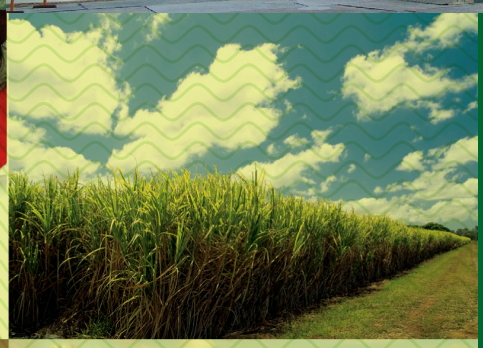









Chapter 1

Priorities for National and Regional Development

1 Priorities for National and Regional Development

1.1 Characterization of the Territory

Brazil is located in South America between the parallels of latitude 5°16'20" north and 33°45'03" south, and the meridians 34°47'30" and 73°59'32" west of Greenwich. Its geodesic center is located at the coordinates 10°35' south latitude and 52°40' west of Greenwich. The eastern limit is the coast of the Atlantic Ocean, and it has several oceanic islands, with a special mention to Fernando de Noronha, Abrolhos and Trindade. To the north, west and south, Brazil borders all South American countries, with the exception of Chile and Ecuador. The country is crossed by the Equator and the Tropic of Capricorn, with most of its lands located in the lower latitudes of the globe, giving it the characteristics of a tropical country.

With an area of 8,514,876.6 km^2, Brazil is the largest country in South America, and the fifth in the world. Its territorial dimension characterizes it as a continental country, since its territory occupies 1.6% of the earth's land mass, 5.7% of the planet's emerged lands and 20.8% of the American continent's surface.

The Federative Republic of Brazil is divided into 26 states, 5,565 municipalities (IBGE, 2009a) and the Federal District, where the capital of the Republic, Brasília, seat of the government and the executive, legislative and judicial branches, is located. The country is governed under the Federal Constitution of 1988.

Brazil has a presidential system where the President of the Republic is elected by direct and secret ballot for a four year term. Re-election for a single consecutive term is permitted for the President of the Republic, governors and mayors. It has a bicameral system exercised by the National Congress, with two representative houses: the Chamber of Deputies, with 513 federal deputies, who represent the population; and the Federal Senate, with 81 senators of the Republic, who represent the states (the units of the Federation).

The vastness of Brazil's territory, in latitude as well as longitude, is home to an extraordinary mosaic of ecosystems, along with extensive climatic and topographic diversity. Throughout its history, these characteristics have determined the various forms of occupation and use by society of the spaces shaped by the country's tropical and subtropical nature, forming, in general terms, five large geographic regions: North, Northeast, Southeast, South and Central-West (Figure 1.1). Each is cited below with their respective states or districts:

- North Region – occupies 45% of national territory, and it is comprised of the following states: Acre - AC, Amapá - AP, Amazonas - AM, Pará - PA, Rondônia - RO, Roraima - RR and Tocantins - TO.

- Northeast Region – occupies 18% of national territory, and it is comprised of the following states: Alagoas - AL, Bahia - BA, Ceará - CE, Maranhão - MA, Paraíba - PB, Pernambuco - PE, Piauí - PI, Rio Grande do Norte - RN and Sergipe - SE.

- Central-West Region – occupies 19% of national territory, and it is comprised of the following states: Goiás - GO, Mato Grosso - MT, Mato Grosso do Sul - MS and Distrito Federal - DF.

- Southeast Region – occupies 11% of national territory, and it is comprised of the following states: Espírito Santo - ES, Minas Gerais - MG, Rio de Janeiro - RJ and São Paulo - SP.

- South Region – occupies 7% of national territory, and it is comprised of the following states: Paraná - PR, Santa Catarina - SC and Rio Grande do Sul - RS.

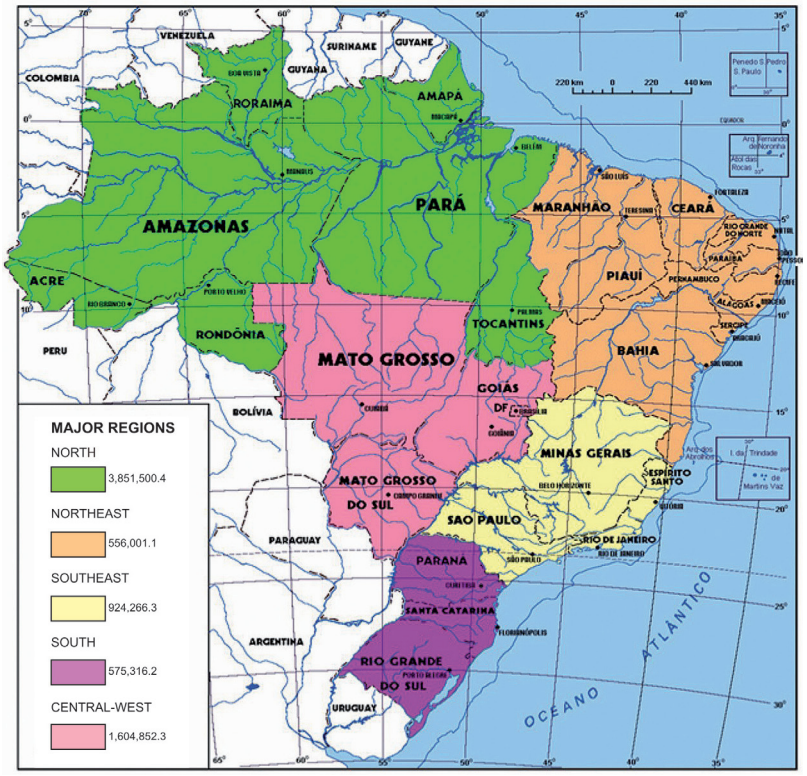
The 2007 Population Count (IBGE, 2007a) provided greater visibility regarding the demographic transformations that have occurred in the country since the 2000 Demographic Census, when Brazil had a population of 169.8 million inhabitants (IBGE, 2000b). During this period, Brazil's population grew 9.5%, at an average annual rate of 1.15%, reaching approximately 186 million inhabitants in 2008, of which 48.8% were men and 51.2% were women[1]. The Southeast is the country's most populous region, with about 42.0% of the total number of inhabitants. The Northeast region is ranked second, with approximately 28.0%, followed by the South region, with 14.5%; North region, with 8.0%; and Central-West region, which is home to only about 7.5% of the population. The urbanization rate jumped from 77.3% in 1970 to 84.4% in 2008[2].

Figure 1.2 provides the distribution of the population across the country's territory, and the map shows Brazil's demographic density.

1 Data re-weighted based on the weight defined by the 2007 Population Count. Available at <http//:www.sidra.ibge.br>.

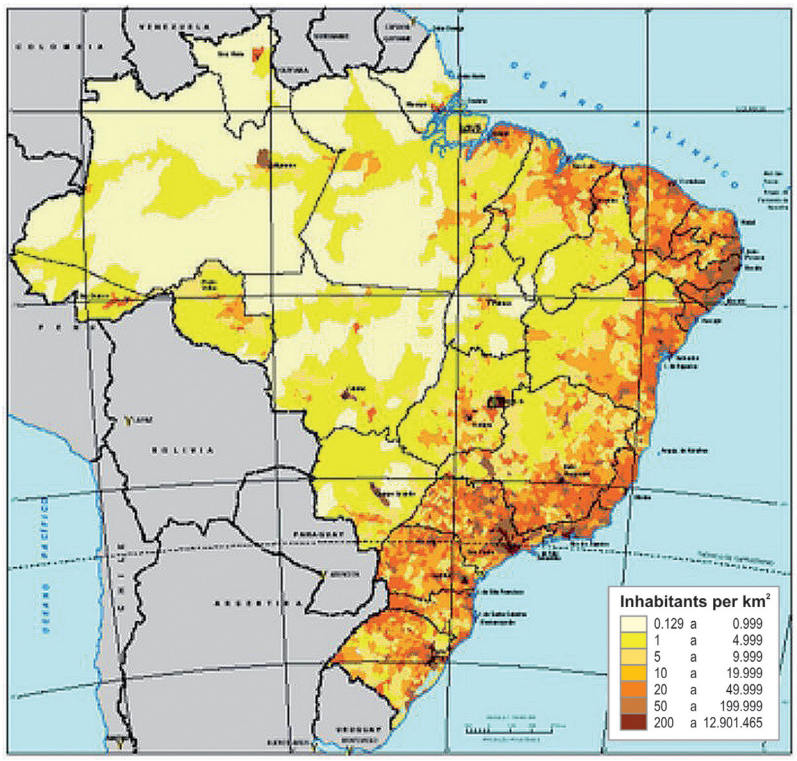
2 Due to the lack of an urban population estimate in the 2007 Population Count, this was estimated at 84% of the total, based on the evolution of the urban fraction from previous official numbers, allowing an estimate of the same fraction for 2005 and 2008.

Figure 1.1 Brazil's political-administrative division



Source: IBGE, 2000a.

Figure 1.2 Demographic Density in Brazil



Source: IBGE, 2000a.

1.1.1 Vegetation and Flora Resources

In 2004, the Brazilian Institute of Geography and Statistics – IBGE introduced a new classification and division of Brazil's vegetation and flora resources. In such a new classification and division, a revision, in terms of concept and design, of phytoecological regions (*regiões fitoecológicas*) classification was undertaken (Figure 1.3). A phytoecological region can be defined as an area covered by flora of typical genera and characteristic biological forms that repeat themselves within a given climate and may occur in areas of different soils, but with well-defined relief. These revisions were based on the interpretation of images obtained from the Landsat 5-TM satellite, along with new techniques and bibliographic and field research. This justifies the changes in the map featured in Brazil's Initial National Communication to the United Nations Framework Convention on Climate Change (BRASIL, 2004).

According to this new classification, the vegetation mapping was based on ecological profiling criteria, following a hierarchy of formations delimited by vegetation ecology and environmental parameters, according to a classification key based on two big formations: forest and field-like (*campestre*) vegetation.

The forest formations were subdivided according to topographic criteria, establishing three large latitude ranges: the first from 5° N to 16° S; the second from 16° S to 24° S; and the third above 24° S. The formations were distributed according to the altitude:

- Lowlands (*Terras baixas*): (1) from 5m to 100m, (2) from 5m to 50m, and (3) from 5m to 30m;

- Sub-montane (*Submontana*): (1) from 100m to 600m, (2) from 50m to 500m and (3) from 30m to 400m;

- Montane (*Montana*): (1) from 600m to 2,000m, (2) from 500m to 1,500m, and (3) from 400m to 1,000m; and

- Upper-Montane (*Altomontana*): (1), (2) and (3) above the maximum limits of montane formations.

The field-like formations were subdivided based on profiling criteria (vegetation density and size) into forested, wooded, park, and wooded-grassland (*gramíneo-lenhosas*) formations.

According to the new classification, in terms of Brazil's phytogeographic conceptualization, Brazilian vegetation is mainly distributed in the neotropical zone which, for geographic purposes, can be divided into two territories: the Amazonian (equatorial rainforest) and the extra-Amazonian (intertropical) area.

In the Amazonian territory (equatorial rainforest area), the vegetation ecological system develops in a climate with an average temperature around 25 ° C, with rainfall well distributed throughout the year, without any monthly water deficit in the annual rainfall and temperature balance (*balanço ombrotérmico*).

In the extra-Amazonian territory (intertropical area), the vegetation ecological system is associated with two climates: a tropical climate, with average temperatures around 22 °C and seasonal rainfall for a period, and a water deficit for more than 60 days in the annual rainfall and temperature balance; and a subtropical climate, with mild temperatures in the winter that soften the annual average to around 18 °C, with moderate and well-distributed rainfall throughout the year, without any monthly water deficit in the annual rainfall and temperature balance, but with thermal seasonality caused by the coldest days of the year.

The following phytoecological regions have been defined in Brazil:

- Savannah Region (*Cerrado*) – vegetation found predominantly in the Central-West region. Discontinuous areas of Cerrado are also found in the Amazon, and in the Northeast, Southeast and South regions of the country. The Brazilian Cerrado includes various field-like formations, with low wooded grassland vegetation alternating with small isolated and grouped trees, and riparian forest formations (riverside vegetation), thus revealing great structural variability and, as a consequence, big differences in size and density.

- Savannah Steppe Regions (*Caatinga, Campos de Roraima, Pantanal* wetlands in Mato Grosso, and the Quaraí River sand bar's Espinilho Park) – type of neotropical vegetation, generally with tree cover containing elements of *phanerophyte*, thorny *Chamaephyte* and a variety of cactus , covering a *hemicryptophyte* grassland stratum, interwoven with some *therophytes.*

- Steppe Region – encompasses the Prairies of Rio Grande do Sul, with discontinuous areas in Uruguaiana - RS and southern Brazil *Campos Gerais*). It is characterized by an essentially field-like vegetation. Cespitose and rhizomatous grasses are predominant, with rare annual and *oxalidaceae* grasses, as well as leguminous and compound grasses. The *phanerophytes* are represented by thorny and deciduous species.

- Campinarana Region – vegetation restricted to areas in the Upper Negro River and adjacent to its tributaries, extending into Colombia and Venezuela, where there are similar areas. It covers lowlands, almost always flooded areas, with groupings of thin and tall trees, which results from the soil's poor nutrient contents.

- Dense Tropical Rainforest Region (*Floresta Ombrófila Densa*) – This covers part of the Amazon area and extends along the Atlantic Coast, from the states of Rio Grande do Norte to Espírito Santo, in areas found between the coast and the pre-Cambrian coast mountains, extending along the mountain slopes to the state of Rio Grande do Sul. It consists of large trees in the alluvial terrace and in the tertiary plateaus, as well as medium-sized trees along the coastal slopes.

- Open Tropical Rainforest Region (*Floresta Ombrófila Aberta*) – type of vegetation located between the Amazon and the Extra-Amazonian area. Forest profile consists of widely spaced trees and sparse shrubby stratum. This is found in climate conditions where the dry season may last from 2 to 4 months, with average temperatures between 24 °C and 25 °C.

- Mixed Tropical Rainforest Region (*Floresta de Araucária*) – This is typical of Brazil's southern plateau, although there are also isolated areas in higher altitudes of the Serra do Mar and Mantiqueira mountain ranges.

- Semi-Evergreen Tropical Forest Region (*Floresta Estacional Semidecidual*) – the ecological concept for this phytoecological region is related to the two-season climate (dry and rainy) in the tropical area (average temperatures around 21 °C), with a short dry season accompanied by an pronounced drop in temperature in the subtropical region (average temperatures around 15 °C). The predominant tree elements, which are adapted to the unfavorable season (cold or dry), undergo foliar seasonality. In both cases, the percentage of deciduous trees found in this sort of forest is between 20% and 50%.

- Seasonal Deciduous Forest Region (*Floresta Estacional Decidual*) - This features a predominantly deciduous tree stratum with more than 50% of the individual trees dropping their leaves during the unfavorable season. This is found in a dispersed and discontinuous manner in Brazil: from the north to the southeast, it can be found between the Open Tropical Rainforest and Savannah regions; from east to west, between the Steppe Savannah and the Semi-Evergreen Tropical Forest; and, in the south, in the subtropical area of the Uruguay River Valley, between the Mixed Tropical Rainforest in the southern plateau and the Steppe.

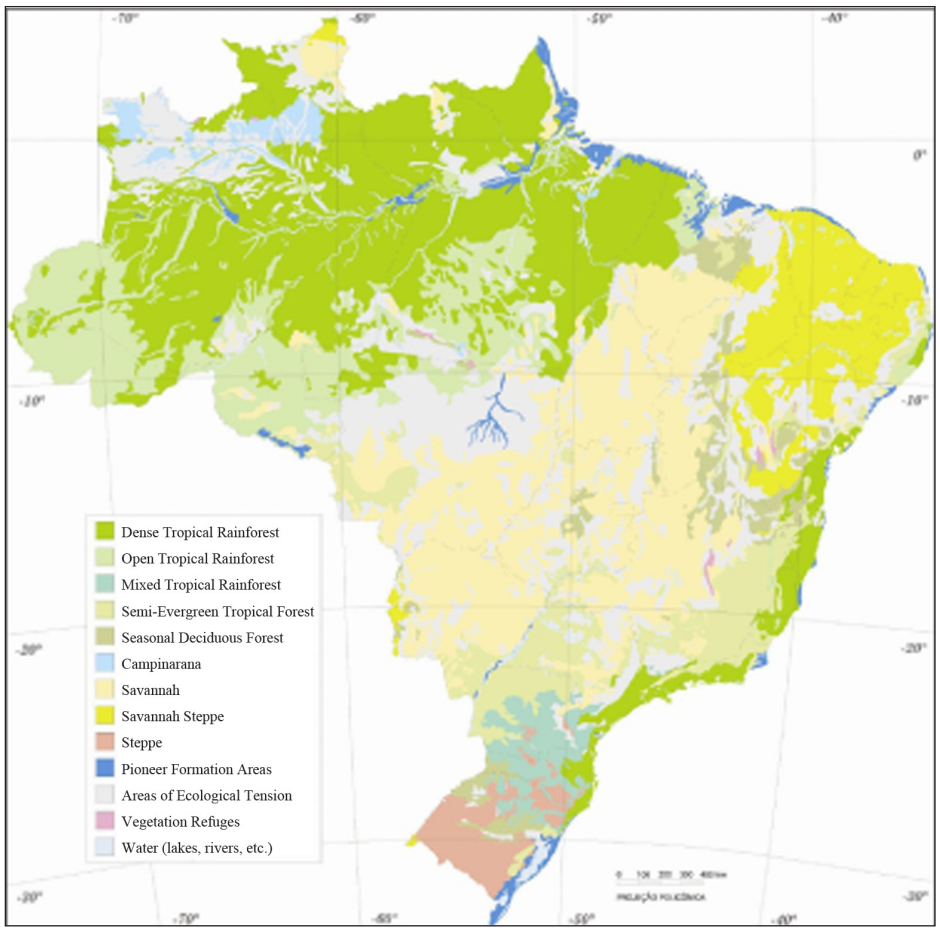
The areas of vegetation should not be taken for the phytoecological regions, because they represent a broader concept and they can encompass various environments and integrate more than one trophic system. These are:

- Pioneer Formation Areas (*Área de Formações Pioneiras - First Occupation of Soil System*) – areas along the coast, water courses and even around lowlands that accumulate water (swamps and lagoons) where field-like wooded grassland vegetation is found. They are pedologically unstable areas, with unconsolidated or poorly consolidated sediment under the influence of different accumulation processes.

- Areas of Ecological Tension (contacts between different types of vegetation) – where these flora come in contact between two or more phytoecological regions either by overlapping or merging, these interactions are called enclaves and ecotones, respectively. In the first case, each vegetation mosaic keeps its flora identity and profile without mixing, and it is possible to distinguish the predominant formation or area under formation. In the case of ecotones, the flora identity assumes a species level, where one region does not prevail over the other. Endemisms that can be better identified frequently occur. Areas of ecological tension can occur in the same area with the contact of two geological formations and with climate transition ranges.

- Vegetation Refuges (*Refúgio Ecológico* - Relic Vegetation Communities) – this is any different vegetation and flora from the general context of the region's flora, translated into a relic vegetation community. There are montane and high montane refuges with shrubby and/or grass-like structures. The profiles are complex, because although limited to small areas, vegetation refuges are significantly diversified.

Figure 1.3 Regional distribution of Brazil's natural vegetation



Source: IBGE, 2004.

Considering the extension and characteristics of its territory, Brazil has a great variety of vegetation and flora resources, which is home to one of the richest flora in the world, with 41,123 known and catalogued species, 3,633 fungi, 3,521 algae, 1,522 bryophytes, 23 gymnosperms and 31,248 angiosperms, according to Brazil's recently updated "List of Brazilian Flora Species" (FORZZA *et al*., 2010).

1.1.2 Fauna

Brazil is one of the richest countries in number of animal species, with about 13% of all the amphibian species described in the world (SILVANO & SEGALLA, 2005); 10% of all mammals (COSTA *et al*., 2005); 17.8% of all butterflies (BROWN & FREITAS, 1999) and 21% of all the continental water fish on the planet (AGOSTINHO *et al.,* 2005). Of the 624 *taxa*[3] of existing primates in the world, 133 species and subspecies live in the Brazilian territory, representing 21% of all *taxa* found on the planet (CHIARELLO *et al.,* 2008).

3 *Taxon*, with Latin plural *taxa*, is a taxonomic unit essentially linked to a classification system. *Taxa* can be at any level of a classification system, thus, an order is a *taxon*; a genus, as a specie, is also a *taxon*, or any other unit for classifying living beings.

Moreover, Brazil is ranked fourth in relation to the total number of reptiles, trailing only Australia, Mexico and India (MARTINS & MOLINA, 2008).

According to the most recent compilation available on the number of Brazilian fauna species – the "Red Book of the Brazilian Endangered Fauna Species" (MACHADO *et al.,* 2008*)*, within the universe of species known by science, Brazil has 652 species of mammals, 800 amphibians, 1,800 birds, 641 reptiles, 2,300 freshwater fish, 1,298 saltwater fish and more than 100,000 species of land invertebrates. However, knowledge about the diversity of Brazilian fauna is still incomplete. It is estimated that less than 10% of the existing total is actually known.

In order to have an idea about the potential of the still unknown fauna, in just 17 years, from 1978 to 1995, 7,320 species of Metazoan animals were described. In just over 10 years, 18 new species of mammals and 19 species of birds were described. In two years of studies in remaining forest areas of the Atlantic Forest in the south of Bahia, researchers identified 14 new species of amphibians (DRUMMOND, 2008).

1.1.3 Water Resources

In Brazil, there are abundant available water resources. Endowed with a vast and dense hydrological network, many of its rivers are noted for their lenght, width and/or depth. Brazilian territory has eight large watersheds: the Amazon River, the Tocantins River, and the South Atlantic — north and northeast sections, the São Francisco River, and the South Atlantic — east section, the Paraná River, the Uruguay River and the South Atlantic — southeast section (Figure 1.4). As a result of the nature of the continental relief, there is a predominance of plateau rivers, which are characterized by sudden drops in altitude, deep narrow valleys, among other characteristics that give them high potential for electric power generation. However, these same characteristics make navigation difficult. Among the great national rivers, only the Amazon and the Paraguay are predominantly lowland rivers and are extensively used for navigation. The main plateau rivers are the São Francisco and Paraná.

The utilization of hydroelectric power in Brazil began in 1883. The accumulated experience in building hydroelectric power plants and the transmission systems associated with them, as well as the production of equipment for energy generation and distribution represents a great advantage to the country.

Brazil's hydroelectric potential by watershed, shown in Table 1.1, shows the contrast between demand — primarily as a result of industrial, residential, commercial and public use — and the real supply capacity. Thus, it is a fact that in the Amazon River watershed, with a potential for 89,738 MW, only 5.3% is in operation/construction.

In 2009, the Paraná, Uruguay, São Francisco, South Atlantic — east section and South Atlantic — southeast section watersheds were responsible for supplying hydroelectric power to the country's areas with the greatest demographic and industrial concentration. Among those, the Paraná watershed stands out, not only because of its potential, but also as having the highest percentage in operation or under construction (69.4% of 61,744 MW).

In terms of depletion of the potential, the most saturated watershed are the Paraná, the Uruguay, the Tocantins and the São Francisco, with usage indexes (ratio between potential used and existing potential) of 69.4%, 50.2%, 50.1% and 41.2%, respectively. The lowest usage rates are seen in the Amazon and the South Atlantic — north and northeast sections. At a national level, about 36.9% of estimated hydroelectric power has already been harnessed. In terms of inventoried potential, this rate increases to 47%.

Figure 1.4 Brazil's watersheds

Source: ANEEL, 2010.

Table 1.1 Brazil's hydroelectric potential by watershed (MW) – December, 2009

Stage/Watershed	Amazonas	Tocantins	North and Northeast Atlantic	São Francisco	East Atlantic	Paraná	Uruguay	Southeast Atlantic	Totals by Stage
Remaining	17,919	1,846	525	760	784	3,697	12	996	26,539
Individualized	24,773	128	182	907	704	2,946	862	1,090	31,592
Estimated Total	42,693	1,974	707	1,667	1,489	6,643	874	2,086	58,131
Inventory	25,842	7,166	1,611	7,339	5,594	7,764	4,404	1,544	61,264
Viability	11,988	3,738	6	6,140	895	2,432	292	2,218	27,709
Basic Design	4,474	190	56	109	760	2,065	1,054	432	9,140
Construction	3,693	1,142	0	107	572	1,950	1,035	105	8,605
Operation	1,047	11,960	320	10,579	4,674	40,890	5,657	3,376	78,502
Total Inventoried	47,045	24,197	1,993	24,273	12,496	55,101	12,442	7,675	185,221
Grand Total	**89,738**	**26,170**	**2,699**	**25,940**	**13,984**	**61,744**	**13,316**	**9,761**	**243,352**

Source: SIPOT, 2009.

The low utilization rates for the Amazon River watershed are due to the predominantly lowland relief, its huge biological diversity and its distance from the main power consumption centers. In the central-south area of the country, the more rapid economic development and the predominant relief (plateaus) made it possible to utilize more of its hydraulic potential. However, with the country's population moving inland and the depletion of the most potential in the South and Southeast regions, it has become necessary to develop hydroelectric power in more remote and economically less developed regions.

In the Northeast region of Brazil, the uneven distribution of rainfall, along with the possibility of a long period of time between rainy seasons, accounts for the intermittent character of many rivers. In view of this climatic peculiarity, ponds are used for water storage and distribution, both for household consumption and for developing irrigated agriculture.

1.2 Climate

The location of Brazil's territory along the eastern edge of the Atlantic Ocean, along with the variations in its relief, results in different characteristics for the atmospheric macrosystems, both continental and oceanic, creating a diversity of climatic domains ranging from the equatorial to the subtropical, with gradation of types and subtypes produced by the geoecological variability that exists in the country.

South America extends from the tropics to the mid-latitudes and it is affected by tropical, subtropical and mid-latitude regimes. One of the main characteristics of South America's tropical region is the Amazon forest, which contributes to the region's humidity and rainfall as well as the planet's energy balance. In the summer in the Southern Hemisphere, this region has strong convection, especially in the Central Amazonia; in the winter, convection activity shift northwest, reaching Central America.

South America's climate has interannual variability, as shown by the differences in wind flow, cloudiness, rainfall and behavior of synoptic systems. One of the large-scale factors responsible for climate variability is the *El Niño* Southern Oscillation – ENSO phenomenon (warming of Pacific Ocean waters). South America is directly influenced by ENSO and indirectly influenced by the variation in atmospheric circulation. The direct influence is by the increase in convection in the Eastern Equatorial Pacific region, which affects the continent's western tropical area. The displacement and intensity of the Walker Circulation, the Pacific North America - PNA teleconnection patterns, and the displacement of the Hadley cell northward are related to the dry conditions in Brazil's Northeast region. Intensification of the subtropical jet stream increasing frontal system convection and blocking situations are related to flooding in Brazil's South and Southeast regions. Other large-scale anomalies affect South America, such as persistent wave trains and patterns with wave number three and four around the Southern Hemisphere.

Convection activity over South America's central and western regions is associated with high level anticyclonic circulation, which, in the summer (Southern Hemisphere) is called the Bolivian High. It is associated with strong warming on the surface, an upward movement, and upper level divergence. In some periods of summer and spring, convection over this region is also associated to a persistent northwest-southeast band of cloud cover, called the South Atlantic Convergence Zone.

The northeast portion of the continent has high interannual and annual variability in terms of rainfall. This region is affected by the Intertropical Convergence Zone – ITCZ, upper level cyclonic vortices, disturbances from the east, instability lines associated with the sea breeze, and by the approach of frontal systems over the ocean. South and southeast are affected by frontal systems, upper level cyclonic vortices, and mesoscale convective complexes, which, in turn, are affected by the subtropical jet and by the low-level jet.

1.2.1 Rainfall and Temperature Climatology

Since Brazil is a country with large territorial extension, it has differentiated rainfall and temperature regimes. From north to south, a great variety of climates with distinct regional characteristics can be found. In the North of the country, there is a rainy equatorial climate, with virtually no dry season. In the Northeast region, the rainy season, with low rainfall levels, is restricted to a few months, characterizing a semi-arid climate. The Southeast and Central-West regions suffer the influence of tropical and mid-latitude systems, with a well-defined dry season in the winter and a rainy season in the summer with convective rains. Due to its latitudinal location, Brazil's South region suffers greater influence from mid-latitude systems, where the frontal systems are the main causes of rains during the year.

High temperatures are observed in the North and Northeast regions, with little variability during the year; this combination is responsible for the hot climate in these regions. In the mid-latitudes, temperature variation during the year has a major influence on the climate. During winter, there is greater penetration of upper latitude cold air masses, which contributes to the predominance of low temperatures.

It should be noted that modern technology has made it possible, to some extent, to overcome the climatic conditioning factors, enabling the expansion of temperate crops to areas with higher temperatures and lower rates of rainfall.

North Region

The North region has spatial and seasonal temperature homogeneity, which does not occur in relation to rainfall. This region has the highest total annual rainfall, most notably at the coast of Amapá, at the mouth of the Amazon River and in the west of the region, where rainfall exceeds 3,000 mm. This region has three centers with abundant rainfall. The first is located in the Amazon's northwest, with rainfall above 3,000 mm/year. The existence of this center is associated with the condensation of humid air brought by easterly winds from the Intertropical Convergence Zone – ITCZ winds, which rise when they reach the slopes of the Andes (NOBRE, 1983). The second center is located in the central part of the Amazonia, around 5º S, with 2,500 mm/year of rainfall; and the third, is in the eastern part of the Amazonia, close to the city of Belém, with rainfall of 2,800 mm/year.

Three rainfall regimes have been documented (MARENGO, 1995) in the northern region of South America: one in the northwest of the subcontinent, where the rain is abundant throughout the year, reaching its peak in April-May-June, with more than 3,000 mm/year; a second in a zone-oriented band extending to the central part of Amazon, where the rainy season occurs in March-April-May; and the third in the southern part of Amazonia, where the rainfall peak occurs in January-February-March. Rainfall in the northwest of the Amazonia can be seen as a response to the dynamic fluctuation of the quasi-permanent convection center in this region (MARENGO & HASTENRATH, 1993).

The rainy season of the North region (December-January-February) changes progressively from January-February-March, in the south of the Amazonia, to April-May-June in the northwest of the Amazon watershed. This variation seems to be related to the ITCZ position, because the rainfall nuclei migrate from the central part of the country, in the austral summer, to the northwest of South America in the austral winter, following the annual migration of deep convection. Weather stations located in the Northern Hemisphere, such as Oiapoque (3º N 60º W), see maximum rainfall in the austral winter (June-July-August) and minimum in the austral summer (December-January-February)(RAO & HADA, 1990).

With regard to temperatures, during the Southern Hemisphere's winter, the entire southern portion of the North region, especially the southwest area (Acre, Rondônia and part of Amazonas state), is frequently invaded by upper latitude anticyclones that cross the Andes Mountains in the south of Chile. Some of them are exceptionally intense and may even cause sudden drops of temperature, known as *friagem* (NIMER, 1979). Because of the relative high humidity and intense cloud cover that are typical of the region, excessive maximum daily temperatures are not recorded during the year.

Northeast Region

Taking into account the rainfall regime, there is a great climatic variety over the Northeast region – NE, ranging from a semi-arid climate inland, with an annual rainfall of less than 500 mm/year, to a rainy climate mainly observed in the eastern coast of the region, with an annual rainfall of more than 1,500 mm (KOUSKY & CHU, 1978). The northern part of the region receives between 1,000 and 1,200 mm/year (HASTENRATH & HELLER, 1977).

Similar to the North region, a large part of the Northeast region also has a great seasonal and spatial temperature homogeneity. Only in the south of the state of Bahia is there a greater seasonal temperature variability as a result of the penetration of relatively cold air masses in winter months.

Different rainfall regimes are identified in the Northeast region. In the north of the Northeast region, the main rainy season is from March to May; in the south and southeast regions, rains occur mainly from December to February; and in the eastern part of the region, the rainy season is from May to July. The Northeast region's main rainy season, including the north and east of the region, which explains 60% of annual rainfall, is from April to July, while the dry season for most of the region occurs from September to December (RAO *et al.*, 1993). Satellite images suggest the importance of easterly disturbances in the rainfall of the Northeast region (YAMAZAKY & RAO, 1977). These disturbances propagate over the Atlantic Ocean, towards the continent, during fall and winter (CHAN, 1990).

Rainfall interannual variations in the east of the Northeast region can be attributed to anomalies in the position and intensity of the ITCZ, caused by positive anomalies in the South Atlantic sea surface temperature (MOURA & SHUKLA, 1981; NOBRE, 1994), and by the occurances of the El Niño in the Equatorial Pacific.

South Region

Annual rainfall distribution over Brazil's South region occurs in a quite uniform manner. Throughout almost the en-

tire region, annual average rainfall ranges between 1,250 and 2,000 mm. Only a few areas are outside of this rainfall range. The coast of the state of Paraná, western section the state of Santa Catarina and the area around São Francisco de Paula, in the state of Rio Grande do Sul, receive above 2,000 mm/year. The southern coast of the state of Santa Catarina and the North of the state of Paraná see less than 1,250 mm/year (NIMER, 1979). It can be thus concluded that the relief, due to its generally smooth characteristics, does not exert any great influence on rainfall distribution. The temperature, in turn, plays a similar role to rainfall, reinforcing the uniform climate in the south of the country. However, this is the region of Brazil with the greatest thermal variability throughout the year.

Some atmospheric phenomena affecting this region are essential in determining temperature and rainfall climatology. Key among these is the movement of frontal systems over the region, which are responsible for much of the total recorded rainfall (OLIVEIRA, 1986). The trajectory of these systems is closely linked to the position and intensity of South America's subtropical jet. Some studies (KOUSKY & CAVALCANTI, 1984) emphasize the importance of the jet stream to rainfall.

The inverted troughs are situated, on average, over the states of Rio Grande do Sul and Santa Catarina, extending to Argentina and Paraguay, and are more frequent in the summer and spring in the Southern Hemisphere (FERNANDES & SATYAMURTY, 1994), with a northwest-southeast (NW-SE) oriented axis, parallel to the frontal surface, and are responsible for the severe weather over the affected regions.

Mesoscale convective systems are also responsible for great amounts of rainfall over this region, as well as in the south of the Southeast and Central-West regions (CUSTÓDIO & HERDIES, 1994).

The cold air cyclonic vortices are formed in the rear of some cold fronts, are often associated with significant rainfall levels (MATSUMOTO *et al.*, 1982). Some studies (SILVA DIAS & HALLAK, 1994) have sought to establish advance indicators of the initial stages of this phenomenon.

The occurrence of cyclogenesis and frontogenesis over the South region of Brazil is also a critical factor determining the rainfall and temperature climatology of this region. Statistical studies (GAN & RAO, 1991) show that the highest frequency of cyclogenesis occurs over Uruguay during the winter in the Southern Hemisphere. On average, there are 60 cyclogenesis over the South region every year.

With regard to temperature, frost can be considered one of the main atmospheric phenomena in Brazil's South region, given that it is associated with air temperatures below 0°C with the formation of ice on exposed surfaces.

Southeast and Central-West Regions

Due to their latitudinal locations, the Southeast and Central-West regions are characterized by being transition regions between low-latitude hot climates and mid-latitude temperate mesothermal climates (NIMER, 1979). The southern Southeast and Central-West regions are affected by most of the synoptic systems that reach the south of the country, with some differences in terms of system intensity and seasonality. The inverted troughs mainly act during the winter (FERNANDES & SATYAMURTY, 1994), causing moderate weather conditions, especially over the states of Mato Grosso do Sul and São Paulo. Upper level cyclonic vortices from the Pacific organize with intense convection associated with the instability caused by the subtropical jet. Pre-frontal lines of instability, generated from the association of large-scale dynamic factors and mesoscale characteristics, are responsible for intense rainfall (CAVALCANTI *et al.*, 1982).

Especially over the Central-West region, the Bolivian High, generated from strong convective warming of the atmosphere (release of latent heat) during the summer months in the Southern Hemisphere (VIRJI, 1981), is considered a typical semi-stationary system of the region. Stationary large-scale circulation in mid-latitudes can directly influence rainfall and temperature in the Southeast, whether or not the region is being affected by systems associated with the atmospheric wave flow. This kind of situation is called blocking and it affects not only the South region of Brazil but also the Southeast region.

The Southeast and Central-West regions are characterized by the action of systems that associate tropical system characteristics with those typical of mid-latitude systems. During the months of greater convective activity, the South Atlantic Convergence Zone – SACZ is one of the most important phenomena that influence the rainfall regime of these regions (QUADRO & ABREU, 1994). The fact that the band of cloud cover and rainfall remain semi-stationary for consecutive days favors the occurrence of flooding in affected areas.

In general, rainfall is evenly distributed in these regions, with average annual accumulated rainfall ranging from 1,500 and 2,000 mm. Two maximum spots exist in the Central-West region and on the coast of the Southeast region of Brazil, whereas in the north of the state of Minas Gerais rainfall is relatively scarce throughout the year.

1.3 Economy

Table 1.2 shows Gross Domestic Product figures and the population in Brazil in 1970, 1980 and during the 1990-2008 period.

Table 1.2 Gross domestic product - GDP and population in Brazil, 1970-2008

	GDP		Population		GDP/inhab.	
	Billion US$ 2007/ year	Annual rate	Millions of inhabitants	Annual rate	thousand US$ 2007/ inhab.	Annual rate
1970	310.5		93.1		3.33	
1980	710.4		119.0		5.97	
1990	830.5		144.8		5.74	
1991	839.1	1.0%	146.8	1.4%	5.71	-0.4%
1992	835.1	-0.5%	148.9	1.4%	5.61	-1.8%
1993	874.1	4.7%	150.9	1.4%	5.79	3.2%
1994	920.7	5.3%	153.0	1.4%	6.02	3.9%
1995	961.4	4.4%	155.0	1.3%	6.20	3.0%
1996	982.1	2.2%	157.1	1.3%	6.25	0.8%
1997	1015.2	3.4%	160.3	2.0%	6.34	1.3%
1998	1015.6	0.0%	163.4	2.0%	6.21	-1.9%
1999	1018.2	0.3%	166.6	1.9%	6.11	-1.7%
2000	1062.0	4.3%	169.8	1.9%	6.25	2.3%
2001	1075.9	1.3%	171.8	1.2%	6.26	0.1%
2002	1104.5	2.7%	173.9	1.2%	6.35	1.5%
2003	1117.2	1.1%	175.9	1.2%	6.35	0.0%
2004	1181.0	5.7%	177.9	1.2%	6.64	4.5%
2005	1218.3	3.2%	179.9	1.1%	6.77	2.0%
2006	1266.7	4.0%	182.0	1.1%	6.96	2.8%
2007	1338.5	5.7%	184.0	1.1%	7.27	4.5%
2008	1406.5	5.1%	186.0	1.1%	7.56	3.9%
1990/ 2005	-	3.6%	-	1.5%	-	-

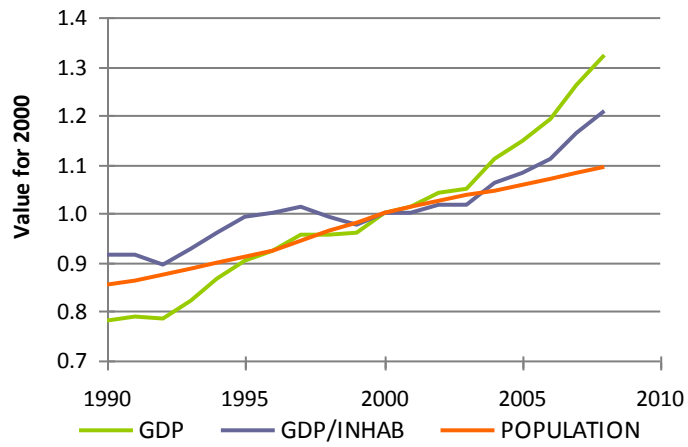
Source: Elaborated from IBGE data, 2009b.

The 1990s saw low economic growth rates and actually reported a 5.74% drop in GDP per inhabitant in its first year. The first years of this decade were marked by high inflation, with double-digit average monthly rates, which was not reverted until July 1994 with the adoption of the Real Plan, which created a new currency, the *real*, and instituted a new monetary and exchange regime. The Federal Government simultaneously conducted a successful deindexation process of the economy with a view to eliminating the inflationary memory of the economic players.

However, this new phase of Brazil's economic history was not problem free. A series of external shocks placed the sustainability of the Real Plan at risk, forcing the government to make use of monetary and exchange policies to slow down domestic consumption and to raise the exchange rate (NEUTZLING, 2007). In 1999, Brazil enters the floating exchange age, beginning to officially adopt the inflation goal system, which consists of an institutional arrangement where the commitment to price stability is monetary policy's main objective. The country thus abandoned strict control over evolution of the exchange rate, a policy known as "exchange anchor" (*âncora cambial*) that was pursued during the first phase of the Real Plan.

GDP growth data in Brazil are highly volatile, despite growing dynamism of the economy. From 2003, there has been a trend in GDP and GDP per capita growth that greatly exceeds population growth, as shown in Figure 1.5.

Figure 1.5 GDP, population and GDP/inhabitant growth in Brazil



Source: Elaborated from IBGE data, 2009b.

During the 1990-2005 period, the Brazilian population grew by 24.3%, which corresponds to an annual rate of 1.5%. During the same period, the country's GDP jumped from US$ 830.5 billion to US$ 1,218.3 billion, i.e., a growth rate of 46.7%, which represents an annual rate of 3.6%.

The IBGE National Accounts have undergone important changes that also alter annual GDP growth figures (IBGE, 2009b). The IBGE published the figures starting in 2000 and conducted what it called a "retropolation"[4] until 1995.

4 See:< http://www.ibge.gov.br/home/estatistica/indicadores/pib/pdf/22_retropolacao.pdf>.

It should also be underscored that the regional accounts, which are calculated on a quarterly basis, also changed in relation to the previous period, in the subdivision by activities starting in 2002 (IBGE, 2009b). The figures for the previous series are available from 1985 to 2003, and thus there is an overlay between the two criteria for 2002 and 2003.

In the evaluation of energy consumption and greenhouse gas emissions, it is always useful to compare the estimated figures to the economic activity indicators in the same sectors or activities. This makes sense when a long time series is available.

Another important factor that must be considered is that the classifications for IBGE's quarterly balance, as well as for some state balances, do not make it possible to establish a more open correlation between economic and energetic data than in the three macro-sectors shown.

Table 1.3 shows a significant change in the calculation method for the share of individual sectors of the economy in Brazil's GDP, especially for those related to industry and services. With regard to annual behavior, a reduction can be observed in the agriculture and livestock share, with a growth in the service sector.

Table 1.3 Tables for "retropolated" shares

	"Retropolated" Values (standardized) (%)			
	Agriculture and Livestock	Industry	Services	Total
1990	5.4	26.8	67.8	100
1991	4.9	25.1	70.0	100
1992	4.4	24.9	70.7	100
1993	4.4	24.0	71.6	100
1994	6.7	26.1	67.3	100
1995	5.7	24.5	69.8	100
1996	5.5	24.7	69.9	100
1997	5.2	24.9	70.0	100
1998	5.3	24.0	70.7	100
1999	5.3	25.1	69.6	100
2000	5.1	26.9	68.0	100
2001	5.7	27.0	67.4	100
2002	6.6	27.1	66.3	100
2003	7.4	27.8	64.8	100
2004	6.9	30.1	63.0	100
2005	5.7	29.3	65.0	100
2006	5.5	28.8	65.8	100

Source: Elaborated by e&e from IBGE data, National Accounts 2009b.

Brazil's macroeconomic and trade balance data make it an urban-industrial country with food exports as its connection to global capitalism. In 2008, Brazil's agribusiness trade balance closed at US$ 60 billion, representing 36.3% of exports, while employing 37% of Brazilian workers (GIRARDI, 2008).

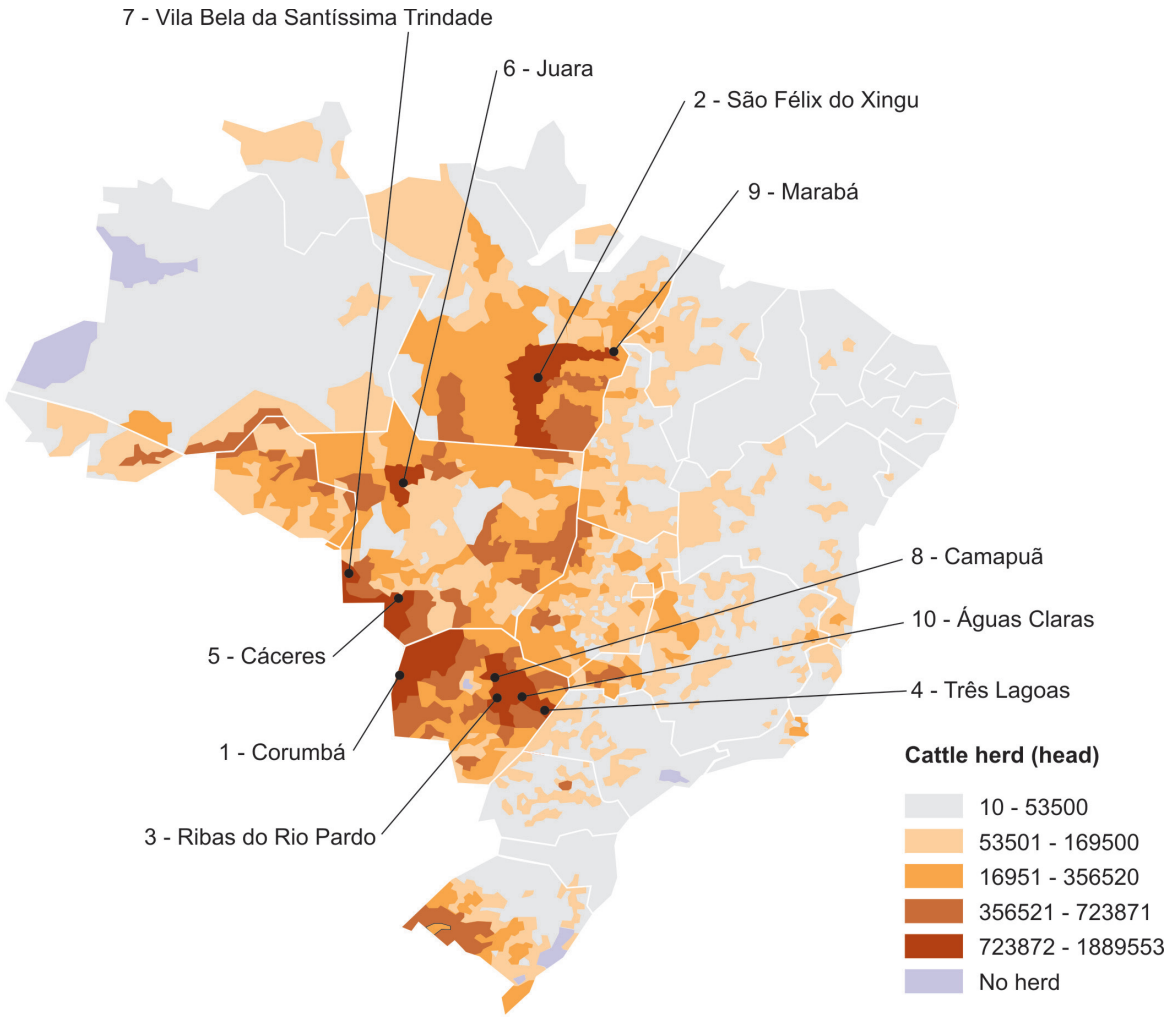
In 2008, Brazil's foreign trade continued to grow, ranking it 22nd among the main global exporters and 24th among the main importers. This includes the fact that the final two months of 2008 witnessed a reduction in export and import trade flows compared to the growth seen until October, due to the international financial crisis, which led to a reduction in international food and mineral commodity prices and in the demand for goods (DANTAS *et al.*, 2009).

Brazil is ranked first in the world in terms of the exportation of several agriculture products: sugarcane, beef, chicken, coffee, orange juice, tobacco, and alcohol. It is also second in soy bean and corn exports and is ranked the fourth largest exporter of pork. However, the country is still far from being the biggest food exporter in the world, as is widely believed.

In the agriculture and livestock sector, animal production growth stands out, and it should be noted that in 2005 the main herd was that of cattle, with 207.2 million head (Figure 1.6); followed by the swine herd, with 34.1 million head; sheep, with 15.6 million head; goat, with 10.3 million head; equine, with 5.8 million head; and bubaline, with 1.2 million head. The total number of hens, roosters, broilers, and chicks in the same year reached 812.5 million.

A series of factors ensured the achievements of the agriculture sector in Brazil over recent years: abundant natural resources (soil, water and sunlight); product diversity; and a relatively favorable exchange rate until 2006 (after which the appreciation of the real jeopardized profitability); increasing demand from Asian countries; and growth in agricultural productivity.

Figure 1.6 Spatial distribution of cattle herd across the Brazilian territory, with an emphasis on the ten top municipalities 2005



Source: IBGE. Available at: <http://www.ibge.gov.br/home/presidencia/noticias/noticia_visualiza.php?id_noticia=499&id_pagina=1>

1.4 Social Development

This section examines the status of social development in the country, based on the variation in the human development index - HDI according to the following data: 2009 Human Development Reports, issued by UNDP (PNUD, 2009); an analysis by the Institute of Research in Applied Economics of the IBGE's 2008 National Household Sample Survey (IPEA, 2009); and the Fourth Brazilian Monitoring Report on Millennium Development Goals (IPEA, 2010a).

The human development index - HDI is a summary measure of human development in a country. More precisely, it is an index that measures the progress achieved by a country, on average, in terms of three basic dimensions: a long and healthy life, based on average life expectancy; access to knowledge, based on adult literacy rates and the combined gross enrollment rate; and a dignified standard of living, based on purchasing power parity - PPP of GDP per capita[5], in U.S. dollars.

These three dimensions are standardized in values between 0 and 1, and by calculating its simple average it is possible to determine the final HDI score. Countries are then ranked based on this score, where a classification of 1 represents the maximum HDI score.

Compared with other countries in South America, in 1980 Brazil had one of the worst Human Development Indexes, ahead of only Paraguay and Bolivia, without considering Su-

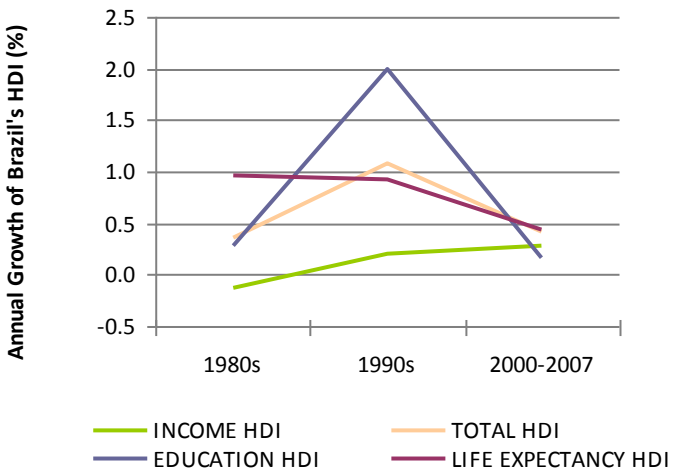
5 Purchasing power parity - PPP is an alternative method to exchange rate for calculating the purchasing power in two countries. PPP measures how much a certain currency can buy in international terms (normally the dollar), since goods and services have different prices from one country to the other. PPP is necessary because a comparison of gross domestic products - GDP in a common currency does not precisely describe the differences in material prosperity. PPP, on the other hand, takes into account the differences in earnings as well as cost of living differences.

riname and Guyana, for which data was not available. Ten years later, it had overtaken only Peru. In 2000, however, Brazil saw the quickest progress, and was ranked ahead of Colombia, Peru, Paraguay, and Bolivia, with an index approaching Venezuela's. From the turn of the millennium on, Brazil's HDI growth slowed down, allowing Peru, Colombia and Ecuador to once again approach Brazil's level. The HDI for Chile, Argentina, Uruguay, and Venezuela during the period considered was always higher than Brazil's (Table 1.4).

Brazil's HDI saw rapid growth in the 1990s, especially the second half of that decade, and then slowed-down growth after the turn of the century (Figure 1.7). Of the three dimensions measured by the HDI, there was a reduction in the pace of improvements in education and life expectancy at birth. The education sub index, which was growing at a clip of 1.99% per year last decade, has seen annual growth of 0.16% this decade. Life expectancy was reporting annual increases of 0.91% in the 1990s, and this decade this rate has fallen to 0.43%. The third dimension, income, saw slight improvements this decade, with annual growth going from 0.22% to 0.29%.

In 2007, Brazil remained among those countries classified as having high human development (HDI between 0.800 and 0.899), a group it joined in 2005. The 2007 HDI leaders were Norway (0.971), Australia (0.970), Iceland (0.969), Canada (0.966), and Ireland (0.965), which are among the 38 countries or territories classified as having very high human development levels by the UNDP. With an HDI of 0.813, Brazil is ranked 75 in the world, among 182 countries and territories considered.

Figure 1.7 Brazil's HDI annual growth rate (%)



Source: Elaborated from data presented by MALI.

A breakdown of HDI (Table 1.5) shows that Brazil had a lower sub index for income than that of Latin America and the Caribbean, and that of the world average. In terms of life expectancy (longevity), Brazil exceeds the global average, but not Latin America's. Education is Brazil's indicator that most approaches a score of 0.900 (very high HDI) and that has most distanced itself from the world average. Therefore, reduced growth in this index was already somewhat expected, taking into account that it is impossible to see great proportional improvements in indicators that increasingly get closer to 100%. Nevertheless, there is still room for growth in terms of the criteria used to measure education (literacy rate and gross school enrollment).

Table 1.4 Variation in the Human Development Index in South America (1980 – 2007)

Countries	1980	1985	1990	1995	2000	2005	2006	2007
Chile	0.748	0.762	0.795	0.822	0.849	0.872	0.874	0.878
Argentina	0.793	0.797	0.804	0.824	.....	0.855	0.861	0.866
Uruguay	0.776	0.783	0.802	0.817	0.837	0.855	0.860	0.865
Venezuela	0.765	0.765	0.790	0.793	0.802	0.822	0.833	0.844
Brazil	0.685	0.694	0.710	0.734	0.790	0.805	0.808	0.813
Colombia	0.688	0.698	0.715	0.757	0.772	0.795	0.800	0.807
Peru	0.687	0.703	0.708	0.744	0.771	0.791	0.799	0.806
Ecuador	0.709	0.723	0.744	0.758	....	....	0.805	0.806
Suriname	....	....	....	....	....	0.759	0.765	0.769
Paraguay	0.677	0.677	0.711	0.726	0.737	0.754	0.757	0.761
Bolivia	0.560	0.577	0.629	0.653	0.699	0.723	0.726	0.729
Guyana	....	....	....	....	....	0.722	0.721	0.729

Source: Elaborated from the 2009 Human Development Report, issued by UNDP (PNUD, 2009).

Table 1.5 Human Development Index (2007) and its components

	2007 HDI	HDI Life Expectancy	HDI Education	HDI Income
Brazil	0.813	0.787	0.891	0.761
Latin America and Caribbean	0.821	0.806	0.886	0.770
Countries with very high HDI	0.955	0.918	....	0.988
Countries with high HDI	0.833	0.790	0.902	0.807
Countries with medium HDI	0.686	0.698	0.744	0.614
Countries with low HDI	0.423	0.434	0.477	0.359
World	0.753	0.708	0.784	0.768

Source: Elaborated from the 2009 Human Development Report, issued by UNDP (PNUD, 2009).

The average life expectancy data shown in Table 1.6 refer to the number of years a new-born is expected to live if the specific mortality rate patterns for each existing age at the time of its birth are maintained. The average life expectancy for a Brazilian in 2007 was 72.2 years, higher than the global average; however, it is 7.9 years lower than the average for countries with a very high HDI, and also lower than the average for Latin American countries. Life expectancy at birth has a positive correlation with infrastructure, a requirement that still needs to be much improved in Brazil for this indicator to grow.

Table 1.6 Average life expectancy and Purchasing Power Parity - PPP of Gross Domestic Product per capita - 2007

	Average life expectancy (years)	GDP per capita (PPP in US$)
Brazil	72.2	9,567
Latin America and Caribbean	73.4	10,077
Countries with very high HDI	80.1	32,272
Countries with high HDI	72.4	12,569
Countries with medium HDI	66.9	3,963
Countries with low HDI	51.0	862
World	67.5	9,972

Source: Elaborated from the 2009 Human Development Report, issued by UNDP (PNUD, 2009).

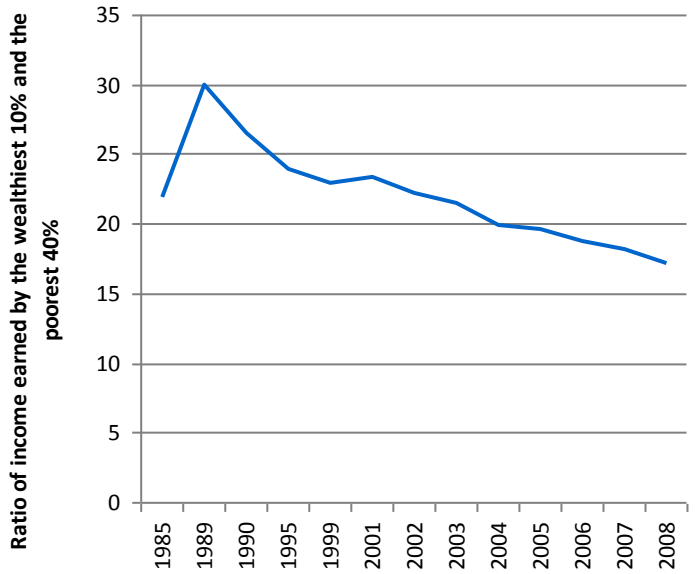
The data in Table 1.6 also shows that in 2007 Brazil's Gross Domestic Product per capita (US$ 9,567, in PPP) was lower than the average for its group, i.e., high HDI countries (US$ 12,569), and much lower than that for the group of very high HDI countries (US$ 32,272), and even lower than the average for Latin America and the Caribbean and the world average.

1.4.1 Degree of Inequality: Brazil and the World

In the beginning of the 1990s, Brazil had one of the highest degrees of inequality in the world, where the average income of the richest 10% was almost thirtyfold greater than the average income of the poorest 40% (BRASIL, 2004). Starting in 2001, the degree of income inequality in Brazil began to fall sharply and continuously, reaching a reduction of 6.21 percentage points in 2008 (Figure 1.8).

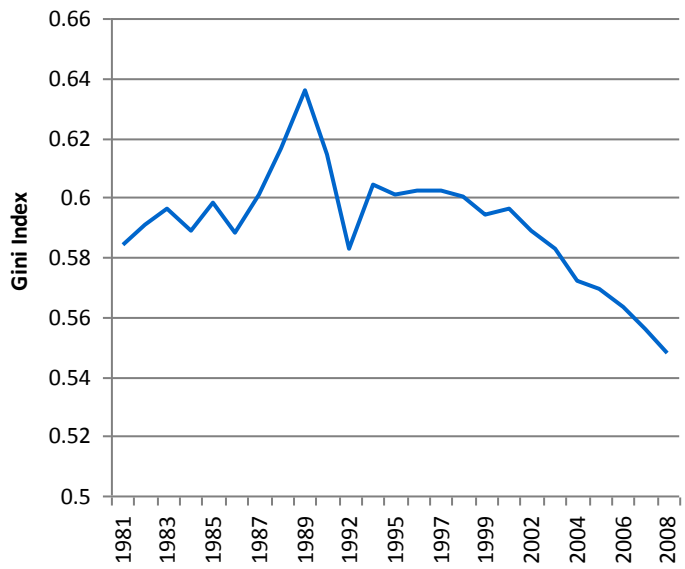
The results obtained from another indicator, the Gini index, which is the most commonly used measure of income inequality in the world, show the same sharp decline in income distribution inequalities between 2001 and 2008 (Figure 1.9). The degree of income concentration in Brazil fell 8.1% between 2001 and 2008, from 0.596 to 0.548, when it reached the lowest recorded value in the country since 1977, corresponding to an average annual reduction rate of 1.2%. From the beginning of the 1980s to 2001, the Gini index oscillated around 0.600, which kept Brazil among the countries with the greatest income inequality in the world.

Figure 1.8 Evolution of inequality in household per capita income in Brazil, according to the ratio of the richest 10% and poorest 40%, 1985-2008



Source: Elaborated from IPEADATA data. Available at: <http://www.ipeadata.gov.br>.

Figure 1.9 Evolution of inequality in household per capita income in Brazil according to the Gini Index, 1985-2008



Source: Elaborated from IPEADATA data. Available at: <http://www.ipeadata.gov.br>.

Despite this sharp drop, the inequality of Brazil's income distribution is still extremely high. According to the United Nations Development Programme's 2009 Human Development Report, in 2007, Brazil was ranked 10th in most unequal income distribution out of a list of 182 countries and territories considered, only better than Colombia, Bolivia, Haiti, Honduras, Botswana, Namibia, South Africa, Comoros, and Angola.

However, it is necessary to explain that, as mentioned in a document published by the United Nations Development Programme (PNUD, 2010), inequality is not only a problem in developing countries.

1.4.2 Evolution in the Proportion of Poor, Hunger and Child Malnutrition in Brazil

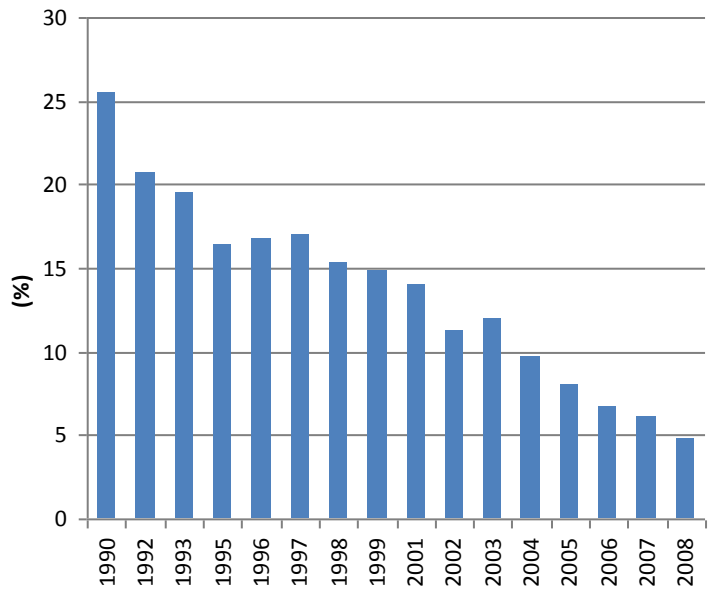
The first and primary Millennium Development Goal - MDG[6] is the eradication of extreme poverty and hunger in the world. In order to meet this goal, the Millennium Summit[7] established two targets to be met by 2015. The first is the reduction of extreme poverty levels in the world's population to half the level in the 1990s; the second is to halve the proportion of people living in hunger.

The extreme poverty and hunger reduction goals do not apply to countries individually, but to the entire world. They can be met even if some countries are unable to achieve them, so long as others have an optimal performance and exceed them. In this context, Brazil has tried to do more than just its part for the world to achieve the first Millennium Development Goal, establishing more ambitious targets than those agreed upon by the international community, and which are to reduce extreme poverty to one fourth of 1990's level and to eradicate hunger by 2015.

According to the Fourth Brazilian Monitoring Report on Millennium Development Goals (IPEA, 2010a), Brazil's goal to cut extreme poverty to one fourth of 1990's level was achieved in 2007 and exceeded in 2008.

In 1990, 25.6% of Brazilians' household per capita income was under the international poverty line of US$1.25 PPP/day, that is, one out of every four Brazilians had a daily income whose purchasing power in the local market was less than the purchasing power of US$1.25 in the USA. The reduction in extreme poverty since 1990 was such that in 2008 only 4.8% of the population (one out of every 20 Brazilians) was poor according to international criteria (Figure 1.10).

Figure 1.10 Percent of the population living on less than US$1.25 PPP per day in Brazil*, 1990-2008



*Excluding the rural population of the states of RO, AC, AM, RR, PA and AP. Sources: Income: IBGE, National Household Survey, PNAD.
PPP Factors: United Nations, Statistics Division (World Bank, ICP 2005). Average annual inflation for Brazil and the USA: International Monetary Fund, World Economic Outook, 2009.
Source: IPEA, 2010a.

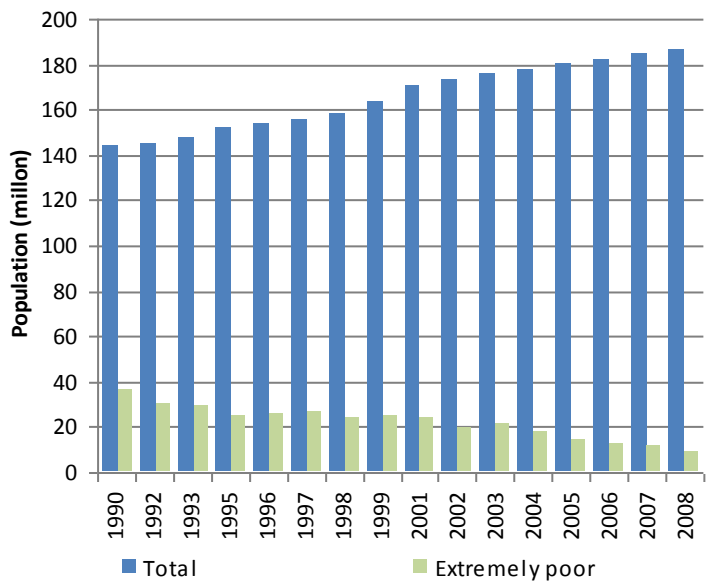
The sharp drop in extreme poverty is better understood when expressed in terms of population (Figure 1.11). From 1990 to 2008, while Brazil's population grew from 141 million to approximately 186 million, the extremely poor population decreased from 36.2 to 8.9 million. In 2008, only one fourth of the population that was poor in 1990, and just of over one third of those who were poor in 1995, remained so.

The main indicator for the second goal — reducing world hunger — is the percentage of children from zero to four years of age considered underweight for their age using the growth curves of healthy and well-fed children used as a reference by the World Health Organization. In 1996, 4.2% of Brazilian children from zero to four years of age were under the expected weight for their age. In 2006, this percentage had been halved, to 1.8% (IPEA, 2010a).

6 The Millennium Development Goals - MDG derive from the United Nations Millennium Declaration, adopted by 191 Member States on September 8, 2000. The Millennium Declaration brings a series of firm commitments that, if fulfilled by the established deadlines, according to the quantitative indicators that accompany them, shall improve humanity's destiny in the 21st Century. Eradicate extreme poverty and hunger; achieve universal primary education; promote gender equality and empower women; reduce child mortality; improve maternal health; combat HIV/AIDS, malaria and other diseases; ensure environmental sustainability; and develop a global partnership for development are the eight Development Goals presented in the Millennium Declaration, and which are to be met by 2015.

7 The Millennium Summit refers to the meeting of the 191 Heads of the Members States of the United Nations, held on September 6-8, 2000, in which the Millennium Development Goals were established.

Figure 1.11 Total population and population living on less than US$ 1.25 PPP per day (in millions) in Brazil*, 1990-2008



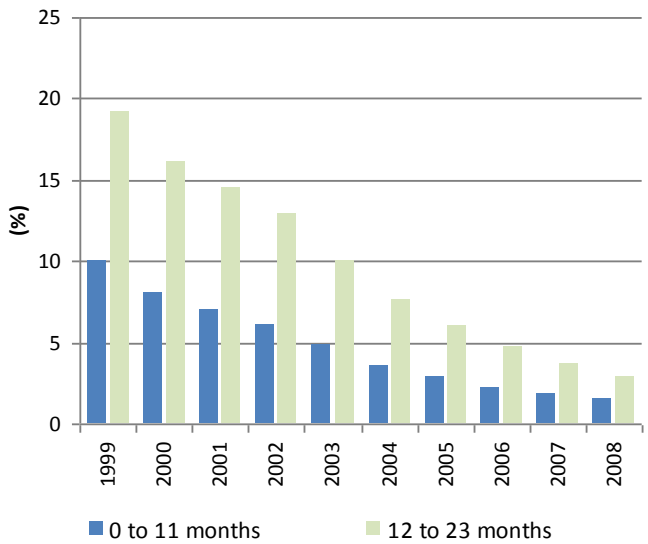
*Excluding the population of the states of RO, AC, AM, RR, PA and AP. Sources: IBGE Income, National Household Survey, PNAD.
PPP Factors: United Nations, Statistics Division (World Bank, ICP 2005). Average annual inflation in Brazil and the USA: International Monetary Fund, World Economic Outook, 2009.
Source: IPEA, 2010a.

Information on children under two years of age and cared for by the Family Health Strategy teams - ESF[8] also show sharp reductions in protein-energy malnutrition in childhood. This is relevant data because although it does not refer to all the children in the country, a great part of those whose socioeconomic profile implies greater risk of malnutrition is cared for by the ESF. Among those children cared for up to 11 months of age, only 1.5% was considered malnourished in 2008. In the next age group — 12 to 23 months of age —, 2.9% were malnourished (Figure 1.12).

Hospital admissions of children up to 11 months of age solely due to malnutrition, vitamin deficiencies and their sequella are less frequent events, and have been reduced from 9.6 per thousand in 1999 to 5.3 per thousand in 2008 (Figure 1.13).

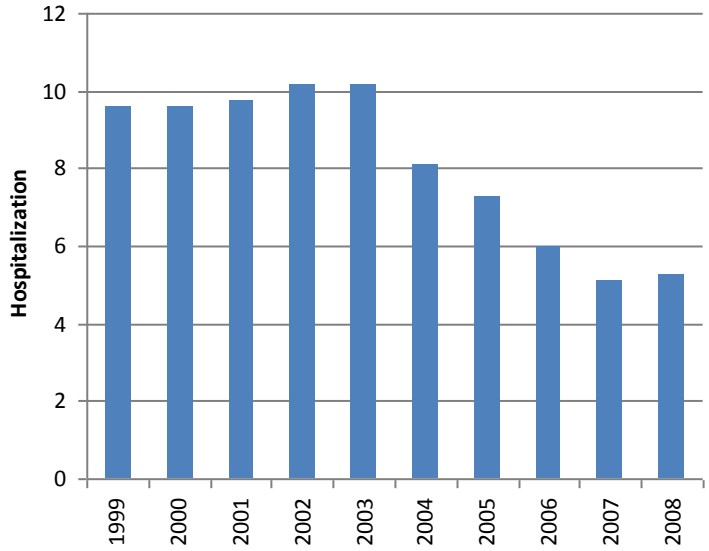
8 In 1994, the Ministry of Health created the Family Health Strategy - ESF with the main objective of reorganizing health care on new foundations, that is, take healthcare closer to families. ESF prioritizes health prevention, promotion and recovery actions in a complete and continuous manner. Care is provided at the basic healthcare unit or at home by professionals (doctors, nurses, nursing aides, and health community agents) who comprise the Family Health Strategy teams. These professionals and the population that participates in the project create ties of co-responsibility, which facilitates the identification and care for community health problems.

Figure 1.12 Percentage of children up to 23 months of age cared for by the Family Health Strategy with lower than expected weight for their age in Brazil*, 1999-2008



* Only children cared for by the Family Health Strategy. Ministry of Health, Secretary of Health Care, Basic Care Information System.
Source: IPEA, 2010a.

Figure 1.13 Hospital admissions due to malnutrition out of every 1,000 admissions of children aged 0 to 11 months in Brazil*, 1999-2008



*Only children cared for by the Family Health Strategy. Ministry of Health, Secretary of Health Care, Basic Care Information System.
Source: IPEA, 2010a.

Considering the reduction in the national percentage of children under expected weight during the period 1996-2006, Brazil has already exceeded the international goal of halving hunger by 2015. More detailed analyses of the nutritional status of children from zero to four years of age, from National Demographic and Health Survey information and other administrative surveys and records, including additional indicators such as the adjustment of weight to height,

and height to age, revealed that Brazil is close to eradicating child malnutrition and achieving its own goal.

1.4.3 National Social Policies System

Since the end of the 1980s, new social concepts became part of the Brazilian public agenda and began to guide the development of social policies in the country, especially the following:

- Reinforcement of selectivity and focus – priority in the agenda, resources and social actions to programs for the poor sectors, focusing expenses and actions on basic needs for the most vulnerable groups based on age and spatial location.

- Combination of universal and selective programs – differently from universalism versus selectivity, an understanding seems to have grown in Brazil that public networks of basic education and healthcare are crucial and strategic both because of their services and because they can hold mass programs. This way, focused programs would complement universal programs, with mutual support.

- Minimum income programs – monetary transfers to guarantee minimum individual or family income levels became part of a list of anti-poverty programs, especially through formulas that establish a link between minimum income targets and targets for improving school and health performances for younger children.

- Public-private partnership – greater acceptance of non-governmental organization participation in offering social services, based on the understanding that, alone, the government is unable to respond to the huge challenge posed by poverty, which makes it necessary, therefore, to expand on initiatives by the various segments of society to provide social services.

- Expansion of production programs – in designing new programs, there is also growing concern for those that may contribute towards reinforcing the capacity and productivity of poor segments in generating income, such as training programs, support for micro and small enterprises and job creation.

- Expansion of access to food programs – the purpose is to increase the supply of high nutritious foods and to improve the living conditions of families living in situations of food insecurity. When designing these programs, food and nutritional security are considered to be the guarantee of access to food on a daily basis, in sufficient quantities and with the necessary quality.

- Job and income generation programs – these are actions to generate jobs and income in a sustainable manner for needy, vulnerable families, who benefit from social programs.

In this context, and with the intent of eliminating extreme poverty, in 2004 the Federal Government created the Family Allowance Program ("*Programa Bolsa Família*"), with a view to guaranteeing the right to food, health, education and achieving citizenship to the population most vulnerable to hunger. In this program, the government transfers funds directly to the families and they assume the commitment to keep their children in school and to monitor the health of children, adolescents and pregnant women.

The main social policies currently in place are those geared towards combating poverty and hunger; universal and qualified education; job and income generation for the poorest; expansion and improvement of health services; combating socioeconomic inequalities and those inequalities resulting from race and gender. In summary, they are policies focused on improving the quality of life of Brazilians, especially those in a situation of social vulnerability (IPEA, 2010a).

1.4.4 Human Development and Changes in the Demographic Pattern

One of the most important structural transformations of Brazilian society in recent decades was the change in its demographic pattern. This change has been underway in a rapid pace since the end of the 1960s.

Despite the immense regional and social inequalities, Brazilian population mortality rates have had a rapid and sustained decline since the beginning of the 1940s, entailing an increase in the population's life expectancy, which jumped from 41 to 54 between the 1930s and 1960s. However, the level of fecundity remained high until the mid 1960s, only declining in the South and Southeast regions (although slightly) and remaining constant, or even increasing in the North, Northeast and Central-West regions. Thus, the total fecundity rate only fell from 6.5 to 5.3 children per woman during this period. The result of this evolution was a significant increase in the average population growth rate, which went up from 2.4% in the 1940s to 3.0% in the 1950s and 2.9% in the 1960s.

Since the Brazilian population has remained basically closed, that is, without significant migratory flows, and with high and quite stable levels of fecundity, its age group distribution remained relatively constant and young from 1940 to 1970, despite the sharp decline in mortality rates and rapid growth. Thus, throughout that entire period, 52% of the population was under the age of 20.

The country underwent a rapid and widespread decline in fecundity at the end of the 1960s. Previously limited to more privileged urban social groups from more developed regions, this process soon extended to every social class and various regions. Thus, the total fecundity rate fell from 5.8 in 1970 to 4.3 in 1975, and 3.6 in 1984, which corresponds to a decline of more than 37% over only 15 years.

Census data from 1991 confirm the tendency for a sharp drop in fecundity in Brazil. Brazil's population grew below expectations, and in 1991 there were only about 147 million inhabitants, with an average annual growth rate between 1980 and 1991 falling to 1.9%, compared to the 2.4% seen in 1980.

Indeed, it can be affirmed that the decline in fecundity in Brazil is not a situational phenomenon, but rather an irreversible process that has come to be called a demographic transition in the demographic jargon. Information on use of contraceptive in Brazil corroborates this assertion.

According to 1980, 1991 and 2000 Census data, this change in the demographic growth pattern has produced some significant consequences in the short term: the average annual growth rate of the population, which in the 1960s was 2.9%, fell to 2.5%, 1.9% and 1.6% over the next three decades, respectively; and the percentage of the population under 10 years of age fell significantly. These data show that Brazil's population underwent continuous decline in growth rates and a destabilization in age group distribution.

A fundamental aspect evidenced by these data is the expressive "aging" of the population, that is, the progressively smaller weight of youths as a result of the decline in fecundity rates that occurred between 1970 and 1991. In the population's age group profile, the 2000 Demographic Census revealed that for every 100 children, Brazil had 30 elderly. This survey showed that, out of the total elderly population, women were the majority. On average, the elderly were 69 years old and had 3.4 years of education, and the majority lived in big cities.

According to the Social Indicators Synthesis (IBGE, 2008), based on the National Household Sample Survey - PNAD, which covered the entire country, in 2008 Brazil's average demographic density was 22 inhabitants/km^2. The population under one year of age declined 27.8%, from 1.8% of the total population in 1998 to 1.3% in 2008; the number of children and adolescents up to 14 years of age represented 24.7% of total population, whereas in 1998 this percentage was 30.0%, representing a 17.7% decline in the previous 10 years. The PNAD was also able to identify a considerable increase in the elderly population aged 70 or more, indicating a total of 9.4 million people in that age group, corresponding to 4.9% of the total population.

Considering continuity in the tendencies for fecundity and life expectancy rates for the Brazilian population, the estimates for the next 20 years indicate that the elderly population could exceed 30 million people in 2020, thus representing nearly 13% of the population.

Fecundity continued to be a fundamental demographic factor for characterizing the evolution of Brazil's population. In 2008, the total fecundity rate was 1.9, compared to 3.6 in 1984, an indication of the continued intense and rapid decline in fecundity that has been taking place in Brazilian society over recent decades.

1.4.5 Profile of Education

Educational indicators in Brazil saw significant improvement over recent decades, with a reduction in illiteracy rates, an increase in enrollments at every level of education and growth in the population's average level of education. Nevertheless, the situation of education in the country is still unsatisfactory both from a quantitative and a qualitative perspective. Some of the main indicators for education in Brazil in the past decades are shown in Table 1.7.

Table 1.7 Main indicators for education in Brazil over the past decades

Education Indicators in Brazil - 1960 to 2006						
Indicators	1960	1970	1980	1991	2000	2006
Adult Literacy Rate (*)	60.4	66.4	74.5	79.9	86.8	89.3
Illiterates	39.6	33.6	25.5	20.1	13.2	10.7
Population's Level of Education (**)						
First phase of elementary (1-4)	41.0	40.0	40.0	38.0	43.0	NA
Second phase of elementary (5-8)	10.0	12.0	14.0	19.0	13.0	NA
High School	2.0	4.0	7.0	13.0	16.0	NA
Higher Education	1.0	2.0	5.0	8.0	7.0	NA
Average Number of Years of Study	2.1	2.4	3.6	5.0	5.7	NA

(*) People 15 years of age or older. (**) People 25 years of age or older, by level of education completed.

Source: IPEA/PNUD, 1996; IBGE, 1960; IBGE, 2000b; IBGE, 2006a.

An appropriate level of education for the population is an essential requirement for the country's development to guarantee the exercise of citizenship and promote equal opportunities in society. Expanding education levels and education quality in Brazil is still a major challenge, especially because of the persistent teaching and learning problems (IPEA, 2006a).

An analysis of the increase in education levels over past decades reveals that, despite the growth reported, from an average of two years of study in 1960 to nearly six years in 2000, this increase is lower than expected as a result of the growth in income per capita over the same period.

In 2000, 86.8% of those people aged 15 or more were literate, and this percentage increased to 89% in 2005. The South region has the lowest illiteracy rate for those 15 years of age or older (5.9%) and the Northeast region has the highest (21.9%) rate. Brazil's illiteracy rate fell from 20.1% in 1990 to 13.6% in 2000, and to 11% in 2005. There has been significant improvement in education level rates due to robust policies geared towards this area. In relation to states, the Federal District has the lowest illiteracy rate in the country: 4.7%. The other states with the best rates are Rio de Janeiro, with 4.8%; Santa Catarina and Rio Grande do Sul, with 5.2%, and São Paulo, with 5.4%. Alagoas has the highest rate of illiteracy in the country: 29.3%. The rural area saw an increase in literacy rates, from 72.4% in 2000 to 75% in 2005. The South region, with 9.8%, has the lowest percentage of illiterates in the rural area. The Northeast region has the worst performance in the country, with 36.4% of all those aged 15 or more unable to read and write.

In the group of people between 7 and 14 years of age, which corresponds to the age group where the vast majority of children should be in elementary school, 2.7% were not enrolled in schools. The lowest figure for this indicator was the Southeast region (1.8%), followed by the South region (2.1%). At the other extreme, 4.3% of that age group was not in school in the North region, and in the Northeast region that percentage was 3.5%. In the Central-West region, the indicator was at 2.4%.

According to the IBGE (2006a), the illiteracy rate for people aged 10 or more fell from 14.7% to 11.4% from 1995 to 2001, and in 2005 it was 10.1%. In the 10-14 age group, when it is expected that a child should at least be able to read and write, the illiteracy rate fell from 9.9% in 1995 to 4.2% in 2001, and finally to 3.2% in 2005. In the Northeast region, this indicator was at 23.9% in 1995, falling to 9.5% in 2001 and 7.0% in 2005. Despite this progress, this final result is still far from the level achieved in the South, Southeast and Central-West regions.

Between 1991 and 2005, 4.6 million students joined elementary education and another 5.2 million entered high school in public education networks. Although illiteracy in Brazil mainly affects the adult population, especially the elderly, the Brazilian education system has been unable to eradicate this problem among the young, as demonstrated in the rates shown above.

There has been a significant improvement in education level rates as a result of education policies. In 2005, 79.8% of the students attended public schools. School attendance improved in all age groups. The highest percentage of children in school (97.3%) is from the 7-14 age group. However, the percentage of slow students or students who drop out of school is still very high.

But the poor quality of the education system is less related to a shortage of resources than to their inefficient distribu-

tion and use. This inefficiency results largely from the system's institutional format, which is marked by strong fragmentation, lack of effective jurisdictions for coordination and precarious mechanisms of information and evaluation. However, Brazil has sought to conduct programs with a view to improving Brazil's educational system as well as the progressive universalization of access to basic education.

Basic education

Brazil has virtually universalized access to school for the population aged 7-14. Between 1992 and 2005, it expressively increased the percentage of youths in school (school attendance rates), and there was also a significant reduction in several types of inequality (Table 1.8).

Table 1.8 School attendance rates for people aged 7-17 by level of education, according to gender and household status, 1992 and 2005 (%)

Selected Characteristics	Elementary 7 to 14 years old		High School 15 to 17 years old	
	1992	2005	1992	2005
Total*	81.4	94.5	18.2	46.0
North*	82.5	93.9	11.7	35.4
Northeast	69.7	92.4	9.5	30.1
Southeast	88.0	95.8	24.3	57.4
South	86.9	95.9	23.1	53.6
Central-West	85.9	94.7	17.5	45.9
Gender				
Men	79.9	94.3	15.1	41.2
Women	82.7	94.8	21.3	50.7
Household situation				
Rural	66.5	92.5	5.3	25.7
Urban	86.2	95.0	22.3	50.4

*Excluding the rural population of the states of RO, AC, AM, RR, PA and AP.
Source: IPEA, 2007.

A comparison between the attendance rates at elementary schools in Brazil's regions shows that there has been a reduction in disparity in this regard. Between 1992 and 2005, the difference between the regions with the highest and lowest rates fell from about 20% to under 4%. High school has seen a similar trend: over the same period, asymmetry between the attendance rates in the Northeast and Southeast regions fell from 61% to 48%.

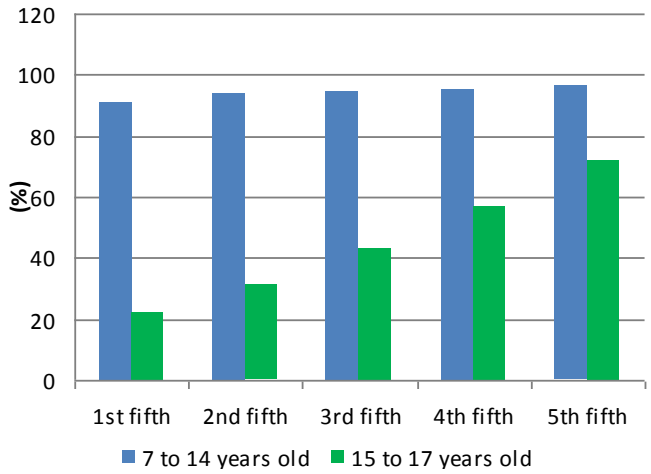
Another great achievement is seen in the rural and urban indicators between 1992 and 2005. While at the beginning of the period, 66.5% of all children aged 7 to 14 from the rural area attended that level of education, by the end of the period this had increased to 92.5%.

However, the comparison of students according to family income shows persistent inequality (Figure 1.14). In elementary education, the difference between school attendance rates for the richest and the poorest is 5 percentage points; in high school, this disparity is nearly tenfold more.

The low attendance rate for high school in the 15-17 age group is mainly due to the enormous age-grade distortion that affects most of these youths, especially those who belong to low-income groups. In 2005, nearly 82% of Brazilians aged 15 to 17 attended school, but only 45% of them were in high school. Among those in the poorest 20% group, attendance rates were half the national average.

Despite the progress made by the Brazilian society, the percentage of slow students or students who drop out of school is still very high. This contributes towards the low conclusion rates for elementary education.

Figure 1.14 Attendance rate (%) of people aged 7-17, by age group, according to the fifths16 of monthly family income per capita in 2005



Source: Elaborated based on data from IPEADATA. Available at: < http://www.ipeadata.gov.br/>

Technical education

There is a great deficiency in technical education in the Brazilian educational system. The total supply for technical education does not reach 1 million enrollments per year, even after the 20% growth reported between 2003 and 2005. Most of this growth occurred in the private sector.

Despite the weight of the private sector, the best-known and consolidated feature of this group is the federal technical school network, with 138 units and nearly 80 thousand students throughout the country. However, the largest slice of the public supply is in the state technical school network, with 553 units and 165 thousand students.

Technical school enrollment represents approximately 10% of all regular high school students (9.2 million in 2005, as per data from the Ministry of Education - MEC/ Anísio Teixeira National Institute of Educational Studies and Research – INEP, 2008) and falls short of 2% of the working population with eight years of education or more (46 million workers), who would be potential candidates for technical courses.

Adolescent and adult education

The growth in Adolescent and Adult Education - EJA has mainly occurred at the elementary level, which is consistent with the fact that nearly half of the working population has at least eight years of education. For this group of adolescents and adults who are employed or looking for a job, EJA is not only the fastest path, but it is also more attractive than regular high school, due to environments, times and, in some cases, methodologies that are more adjusted to their profile, such as the *Novo Telecurso* and *Telecurso 2000*[9]*; Tecendo o Saber*[10] and *Escola da Juventude*[11].

In general, the current supply of EJA (around 6 million enrollments) is still small, considering its market potential of 45 million adolescents and adults who are in the working population (whether employed or not) and who have not completed elementary school.

It is estimated that between 2003 and 2004 nearly 8 million adolescents and adults were theoretically taught to read and write, which would have been sufficient to cover nearly 90% of the working population with less than one year of education. At this pace, absolute illiteracy (i.e., total inability to read and write) could be eradicated in a short period of time.

However, this issue is more complex since there are doubts as to the efficacy of shortduration adult literacy programs, without any follow-up in high school equivalency programs or vocational courses. Furthermore, the problem of functional illiteracy persists.

Higher Education

From 2002 to 2007, Brazil saw big improvements in various higher education indicators, such as the increase in courses offered (Table 1.9), increase in openings (Table 1.10) and increase in enrollments (Table 1.11). In relation to classroom-based undergraduate education, the 2007 National Household Sample Survey revealed that there were 23,488 courses throughout Brazil, thus representing a 6.3% increase compared to 2006. The lowest growth in course numbers was reported by the Northeast region (0.5%), although other regions with poor higher education coverage saw above-average growth for Brazil, such as the North (8.7%) and Central-West (7.2%) regions. As in previous years, the private Higher Education Institutions - IES were responsible for offering the highest number of courses in 2007, in a total of 16,892. However, federal higher education institutions saw the highest percentage growth (8.8%) in the number of courses compared to 2006 (IBGE, 2007b).

9 These programs are updated continuously. In 1978, *Telecurso 2° grau* was created, which was a pioneer project in Brazilian distance education. In 1981, *Telecurso 1° grau* became available. In 1994, the Roberto Marinho Foundation, in a partnership with the Federation of Industries of the State of São Paulo - FIESP, launched *Telecurso* 2000, which consisted of an innovative educational proposal geared towards people who had not completed elementary and high school education. Nowadays, *Telecurso* is recognized around the world as a methodology that promotes a quality leap in education, and it has benefited more than 5.5 million people. In 2006, *Telecurso* began a new virtuous cycle. Its partners launched a set of measures to enlarge its scope: expanding content and including new actions, subjects and technologies. And thus Novo *Telecurso* came into being: an enormous investment with social relevance for another 10 years.

10 *Tecendo o Saber* is a project that offers teens and adults an opportunity to study first phase elementary education content, which corresponds to grades 1-4. The *Tecendo o Saber* programs are broadcast by TV Globo, on Canal Futura and TV Escola. They are also made available to all the other educational, community and university TV stations.

11 The *Escola da Juventude* is a state government program for adolescents and adults to attend High School for a shorter period of time than the conventional program through weekend classes and technologies that accelerate the learning process, such as computer laboratories and video rooms.

Table 1.9 Evolution in the number of courses, according to administrative category, 2002 to 2007

Year	Total	%Δ	Public						Private	%Δ
			Federal	%Δ	State	%Δ	Municipal	%Δ		
2002	14,399	-	2,316	-	2,556	-	380	-	9,147	-
2003	16,453	14.3	2,392	3.3	2,788	9.1	482	26.8	10,791	18
2004	18,644	13.3	2,450	2.4	3,294	18.1	518	7.5	12,382	14.7
2005	20,407	9.5	2,449	0	3,171	-3.7	571	10.2	14,216	14.8
2006	22,101	8.3	2,785	13.7	3,188	0.5	576	0.9	15,552	9.4
2007	23,488	6.3	3,030	8.8	2,943	-7.7	623	8.2	16,892	8.6

Source: INEP, 2008.

Table 1.10 Evolution in the number of openings, according to administrative category, 2002 to 2007

Year	Total	%Δ	Public						Private	%Δ
			Federal	%Δ	State	%Δ	Municipal	%Δ		
2002	1,773,087	-	124,196	-	132,270	-	38,888	-	1,477,733	-
2003	2,002,733	13	121,455	-2.2	111,863	-15.4	47,895	23.2	1,721,520	16.5
2004	2,320,421	15.9	123,959	2.1	131,675	17.7	52,858	10.4	2,011,929	16.9
2005	2,435,987	5	127,334	2.7	128,948	-2.1	57,086	8	2,122,619	5.5
2006	2,629,598	7.9	144,445	13.4	125,871	-2.4	60,789	6.5	2,298,493	8.3
2007	2,823,942	7.4	155,040	7.3	113,731	-9.6	60,489	-0.5	2,494,682	8.5

Source: INEP, 2008.

Table 1.11 Evolution in the number of enrollments, according to administrative category, 2002 to 2007

Year	Total	%Δ	Public						Private	%Δ
			Federal	%Δ	State	%Δ	Municipal	%Δ		
2002	1,205,140	-	122,491	-	125,499	-	32,501	-	924,649	-
2003	1,262,954	4.8	120,562	-1.6	108,778	-13.3	37,741	16.1	995,873	7.7
2004	1,303,110	3.2	122,899	1.9	125,453	15.3	38,890	3	1,015,868	2
2005	1,397,281	7.2	125,375	2	122,705	-2.2	40,601	4.4	1,108,600	9.1
2006	1,,448,,509	3.7	141,989	13.3	117,299	-4.4	38,119	-6.1	1,151,102	3.8
2007	1,481,955	2.3	151,640	6.8	109,720	-6.5	37,131	-2.6	1,183,464	2.8

Source: INEP, 2008.

The student population in higher education has tripled since 1980 — from 1.4 million to 4.2 million —, the number of institutions has doubled and the predominance of private institutions has grown. Today, they represent virtually 90% of the IES in the country, and offer 88% of the openings.

In this context of higher education expansion, it is important to recognize that Brazil's graduate study system is still markedly public. It is by far the best segment of higher education in Brazil, and it adequately supplies undergraduate studies with professors with Masters and PhDs.

It could be argued whether Masters use their potential and whether the per hour wage system, which prevails in private institutions, is a good solution. But it is impossible not to appreciate the huge progress of private sector faculty members since 70% of the teachers with a Master Degree work at these institutions. This shows that even with the recent major expansion, faculty staff is increasingly more qualified, that is, there are no problems in supplying teachers or in offering openings in the undergraduate segment.

The Federal Government has been pursuing initiatives in recent years to extend the coverage of higher education to every social class. These measures include the Support Program for the Restructuring and Expansion of Federal Universities - Reuni[12] , which is one of the actions in the Education Development Plan - PDE, and it was instituted in recognition of the strategic role of universities — especially in the public sector — for economic and social development.

With Reuni, the Federal Government adopted a series of measures to resume growth of public higher education, creating a program that is both multidimensional and academic, political and strategic. The effects of the initiative are reflected in the significant expansion in the number of openings, initiated in 2008 and expected to end in 2012, and the opportunity this represents for academic restructuring with innovation, which in the short term will mean a true revolution in the country's public higher education.

Below is a description of the three cycles of recent expansion undergone by Brazil's federal universities:

- First Cycle – Expansion towards the Countryside (2003/2006): creation of ten new federal universities in every region; consolidation of two federal universities; creation and consolidation of 49 university campuses, taking free and public education to smaller cities with immediate effects on meeting the existing strong demand; positive impact on physical, political, social, cultural, economic, environmental levels; creation and expansion of new local and regional opportunities available; and fight against regional and spatial inequalities.

12 See: <http://reuni.mec.gov.br/>.

- Second Cycle - Expansion with Restructuring (2007/2012): adherence by all 54 federal institutions of higher education (existing as of December 2007); 26 projects with innovation components; consolidation and establishment of 95 university campuses; apparent increase in the number of openings for higher education, especially night courses;

- Third Cycle - Expansion with an emphasis on international linkages (2008): creation of federal universities in strategic territorial regions for education, research and extension purposes within the scope of international integration and cooperation under Brazilian leadership.

Reuni's general objectives, goals and guidelines are to create conditions (through allocation of resources) for expanding access to and staying in higher education; increase the quality of education through academic innovation and adaptation, with integration between professional and technological undergraduate, graduate and basic education; improve the use of human resources and physical infrastructure of federal universities; gradually increase the average conclusion rate for classroom-based undergraduate courses to 90% and achieve the student/teacher ratio of 18 in classroom-based undergraduate courses; increase enrollments in undergraduate courses by at least 20%; create a five-year deadline, counted from the start of each plan, to comply with the goals established by federal higher education institutions.

The desired quality for higher education begins to become a reality as federal universities join the program and adopt its guidelines, according to six components: expansion of the offer of public higher education; academic-curriculum restructuring; pedagogical renewal of higher education; intra and inter-institutional mobility; institutional social commitment, and; graduate studies support for the qualitative development and improvement of undergraduate courses.

Expansion and restructuring are pressing needs of the country's public higher education. Expansion is necessary because on the national average only 12% of Brazilian youths between 18 and 24 years of age have access to university education, and restructuring is necessary as a means to ensure the academic, political and strategic responses to the 21st Century's new challenges, i.e., academically adapting universities in their qualitative (essence and structure) and quantitative (expansion of supply) aspects to the new demands and new roles and global contexts that stem from a society of knowledge that is getting stronger and stronger at the beginning of this century; strategically preparing qualified labor to meet the country's social, economic and ecological needs of this new cycle of growth and development currently underway in Brazil; producing scientific, technological and innovative knowledge to insert the country in a sovereign manner in the new global order of knowledge that is arising in the 21st Century.

Graduate studies

In terms of performance, graduate studies are incredibly robust. In 15 years, the number of enrollments in Masters programs doubled, and for PhDs they grew fivefold. In 2004, there were 66,306 Masters and 39,948 PhD enrollments. The search for graduate studies continues to report rapid growth, as do the requests for Coordination for the Improvement of Higher Level Personnel — Capes authorization for the creation of new Masters programs. The result is that scientific production is now growing continuously. In 50 years, Brazil shifted from a production that virtually equaled zero to a 1.7% share in global science, ahead of virtually every non-industrialized country (except for China and India).

1.4.6 Profile of Healthcare

The objective of this section is to introduce Brazil's health profile, focusing on epidemiological characteristics, the demand and supply of health services and the expenses at different levels of public administration.

Infant mortality

Based on 1991 Demographic Census data, it is possible to estimate the child mortality rate tendencies in the 1980s. This rate has been seeing a significant reduction, and it fell from 163/1,000 in 1940 to 73/1,000 in 1980, to 47.2/1,000 in 1990, and to 21.7/1,000 in 2005.

A reduction in child mortality is a tendency that has been ongoing since the beginning of the 1990s. The rate fell from 31.9 per thousand live births, in 1997, to 21.17 in 2005. Child mortality has fallen in every region, with the Northeast region reporting the greatest reduction (37%). However, according to IPEA (2010b), even with reductions in every state, regional differences are the factor of greatest concern and reveal the inequalities in the Brazilian population's living conditions. In the Northeast region, with 31.6 per thousand live births, and North region, with 23.35 per thousand, the rates were much higher than those seen in the South (13.8), Southeast (14.20) and Central-West (17.80) regions.

Available data suggests a strong drop in child mortality over the past decade, reflecting improved living conditions as a result of an increase in spending on health, sanitation, food and nutrition, since 1986. It is worth pointing out that the reduction in child mortality in Brazil between 1990 and 2005 was only possible through the adoption of various actions, such as an increase in vaccination coverage for the population; increased prenatal care; expansion of health services; continued reduction in fecundity; improvement in the population's environmental conditions and nutrition; improvements in basic sanitation and the increase in mother education.

Changes in the profile of child mortality causes over recent decades basically reflect the transformations resulting from the urbanization process and the weight of health institutions in relation to births and primary child health care. Although most births occur in hospitals and there has been an considerable increase in medical care for the population, quality is still precarious, which is reflected in the high incidence of diseases stemming from the perinatal period in the child mortality structure, which in recent years has become the main cause of deaths for children up to one year of age. In 2005, infectious diseases accounted for 7.6% of mortality, but mortality from perinatal causes was 61%.

Over the past ten years, living conditions for Brazilians and access to basic health service have improved considerably. However, compared to other South American countries, like Argentina and Chile, Brazil still has a high rate of child mortality. Even with the increase in health services, quantitative improvements are necessary in the care given to pregnant women, at birth and new-borns.

Overall mortality

According to the Unified Health System Database (IDB/SUS, 2008), the gross mortality rate in Brazil in 2004 was 6.29/1,000. The major cause of death in the country is related to circulatory diseases, which were responsible for 31.5% of deaths in 2005. Neoplasia (cancer) comes second, responsible for 16.3%; external causes, with accidents as a major cause, mainly traffic accidents, come third, with 14.1%; respiratory tract diseases are ranked fourth, with 10.8%; in fifth, infectious and parasitic diseases, with 5.2%; the sixth position is held by diseases stemming from the perinatal period (3.3%); and other causes with 18.8%.

According to the IPEA (2010b), the tendency towards a reduction in mortality, which was already the case in the 1990s, has been maintained, thanks to socioeconomic development, aging of the population and increase in coverage by health and sanitation actions. The profile of mortality has been changing in the country: mortality from non-transmissible diseases, such as neoplasia, has increased from 14.9% in 2000 to 16.3% in 2005. These causes are associated with life style and working conditions, and can be reduced with measures to control risk factors. A mortality profile where non-transmissible diseases predominate is an indicator of a population at a higher socioeconomic stage. However, in Brazil's case, there is still an uncomfortable percentage of deaths from infectious and parasitic diseases (5.2%), especially in the North and Northeast region, where this indicator is approximately 8% in some states. Although the participation of infectious and parasitic diseases fell from 6.23% in 1990, to 5.1% in 2004 of total deaths with known causes, the absolute number of deaths by this group of diseases grew from 41,676 in 1990 to 46,628, in 2005.

Demand and supply of health services

The demand for health services is associated with the level of development and the actual supply of these services. Health care use rates grow according to income levels. Furthermore, it has been ascertained that the higher the family income per capita, the higher the percentage of people who pay for the health services used, which is close to 60% in classes with family income per capita greater than two monthly minimum salaries.

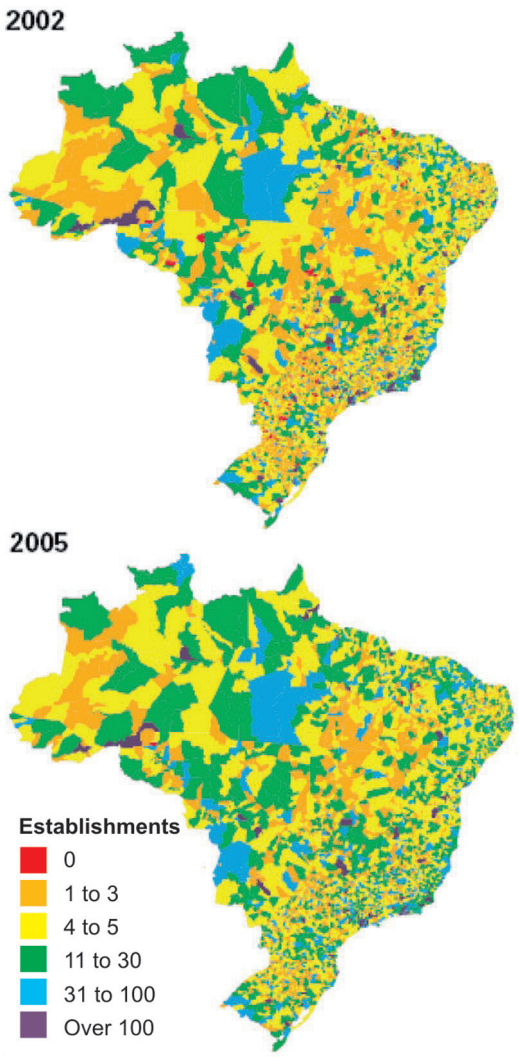
In 2006, IBGE's Medical-Health Assistance Survey - AMS revealed a total of 83,379 health care establishments, 3,606 of which were out of service, 2,769 had been shut down and 77,004 were in full or partial operation. The public and private sectors had differentiated behaviors by region. The public sector saw most growth in the North (2.7% per year), Northeast (7.0% per year) and Southeast (5.8% per year) regions, whereas the private sector saw most growth in the South (5.0% per year) and Central-West (15.2% per year) regions, as shown in Figure 1.15.

According to IBGE (2006b), the number of beds had jumped from 443,888 in 1976 to 544,357 in 1992, which meant an increase of 22.6%, or 1.3% per year, and fell to 443,210 in 2005, representing an 18.6% reduction (1.6% p.a.). In 2005, the bed per 1,000 inhabitants ratio was 2.4. In 2002, this ratio was 2.7 per 1,000 inhabitants. The private sector was responsible for the biggest decline in this rate (4.9% p.a.). The decline was 1.2% in the public sector.

The supply of beds is distributed as follows around Brazil's major regions: the North region has 6.1% of the total number of beds (27,163); the Northeast region, 26.1% (115,857); the Southeast region, 43.2% (191,453); the

South region, 16.8% (74,558); and the Central-West region, 7.7% (34,179). But the North region has the highest percentage of public beds (57.7%) followed by the Northeast (45.3%) and the Central-West (36.6%) regions. In the Southeast region, the percentage is 27.9% and in the South region, the lowest, at 19.9%.

Figure 1.15 Health establishments by municipality



Source: IBGE, 2006b.

1.4.7 Access to Urban Sanitation Services

This item discusses the data on sanitary sewage[13], water supply and garbage collection in urban and rural zones, divided by geographical region, in 1991 and 2006, which are summarized in Table 1.12.

In general, access to sanitary sewage services in Brazil reveals significant discrepancies among the different social classes. Sanitary sewage is the service with the lowest rate of public service, being offered to only 68.24% (20.27% in the rural zone and 77.85% in the urban zone) of Brazilian municipalities in 2005, and where the Central-West region has the lowest rate, 43.83% for the same year. Four out of five cases of disease are caused by water contamination and the lack of appropriate sewage treatment.

From 2001 to 2005, in the total number of permanent private households the proportion of dwellings with proper sanitary sewage grew from 66.8% to 70.4%. The proportion of houses served by a sewage collection network grew continuously, from 45.4% to 49.0%, from 2001 to 2005.

Water supply is another major urban sanitation problem in the country. The geographical regions display enormous differences, as do the rural and urban zones. The proportion of homes served by a general network went up from 81.1% in 2001 to 83.4% in 2005.

Another source of problems in major urban centers is urban solid waste from the household and industrial sectors. Garbage collected and improperly disposed of in open air landfills and in marsh areas causes health problems and water contamination. When a toxic load is involved, generally from industrial and agricultural settings, environmental consequences for human health and for the preservation of fauna and flora are more significant. Disposal is a problem: incineration is expensive and also poses risks of contamination; recycling is not always possible, given the quality of the waste or collection and transportation costs. Only 8% of Brazil's municipalities maintain selective garbage collection programs; 62% collect hospital waste; however, 34% of those do not submit it to any treatment. From 2001 to 2005, the percentage of homes with garbage collection service grew from 83.2% to 86.8%.

Access to proper basic sanitation makes the population less vulnerable to water-transmitted diseases. There is a high correlation between child mortality rates and the lack of sanitation services.

Despite the increase in the percentage of people with simultaneous access to proper water, sewage and garbage collection, the lack of proper basic sanitation still afflicted 28.7% of Brazil's urban population in 2004. Coverage levels are lower in Brazil's North and Central-West regions. Among Brazil's

13 Sanitary sewage consists of an appropriate system for collecting, treating and disposing of dejects generated by human, commercial and industrial activities.

states, the biggest declines in population numbers with improper basic sanitation were reported in the states of Tocantins, Amazonas, Espírito Santo, Paraná, and Rio Grande do Sul. In turn, the states of Amapá and Alagoas had the worst performances, with an increase of more than 12 percentage points in the number of people dwelling in homes with inadequate basic sanitation between 2001 and 2004. The pollution potential from this lack of sewage treatment is worsened by the lack of proper disposal for a great part of collected solid waste. Despite the improvement in the indicators, access to proper basic sanitation is still very unequal in both regional and social terms.

Table 1.12 Proportion of sanitary sewage, water supply and garbage collection in urban and rural zones, divided by geographical region, in 1991 and 2006.

	Proportion of sanitary sewage (%)				Proportion of water supply (%)				Proportion of garbage collection (%)			
	1991		2006		1991		2006		1991		2006	
	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban
Brazil	8.84	61.8	20.27	77.85	9.31	86.98	29.01	97.03	5.29	77.98	24.63	97.15
Southeast	15.63	79.57	30.57	91.52	11.71	93.17	29.01	97.03	8.16	85.77	41.77	99.04
South	16.55	63.2	45.17	83.3	7.37	90.26	31.92	95.04	5.05	86.44	39.42	99.23
Northeast	3.88	35.3	9.76	61.51	9.53	78.39	29.32	90.85	3.69	62.56	14.51	92.96
North	8.26	34.83	19.67	60.31	8.52	67.99	15.57	89.33	7.83	52.9	19.2	92.82
Central-West	3.35	40.85	6.71	49.64	5.05	78.97	16.92	69.02	3.27	75.08	20.14	98.72

Source: Elaborated from SIDRA/IBGE data. Available at: <http://www.sidra.ibge.gov.br/>.

1.5 Summary of National Circumstances

Overall, despite its progress in economic and social indicators in recent years, Brazil is a country with a growing population, where most of the population's basic needs have yet to be met, infrastructure is still incipient and substantial improvements are required. All this justifies the fact that Brazil is still a developing country.

Table 1.13 Summary of National Circumstances

Criteria	1994	2000	2005	2008
Population (millions of inhabitants)	153.0[1]	169.8[2]	179.9[3]	186.0[3]
Corresponding surfaces (km²)	8,514,876.6	8,514,876.6	8,514,876.6	8,514,876.6
GDP (billion US$ 2007/year)[4]	920.7	1,062.0	1,218.3	1,406.5
GDP per capita (thousand US$ 2007/inhab.)[4]	6.02	6.25	6.77	7.56
Informal sector's share of GDP (%)	NA	12.98%	NA	NA
Industry's share of GDP (%)[4]	26.1	26.9	29.3	28.8 (2006)
Services' share of GDP (%)[4]	67.3	68.0	65.0	65.8 (2006)
Agriculture's share of GDP (%)[4]	6.7	5.1	5.7	5.5 (2006)
Surface for agricultural use (km²)[5]	2,206,790	2,190,883	2,186,818	NA
Urban population as a percentage of total population (%)	77.3[1]	81.2[2]	83.3[6]	84.4[6]
Number of head of cattle (millions) [7]	158.2	169.9	207.2	202.3
Forest surface (km²) [8]	5,582,197	5,407,6747	5,247,288	5,121,048
Number of inhabitants in extreme poverty (millions)[9]	32	22	15	9
Life expectancy at birth (years)[10]	66.4	68.6	71.9	72.9
Literacy rate (%)[10]	84	86.4	86.8	89.3 (2006)

Notes:
NA: Not available.
1 – IBGE, linear interpolation between the 1991 Census and the 1996 Population Count.
2 - IBGE, 2000b.
3 – IBGE, linear interpolation between the 2000 Census and the 2007 Population Count.
4 – IBGE, 2009b.
5 – SIDRA. Municipal Livestock Survey (total area of farms by land use). Data for 1994, 2000 and 2005 obtained through interpolation.
6 – Due to the lack of an urban population estimate in the 2007 Population Count, this was estimated at 84% of the total, based on the evolution of the urban proportion from previous official figures, thus allowing for an estimate of the same fraction for 2005 and 2008.
7 – Available at: <http://www.sidra.ibge.gov.br>.
8 – FAO, 2010 (data for 1994 obtained through interpolation).
9 – IPEA, 2010a; IPEADATA (<http://ipeadata.gov.br>).
10 – IBGE, 2000b; 2006a; 2007a; 2007b; 2008; 2010 (<http://www.ibge.gov.br/home/mapa_site/mapa_site.php# populacao>).