollution of the atmosphere - Environmental impact - Generation of hazarduous solid waste - Risk of accidentes
Mechanized agriculture w/ high consumption of toxic pesticides and large homogeneous areas	- South of the state of Minas Gerais - The whole state of São Paulo	- Compacting, erosion and soil contamination - Ecologic imbalance - Decreased soil fertility - Socio-economic damages - Waterways silting
Sugar and alcohol, paper and pulp agroindustry	- Among all states of the region, São Paulo stands out with some 50% of the domestic production	- Pollution of watercourses - Soil pollution - Air pollution - Environmental imbalance - monoculture
Fuels transportation by pipeline	- Betim/MG to Rio de Janeiro - Paulínea/SP to São Sebastião - Campos/RJ to São Sebastião	- Deforestation of natural aereas - Erosion - Risk of accidents with damage to fauna, floram and human life
Disordered urban expansion along the coast strip	- Among all the coastal region the outstanding are: . São Paulo northern coast . Espírito Santo mid and southern coast . Rio de Janeiro mid and southern coast	- Destruction of ecosystems fundamental for marine life: ..... - Degradation of landscapes,..... - Pollution of beaches - Destruction of natural areas - Socio-economic damages in the recreational, tourism and fishing industry
Iron ore mining, gold (gold-panning), calcarius, granite and argile	- Minas Gerais: iron ore an gold - Rio de Janeiro: granite and calcarium - Espírito Santo: calcarium and granite	- Degradation of large areas, making them useless - Water pollution and watercourses silting - Landscape degradation - Serious socio-economic problems
Primitive steel industries - pig-iron	- Vale do Rio Doce region in Minas Gerais and Espírito Santo - Southeastern Minas Gerais	- Destruction of native forests for coal production - Pollution of water and rivers - Air pollution

Table III.11

General Table of the Main Environmental Impacts - Southern Region

Activities of Greatest Potential Environmental Impacts	Area of Occurence	Type of Degradation
Mechanized agriculture, high consumption of pesticides and monoculture	- States: Paraná Santa Catarina Rio Grande do Sul	- Clearing of remaining forests - Land compacting - Soil erosion - Soil contamination by toxic pesticides - Ecological imbalance - pests - Silting of rivers
Slaughter houses and tanneries	Rio Grande do Sul	- Water pollution - damage to aquatic life
Thermoelectric plant	Candiota (Rio Grande do Sul)	- Pollution of the atmosphere
Extraction of mineral coal	- Santa Catarina: several municiplalities in the south of that state - Rio Grande do Sul: the following mines: . Charqueadas . Candiota . Leão . Iruí . Recreio	- Water pollution - Visual pollution - landscape degradation - Destruction of natural areas - Degradation of large areas, which become useless - Damage to agriculture
Disorderly occupation of the coast and urban expansion	Along the coastline	- Pollution of agriculture - Destruction of natural coastal ecosystems - Landscape degradation - Socio-economic damages - leisure, tourism and fishing
Industrial centers	- Joinville and Blumenau (SC) - Araucária (PR) - Canoas (RS) - Rio Grande (RS) - Triunfo (RS) - Porto Alegre - São Leopoldo	- Air pollution - Domestic and coastal water pollution - Pollution by solid residues - inert and toxic waste - Socio-economic problems - conflict between agricultural use, tourism and housing
Port activities	- Antonina (PR) - Paranaguá (PR) - Itajaí (SC) - Imbituba (SC) - Laguna (SC) - Rio Grande (RS) - Porto ALegre (RS) - Tramandaie (RS) - Charquadas (RS)	- Coastal water pollution - Pollution of the atmosphere - Impact on urban environment - conflict with urban development and tourism - Generation of hazardous solid residues - Risk of accidents
Industries using wood as raw material	In all states	- Destruction of native forests - Ecological imbalance - Reduction of water absortion capacity - Extinction of native species - gene banks

Table III.12

General Table on the Main Environmental Impacts - Mid-West Region

Activities of Greatest Potentail Environmental Impact	Area of Occurence	Type of Degradation
Large agricultural projects	- Cerrados (savannahs): cultivation area of soybeans, rice and other cereals - Pantanal (marshlands): extensive cattle raising - Throughout the region: extensive cattle raising	- Forest clearing of native areas and great burnings - Drainage: erosion, aleration of the rivers'outflow, silting - Extensive monoculture: ecologic imbalance - Use of large quantities of toxic pesticides: water pollution - Intensive mechanization: soil compacting
Prospecting for gold and precious stones	- North of Mato Grosso - Headwater of Rio Paraguay - Poconé: near Cuiabá	- Erosion, silting, contamination of watercourses that compose the Paraguay River basin (indirect impact on Pantanal) - Socio-economic impact
Predatory fishing in Pantanal and alligator hunting	- The whole pantanal region specially near Campo Grande (Mato Grosso do Sul)	- Decrease of fishing stock - Ecologic imbalance - Risk of extinction of some species of alligators
Brick factories	- Cuiabá and northeast of Mato Grosso - Goiânia (Goiás)	- Demand for charcoal - Deforestation of the Cerrado - Pre amazonic forest: north of the region
Activities using timber as raw material (sawmills and furniture factories)	- Vera: notheast of Mato Grosso plain	- Deforestation of the Amazon forest and Cerrado - Destruction of flora and fauna
Large industrial projects - alcohol plants	- Mato Grosso	- Contamination of watercourses and headwaters of Pantanal - Extensive sugar cane monoculture: imbalances
Slaughterhouses, cold storage and dairy products	- Region of Cuiabá (Mato Grosso)	- Watercourse pollution
Invasion of indigenous reserves in the Cerrado - north of Mato Grosso	- Region of Guaponé: north of Mato Grosso	- Social and cultural impacts on indigenous population - Deforestation
Disorderly urban expansion	- In several centers near Cuiabá, north of Goiás and the Campo Grande region (MT)	- Destruction of river sources that make up the Pantanal basin - Landscape destruction - Pollution caused by lack of basic sanitation
Extensive cattle raising in Pantanal	- Pantanal Region	- Competition with native fauna - Imbalance

Chapter IV

Brazil and the Global Themes

1. Global climate change and its implications for Brazil

One of the great issues on which international attention has been concentrated is he warming of the Earth's temperature, the so-called "greenhouse effect" caused by emissions of gases such as carbon dioxide (CO_2), methane gas (CH_4), nitrous oxides (NO_2), ozone (O_3), and halogenated hydrocarbons (CFCs and halons).

Among the anthropogenic activities that are responsible for the higher concentration of these gases, the following stand out: the production of energy from fossil fuels, which accounts for a CO_2 increase of 5.5 carbon gigatons/year; agricultural activities, which are particularly related to CH_4 and NO_2 increases; production and use of CFCs; and deforestation, which accounts for the production of between 0.4 and 2.6 carbon gigatons/year of CO_2.

CO_2 concentration in the atmosphere is 25% higher than it was in the preindustrial era. The present concentration is 735 Gt, and the accumulated annual increase is 3 Gt. Methane gas concentration has doubled in the past three centuries and is increasing at a rate of 1% a year. NO_2 increase in the atmosphere since the preindustrial era has been 5-10%, while the annual rate of increase is 0.25%.

The control of emissions of gases that can cause climatic changes became the object of international consideration only in 1987. In that year, the Governing Council of UNEP adopted a resolution on World Climate Change, subsequently endorsed by the General Assembly of the United Nations, calling for the establishment of a working group to study the various aspects of the phenomenon.

The report prepared by that group revealed the difficulties that were being faced by policy formulators and decision-takers in relation to the issue of climatic changes. Both the effectiveness and the cost of the measures aimed at minimizing these changes, as well as their effects on economic growth and their social implications, require closer examination. Due to the increase in gas emissions into the atmosphere related to the so-called "greenhouse effect", the immediate challenges raised by current climatic changes would seem to warrant measures aimed at minimizing them, even before results from more extensive research are available.

The report anticipates profound changes in the climate of the planet in coming decades, with significant impact on human activities. It highlights the importance of evaluating the impact of global climatic change on the climate in Brazil, particularly in view of the growing "greenhouse effect". The problem of climatic changes in Brazil is complex. An analysis leads to three basic questions:

- How can changes in the vegetation, particularly deforestation, alter the present climatic balance in Amazônia and in other areas of Brazil?
- How can the emissions caused by deforestation, as well as by industrial, transportation, and energy-producing activities contribute to increasing global changes?
- How do these changes affect the natural ecosystems and the agricultural production sites in the Brazilian territory, and what would be the effects of the emissions of other gases on the global climate, even if the emissions and deforestation activities were controlled in Brazil?

There are no complete answers to these questions. However, available scientific knowledge makes it possible for us to analyze these problems from different angles.

Quantitative estimates of the effects on temperature, circulation and precipitation derived from important changes in the Earth's ecosystems are difficult to make.

Research carried out in the past 20 years has shown that the Amazon vegetation plays an important role in the present climate of the region. Many independent assessments of real evapotranspiration show that it is responsible for over 50% of the local precipitation levels. The moisture content in the atmosphere in western Amazônia is higher than it is near the coast, indicating air moisture close to the surface - as the air ascends from the forest - that is probably caused by the recycling of the water vapor by the vegetation. The available evidence as a whole suggests that the Amazon forest is very efficient in recycling rainwater back to the atmosphere. The results of simulations and the scarce available observation indicates that pastures could not

produce such high evapotranspiration rates. The data show that if there were to be large-scale deforestation, climatic changes might be expected in the region.

The deforestation of tropical rain forests is increasing rapidly in Amazônia, as shown by estimates of total deforested area based on analysis of images provided by the Landsat satellite. Estimates of the total deforested area by 1990 indicate the deforesting of about 415,000 square kilometers. There was a decrease however in the annual rate of deforestation between 1989 (19,000 square kilometers) and 1990 (14,000 square kilometers). Table IV.I provides estimates of the total deforested area with annual deforestation rates in the Brazilian Amazon region. Given this scenario, the question may be raised whether large-scale deforestation in Amazônia could affect the regional climate, with consequences for the region's biota.

Once the total deforested area and the annual deforestation rate is known, it is possible, in principle, to estimate the amount of CO_2 released into the atmosphere by the burning of the biomass. There are many difficulties involved in making these calculations, given the high degree of uncertainty involved in calculating the biomass per unit area, the amount of carbon in the biomass that becomes CO_2, and the amount of carbon removed from the atmosphere by the secondary growth of the forest, among other factors. Estimates of the biomass above ground level vary between 230 and 400 tons/year. To convert total biomass into amount of stocked carbon, an empirical factor is used that varies between 0.40 and 0.50. Based on a mean deforestation rate in Brazilian Amazônia of 21,000 square kilometers/year in the eighties, the maximum annual contribution of slash-and-burn activities in Amazônia would be equivalent to 12-21% of the world contribution. However, it must be considered that the burning of forest areas in Amazônia does not have full combustion efficiency, that part of carbon in the biomass remains in organic form or becomes charcoal, and that the carbon is fixed by the growth of the secondary forest. Therefore, this contribution could be even smaller. Deforestation of the Amazon represents from 4.4% to 7.6% of the global burning of fossil fuels, and the amount of CO_2 released into the atmosphere corresponds only to what the vegetation has recently taken from available nutrients.

Table IV.1 - Extension and Deforestation Rate in the Brazilian Amazon - Legal Amazon

Political Unit	Original Area of forest Km2 x 103	Deforested Area (Km2 x 103)				Cleared Area (% of original forest area)				Rate of Clearing (km2 x 103/year)		
		Jan 78	Apr 88	Aug 89	Aug 90	Jan 78	Apr 88	Aug 89	Aug 90	78-88	88-89	89-90
1	3	4	5	6	7	8	9	10	11	12	14	15
		DEFORESTATION EXCLUDING FLOODING AREA										
Acre	154	2,5	8,9	9,8	10,3	1,6	5,8	6,4	6,7	0,6	0,6	0,6
Amapá	132	0,2	1,0	1,0	1,3	0,1	0,6	0,8	1,0	0,1	0,2	0,3
Amazonas	1.561	1,7	17,3	19,3	19,8	0,1	1,1	1,2	1,3	1,6	1,3	0,5
Maranhão	155	63,9	90,8	92,3	93,4	41,2	58,5	59,5	60,2	2,7	1,4	1,1
M. Grosso	585	20,0	71,5	79,6	83,6	3,4	12,2	13,6	14,3	5,1	6,0	4,0
Pará	1.218	56,3	129,5	137,3	142,2	4,6	10,6	11,3	11,7	7,3	5,8	4,9
Rondônia	224	4,2	29,6	31,4	33,1	1,9	13,2	14,0	14,8	2,3	1,4	1,7
Roraima	188	0,1	2,7	3,6	3,8	0,1	1,5	1,9	2,0	0,2	0,7	0,2
Tocant. 30	58	3,2	21,6	22,3	22,9	5,4	37,0	38,3	39,3	1,7	0,7	0,6
Amazônia L.	4.275	152,1	372,8	396,6	410,4	3,6	8,7	9,3	9,6	21,6	18,1	13,8
Forest Hydroel. Flooding		0,1	3,9	4,8	4,8	0,0	0,1	0,1	0,1	0,4	0,1	0,0
Deforest. all sources		152,2	376,7	401,4	415,2	3,6	8,8	9,4	9,7	22,0	19,0	13,8

The energy matrix of Brazil indicates that most of the electric power comes from hydroelectric power stations. The contribution of coal-activated thermoelectric plants is small. Therefore, the contribution of Brazil to the greenhouse effect is derived from deforestation activities and the use of oil by-products, according to the international comparisons shown in Figure IV.1. On the other hand, the use of alcohol as fuel minimizes this contribution. There are few estimates on the contribution of other "greenhouse gases" (NO_x, CH_4 and CFCs). The contribution of methane gas may be significant, bearing in mind the size of the bovine herd in Brazil (Figure IV.2). This participation becomes more relevant because of the contribution of agricultural practices to global warming (Figure IV.3).

The question often is raised as to whether reforestation actions can change the climate to the point of increasing local rainfall levels. For reasons mentioned above, this is unlikely to happen in the nontropical areas of the country. In the tropical areas of Central Brazil and the Northeast, the answer to this question is unknown. For the Northeast, however, reforestation actions could have the positive effect of lessening the albedo and increasing surface rugosity, creating favorable conditions for higher rainfall levels. Another important consequence of reforestation in the Northeast would be greater water retention in the soil. However, a reversion of semiarid conditions should not be expected, though perhaps an attenuation might be possible.

Large-scale reforestation actions with the aim of removing CO_2 from the atmosphere and fixing it in the biomass could be carried out in degraded Amazon areas and in many other parts of Brazil and of the world. In Amazônia, it is estimated that over half the total deforested area, that is, over 200,000 square kilometers, is already degraded. It is plausible to imagine that 10,000 square kilometers per year throughout Brazil could be reforested within 40 years. This would mean that by year 2030, 0.1 carbon gigatons would be absorbed yearly until the forests reached their maturity, which would happen in a period of 40-100 years. This could lead to carbon absorption corresponding to a percentage varying from 25% to more than 50% of the present Brazilian carbon emissions due to deforestation in the Amazon.

During the growth period, until the total area envisioned is reforested, the total amount of accumulated carbon would be about 2.5 carbon gigatons a year. From then on, the fixation rate would be approximately 0.1 carbon gigatons/year for an additional period of 40-60 years.

It is important to stress that in addition to removing carbon gas from the atmosphere, reforestation reestablishes the dynamic balance of water and energy, and can create a habitat for the preservation of animal species. These forests also can become reserves of

resources for rational and sustainable exploitation within alternating cycles of secondary succession.

Another important point to be stressed is the possibility of increasing the biomass of existing forests. In certain areas of the Amazon region characterized by poor soils, forests have a lower biomass content. The limiting factor for growth is neither water, energy or transport, but rather the availability of nutrients, particularly in open forests. One way to solve the problem would be to raise the nutritional levels of the soil with phosphate, which has slow solubility, due to the acid conditions of the soil and climatic features. Through neutron activation, analyses are being made on the solubility and absorption of elements of several rock samples in natural conditions.

In natural and agricultural ecosystems, the increase of CO_2 concentration in the atmosphere may lead to a higher photosynthetic fixation rate, particularly in plants of the C-3 cycle, which include most forest species and cultivated plants. In agricultural ecosystems, adaptation to climatic changes is possible through the introduction of appropriate practices and by changing existing agricultural methods or the species being cultivated. Sometimes, however, it is very likely that this process, which is technically possible, may be economically unfeasible or contingent on high investments. Certain areas of production that are traditionally associated with one temperature range may not be able to adapt to other temperatures. Cultivation of Coffea arabica, for example, is limited by temperature. However, if natural or agricultural ecosystems are to benefit from this higher CO_2 content in the atmosphere, other factors that decide primary productivity cannot be in demand; that is, there should be no restrictions in terms of fertility and groundwater.

Regarding the adaptation of species in natural ecosystems, we must bear in mind that there is always a selection and a migration of species to more propitious areas. During past climatic changes, these variations took place at a somewhat slow pace, which made room for better adaptation and positive selection. For expected changes resulting from human actions, the time-frame is measures in decades; therefore, the selection and adaptation process will be very difficult. It is anticipated that many species will simply disappear.

The maritime ecosystems close to the shore will be affected by changes in the circulation of the oceans, and also by changes taking place between continents and oceanic waters near the shore, which are vitally important to various sea and intermediate water species.

Scientific investigations indicate a variation of sea level between 0.5 and 3.0 mm/year in the past 100 years, and predict that this trend will continue. The best available

FIGURE IV.1

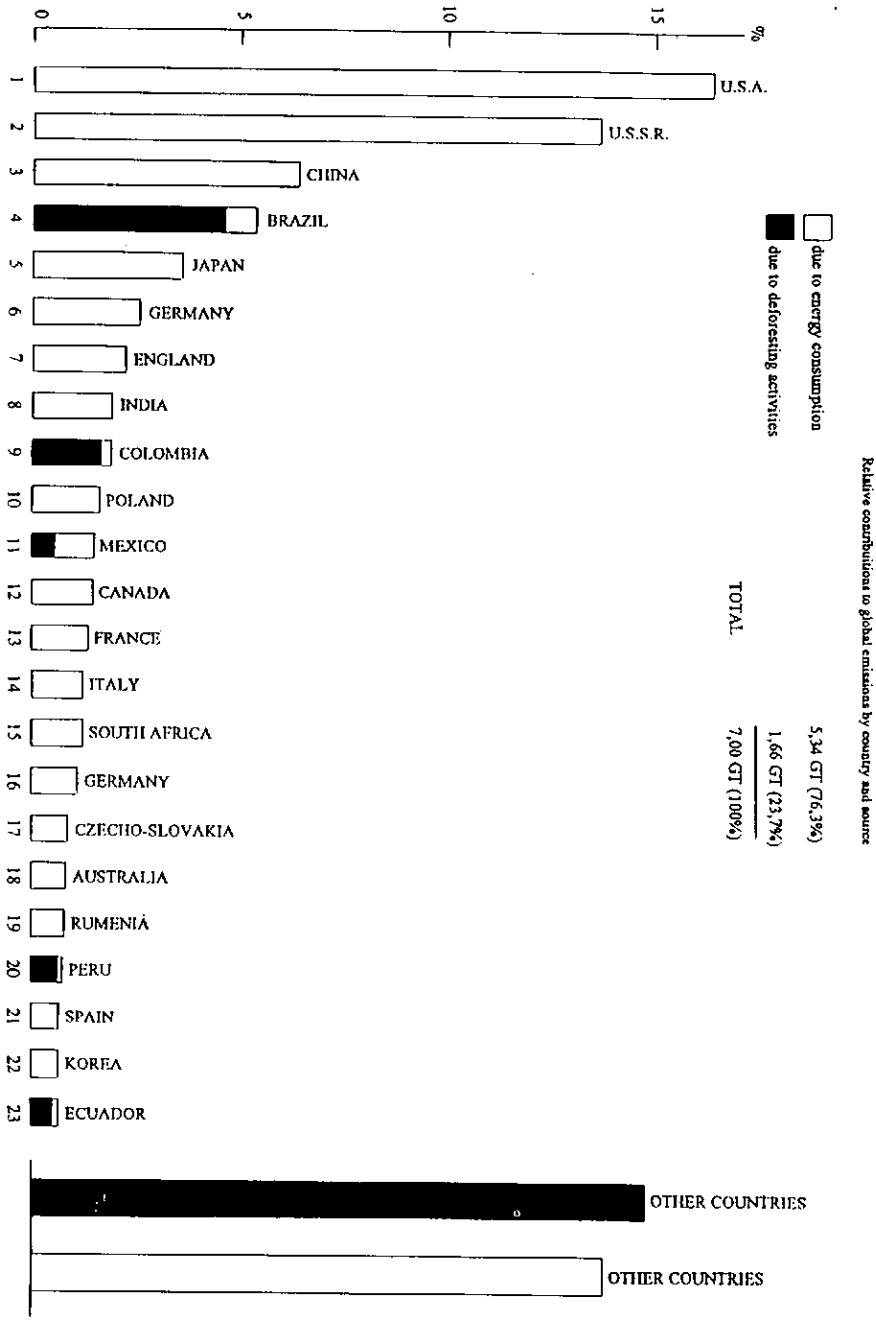
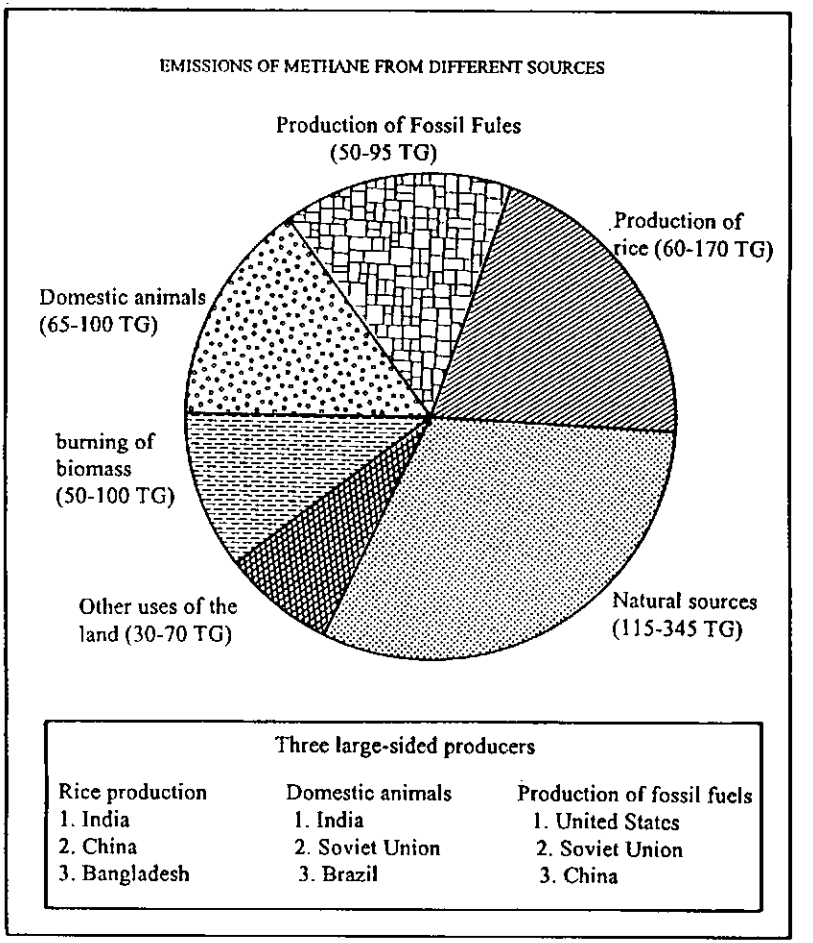

0
5
10
15
%
1 U.S.A.
2 U.S.S.R.
3 CHINA
4 BRAZIL
5 JAPAN
6 GERMANY
7 ENGLAND
8 INDIA
9 COLOMBIA
10 POLAND
11 MEXICO
12 CANADA
13 FRANCE
14 ITALY
15 SOUTH AFRICA
16 GERMANY
17 CZECHO-SLOVAKIA
18 AUSTRALIA
19 RUMENIA
20 PERU
21 SPAIN
22 KOREA
23 ECUADOR
OTHER COUNTRIES
OTHER COUNTRIES
due to energy consumption
due to deforesting activities
TOTAL
5,34 GT (76,3%)
1,66 GT (23,7%)
7,00 GT (100%)
Relative contributions to global emissions by country and source

FIGURE IV.2

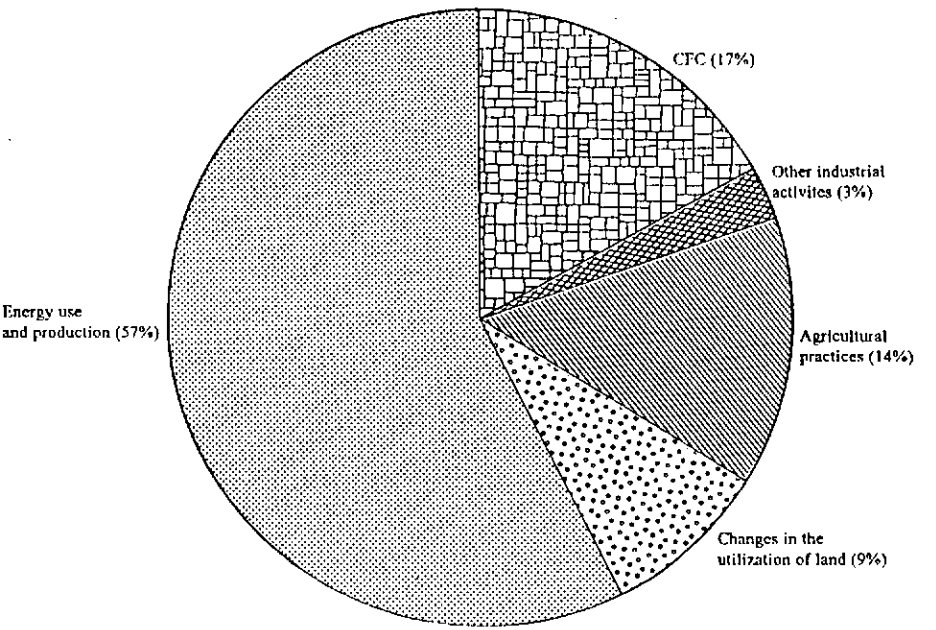


Source: Cicerone and Oremland, 1988: Crutzen and cel. 1986.

Note: Human activities in the agricultural sector (domestic animals, rice production and burning of biomass) and the production of energy from fossil fuels are the most important sources of emissions of methane into the atmosphere. Natural sources as ocean, lakes and humid zones may contribute with less than 25% of the total emissions.

FIGURE IV.3

ACTIVITIES THAT CONTRIBUTE TO THE "GREENHOUSE EFFECT"



Note: Estimate of contributions from various activities to the greenhouse effect in the Eighties

estimates indicate that the sea level will rise 18 cm by the year 2030 and 44 cm by 2070. This phenomenon will have an impact on several areas, affecting both the population living in coastal regions as well as natural ecosystems, such as mangrove swamps and areas where the mouths of large or small rivers are located.

In large urban areas, the situation may become disastrous, requiring detailed studies for every city located on the Brazilian coast. One possible climatic change would be an increase in the number and intensity of tropical storms, which, given a higher ocean level could cause serious problems in areas located along tropical strips in Brazil.

Specifically with regard to fishing activities, particularly the fishing of shrimp in coastal zones, the situation might also become serious, as any change in ocean level or in the quality of the water may affect production capacity.

An increase of a few degrees in surface temperature, with little seasonal variation, can lead to more frequent hot days and fewer cold nights. The occurrence of frost in the South and Southeast regions could become rarer. Due to higher temperatures, there could be an increase in evaporation demand and a reduction in available groundwater, even in areas with increased rainfall.

2. Biodiversity and extinction of species

The concept of biodiversity comprises all the species of plants, animals and microorganisms, as well as the ecosystems and ecological processes of which they are components. It is a comprehensive term for natural variety, which includes the number and frequency of species or genes, in addition to their respective ecosystems. Three distinct levels are considered to express biodiversity: genetic variation, diversity of species, and diversity of ecosystems.

The number of species of described organisms is approximately 1.4 million, of which 751,000 are insects, 41,000 are vertebrate animals, and 250,000 are plant species, including vascular and bryophyte plants. The remainder are invertebrate animals, fungi, algae and microorganisms.

Amazônia attracts special attention in this context, since 51% of all tropical plant species are located in the neotropical zone, located in Central and South America, while Africa and Madagascar are home to 23% and Asia to 26% of such species. Knowledge of the exact number of existing species is still incomplete and the remarkable complexity of the structure of

biological communities, of the ecology and geographic distribution of species as distinct as large mammals, trees, insects or fungi pose great difficulties to researchers.

Recent studies indicate that the world will lose between 2% and 7% of its species within the next 25 years. If the number of existing species is 10 million, this means that 8 to 28 thousand species will be lost every year, or 20 to 75 species a day. This situation becomes even more serious when attempts are made to list acknowledgedly extinct species.

The list of species of the Brazilian fauna threatened by extinction includes all the animals classified by the International Union for the Conservation of Nature (IUCN) in the three most critical categories (vulnerable, threatened, or actually extinct species). Among the 171 species of the Atlantic Forest included in the list, only six are mentioned as probably extinct.

In spite of these methodological difficulties in making accurate assessments, there is no room for doubt concerning the threat posed by the biological impoverishment of the biosphere. Between 1900 and 1950, 60 species of mammals and birds became extinct, which is a high figure if compared to the average world-level of extinction for these groups - one every 100 to 1000 years.

On the other hand, such uncertainties arise from global extinction estimates and from attempts to regard geographic distribution patterns and admittedly complex ecological behaviors as homogeneous, at the regional and local level. At these levels, existing knowledge does allow the adoption of a planning strategy aimed at the definition of a rational approach to the conservation of biodiversity.

An important factor to be considered with respect to the conservation of biodiversity, particularly in tropical regions where two thirds of the Earth's species live, is the phenomenon of the evolution of species to adapt themselves to climatic changes. The extinction of species has been occurring since life began on Earth, resulting, however, from natural causes. Because of the genetic variation of organisms, adaption to climatic changes took place as new species appeared, the descendants of which now enrich the flora and fauna. The accelerated extinction we are witnessing today is limiting the evolutionary process of adaptation to climatic changes, particularly the process of extinction related to the greenhouse effect and to the destruction of the ozone layer. The consequences are unpredictable, but will certainly be catastrophic and may jeopardize the survival of biodiversity, including humankind itself.

Lack of knowledge concerning biodiversity has represented a serious obstacle for decision takers as regards the recognition of the need for conservation of biological resources in national development plans.

In the specific case of Amazônia, for example, scientific information on the geographic distribution of plants and animals reveals the existence of areas with a higher concentration of species, as well as centers of endemism, that is, areas characterized by a limited occurrence of certain species. This knowledge is of the utmost importance to the implementation of biodiversity conservation plans through the establishment of parks, biological reserves and other conservation units.

Since 1988, a medium and long-term plan is being developed for in situ and ex situ conservation of the genetic resources of animals, plants and microorganisms of Amazônia. Ex situ conservation will include the setting up of plural and specific germplasm bases; in situ conservation will be expanded through the integrated establishment of genetic reserves in conservation units in general, and possibly in Indigenous reserves.

The importance of present and future uses of biodiversity justifies investing in its conservation, mainly because of its potential in the field of biotechnological applications - particularly genetic engineering - and in the development of new food and industrial cultures.

The use of sylvan species in genetic improvement activities has been successful thanks to the adoption of additional techniques developed by biotechnology experts. Positive results have been obtained in the development of new cultures with a higher resistance to plagues, diseases and adverse environmental conditions, including improvements in organoleptic aspects. In this context, experiments are being carried out with rice, pineapple, banana, potato and wheat.

Regarding the use of medicinal sylvan species, there are frequent references to their direct use in industry. It is true that nowadays there is little interest in medicine derived from medicinal plants in some countries. However, according to the World Health Organization, 80% of the population in developing countries uses traditional medicines, and 85% of the traditional drugs include extracts from medicinal plants.

3. The ozone problem

The destruction of the ozone layer protecting the Earth is caused by chlorine, a chemical substance that is part of the molecule of synthetic substances known as CFC. These substances were synthesized in the late thirties to be used in the refrigeration cycle. Their large scale utilization began in the sixties. In contrast with previous products, CFC is not flammable, explosive or toxic, does not have an unpleasant odor, and was regarded as completely harmless for many decades.

Brazil produced 10 thousand tons of CFC in 1988 and 8.6 thousand tons in 1990. The production in the United States, in turn, was 280 thousand tons in 1985, when the existence of a hole in the ozone layer was first detected over the Antarctic Circle.

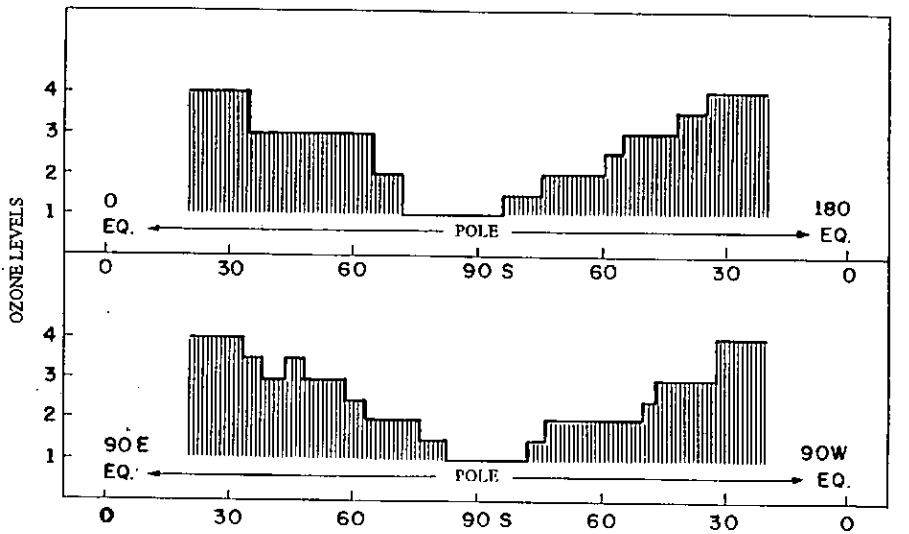
The reduction in ozone levels occurs mainly in the lower stratosphere, during September, when solar illumination returns to the polar region. Reductions of over 50% in the ozone have been recorded. The data available on this phenomenon demonstrates that after the maximum reduction in late September or early October, the ozone column recovers in a few weeks, producing a final warming in the area and the disappearance of the polar vortex.

There are no signs that the ozone layer has diminished in tropical latitudes. There is, however, concern over the increasing hole in the ozone layer detected in the Antarctic Circle, which is caused by the diversion of air masses with a low ozone content to low latitudes.

No signs of destruction of the ozone layer covering Brazil have been detected to date, although the possibility has been under investigation by sounding balloons since 1978. Most of the stations for measuring ozone - about 20 - are located in the Northern hemisphere, with only three in the Southern hemisphere. The Brazilian station located on the coast of the Northeast region with its present data base has become the most important observation center in the tropics.

The horizontal span of the hole in the ozone layer is cause for concern, because it could reach regions of greater population density. Figure IV.4 shows the hole in the ozone layer in two dimensions, that is, its depth in Dobson units and its span between the pole and the equator. Two cross sections in perpendicular planes between them are shown, both of which are centralized in the South Pole. The first one begins at the intersection with the 0 degree meridian and ends at the 90 degree W meridian. As the figure shows, the hole is not exactly symmetrical. Another observable fact is that the hole is already influencing regions close to 40-45 degrees, where in several longitudes the drop in ozone concentration has reached 33% of the maximum polar drop, affecting southern parts of Chile and Argentina, in South America, and also part of New Zealand, in Oceania.

FIGURE IV.4



Ozone concentrations in different latitudes beginning from the South Pole. The cuts are on perpendicular planes between themselves

Chapter V

Elements for a Sustainable Development Strategy

An innovative development model should allow for an in-depth revision of current practices of incorporation of natural assets, through new forms of social organization and patterns of production and consumption. This chapter aims specifically at highlighting the major challenges that must be faced for this model to take shape and succeed in conquering the imagination and political will of the social actors involved in bringing about much-needed changes to the present style of development.

Two of these challenges are particularly stressed. Above all, one cannot envision an environmentally sustainable development model without solving the serious imbalance caused by situations of extreme poverty and socioeconomic iniquity that characterize Brazilian society at the turn of this century. Not only are wealth and natural assets unequally distributed in the country; this also is the case with unequal access to decision-making. Therefore, it is equally important to perfect Brazilian democracy, to overcome the divorce between society and the state, and to solve the problem of political poverty, which aggravates and perpetuates socioeconomic inequality.

1. Main challenges

1.1 Overcoming poverty

Brazil entered the nineties facing a deep economic crisis. Recent development patterns have not managed to solve the problem of social dualism. About 40% of Brazilian families live in poverty, with monthly per capita income of less than one-fourth of the minimum salary. Among these, 45%, or 4.7 million families, live in extreme-poverty. In 1989, the richest have often not been channeled to the poorer segments, but rather to subsidize consumption by

5% of the population received 38.5% of the income, while the poorest 40% received 7.1%. These high rates of concentration of wealth are caused by income differentials between regions and productive sectors, in addition to the characteristics of the age and educational pyramids. The Northeast region, where 29% of the Brazilian population lives, holds 53% of the poor people in the country. In 1980, each inhabitant of the Northeast had an average income equivalent to little over one-fourth of that of an inhabitant of the Mid-Southern region.

The implications of this unresolved problem from the past, which is similar to that of a mortgage on the prospects for the future development of Brazil, are creating dramatic tensions in the social fabric of the country.

Social inequalities also can be felt among various groups, showing the persistence of racial discrimination. An official study showed that in the early eighties, the black population had a lower income than that of the equivalent white population in all occupational categories, besides lower educational levels. There were practically no interracial marriages. Two-thirds of the black population had a monthly income equivalent to or lower than one minimum salary, while only one third of the white population faced a similar situation. At the other extreme, only 3% of the black population had an income of more than five minimum salaries a month, a percentage that was four times higher for the white population. One out of every 12 white persons in the labor force had an occupation requiring a university degree, while only one out of every 25 black persons had a similar occupation. One-seventh of the white population is illiterate, while two-fifths of the black population cannot read or write.

If the period of rapid economic growth of the seventies did not solve the poverty problem, it contributed to reducing it temporarily and to improving the standard of living of the poor. At the end of the seventies, poverty rates had been reduced to less than half what they had been at the beginning of that decade. Nonmonetary indicators of well being also reflected significant improvements, showing, for example, that the lower income population enjoyed greater access to durable goods. Economic uncertainties and, finally, the recession of the eighties, reverted these improvements in poverty indicators, bringing back the low levels of the beginning of the preceding decade.

The economic crisis of the eighties affected the population in different ways. In 1987, there were 32 million children and adolescents living in extreme poverty (43% under the age of seven). Although poverty levels are higher in rural areas, they are more serious, in absolute terms, in urban zones. At a regional level, the greatest problem is concentrated in the Northeast, where there are 6 million poor children under the age of six. Therefore, children

represent a fragile and vulnerable segment of the Brazilian population. They are particularly affected by adverse environmental conditions.

Women are also proportionally better represented in the lower income groups. About 20% of them are heads of households. There is no data available as to how many of them are responsible for the family income due to the unemployment of their mates. Their participation in the labor market is growing: from 18% of the economically active population in 1970 to 37% in 1985. In spite of this, their mean income is equivalent to only 52% of the average income for men.

Resuming economic growth is not the only solution to these serious problems. Transformation of the productive framework, which is essential to the recovery of economic dynamism, must be accompanied by an effective policy aimed at ensuring greater social equality, not only for the present population, but also for future generations.

Conditions of economic efficiency based on market forces alone, do not determine reduced social and regional inequalities and the rational use of natural resources. The Brazilian experience has shown that intensive mobilization of production factors leads to a predatory use of environmental resources and tends to reproduce, spontaneously, the social and spatial conditions which initially sustained it.

The economic growth process does not take place in a social vacuum. In the first place, no matter what diagnoses are made to provide a basis for economic policy proposals furthering the socio-environmental sustainability of development activities, they must examine the different global economic options proposed in terms of overcoming present problems, and their implications, for the attainment of social equality and a reduction of poverty.

Secondly, social development should not be confused with social policy. From a strictly social point of view, the same logic can be applied to economic policy, to respond to the demands for equity in social policy. Social policies should propose something more than reducing poverty, which no doubt will continue to grow. However, in some countries the poverty line is so close to the average income that it is difficult to distinguish between policies aimed at overcoming poverty, and the development process itself. An anti-poverty social policy is a priority and is even indispensable, but it cannot be regarded as an end in itself.

In third place, reforming organizations and programs in the social area is a priority task and one with a long-term impact. Brazil has the paradox of having social expenditures that are higher than in other developing countries and simultaneously the lowest standard of living indicators. The are two explanations for this fact. On the one hand, resources

higher income groups. On the other hand, the management of public resources for social programs is inadequate.

If public social expenditures potentially have a redistributive effect, it tends to benefit the formal-modern sector of the economy, urban centers and, in general, the high-income sectors. Increasing funding for social programs without a deep institutional reform will have the effect of reproducing the present patterns of inequality, and perhaps creating even greater ones.

Conclusively, it seems that there are no economic obstacles to favouring macroeconomic political options that can meet the basic needs of the poorer sectors, developing integrated social policies with an impact that goes beyond the immediate struggle against poverty, channeling a greater share of the national product to social sectors making fundamental changes in the distribution of public expenditures and redirecting social programs to the more vulnerable groups. The greatest challenge still lies in the political-institutional realm, where new alliances must be established among all social groups, and public institutions reformed with the aim of winning support and consensus for the proposed changes.

1.2 Participation and social control over development

Latin American social inequalities and democratic instability have been caused less by a lack of resources or economic dynamism, than by how the available resources are shared. Accumulation, distribution and citizenship are synchronous processes, as they are the form and substance of the same historical process. For this reason, the economic and social evolution of the country indicates a need to overcome the gaps between material progress, social justice and environmental sustainability. This is, above all, a political challenge to be dealt with through the establishment of alliances among different social groups, to attain the consensus needed to promote the necessary reform of public institutions.

At this level, participation blends with autonomous social organization. At a micro level, the solution to institutional problems caused by the Brazilian development sustainability crisis lies in social democratization; at a macro level, it lies in the democratization of the state. The former objective requires strengthening social and community organizations, redistributing resources and providing information to subordinate sectors, increasing the ability of these organizations to analyze facts and their capacity to take decisions. The latter can be attained through greater participation by citizens in state affairs, modernizing the political parties and electoral processes, and introducing the concept of political responsibility into public activity.

To consolidate democratization efforts, measures must first be taken to strengthen the political capacity of the State by improving its ability to regulate relations between social

organizations and political institutions. This can only be attained by sharing the scarce resources available, such as the access to property and information, as well as by creating multiple jurisdictions in the decision-making process and by creating decision-making capacity.

Secondly, the technical-administrative capacity of the State must also be strengthened. Decentralization is a crucial element in this process, and it implies not only the possibility of assuming certain functions without having to resort to higher jurisdictions, but also the power to make decisions. In other words, decentralization presupposes an effective transfer of part of the power to manage resources and assets to other parties.

Thirdly, the present challenges require the strengthening of the State's planning capacity. The strategy of democratic and environmentally sustainable development must be based on the promotion of structural changes in society, which presupposes the emergence of divergent and sometimes contradictory interests.

Finally, a sustainable development strategy requires an approach that goes beyond geopolitical considerations regarding the use and conservation of natural resources and social spaces.

2. Society and the environmental issue

Now that the need and urgency for an innovative development model are being discussed, it is important to determine the extent to which Brazilian society can implement the changes that are needed. According to this new style, economic development should not only be sustainable; it also should also provide a solution to the most important social problems of the day and allow for the use of environmental resources in such a way as to allow them to be enjoyed by future generations without any loss of productivity.

Society's concern with environmental issues and sustainable development is still at an embryonic stage. The space dedicated by the media to disseminating these issues is growing, but it has limitations that hinder public understanding of their scope and meaning. One of these limits is a biased over-concentration on topics related to the conservation of nature - particularly species of fauna and flora threatened by extinction - and emblematic ecosystems, such as Amazônia.

Therefore, although exposed to the effects of acute forms of environmental imbalance, high percentages of the population do not establish a link between their daily problems and the degradation of the environment and do not regard themselves as parties affected by these issues. Environmental perception of the development process by two large segments of society also contribute to establish this resistance. At one end, there are political organizations and parties that deal more directly with social and labor revindications. The

perception of the basic issue of survival in a hierarchy of issues, ends up ranking ecological problems as almost superfluous. At the other extreme, there are sectors that are more strongly concerned with the historical use, in accordance with the national development model, of natural resources for private appropriation under the protection of the state and without any legal-economic determinants.

Public opinion

National and regional opinion polls were conducted between 1989 and February of 1991, for electoral purposes and not exclusively dedicated to ecological issues; they can serve, however, as an indicator of how prominent these issues are among the concerns of the Brazilian people.

The main results show, first, that in relation to other problems facing the country, the environmental issue is, as expected, a minor worry in a list where the most serious issues mentioned are the rate of inflation rate, health, education and unemployment.

This does not mean that people regard the environmental issue as unimportant. When it is dealt with separately, the country's ecological situation is regarded as very serious by the majority.

As for future expectations, the demand for industrialization is higher in the rural areas than the concern for a sound environment. In urban areas, it seems that awareness to environmental issues is greater than the demand for industrial development.

In an assessment of the future scenario carried out in various population groups, the relationship between age and environmental demand is inversed, while it is direct between the latter and education and income.

Among the set of specific environmental problems, the burning of forests ranks first, both in urban and rural areas. Industrial pollution is seen as a priority only in the Southeast region, but only by a slight margin. The destruction of the Atlantic Forest and the risks posed by nuclear accidents are also widely seen as important problems.

When asked whether they would opt for development and the creation of new jobs or for the protection of nature and environmental preservation, most Brazilians seem to adopt an intermediate position between the two options.

The issue of sovereignty, for environmental problems, was the object of a specific poll in 1989, when a proposed highway connecting the Brazilian Amazon region to Peru and the Pacific Ocean was under discussion. The majority of persons interviewed recognized the need to protect the environment, criticized the inefficiency of actions undertaken by the government in this area, and believe that behind the international interest in protecting the Amazon there is an intention to exploit Brazilian riches.

Since 1988, environmentalism in Brazil has become frequently open to problems related to sustainable development. Until the mid-eighties, most environmentalists had not included development problems among their concerns. Ecology and economy were seen as two antagonistic realms.

There has been a remarkable change in this point of view. Both society and government are becoming more aware that, to tackle environmental issues, discussions must be carried out with the populations affected. There is more room for dialogue, considering that several technicians and directors of government agencies are also activists in the movement. The decision made by the Brazilian government at the beginning of 1990 to be the host country for the United Nations Conference on Environment and Development is a remarkable stimulus, not only to the interest in the activities of the environmentalist movement, but also to the interest in the concept of sustainable development, an underlying principle in the convocation of the Conference.

In June of 1990, a forum of non-governmental organizations was set up to address matters related to the Conference on Environment and Development. One year later, in June of 1991, 700 organizations were participating in that forum. The coordinating committee of the forum is made up of ten organizations that represent the environmentalist movement and Brazilian society in general. The forum defined its agenda of priorities as follows: to make a diagnosis of the social and environmental crisis; to define proposals for a new international economic order; to identify innovative development models for Brazil; and to influence the result of the intergovernmental Conference through joint coordination of efforts with worldwide NGOs.

The recent institutionalization process towards sustainable development experienced by the Brazilian environmentalist movement, is linked to ongoing changes in national and international public opinion. Problems related to the natural ecosystems of Brazil have become very important and visible at a planetary level.

Therefore, environmental education should be seen as an issue directly linked to citizenship rights, on the same level as political education.

From the point of view of the State's action, there is a tendency to include environmental education actions in the development programmes of different productive sectors. Through these actions, the generic and fragmented approach to environmental issues, which limits the environment to the idea of protecting nature without any links to tangible social matters, may gradually be abandoned.

To provide education with the interdisciplinary perspective imposed by environmental problems, new methodologies must be developed to integrate different fields of knowledge. These methodologies must be built upon a comprehensive conceptual foundation that should take into account technical and cultural factors, to surpass the obstacles to the sustainable use of the environment. This task will require the incorporation, by universities, of the experience acquired by community organizations.

From the view point of structures of education, research and technological development, the most likely trend is towards broadening environmental education. The new technological paradigms are expanding the labor market and the demand for human resources with a new profile.

It can be anticipate that there will be a growing supply of information, teaching material and courses, among other instructional resources, from the communication industry, since the market for subjects linked to the environment will surely and steadily expand.

TABLE V.1 - Strategic Scenarios for Assessments of Energy Consumption

SPECIFICATION	Physical Evolution (millions of EOT)			Composition %		
	1990	2010		1990	2010	
	(REAL)	C-I	C-II	(REAL)	C-I	C-II
Final Consumption (million EOT)						
Oil byproducts	55.2	116.7	103.3	32.7	33.1	28.9
Natural gas	3.2	25.0	22.4	1.9	7.1	6.3
Coke and Mineral Coal	5.9	17.5	0.4	3.5	5.0	2.6
Other Fuels	3.2	6.8	14.0	1.9	1.9	3.9
Electricity	62.8	145.4	145.4	37.2	41.4	40.8
Firewood and Charcoal	20.9	13.5	32.6	12.4	3.8	9.1
Álcohol and Sugarcane Bagasse	17.5	27.2	30.2	10.4	7.7	8.4
T O T A L	168.7	352.1	357.5	100.0	100.0	100.0
Gross Domestic Supply (million EOT)						
Nonrenewable	68.5	198.6	164.8	37.3	49.4	40.1
Oil	55.1	125.5	110.0	30.0	31.2	27.0
Natural Gas	3.7	30.0	27.1	2.0	7.4	6.6
Mineral Coal	9.1	33.6	21.4	5.0	8.4	5.2
Nuclear	0.6	9.5	5.3	0.3	2.4	1.3
Renewable	115.1	203.4	246.1	62.7	50.6	59.9
Hydraulic	67.8	150.6	141.2	36.4	37.5	34.4
Firewood	27.4	18.8	47.7	14.9	4.7	11.6
Sugarcane Products	18.1	28.7	41.0	9.9	7.1	10.0
Other Renewable Sources	1.8	5.3	16.2	1.0	1.3	3.9
T O T A L	183.6	402.0	410.9	100.0	100.0	100.0
Primary Production						
Nonrenewable	40.7	156.2	141.5	28.8	46.5	40.9
Oil	31.6	112.8	101.3	22.3	33.6	29.3
Natural Gas	6.3	32.1	28.9	4.5	9.5	8.4
Coal	2.8	11.3	11.3	2.0	3.4	3.3
Renewable	100.8	180.0	204.2	71.2	53.5	59.1
Hydraulic	67.6	150.5	141.2	47.8	44.8	40.8
Firewood	27.5	18.7	47.7	19.4	5.5	13.8
Alcohol	5.7	10.8	15.3	4.0	3.2	4.4
T O T A L	141.5	336.2	345.7	100.0	100.0	100.0

Source: National Energy Secretariat

C-I -Concentrated scenarios
C-II-Decentralized scenarios

3. Strategies for sustainable development

The transition to a new style of development presupposes well-defined strategies aimed at promoting changes in productive sectors essential to economy and social welfare. The present economic and environmental crisis that most countries are facing can be blamed on the imbalance caused by a development model based on productive processes that rely on intensive use of natural resources and fossil fuels, which until now had been perceived as abundant. Above all, it can be blamed on the belief that nature's "free goods," such as the air, the water, and even the forests, are infinite and can receive a limitless amount of residues, waste, polluting gases, etc., generated by consumer societies that squander natural resources.

The scientific and technological advances of recent decades provide a basis for the comprehensive understanding of ecological processes of the biosphere, and offer techniques for monitoring global changes in those processes. They also suggest the possibility of implementing new productive processes, which could be quantitatively less dependent on energy and raw materials, through the use of new energy sources based on new materials, besides valuing biological resources in an unprecedented way.

The common denominator of this transformation may be identified as a shift from the emphasis that has thus far been placed on matter and energy to an emphasis on information, a shift from quantity to quality. In other words, the economic production model which is taking shape internationally is the result of intensive scientific and technological research, to the detriment of natural resources per se. For this reason some countries with limited natural resources, such as Japan, have high economic and social development rates.

These scientific and technological advances are being incorporated into the productive sector with advantages for the environment in three main ways: high-technology industrial development; use of advanced knowledge by the existing productive framework; and new undertakings aimed at restoring the environment.

By making correct use of technology, clean industries that form the basis for a more balanced and environmentally-integrated economic growth can be set up.

Regarding the existing productive framework, it is now evident that the limited use of technological knowledge adversely affects the management of production. Innovations are needed to improve the management of technology. Therefore, a management philosophy based on quality and productivity, that takes into account environmental considerations, should be further promoted.

With respect to the assimilation of new and environmentally desirable technologies by the productive sector, the market for environment-directed activities and enterprises is growing. A typical example of this is the recycling of waste and the reutilization of residues.

The use of appropriate technologies provides opportunities for optimizing regional situations, as these technologies, after being developed over years or decades, absorb the cultural tradition of the regions where they are applied, provide an empirical basis for understanding problems, and promote new initiatives.

Biotechnology is a natural option for Brazilian development. The use of biotechnological systems to convert energy forms or chemical substances (bioconversion) has several advantages: high selectivity, flexibility, a reduced need for energy inputs, remarkable catalytic activity, environmental compatibility, easy installation regardless of location, and renewable capacity.

Brazil has begun to experience a change towards a new standard of development. In the next 20 years, trends point to the predominating use of oil and hydroelectricity, as sources of energy supply for Brazil, jointly accounting for 60-70% of the total. It is also expected that the traditional use of natural gas will grow and that of firewood will decrease during that period. From the environmental point of view, however, the most important political decisions concern the role to be played by decentralized energy sources, particularly biomass, in the country's energy matrix.

There are alternative scenarios for the national energy matrix in the next 20 years. The difference between these scenarios should not be seen merely as a result of the evolution of technical and economic parameters that condition decisions in the energy area; rather, they represent different conceptions of the role to be played by energy in the economic and social development process.

In the first scenario, oil, large hydroelectric plants, and coke iron and steel metallurgy, among other sources, play a predominant role. An alignment with present international standards is sought here. In the second scenario, an attempt is made to appraise the strategic role that decentralized sources may play as they adapt to regional features - not as an alternative, but rather as a dynamic and interactive complement to the large centralized oil and hydroelectric systems. Table V.1 summarizes the projections of these two scenarios (I and II), covering final consumption, domestic supply, and primary production.

Regarding renewable energy sources, the main alternatives or complementary energy sources of oil are natural gas, schist, peat, and nuclear energy. All, except peat, are centralized energy sources. In the category of decentralized renewable energy sources, there is

a broad range of possibilities, including firewood and charcoal, liquid fuels such as alcohol and vegetable oils, gaseous fuels derived from biomass, and small hydroelectric stations, in addition to technologies of a more limited use, such as biogas, and direct, thermal, or voltaic solar energy. The basic decisions to be made are not limited to the technical and economic levels, but involve political decisions, since they are determined by the entire society and its development approach.

In this context, a referential development scenario was constructed and analyzed, half way between the two alternatives presented on Table V.1. These opportunities are explored, with a view to determining their potentialities and limitations.

An innovative development style requires profound changes in the country's transportation system, with greater participation of railroad, maritime and river cargo transportation, as well as support for programs aimed at expanding the use of collective transport systems and replacing diesel oil with natural gas, biogas, or electricity in urban centers. According to the Constitution, cities with more than 20,000 inhabitants must have a master plan for urban development, comprising guidelines for the development of integrated transportation systems.

One prerequisite for the installation of infrastructure should be the control of land use, given that the highway system administration is responsible only for the area of public domain immediately adjacent to roads.

4. Sustainable development in the different Brazilian regions

The acheivement of sustainable development consistent with the features of the different Brazilian regions necessarily requires ecological-economic zoning.

In the **Amazon region**, the list of outstanding features includes mineral wealth, hydraulic energy potential on the order of one hundred thousand megawatts, and particularly the exuberance of the rain forest, the main point of controversy and convergence of interests with regard to alternative uses of its riches and socioeconomic development. The current knowledge on ecology indicates that forest ecosystems in Amazônia are very fragile, particularly as regards the relationship between biological diversity and the recycling of nutrients, and emphasizes the importance of the forest for regulating the hydrological cycle.

Various economic and social interests must be harmonized with the need to preserve ecosystems and their biological riches. This does not imply that the Amazon region should be dealt with as an untouchable area, but rather that it should be exploited in a way such

that its regional natural resources may be upgraded, its conservation stimulated, and income generated.

Among the aquatic ecosystems, special mention must be made of the floodland vegetation, which is very productive. The sustainable utilization of the fishing-agriculture-lumber triad must be taken into account, with priority being given to fish production as a source of protein.

In the **Semi-Arid** region, an environmental conservation and recovery program must be urgently adopted for the recovery of certain regions of stunted vegetation known as caatinga. Planting native species and managing their forests is seen as a possible solution, with an appropriate irrigation policy.

Consequently, areas the benefitting from these public actions should be previously purchased or expropriated. Land expropriated by public authorities, as well as that containing soils of superior quality, should be set aside for small rural producers. Land areas requiring sophisticated management should be reserved for companies with the capital and means to make them productive.

In the area known as the cerrado, on the Central-Western plateau, an agricultural and urban expansion process is expected to continue in the short and medium term, due to the increasingly easier access to the region, the expansion and metropolization of its urban areas, growing regional industrialization, the expansion of the mining industry and the intense depletion of resources to meet the demands of the domestic and foreign markets. All these developments tend to reinforce and accelerate the anthropization of the region, deforestation, loss of soil, water pollution, and extinction of the biota. Therefore, there is a clear need to diffuse new production systems to the rural producers, enabling them to absorb available technologies and also in order to avoid actions that can harm the environment. The preparation of a quantitative inventory of the natural resources of the region, particularly its waters and biota, must be accelerated; the areas reserved for in situ conservation of genetic assets must be expanded; programs aimed at the sustained management of biotic resources must be stimulated and guided, particularly in agricultural and lumber-producing properties and also on Indigenous reserves; large fires must be avoided by controlling the accumulation of combustible materials; conservation laws must be revised to upgrade the sustained utilization of natural resources.

In the **Atlantic Forest** region - where the only biosphere reserve in the country is found, the legal and ethical obligation to preserve its primary and secondary remnants is recognized.

An enormous research effort and actions for the recovery of considerable areas of devastated forest are also needed in the Northeast, the southern region of the state of Espírito Santo, the western region of São Paulo and the state of Paraná, to restore river flows, protect water sources, control erosion and reintroduce species into those areas.

Moreover, complementary areas of remnant groups must be recovered, to turn them into continuous forest areas and establish corridors allowing a larger genic flow among populations of plants and flowers.

In 1988, the Atlantic Forest Consortium was created. Today it includes eight states of the Federation, in addition to the Federal Government, and has four main objectives: the protection of biodiversity by the preservation of forest remnants and the implementation of conservation units; the search for sustainable development through the attempt to define and solve the serious economic and social problems of local populations, ensuring their understanding of the importance of protecting the environment; the promotion of environmental information and education, in an attempt to reach large social groups; and the raising of all necessary funds to carry out these activities.

In the Campos do Sul (Southern Plains) region, it is necessary to define and demarcate conservation units, to ensure, among other actions, that studies on alternatives for agricultural activities are carried out only in areas of established potential.

In the **Araucaria Woods** region, a very original area of the country in terms of biodiversity, priority must be given to preserving its remnants, because of their scarcity. It should be added that incentives to the production of artificial forests must be regulated.

In the plains of the **Pantanal** region, in addition to extensive livestock raising that has been practiced since the days of colonization, in relative harmony with the environment, alternatives for the economic use of the region must be developed, in ways that upgrade the environment and the areas characterized by seasonal floods.

Special attention must be paid to the surrounding ecosystems, which play a role in the maintenance of the hydrological cycle of the Pantanal region.

The requirement that every farm must have a legal forest reserve corresponding to 20% of its area is extremely important to the preservation of the genetic diversity of the ecosystems in agricultural and sylvan pastoral activities.

The creation of biological reserves must be promoted, since 12 swampland areas have been identified as priority areas for in situ maintenance of the region's biodiversity.

Ecotourism - An option for sustainable development

In spite of the remarkable natural potential of the country, tourism in Brazil is still an incipient activity.

Ecotourism requires relatively low investments and offers a fast return. By absorbing local labor, it enhances the local inhabitant's utility and contributes to reducing migration. It is also a powerful tool for environmental education, both for those who make their living from it and for those who enjoy it.

No other segment of the tourism industry is expected to grow worldwide as much as ecotourism; the expectations are that in the nineties it will grow twice as fast as conventional tourism. According to studies carried out by the Organization of American States (OAS), there is a large repressed demand for ecotourism in the Amazon, in the most traditional tourist markets.

The integrated tourism development of Amazônia requires certain minimum actions such as the expansion of air transportation in the region, incentives for river tourist transportation, the implementation of a health and basic sanitation infrastructure, and the expansion of jungle accommodations, of which there are presently no more than seven in the entire region.

The implementation of the Ecotourism Project at a national level provides an additional basis for sustainable development. It was planned to ensure that all funded undertakings in this area comply with the environmental laws in force.

5. Agriculture, food safety, and biodiversity

In 1990, hunger and malnutrition affected two-thirds of the Brazilian population as a direct result of the agricultural policy implemented in the past two decades and of the income distribution system. The presence of Brazilian agriculture in the international productive system, as of the sixties, paved the way for modernization, which was characterized by monocultures such as coffee, soybeans, orange, wheat and sugarcane, through two combined factors: greater use of machines and modern tecniques and more intense capitalist forms of production and social structures. These factors led to a higher concentration of land ownership and a marked rural-urban migration, substantially increasing the demand for food products on the domestic market.

Aside from higher hunger and malnutrition rates, the modernization of Brazilian agriculture provoked rapid changes, which unbalanced the environment. Erosion is an example of this process, with its ensuing deterioration, loss of fertility and degradation of the soil.

The process of agricultural institutionalization activities, which was subsidized by the State, led to higher poverty rates and to the destruction of a substantial portion of natural

resources. To revert this situation, changes in agricultural priorities are required, and a new model must be implemented, envisioning a more even distribution of the rural population within the Brazilian territory. This model should give priority to food production, appropriate land management, correct allocation of water resources, and use of appropriate technologies in each region.

To ensure food security, the genetic base contained in plants that are traditionally used as food must be expanded. As a requirement of fundamental importance, the country must look for alternatives through agricultural research in situ and ex situ in conservation systems based on germplasm banks, botanical gardens and genetic reserves.

6. Opportunities for development based on biodiversity

Conservation of genetic resources and preservation of biodiversity focuses on species that may have an impact on the modernization of strategic sectors, such as human and animal health, agriculture and the environment. Another priority consists in ensuring availability of this genetic material, as well as information in its regard, to both present and future generations.

The internationalization of industrial property laws applied to biological products, according to the proposal presented by certain developed countries, will permit the legal appropriation of these resources by the more advanced nations, which have an undeniable advantage over developing countries regarding techniques for the utilization of genetic resources.

It is a known fact today that true control over genetic resources resides in the access to information on genetic materials and the possibility of using them, which is afforded by the mastery of management techniques. Therefore, any industrial property law applied to this area will tend to benefit countries endowed with more advanced management techniques.

Brazil is particularly interested in the international discussions being held on this matter, because of its remarkable biological diversity. Information on biodiversity, at both the scientific and popular levels, is part of the scientific and cultural patrimony of each country; its use should therefore be duly regulated and controlled by the country that possesses it.

7. Tools for sustainable development

In the conception of an innovative development model, the strategy adopted for human resources development plays a central role. It should provide for unrestricted access to basic education and to a generalized awareness of environmental problems.

The development of human resources should be the top priority of all public policies in the social area. Furthermore, the training of educators and professionals in the various scientific fields must be expanded and intensified.

Facing the challenges posed by sustainable development, which is based on new organizational and managerial patterns applied to industrial, agricultural and mining activities and to services in general, also requires the participation of producers in decisions that affect their lives, as an example of the systematic decentralization of decision-making mechanisms which should be emphasized.

Specific policies should be adapted to regional features and to the priority promotion of employment-generating activities, that may assimilate and incorporate technologies aimed at maximizing the use of local energy resources and the development of new products for domestic and foreign markets. Considering the scale of most agricultural and extractive activities, the traditional technologies, subject to gradual improvements, could be efficient and more readily accessible to small rural producers, without disrupting socio-cultural and ecological patterns.

The efforts undertaken to train researchers domestically and to promote exchanges with foreign researchers, who have subsequently remained in Brazilian teaching and research institutions, have made it possible to generate an emerging scientific capability in environmental matters. However, the undergraduate, refresher and postgraduate environmental study programs have maintained a trend towards a marked sectorial orientation, as opposed to the trans-sectorial and multi-disciplinarian approach that this subject calls for.

Besides the need to prepare teachers and researchers for university-level institutions, duly trained on the basis of an integrated view of environmental problems, there is a considerable unmet demand in private companies and in public institutions for intensive training in the field of management of environmental resources and impacts.

In addition to adequate tools, the implementation of sustainable development strategies requires an organizational framework consistent with new management models.

The present crisis faced by the State has introduced a new parameter into public policy, namely the low saving capacity of the public sector, resulting in a comparatively better endowed private sector. Therefore, the discussion of the sharing of responsability must now include both these sectors, and not only the different levels of the public sector.

The effective implementation of a new environmental management system is largely the state's responsibility. The definition of optimal environmental management requires

the sharing of responsibilities between the state and the private sector, non-governmental organizations and society as a whole, not only as consequent to the financial crisis but also as a means of promoting further democratization of the country. The new management system should be decentralized, sharing costs with greater equality. It should also adopt a comprehensive approach, so as to consider both the environmental issue and matters related to economic and social development.

The Federal Constitution establishes principles of decentralization in various areas, including environmental policy matters, and refers to a tax reform that allocates 63% of the total tax revenue of the country to the states and municipalities.

Environment-related matters are central to all the topics addressed. The Constitution deals with them in a complex manner, decentralizing some responsibilities and maintaining others centralized. At any rate, the Constitution represents a remarkable advance towards the institutionalization of matters related to the environment and sustainable development, providing the government and society with the necessary basis for defining an innovative development model.

The implementation of this new form of development, in turn, presupposes the recovery of the capacity of the Brazilian economy to generate savings. With that purpose in view, the fiscal crisis and the foreign debt issue must be tackled, in order to overcome the present impasse, in which the surplus of the balance of payments is used to pay the foreign debt and its service.

Table V.2 shows the main indicators of the Brazilian foreign debt, particularly its impact on the exchange rate and the degree of openness of the economy, which is affected by import restrictions and by ongoing trade deterioration. The fiscal impacts of the foreign debt also deserve special mention, as well as the limitations to the adjustment of assets. The rescheduling of the debt merely reduces the frequency of renegotiations, as charges become eternal and the international banks become rentiers established in the economy of the country, free of risks.

Among the domestic sources of funding for the agencies comprising the National Environmental System (SISNAMA), in addition to budgetary allotments, special mention should be made of the fines applied by the system. However, the lack of feasibility to expand the actions undertaken by these agencies, the inability of the courts to act quickly, and the low sums of money involved in these fines limit these resources.

To increase this revenue, it would be important to use market mechanisms, such as surcharges and fees incorporating environmental preservation costs in private costs by means

of mechanisms such as the polluter-payer principle. Despite the revenue potential of these market mechanisms, external funding is fundamental.

The conversion of foreign debt into environmental projects and, more broadly, into sustainable development projects, is an important alternative for raising funds, for both governmental and non-governmental organizations.

Bilateral loans and loans granted by multilateral credit agencies will continue to be essential for the implementation of environmental and development projects. However, that which may, strictly speaking, be valid for some projects, could be meaningless from a more comprehensive point of view: if the level of indebtedness is to be controlled, there is no new money. The borrowed dollars end up being used to service the debt, and the "financed" projects are in fact funded with cruzeiros, in other words, with domestic savings.

Considering that environmental preservation is an investment, the return of which cannot be easily quantified, often involving global responsibilities, foreign resources for environmental preservation projects should not be subordinated to market conditions. Donations or concessional loans should therefore be emphasized, particularly for projects of a regional scope.

Some alternatives do exist, such as financing exclusively for the environmental area, in addition to the Global Environmental Fund (GEF), which is aimed at supporting projects related to climatic changes, degradation of international waters, loss of biodiversity and destruction of the ozone layer.

Table V.2 - Indicators of External Indebtedness of Brazil

SPECIFICATION	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
A- Registered Debt											
1-Gross Indebtedness	53,847	61,411	70,197	81,319	91,091	95,857	101,759	107,514	102,555	99,285	97,469
2-Internal Reserves	6,913	7,507	3,994	4,563	11,995	11,608	6,760	7,458	9,140	9,679	9,973
3-Net Indebtedness	46,934	53,904	66,203	76,756	79,096	84,249	94,999	100,056	93,415	89,606	87,496
4-Short Term Debt	10,397	12,552	15,106	12,237	10,948	9,268	9,286	13,660	10,914	15,811	24,483
Total Debt (3+4+	62,224	73,963	85,303	93,556	102,109	105,125	111,045	121,174	113,469	115,096	121,952
B- Debt Service (1+2)	14,115	17,800	20,630	12,615	13,070	12,793	13,762	9,762	19,377	12,819	8,284
1-Amortization	6,658	7,495	8,079	2,135	2,135	2,275	3,700	4,219	*5,541	* 5,581	* 4,456
2-Gross Interest	7,457	10,305	12,551	10,935	10,935	10,518	19,062	*5,543	13,838	* 7,237	* 3,819
C- Gross Domestic Product	161,702	170,509	181,996	199,456	199,456	223,167	244,463	263,381	272,865	296,114	298,742
D- Balance of Trade (1-2)	-2,823	1,213	778	11,796	11,796	12,486	8,349	11,172	19,184	16,120	11,052
1-Exports	20,138	23,293	20,175	27,005	27,005	25,639	22,349	26,224	33,789	34,383	31,414
2-Imports	22,955	22,080	19,397	15,209	15,209	13,153	14,044	15,052	14,605	18,263	20,362
E- Indicators											
1-Openness (%D1/C)	12.5	13.7	11.1	12,1	13,5	11.5	9,1	10.0	12,4	11.6	10.6
2-Openness (%D1.2/2xC)	4.4	5.2	5.7	3,5	3,3	2.9	2,8	1.9	3.6	2.2	1.4
3-Trade Ratl (1977=100)	65	55	54	53	58	58	78	71	72	65	
4-Debt Service:Balance (%B/D)		1.467	2652		111	102	165	87	101	80	75
5-Debt Service:Export (%B/D-1)				195							
6-Debt Service:GDP (%B/C)	70	76	102		48	50	62	37	57	37	26
7-Debt:Export (%A-5/D)	9	10	11	58	7	6	6	4	7	4	3
8-Debt:GDP (%A-5/C)				7							
9-Interest:Debt (%B-2/A-5)											
	319	318	423		378	410	497	462	336	335	388
	40	43	47	427	51	47	45	46	42	39	41
	12.0	13.9	14.7	52	10,7	10,0	9.1	* 4.6	12,2	* 6.3	* 3.1
				10,7							

SOURCE: Central Bank - Annual Report, 1990

NOTES: B-1 Exclude payments in Brazilian currency and amortizations financed as of 1983

C-1985 GDP converted by the average exchange rate and currency series reconstructed by the IPR plus U.S. inflation (*) Excluing payments in arrears and bridge loans

Table V.3

Brazil - Financial Flows with Multinational Agencies

US$ MILLION

Specification	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
World Bank										
1- Inflows	387	623	1,204	1,300	760	1,608	900	1,099	903	928
2- Transfers	396	382	449	549	870	994	1,267	1,664	1,784	1,991
a) Amortizations	137	218	273	357	447	479	627	1,048	1,049	1,266
b) Interest	259	164	176	192	293	515	640	616	715	725
3- Net Flow (1-2a)	250	405	931	943	283	1,129	273	51	-166	-338
4- Net Transfers (1-2)	-9	241	755	751	-110	614	-367	-565	-881	-1,063
Interamerican Bank										
1- Inflows	238	328	270	336	454	362	302	343	280	244
2- Transfers	205	197	230	232	291	350	428	410	417	475
a) Amortizations	103	118	137	122	152	172	232	219	248	254
b) Interest	102	79	93	110	139	178	196	191	169	221
3- Net Flows (1-2a)	135	210	133	214	302	190	70	124	32	-10
4- Net Transfers (1-2)	33	131	40	104	163	12	-126	-67	-137	-231
Total										
1- Inflows	625	951	1,474	1,636	1,214	1,970	1,202	1,442	1,183	1,172
2- Transfers	601	579	679	781	1,161	1,344	1,695	2,074	2,201	2,466
a) Amortizations	240	336	410	479	629	651	859	1,267	1,317	1,520
b) Interest	361	243	269	302	532	693	836	807	884	946
3- Net Flow (1-2a)	385	615	1,064	1,157	585	1,319	343	175	-134	-348
4- Net Transfers (1-2)	24	372	795	855	53	626	-493	-632	-1,018	-1,294

Source: Central Bank of Brazil

Conclusion

The 1992 Conference and the Prospects for Sustainable Development

The harmonization of economic and environmental goals in countries with an advanced capitalist system depends on technologies capable of transforming industry and current means of transportation into systems that use fuels and raw materials in a highly efficient manner, and which are based on inputs of low environmental cost, producing little waste. Therefore, closed technological systems must be created, that is, systems with as little dependance as possible on natural resources.

Ongoing technological changes rely on advances in the fields of biotechnology, informatics and research on new materials. For developing countries, which are basically exporters of commodities, the scenario of inaccessible technological systems represents a bleak prospect.

Countries in the South have only advanced modestly in conquering new technologies. To have access to them, usually in the private sector of the developed countries, they must pay royalties and assume commitments of a financial, commercial and, at times, political nature.

Therefore, technological solutions for environmental problems being proposed by industrialized countries raise questions regarding the very role of developing countries in the international economic system in the future. The traditional role of commodity suppliers, which is already inadequate to meet basic development requirements, is in itself at stake. The emergence of new technologies clearly highlights the need to undertake concentrated domestic efforts with a view to developing advanced and nonaggressive technologies, and to foster

international commitments aimed at facilitating access to technologies from the industrialized countries.

A thesis which is only starting to be disseminated, defends the notion that both the intrinsic cost and the cost for the preservation of natural resourses should be taken into consideration, and not only the costs involved in their extraction, such as labor, equipment and technology. With a few exceptions, foreign marketing and the mechanisms used for setting international market prices of natural resources - as industrial inputs or food products - are not controlled by developing countries, where they are found on a larger scale.

The simultaneous occurrence of a financial crisis and an environmental crisis was particularly harmful to certain developing countries more affected by imbalances in their external accounts. While they became net capital exporters, additional expenditures were demanded of them to protect the environment. The burden of the service of the Latin American, Asian, and African foreign debts which amount to US$ 1.3 trillion, is equivalent to almost half of their collective GDP. The net capital transfer from the South to the North amounts to more than US$ 40 billion a year.

Some of these countries exploit their natural resources more intensely, although not always appropriately, to boost their often decreasing export earnings. This situation is further aggravated by the protectionist barriers imposed by developed countries, which account for a loss of about US$ 100 billion a year in the trade balance of the developing countries, that is, twice as much the official aid they can count on to implement development projects.

In Brazil, there have been substantial changes in the way environmental issues are dealt with from the political, legal and institutional points of view. However, from the economic, financial, scientific and technological standpoint, structural matters have impeded the fulfillment of short term expectations. Restrictions on public spending, measures taken to control inflation, and the burden of the foreign debt are some factors which considerably limit any large-scale action by the Government.

Actions aimed at correcting environmental damages have a concomitant effect on the socioeconomic sphere. In addition to favourable political conditions and political will, investments in infrastructure, as well as social investments, are required to correct environmental distortions. It is important to stress that an economic model that guarantees growth while not placing undue pressure on natural resources is yet to be tested on most ecosystems in Brazil and in the world at large.

Problems inherent to developing countries are often amplified in Brazil, due to the unique features of the country. Having the largest reserve of rain forests on the planet, the heterogeneity of its ecosystems, its biodiversity, the existence of huge mineral deposits in its subsoil and the presence of rivers capable of providing energy and food within its territory are among the remarkable assets of the country, and constitute at the same time challenges that cannot be ignored by politicians, planners and scientists.

In contrast with what happened in the developed countries, the assessment of damages caused to ecosystems by the occupation of new spaces in Brazil was almost concurrent with the discovery of the greenhouse effect and the deterioration of the ozone layer. The developed world occupied its available spaces a long time ago, consumed a substantial part of its natural resources and, directly or indirectly, contributes to the exhaustion of the natural resources of the developing countries.

Also, there are only few developing countries which theoretically still dispose of available space to be occupied or enjoy the economic means to promote this occupation at a large scale. None of them, however, have so many areas and such a huge biological diversity to be investigated, surveyed, and finally preserved or used as Brazil.

Because of these features, the environmental problems in Brazil have a global dimension and demand the country's compulsory participation in multilateral efforts aimed at finding solutions to the planetary imbalances of the environment.

The topics that make up the global agenda present a challenge to Latin America as a whole, and to Brazil particularly, in an unprecedented way. The environmental crisis coincides with a period in which the region is facing an equally unfavourable situation in many other areas. Development cannot be resumed without strengthening democracy; but, at the same time, there is a need to stabilize the economy - that presupposes a solution to the foreign debt issue - a need to insert the economy into the worldwide stream of technological interchange, to implement more austere and socially equitable standards of consumption, and to improve the distribution of income. Any development alternative if it is to be durable must be environmentally and socially sustainable; that is, it must focus on the basic needs of present and future generations, as well as on preserving the current stocks of resources.

Finding solutions to the world crisis demands new forms of cooperation and coordination among the countries of the region, since the more developed countries are permanently inclined to coordinate their own action so as to define and defend their interests. In contrast with the foreign debt negotiations, which destroyed the basis for multilateral

negotiations by privileging one-to-one dealings between creditors and debtors, the environmental problem can only offer new opportunities to the countries of the region if they learn to act together. There can be no breakthrough through bilateral negotiations on these problems, because it is impossible to individualize a reality that ignores national boundaries, a fact that the developed world perceives very clearly.

This means, for example, that we should carefully examine proposals aimed at introducing credit restrictions in international financial organizations, imposed upon developing country projects under the pretext of environmental criteria. These criteria must originate from political decisions of the society in question; they should not be imposed on any society, lest they end up being used for manipulative purposes in the complex spectrum of power politcs among countries, typical of the present world order. For this reason, new modalities for the transfer of resources and technology must be devised so as to overcome the adverse effects of the crisis by means of negotiated strategies.

Moreover, the environmental crisis calls for the reconstruction of the institutional framework that permeates international relations. The old framework precedes the present consensus, as it belongs to a time when the interdependence that characterizes contemporary society at the end of this century had not been perceived, a time when there was a belief in the possibility of compartmentalizing problems (energy, health, poverty) through bureaucratic mechanisms. The time has come to internationalize the intergovernmental organizations, which in practice tend to crystalize the distribution of power among nations.

Again, multilateral initiatives are required in this context to prevent the consolidation of proposals aimed at establishing supranational authorities to supervise the use of natural resources. For example, decisions on the use of common areas, such as the oceans, are still being taken by a handful of countries, which is confirmed by that fact that many developed countries have not adhered to the United Nations Convention on the Law of the Sea, and are resisting the adoption of effective mechanisms to make possible the creation of a convention on transborder movements of toxic residues.

The United Nations Conference on Environment and Development, as a political-diplomatic meeting at the highest level, should lay the foundations for new parameters of international cooperation, with the aim of correcting environmental imbalances that threaten the planet. Lasting solutions to global problems require the participation of the whole international community, according to the responsibility of each country for the generation of these problems and their resolution, and to the individual financial and technological capacity to resolve them.

To be lasting, these solutions must necessarily incorporate the conceptual advances of the eighties, particularly the principle of sustainable development. How can the objective of "sustainability" of economic policies be attained both in developed and developing countries, while making way for the eradication of poverty and doing away with unsustainable patterns of production and consumption? This is what will be discussed at the Rio Conference.

The institutional and legal basis for dealing with the environmental issue - a Governmental responsibility - improved significantly in various countries in the world after the 1972 Stockholm Conference, with regard to specific topics. However, national environmental policies, even when there is a legal-institutional basis and community participation, have not been adequate for dealing with global problems, as they lack sustainable models and appropriate technologies or financial resources. In this context, the Interamerican Development Bank and the Economic Commission for Latin America and the Caribbean believe that Latin America and the Caribbean have a deficit of investments of the order of US$80 billion a year, due in part to the foreign debt problem and to the deterioration of trade.

These facts demonstrate the need to devise new strategies so as to make sustainable development models feasible, and reveal the need for the urgent adoption of new patterns in the relationship among nations, particularly in the technological and financial areas. This includes of course the private sector, because of its important role in the generation of technologies and in the international financial system. It is necessary to promote a new ethic based on the premise that progress can only be attainable in the long run if it is conceived as a process allowing all peoples to fulfill their aspirations for a sustainable development.

On the other hand, transferring environmentally appropriate technologies requires an innovative approach to the question of intellectual property, as the basis for creating a legal framework which might effectively further the access of developing countries to the technological advances of the industrialized world.

In contrast with the 1972 Stockholm Conference, which was dedicated to the human environment, the United Nations Conference on Environment and Development will seek to deal jointly with the environment and with development, and to promote discussions, from a new perspective, on all the claims of developing countries placed before international economic forums since the sixties. These justifiable claims should not be seen as an exercise in North-South confrontation. They should be considered as attempts to seize this unique opportunity to reformulate the international system at a crucial time in history, and to make possible the survival of humankind on a fairer and more equitable basis.

Annex

The Environment and International Negotiations

The United Nations Conference on Environment and Development should serve as a universal forum at the highest level, for the definition of forms of cooperation that ensure the reconciliation of the two terms expressed in its title, which, usually, seem mutually antagonistic.

For developing countries, which represent three fourths of humanity, the reconciliation of development with the elimination of poverty in this phase of systematic environmental crisis will be carried out through discussions on certain fundamental issues, both domestically and in international forums on the environment. Among the developed countries, discussions will focus on the manner through which changes are to be introduced, regarding industrialization and standards of consumption in face of environmental imperatives, without causing serious economic imbalance.

The world faces the following alternatives: it either perpetuates the current model, with intensive consumption of natural resources by the more developed countries, allowing their population a high degree of consumption, in stark contrast with the scarcities found in the developing world; or it reexamines this pattern, in favour of a model that places less pressure on the natural resource base and permits more balanced levels of development.

This latter model presupposes a new international division of labor, a profound industrial reconversion, the alteration of consumer habits in the developed countries and greater international solidarity, capable of creating access to scientific and technological advances for developing countries.

1. The 1972 Stockholm Conference

In 1968, the United Nations General Assembly convened a Conference on the Human Environment, which was to be held in 1972. Its main proposal was to encourage action by Governments and international agencies, and to provide guidelines for the protection and improvement of the human

environment through international cooperation. Environmental problems, understood as air, water and soil pollution resulting from industrialization, should be corrected; the developing countries ought to be provided with the instruments to prevent environmental evils.

Two elements comprised the Brazilian pronouncements since the preparatory stage of the Conference: concern with the possibility that the environmental issue could lead to interference in internal affairs, and criticism of the stance adopted by developed countries.

The Brazilian delegation to the XXV General Assembly (1970) proposed that international cooperation include improved terms of trade and additional technical assistance and funding from the North to the South, for solving the environmental imbalance in developing countries. The Resolution, as formulated by Brazil and adopted then, further recommended the inclusion in the agenda of the subsequent Preparatory Meetings of specific items regarding social and economic issues, to safeguard and promote the interests of the developing countries and to allow them to reconcile their national environmental policies with national plans for development.

Other elements included concerns regarding the possibility that developed countries might impose non-tariff barriers on exports from developing countries, the directs adoption of environmental criteria, and preoccupation with the developing economics' capacity to absorb environmental costs in their price structure for products.

In the pre-Stockholm period there was also a proposal to transfer environmental technologies to developing countries at a favourable price, since the balance of payments of those countries had been overburdened with the cost of patents and royalty payments.

It was also during this phase that a proposal from some developed countries was put forth, placing natural resources under the administration of a world trust to be shared by all humanity.

The Brazilian delegation vigorously opposed this proposal, based on the argument that the international community should have a single framework for all aspects and sectors of the life of nations. The developed countries' proposal to share natural resources which fell under the national jurisdiction of other nations, without offering in return to share the economic and financial power that they exercised over the international community was inadmissible.

The Panel of Experts on Development and Environment, held in Founex, Switzerland, in which Brazil took part, revealed with precision the divergence of opinion between developed and developing countries.

For the former, development was the cause of environmental problems. For the latter, it would be the vehicle for correcting environmental and social imbalances. Improvements in the quality of the environment in developing countries would depend on better conditions in the fields of health, education, nutrition and housing, attainable only through economic development. Environmental considerations, therefore, should be incorporated into the process of integrated development.

Correction of environmental imbalances and protection of the environment should fall under the responsibility of developed countries. The priority commitment of developing countries should continue to be that of accelerated development.

The Founex Report was of fundamental importance in consolidating the conceptual underpinnings that would be discussed at the 1972 Stockholm Conference. Consideration of environmental questions as inherent to the process of development broadened the very concept of development itself.

Nowadays, the industrialized countries'line of argument includes many concepts put forward by delegations from developing countries in the 1972 Stockholm Conference. The international community not only began to admit the link between development and the environment, but also began to acknowledge, as a result of scientific evidence, the greater responsibility of developed countries regarding the contamination of the planet.

Building on the conclusions of the Founex meeting and of the 1972 Stockholm Conference, the Brundtland Report developed the idea of sustainable development, understood as a process of change in which the use of resources, targets for investment, orientation of technological development and institutional changes bring about the potential for meeting present and future human needs.

Sustainable development could be achieved by the resumption of growth and better distribution of its benefits, by rationalizing energy use and meeting the basic needs of populations, by stabilizing demographic levels and conservation of resource bases, by reorienting technology to reduce its ecological impact and by incorporating environmental criteria into economic decisions.

Developing countries were eager to point out the risk that the objective of sustainable development might pose in practice: a real reduction in the resources required for the implementation of programmes and projects defined in terms of national priorities. Therefore, in contrast with environmental conditions imposed by bilateral programmes and multilateral agencies, they have been promoting the idea of additional resources, furnished under favourable conditions, for the implementation of their environmental policies. From the Brazilian point of view, the concept of sustainable development cannot be regarded as a mere transfer of environmental conservation standards and models from the industrialized countries to the developing world.

While the attitude of the industrialized countries has substantially changed, the concrete effects of such a change have still not been translated into reality. Since 1964, the date of the First United Nations Conference on Trade and Development (UNCTAD), all multilateral efforts have fallen short in the attempt to accelerate the development of the countries of the South and to reduce the differences between the economic situation of the rich and the poor. The United Nations Decade for Development, the 1975 Paris Conference on North-South Cooperation, the North-South Dialogue and the New International Economic Order have done no more than set forth well formulated ideas without any practical results, because they were unable to bring about structural reforms in economic-financial and political relationships among nations.

The change in the perceptions of industrialized countries and the improvement in the economic conditions of certain developing countries do not mean that the international economic problems from past decades have been overcome. As the Brundtland Report states, little has been done regarding old issues, such as the recovery of terms of trade and a new and more desirable international division of labor. The flow of financial concessions for developing countries continues to be limited, and technology transfer is more associated to

the strategies of multinational companies than to the interests of the less developed nations.

2. The United Nations Conference on Environment and Development

Twenty years after the presentation of the Swedish proposal for holding a Conference on the Human Environment, the XLIII United Nations General Assembly (1988) adopted Resolution 43/196, which determined that a conference on environmental issues should be held by 1992; it suggested that, among other aspects, the meeting assess the trends in policies and actions of nations and international organizations for protecting and improving the environment, in addition to examining how environmental criteria have been incorporated into policies and economic and social planning since the 1972 Stockholm Conference.

The principle that developed countries have a larger share of responsibility for the degradation of the environment was mentioned for the first time in this resolution, approved by consensus. At the XLIV Session of the General Assembly session, Brazil offered to host the Conference.

Resolution 44/228, adopted by the XLIV General Assembly (1989), decided that the United Nations Conference on Environment and Development would be held in Brazil, coinciding with World Environment Day (June 5), and would last for two weeks.

The Resolution further reaffirmed that the foreign debt of developing countries' should be approached in an efficient and urgent fashion, so that these countries might be enabled to contribute fully to the global efforts for environmental protection.

During the United Nations General Assembly meeting of November 12, 1990, the Secretary General of the upcoming Conference, Maurice Strong, gave a speech in which he outlined the following results expected from the United Nations Conference on Environment and Development, to be held in 1992:

- Conventions, particularly on climate, biodiversity and possibly forests;
- A Charter or Earth Declaration which would establish the principles of basic conduct for nations in their mutual relationship and in their relationship with the earth;
- An Programme of Action (Agenda 21), which would contain concrete measures for implementation of the principles of the Charter, integrated into a working programme internationally agreed upon for the period extending from the Conference until the 21st Century.

The Conference should also focus on the necessary means for the adoption of Agenda 21, such as:

- New and additional funding for developing countries, aimed at permitting them to integrate the environmental dimension into their plans for development, including the additional cost resulting from the fulfillment of international agreements of an environmental nature;

- Access by developing countries to environmentally sound technologies, including the offer of concessions and preferential treatment, thus reinforcing the capacity of these countries to absorb and use such technologies;
- Strengthening of institutions dedicated to the environment, of environmental agencies, and of development institutions and agencies.

2.1 The Tlatelolco Platform on Environment and Development

As with the preparatory stage for the 1972 Stockholm Conference, the General Assembly Resolution 44/228 provided for preparatory meetings on the environment and development in every region, and integration of the results of such meetings into the process for the 1992 Conference. The Latin American & Caribbean Regional Preparatory Meeting for the United Nations Conference on Environment and Development was held in Mexico City in March, 1991, when the Tlatelolco Platform on Environment and Development was adopted. The document includes the position of countries in the region regarding issues that will be part of the United Nations Conference on Environment and Development's Agenda.

The Platform expresses concern over the deterioration of global ecosystems that has occurred since the 1972 Stockholm Conference, linked to models of unsustainable development that prevail especially in the developed countries.

The document highlights the importance of consolidating democratic movements in the region, and recognizes that the causes for their social and economic problems, including the foreign debt, persist, which increases poverty and deteriorates the quality of the environment. Thus, it is only when the foreign debt issue has been resolved that the region will be able to achieve sustainable development from the environmental, economic and social points of view.

With regard to the financial aspect, the Platform foresees the creation of a special fund, to furnish new and additional concessionary funds to developing countries for the implementation of environmental programmes, priorities and plans. Contributions to this fund must not affect current funds allocated to international cooperation for economic development. Eligibility criteria for programmes and projects to benefit from this fund must not be based exclusively on the criterion of per capita income, which is currently applied by multilateral lending institutions.

The Platform incorporates the thesis that national accounts should follow new criteria, which consider activities responsible for soil erosion and for air and water pollution and the decrease of forests and living resources as capital depreciation, and not as increases in national income. Also expressed was the conviction that environmental and social costs of activities in the productive sector must be taken into consideration, to ensure harmonization of national instruments for environmental protection with economic and financial policies.

The following issues are considered as important to the region, and should therefore figure in the agenda for the United Nations Conference on Environment and Development:

Protection of the atmosphere and climate change

The Convention must consider the relative responsibility of countries that produce gases related to the greenhouse effect and of countries possessing drains for these gases; the obligations of each must be determined, according to the respective contribution of each to a solution to the problem of climate change. On the one hand, the convention must admit the primary responsibility of the developed countries for the effects of transboundary pollution. On the other, it must recognize the need for developing countries to benefit from their natural resources in a sustainable way, so as to improve the standard and quality of living of their peoples.

Biodiversity and biotechnology

The region must promote, in international fora, the preparation of legal instruments to protect its genetic heritage, and for trade regulation of the genetic base. The advances made in biotechnology and the economic potential of biodiversity make international agreements necessary to establish transparent mechanisms, subject to the express consent of the country possessing the genetic resources, with respect to their commercial exploitation and scientific use. These mechanisms must explicitly guarantee the fair distribution of the benefits of exploitation and use. Developing countries must have access to biotechnological progress, on a concessionary basis, and to information related to the biological and ecological security of the technologies already developed. The Convention on this issue must include obligations to conserve biodiversity, and cover the benefits derived from biotechnology.

Protection and management of Earth's resources

The economic and ecological potential of forest ecosystems must be the central issue in discussions on agreements relating to multilateral measures for the protection and sustainable management of such ecosystems. These measures must supplement international instruments under negotiation regarding the climatic effects of forests, and concerning the aspects of forests as repositories of biodiversity.

Multilateral measures must provide for enhancing the economic value of forest resources available to those who depend on them, and provide for the formulation of strategies for rational use, protection and recovery of these ecosystems, with participation by local communities. International cooperation agreements on the matter must include mechanisms for technology transfer and funding.

Forestry management must be the primary objective of activities that prevent deforestation. Saleable timber and non-logged forest products to be sold must be obtained through forestry management, according to criteria established by the countries possessing forests.

Soil degradation

Degradation, acidification, erosion and salinization of soils affect all the countries of Latin America in different ways, as a result of inadequate farming techniques and soil abuse, whether to maximize profits over the short term or to ensure survival. Degradation is compounded by current techniques of intensive exploitation of the soil.

Protection and management of oceans, seas and coastal zones

Degradation of marine and coastal resources due to irrational exploitation and contamination constitutes a serious problem for the countries of the region. Programmes related to regional seas (in the Caribbean and Southeast Pacific) and other regional cooperation programmes, such as the South Atlantic's, must be reinforced. Measures for scientific, technological and financial cooperation are proposed by the Platform, as well as actions for controlling marine pollution and commercial exploitation of resources.

Protection of the quality and supply of fresh water

A proposal is presented for setting up management and administration plans for basins and regional conservation programmes and integral development of water resources, guaranteeing sustainable development in national and international basins, as well as research and monitoring programmes to reduce or eliminate river pollution.

Eradication of poverty in human settlements

It is considered indispensable at the internal level to resume growth and to foster the promotion of structural reforms and reformulation of economic and social policies to provide the population with adequate health and education services, as well as better housing conditions in both urban and rural areas. On the external level, it is indispensable that there be cooperation in the areas of trade, foreign debt, and transfer of additional financial and technological resources.

Urban development and the environment

In order to eliminate urban environmental deterioration in Latin America and the Caribbean cities, the financial mechanism for sustainable development should, at the very least, give priority to improving housing and infrastructural conditions, eliminating solid and liquid wastes and dealing with air pollution.

Mechanisms for monitoring and controlling the illicit traffic of toxic substances, wastes and dangerous products, supplementary to the Basel Convention, must receive priority attention. A mechanism must also be set up to prohibit the marketing, in developing countries, of products, processes and dangerous substances banned in their countries of origin.

2.2 Sectoral conventions

Protection of the ozone layer

The Vienna Convention (1985), in its preamble, restates Principle 21 of the Stockholm Declaration, which became the basis for research and subsequent control actions regarding transboundary air pollution. The objectives of the convention are to protect human health and the environment against the adverse effects resulting, or possibly resulting, from activities that modify or could modify the ozone layer.

The first Protocol concluded at the Vienna Convention was adopted at the Conference of Plenipotentiaries held in Montreal, September 14-16, 1987, according to a decision of the UNEP Governing Council. The preamble of the protocol reiterates the determination to protect the ozone layer by worldwide measures to control emissions of substances that could deteriorate the ozone layer. It sets as an objective the elimination of these substances, and introduces the notion that in the process, economic considerations should be looked into. The other signatory countries committed themselves to gradually reduce production and consumption to 50% of the 1986 level by 1999. With regard to halons, the commitment was to lower production and consumption to 1986 levels by June 30, 1993.

The Second Meeting of the Contracting Parties to the Montreal Protocol on Substances that Deplete the Ozone Layer concluded the stage of revision of the protocol in a manner favourable to the protection of the ozone layer and to meeting the demands of developing countries.

Brazil adhered to the Vienna Convention and to the Montreal Protocol on March 19, 1990 - following approval of the respective texts by the National Congress - since it considered it politically important to participate in the international effort to contain the damage to the ozone layer. Brazil also thought it fitting to participate in the negotiations then under way for revising the protocol, and that came to define mandatory mechanisms of financial and technological cooperation for developed countries. Since the technological and commercial benefits resulting from the protocol were restricted to the contracting parties - agents of acceleration of technological progress - it was considered necessary to provide Brazilian industry with refrigeration, compressor production, foaming, electrical and electronic equipment and components, computers, and access to these technologies and market advantages.

There are important economic interests involved in the reduction of CFCs and halons. For example, the world market of CFC's for refrigeration is estimated at one billion dollars a year. The costs of industrial adaptation and

development of capital goods for emission of new substances, just in the USA, would be on the order of US$135 billion.

The Convention on Climate Change

The First Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) included most of the theses from the developing countries, including the theory whereby reducing the differences between the industrialized and developing countries would enhance the treatment of climatic issues.

The Convention should provide for general obligations, such as:

- The adoption of means for limiting and reducing climate change (which would be justified as well by other non-environmental considerations) and of means of adaptation, according to the capacity of each country;
- Protection of the atmosphere and stabilization and improvement of its conditions;
- Encouragement of relevant technology transfer, and technical and financial assistance so that developing countries may fulfill the obligations to which they have committed themselves;
- Provisions for funding mechanisms and for technology development and transfer.

The Convention was also to contain a chapter on institutional mechanisms, research, information and exchange of reports, in addition to the solution of conflicts.

The Second World Climate Conference adopted a Declaration that reiterated the recommendations of the IPCC report and affirmed that from a technical point of view, there are cost-effective measures for reducing carbon dioxide emissions into the atmosphere by anthropogenic causes, especially in the industrialized countries, which are responsible for 75% of the emissions of this gas. These measures are concentrated in the energy sector (increased efficiency and use of alternative sources).

The Declaration recognized that the developing countries are being called in to alleviate a legacy of damage to the environment that they did not cause. If they wish to avoid the disastrous course taken by the developed countries, they must adopt modern technologies before they move down the same road of industrialization, in particular with respect to energy efficiency. Thus, the developing countries will only be able to contribute to lessening the changes in the climate to the extent that they have access to clean technologies, now available only in the more industrialized countries.

The document also acknowledged the need for the developing countries to be able to count on additional funding to implement strategies for mitigating climate change.

Financial commitments and mechanisms and means for transfer of technology to developing countries, as well as international scientific and technological cooperation, will be integrated elements in the negotiations.

The Convention must cover, in an integrated fashion, emissions, sinks, technology transfer, financial resources and mechanisms for developing countries, scientific and technological cooperation and measures for counteracting the effects of climatic changes and their possible adverse impact, particularly on developing countries.

As the host country for the United Nations Conference on Environment and Development, the Brazilian Government is interested in seeing that the Convention on Climate Change be signed, as expected, in Rio de Janeiro, and that it contain provisions along the lines of the elements pointed out in the first IPCC Report, and repeated in meetings after publication of that document.

Biodiversity Protection

Protection of biodiversity has, in recent years, been the object of the attention of several specialized United Nations agencies and non-governmental organizations, closely linked to the protection of tropical forests. Besides being more heterogeneous than the temperate or boreal forests, they nowadays cover greater areas than forests of other climatic zones, despite the devastation rate of 11.5 million hectares per year, according to FAO.

The protection of biodiversity is, however, only one side of the question. Just as important as the preservation of genetic diversity is its use as the basis, through biotechnology, for advances in health, agriculture, food supply and many other fields. Biotechnological expertise is heavily concentrated in the developed countries of the temperate zone, which reap the greatest economic benefits from this knowledge.

The eventual convention and its protocols should be supported by a fund to finance projects for the preservation of biodiversity, so that resources will flow from those who have the technology to those with the genetic resources. Aspects such as the cost of conservation, access to genetic resources, intellectual property and biotechnology had to be discussed prior to the beginning of negotiations. To take up these issues a working group of legal and technical experts was formed and met in February, 1991, in Spain, with the work group objective of drawing up the first draft of the convention. During the meetings of the ad hoc working group, the issue of "free access" was brought up, even if remunerated, to germplasm banks, based on the principle that biodiversity is the common heritage of humanity, in contrast to the Brazilian thesis of access to biodiversity regulated by agreement, at the discretion of the country possessing it.

Preservation of biological diversity and biotechnology requires innovative regulation, with the objective of inaugurating, within the context of international economic relations, a new stage in the equitable distribution of benefits between the holders of genetic resources and preserved raw material, on the one hand, and those who have technological benefits assured, mainly because of the genetic resource base, on the other. It would be appropriate to establish mechanisms to ensure participation by countries holding genetic resources in the development and application of technologies related to these resources, even if such technologies originate in the private sector of developed countries.

Among the aspects discussed by the ad hoc working group, the idea of compensation for the use of germplasm was introduced: countries interested in obtaining genetic resources would compensate the holders of such resources for their conservation and would be ensured, in turn, to access them freely. Brazil considers that the incorporation of this concept into the future convention would explicitly define an asymmetrical relationship aligning "holders" against "users" of biodiversity, and would attribute an assistance character to the issue, to the detriment of fundamental aspects such as the rational use of biological resources, and easier access to biotechnology by developing countries.

In contrast to the idea of compensation, the notion of biological diversity preservation is proposed as a "service" within the context of a relationship that would not necessarily be asymmetrical. That is, the holders of genetic heritage would provide a service in conserving it, which would be remunerated; and those interested in using such heritage would assume the costs of its preservation in the owner country.

In this calculation of costs, a broad approach must be used, taking into account the non-commercial value of biodiversity, such as the quality of life, mitigation of climatic changes and the quality of the air and water, etc. Not only would the issue of level definition be subject to negotiation, but the modes of remuneration and the respective division of responsibilities as well.

One of the issues that has come to the attention of the Brazilian group is the relationship between intellectual property rights, on the one hand, and access to biological resources and biotechnology, on the other. The question of intellectual property is the object of intense internal debate, both due to the need for an adequate Code of Intellectual Property relating to the new guidelines for Brazilian industrial policy, and as a result of the progress of discussions on this issue at the World Intellectual Property Organization (WIPO) and at the Uruguay Round.

A legal instrument for forests

Developed countries have presented multilateral proposals regarding the forestry issue, outside the context of the Convention Framework on Climate. The convention would be the framework for international cooperation to, among other purposes, undertake an inventory of world forestry resources, monitoring the forests of the world by an international communication network, and promoting programmes for the protection of forests by debt conversion arrangements, with the support of multilateral lending agencies.

There is consensus that this instrument must cover the temperate and tropical forests, the sustained exploitation of forest resources, the protection of biodiversity and trade barriers. There are, however, differences regarding the form and legal nature of the document.

The position of the Brazilian delegation on the issue has been that protection of the forests should not be focused on a reductionist view of the mere preservation of the forest cover. Rather, it should be integrated into a broader scope of considerations of a financial, technological, commercial, agricultural, energy and social nature.

Unilateral measures by the countries possessing forests are not sufficient to stop degradation and clearing, either in the developing or the developed countries. In the latter, the adoption of policies for the reduction of acid rain would be indispensable for reducing forest degradation. It is necessary to enhance the value of forest resources on international markets, to ensure their protection and sustainable management.

The negotiating forum is an ad hoc group of the Preparatory Committee for the United Nations Conference on Environment and Development.

Transfrontier shipments of hazardous wastes

The transportation of dangerous merchandise has been calling the attention of governments since the 1950's. In 1957, the United Nations created the Committee of Experts on the Transportation of Dangerous Substances. The committee made recommendations that have not, however, been sufficient to eliminate the transboundary movement and deposit of toxic substances, especially in the North-South direction. Between 1986 and 1988, industrialized countries shipped over three million tons of hazardous waste to Third World countries.

The transportation of dangerous substances to developing countries has intensified in direct proportion to the establishment of more rigorous and costly regulations and standards for waste disposal in the industrialized countries. The shipping of waste to developing countries and the construction of deposits in the Third World, where standards and regulations are often more flexible, have become options that are economically attractive to various multinational conglomerates.

The XLIII United Nations General Assembly ratified the preparation of a global convention and of a document, Resolution 43/212, on the prevention of illicit shipment and disposal of toxic and hazardous products and waste, which demanded the Sates to take legal and technical measures necessary to prevent illegal international traffic, disposal and accumulation of toxic products and waste; prohibition of transfrontier movements without previous authorization of the importing country; to increase cooperation enabling developing countries to manage adequately generated toxic waste.

In March 1991, the Basel Convention on the Control of Transfrontier Shipments and Final Disposal of Hazardous Waste, 198 (Basel Convention) was adopted, establishing, in its introduction, that a State has the sovereign right to prohibit the entrance or eliminatation on its territory of waste generated in a third country; hazardous waste must be eliminated in the State of origin; the elimination of hazardous waste in countries that did not generate it, especially in developing countries must be withheld; and States must exchange information on transboundary movements of hazardous waste. The countries that want to adopt this decision must inform the other countries that have ratified the convention.

Brazil has actively participated in the ad hoc work group and in the Conference of Plenipotentiaries, held in Basel. The statement of the Brazilian participants to the Conference of Plenipotentiaries expressed their concern with the fact that the control established by the Convention was not as strict as was to be desired for such an important issue, to the extent of considering that some States should use it as an instrument to legalize and facilitate the trade of waste.

Brazil's position, and that of other developing countries, is based on the fact that the Convention enables the export of dangerous substances even without the explicit agreement of the importing country. According to the convention, the responsibility of eliminating illicit hazardous waste rests on the importing country, which is a developing country as a rule, without any laws on civil responsibility and indemnity, assuring the reimportation obligation by the country exporting illegally transferred waste. It merely establishes a 30-day period for reimportation. Should an illegal exporting country declare that reimportation is "unfeasible," waste disposal must be processed " in a balanced manner, from the environmental point of view," an expression that has not yet been defined.

Thus far, countries that generate most of the hazardous waste have not signed the Convention, although its text does not contain commitments to reduce the generation of such substances.

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