

Introduction

Population and Environment in Brazil:
Stockholm+30
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As one of the world's largest countries, in terms of both territory and population, Brazil has been an inevitable focus of attention for population-environment concerns. In the last quarter of the 20th century, as both issues moved to center stage on international policy agendas, the realities behind these concerns, and political response to them, were polemical issues. At the level of international diplomacy, Brazil was an active participant in UN conferences on population and on environment. At the level of scientific inquiry, demographic studies sought to avoid the over-simplifications often present in such political debate, while seeking to contribute to an understanding of the relationships between these two order of phenomena. Research agendas were defined, to a considerable extent, by Brazil's specific socio-economic realities and their political context.

What has Brazilian demography had to say about population and environment? The first challenge was to develop approaches which did not simply extend run-of-the-mill neo-Malthusianism; i.e., the issue was not reducible to the pressure of numbers on resources, but the two dynamics – demographic and ecological – had important interactions which (1) were new, inasmuch as the environmental situation had changed so radically over the 20th century and (2) had been largely unrecognized or ignored by demographers. This process occurred at a moment when Brazil's demographic transition was entering a new phase and population stability was visible. This fact had two important implications for the development of this field. On the one hand, it was now possible to separate consequences of rapid growth and identify environmental determinants and consequences of demographic phenomena. On the other hand, Brazilian (and in general, Latin American) demography, relaxing a decades-long resistance to the *controlista* view of the relations between population and development (given the waning of this view within the demographic establishment), was able to consider, as legitimate fields of research, themes which earlier had been regarded as mere apologies of such a view.¹ This discussion has been developed in several papers (Hogan, 1991, 1992, 2000) and will not be repeated in this text.

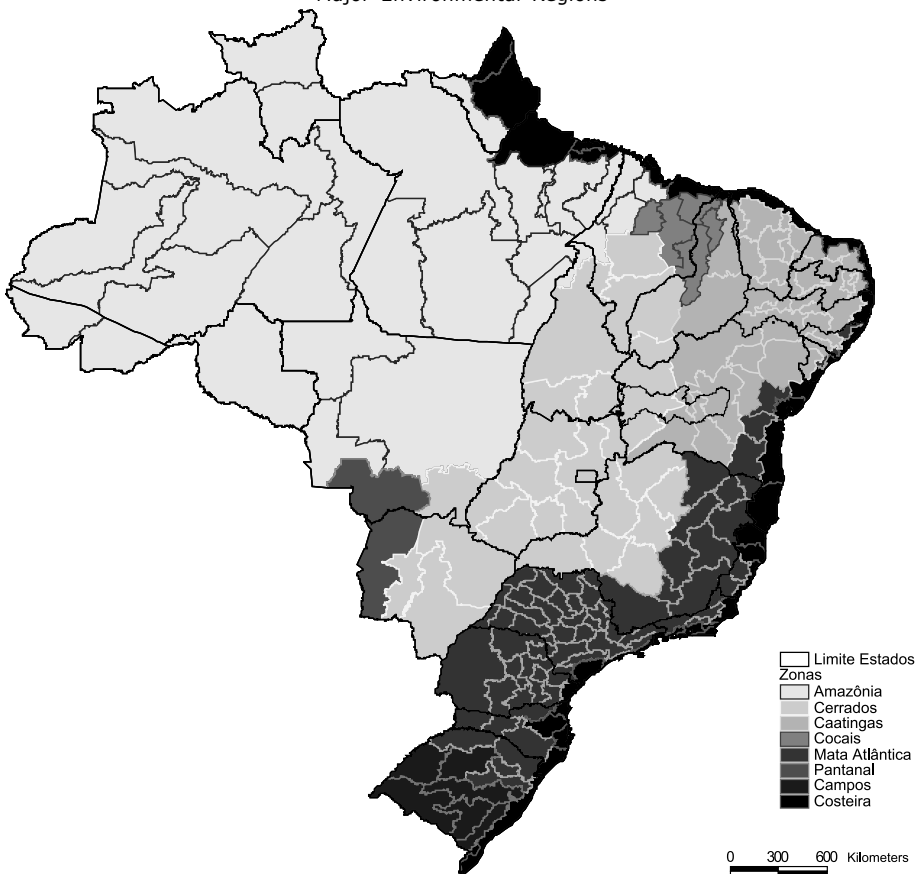
The second challenge was to identify these interactions and search for concepts and methodologies capable of analyzing and explaining them. Much of the 1990s was given over to this task, mirroring developments at the international level. This work is examined in the chapters of this book.

Finally, this work has led some demographers to view the population and environment issue as not merely adding one more variable to population analysis, but as requiring an entirely new approach to the field of population and development. A new "environmental demography" has been proposed (Hogan, 2001).

Population and Environment in Brazil's Major Biomes

Among world nations, Brazil has one of the greatest ecological and cultural diversities. Such diversity provides greater resilience to Brazilian development, with more degrees of freedom than most countries enjoy. This section presents an overview of population and environment relationships in the major biomes of Brazil, with a view to identifying the distinct roles each area has in answering the competing needs of economic development and environmental preservation.²

Map 1
Major Environmental Regions



A country as diverse as Brazil must be seen in the overall context of the differential distribution of population and resources. As a first step in characterizing these differences, this section examines some population characteristics of Brazil's principal ecological formations. In assessing the prospects for sustainable development, it is clear that not all socially desirable goals can be met in all points of the nation's territory. If we are to understand the possibilities and limits of economic activities (and the jobs and population movements inspired by these activities) in Brazil's remarkable ecological diversity, we must start by examining the present situation.

The following paragraphs discuss five of Brazil's major ecosystems: the Amazon Forest, the savanna-like *cerrado*³, the semi-arid *caatinga*, the Atlantic Rainforest and the savanna lands in Southern Brazil (Campos do Sul). The ideal strategy would be to form these areas by dismembering the municipalities⁴ according, not to state or regional boundaries, but to the ecosystems themselves.⁵ Considering this limitation, the population data do not precisely refer to these ecosystems, but may be considered to represent the level of pressure exerted on an ecosystem by its "area of influence." The states have been identified by their major ecosystem, a procedure which does not account for situations such as Mato Grosso, which in its Southern part is dominated by cerrado and in the North by the Amazon Forest. This limitation also ignores the Pantanal (one of the world's major wetlands), whose Brazilian portion is located in the states of Mato Grosso and Mato Grosso do Sul.

Table 1

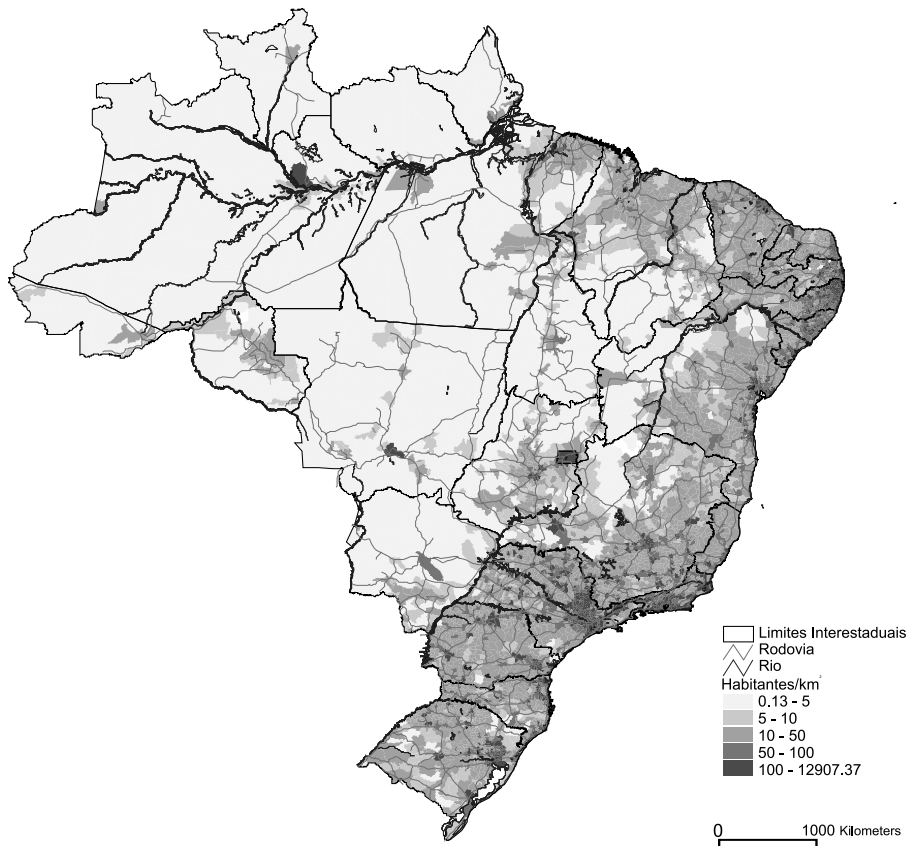
Population and urbanization in Brazil's major ecosystems, 1996 and 2000

Ecosystem	1996		2000	
	Population	Percent urban	Population	Percent urban
<i>Amazon Rainforest</i>	14,233,009	58	16,025,287	66
Cerrado	10,959,183	79	12,101,365	81
Semi-arid (<i>caatinga</i>)	37,927,461	63	40,261,478	70
Atlantic Rainforest	64,209,020	89	66,880,948	94
Campos do Sul (savanna)	9,637,682	79	10,179,801	82

Table 2Area (km²) population density in Brasil's major ecosystems, 2000

Ecosystem	Area (km ²)	Population Density (persons/km ²)
<i>Amazon Rainforest</i>	3,686,070	4.35
Cerrado	2,123,189	5.70
Semi-arid (<i>caatinga</i>)	607,556	66.27
Atlantic Rainforest	634,054	105.48
Campos do Sul (savanna)	282,062	36.09

Map 2
BRASIL Population Density - 2000



Elaborado por Cláudio A. G. Egler

Source: FIBGE: Resultados Preliminares do Censo de 2000.

The Amazon Rainforest, Brazil's largest formation, according to the definition used here⁶ (the states of Amazonas, Para, Acre, Amapá and Roraima) has an area of 3,686,070 km². It is Brazil's major forest formation, with a humid climate and a large variety of vegetation, from forest to savanna-like areas at low elevations. The principal environmental problem of the Amazon is deforestation, which occurs from fires provoked by the expansion of agricultural activities and by the exploitation of lumber. Data from the Environment Ministry register an increase in the pace of deforestation of 14.9% between 1999 and 2000. This situation has provoked much concern, first in Brazil and later internationally, and for much of world opinion represents Brazil's major environmental dilemma. Its population of 16 million in 2000, however, was concentrated in cities (66%), not in forest lands. And overall population density of 4.35 persons/km² is extremely

low. It is difficult to conclude that "population pressure" is responsible for the environmental threats facing the Amazon, bearing in mind that interregional migration, including frontier migration, was on the wane by 2000. The driving forces of deforestation have been identified and well-documented over the last 20 years. It has not been the land-hungry poor and their large families who bear the greater responsibility, but economic interventions, in the name of financial gain or national security. The Amazon region, considering its important biological diversity, its numerous indigenous groups and generally poor soils, would not be a major focus of economic development from a sustainability perspective. Large population contingents are not supported by extensive agriculture. Indeed, in the state of Amazonas, half the population lives in the capital of Manaus, sustained by an enclave of duty-free production of electronics. This is an arrangement whose days are numbered, but reveals the limited possibilities for absorbing population in the extensive forested regions.

The population-environment equation in the Amazon is not now in a critical state, but neither can it be seen in the future as an important alternative for population settlement. Crucial factors are such large-scale economic development projects, such as those planned in the government's *Avança Brasil* project. The environmental consequences of this program of infra-structure development are predicted to be disastrous (Laurence, 2000). Sustainability, from the perspectives of the region's biodiversity and its limited capacity to support large populations, reserves this region as the low-density area which it is today. Not population policy, but economic-ecological policy must be tailored to this end.

The *cerrado* (whose area of impact is defined here as the states of Mato Grosso, Mato Grosso do Sul, Goiás and the Federal District) has an area of 2,123,189 km² and a 2000 population of 10,959,183. While international concern for its biodiversity is more recent, Brazil's second largest ecosystem is a valuable national resource. The region has undergone rapid development over the last three decades. In this period, the region has moved from (1) a sparsely populated area of subsistence agriculture to (2) a major migration destination for land-seeking migrants from other regions to (3) dynamic, export-oriented monoculture. This has been a rapid process, coinciding with the modernization of Brazilian agriculture; increasing mechanization and government incentives have contributed to the transformation of vast extensions of land to the production of grains (especially soybeans, but also cotton, corn and rice) and cattle-raising. Great expectations have been placed on an expanding world market for soybeans and Brazil's comparative advantage in this field.

Considered as unproductive for farming until the use of modern methods since 1970, the *cerrado* has always been considered as not worth preserving. The *cerrado*, with an almost entirely tropical climate, is a complex of different forms of vegetation which have variable physiognomies and floristic compositions, forming an ecological mosaic. According to Goodland and Ferri (1979), the *cerrado* is "a mixture of low trees and a well developed herbaceous strata." (cited in SMA, 9)⁷

Since the seventies, when soil management methods were developed for the region⁸, the *cerrado* has been definitively incorporated into the national economy, and is now seen by planners, investors and farmers as unoccupied

and available for agroforestry, cattle raising and large-scale grain production. The intensive use of machinery and agricultural equipment, fertilizers, pesticides, herbicides and selected species have transformed the natural landscape of the region, frequently leading to the depletion of natural resources (desertification) and the contamination of food, soils and water. The original vegetation has been greatly reduced, 37% having been converted to pasture, annual crops such as soybeans, corn and rice and perennial crops such as eucalyptus and pine plantings, as well as such urban-generated land uses as reservoirs, cities and garbage disposal. In many areas, environmental degradation has already produced decreasing productivity and greater costs. These agricultural activities were rarely introduced with any environmental concern. Local varieties of plants were ignored and instead of adapting farming to the characteristics of the region, especially to the soil, the region's characteristics were adopted to the products. (Shigeo, 1999) The result has been compacting of soils, erosion and the genetic impoverishment of the native biota.⁹

Environmentalist concern is related to three major questions:

1. biological diversity: the *cerrado* is home to an estimated 420 species of trees, 10,000 different species of plants and 800 species of birds; 40% of its woody plants and 40% of its bees are endemic. It is the world's most biologically diverse savana, home to at least 5% of the planet's flora. One of the so-called biodiversity *hotspots* of the world, the *cerrado* is one of the most threatened biomes of the planet.
2. carbon sequestration: although it has not yet received much attention, the capacity of the *cerrado* to store carbon is immense. While it does not have dense forest, this is compensated by its enormous size and a vegetation with deep roots, forming an "underground forest," which makes a significant global contribution as a carbon sink. (Sawyer, forthcoming)
3. watershed protection: the sources of the three major Brazilian and South American river basins – the Amazon, the Rio de la Plata, and the Rio São Francisco – are located in this region. Large-scale transformation of land use will have continental consequences in terms of water supply and quality. This biome also plays an important role in the support of biodiversity in general, inasmuch as its river network functions as a corridor for fauna and genetic exchange.

The *cerrado's* population density, like the Amazon's, is also decidedly low. Its precocious urbanization (81% in 2000) is testimony to the importance of capital-intensive monocultures of soybeans and cotton in its environmental transformation. In part, these urban populations represent centers of support, including agro-industry, for agricultural activities. But these cities are also reservoirs of unemployed and under-employed poor, who were unable to sustain their families on small farms, in the face of the region's monocultures.

The *cerrado* is a region whose biodiversity must be zealously defended. It is perhaps not so fragile as the Amazon, however, and greater proximity to

major urban centers suggest that economic activities may be conciliated with environmental protection. Greater fine-tuning of the population-environment relation will be required to identify those regions and those economic activities which may be sustainably explored. Agro-industry has already begun to shift processing activities to the region, decentralizing job-creation but also decentralizing environmental pollution. From social, economic and demographic perspectives, this development makes sense. But these activities must be accompanied by pollution control and treatment of effluents, and must be carefully located within the region's territory. The population-environment balance is not critical and the cerrado may still absorb population, but much more ecological-economic planning is required to revert the pell-mell development activities of recent decades.

The *caatinga*, Brazil's semi-arid region, is its second most populous. Its vegetation is conditioned by its dry climate, which predominates during the winter and is renewed with summer rains. Its vegetation composes an aggressive landscape of species resistant to drought, with occasional islands of humidity, where higher vegetation and more fertile soils are found. The major environmental problem is desertification, aggravated by the intense use of irrigation with inappropriate technology, by the contamination of the limited water sources available and by deforestation to obtain firewood and charcoal. The 2000 population of 40 million is an inheritance of the region's importance in the production of sugar cane, since colonial days. For a long time, the more fertile coastal lands have not supported the region's population. Subsistence agriculture in the semi-arid backlands is precarious and the Northeast is Brazil's classic case of out-migration. Social concern and political pressure of the traditional oligarchy has produced an impressive array of water projects aimed at permitting a sustainable way of life for family farmers. In an area of 607,556 km², with a population density of 66.27 persons/km² in 2000, however, such projects have generated much environmental concern. It is not only that much of the investment in water projects has benefited only rich landowners, a scandalous remnant of traditional politics as yet unchecked. Such projects as deep wells which tap into non-replenishable fossil water and the reversion of the São Francisco River for irrigation of dry lands have been questioned by environmentalists. The history of other nations has provided innumerable examples (McPhee, 1990) of the futility of controlling nature. Only in man's omnipotent imagination is it possible to realize all goals and values in all regions.

Furthermore, the *caatinga's* biodiversity has its own, largely unrecognized, importance. Thousands of species have adapted to this apparently hostile environment and are not likely to survive transformation to irrigated farmland. The question which must be posed, as it was by economist Celso Furtado many years ago, is whether this large population can be sustainably supported in this region. Declining birth rates will stem secular out-migration, but will this be enough? From a sustainability perspective, it cannot be taken for granted that useful, productive employment can be found for such large numbers in this hostile environment. Continued investment is necessary to rectify centuries of neglect and impoverishment. But it cannot be taken for granted that nature can or should be tamed and trained to these ends.

The Atlantic Rainforest (considering in this text the states of Espírito Santo, Rio de Janeiro, São Paulo, Paraná and Santa Catarina, which account for 634,054 km²) has been reduced to 5% of its extent 500 years ago. In Rio de Janeiro, for example, 20% of the territory is covered by forest, compared to 97% originally; in Minas Gerais, forest extent has declined from 51.7% to 1.5%. This is the region in which Brazil's "crab civilization" (because it clung to the shore) has developed. With the exception of timid and short-lived colonization efforts in the Amazon, Brazilian development only began to reach beyond this coastal region in 1960, with the construction of Brasília. Home to 66.9 million people in 2000, this is the most urbanized (94% in 2000) and densely populated (105.48 persons/km²)¹⁰ region. It is also home to a rich biodiversity. Its vegetation is composed of dense forest closer to the ocean, less dense on the steep slopes and open fields on the tops of these slopes.

This is undoubtedly the region whose population-environment balance is most precarious. Both source and sink functions of nature have been acutely affected. The limited remnants of the Atlantic Rainforest were the first to generate protective measures, a movement which continues today. Nevertheless, the forest continues to shrink each year. Most remaining intact areas are in coastal regions, interior portions having been almost completely substituted by agriculture over the centuries. Today, both urban population growth and a growing consumer culture have generated large-scale tourist development on the coast. This development threatens to complete what isolation and lack of other economic options did not do, and the biodiversity of the Atlantic Rainforest is more threatened than that of the Amazon.

But ecosystem limits to absorbing waste have also been stretched, often beyond the breaking point. Two of the world's largest cities (São Paulo and Rio de Janeiro), along with a large number of smaller (but still large) cities, have sprawled over rich soils, deforested their hinterlands, degraded rivers, lakes, bays and estuaries, contaminated soils and groundwater and saturated local capacities for absorbing solid waste. Accelerated economic development and rapid population growth in the second half of the 20th century created environmental liabilities which will require much time, planning and investment to overcome. In areas like the São Paulo Metropolitan Area, environmental degradation is so severe, pressure on resources so great and water supplies (for example) so limited, that simple remedial measures may never be adequate. The interiorization of development and population growth in São Paulo State since the 1970s is a reflection of such problems. Considering the vast social infrastructure in place (transportation, schools, universities and research centers, health care facilities), the region of influence of the Atlantic Rainforest must continue to meet the needs of a large part of Brazilian population. Smaller and middle-size cities, however (as in the São Paulo case), may provide greater possibilities for promoting quality of life, including environmental quality, which is the goal of sustainable development. It must be remembered that earlier efforts to promote the growth of middle-size cities – a generally frustrated effort – were undertaken in the context of rapid population growth, especially urbanization. In today's different demographic context, such planning efforts may be more viable.

This region, then, must continue to be home to most Brazilians. Internal redistribution of economic activity (and population), together with environmental remediation and enforced environmental protection may ameliorate environmental pressure. For the reasons mentioned above, redistribution of population to other regions, however, will play a minor role in bringing population and environment into more harmonious balance. Sustainable solutions must be found within the region itself.

Finally, the Campos do Sul savanna is a smaller (282,062 km²) but distinct ecosystem (in the division used here, covering the state of Rio Grande do Sul). This region has level or slightly hilly lands, with isolated areas of forest and grassy plains. This is a highly urbanized (82% in 2000) region, with a population of 10 million. One of Brazil's more developed, industrialized regions, its population density is relatively low (36.09 persons/km²). The small-scale agriculture which predominated for over a century (especially since European immigration in the 19th century) began to lose its viability in the last decades of the 20th century. The region's emigrants were important contributors to colonization efforts in the Center-West and Amazon regions. One of the local consequences of these developments has been the regeneration of forest cover over the last decades. Considering the human resources in this area (one of the most educated and skilled populations in the country) and the diminished pressure on natural resources, this may be the region where population-environment balance may be more easily reached. It is not likely, however, to represent an important alternative to the highly urbanized and densely populated Northeast and Southeast.

This brief overview of the population/environment balance reveals the great diversity which characterizes the relations between man and nature in Brazil. This diversity is not homogeneously distributed over the national territory. Differential natural resource endowments and the history of economic and population growth which impacted different regions at different moments have produced a situation in which the major ecosystems are still clearly visible in demographic and environmental terms. Synthesizing the major differences, which have important consequences for sustainable development, we can emphasize:

1. the Amazon region, still sparsely populated, concentrates most of its population in cities. In terms of national and planetary biological and cultural diversity, this is a region whose development must be carefully monitored. Environmental considerations should be paramount. In the long run, it will be recognized that Brazil was fortunate in that Amazon deforestation began in an era of environmental consciousness. There is still time to preserve, an option not open to many countries. Brazil will harbor, in the future, one of the only undisturbed tropical forests. The long-term advantages far outweigh the short-term gains intense development could bring. This favorable situation depends, for its realization, on maintaining low population densities.

2. the savanna-like *cerrado*, already intensively explored for grain production and cattle-raising, is also important in terms of biodiversity and potential carbon sequestration. Also a sparsely populated region, the *cerrado* offers more opportunities for environmentally sustainable development. Population

growth has not reached a situation of limits, but much care must be taken in locating economic activities in space.

3. the Atlantic Rainforest is the most complex of these ecosystems. While intact remnants of primary vegetation must be carefully protected, most of this forest has been lost, and the region's economic-ecological vocation has long been determined. In this region, the major environmental challenge is the recuperation of degraded areas and the implementation of long-term environmental safeguards. For extreme cases, such as the São Paulo Metropolitan Area, recuperation will probably have to be accompanied by population deconcentration. This process, already underway, if accelerated, could contribute to the region's sustainability. Considering the limited possibilities in other regions, most of the deconcentration will be in the direction of smaller cities within the region itself. Most likely, this region will also continue to absorb population contingents from the semi-arid region. The greater natural resiliency of this region has permitted – and will continue to permit – greater population densities.

4. the semi-arid *caatinga* faces enormous difficulties – perhaps insurmountable – in the effort to balance population and environment. With its inheritance of poverty and high population density, the solutions proposed may not be environmentally sustainable. Sustainable development may require investments and job-creation for this population in environmentally more amenable areas.

5. the savannas of Southern Brazil offer limited possibilities for absorbing population. Considering its relatively well-educated population and higher levels of development, this region – if development is directed toward modern industrial and service sectors – should be able to retain its current population.

This brief review of population-environment concerns in Brazil's major ecological formations reveals the great diversity of situations in the country, as well as the greater range of possibilities for achieving population-environment balance, compared to other countries. But it is time to begin to ask hard questions about centuries-long settlement patterns and their sustainability in the centuries ahead. Brazil has some room for maneuver. Optimizing quality of life suggests that the earlier consensus is reached on the "ecological-economic vocations" of different regions, the greater is the possibility of achieving this optimum.

In demographic terms, it is the distribution factor that will be of paramount importance in the long run. The emphasis on size and growth rates, a result of Brazil's having passed through critical periods of its demographic transition in parallel with the awakening of international environmental consciousness, must give way to spatial concerns, adjusting population densities and distribution according to the ecological possibilities of the different regions of the national territory. This point of view has been slow to enter the debate at United Nations conferences on population, development and environment. The following section reviews the evolution of this debate, in the light of these considerations. The

challenge of the World Summit on Sustainable Development is to move beyond earlier formulations of the population-environment question in the direction of more complex views, where the distribution factor, for example, would receive greater attention.

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Contemporary environmental awareness is often dated from the United Nations Conference on the Human Environment, held in Stockholm in 1972. Coinciding with such events as the first *Earth Day* in the United States and the publication, also in 1972, of the Club of Rome's *Limits to Growth*, the Stockholm conference was a watershed moment in linking environmental concerns to efforts to promote economic development. The idea of *ecodevelopment*, a term coined by conference leader Maurice Strong, would be the precursor of the concept of sustainable development – the touchstone of contemporary debate on environment-development relationships.

In population terms, this was the height of the rapid growth phase in many countries. In Brazil, only at this moment would it become clear that fertility decline had begun some years earlier, a decline which would accelerate in the following decades. Such influential books as Paul Ehrlich's *The Population Bomb* in 1968 and the Club of Rome's report itself would promote a catastrophic vision of population-environment relationships: too much population for too few resources. The recipe of population control as the answer to third world development reached its widest circulation at this time. Poor countries' response would be forcefully declared at the 1974 Population Conference in Bucharest, where development was declared to be the "best contraceptive." In this heated context, any reasoned debate on the importance of environmental considerations for economic development was hardly possible. The Brazilian delegate to the Stockholm conference had declared that smoking chimneys were a sign of progress and environmentalism a luxury only rich countries could afford. The population control movement had appropriated the environmental issue and discouraged other views from appearing.

By the nineties, the environmental question had mobilized the international community, but the population dimension had not advanced over the intervening decades. Population control was no longer so easy to advocate in world fora; population issues were soon to be treated in more complex ways; but the emphasis of the present discussion on population distribution issues had not yet replaced the void left by the abandonment of the simpler "population pressure" view. It was as though population concerns – no longer identified as the exclusive cause of underdevelopment or environmental degradation – were irrelevant.

Even the international conferences of the nineteen nineties did not give more than limited attention to the distribution issue. *Agenda 21*, victim of North-South polarization on the population vs. consumption issue, never got beyond generalities in dealing with population. "Policies should be designed to deal with the consequences of population growth... Research should be conducted on how environmental factors interact with socio-economic factors as a cause of

migration... An assessment should also be made of national population carrying capacity..." (See Chapter 5 on "Demographic dynamics and sustainability.")

In its chapter on human settlements, major objectives did not include their spatial distribution, but focused on housing needs. While some attention was given to promoting the growth of intermediate cities ("...to insure that urban sprawl does not expand resource degradation over an ever wider land area and increase pressures to convert open space and agricultural/buffer lands for development" (see Chapter 7 on "Promoting sustainable human settlement development," Paragraph 43, -i, -n and -p.), there is no recognition of the need to accommodate the distribution of settlements on the basis of the distinct resource endowments of a country's different regions.

The ICPD (Cairo 94), whose synthetic action program recognized population distribution as part of the larger demographic dynamic, touched on these issues in both the sustainability (3) and migration (9) chapters, but with little effort to develop the relevant interrelations. The United Nations Environment Program (2002), in its *Global Environmental Outlook*, only mentions population in the context of increasing demands on natural resources.

With the *Habitat Agenda*, this issue was put more clearly. Going beyond the call for the development of intermediate cities, the *Agenda* specifically recommended "promoting spatial development patterns" in the name of environmental quality, and recognizes the need for trade-offs in regional patterns of land use: "...land management practices that deal comprehensively with potentially competing land requirements for agriculture, industry, transport, urban development, green space, protected areas and other vital needs." These concerns need to be explicitly addressed from a demographic perspective on population distribution.

Some more recent publications have placed population distribution and environment relations higher on the policy agenda and may serve as support for more explicit treatment at the WSSD. In particular, the United Nations Population Division's review (2001) of *Population, Environment and Development* deals extensively with the issue in rural settings (pp. 27-34), although not in cities. In its chapter on urbanization, the emphasis is on population size and growth rates and how these relate to environmental problems. Distribution of settlements is not treated. The UNFPA's *State of the World Population 2001* focused on population and environmental change, but was organized thematically and not according to demographic processes. Another UNFPA (2001) document, *Population, Environment and Poverty Linkages*, also does not deal at length with the relevant links in its treatment of urbanization and migration. It does, however, call attention to recent tendencies in policy orientations, expressing a concern similar to those of presented in the first part of this chapter:

The policy approach taken by a majority of countries favours integrated urban and rural development programmes that adapt to, rather than attempt to modify, population dynamics. Unlike policies adopted in the 1970s and 1980s, there are very few attempts being made to contain urban growth and to relocate population to new, secondary cities. Land management policies and human settlement programmes typically include measures to upgrade infrastructure and services, control the location of new housing and, in general, ensure sound land use (p. 16).

Population specialists, for their part, have intensified work on population-environment issues. The International Union for the Scientific Study of Population created a very productive Working Group on Population and Environment in the early nineties (see *European Journal of Population*, 1992; Zaba and Clarke, 1993; Clarke and Tabah, 1995; Potrikowska and Clarke, 1995; Clarke and Noin, 1998; and Bilsborrow and Hogan, 1999); later founded the Population and Environment Research Network, an on-line forum and bibliographic data base; and more recently, in conjunction with the International Human Dimensions Program and the United Nations University, the Global Science Panel on Population and Environment, which has produced a synthetic statement on these issues ("Population in Sustainable Development") for the Johannesburg conference. In Latin America, the nineties saw the creation of similar working groups by the Mexican Demographic Society (Somede) and the Brazilian Population Studies Association (ABEP). Among other activities these associations produced several syntheses of ongoing work in Latin America (Martine, 1993; Izazola and Lerner, 1993; Izazola, 1999; and Torres and Costa, 2000).

The World Summit on Sustainable Development is an opportune moment for the population community to insist on the importance of the population factor. This book hopes to stimulate such discussion.

The present book is an initiative of Brazil's National Commission on Population and Development, the Brazilian Association for Population Studies and the Population Studies Center of the State University of Campinas. Considering the often one-sided view of the relationship between population dynamics and environmental change, which regards the number of people using resources as the only issue (and in Brazil's case, this is identified as the Amazon question), these organizations seek to present a more complex picture. Both politically and academically, Brazilian debate on the relationships between population and environment has evolved considerably in the decade since Rio-92. Each of these organizations, in its own sphere, has contributed to this process.

The book was planned by a committee composed of Daniel Joseph Hogan, Director of the Population Studies Center, Heloisa S. Moura Costa, Coordinator of the Population Association's Working Group on Population and Environment, and Eduardo Viola, on behalf of the National Commission. The committee sought to present an overview of three of Brazil's major and distinct ecosystems and explore a set of issues representative of the complex ways population factors relate to environmental processes. The *Amazon Rainforest*, the *cerrado* and the *caatinga* are examples of the ecological and cultural diversity that mark Brazilian life. These chapters underline our guiding principle that there are no simple, direct and universal ways of conceiving the population-environment relationship. The following chapters treat a range of issues that reinforce this principle.

Preliminary versions of these chapters were presented and discussed at a workshop held at the Population Studies Center in June of 2002. The committee is especially grateful to the group of discussants of these papers, whose comments helped improve the quality of the final book: João Antônio de Paula, Leonardo Guimarães, Álvaro D'Antona, Magda Lombardo, Edmilson Lopes Jr., Henri Acselrad, Pedro Jacobi, Julia Guivant and Iñez Pérpetuo.

The opinions and perspectives expressed in this book are the exclusive responsibility of the authors. No effort was made to reach a consensus acceptable to the three organizations that sponsored the book. The diversity of perspectives mirrors the diversity of the subject matter and reflects the challenge of the environmental question.

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Notes

¹ Donald Sawyer's presentation (1993) at a preparatory meeting for the ICPD (Cairo 1994) questioned, perhaps for the first time, the discipline's conventional wisdom on population, development and environment. That this discussion did not provoke serious polemics among Brazilian demographers was a clear sign of changing times.

² The chapters of Sydenstricker-Neto, Carvalho and Guimarães provide more in-depth perspectives on the Amazon, the *cerrado* and the semi-arid regions, respectively.

³ The *cerrado*, with an almost entirely tropical climate, is a complex of different forms of vegetation that have variable physiognomies and floristic compositions, forming an ecological mosaic. Ecologists define it as a mixture of low trees and

a well developed herbaceous strata. The core of the *cerrado*, considered the most characteristic and continuous portions, occupies 1,500,000 km² in the Central Brazilian Plateau, in the states of Goiás, Tocantins, Federal District, part of Minas Gerais, Bahia, Mato Grosso, Mato Grosso do Sul and part of Maranhão, Piauí, and Rondônia. Unconnected portions, forming islands of *cerrado*, are found in Amazonas, Amapá, Roraima, Alagoas, Bahia, Ceará, Paraíba, Pernambuco, São Paulo and Paraná. This fact, in addition to biological and political differences in defining *cerrado*, has led to a range of estimations of total area.

⁴ This procedure is to be followed in research now underway, which will separate the Pantanal (one of the world's most important wetlands) and several sub-categories, as well as the major ecotones (areas of transition between major formations).

⁵ The degree of resolution can be improved by using census blocks, although not all ecosystems have boundaries so precisely defined by ecologists. In such densely occupied areas as the Atlantic Rainforest, however, this procedure is possible and necessary (see Alves, 2001).

⁶ For political-administrative reasons, government publications, as well as much scientific analysis, use the "Brazilian Legal Amazon," which includes other states.

⁷ The core of the *cerrado*, considered the most characteristic and continuous portions, occupies 1,500,000 km² in the Central Brazilian Plateau, in the states of Goiás, Tocantins, Federal District, part of Minas Gerais, Bahia, Mato Grosso, Mato Grosso do Sul and part of Maranhão, Piauí, and Rondônia. Unconnected portions, forming islands of *cerrado*, are found in Amazonas, Amapá, Roraima, Alagoas, Bahia, Ceará, Paraíba, Pernambuco, São Paulo and Paraná. This fact, in addition to biological and political differences in defining *cerrado*, has led to a range of estimations of total area.

⁸ Government policy was fundamental to this process. Embrapa, a research arm of the Ministry of Agriculture, created in the early 1970s, soon developed varieties of soybeans adapted to the climate and soils of the *cerrado*.

⁹ An example of inadequate soil use is soybean production in the headwaters of the Taquari, in the North of Mato Grosso do Sul. "The plantations provoke erosion and silting of the river, which result in floods in the Pantanal. To avoid the floods on their properties, farmers dredge the river and end up blocking off its affluents. This then diminishes the oxygenation of the water and kills fish, leading to loss of biodiversity in the river." (WWF, 2001)

¹⁰ Densely populated in Brazilian terms. China's population density, in 2000, was 132 persons/km² and India's in 2001, 324 persons/km² (in its most densely populated state, West Bengal, density was 904 persons/km²).