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"Population and Urbanization" by Jonathan M. Harris

POPULATION IN THE TWENTY-FIRST CENTURY

For the last two hundred years, population growth has accompanied economic growth. The relationship between the two has often been in dispute. Some have argued that population growth promotes economic growth, others that economic growth promotes population growth. Thomas Malthus and his followers famously maintained that population growth must ultimately act as a check on economic growth and living standards, while many economists and proponents of technological progress have dismissed this view as unwarranted pessimism. A related debate has been over whether there is an identifiable planetary "carrying capacity" for the human population, and if so, whether we are approaching or have surpassed this maximum level (Marquette and Bilsborrow, 1999; Cohen, 1995).

Theorists of sustainable development have generally rejected the concept of unlimited growth, whether of population or of economic production. Even if a specific carrying capacity for humans is difficult to identify, resource and environmental constraints will eventually be reached, if they have not been already. A sustainable society, it is widely thought, must ultimately imply a stable level of population. But what does this mean in more specific terms for local, national, and global development policy? Where are we now in terms of population growth or stabilization, and where should we seek to be?

According to the theory of demographic transition, falling birth rates should eventually stabilize population levels. This process has been completed in Europe, which now has a stable population with only slight rates of growth or decline in individual countries. The global demographic transition is different both in quantity and quality. Much larger total numbers, and the still rapid growth rates in many areas, mean that the global demographic transition is far from accomplished, and the future course of global population growth is still uncertain (Figure IV.1).

Net annual additions to global population peaked around 1990, but are projected to decline only slowly over the next several decades (Figure IV.2). This means that while world population is probably headed towards stabilization by the middle of the twenty-first century, there will be very large increases in absolute numbers throughout the developing world before stabilization is reached. For example in India, where population reached one billion in 2000, an additional four hundred million people are expected to be added by 2025. Africa, with a

population of 790 million in 2000, is projected to reach 1 billion by 2012, then add nearly 300 million more by 2025.

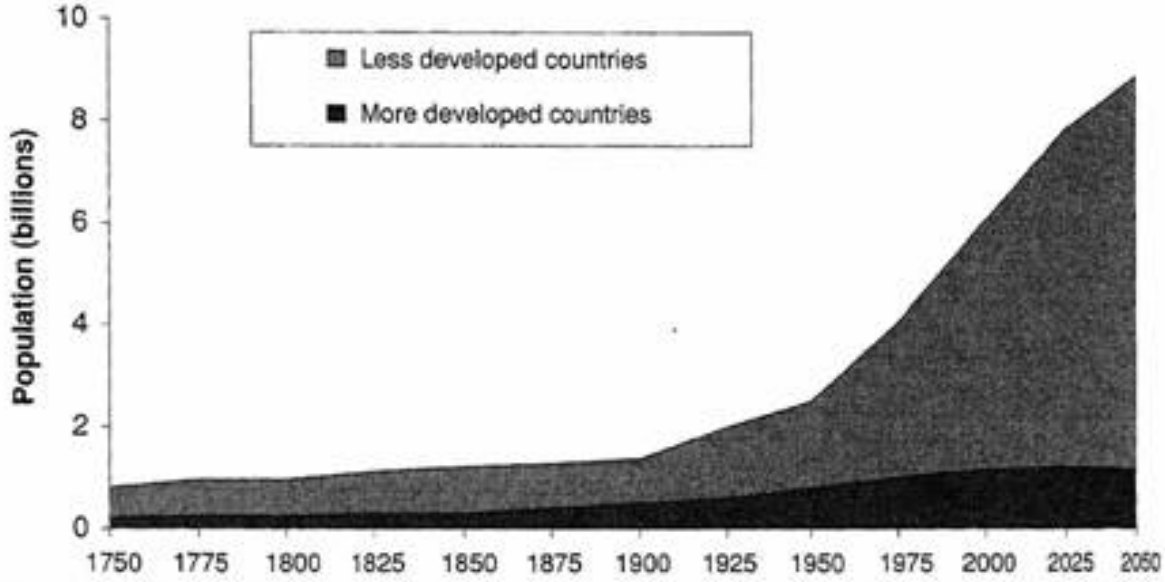

Figure IV.1. Population Growth in Developed and Developing Countries, 1750 to 2050.
Source: United Nations Economic and Social Council, World Population Prospects: The 1998 Revision.

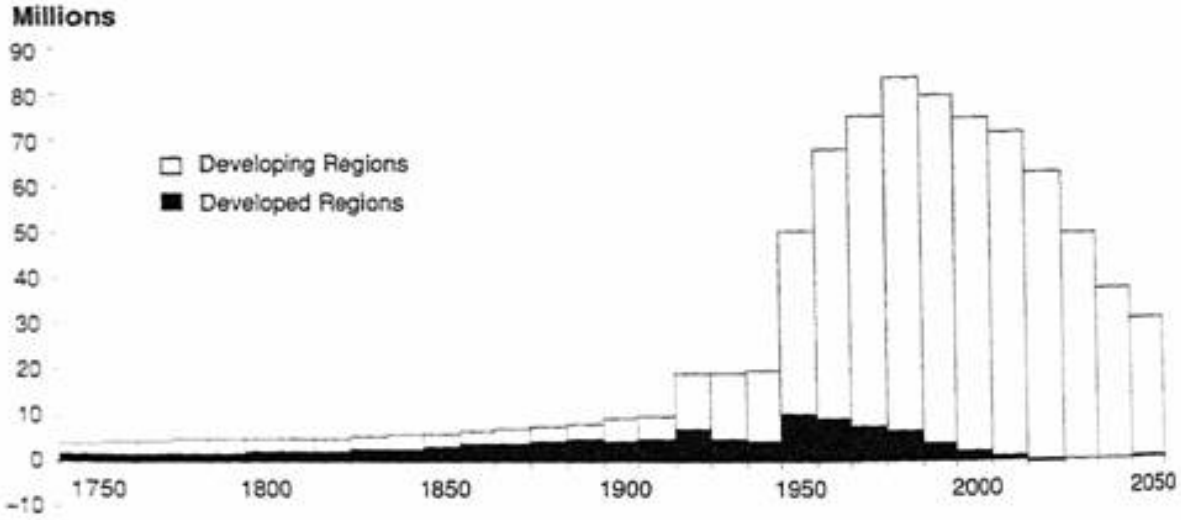

Figure IV.2. Net Annual Increase in Population per Decade, 1750 to 2050.
Source: United Nations Economic and Social Council; World Population Prospects: The 1998 Revision, and Repetto (1991).

Continuing global population growth has clear social, resource and environmental implications for developing nations, and for the world as a whole. From one point of view,

stabilizing population is a natural concomitant of economic development. Indeed, the record shows that in almost every country growth in per capita economic output has been accompanied by slowing rates of growth in population. But for countries still facing substantial added numbers, resource and environmental limits are a significant problem. Globally, many resource systems are under significant stress from a combination of population pressures and poor management. Examples are water supplies in South Asia, China, and arid parts of North America, fisheries and grazing lands in many areas of the world, as well as the pollution absorption capacity of ocean and atmospheric systems (Brown, 2000).

Even more significant than absolute limits, however, are the interactions of social, economic, and environmental factors. Economists have often pointed out that a resource base that is adequate to support a given population can easily be squandered by inefficient and wasteful patterns of use (Panayotou, 1998). Unfortunately, such inefficient use is more often the rule than the exception.

Economic inequality, both international and intranational, also contributes to environmental damage in two ways. First, the consumption of the rich imposes excessive resource demands, meaning that the ecological impact of consumption by affluent nations often extends well beyond their physical boundaries (Wackernagel and Rees, 1996). Second, the poor are often forced by their circumstances to adopt destructive resource use patterns. Demand pressures on higher-quality lands force poorer farmers to move onto marginal lands including hillsides, forests, and arid areas. Lack of credit and market access make it difficult for small farmers to invest in land and water conserving techniques. At the same time, subsidized inputs often encourage more affluent farmers to waste resources. Problems of inequity and inefficiency are not a result of population growth (though population growth can sometimes exacerbate them), but they combine with expanded human numbers to cause rising environmental pressures.

For this reason, standard economic approaches that neglect population must be altered to take specific account of the interrelationships between population, economic activity, and the environment. An extensive, interdisciplinary literature has developed to address this question. In general, simple models have proved unsatisfactory. An adequate understanding of the role of population in sustainable development requires insights from both ecology and economics, as well as social and political theory. The articles summarized and reviewed in this section draw insights from a variety of disciplines, and from empirical observation, to develop a richer analysis of population and development issues.

DIFFERING PERSPECTIVES ON POPULATION GROWTH

Economists and ecologists have different perspectives on population growth, economic growth, and the environment. Economists emphasize the role of institutions and incentives, while ecologists emphasize human/environmental interactions and the far-reaching consequences of ecosystem damage. A third perspective focuses on the importance of social and cultural factors both in determining the course of population growth and in responding to its impacts. The three views are not incompatible. In fact, it is essential to combine insights from all three perspectives to understand the issue and devise appropriate responses.

In an article summarized here, **Nancy Birdsall** suggests that a careful analysis of the relationship between economic growth and population growth can identify policies for promoting sustainability. Birdsall's earlier work includes a thorough overview of economic perspectives on population (1989). Based on this overview, she suggests that the effects of population growth may be neutral, beneficial, or detrimental depending on specific circumstances and existing institutions.

Birdsall focuses on the link between high fertility and poverty, which creates a "vicious circle" of negative social and environmental outcomes. She identifies a significant range of policies that can bring benefits both in slowing population growth and improving economic efficiency and output. Prominent among these are the promotion of education and other social programs, improvement in the status of women, and improved health care including contraceptive availability.

Birdsall also recommends policies which promote broad-based economic growth as an effective means to reduce both poverty and high birth rates. This is consistent with the evidence showing that people who are more economically secure favor smaller family size. However, Birdsall's analysis clearly differs from the more simplistic assertion that economic growth will solve population problems. If economic growth leads to highly inequitable social systems, the vicious circle of population, poverty, and environmental degradation will worsen. Specific social and economic interventions are essential to avoid this outcome, but these interventions can often be good both for the economy and for stabilizing population.

Ecologist **C.S. Holling** offers a less optimistic perspective. He maintains that ecologists have good reason to be "gloomy Malthusians". Unlike economists, whose models provide no upper bound on economic growth, physical scientists and ecologists are accustomed to the idea of limits. Natural systems must exist subject to the unyielding laws of thermodynamics, and the science of population ecology has explored the implications of these laws for living organisms. In an ecological perspective sustainability must involve limits on population and consumption levels. These limits apply to all biological systems. While humans may appear to evade them for a time, they must ultimately accept the boundaries of a finite planet.

However, this simple assertion of limits does not fully capture the contribution of ecologists to the discussion of sustainability. What Holling identifies as a third axiom of ecology has even more significant implications. The third axiom "concerns processes that generate variability and novelty" – the generation of genetic diversity and the resultant processes of evolution and change in species and ecosystems.

Genetic diversity gives rise to *resilience* in ecosystems. Resilience is a "bounce-back" capacity which enables a system to respond to disturbances or damage. For example, a forest ecosystem may recover from a pest infestation through an increase in the population of predators which control the pest, an expansion of species unaffected by the pest, and possibly a development of pest resistance in affected species. The patterns of response will be widely variable, but the resilient ecosystem will maintain its effective functions, and its capacity to

respond to further environmental changes. The key to resilience is the existence of a wide variety of species, interacting with each other and providing a reservoir of genetic forms which provide the potential to adapt to changing conditions.[1]

The importance of the ecological perspective is increasingly evident, as more of the critical problems facing humanity arise from failures of ecological resilience resulting from human impact. The resurgence of diseases due to the development of antibiotic resistance, the disruption of ecosystems by introduced species, the formation of "dead zones" in coastal waters, and the multiple ecological threats related to climate change and increased climate volatility, all testify to the impacts of expanding human economic activity.

The horrifying impact of AIDS, most especially on the African continent, may be a case of feedback effects from the increased size and mobility of human populations. AIDS probably originated in rain-forest primates, and spread to humans through human intrusion into the forest. Rather than remaining isolated in small communities, it then spread worldwide through global commerce and travel, like many other destructive viruses and pests. Population checks through such drastic ecological backlash are, of course, familiar to ecologists. But they have generally been far from the thoughts of the economists and policy-makers who up until now have shaped our conceptions of development.

How can we balance the more optimistic perspective set forth by Birdsall with Holling's compelling ecological pessimism? Clearly there needs to be some combination of economic and ecological analyses. In Part 1 of this volume, Guiseppe Munda and others argued that an ecological economics approach requires setting aside a linear view of economic development in favor of a concept of *codevelopment* of economic, ecological, and social systems. At the macro level, we need a more accurate estimate of the impact of economic expansion on the environment --something which is generally completely lacking in macroeconomic theory, as Herman Daly has emphasized (Daly, 1991). At the micro level, we should consider the interactions of social, economic, and environmental factors in specific situations. Here we will consider some efforts to develop analyses both at the macro and micro level, looking first at the overall impacts of population and consumption, then at specific development cases.

Table IV.1. Consumption and Ecological Footprints

Consumption per capita, 1991	Canada	United States	India	World
CO_2 emissions (tons/year)	15.2	19.5	0.81	4.2
Paper Consumption (kg/yr)	247.0	317.0	2.0	44.0
Fossil Energy Use (gigajoules/yr)	250.0 (237 excluding exports)	287.0	5.0	56.0
Fresh water withdrawal (m^3/yr)	1,688.0	1,868.0	612.0	644.0
Ecological Footprint (ha/person)	4.3	5.1	0.4	1.8

Source: Wackernagel and Rees 1996, p. 85.

Box IV.1. The Ecological Footprint

How can we measure the impact of human activity on global ecosystems? One approach is to recognize that all life is dependent on photosynthesis. Green plants convert solar energy into a usable form, which may then be used by animals. An increasing portion of this fundamental energy supply, the net primary product (NPP) of photosynthesis, is used by humans. Human activity also preempts some photosynthetic potential by converting land to urban, residential, and transportation uses.

Ecologist Paul Ehrlich and colleagues have estimated that humans are now directly or indirectly appropriating about 40 percent of the energy supply available from photosynthesis. (Vitousek 1986; Ehrlich 1994.) Clearly, a doubling of this demand, as might well be implied by a 33 percent increase in population (to 8 billion) and a 50 percent increase in per capita consumption by 2050, would leave little room for any other species on the planet. This perspective can be used as a kind of macro framework for the analysis of ecological sustainability (Haberl 1997; Wackernagel et al. 1999).

A related approach, the ecological footprint analysis, has been proposed by Mathis Wackernagel and William Rees (1996). Rather than focusing on NPP, they focus on the land use required to support human consumption. By computing the land use directly or indirectly associated with economic activity, they compute a "footprint" expressed in acres per capita, or total acres for a country, city, or region. By comparing the size of this "footprint" to the available land area within the region under consideration, they compute an ecological surplus or deficit associated with that region. For example, the United States is estimated to have a deficit of 10 acres per capita. Supporting the consumption of the residents of the United States requires 9.8 million square miles of land, whereas the actual land area of the United States is 5.7 million square miles. Thus the total ecological deficit is 4.1 million square miles of land.

The ecological footprint approach has the significant advantage of focusing on consumption levels. This gives essential insight into the relationship of population and resource use. The resource demands of a typical citizen of the United States or Canada, for example, are ten times those of an average Indian (Table IV.1).

Authors from developing nations have often pointed out that Northern consumption, rather than Southern population levels, impose the main burden on the earth's ecosystems (see Rahman in Part III of this volume). At the same time, the ecological footprint approach indicates the extent of added stress that will be imposed on ecosystems as the developing nations increase their consumption requirements toward Northern levels. China and India, despite much smaller per capita footprints, already have overall ecological deficits (Wackernagel et al. 1997).

Critics of the ecological footprint analysis have pointed out that it is a very crude measure of ecological impact, failing to differentiate between destructive and relatively benign uses of land (e.g., an acre used for organic agriculture and an acre used for a toxic waste dump would be rated the same). In addition, it measures hypothetical rather than actual land use, for example calculating the number of forest acres that *would* be necessary to store carbon from fossil fuel emissions (van den Bergh and Verbruggen 1999). This limits its usefulness as an analytical measure and also its policy relevance. However, the ecological footprint retains considerable value as a "tool for communicating human dependence on life-support ecosystems." (Deutch et al. 2000)

RURAL POPULATION GROWTH, AGRICULTURE, AND RESOURCE DEGRADATION

The relationship between population growth, agriculture, and the environment is complex. Responses to population growth include extensive and intensive agricultural expansion, innovation, migration, and changing fertility patterns. It is the balance between these which determines social outcomes and environmental impacts. Population growth can stimulate innovation and increased agricultural productivity (Boserup, 1965, 1981), but there are also many ways in which population growth can contribute to environmental degradation.

Michael Lipton examines the interaction between Malthusian pressures leading to agricultural resource degradation and mitigating factors such as incentives, innovation, and migration. He notes that migration typically increases cultivation on marginal lands, creating both environmental damage and social conflict between residents and immigrants. The situation can be much improved by appropriate policies including land redistribution and incentives for conservation techniques. Agricultural intensification also can have differing results depending on the policy environment, technology, and price incentives.

In Lipton's view, economic growth is not a panacea, as the forces it unleashes can result either in improved technology and land management, or in increased resource degradation. Institutional issues such as effective management of common property resources, or a transition to secure and equitable private property rights, play a central role. Population growth places stress on existing institutions, but this stress is not necessarily unmanageable. While the issues which Lipton discusses are more specifically related to agriculture, his conclusions are consistent with the approach set forth by Birdsall. Both assert that policy responses are crucial in determining whether population growth has benign or destructive impacts.

Sara Scherr also finds that economic and institutional factors play the central role in shaping the outcomes of population growth. Population has grown significantly faster than agricultural land area, resulting in a steady decline in arable land per capita. Increased yields have made possible rising food production per capita, but this has been accompanied by widespread land degradation. Patterns of land use vary between irrigated, high-potential, and marginal lands. In all cases significant environmental problems exist, but in some areas these are more easily remediable through sustainable management techniques. The greatest problems exist in marginal areas where degradation tends to be more severe, and the institutions and incentives for better management techniques are weakest.

Like Birdsall and Lipton, Scherr emphasizes the importance of economic incentives. But she also sees a direct role for population growth rates in determining outcomes. As people struggle to respond to higher demands on the land, slower population growth allows crucial breathing space -- time to innovate and adapt. Higher population growth rates can push rural communities over the edge into neo-Malthusian collapse -- not because of an absolute limit on carrying capacity, but because the means and incentives to adopt new techniques were not

forthcoming in time. Scherr's article strikes a fine balance, indicating both the urgency of the situation in marginal rural areas and the potential for effective policy responses.[2]

Box IV.2. Population Growth and Migration

With an annual growth in world population of over 80 million per year, it might be expected that international migration would play a significant role in redistributing population among countries. In fact, migration flows are relatively small on a global scale (Zlotnik 1998). Among developed nations, the country receiving the largest amount of immigration from the developing world is the United States (see Table IV.2). Total immigration from developing nations to the five developed nations experiencing the largest immigrant flows is only about 1 million annually.

In the United States, about half of current annual population growth of 1.6 million is from natural increase and half is from immigration. But by 2020 almost all net population growth in the United States will be from post-2000 immigrants and their descendants. Without immigration, the population of the United States (274 million in 2000) would peak at about 290 million by 2025; with immigration continuing at current rates, it will grow to 335 million by 2025 (Bouvier and Grant 1995; Population Reference Bureau 1999). Immigration, primarily from the developing world, is thus a significant contributor to population growth in the United States as well as to population growth in Canada and Australia. In Europe, the proportion of immigrants from the developing world is much smaller—only about 0.1 percent—and population growth is also lower—also about 0.1 percent.

Table IV.2. International Migration to Selected Countries

Country	Annual Immigration 1995–96 (Canada 1990–1994)	Immigration from Developing Countries
United States	813,730	653,518
Canada	235,509	184,547
Australia	102,030	74,190
Germany	397,935	70,099
United Kingdom	53,900	37,100

Source: Zlotnik 1998.

URBAN GROWTH: POVERTY, INFRASTRUCTURE, AND ENVIRONMENTAL CRISES

Population growth is most rapid in urban areas. The world's urban population grew from 1.54 billion in 1975 to 2.58 billion in 1995, and is projected to reach 5 billion by 2025 (World Resources, 1996, p. 150). While rural growth rates worldwide are about 0.8% per annum, urban growth rates, driven by natural increase and by in-migration, are 2.5%. In Africa, urban growth rates are 4.4% per annum, and in Asia 3.3%. These growth rates imply a doubling in population size within a generation. They usually reflect a combination of natural increase and of rapid in-migration, and pose a huge challenge for twenty-first century development.

Rapid urban growth has led to major social and infrastructure problems in rapidly growing cities in developing nations. Inadequate housing and sanitation, congestion, air and water pollution, disruption of water cycles, deforestation, solid waste problems and soil contamination are typical of large cities in the developing world.

Sai Felicia Krishna-Hensel discusses the role of urbanization in Indian development. A staggering combination of health, environmental, and social problems affect India's megacities. Water supply is one of the most critical issues, with limited availability exacerbated by serious pollution of existing supplies. Meanwhile, population growth is relentless. The population of Calcutta doubled from 1950 to 1980, and will have doubled again by about 2010. For India as a whole, urban population is projected to rise from 250 million in 1995 to 630 million in 2025 (World Resources, 1996, p. 151). How can urban authorities cope with existing problems, let alone manage this continued massive growth?

Krishna-Hensel sees some positive trends: projects by governmental and non-governmental agencies, as well as private firms, to improve health, nutrition, and sanitation, as well as self-help movements among the urban poor. Strategies of decentralization, service privatization, and community-based development have had success. However, the point made by Sara Scherr regarding rural growth and adaptation surely applies with even greater force to the urban situation. The struggle to respond to massive social and environmental problems is clearly made far more difficult by continuing rapid and unplanned growth. Moderation of overall population growth, and possibly also of in-migration, will have to be an essential component of efforts to achieve urban sustainability.

Priscilla Connolly examines the case of Mexico City, where urban population tripled between 1950 and 1970, from 3.1 to 9.3 million, then grew by another 60% to reach 15 million by 1995. Growth rates have now slowed, however, with net in-migration becoming negative. The city will continue to grow as a result of natural increase, but at a slower rate. Major problems include overdraft of water supplies and serious air pollution. Unfortunately, the transportation system of the city has been heavily oriented towards automobile transport, with the number of cars rising much more rapidly than the population. This trend has been supported by direct or indirect government subsidies for road-building and fuel. Similarly, water management policy has been oriented to augmenting supply rather than limiting demand or increasing conservation.

While the picture Connolly presents of the current situation in Mexico City is not encouraging, she does not see current population growth as the most crucial issue in urban problems. The central problem is poor policies which have contributed to worsened housing, health, sanitation, and environmental conditions. In theory, then, policy reversals could lead to significant improvements in well-being. The main barriers which Connolly sees to the development of a better policy environment include concentrations of political power, corruption, and income inequality.

The studies by Krishna-Hensel and Connolly frame the issue of urban sustainability, showing once again the interaction between underlying population growth and policy responses.

The relative weighting differs depending on the particular situation. Cities such as Mexico City, Buenos Aires, and Rio de Janeiro, as well as major cities in the developed world, are now experiencing relatively low growth rates, which may provide the opportunity for policy reform in the direction of sustainability. Other major cities such as Bombay, Shanghai, Beijing, Calcutta, Jakarta, Karachi, Dhaka, and Lagos are still experiencing rapid population growth (Table 2)
In almost all cases, the problems are urgent, but the situation in the still rapidly growing cities may be more critical.

Table IV.3. The World's Twenty Largest Cities and Their Average Annual Growth Rates*

	1995 Population (millions)	Average Annual Growth Rate, 1990–95		Population (millions)	Average Annual Growth Rate, 1990–95
Tokyo, Japan	26.8	1.41	Jakarta, Indonesia	11.5	4.35
São Paulo, Brazil	16.4	2.01	Buenos Aires, Argentina	11.0	0.68
New York, USA	16.3	0.34	Tianjin, China	10.7	2.88
Mexico City, Mexico	15.6	0.73	Osaka, Japan	10.6	0.23
Bombay, India	15.1	4.22	Lagos, Nigeria	10.3	5.68
Shanghai, China	15.1	2.29	Rio de Janeiro, Brazil	9.9	0.77
Los Angeles, USA	12.4	1.60	Delhi, India	9.9	3.80
Beijing, China	12.4	2.57	Karachi, Pakistan	9.9	4.27
Calcutta, India	11.7	1.67	Cairo, Egypt	9.7	2.24
Seoul, S. Korea	11.6	1.95	Paris, France	9.5	0.29

*Dhaka, Bangladesh, is twenty-third in size but is growing at 5.74 percent per annum.
Source: World Resources, 1996; O'Meara 1999.

Fortunately, there is extensive experience with effective urban policy reform, albeit rarely at a scale commensurate to the size of the problems. **Molly O'Meara** reviews efforts to improve urban policies and institutions governing patterns of water, waste, food, energy, transportation, and land use. These include:

- Investing in transportation infrastructure, water and sewer systems
- Decentralized, community-based systems for water supply, sanitation, and recycling.
- Urban food production
- Use of decentralized and renewable energy technologies
- Effective public transportation systems and road pricing
- Tax and zoning systems which reward urban land improvement and reduce sprawl
- Effective use of service fees and municipal bonds

O'Meara notes the emergence of new networks providing data bases and information exchange on effective urban policies, including the Urban Management Program, a joint effort of multinational development organizations, and the non-governmental International Council on Local Environmental Initiative (ICLEI). The importance of these and similar institutions will certainly increase as the urban portion of the world's population grows from 45% to over 60% during the next quarter century.

Box IV.3. Sustainable Urban Management in Curitiba, Brazil

"Curitiba, Brazil, has received international acclaim as a city that works—a good example of sustainability and exemplary urban planning. In 1950, however, all trends indicated that Curitiba was likely to become yet another city overwhelmed by rapid population growth and urban environmental problems. From 1950 to 1990, Curitiba mushroomed from a town of 300,000 to a metropolis of about 2.3 million. Migrants, pushed from the land as a result of agricultural mechanization, flocked to the city and settled in squatter housing at the urban periphery. . . . How did Curitiba manage to turn itself into a positive example for cities in both developed and developing countries? . . . The most important feature of Curitiba's success is its emphasis on integrating transportation and land use planning." (World Resources, 1996)

Curitiba used a radial pattern of public transit to channel development outward, keeping the central city as a pedestrian zone. Automobile use has been kept to a minimum. Effective water and sewer networks have been developed. Green space and parks have been protected by legislation, and an effective recycling program handles two-thirds of the city's trash. Publicly subsidized loan programs encourage the development of low-cost housing.

Key to the success of Curitiba has been a responsive, democratic government oriented toward public participation. Incentives have been developed for the urban poor to participate in housing, streetcleaning, and recycling programs. Street vendor activity has been licensed. City programs for children offer food, shelter, and work opportunities to streetchildren, as well as a network of daycare centers for working parents and sports centers for after-school activity. An "Open University of the Environment" provides education and opportunity for involvement in city planning, and is establishing an economic and environmental database for the city. Despite continuing poverty, the city has low crime rates and has been able to maintain a high quality of life and sense of civic involvement.

Sources: World Resources 1996,120–121; Rabinovitch and Leitmann 1993; McKibben 1995.

TOWARDS CONSENSUS ON POLICY SOLUTIONS?

It is apparent that population growth has been a major factor in shaping development patterns during the second half of the twentieth century, and will continue to play a central role during the first half of the twenty-first. Its role has generally been neglected in economic theory. As we have seen, however, when the perspectives of economists, ecologists, and other social theorists are brought to bear on issues related to population, new insights emerge. This interdisciplinary analysis will be crucial in shaping policies for sustainable development for the foreseeable future.

Despite the wide array of differing analytical perspectives, some consensus has emerged regarding responses to population growth. Extreme pro-natalist perspectives have generally been discredited: there is broad agreement that moderating population growth is an important goal. Top-down population control policies have also been discredited both on human rights grounds and as failing to alter basic incentives regarding fertility. Sen (1999) points out that the voluntary reduction of birthrates in Kerala, India, associated with higher levels of basic

education and health care, has actually been more effective than China's draconian "one-child family" policy.

Improving nutrition, health care, and education, especially women's education, are seen as key factors in lowering fertility rates. Improving employment possibilities (for women and in general), improved pension systems, access to contraception, and better information on methods and benefits of family planning, are all "win-win" policies. Sound macroeconomic policies, improved credit markets, and improved terms of trade for agriculture are important in promoting broad-based growth and poverty reduction, which in turn is essential to population/environment balance.

Significant differences among the various perspectives remain, and we will make no attempt to resolve them here. However, it is evident that a serious focus on population issues is essential, and can serve as the basis for a better understanding of the relationship between population, resources, economic growth, ecosystem health, and human well-being.

Notes

1. In *The Diversity of Life*, E.O. Wilson asserts that "biological diversity is the key to the maintenance of the world as we know it (Wilson, 1992).
2. A similar argument concerning the urgency of implementing sound population policies before ecological thresholds are crossed has been made by Robert Engelman (1999).