

THE STATE OF WORLD POPULATION 2001



PhotoLink

Footprints and Milestones: Population and Environmental Change



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*Girls collecting water in Burkina Faso. By 2050, 4.2 billion people will be living in countries that cannot provide enough water per person to meet basic needs.
Mark Edwards, Still Pictures*

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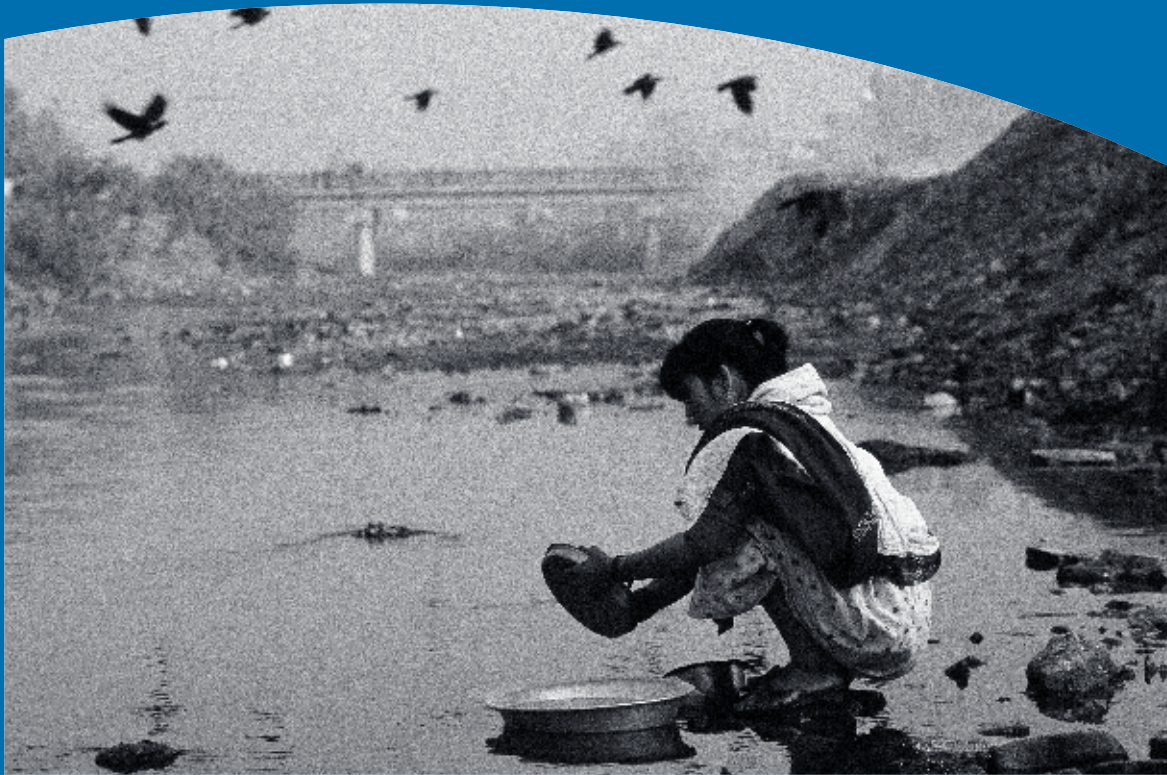
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CHAPTER 1

OVERVIEW



Woman washes dishes in river in Nepal. In developing countries, more than 90 per cent of sewage and 70 per cent of industrial wastes are dumped untreated into surface waters.
Hartmut Schwarzbach, Still Pictures

INTRODUCTION

Over three and a half million years ago, two of modern humanity's ancestors left their footprints in the sand near what is now Laetoli in the United Republic of Tanzania. This couple was walking barefoot along a plain. Their people probably numbered in the hundreds or thousands and possessed very rudimentary implements. Only a remarkable chain of coincidences preserved their trail for our current inspection and wonder.

Today the footprints of humanity are impossible to miss. Human activity has affected every part of the planet, no matter how remote, and every ecosystem, from the simplest to the most complex. Our choices and interventions have transformed the natural world, pos-

ing both great possibilities and extreme dangers for the quality and sustainability of our civilizations, and for the intricate balances of nature.

Our numbers have doubled since 1960 to 6.1 billion, with growth mostly in poorer countries. Consumption expenditures have more than doubled since 1970, with increases mostly in richer countries. During this time, we have created wealth on an unimaginable scale, yet half the world still exists on less than \$2 a day. We have learned how to extract resources for our use, but not how to deal with the resulting waste: emissions of carbon dioxide, for example, grew 12 times between 1900 and 2000. In the process we are changing the world's climate.

The great questions for the 21st century are whether the activities of the 20th century have set us on a collision course with the environment, and if so, what can we do about it? Human ingenuity has brought us this far. How can we apply it to the future so as to ensure the well-being of human populations, and still protect the natural world?

The stewardship of the planet and the well-being of its people are a collective responsibility. Everywhere we face critical decisions. Some are about how to protect and promote fundamental values such as the right to health and human dignity. Others reflect trade-offs between available options, or the desire to broaden the range of choice. We need to think carefully but urgently about what the choices

are, and to take every action that will broaden choices and extend the time in which to understand their implications.

Today every part of the natural and human world is linked to every other. Local decisions have a global impact. Global policy, or the lack of it, affects local communities and the conditions in which they live. Humans have always changed and been changed by the natural world; the prospects for human development now depend on our wisdom in managing the relationship.

One of the key factors will be population. It is also one of the areas where action to broaden choices is universally available, affordable and agreed upon.

THE CONNECTIONS

Population and the environment are closely related, but the links between them are complex and varied, and depend on specific circumstances. Generalizations about the negative effects of population growth on the environment are often misleading. Population scientists long ago abandoned such an approach, yet policy in some cases still proceeds as if it were a reality.¹

As human populations increase and globalization proceeds, key policy questions are: how to use available resources of land and water to produce food for all; how to promote economic development and end poverty so that all can afford to eat; and, in doing so how to address the human and environmental consequences of industrialization and concerns like global warming, climate change and the loss of biological diversity.

Environmental devastation is not simply a waste of resources; it is a threat to the complex structures that support human development.

Understanding the ways in which population and environment are linked requires detailed consideration of the way in which factors interrelate, including affluence, consumption, technology and population growth, but also previously ignored or underrated social con-

cerns such as gender roles and relations, political structures, and governance at all levels.

The relationships among environment, population and social development are increasingly better understood. There is broad agreement on means and ends. Women's empowerment, for example, is a development end in itself. Removing the obstacles to women's exercise of economic and political power is also one of the means to end poverty.

Reproductive health is part of an essential package of health care and education. It is a means to the goal of women's empowerment, but it is also a human right and includes the right to choose the size and spacing of the family. Achieving equal status between men and women, guaranteeing the right to reproductive health, and ensuring that individuals and couples can make their own choices about family size will also help to slow population growth rates and reduce the future size of world population.

Among other things, slower population growth in developing countries will contribute measurably towards relieving environmental stress.

DEMOGRAPHIC CHALLENGES AND OPPORTUNITIES

Changes in the size, rate of growth and distribution of human populations have a broad impact on the environment and on development prospects. A variety of demographic changes in different areas provide new challenges and opportunities.

Population and fertility trends

Fertility is highest in the poorest countries and among the poorest people in these countries. Failures in health, education and other services, especially for women, contribute to poverty in these countries. Reproductive health services cannot meet even the existing needs of women who want to prevent or delay pregnancy, and demand is expected to increase rapidly in the next 20 years.² Maternal mortality

is high and rates of contraceptive use low (often less than 15 per cent of all couples).

These countries are also among the most severely challenged by soil and water degradation, and the most severely affected by food deficits. In some ecologically rich but fragile zones, known as "biodiversity hotspots", population growth is well above the global average of 1.3 per cent a year.³ Rising demand from more affluent areas adds to the pressures on natural resources in these ecosystems.

The good news is that fertility in developing countries as a whole has dropped to just under three children per woman, about half what it was in 1969, and the expectation is that it will fall further, to 2.17 children per woman by 2045-2050. At the same time, global life expectancy has increased to an average of 66 (up from 46 in 1950), and—outside the areas worst affected by HIV/AIDS—people are healthier throughout the life cycle than at any time in history.⁴

The AIDS pandemic will have severe demographic effects. By 2015, life expectancy in the worst affected countries will be 60, five years lower than it would be in the absence of AIDS.

In some countries, including Mexico and parts of South-east Asia, fertility has fallen very sharply over the past generation, creating the "demographic bonus" of a large generation of 15-24 year-olds ready to enter the workforce, without the pressure of an equally large generation of children behind them. These countries can also expect a rapidly growing generation of older people, but the demographic bonus offers the opportunity for preparation to meet their needs. Countries where fertility is still high and life expectancy is increasing have no such opportunity. Globally, there are over 1 billion young people between 15 and 24.

In industrial countries, fertility is now 1.6 children per woman, below replacement level.⁵ Their populations are rapidly ageing, and in some countries might actually

POPULATION GROWING FASTEST WHERE NEEDS ARE GREATEST

World population will grow by 50 per cent, from 6.1 billion in mid-2001 to 9.3 billion by 2050. The 49 least-developed countries will nearly triple in size, from 668 million to 1.86 billion people, according to the United Nations Population Division's *World Population Prospects: The 2000 Revision*.

These latest estimates and projections by the Population Division of the Department of Economic and Social Affairs indicate that world population is now growing by 1.3 per cent, or 77 million people per year. Six countries account for half of this growth: India (with 21 per cent of the total increase), China, Pakistan, Nigeria, Bangladesh and Indonesia.

All of the projected growth will take place in today's developing countries, which by 2050 will account for over 85 per cent of world population. Total population in developed countries will remain at around 1.2 billion. But population will decline in 39 low-fertility countries, most sharply in Eastern Europe. Populations in both developed and developing countries will be older in 2050 than today.

Some commentators have selectively emphasized the trends of ageing and declining populations in parts of the world to argue that continued concern about global population growth is unwarranted. The facts suggest otherwise: as many people will be added in the next 50 years as were added in the past 40 years; and the increase will be concentrated in the world's poorest countries, which are already straining to provide basic social services to their people.

The report says that HIV/AIDS will result in 15.5 million more deaths than would otherwise be expected in the 45 most-affected countries in the next five years, a higher figure than previously projected. By 2015, life expectancy in those countries will be 60, five years lower than it would be in the absence of AIDS. Nevertheless, population growth is expected to continue because of continued high fertility. Even in Botswana, where HIV prevalence is 36 per cent, a 37 per cent population increase is projected by 2050.

The Population Division's medium variant projection of the global population in 2050 is 9.3 billion, 413 million more than its last projection in *The 1998 Revision*. This reflects higher projections of future fertility levels in 16 poor countries where fertility remains high (responsible for 59 per cent of the difference) and in several populous countries including India, Nigeria and Bangladesh (32 per cent of the difference).

Source: *United Nations. 2001. World Population Prospects, The 2000 Revision: Highlights. Population Division, Department of Economic and Social Affairs.*

shrink unless supplemented by migration. The downward trend in fertility is well established. However, recent studies in the United Kingdom show that family size in some low-income families is smaller than the parents desire.

The vast bulk of consumption is

in the industrial countries, but it is rising fast elsewhere as incomes grow. Measures to conserve energy, curb pollution and promote sustainable use of natural resources are essential for sustainable development in the future.

Parallel measures are needed to

stabilize global population growth. Whether world population in 2050 reaches the high projection of 10.9 billion, the low of 7.9 billion or the medium projection of 9.3 billion will depend on choices and commitments in the coming years. Two actions are central: first, ensuring that the right to education and health, including reproductive health, becomes a reality for all women; and second, bringing an end to the absolute poverty that affects the 1.2 billion people who live on less than \$1 a day. These two aims are closely linked because most of the absolutely poor are female; action towards one will reinforce the other.

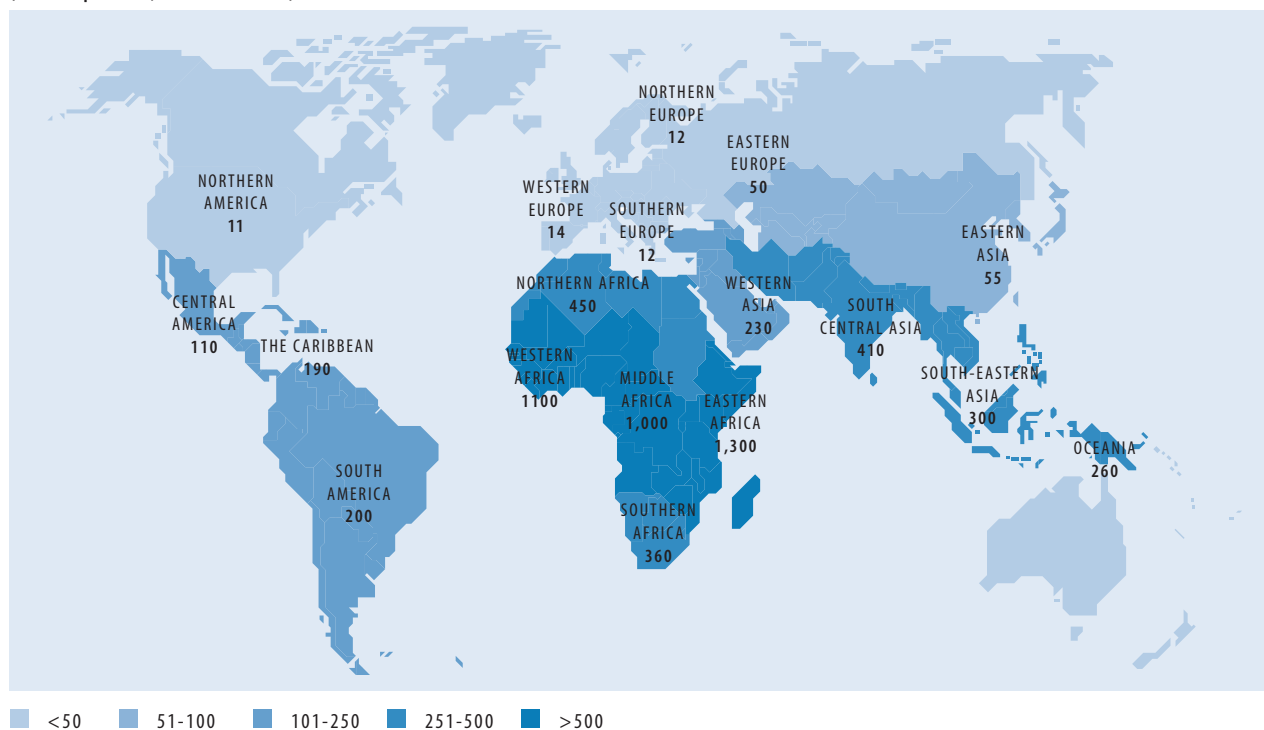
Governments, international donors, civil society and, in many cases, the private sector all have important roles to play in achieving these goals and creating a virtuous circle of smaller, healthier families, healthier and better-educated children with expanded opportunities, and increased progress towards population stabilization and environmental sustainability.

MILESTONES

In the past decade we have learned more about the deepening ecological footprint resulting from the growth of human numbers, changing population distributions and unsustainable consumption and production patterns. The stark challenges to sustainable development have become clearer. At the same time, there are some important signs of positive change, including a growing international consensus on actions to promote development while protecting the environment.

Important milestones in this regard are the agreements of the United Nations conferences of the 1990s. The United Nations Conference on Environment and Development (UNCED), held in Rio de Janeiro in 1992, was one such milestone. The international community recognized that environmental protection and natural resource management had to be integrated with action to alleviate poverty and underdevelopment.

FIGURE 1: MATERNAL MORTALITY BY SUBREGION, 1995
(deaths per 100,000 live births)



4

Source: WHO/UNICEF/UNFPA

Progress recognizing the importance of population and women's rights and empowerment to the development agenda was marked at the Vienna Conference on Human Rights (1993), the International Conference on Population and Development (ICPD, 1994) and the Fourth World Conference on Women (1995). Participatory development strategies featured strongly in the World Summit on Social Development (1995).

The ICPD agreed on an explicit and detailed series of goals, using an approach based on human rights and individual decision-making. Among them are elimination of the gender gap in primary and secondary education by 2005, and universal primary education before 2015; sharp reductions in maternal mortality and in infant and under-5 mortality; and universal access to reproductive and sexual health services including a full range of safe and reliable family planning methods by 2015. Attaining these goals would also lead to early population stabilization.

Implementing the ICPD recom-

mendations for development (including better reproductive health and moves towards gender equality) will help defeat poverty and protect the environment. By promoting slower population growth, it will buy time in which critical decisions can be made.

Each of these major conferences stimulated a wide range of specific actions and policy reviews, including formulation and implementation of national plans and changes in national policies and priorities. Fifth-year reviews of progress in implementing each agreement have identified key future actions. Each step marks further progress towards the realization of sustainable development.

At the Millennium Summit (2000) national heads of state outlined priorities for development and poverty eradication. This milestone event consolidated the commitments undertaken at the earlier conferences, defining specific goals to measure progress, and providing a vision of the changes needed for a sustainable future.

Next year's "Rio+10" review of UNCED will present an opportu-

nity to incorporate the social agenda of these milestone events into initiatives to promote sustainable development.

MAJOR THEMES OF THE REPORT

ENVIRONMENTAL TRENDS (CHAPTER 2)

As populations grow and demand increases, the search for water, food, and energy resources and the resulting impact on the environment are calling sustainability into question. The limits of technologies and the wisdom of our use of them are growing challenges, and questions of governance, social organization and human rights are increasingly important to a sustainable outcome.

Water

Water may be the resource that defines the limits of sustainable development. The supply of fresh water is essentially fixed, and the

balance between humanity's demands and available quantity is already precarious.

Not all countries are affected equally. The more-developed regions have, on average, substantially higher rainfall than less developed regions and have developed technology to use water more efficiently.

While global population has tripled over the past 70 years, water use has grown six-fold. Worldwide, 54 per cent of the annual available fresh water is being used, two thirds of it for agriculture. By 2025 it could be 70 per cent because of population growth alone, or—if per capita consumption everywhere reached the level of more developed countries—90 per cent.

In the year 2000, 508 million people lived in 31 water-stressed or water-scarce countries. By 2025, 3 billion people will be living in 48 such countries. By 2050, 4.2 billion people (over 45 per cent of the global total) will be living in countries that cannot meet the requirement of 50 litres of water per person each day to meet basic human needs.

Many countries use unsustainable means to meet their water needs, depleting local aquifers. The water tables under some cities in China, Latin America and South Asia are declining over one metre per year. Water from seas and rivers is also being diverted to meet the growing needs of agriculture and industry, with sometimes-disastrous effects. In 1997, the Yellow River in China ran dry for a record 226 days.

The World Health Organization (WHO) estimates that about 1.1 billion people do not have access to clean water. For the first time, official statistics reflect a decline in water coverage compared to previous estimates.

In developing countries, 90-95 per cent of sewage and 70 per cent of industrial wastes are dumped untreated into surface waters where they pollute the water supply. In many industrial countries, chemical run-off from fertilizers and pesticides, and acid rain from air pol-

lution require expensive and energy-intensive filtration and treatment to restore acceptable water quality.

Purely technological solutions to water scarcity are likely to have limited effect. Desalinated seawater is expensive and now accounts for less than 1 per cent of the water people consume.

Protecting water supplies from pollutants, restoring natural flow patterns to river systems, managing irrigation and chemical use, and curbing industrial air pollution are vital steps to improving water quality and availability.

Food

In many countries, population growth has raced ahead of food production in recent years. Between 1985 and 1995, food production lagged behind population growth in 64 of 105 developing countries studied, with Africa faring the worst.

Australia, Europe and North America have large surpluses of food for export and are probably capable of expanding food production. However, there are questions over the long-term sustainability of intensive agricultural practices.

Most of the developing world is classified as "low-income, food deficit countries" by the Food and Agriculture Organization of the United Nations (FAO). These countries do not produce enough food to feed their people and cannot afford to import sufficient amounts to close the gap. In these countries, some 800 million people are chronically malnourished and 2 billion people lack food security.

Food production capacities in many poor countries are deteriorating due to soil degradation, chronic water shortages, inappropriate agricultural practices and rapid population growth. Much agricultural land is also increasingly devoted to cash crops for export, depriving poor local people of land to farm and food to eat.

Today, 15 crops provide 90 per cent of the world's food intake. Three—rice, wheat and maize (corn)—are staple foods for two out

of three people. The continuing genetic erosion of the earth's wild strains of cereals and other cultivated plants threatens continuing efforts to improve staple crops. Unless the rate of plant genetic loss is halted or slowed substantially, as many as 60,000 plant species—roughly one quarter of the world's total—could be lost by 2025.

Fish stocks are also under threat. According to FAO, 69 per cent of the world's commercial marine fish stocks are "fully exploited, overfished, depleted, or slowly recovering."

To accommodate the nearly 8 billion people expected on earth by 2025 and improve their diets, the world will have to double food production, and improve distribution to ensure that people do not go hungry. Since available cropland is shrinking, most production will have to come from higher yields rather than new cultivation. However, new high-yielding crop varieties require specialized fertilizers and pesticides, which may disturb the ecological balance and create new disease and pest problems.

To achieve food security, countries must reverse the current course of land and water degradation. Even the poorest countries can safeguard their resource base—particularly topsoil and freshwater, improve the productive capacity of land, and increase agricultural yields. Needed are responsible governance balancing many interests, community participation (including women, who often manage local resources), a commitment to food security, and the cooperation of the international community.

Climate change

In the 20th century, human population quadrupled—from 1.6 billion to 6.1 billion, and carbon dioxide emissions, which trap heat in the atmosphere, grew 12-fold—from 534 million metric tons in 1900 to 6.59 billion metric tons in 1997.

The Intergovernmental Panel on Climate Change (IPCC) estimates that the earth's atmosphere will warm by as much as 5.8 degrees Celsius over the coming century, a

rate unmatched over the past 10,000 years. The panel's "best estimate" scenario projects a sea-level rise of about half a metre by 2100.

In 1995, the 20 per cent of the world's population living in countries with the highest per capita fossil-fuel carbon dioxide emissions contributed 63 per cent of the total global emissions. The 20 per cent in the lowest-emission countries contributed just 2 per cent of the total. The United States, with only 4.6 per cent of the world's population, produces one fourth of global greenhouse gas emissions.

For industrial countries as a whole, per capita emissions have been relatively flat since 1970, about 3 metric tons per person. While per capita emissions of developing countries are still far lower than those of developed regions, the gap is narrowing.

Climate change will have a serious impact including increased storms, flooding and soil erosion, accelerated extinction of plants and animals, shifting agricultural zones, and a threat to public health due to increased water stress and tropical disease. These conditions could increase environmental refugees and international economic migration.

Equalizing the benefits and costs of climate change for the good of all will require responsible leadership, concrete steps by the wealthier countries to curb their emissions, coupled with financing, technology transfer and capacity-building to help poorer regions respond to the significant challenges ahead.

Sometime early in the 21st century, developing countries will contribute more than half of total emissions. As the gap in per capita emissions closes, population size and rate of growth will become more significant in policy discussions.

Forests, habitat and biodiversity

In the last few decades as population growth has peaked, deforestation rates have reached the highest levels in history.

Since tropical forests contain an estimated 50 per cent of the world's

remaining biodiversity, their destruction is particularly devastating. At current rates of deforestation, the last significant primary tropical forest could be harvested within 50 years, causing irreversible loss of species. Tropical deforestation also contributes to the build-up of carbon dioxide in the atmosphere.

While sustainable forestry holds some promise, projected increases in population growth over the next few decades will present challenges and difficult choices. Many of the countries that contain the largest blocks of remaining tropical forest are also those with the highest population growth rates.

One key to preserving remaining forests and biodiversity may be the integration of reproductive health and family planning programmes with park and forest management efforts.

DEVELOPMENT, POVERTY, AND ENVIRONMENTAL IMPACT (CHAPTER 3)

More people are using more resources with more intensity than at any point in human history. Affluence consumes energy and produces waste at far higher rates than poverty. The effects of poverty also destroy environments, but the poor are at the end of a long chain of cause and effect. They are the messengers of unsustainability rather than its agents.

Population growth, increasing affluence—with rising consumption, pollution and waste—and persistent poverty—with the lack of resources and the technology to use them and lack of power to change these circumstances—are putting increasing pressure on the environment.

The consumption gap

A huge "consumption gap" exists between industrialized and developing countries. The world's richest countries, with 20 per cent of global population, account for 86 per cent of total private consumption, whereas the poorest 20 per cent of the world's people account for just 1.3 per cent.

A child born today in an industrialized country will add more to consumption and pollution over his or her lifetime than 30 to 50 children born in developing countries. The ecological "footprint" of the more affluent is far deeper than that of the poor and, in many cases, exceeds the regenerative capacity of the earth.

Poverty and the environment

Despite soaring economic activity, now estimated at over \$30 trillion annually, some 1.2 billion people live on less than \$1 a day. Nearly 60 per cent of the 4.4 billion people in developing countries lack basic sanitation, almost a third do not have access to clean water, one quarter lack adequate housing, 20 per cent do not have access to modern health services, and 20 per cent of children do not attend school through grade five.

Globalization has clearly increased global wealth and stimulated growth. It has also increased income inequality and environmental degradation. Poverty is causing many poor people to increase their pressure on fragile natural resources to survive.

Increasing urbanization presents another challenge. Every day about 160,000 people move from rural areas to cities. Today almost half of all people live in urban areas. Many cities in developing countries face serious environmental health challenges and worsening conditions due to rapid growth, lack of proper infrastructure to meet growing needs, contaminated water and air, and more garbage than they can handle.

There is increasing consensus that only an integrated approach to the problems of poverty and environmental degradation can result in sustainable development. The building blocks for success include increasing the resource base of the poor, investing in energy services and infrastructure, supporting green technologies, and implementing appropriate pricing policies for resources such as water, electricity and fertilizer.

Poor people often spend long hours gathering fuel and pay higher unit prices for energy, while electricity subsidies favour urban elites.

Rural population growth does not necessarily damage the environment, but limited land availability often leads poor people to settle in fragile areas. Constructive policies, including population policies, will make the most of opportunities, avoid limits and promote equity.

Only an integrated approach to defeating poverty and protecting the environment can result in sustainable development. Local control and respect for local knowledge will be important. Attention to the voices of women, who are responsible for food, water, fuel and other household resources, is essential.

Human impact on the environment is exacerbating the intensity of natural disasters, and the poor suffer the consequences. There are 25 million environmental refugees.

WOMEN AND THE ENVIRONMENT (CHAPTER 4)

Worldwide, women have primary responsibility for rearing children and ensuring sufficient resources to meet their needs. In the rural areas of developing countries, women are also the main managers of essential household resources like clean water, fuel for cooking and heating, and fodder for domestic animals.

Women make up more than half of the world's agricultural workforce. They grow crops for the home and market and often produce most staple crops. In the world's poorest countries, women head almost a quarter of rural households.

However, although women have the primary responsibility for managing resources, they usually do not have control. National law or local customs often deny women the right to secure title or inherit land, which means they have no collateral to raise credit and improve their conditions.

Women often lack rights in other aspects of their lives, reinforcing gender inequalities. High

fertility and large families are still a feature of rural life, though the rationale has long since passed. In part, this reflects women's lack of choice in the matter.

Sustainable development demands recognition and value for the many ways in which women's lives intertwine with environmental realities. Women need legal and social support for land ownership, tenure and inheritance. They also need access to credit, and agricultural extension and resource management services.

With fewer opportunities on the land, many men migrate, increasing women's family burdens and responsibilities, though they may receive money for housing, education and health care.

Urbanization offers a series of risks and opportunities to women. Pregnancy and childbirth are generally safer in urban areas, where health care is more likely to be accessible. City life also offers women a broader range of choices for education, employment and marriage, but it also carries heightened risk of sexual violence, abuse and exploitation.

Whether urban or rural, choices over family size and spacing; health care, including reproductive health; education and partnership with men, are among the range of options women need in order to be effective managers of household and other resources. Women's involvement in health and environmental decisions is essential. A growing body of experience shows that reproductive health and environmental services can work very profitably together, if they are designed to meet communities' own priorities.

Laws and policies on women's rights and equality, and on the sustainable use and protection of natural resources, are also essential. Without such support, many women are trapped in a vicious spiral of continuing environmental degradation, poverty, high fertility and limited opportunity.

Women's groups are organizing to integrate women fully into the political process, so they can take their full part in making policy decisions affecting their lives.

HEALTH AND THE ENVIRONMENT (CHAPTER 5)

Environmental conditions help determine whether people are healthy or not, and how long they live. There is a close relationship between the environment and reproductive health.

Environmental conditions contribute significantly to communicable diseases, which account for about 20-25 per cent of deaths annually worldwide. An estimated 60 per cent of the global burden of disease from acute respiratory infections, 90 per cent from diarrhoeal disease, 50 per cent from chronic respiratory conditions and 90 per cent from malaria could be avoided by simple environmental interventions.

Unclean water and associated poor sanitation kill over 12 million people each year. Air pollution kills nearly 3 million more, mostly in developing countries.

Changes in land use can have many effects on health. Dams and irrigation can create breeding grounds for disease carriers; increased use of pesticides and fertilizers can expose local populations to toxic chemicals.

Densely populated and rapidly growing megacities subject their populations to air pollution levels far in excess of allowances recommended by WHO.

Indoor air pollution—soot from the burning of wood, dung, crop residues and coal for cooking and heating—affects about 2.5 billion people, mostly women and girls, and is estimated to kill more than 2.2 million each year, over 98 per cent of them in developing countries.

Pollution has a direct effect on reproductive health, especially among the poor. Unplanned urban development and the opening of marginal, rural lands increase the number of people without access to reproductive health services, increasing the risks of maternal mortality and unwanted pregnancy. Lack of clean water at health facilities undermines service quality.

Since 1900, industrialization has introduced almost 100,000 previously unknown chemicals into

the environment. Most of these chemicals have not been studied, either individually or in combination, for their health effects. Some of them, banned in industrialized countries because of their harmful effects, continue to be widely used in developing countries.

Many chemicals have found their way into the air, water, soil and food—and human beings. Exposure begins in the womb. Some agricultural and industrial chemicals are associated with pregnancy failures and with infant and childhood developmental difficulties, illness and mortality. Exposure to nuclear radiation and some heavy metals has genetic impacts.

Climate change will have a variety of effects on health, for example changing the zones of risk for insect-borne diseases.

Migration and trade between rural and urban areas, and between different countries help to spread diseases. Human settlements in new areas are poorly served by health services.

The HIV/AIDS crisis is closely linked to wider development issues, including poverty, malnutrition, exposure to other infections, gender inequality and insecure livelihoods. The epidemic, with its direct and devastating impact on health and the family, complicates environmental protection, intensifies agricultural labour problems and adds to the burdens of rural women.

ACTION FOR SUSTAINABLE AND EQUITABLE DEVELOPMENT (CHAPTER 6)

Definitions and understandings of development have changed. Economic development; the state of the environment; the health of men, women and children; and the status of women are all intricately intertwined. Development requires improvements in the lives of individuals, usually by their own hand, the status of women powerfully determines the state of development, and women require good reproductive health care for their status to improve.

This understanding has been articulated in consensus documents negotiated at a series of global meetings convened in the 1990s. These meetings dealt with environment and development in 1992, with population and development in 1994, and, in 1995, with social development and with women's rights.

The 1994 ICPD recognized the interconnectedness of slowing population growth, reducing poverty, achieving economic progress, protecting the environment, and reducing unsustainable consumption and production. It emphasized the need to ensure women's rights, including the right to reproductive health, as essential in its own right and a key to sustainable development.

A 1999 review by 185 countries of progress in implementing the ICPD Programme of Action found that the goals and approach remained valid, that many governments had made changes in their health and population programmes to conform more closely with the Cairo approach, that a handful of issues—notably HIV/AIDS—had grown in urgency since 1994, and that funding was falling alarmingly short of hopes and goals expressed in Cairo. The review adopted new benchmarks and commitments to action.

Next year's review of the 1992 Agenda 21 agreement reached in Rio de Janeiro will present an opportunity to incorporate the ICPD agenda into sustainable development initiatives.

Actions and resources

Urgent action is needed to mobilize the resources to implement the ICPD Programme of Action. Current resources for reproductive health and population programmes are well below the \$17 billion the ICPD agreed would be needed in 2000. While developing countries are providing most of their two thirds share of needed resources, support from international donors is less than half of the \$5.7 billion called for in 2000.

HIV/AIDS prevention was part

of the ICPD package. But considerably more funds are needed for treatment and care of the millions of people living with HIV. The total elimination of unmet need for family planning by 2015 is now an internationally agreed goal; this will require further resources. Reducing maternal mortality is another major challenge.

The funding shortfall is already showing its effects: fertility declines have been slower than would be expected if more couples and individuals could have the family size they desire. The costs of delaying action will increase rapidly over time.

Returns for slower growth

Policies and programmes addressing issues of population growth, reproductive health and women's empowerment meet pressing human needs and advance human rights. They also have important environmental benefits. It is hard to quantify these, because of the multiple interactions. But it is clear that providing full access to reproductive health services, which are relatively inexpensive, is far less costly in the long run than the environmental consequences of the faster population growth that will result if reproductive health needs are not met. There would also be substantial benefits in terms of health and economic and social opportunity.

Recommendations

Promoting human rights, eradicating poverty, improving reproductive health and achieving a balance between population and development needs and environmental protection will require a broad range of actions. Some priorities are to:

1. Implement the global consensus agreement of the International Conference on Population and Development.
2. Provide incentives for the dissemination, further development and use of more sustainable production processes.
3. Improve the information base for more-sustainable population,

development and environment practices.

4. Implement internationally agreed actions to reduce poverty and promote social development.

Action on population, environment and development issues is both necessary and practical. The various international environmental agreements and the international consensus on population and development are being translated into working realities. These agreements only underline the need for broader and more extensive efforts.

CULTURAL CHANGE, POPULATION AND ENVIRONMENT

All communities seek to secure what they value. Cultural change is the means by which a society accommodates and adapts to a changing world. But it is not a one-way process—social change may begin with changing perceptions at the local level as well as being a response to change in the external environment.

Cultural understandings mediate the application of transcendent values to everyday life. Most cultural traditions, for example, recognize human stewardship of the environment. They value each generation's natural inheritance, which it leaves in turn to future generations. They emphasize the long-term perspective when making immediate choices (though this wisdom is often ignored).

Cultures tend to evolve slowly and cautiously in the face of the risks and uncertainties of change. But vibrant cultures evolve in response to change in the external environment.

Cultural understandings can recognize and adapt to changing economic, social and environmental realities, and culturally based resistance to change may reflect short-term interests rather than fundamental values.

These general principles are reflected in the international dis-

cussion of the issues covered in this report. Their marks can be found in the consensus agreements on social development reached by the global community.⁶

Cultural practices can be a source of important information. Indigenous knowledge and practices reflect adaptation to environmental realities that scientists and technocrats may not fully appreciate. Modern science has relearned lessons from traditional agricultural practices. For example, terraced farming of potato crops in Meso-America generate higher yields and more pest protection at lower cost than many successor techniques. Farmers and ecologists have achieved similar benefits from alternating rows of selected crops in fields—local diversity produces

results that large-scale monoculture cannot.

Yet the diversity of cultures is threatened along with the diversity of species. Many forms of traditional knowledge may disappear before they can be validated and more widely disseminated. Many drugs in the modern medical toolkit are derived from natural plant or animal substances that have been used in historical cultural practices.⁷ Changing forest patterns have already transformed cultures in the Amazon region, Central America, Africa and South-eastern Asia.

Rapid environmental change, from natural causes, human agency or a combination of the two, threatens traditional cultures. Lake Chad in Africa has lost 95 per cent of its area in 40 years as a result of drier



Bangladeshi woman at adult literacy class. Educating women and enabling them to have only the number of children they want would lead to smaller families and slower population growth.
Shehzad Noorani, Still Pictures

BOX 2
GLOBALIZATION AND THE PUBLIC SECTOR

The international consensus promotes the human rights of individuals at the same time as it works towards social cohesion and the solution of global problems such as rapid population growth. Implementing the agenda is a goal in itself, but it will also help countries to end poverty and protect the environment.

Most people in most countries, including the wealthier industrial countries, rely on public services for health, education, justice and other services that maintain the social fabric. They will continue to do so, since profit-oriented services cannot guarantee access and equity.

Despite the challenges of impoverished rural areas and overburdened cities, poorer countries can provide an adequate level of public services—but they need systems of governance which allow significant expression of community interests, leaders who are willing to respond, commitment to improved public services as a development goal and an international economic system which favours, or at least does not militate against, social investment.

The pace of globalization appears to be unstoppable. But for globalization to be sustainable it is not sufficient to liberalize trade and economic activity—there must be parallel efforts to ensure that social investment, including environmental protection, is also available. International as well as national efforts for health, education and social services depend on the public sector. These cannot succeed without transfers from richer to poorer nations. Globalization in the social as well as the economic sense is central to the success of local efforts to maintain and rescue environments.

Policy makers in favour of globalization must also concern themselves with “localization”—ensuring that economic activity benefits local communities, or at least leaves them no worse off.

weather and increased demand for irrigation.⁸ Settled farmers have replaced the nomadic cultures and fishermen that depended on its waters.

Dams have made possible power generation and irrigation on a vast scale; but existing dams contribute to many environmental problems, and new dams will displace communities and long established ways of life, from the marsh Arabs of the Tigris-Euphrates delta⁹ to the Himba of Namibia and their neighbours.¹⁰ The World Commission on Dams reports that 68 of the 123 dams they studied worldwide will displace settlements, many of which represent unique cultures.

Cultural adaptation takes many forms, the most widespread being the change to urban life now in

progress in all regions. Urbanization offers many advantages, but a specifically urban culture, reflecting concern for the well-being of individuals, the community and the wider environment, is slow to grow. Developing the mechanisms for cultural organization on a large scale—including governance of a diverse group which may be far larger than the traditional homogeneous community—is a development project to which too little attention has been paid.

The forces of change are many and powerful. Additional changes are being introduced worldwide by greater information about other lifestyles, by economic and social trends (including local, regional and global market impacts) and by changes in education, civil institu-

tions and social roles. Agents of change are not likely to command respect unless they in turn respect communal values, nor benefit from local knowledge unless they have some contact with the community.

Policy makers at all levels, public institutions and private businesses, including multinational operations, should seek dialogue in terms that are locally understood. They should respond to local concerns and incorporate local perspectives. Diverse cultural understandings can be a source of strength and improved decision-making if they are voiced and acted on.

With an inclusive approach, cultures adapt. The Tuareg of the Sahel, to take only one example, are forsaking their nomadic trading and herding lifestyle, as mechanized transport becomes the preferred means of pan-Saharan travel. With a switch to settled agricultural occupations, strict gender roles have been changing, providing women with greater communication with men and increased opportunities for valued economic and social participation. Yet along with such changes, respect for the desert and its ecology remains.¹¹

In a diverse society, means must be found to reflect the interests of the wider as well as the local community. Thinkers such as Amartya Sen are exploring the cultural dimensions of democracy and its positive implications for development.

The population-environment-development debate is concerned among other things with the relationship between individual freedom of expression and choice on one hand, and the broader interests of the community on the other. A measure of consensus has already been reached; it is agreed, for example, that free individual choice on the size and spacing of the family will promote slower population growth. By moving towards gender equality and the empowerment of women, reproductive choice also promotes environmental conservation.

CHAPTER 2

ENVIRONMENTAL TRENDS



Recycling refrigerators in Germany. The world's richest countries, with 20 per cent of the global population, account for 86 per cent of private consumption.
Thomas Raupach, Still Pictures

WATER AND POPULATION

Water may be the resource that defines the limits of sustainable development. It has no substitute, and the balance between humanity's demands and the quantity available is already precarious.¹

Only about 2.5 per cent of all water on the planet is fresh water—essential for most human purposes—and only about 0.5 per cent is accessible groundwater or surface water. Rainfall quantities vary greatly around the world. Portions of Northern Africa and Western Asia receive very small amounts of rain.

Income is related to the availability of water between and within

nations. The more developed regions have on average substantially higher rainfall than those less and least developed.² Additionally, richer countries can better afford the investments needed to develop reservoirs, dams and other technologies to capture fresh water run-off and available groundwater.

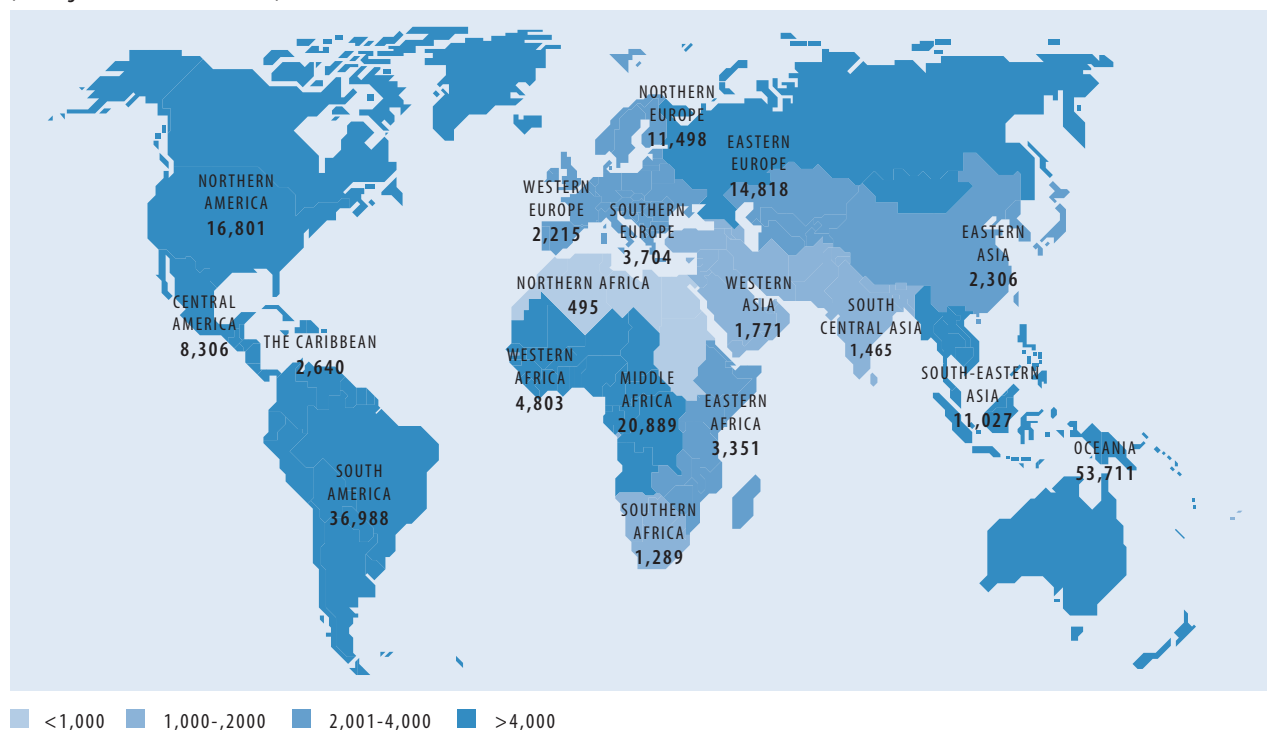
Global population has tripled over the past 70 years and water use has grown six-fold as the result of industrial development and increased use of irrigation. More recently, per capita use of water has levelled off, so total water consumption is growing at about the same pace as population. Satisfying the water needs of 77 million additional people each year has been estimated as requiring an amount roughly equal to the flow of the

Rhine. But the amount of available fresh water has not changed.

Worldwide, 54 per cent of the annual available fresh water is being used. If consumption per person remains steady, by 2025 we could be using 70 per cent of the total because of population growth alone. If per capita consumption everywhere reached the level of more developed countries we could be using 90 per cent of the available water by 2025.

Such extrapolations assume no change in the efficiency of water use. It has been estimated, however, that relatively low-cost technologies could double agricultural productivity per unit of available water.³ In the past 50 years, industrialized countries have significantly increased efficiencies in indus-

FIGURE 2: WATER RESOURCES PER CAPITA, BY SUBREGION, 2000
(average annual cubic metres)



Source: United Nations Population Division

trial and agricultural water use. Many of the same technologies—for example, drip irrigation instead of flood irrigation—are increasingly available in developing countries, but cost and cultural issues (like educational outreach to facilitate behaviour change) must be addressed.

WATER AVAILABILITY

Countries are characterized as water-stressed or -scarce depending on the amount of renewable water available.⁴ Water-stressed countries have fewer than 1,700 cubic metres of water available per person per year. In this circumstance, water is often temporarily unavailable at particular locations, and difficult choices must be made among uses of water for personal consumption, agriculture or industry. Water-scarce countries have fewer than 1,000 cubic metres per year. At this level, there may not be enough water to provide adequate food,⁵ economic development is hampered and severe environmental difficulties may develop.

In the year 2000, 508 million

people lived in 31 water-stressed or -scarce countries. By 2025, 3 billion people will be living in 48 such countries.⁶ The number of people living in conditions of scarcity will double, and those living in water stress will increase six-fold.

For some purposes, river basins are a more appropriate unit than countries for analysing water flows. Many of the world’s major river basins encompass more than one country. Currently 2.3 billion people live in river basins that are at least water stressed; 1.7 billion live in basins where scarcity conditions prevail. By 2025 these numbers will be 3.5 billion and 2.4 billion, respectively.

Domestic consumption needs

“Access to safe water is a fundamental human need and, therefore, a basic human right,” according to United Nations Secretary-General Kofi Annan.⁷

Experts have outlined a basic daily water requirement (BWR)—50 litres per capita per day for the purposes of drinking, sanitation, bathing, cooking and kitchen needs—

and urged its recognition as the standard against which to measure the right to safe water.⁸

Countries use different methods for collecting data on domestic water use, and uniform standards for assessing quality have not been set. Available country estimates indicate that 61 countries, with combined populations of 2.1 billion people in 2000, were using less water than the BWR. By 2050, 4.2 billion people (over 45 per cent of the global total) will be living in countries below the BWR standard.

This minimal standard does not take into account other necessary uses of water—for agriculture, ecosystem protection and industry. A consumption standard of 100 litres per person per day would reflect these additional needs; in 2000 there were 3.75 billion people in 80 countries below this level. The population of these countries will increase to 6.4 billion by 2050.

Women in many parts of the world have the primary responsibility for collecting water for their families, and spend up to five times as much time on this as men do.

The more distant the water source, the greater the burden on women.

Both distance and the source affect the amount of water used by individual households. For example, when the source is a public standpipe more than a kilometre from home, use is typically less than 10 litres per day; water consumption might be twice as high when the standpipe is closer, and considerably higher in households with running water connections.

Unsustainable water use

Many countries use unsustainable means to meet their water needs. If more water is withdrawn than is replenished by natural processes, the excess is essentially “mined” from reserves. These can be recent local aquifers or, in extreme cases,⁹ ancient sources of underground “paleo-water”. The water tables under some cities in China, Latin America and South Asia are declining at over one metre per year.

Agriculture and industry divert large amounts of water with sometimes-disastrous effects. The best-known example is the Aral Sea, which has been destroyed by diverting its feeder waters for irrigation. The Yellow River in China ran dry from 600 kilometres upstream to the river’s mouth every year in the 1990s. In 1997, it ran dry a record 226 days.¹⁰ The Rio Grande River on the U.S.-Mexico border developed a sandbar at its mouth recently, highlighting the loss of its flow.

The construction of large dams has slowed, particularly in more-developed countries, as their disadvantages are appreciated: environmental disruption, displacement of long-settled populations, loss of agricultural land, silting and denial of water to downstream areas, sometimes in other countries. Large dam projects continue in Turkey, China and India.

WATER QUALITY

Quantitative estimates of water availability or consumption do not capture the full challenge of water needs. The quality of the available

water is far from adequate. The World Health Organization reports that about 1.1 billion people do not have access to clean water (whatever its quantity).¹¹ Fully 2.4-3.0 billion people lack access to sanitation.

These shortcomings are most pronounced in rural areas, where 29 per cent of residents lack access to clean water and 62 per cent to sanitation systems.

Rapid and unplanned population growth in and around urban areas is overwhelming their capacity to meet water needs. For the first time, official statistics reflect a decline in coverage compared to previous estimates: current estimates are that clean water is not available to at least 6 per cent of urban dwellers and 14 per cent lack sanitation, but this clearly understates the problem.

Water quality is closely related to availability, and to decisions about land use, industrial and agricultural production, and waste disposal. In developing countries, 90-95 per cent of sewage and 70 per cent of industrial wastes are dumped untreated into surface waters where they pollute the usable water supply.

Natural systems purify circulating water when there is enough available. When water becomes progressively scarcer, it is also generally of poorer quality. Intensive land use and industrial development also affect quality. In many industrial countries fertilizer, pesticide and manure run-off from the land and acid rain from atmospheric contamination call for expensive and energy-intensive filtration and treatment to restore acceptable quality. Restoring natural flow patterns to river systems, managing irrigation, chemical use and animal wastes, and curbing industrial air pollution are vital steps towards improving overall sustainability as well as water quality.

NEW CHALLENGES

Agriculture uses two thirds of the available fresh water. Rising incomes in recent decades have led to an increase in meat consumption in many countries. This requires sub-

stantial additional inputs of grain and water.¹²

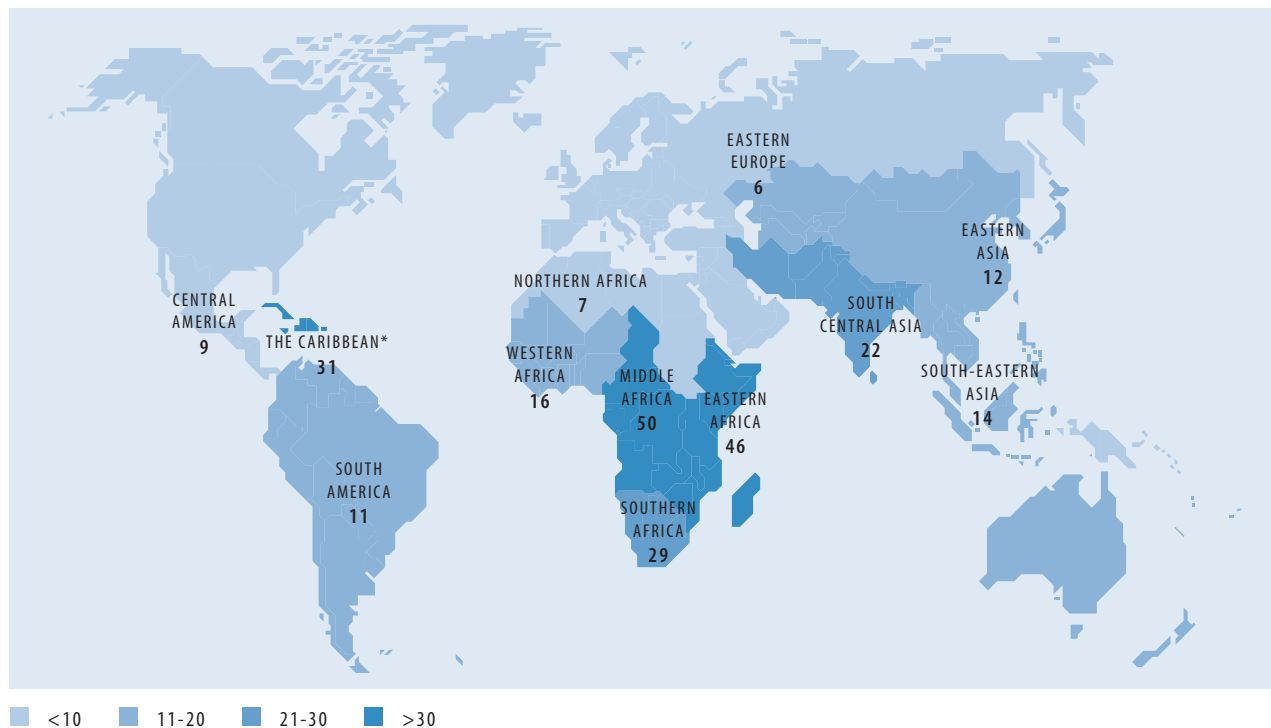
Competition for increasingly scarce water increases the likelihood of international conflict (both economic and military) over water quality and diversion schemes.¹³ More than 200 river systems cross national boundaries. Thirteen major rivers and lakes are shared by 100 countries.

There are great uncertainties as to the future impacts of global warming on water availability and thus on the sustainability of human settlement patterns. Rainfall patterns, including the intensity and timing of storms and the rate of evaporation, are likely to change significantly as the climate warms.

Purely technological solutions to water scarcity are likely to have limited effect. Desalinated seawater now accounts for less than 1 per cent of the water people consume. It is likely that this will increase, but it is only feasible in countries wealthy enough to take on the costs—currently oil-producing states of west Asia—with no need to transport the water over long distances. Movement of fresh water in large plastic bags pulled by ships has been of some value in the eastern Mediterranean, but as with desalination, it is of little help to landlocked countries or inland populations and of limited scale.

More ambitious proposals, such as transporting icebergs, have proven unfeasible to date. Collecting large amounts of rainfall that lands on the oceans may become feasible but the effects of reflected light and heat from the plastic sheets required could create problems. Transport of such water to needy populations may very well pose insurmountable problems. As in so many other areas, technology will not ride to the rescue: political and social decisions are needed, which may be difficult now but will certainly be still more difficult as populations grow and their requirements demand more from the same fixed resource.

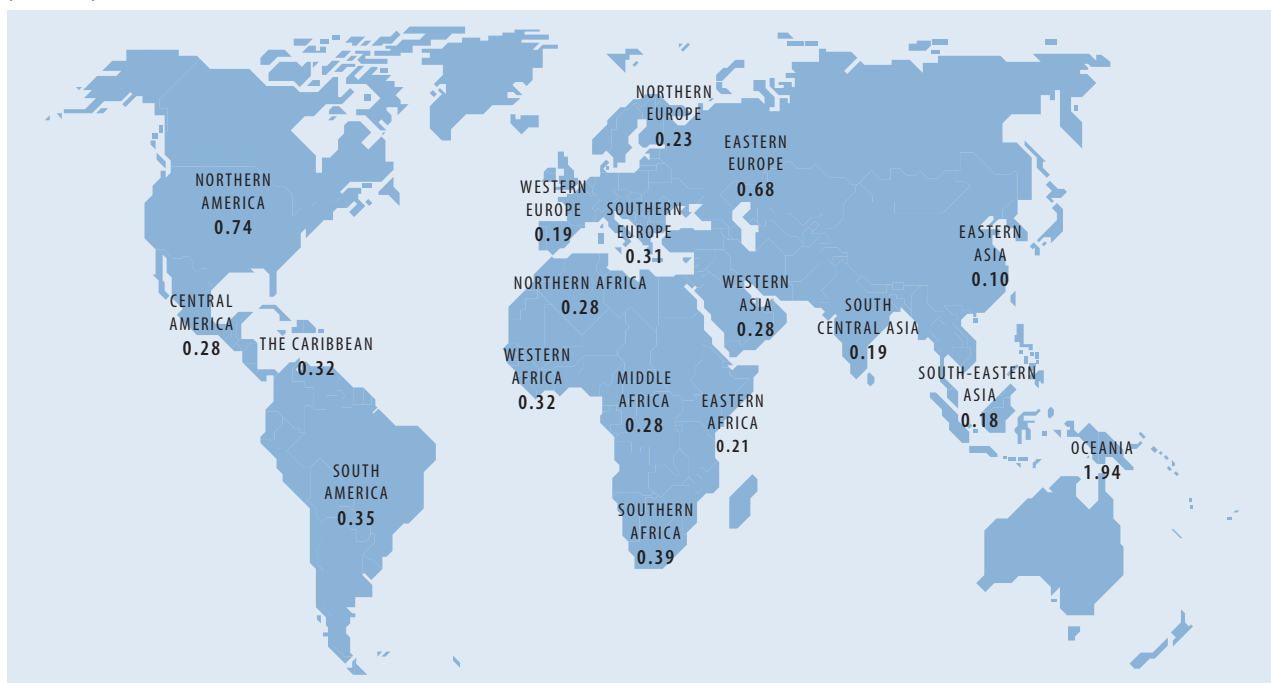
FIGURE 3: PERCENTAGE OF POPULATION UNDERNOURISHED, BY SUBREGION, 1996-1998



Source: United Nations Population Division

*Caribbean average is skewed by high malnourishment in Haiti.

FIGURE 4: CROPLAND PER CAPITA, BY SUBREGION, 1996-1998
(hectares)



Source: United Nations Population Division

FEEDING A FUTURE WORLD

Environmental degradation, population growth, overstressed agricul-

ture and inadequate international food distribution raise the question: Will there be enough food in the future?

Two billion people lack food security as the Food and Agri-

culture Organization of the United Nations defines it, a “state of affairs where all people at all times have access to safe and nutritious food to maintain a healthy and active life”.¹⁴

In many countries population growth has raced ahead of food production in recent years.¹⁵ The world grain harvest increased about 1 per cent annually between 1990 and 1997, less than the average population growth rate of 1.6 per cent in the developing world.¹⁶ Between 1985 and 1995 food production lagged behind population growth in 64 of 105 developing countries studied by FAO.¹⁷ Africa fared worst among major regions. Food production per person fell in 31 of 46 African countries.¹⁸

The average amount of grain land per person dropped by almost half between 1950 and 1996—from 0.23 hectares to 0.12 hectares. By 2030, when world population is projected to be at least 8 billion, there would be just 0.08 hectares of grain land per person.¹⁹ As for developing countries, in 1992, there were about 0.2 hectares of arable land per person. By 2050, this figure could fall to about 0.1 hectare per capita.²⁰

According to the International Food Policy Research Institute (IFPRI), the world's farmers will have to produce 40 per cent more grain in 2020 than in 1999. Most of this projected increase will have to come from yield increases on existing land, not the cultivation of new land.²¹

Countries are not equally affected. Australia, Europe, and North America have large surpluses of food for export.²² Their populations are growing slowly, if at all, and per capita consumption is not increasing.

These countries are probably capable of expanding food production considerably beyond current levels, though the long-term sustainability of intensive farming practices has been brought into question by recent events. The most widely publicized are outbreaks of “mad cow disease” (bovine spongiform encephalopathy) and foot-and-mouth disease; but there is also considerable concern about salmonella poisoning from eggs and chickens, and mutant, drug-resistant *E. coli* infections from contami-

nated meat and water, all of which can be traced in some way to the desire to maximize agricultural output and reduce costs.²³

There is also considerable controversy over genetic modifications (GM) to food crops and animals. Though GM has not been shown to be directly harmful to humans, the practice carries risks, including social effects, which have yet to be fully evaluated. A British government report has raised fears that GM will threaten biodiversity.²⁴

Another group of countries cannot grow enough food on their own land to feed their populations but can make up the shortfall through imports. Such countries include Japan, Singapore, Chile and the oil-producing states of the Arabian Gulf.

Over half the world's population, most of the people of the developing world—including nearly all of sub-Saharan Africa—live in “low-income, food-deficit countries”, according to FAO.²⁵

The low-income, food-deficit countries do not produce enough to feed their people and cannot import sufficient food to close the gap. In these countries just under 800 million people are chronically malnourished, according to a 1999 estimate by FAO.²⁶

PROBLEMS OF FOOD-DEFICIT COUNTRIES

In many low-income food-deficit countries, food production capacities are deteriorating in the face of soil degradation, chronic water shortages, inappropriate agricultural policies and rapid population growth.²⁷ The gap between production and market demand for cereals in South Asia is forecast to widen from 1 million metric tons in 1990 to 24 million tons in 2020, and in sub-Saharan Africa from 9 million to 27 million metric tons. The gap between production and need in these grain-short regions will be even greater unless poverty can be significantly reduced.²⁸

Low-income food-deficit countries face the following constraints to achieving food security:

- **Limited arable land.** Increases in food production will have to come from existing agricultural land.²⁹ Arable land could in theory be increased by 40 per cent, or 2 billion hectares, but most of the uncultivated land is marginal, with poor soils and either not enough rainfall or too much. Bringing it into production would require costly irrigation and water-management systems and large-scale measures to enrich the soil. Much of this land is now under forest, and clearing it would have unforeseeable consequences for erosion, degradation and local climate change, among others.
- **Shrinking size of family farms.** One effect of rapid population growth is the shrinking size of family farms. In most developing countries, the size of small family farms has been cut in half over the past four decades, as plots are divided into smaller and smaller pieces for each new and larger generation of heirs. For example, in 57 developing countries surveyed by FAO in the early 1990s, over half of all farms were less than one hectare, not enough to feed the average rural family with four to six children. In India three fifths of all farms are less than one hectare.³⁰
- **Land degradation.** Moderate to severe soil degradation affects nearly 2 billion hectares of crop and grazing land. This is an area larger than the United States and Mexico combined.³¹ When soils are overworked and exposed, they are easily eroded by wind and water, the main agents of soil degradation. Faulty irrigation and drainage can make land useless through waterlogging and salinization (see below). Misuse of fertilizers, herbicides and pesticides also plays a role in soil degradation.

Soil erosion and other forms of land degradation claim 5 million to 7 million hectares of farm land each year.³² In Kazakhstan, for instance, the Institute of Soil Management

BOX 3
THE PROS AND CONS OF FISH FARMING

In the 20th century, ocean fish catches increased 25-fold—from 3 million metric tons to a peak of about 82 million metric tons in 1989. It declined in 1990 and has stagnated since despite increased fishing efforts.

According to FAO, 69 per cent of the world's commercial marine fish stocks are "fully exploited, over-fished, depleted, or slowly recovering." Two thirds of commercially valuable ocean species are in decline and in urgent need of management.

Worldwide, about 200 million people depend on fishing for their livelihoods.

Rapid population growth along coasts has boosted demand for fish, while a combination of over-fishing and pollution has contributed to lower productivity in all but four of the world's 15 major fishing regions.

Many developing countries are turning to aquaculture, or fish farming, to satisfy their growing appetite for seafood as a source of animal protein. In aquaculture, fish are spawned, reared, fattened and then prepared for consumption. One in four food fish consumed by humans in 1995 came from aquaculture.

Like most technologies, aquaculture has its liabilities. For one, intensive aquaculture is in itself a source of pollution, releasing excess feed and faeces in semi-enclosed areas and creating oxygen deficiencies in waterways.

Farmed fish require amino acids from other fish for growth; these are provided in the form of high-protein feed pellets made from wild fish. About 5 kilograms of oceanic fish reduced into fish-meal are required to raise one kilogram of shrimp, representing a large net protein loss. Aquaculture's reliance on wild stocks puts further pressure on marine ecosystems.

Erosion, sedimentation and siltation result from the proliferation of fish cages and fishponds in shallow lakes and rivers. Escapes of farmed fish into rivers, lakes and coastal waters have also become a growing risk to already decimated stocks of wild fish.

has estimated that the country will lose nearly half of its crop-land by 2025 due to soil erosion and degradation.³³ Globally, land degradation threatens the livelihoods of at least 1 billion farmers and ranchers, most of them in poor countries.³⁴

• **Water shortages and degradation.** (See section above.) Water for irrigated agriculture accounts for roughly 70 per cent of all water withdrawn for human use annually on a global basis. When water becomes short, rural farmers often find it difficult to maintain food supplies. In the Indian state of Uttar Pradesh, for instance, the number of water-short villages has

soared from 17,000 to 70,000 in two decades, suppressing crop production.³⁵

Conflicts within countries are also of mounting concern to national governments. In China, for instance, conflicts over water seem to be escalating. In August 2000, six people were killed when officials from Luhe County, in Guangdong Province, blew up a water channel to stop a neighbouring county (Puding) from diverting water from the Yellow River, as agreed to in a court settlement. Farmers in both counties depend on river water to irrigate their crops. Within increasingly limited and polluted supplies,

their yields (and incomes) are falling dramatically.³⁶

• **Irrigation problems.** Food supply is threatened not only by water shortages themselves but also by ineffective irrigation practices. Although only 17 per cent of all croplands are under irrigation, these lands produce one third of the world's total food supply.³⁷ Less than half of all water withdrawn for irrigation purposes actually reaches the crops. The rest soaks into unlined canals, leaks out of pipes or evaporates on its way to the fields.³⁸

Badly planned and poorly built irrigation systems have reduced yields on one half of all irrigated land, according to a 1995 estimate by FAO.³⁹ The two main problems are salinization and waterlogging of crops. FAO estimates that salt build-up in soil has severely damaged 25-30 million hectares of the world's 255 million hectares of irrigated land.⁴⁰ Another 80 million hectares are affected by a combination of salinization and waterlogging.⁴¹

Every year, on average, about 1.5 million hectares of irrigated land is taken out of production because of salt build-up alone, half of the amount of land brought into production.⁴² With such problems, the world's irrigated croplands may actually be shrinking at a time when they should be expanding to meet growing demand for food, according to the International Irrigation Management Institute.⁴³

• **Waste.** Tremendous amounts of food are wasted annually through the effects of rat or insect infestation, spoilage and losses that occur during the transportation process. In China, for instance, an estimated 25 per cent of grain collected is wasted; rats or other pests consume much of it. Similarly, according to the Vietnamese Government, about 13-16 per cent of rice and 20 per cent of vegetables harvested in Viet Nam are wasted because of poor preservation conditions and practices.⁴⁴

THE VALUE OF GENETIC DIVERSITY

After 10,000 years of settled agriculture and the discovery of some 50,000 varieties of edible plants, just 15 food crops provide 90 per cent of the world's food energy intake. Three of them—rice, wheat and maize (corn)—are the staple foods of 4 billion people.⁴⁵ Dependence on only a few crops is dangerous because disease can spread rapidly through monocultures, as it did through the Irish potato harvest in the 1840s, starving to death a fifth of the country's population.⁴⁶

Since 1900 about three quarters of the genetic diversity of domestic agricultural crops has been lost, FAO estimates.⁴⁷ Without constant infusions of new genes from the wild, geneticists cannot continue to improve staple crops. Cultivars (cultivated plants) need to be reinvigorated every 5 to 15 years in order to give them greater resistance against diseases and insects, as well as to introduce new yield-enhancing traits, such as increased tolerance for drought or saline soils. The most effective way to do this is to interbreed domestic varieties with wild ones.

Plant breeders are alarmed at the continuing genetic erosion of the earth's wild strains of cereals and other cultivars. Tropical deforestation, rapid urbanization, the destruction of vital wetlands and the over-cultivation of dry lands has destroyed countless habitats for wild progenitors of domestic crops.⁴⁸ Unless the rate of plant genetic loss is halted or slowed substantially, as many as 60,000 plant species—roughly one quarter of the world's total—could be lost by 2025, according to the International Center for Agricultural Research in Dry Areas.⁴⁹

THE MEAT CONSUMPTION REVOLUTION

For many food deficit low-income countries, feeding a growing population means coaxing more food out of the same amount of land. Canadian geographer Vaclav Smil estimated that the minimum amount of land needed to supply a vegetar-

ian diet for one person without any use of artificial chemical inputs is 0.07 hectare, or slightly less than a quarter of an acre. Based on this, Population Action International estimated that currently some 420 million people live in land-scarce developing countries. If fertility and population growth in developing countries continue to fall, there could be 560 million by 2025. If not, there could be 1.04 billion such people.⁵⁰

According to IFPRI, a "demand-driven livestock revolution is under way in the developing world with profound implications for global agriculture, health, livelihoods and the environment".⁵¹ IFPRI projects that meat demand in the developing world will double between 1995 and 2020 to 190 million metric tons. Demand for meat in the developing world is expected to grow much faster than for cereals—by close to 3 per cent per year for meat compared with 1.8 per cent for cereals. In per capita terms, demand for meat will increase 40 per cent between 1995 and 2020.

What this means is that demand for cereals to feed livestock will double in developing countries over the next generation. By 2020, feed grain demand is projected to reach just under 450 million metric tons. Given this trend, well under way in much of Asia, demand for maize (corn) will increase much faster than any other cereal, growing by 2.35 per cent per year over the next 20 years. Nearly two thirds of this increased demand will go towards feeding livestock.

In China, rising incomes and changing diets have resulted in a tremendous demand for meat, particularly poultry and pigs. Over the next two decades total demand for meat will double, increasing pressure on grain producers. It takes 4-5 kilograms of feed to produce 1 kilogram of meat.⁵²

MOVING TOWARDS FOOD SECURITY

Achieving food security—assuring that everyone has access to enough

food to be healthy—requires action to increase food production, and at the same time protect the environment. Slower population growth in poor countries would allow more time to achieve sustainable food production. Actions that promote slower population growth, especially the empowerment of women, also work towards protecting the natural resource base on which increased food production depends.

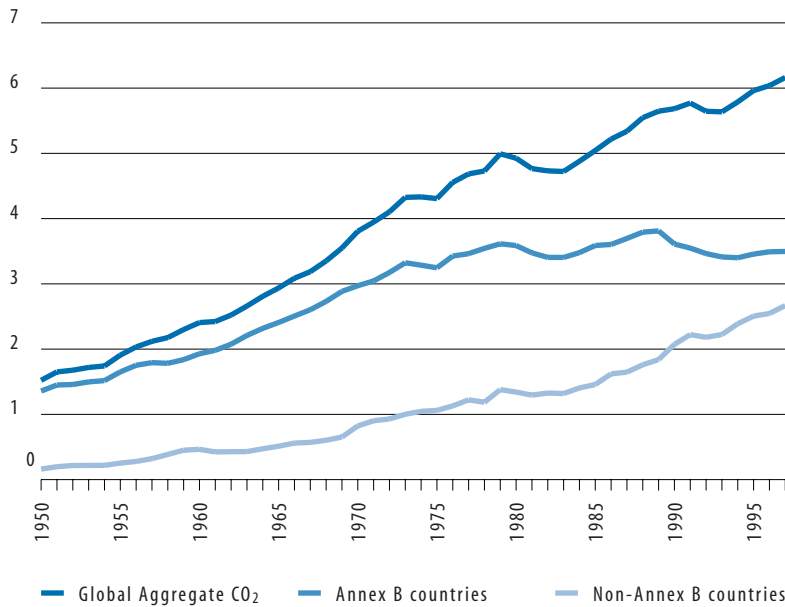
Increasing food production. To accommodate the nearly 8 billion people expected on earth by 2025 and improve their diets, the world will have to double food production over current levels.⁵³ In recent years, there have been some promising developments. These include a new strain of super rice capable of boosting yields by 25 per cent,⁵⁴ improved varieties of maize that could increase yields by up to 40 per cent and could be grown on marginal land,⁵⁵ and a new blight-resistant potato.⁵⁶

Experience with the Green Revolution of the 1960s indicates that technological advances and market forces can dramatically increase food production, but do not necessarily solve food security problems. New high-yielding varieties, for example, call for specialized fertilizers and pesticides. These inputs increase yields but there is increasing evidence that they disturb the ecological balance, creating new disease and pest problems, which call for further inputs. In low-income areas, these inputs represent a considerable expense, which biases success towards large holdings with considerable cash reserves to invest. Smaller farmers may be less successful and may even be forced to give up their land, becoming casual labourers with an uncertain income.

As Amartya Sen and others have pointed out, the problems of food shortage are often not absolute but related to income. During famines, poor people have often starved while food was plentiful, but beyond their reach. Social mechanisms such as overall responsible governance,

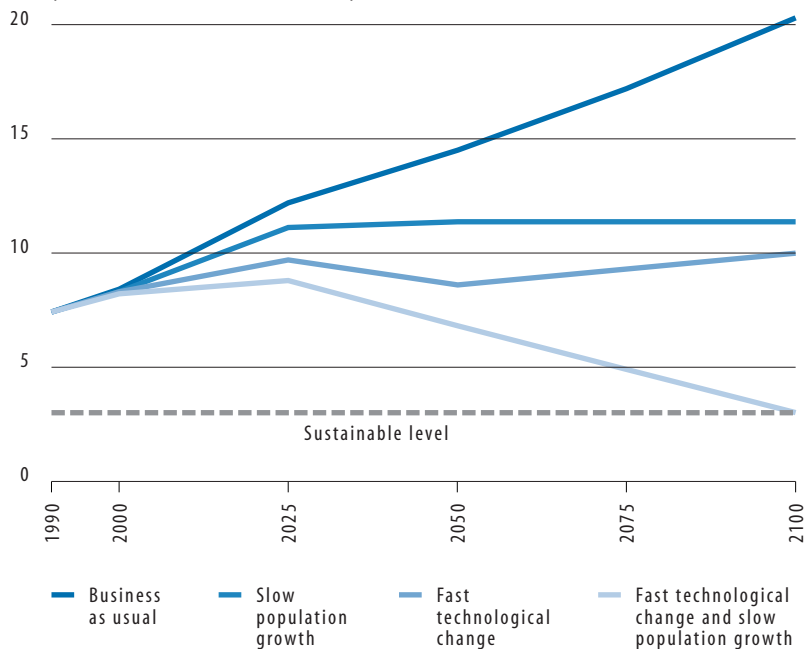
FIGURE 5: GLOBAL CO₂ EMISSIONS, 1950-1997

(billions of metric tons of carbon)



Source: Meyerson, F. A. B. 2001. "Population and Climate Change Policy." In: *Climate Change Policy: A Survey*, edited by S. Schneider, A. Rosencranz, and J. Niles. (Forthcoming.) Washington, D.C.: Island Press.

FIGURE 6: PROJECTED CO₂ EMISSIONS UNDER DIFFERENT POPULATION AND TECHNOLOGY ASSUMPTIONS, 1990-2100
(billions of metric tons of carbon)



This figure expresses CO₂ emissions as elemental carbon. 1 ton elemental carbon = 33.664 tons CO₂

Source: Harrison, Paul, and Fred Pearce, 2001. *AAAS Atlas of Population and Environment* (Victoria Dompka Markham, editor). American Association for the Advancement of Science and the University of California Press.

local control over food production and supply, and emergency stocks to ensure fair prices are needed to avoid hunger.

Protecting the environment. Protecting the environment enhances a country's food production potential.⁵⁷ To achieve food security, countries must reverse the current course of land and water resource degradation. Specific actions include local management, including land ownership reform, and a careful review of land use, especially for cash crops calling for intensive fertilizer application and irrigation. Trade-offs may be sought between different forms of land use, for example, between building dams to increase water supply and losing arable land to reservoirs, or between higher yields and environmental costs. Finding the correct balance calls for careful and responsible discussion among all the parties involved.

One frequent problem is where alternative uses are proposed for land and water resources among remote and scattered communities with little political power. The interests of such communities need protection. In many cases, they represent more than local interests and should be carefully weighed. Such remote areas may be important upland watersheds, or they may be forests that harbour genetic diversity. The simple prospect of increasing food production in the short term may be less important than a more complex long-term calculus taking these factors into account.

Local voices should often be those of women, who have most of the responsibility for finding food, water and fuel for the family. In most of the food deficit countries, women's power to manage local land and water resources does not match their responsibility. Actions to empower women in this area include health care and education, which also give women control over other areas of their lives, including fertility and family size.

Even the poorest countries can safeguard their resource base—par-

ticularly topsoil and freshwater sources—improve the productive capacity of land, increase agricultural yields and hope to achieve food security in the future. To do this successfully, however, calls for responsible governance balancing many interests, a commitment to food security, considered action and the cooperation of the international community.

GREENHOUSE GAS EMISSIONS AND CLIMATE CHANGE

Carbon dioxide and other “greenhouse gases” trap heat in the atmosphere and raise average global surface temperatures. Emissions of carbon dioxide grew 12-fold between 1900 and 2000, from 534 million metric tons per year in 1900 to 6.59 billion metric tons in 1997.⁵⁸

In the same period, human population nearly quadrupled, from 1.6 billion to 6.1 billion, progressively consuming greater quantities of fossil fuels—oil, gas and coal. Expanded agriculture, destruction of forests and increased production of certain chemicals also increase greenhouse gases in the atmosphere.

It is unlikely that the human population could ever have reached its present size without the energy provided by fossil fuels. Conversely, the needs of the growing population have provided an ever-expanding market for exploration and production.⁵⁹

Climate change will have a serious impact. The Intergovernmental Panel on Climate Change (IPCC) estimates that the earth’s atmosphere will warm by as much as 5.8 degrees Celsius over the coming century, a rate unmatched over the past 10,000 years.⁶⁰ The IPCC’s “best estimate” scenario projects a sea-level rise of about half a metre by 2100 (with a range of 15 to 95 centimetres), substantially greater than the increase over the last century.⁶¹

The human and ecological impacts of rising oceans include increased flooding, coastal erosion, salinization of aquifers, and loss of

BOX 4

EQUITY AND ENVIRONMENTAL INTERVENTION

As the earth’s atmosphere warms, the impacts will be felt in all the world’s regions, although not with equal force. While there may be some benefits, for example, warmer temperatures and an extended growing season in some Northern regions, many more negative consequences can be expected. These include:

- An average global sea level rise of as much as 0.88 metres from warming oceans and melting glaciers; this may engulf low-lying coastal cities and smaller settlements;
- Decreasing agricultural and fisheries productivity in warm, sub-tropical and tropical areas;
- Less predictable, more common and more severe storms, floods, droughts, heat waves, avalanches and windstorms, with accompanying threats to human health;
- Larger zones for insect-borne infectious diseases such as malaria and dengue fever;
- Increased soil erosion, drying out and shrinking of tropical forests, and invasions of exotic species, including fast-growing weeds;
- Accelerated extinction rates as plants and animals fail to adapt or migrate. Many species are at risk, particularly those whose habitats are isolated or fragmented by human activity; up to a third of existing plant and animal habitats could be lost by 2100.
- Southern countries in ecologically vulnerable tropical regions, small islands or large deserts, are likely to be hardest hit by climate change and also least able to adapt.

BOX 5

MELTING ICE CONFIRMS WARMING IS UNDER WAY

The ice sheet surrounding the earth’s largest island is rapidly thinning, in some places at a rate of nearly one metre per year, according to a study by the U.S. National Aeronautics and Space Administration (NASA). The researchers estimate there is a 98 per cent chance that the melt is due, at least in part, to global warming caused by human activities.

In an article published in *Science* in 2000, NASA scientist Bill Krabill reported that Greenland’s ice sheet is losing approximately 51 cubic kilometres of ice per year, an amount sufficient to raise global sea level by 0.01 centimetres per year.

"This amount of sea level rise does not threaten coastal regions, but these results provide evidence that the margins of the ice sheet are in a process of change," Krabill said. "The thinning cannot be accounted for by increased melting alone. It appears that ice must be flowing more quickly into the sea through glaciers."

Various other studies indicate that Arctic ice and mountain glaciers around the world have been reduced significantly in the past several decades and are continuing to diminish rapidly.

Source: Krabill, W., et al. 2000. "Greenland Ice Sheet: High-elevation Balance and Peripheral Thinning." *Science* 289: 428-430.

coastal cropland, wetlands and living space. The intensity and frequency of hurricanes and other hazardous weather may also increase, endangering the growing human population in coastal areas.⁶²

Rising global surface temperatures and changes in precipitation magnitude, intensity and geographical distribution may well redraw the world renewable resources map. Whether or not these climatic changes affect net global agricultural production, they are almost certain to shift productivity among regions and countries, and within nations.⁶³

For example, recent projections suggest that while total U.S. agriculture production may not diminish, certain regions of the country are likely to suffer substantially relative to others, as a result of changes in precipitation and temperature.⁶⁴ Climate change policy will have to address changing regional and national fortunes, as well as the global economic and biological impact.⁶⁵

A warming climate also poses a significant public health threat. The redistribution of precipitation would markedly increase the number of people living in regions under extreme water stress—a problem compounded by increasing population.⁶⁶ The geographical range of temperature-sensitive tropical diseases, such as malaria and dengue fever, would also expand.⁶⁷ Higher average temperatures mean longer and more-intense heat waves, with a corresponding rise in heat-related health problems.

The combined effects of population growth and climate change could produce regional resource shortages, which in turn could result in the exploitation of environmentally sensitive areas such as hillsides, flood plains, coastal areas and wetlands.⁶⁸ These conditions may also increase environmental refugees, international economic migration and associated socio-political challenges.⁶⁹ Climate and environmental policy should address the geographical distribution and movement of people in the 21st century, as well as their absolute numbers.⁷⁰

POPULATION AND CLIMATE POLICY

Since 1970, average carbon dioxide emissions per capita have been relatively stable, so that on a worldwide scale the rise in industrial emissions over the last three decades correlates closely with population growth.⁷¹ Population trends and policy have therefore

played a major part in the trajectory of emissions in the past, and they could have an even greater role in the future.⁷²

The 1997 Kyoto Protocol to the Framework Convention on Climate Change, if ratified, would commit 38 “Annex B” countries (broadly, the industrial countries) to cut their national emissions of greenhouse gases by an average of 5.2 per cent

BOX 6

KYOTO PROTOCOL FACES UNCERTAIN FATE

The United States supported the Kyoto Protocol when it was negotiated in 1997 after years of scientific reviews and sensitive international discussions. In February 2001, however, the new U.S. administration called for a different agreement and declared it would not support the protocol, which it said was based on weak science and failed to limit carbon dioxide emissions in all countries. Required emission cuts would hurt the U.S. economy, it contended.

Worldwide reaction was largely negative, particularly in the scientific community and in the countries of the European Union. Concerns increased in May 2001 when Washington announced a new energy policy intended to increase the supply of gas, oil and coal—fossil fuels that are major contributors to greenhouse gas emissions. The United States, with only 4.6 per cent of the world’s population, already produces one fourth of global greenhouse gas emissions—a per capita emissions level five times the level scientists believe the atmosphere can support without significant global warming.

Several other developed countries have also said they are uncertain that they would be able to meet the protocol’s emission reduction timetables.

The next round of Kyoto Protocol negotiations was scheduled to take place after this report went to press. Failure to resolve the impasse between the United States and other countries would delay emissions reductions; any agreement that does not include the United States, the world’s largest economy and producer of greenhouse gases, is unlikely to be workable or effective.

Agreement on the scientific front was stronger. Working Groups of the Intergovernmental Panel on Climate Change (IPCC) reached greater agreement and certainty in 2001 about the projected effects of greenhouse gases on the climate, as well as the potential environmental and human impacts.

However, there is still no consensus on the actions to be taken. The IPCC called for countries to adopt a portfolio of policy instruments to limit or reduce greenhouse gas emissions (mixes of taxes, permits, subsidies, technology or performance standards, energy mix requirements, product bans, voluntary agreements, government spending and investment, and support for research and development) and to enter into well-designed international instruments. The panel held that mitigating climate change would depend on integrating such policies with broader policy objectives and the adoption of strategies to achieve long-term social and technological changes.

between 1990 and 2008-2012 (herein after referred to as 2010).⁷³ Developing (non-Annex B) nations face no specific emissions limitation obligations in the protocol, on the principle that industrialized nations have contributed the most to the problem and thus have an obligation to take the first steps.⁷⁴

The Kyoto Protocol does not refer to population, but population factors will play a major role in its success or failure, and in future climate policy. The protocol is based on national caps on emissions; these will not be adjusted for increases or decreases in population due to either fertility or migration between 1990 and 2010.⁷⁵ Since population increases, especially in more-developed economies, result in more houses, cars and other consumption, countries with rising populations and growing economies are at a comparative disadvantage under the national cap formula used in Kyoto.⁷⁶

Demographic divergences among the major Annex B countries are projected to continue or become sharper after 2012. The population of the United States, for instance, is projected to rise from 255 million in 1990 to 397 million in 2050 (middle scenario), a 56 per cent increase.⁷⁷ Germany, meanwhile, is projected to experience a population decline from 79 million to 71 million over the same period, a 10 per cent decrease, while the Russian Federation is projected to fall from 148 million to 104 million people, a 30 per cent decrease.

Population projections for the developing world (non-Annex B countries) vary even more dramatically. For example, Pakistan's population is projected to rise from 119 million to 344 million between 1990 and 2050 (a 189 per cent rise), while South Korea's is projected to grow only from 43 million to 51.6 million (a 20 per cent increase) over the same period.

For the developed (Annex B) countries as a whole, per capita emissions have been relatively flat since 1970, fluctuating in a range above 3 metric tons per person. In

1950, the developing (non-Annex B) country per capita average emission was only 0.1 metric tons, but it increased six-fold to 0.59 metric tons by 1996 and continues to rise (see Figure 5).⁷⁸ Per capita developing country emissions are still far lower than those of developed countries, but the gap declined from 1:17 to 1:5 from 1950 to 1996,⁷⁹ and this trend is expected to continue.

One reason the gap is closing is that as family size drops in developing countries, as it already has in the United States and other developed countries, households are getting smaller and significant economies of scale in energy use are being lost. In 1990, average house-

BOX 7

POPULATION AND INTERNATIONAL ENVIRONMENTAL AGREEMENTS

Population change has a significant impact on international policy involving the depletion or use of natural resources or global common resources. For example, the viability and fairness of a global climate agreement is affected by the size of the human population and per capita carbon emissions, as well as by population distribution, migration and growth or decline rates.

Similarly, a country's ability to comply with agreements designed to protect forests, biodiversity, fresh water, or coastal and marine zones partly depends on its current and projected population size, growth (or decline) rates and internal distribution.

Per capita greenhouse gas emissions in most developed countries far exceed the level the world would need to achieve to slow or stop global warming; in many developing countries, per capita emissions are lower than that level.

Agreements related to human health—for instance, those specifying minimum availability and quality standards for fresh water and food—are also greatly affected by demographic change.

In virtually all cases, environmental goals, legal or otherwise, can be more easily achieved where human population is stable, growing only slowly or declining slightly. However, population is often ignored in the negotiation and structuring of environmental agreements, as well as national environmental strategies and action plans. There are significant opportunities to better integrate demographic data, processes and projections into environmental agreements at all scales to improve their effectiveness, fairness and long-term flexibility.

Sources: Meyerson, F. A. B. 1998. "Toward a Per Capita-based Climate Treaty: Reply." *Population and Development Review* 24: 804-810; and Engelman, R. 1998. *Profiles in Carbon: An Update on Population, Consumption and Carbon Dioxide Emissions*. Washington, D.C.: Population Action International.

hold size in developed and developing countries was 2.7 and 4.8 persons, respectively. By 2050, one analysis projects the ratio may be only 2.6 to 3.4.⁸⁰ Population ageing also has significant implications for household and per capita greenhouse gas emissions.⁸¹

In 1995, the 20 per cent of the world's population living in countries with the highest per capita fossil-fuel carbon dioxide emissions contributed 63 per cent of the world's total emissions. The 20 per cent with the lowest per capita emissions contributed just 2 per cent of all carbon dioxide emissions.⁸²

Almost all additional significant

BOX 8
PROTECTING 'BIODIVERSITY HOTSPOTS'

Biodiversity (biological diversity) refers to all organisms, species, and populations; the genetic variation among these; and all their complex assemblages of communities and ecosystems. It also refers to the interrelatedness of genes, species, and ecosystems and their interactions with the environment.

"Biodiversity hotspots" are areas that contain a superabundance of plant and animal species but are threatened by human activities. Collectively, hotspots contain slightly more than half of all terrestrial species on just 2 per cent of the world's land area.

The poor state of most hotspots results directly from population growth and migration into these areas. A study by Population Action International found that by 1995, around 1.1 billion people, or 20 per cent of the global population, were living within 25 hotspots. Moreover, the average annual population growth rate in these areas was 1.8 per cent, substantially higher than the 1.4 per cent global rate and even above the average for developing countries, at 1.6 per cent.

In a variety of ecologically sensitive settings, UNFPA is working with international and national NGOs to provide integrated community-based training linking income generation, environmental protection and reproductive health.

With funding from the United Nations Foundation, work is starting in Bangladesh and India to protect the Sundarbans—a unique area of marsh and forest in the Bay of Bengal which is rich in animal life and treasured in Bengali culture, but is also home to some of the world's poorest people.

UNFPA has also initiated programmes in ecologically sensitive regions of Ecuador. Similar efforts have been initiated by Conservation International, World Neighbors and the World Wide Fund for Nature, and their local affiliates.

population growth is projected to occur in developing countries (the notable exception being the United States).⁸³ Developing country emissions will become the major factor early in the 21st century, and a future global climate change treaty will need to respond to this coming demographic reality.⁸⁴ Per capita emissions must be reduced, in the developed countries but also in major developing nations such as China and Mexico.

FORESTS, HABITAT AND BIODIVERSITY

People now use or appropriate an estimated 39-50 per cent or more of the earth's biological production,

through agriculture, forestry and other activities.⁸⁵ Half of the world's forests have disappeared since the end of the last Ice Age, and only 22 per cent of the original forest cover remains in large, unbroken areas without substantial human influence.⁸⁶ Deforestation rates in the last few decades have reached the highest levels in history, as global population growth has also peaked.

In the last 40 years, per capita forest area worldwide has fallen by more than 50 per cent, from a global average of 1.2 hectares to less than 0.6 hectares per person. This is due to both decreasing forest area and increasing population, and it threatens the well-being of both people and the forests they depend on. The proportional loss of forests

(the amount lost relative to the amount remaining) has been greatest in Asia, followed by Africa and Latin America. These ongoing losses have been partially offset (by about 10 per cent) by a relatively small increase in forest plantations and re-growth in some developed countries.⁸⁷

Tropical forests contain an estimated 50 per cent of the world's remaining biodiversity (plant and animal species).⁸⁸ At current rapid deforestation rates, and in the absence of any intervention, the last significant primary tropical forest could be harvested within 50 years.⁸⁹ Because habitat destruction is the leading cause of species extinction, the loss of tropical forests is likely to lead to a substantial and irreversible decline in global biodiversity.⁹⁰

Biomass (both above and below-ground) in tropical forests amounts to a substantial carbon sink within the global ecosystem. After fossil fuel combustion, tropical deforestation is the second most important source of carbon dioxide, the primary greenhouse gas. Only 8 per cent of the remaining tropical forests are legally well-protected, and often protected status does not confer actual protection.⁹¹

International development and conservation organizations have promoted "integrated conservation and development projects" as a strategy for developing countries where people depend on land and biotic resources within reserves.⁹² Tropical parks have been somewhat effective in reducing land clearing (deforestation) relative to surrounding unmanaged areas.⁹³ However, their success in slowing tropical deforestation has been mixed or poor, in part because such projects may attract people to the remaining forests.⁹⁴

Human population growth, density and other demographic variables, and their effect on deforestation, are critically important but under-studied factors in this context.⁹⁵ Many of the countries that contain the largest blocks of remaining tropical forest are also those with the highest population growth rates

(2-4 per cent per year).⁹⁶ Ongoing human migration, both national and international, is another critical factor that affects forests, habitat and biodiversity.

Recent research in Central America has shown that human population density and loss of forest cover are closely correlated at local, district, and national levels and over time, both outside and within protected and managed reserves.⁹⁷

Evidence to date suggests that reserves with essentially unbroken forest cover may be successful only where very low human population densities (1-2 persons per square kilometre) can be maintained.⁹⁸ Unfortunately, population growth and fertility rates are often very high in and near developing country forest reserves, while access to reproductive health care and contraceptive prevalence rates are low in these rural and frequently isolated areas.⁹⁹

Sustainable forestry and other sustainable development approaches hold some promise for reducing habitat destruction and species loss. However, the projected increases in human population over the next few decades, particularly in the tropics, will inevitably continue to present very difficult choices between the use of land for forests, habitat and biodiversity preservation, and human uses such as the production of food and fuel.

REGIONAL ENVIRONMENTAL TRENDS

The following are highlights of major environmental trends in Asia, Africa, and Latin America, as reported in the United Nations Environment Programme's *Global Environment Outlook 2000* (GEO-2000) report.¹⁰⁰

ASIA AND THE PACIFIC

Asia, with 29.5 per cent of the world's land area, supports 60 per cent of its population. High popula-

tion densities and widespread poverty are putting enormous stress on the environment. Major challenges include¹⁰¹:

Land degradation: At least 1.3 billion people (39 per cent of the region's population) live in areas prone to drought and desertification. More than 350 million hectares are already desertified. About 20 per cent (around 550 million hectares) of Asia's vegetated land is affected by soil degradation. In India, Iran and Pakistan, water and wind erosion are major contributors to soil degradation. In India, as much as 27 per cent of the soil has been affected by severe erosion. China, India and Pakistan all suffer from land salinization resulting from excessive groundwater irrigation. Excessive agrochemical inputs are also responsible for land degradation in many countries of this region.

Deforestation: Forest cover has been receding rapidly across Asia, largely due to the unsustainable exploitation of timber reserves and unchecked agricultural expansion. Six countries (China, Indonesia, Malaysia, Myanmar, the Philippines, and Thailand) account for three quarters of recent deforestation in the region. Many forests, such as those in the Mekong Basin, have been logged to the point that they are of critically low quality. Illegal

BOX 9

'ECO-TOURISM': BOON OR BOOM?

Preservation of wildlife habitats and other sensitive ecosystems can become a priority for governments and communities when it becomes clear that significant profits can be made from tourism. This strategy has been very successful in the Philippines, for example, where coral reefs are being protected by a local coalition of business and community groups. Local business groups, interested in protecting the reefs and promoting tourism, are paying local fishers to stop using explosives and harmful chemicals used to increase their fishing yields.

On the negative side, rapid development of housing and satellite businesses for tourists can quickly exceed the limits of sustainability. Over-development of the Pacific Coast in Mexico in areas where whales frolic has led to the degradation of beaches.

logging amplifies the pressure on forest resources in several Asian countries. Fuelwood harvesting, irrigation schemes, hydroelectric power projects, urbanization, infrastructure development, natural disasters and fires also contribute to deforestation. Wars denuded forest cover in Viet Nam and Laos, while forest fires were a significant factor in Indonesia. The adoption of sustainable forest and agricultural management policies has slowed forest depletion in Thailand, Viet Nam and Cambodia.

Water resource depletion: Agriculture accounts for a larger percentage of freshwater usage in Asia than in any other part of the world and freshwater will be the major limiting factor to producing more food in the future. Dams and groundwater irrigation have disrupted the natural hydrological cycle, reducing river levels, depleting wetlands and aquifers, and salinizing agricultural lands. Dirty water and poor sanitation claim more than 500,000 infant deaths a year. Asia's rivers contain three times as many bacteria from human waste as the world average. One in three Asians has no access to safe drinking water, often as a result of contamination of groundwater and surface water reserves by sewage and industrial waste. A study of 15 Japanese cities, for example,

showed that chlorinated solvents from industry contaminate 30 per cent of all groundwater supplies. Agrochemical inputs are a growing source of water contamination as nitrates leach into freshwater bodies. Salt-water intrusion also threatens the water supply in many areas; in Madras, India, for instance, salt water has rendered many irrigation wells useless as far as 10 kilometres inland.

Biodiversity depletion: Indonesia, India, and China are among the countries with the most threatened species of mammals and birds, according to the World Conservation Union (IUCN).¹⁰² Indonesia has the highest number of threatened mammals (135 species), followed by India (80) and China (72). The Philippines has more critically endangered birds than any other country in the world.

Air quality and carbon emissions: Air pollution is now becoming a part of the region's environment, causing deaths. In China, for instance, smoke and small particles from burning coal cause more than 50,000 premature deaths and 400,000 new cases of chronic bronchitis a year. Led by China and Japan, emissions of carbon dioxide increased at twice the average world rate of 2.6 per cent per year during 1975-1995.

Urbanization: Asia has 160 of the world's 369 cities with more than 750,000 residents. Growing populations have frequently outpaced the development of urban infrastructures, and slums and shanty towns are growing in many cities. In Colombo, for example, some 50 per cent of the urban population resides in slums and squatter areas. The urban population of the region, now about 35 per cent of the total population, grew by 3.2 per cent a year between 1990 and 1995, compared with 0.8 per cent a year for the rural population. In most countries, the urban population is likely to grow threefold in the next 40 years. China alone is expected to have 832 million urban residents by 2025.

GEO-2000 reports that "some

governments are now taking action to reconcile trade and environmental interests through special policies, agreements on products standards, enforcement of the Polluter Pays Principle, and the enforcement of health and sanitary standards for food exports."

AFRICA

Africa's population density of 249 people per 1,000 hectares is well below the world average of 442. However, a great deal of the total destruction of the natural environment is occurring in the region. Poverty is a major cause and consequence. Natural disasters such as storms, floods and droughts are common and highly destructive. Global warming may make Africa even dryer in the future; this could seriously disrupt natural ecosystems and make food security a major problem. Widespread poverty, HIV/AIDS and diseases spread by water and insects remain critical challenges for the region. Major environmental issues include¹⁰³:

Land degradation: Soil degradation is a major concern in Africa, where 500 million hectares have been affected, including 65 per cent of the agricultural land. Crop yields could be cut in half in 40 years if degradation continues at the current rate. In Southern Africa, overgrazing of livestock is a major contributor to soil degradation. Large portions of Northern Africa are facing desertification caused by a combination of overgrazing, rainfall variability and drought conditions. In Western and Central Africa, rising populations and shifting agriculture have damaged large swathes of land.

Deforestation: Although Africa still accounts for 17 per cent of global forest cover, forests are being steadily degraded by population growth, drought, agricultural expansion, fuelwood extraction, commercial exploitation, bush fires, civil wars and political instability. During 1990-1995, Africa lost its forest cover at an annual rate of 0.7 per cent. Unsustainable agricultu-

ral practices such as shifting cultivation and slash-and-burn techniques in Southern and Central Africa contributed, as did commercial logging, oil-exploration and mining activities. Ninety per cent of the population depends on firewood and other biomass for energy. Production and consumption of firewood and charcoal doubled between 1970 and 1994 and is expected to rise by another 5 per cent by 2010.

Water resource depletion: While Africa uses only about 4 per cent of its renewable freshwater resources and some countries have abundant lakes and rivers, countries in arid regions depend on limited groundwater reserves. Already, 14 countries in Africa are facing water stress. By 2025, another 11 countries can be expected to face the same conditions. The prospects are particularly bad in northern Africa. The demand for water is expected to grow by at least 3 per cent annually until 2020 as populations increase and economies develop. Surface water contamination is a growing problem with serious implications for public health.

Urbanization: Africa's annual urban growth is now the highest in the world, at more than 4 per cent. In the 1960s about 20 per cent of the population lived in urban areas; the figure rose to 35 per cent in 1995. Urban infrastructure is poorly developed, and peri-urban areas are expanding, often without planned services and amenities. Much of the urban population lives in medium-sized cities that lack the economic dynamism of larger cities.

Biodiversity depletion: Africa is home to more than 50,000 known plant species, 1,000 mammal species, and 1,500 bird species. This diverse biological heritage is at risk in all subregions.

Carbon emissions: Africa's emissions of greenhouse gases are still low. The region contributes only 3.5 per cent of the world's total carbon dioxide emissions and this figure is expected to increase to only 3.8 per cent by 2010.

LATIN AMERICA AND THE CARIBBEAN

Major environmental challenges in Latin America and the Caribbean include¹⁰⁴:

Land degradation: An estimated 300 million hectares of land have been affected by soil degradation, mostly the result of soil erosion and chemical use. Approximately 100 million hectares are estimated to have been degraded through deforestation and 70 million hectares were overgrazed.

Deforestation: Endowed with the world's most luxuriant tropical forest cover, Latin America is the focus of the global effort to achieve sustainability. Nearly half the region is still covered by natural forest, but 3 per cent of the forest cover was lost during 1990-95. Brazil lost some 15 million hectares of forest area in 1988-97, according to the GEO-2000 report. Agricultural expansion through traditional slash-and-burn practices is considered the prime cause of deforestation. Modern agriculture, logging, mining, infrastructure development, fires and urbanization also contribute.

Water resource depletion: Although Latin America has extensive freshwater systems, nearly two thirds of the region is classified as arid or semi-arid. In some areas, aquifers are being exploited at unsustainable rates as demand for water from domestic, industrial and agricultural users increases. Pollution and sanitation continue to be major issues. The region is also vulnerable to toxic chemical discharge into its water systems from extensive mining and industrial activities.

Urbanization: Nearly 75 per cent of the region's population is already urbanized, many in megacities such as Mexico City (16.5 million people), São Paulo (16 million), Buenos Aires (12 million) and Rio de Janeiro (10 million). Large numbers of city dwellers live in squatter settlements and shantytowns, including 4 million of Rio de Janeiro's 10.6 million residents.

Air pollution and carbon emissions: Air quality in most major cities threatens human health. In São

Paulo and Rio de Janeiro, air pollution is estimated to cause 4,000 premature deaths a year. The average ozone concentration in 1995 in Mexico City was about 0.15 parts per million, 10 times the natural atmospheric concentration. The main source of carbon dioxide emissions is deforestation. The region is responsible for 4.3 per cent of the world's total carbon dioxide emissions from industrial processes and 48.3 per cent from land-use changes.

Depletion of biodiversity: The loss of forest cover threatens the region's biological diversity. Already, more than 1,000 vertebrate species are now threatened with extinction. Brazil has the second largest number of threatened bird species (103 species) in the world, and Peru and Colombia occupy fifth place with

64 species each. More than half of the Argentinean mammals and birds are threatened.

WESTERN ASIA

Western Asia's population density is well below the world average. However, the scarcity and degradation of water and land resources pose an increasing challenge. Exploitation of the region's oil resources has conferred great benefits to some countries but has also exacted significant costs. Pollution and inadequate waste management are causing degradation of the marine and coastal environment. Major environmental issues include¹⁰⁵:

Land degradation: Soil degradation has long been a serious problem, increasingly so in the past few



*Construction boom in Shanghai. China will have more than 832 million urban residents by 2025.
Hartmut Swarzbach, Still Pictures*

decades. Nearly 96 per cent of the land is vulnerable to desertification; nearly four fifths is desert or desertified. Increasing food demand due to population growth has resulted in overgrazing and the extension of cereals onto rangelands in fragile ecosystems; laws and decrees to protect rangeland have not produced significant results. Poor irrigation techniques have also led to soil salinization and nutrient depletion.

Deforestation: Much of the natural forests that once covered much of the north of the region was long ago cleared for settlements, agriculture, grazing and charcoal production. Reforestation programmes have kept forest areas at their current levels over the past two decades, but the high cost of imported timber could increase pressures for further clearing. Clearing of mountain slopes for agriculture has led to severe soil erosion in Jordan, Lebanon, Syria and Yemen.

Water resource depletion: Water is a precious and limited resource in the region, and a potential trigger for serious national conflicts; rainfall is low and erratic and evaporation high. Rapid population growth, relative to water resource development, is reducing per capita use. The Mashriq subregion¹⁰⁶ has rivers that originate outside and short seasonal or perennial rivers.

The Arabian Peninsula is poor in surface water but has larger groundwater reserves than the Mashriq; those reserves are being withdrawn faster than natural recharge rates, however. Conflicts and disputes over water allocations have impeded improvements in the use of surface water. Seawater intrusion and contamination by human and industrial waste and pesticides are affecting water quality. Surface water contamination is a growing problem with serious implications for public health. Costly desalination and wastewater treatment alleviate but do not solve the problems.

Global warming is not expected to reduce, and may worsen, water constraints. Small projected increases

in rainfall may be offset by higher temperatures and evaporation.

Urbanization: Urban growth in some countries has been proceeding at twice the rate of overall population growth. More than two thirds of the people live in urban areas (even higher levels obtain in the Gulf countries). Much growth has been concentrated in a small number of cities where opportunities and infrastructure are concentrated. Though land use planning has been attempted, chaotic physical growth and encroachment on agricultural land are common. Peri-urban areas are expanding, often without planned services and amenities.

Biodiversity depletion: The diverse ecosystems of the region are home to many endangered species. Marine ecosystems (mudflats, mangrove swamps, sea grass and coral reefs) are under particular stress.

BOX 10

LIVING PLANET INDEX

The Living Planet Index is a useful measure of the natural wealth of the earth's forests, freshwater ecosystems and oceans and coasts in a given year. It integrates information contained in three constituent indices:

The Forest Species Population Index indicates that 319 species populations, mostly mammals and birds, declined over the past 30 years. Tropical forest species populations fell by 25 per cent, while temperate forest species populations increased marginally in that time. Currently, tropical forests in Latin America, Africa and South-east Asia are witnessing serious degradation of their ecosystems.

The Freshwater Species Population Index reveals a nearly 50 per cent global decline in numbers among 194 species of freshwater birds, mammals, reptiles, amphibians, and fishes since 1970. The most serious declines were in Latin America, Australasia, Asia/Pacific and Africa. Freshwater ecosystems in North America and Europe experienced considerable degradation before 1970.

The Marine Species Population Index similarly reveals a 35 per cent decline in 217 diverse species populations since 1970. The worst declines in numbers have been in Southern oceans, including the South Atlantic, the Indian Ocean and the South Pacific.

Source: *World Wide Fund for Nature, the UNEP World Conservation Monitoring Centre and the Centre for Sustainability Studies. 2000. Living Planet Report 2000. Gland, Switzerland: World Wide Fund for Nature.*

Marine biodiversity has been harmed by over-fishing, pollution and habitat destruction. Protected areas have been established in all parts of the region but depletion of water resources, soil salinization and plant pests are having a large impact on many endemic plant and animal species. Oil and waste spillage into the Persian Gulf is also having a growing impact.

Carbon emissions: The development of the oil industry and rapid industrial and population growth have led some countries to become high energy consumers. Atmospheric emissions of hydrocarbons, carbon dioxide and other pollutants have reached alarming levels, particularly in larger cities. Year-round sunshine and high temperatures help convert primary pollutants to ozone and sulphates, which can be more hazardous to health and the environment.

CHAPTER 3

DEVELOPMENT LEVELS AND ENVIRONMENTAL IMPACT



*Rio de Janeiro slum. In developing countries, one person in four lacks adequate housing.
Werner Rudhart, Still Pictures*

DETERMINING THE IMPACT OF HUMAN ACTIVITY

More people are using more resources with more intensity than at any point in human history. Fresh water, cropland, forests, fisheries and biodiversity all show signs of stress at local, regional and global levels. Increasing pressure on the environment is the result of, on one hand, increasing affluence—that is, more consumption, pollution and waste, and on the other persistent poverty—that is, lack of resources and the technology to use them, and lack of the power to change these circumstances.

Growing human numbers play a role in both scenarios. Global use of

fuel-wood, for example, has doubled over the past 50 years; the Worldwatch Institute attributes this increase largely to population growth. But the six-fold increase in the use of paper since 1950 is ascribed mainly to rising affluence, and the multiple uses for paper products in an increasingly urban environment.

Population size, growth, distribution and movement help determine the relationship between people and their environments. Similar numbers of people can have very different impacts on the environment, depending on for example social institutions, means of production, property rules and forms of governance.¹ Access to education, health and economic opportunity; consumption levels; and gender

differentials (the “quality of human capital”) all have an influence.

The most basic determinant of impact is scale. Thirty years ago Paul Ehrlich and J. Holdren described this relationship in the now-famous equation²: $I = PAT$, meaning that people’s impact on their environment (I) is a product of population size (P), affluence (A, representing output per capita or the level of consumption) and technology (T, representing the per unit output or efficiency in production).

This equation has been often used³ but also often criticized or elaborated.⁴ The main shortcoming is that the factors in the relationship are not independent, but are related in complex ways. Nonetheless, the approach has been useful in demonstrating that population

dynamics are central to environmental change.

For example, since 1970 global carbon dioxide emissions per capita have been relatively constant, while GDP per capita has increased in both more developed and less developed regions.⁵ This means that improvements in technology have offset the effects of increased consumption.⁶ Whether carbon dioxide emissions continue to increase in step with population size will depend on economic and social trends, the institutional response to environmental problems and the pace of technological change.

POVERTY AND THE ENVIRONMENT

Despite soaring global wealth, now estimated at \$24 trillion annually, some 1.2 billion people across the world live on less than \$1 a day—a condition classified as “extreme poverty” and characterized by hunger, illiteracy, vulnerability, sickness and premature death. Half the world lives on \$2 a day or less.⁷

More than a billion people cannot fulfil their basic needs for food, water, sanitation, health care, housing and education. Nearly 60 per cent of the 4.4 billion people living in developing countries lack basic sanitation, almost one third do not have access to clean water supplies, one quarter lack adequate housing, 20 per cent do not have access to modern health services, and 20 per cent of children do not attend school through grade five. Worldwide, 1.1 billion people are malnourished, unable to meet minimum standards for dietary energy; and protein and micronutrient deficiencies are widespread.⁸ Nearly 2 billion people in developing countries are anaemic.⁹

Ending poverty has been an international aim since 1960. After significant advances between 1970 and 1990, the rate of poverty reduction in the 1990s fell to only one third of the pace required to meet the United Nations’ commitment to halve poverty levels by 2015.

Although affluence consumes

energy and produces waste at far higher rates, the effects of poverty also destroy the environment. Global attention has consequently focused on the complex relationship between environmental degradation, poverty and sustainability. Understanding it may be key to ending poverty and closing the gap between more and less affluent, as well as meeting the objective of sustainable development.

A COMPLEX INTERACTION

Population pressures are increasing in many poor and ecologically fragile zones in urban as well as rural areas. Fertility in many of these places is already high, and more people are being driven to them by a shortage of land for subsistence farming, by economic policies encouraging large holdings, intensive agriculture and cash crops, and by poverty and high population densities elsewhere.

For example, slash-and-burn agriculture and logging are expanding in and around Mexico’s Calakmul Biosphere Reserve on the Yucatan Peninsula, because of rapid immigration and high fertility. Under unrelenting population pressure, subsistence farmers have stripped forest cover from the Garo Hills in north-east India. Growing poverty in coastal communities and rapid population growth in large towns along the coast of West Africa are similarly driving destruction of the mangrove swamps for firewood and dynamite fishing in nursery waters.

In these and many other examples, the poor are the most visible agents of destruction in degraded environments. Poor people depend heavily on natural resources for direct income and their poverty offers them few choices. In the case of Garo alternative land was not available; on the West African coast urban demand for fish and firewood offered a source of immediate income. Here and elsewhere, the poor stand at the end of a long chain of cause and effect. They are the messengers of unsustainability rather than its agents.

A breakdown of consumption patterns shows that the “ecological footprint” (see below) of the more affluent is far deeper than that of the poor, and in many cases exceeds the regenerative capacity of the earth.

In most instances it is the wealthier farmers who engage in large-scale clearing of vegetation, over-use of agricultural chemicals, over-use of groundwater resources for irrigation, over-use of pastoral land for grazing and over-exploitation of soils for export production. Distorted pricing structures perpetuate wasteful input use. In Gujarat in India, poor tribal farmers pay the full cost of pump irrigation provided through a non-governmental organization while the richer farmers receive subsidized water through state schemes.

Higher-income groups consume more energy and produce more waste than the poor, who must extract value from every scrap. Very low-income households in Pakistan spend one 30th as much on fuel as rich households, although they expend much more time and energy on gathering it.

Rural communities will continue to depend heavily on agriculture and natural resources for their livelihood. Environmental degradation will only deepen their poverty, so environmental conservation and poverty alleviation are parallel objectives. In most situations where they enjoy secure tenure, the poor will invest to protect their land and their environment.

Local control may be important: studies indicate that the condition of Nepal’s forests has improved since management of forest resource was decentralized to communities. India’s Joint Forest Management programme, which also devolves resource management to local people, has had similar environmental benefits in areas such as south-west Bengal. Local control may be more effective than government efforts in limiting illegal logging, fishing, water use and theft, but government participation can help offset the high cost and delayed benefits of investment in conservation.

BOX 11
RURAL MIGRATION

Migration of the poor to more marginal lands is threatening biodiversity preserves and depleting the forest cover needed to counter global warming.

In the Philippines, 60 per cent of the country's 30 million hectares are classified as upland. Upland inhabitants, about one third of the total population, are primarily poor farming families with insecure land tenure. Their sources of water are either mountain springs or streams. As their numbers continue to surge and with recent attempts at industrialization, many uplanders are pushed to more fragile upland areas.

A major consequence of deforestation is the loss of endemic wildlife resources. So far, 89 species of birds, 44 species of mammals, and 8 species of reptiles are internationally recognized as threatened.

People from the lowlands who move into upland areas in search of cultivable land often use inappropriate farming techniques. They also bring different cultural values from the traditional ethnic groups in the hills, and often clash with local people over ownership of land that has traditionally been farmed on a shifting cultivation basis.

"Natural growth and migration from the lowlands mean that upland populations are rising, forcing farmers to cultivate steeper slopes and poorer soils and to leave land fallow for shorter periods," explains the International Institute of Rural Reconstruction. "This exacerbates the problems of erosion, soil fertility and water conservation."

Over the generations poor farmers have accumulated a vast amount of knowledge about sustainable environmental practices. Practices such as shifting cultivation sustained the poor for centuries, until populations grew too large or other factors intervened. Traditional practices may incorporate an understanding of local conditions not immediately evident to outside observers, however expert. In the mountainous areas of Sumatra, farmers rely on simple stone headworks to create irrigation systems along small streams. Although these structures seem leaky and inefficient, the leakage ensures an equitable distribution of water across the community.

When poor people move to new environments or when the balance of their old environment is altered, for example by rapidly rising populations, there may be a period of relearning in which a certain degree of degradation may occur. But

imposing standardized technical solutions that ignore and wipe out indigenous knowledge may have a disastrous ecological impact.

Population growth is not necessarily detrimental to environmental sustainability but it does affect available choices and the prospects of any intervention. Although degradation invariably occurs initially as very low population densities increase, what follows depends on a confluence of factors. If investment needed to improve land is too expensive or the benefits too-long delayed, further degradation will almost certainly result as population rises. In other cases, where a higher population can result in a lower per capita charge for fixed investments (such as water harvesting technology), sustainability and productivity may actually improve in a supportive environment.

If developing countries with rapidly growing populations were encouraged and supported to

adopt cleaner technologies, environmental degradation could be mitigated. At current levels of growth, Asia's greenhouse gas emissions are expected to triple in the next 20 years. Effective technology, if it were made affordable, could reduce the growth in emissions.

GLOBALIZATION AND POVERTY

In the past 20 years, over 100 developing and transition countries have begun to undertake reform measures to improve the efficiency of their economies. These reform packages typically include fiscal discipline, lower budget deficits, reduced subsidies, tax restructuring, financial liberalization, market-determined interest rates, competitive and stable exchange rates, trade liberalization, encouragement of foreign direct investment, privatization of state enterprises, deregulation of protected industrial sectors and enhanced guarantees of property rights.

These reforms have been intended to increase countries' competitiveness in the global marketplace. International trade has increased dramatically during the period, though a small number of developing countries account for most of the increase outside of the more-advanced market economies. The desire to integrate into the global economy or to offset losses in financial crises has motivated many developing countries to increase their exploitation of natural resources.

Globalization has clearly increased overall prosperity and stimulated growth. It has also increased income inequality and environmental degradation. Although poverty has declined in percentage terms, the number of people living in poverty has steadily increased, and average incomes in many developing countries have remained low. At the same time, environmental degradation is worse than in any comparable period in human history. There is a clear link between environmental degradation and the rising

BOX 12
KENYAN DISTRICT ADAPTS TO MEET
POPULATION CHALLENGE

In Kenya's Machakos District, near Nairobi, new agricultural technologies have been employed in response to rapid population growth, with mixed results.

Innovations, made possible through agricultural extension activities and financial and technical support, include increased use of terracing; adoption of diverse crops; planting of trees for soil stabilization, water management and fuel-wood; and other strategies.

Women have benefited from the planting of fruit trees for household food and market value, and from the shift from communal grazing to farm-feeding of cattle, which increased the output of dairy products marketed by women.

Machakos's proximity to the capital facilitated its inclusion in an effective market system with reduced transport and storage challenges. It has also benefited from migration to and from the capital, which brings new skills and added financing for local development. But heavy out-migration by men to the city has resulted in labour shortages and additional farm work for women already burdened with housekeeping, child-rearing and gathering fuel and water.

New hillside cropping technologies have also added to the area's water requirements. Farm sizes have shrunk to an average just above one hectare and more marginal land is all that remains for the growing numbers of families. Increasing agricultural production has also resulted in the loss of regional wildlife and biodiversity.

Source: UNDP, UNEP, the World Bank and the World Resources Institute. 2000. *World Resources 2000-2001: People and Ecosystems: The Fraying Web of Life*. Washington, D.C.: World Resources Institute, pp. 149-158.

inequality accompanying globalization—increasing poverty is causing many poor people to increase their pressure on fragile natural resources in order to survive.

Some critics¹⁰ have concluded that while globalization has led to significant economic reforms, policy makers have ignored the parallel social, environmental and institutional reforms required to prevent increases in inequality, poverty and environmental degradation.

MEASURING POVERTY'S DIMENSIONS

Traditionally, economists have defined poverty in terms of income, using either a relative standard such as the median income in a country, or an absolute standard

such as the cost of a typical basket of goods and services.

More recent definitions also encompass measures of health, education, security, political voice and discrimination. *The World Development Report 2000-2001*¹¹ measures poverty across three dimensions: *opportunity, empowerment and security*. The World Bank includes another dimension: *capabilities*.¹² These dimensions have multiple determinants, but environmental sustainability runs through each as a common thread.

Opportunity measures an individual's income, consumption and the level of inequality in a society. Opportunity may be enhanced by a stable economic environment, equitable asset distribution, and easy availability of infrastructure. Specific

environmental interventions that improve opportunity include improving the productivity of land and fisheries, and environmentally sensitive pricing structures.

Empowerment measures an individual's participation in community decision-making. Empowerment is strengthened by decentralization, transparency and accountability in all aspects of governance, including the management of natural resources.

Security is a measure of an individual's protection against economic shocks and personal violence. Environment-focused interventions include disaster prediction and prevention mechanisms, and protection against the illegal exploitation of resources.

Capabilities are the substantive freedoms that allow a person to lead the kind of life he or she values. Reproductive health care, access to safe drinking water, better sanitation, reduction of indoor and urban air pollution, integrated programmes to combat vector-borne diseases, and other environment-focused interventions that reduce poverty are all relevant in this regard.

Each of these must be assessed not just in terms of national averages but also in terms of their equitable distribution. Women are often multiply disadvantaged.

WIN-WIN SOLUTIONS FOR POVERTY AND THE ENVIRONMENT

There is increasing consensus that only an integrated approach to the problems of poverty and environmental degradation can result in sustainable development (see Chapter 6). The building blocks of a sustainable development strategy include:

- **Increasing the resource base of the poor**, through measures such as land ownership reform, participatory management of common resources, public investments in land conservation and the creation of employment opportunities.

- **Investing in alternative energy services and infrastructure**, such as sanitation, clean water, education, health care and other services.
- **Support to “green” technologies.**
- **Pricing policies** that do not encourage profligate use of resources such as electricity, water and fertilizer

ENERGY AND POVERTY

Increasing consumption of energy is associated with advanced economies, as well as with longer life expectancies, higher levels of education and other indicators of social development. The correlation is not precise—among industrial economies for example the United States has far higher levels of energy consumption per capita or per dollar of GDP than European countries or Japan. Social development in particular can often be achieved without high levels of energy consumption, as for instance in the state of Kerala in India, or Sri Lanka.

High energy consumption can also fail to produce economic growth if it is misdirected, as in the former Soviet Union, but there are no examples of substantial economic growth without corresponding growth in energy consumption.

This is one of the central riddles of development. All models of development are directed to economic growth—yet if all countries consumed energy at U.S. or even European rates, sources of energy would rapidly be depleted, and the unwanted by-products of energy use would at best tax the ability of the environment to absorb them. The challenge is to find the means for the more affluent to reduce the burdens of consumption, and for poor countries and people to escape poverty without crippling either economies or the ecosphere.

Escaping poverty is not merely a question of finding ways to increase energy consumption, but of changing the kinds of energy used.

The energy sources of the poor

are inefficient, polluting and unhealthy. Per unit of emitted light or heat, the poor pay higher prices than the rich, including the time they spend obtaining or collecting fuel. Cook stoves burning biomass fuel use only around 15 per cent of its potential energy. Charcoal, coal and kerosene stoves are about 50 per cent efficient. Electricity and liquid propane gas burners convert 65 per cent of their energy.

A study in Pakistan showed that nearly 90 per cent of poor households rely on biomass fuels for cooking and the majority use kerosene rather than electricity for lighting. In contrast more than one third of better-off households use gas for cooking and most use electric light.

Biomass cooking produces soot and other substances¹³ linked to acute respiratory infections, chronic obstructive lung diseases, lung cancer and eye problems, as well as low birth weight.¹⁴ Coal in open fires or stoves produces sulphur and toxins such as arsenic, fluoride and lead. The effects of these pollutants are compounded by poor ventilation.

Failure to cook food or boil water adequately because of fuel shortage or inefficiency also contributes to malnutrition, intestinal disorders and parasites.

Gathering fuel-wood and related materials takes its toll in time and injury, mostly on women. A study in the United Republic of Tanzania¹⁵ showed that able-bodied women in rural areas carry about 25 metric tons kilometres (combining weight and distance) per year in firewood collection; men expend a very small fraction of this effort. A study in Addis Ababa found that fuel gatherers, who often carry loads nearly equal to their own weights, frequently suffer falls and bone fractures; eye problems; headaches; rheumatism; anaemia; chest, back and internal disorders; and miscarriages.¹⁶

Poor families spend more than twice as much time gathering fuel as more affluent ones.¹⁷ Wealthier families spend as much as 30 times more on energy but it is cleaner,

more efficient and less burdensome—and they buy it at preferential prices. Electricity costs, particularly for urban elites, are often subsidized.

The poor pay higher unit prices for energy in small amounts: items such as batteries, battery recharging, candles, kerosene and charcoal. A survey in Uganda showed that rural and peri-urban families spend over \$10 per month on candles, lighting, kerosene, dry cell batteries and recharging car batteries. More households in the country derive electricity from car batteries than are connected to the public power grid.

Policy actions to correct these conditions need not be prohibitively expensive and would yield long-term savings. Supplying solar power is often cheaper than extending electrical grids. Subsidies or credit guarantees can put more efficient stoves within reach. Subsidies on electricity prices for the more affluent could be transferred to cleaner fuel for the poor.

RURAL DEVELOPMENT AND POPULATION

The effect of population increase in rural areas can be either positive or negative.

A gradual shift from very low to moderate population densities, for example, can encourage new agricultural practices, providing increased yields and supporting larger populations. Such a process may have encouraged the development of intensive settled agriculture.¹⁸ Increasing rural population density increases the labour available for managing fires, working on infrastructure such as irrigation channels and terraces, and improving soils.

But there are many cases where population growth has worked against both people and their environment.¹⁹ Rapid population growth in the last 50 years has doubled and redoubled poor rural populations, faster than their ability to adapt. Their resource base has been sharply reduced by overuse and commer-

cial exploitation. Without a surplus for investment, the technologies available to poor rural populations have also remained unchanged.

Continuing improvements in agricultural yields and the quality of life depend on the complex interplay of environmental conditions, availability of technology and social organization, and on choices concerning land use. Higher densities require successive adaptations to new circumstances. Eventually, further progress may be constrained by natural limits, for example on water for irrigation; by technological consequences, such as soil degradation from repeated use of chemical fertilizers; by political decisions concerning land use and social organization; or by economic factors such as poverty.

Communities with access to better technology and social investments such as education and universal health care, including reproductive health, have made good use of them to conserve resources and build viable rural economies—examples can be seen in Kerala and in parts of Sri Lanka. These communities feature less gender inequality, later marriage, lower fertility and slower population growth, despite low incomes.

Intensive agriculture has increased yields in many rural areas, but it has provided cheap food for increasing urban populations, rather than a living for rural populations. Commercial agriculture and timber operations by individuals on common land can be highly profitable as long as inputs are available and resources last, but the benefits rarely go to local communities. The rural poor are often using, and overusing, whatever land, water and timber resources are left over from commercial operations. The combined results can be seen in bare hillsides, shrinking watercourses, floods, droughts and vanishing wildlife.

Recent studies of the Green Revolution in India²⁰ reveal that increased productivity has led to greater incentive to expand areas under cultivation. Where forests

are owned in common, this has led to deforestation, because there is no control over the use of common land. Other studies have shown that the benefits of the Green Revolution have accrued principally to the larger landowners and users of common resources, presumably because they had the most to invest and the most to gain. Landlessness among former subsistence farmers and impoverishment by loss of common resources have been unlooked-for consequences of the Green Revolution.

Individual property rights may provide a higher motivation for individual protection of the resource base, but do not automatically offset the impact of sheer numbers of people, or of commercial exploitation.²¹ Individual property rights may have to be limited by measures to protect the commons: many of the world's prime fisheries have collapsed from commercial overuse, and it remains to be seen whether a public policy of limits on fish catches can bring them back.

URBANIZATION

Concentration of people allows economies of scale in the costs of transport, production and consumption, and in providing protection such as clean water and effective sanitation. But concentration can also increase the burdens and require more inclusive, and sometimes expensive, technologies for effective and sustainable protection for both humans and their environment.

Urbanization has been one of the most striking developments of the past century. In Africa, for example, only 5 per cent of the population lived in urban areas in 1900, about 20 per cent in 1960 and about 38 per cent today. Africa's current annual urban growth is the highest in the world, at more than 4 per cent.

The Asia-Pacific region is close behind. The urban population, now about 35 per cent of the total, grew by about 2.6 per cent a year between 1995 and 2000, compared with 0.7 per cent a year for the rural population.

In the less-developed regions, the numbers of city dwellers will double in the next 30 years, from 1.9 billion to 3.9 billion. As dynamos of economic and social development, cities now account for a large and growing portion of demand on resources. Some analyses suggest that urban areas, with just over half the world's people, account for fully 80 per cent of carbon emissions, 75 per cent of all wood use and 60 per cent of freshwater withdrawn for human uses (including water for irrigated crops consumed by urban dwellers).²²

Today, almost 3 billion people live in urban areas. Over 75 per cent of the population of North America, Europe and Latin America now live in cities, and worldwide 411 cities have populations of more than 1 million, compared with 326 in 1990. In Western Europe and North America, in contrast with most other regions, there is a move out of large cities into suburbs and smaller urban centres.

By 2015, 1.6 billion people will be living in cities of more than 1 million people, 622 million in cities of more than 5 million. In the less-developed regions, the numbers of city dwellers will swell in the next 15 years, from 1.9 billion to 2.9 billion. (In more-developed regions they will increase from 0.9 to 1.0 billion.) By 2030, most people in every major region will live in cities. Growth on this scale will have severe consequences for the quality of life and surrounding environments.

In the 1970s, the United Nations coined the term "megacities" to describe cities with 10 million or more residents. In 1975, there were five megacities worldwide. Today, there are 19 megacities. By 2015, the number of megacities will grow to 23.

Cities in many parts of the developing world are growing at twice the rate of overall population growth. About 160,000 people move from rural areas to cities every day. This explosive urban growth is often due as much to the push of collapsing rural environments, poverty, land-

lessness, and a lack of job opportunities as to the pull of better jobs and social services in the cities.

Migrants often find that their lives become more difficult. Growth is fastest in small cities, which often lack infrastructure, and in shanty towns and squatter settlements around many large cities. In Africa 37 per cent of urban residents live in such “informal” settlements, in Asia 18 per cent, and in Latin America and the Caribbean 9 per cent. In many cities the figure is 25 to 30 per cent. Four million of Rio de Janeiro’s 10.6 million residents live in such settlements—some perched precariously on steep hillsides, in flood plains or in areas of high pollution where no one with a choice would live. Dense settlements, particularly if they are badly built, are highly vulnerable to catastrophic events like floods, storms or earthquakes.

POLLUTION

Rapid industrial growth and the concentration of urban populations combine to contaminate water and air. Raw sewage is often dumped untreated into local waterways along with industrial wastes. Most developing countries lack the resources to monitor and treat human waste or modern chemical pollutants.

As urban population continues to increase, more people must share whatever water is available. The London-based Water Aid reports that the world’s biggest cities are already outstripping their water

supplies. Urban centres like New Delhi, Santiago and Mexico City are pumping water from increasingly distant sites. Cities in northern India and China have seriously lowered the water tables in surrounding areas.

More people means more air pollution. In India, levels of suspended particles in 10 of the largest cities are three to five times greater than WHO standards. Jakarta is one of many Asian cities polluted by burning garbage and motor vehicle exhaust. Manila has reportedly far higher levels of suspended particulate matter—the tiny solid particles dispersed from pesticides, asbestos and thousands of other products—in its air than New York, London, or Tokyo.

Most cities around the world produce far more garbage and other wastes than they can handle.

Manila’s primary sewer network was designed early in the 20th century to serve about 500,000 people. Only 11 per cent of the population of Metropolitan Manila has sewer connections. In underserved areas, sewage flows via road gutters, open ditches and canals to overburdened mains to be pumped untreated into Manila Bay or flow in with the tides.

Around Mexico City, 3 million persons in peripheral areas are not connected to the sewers. Underground aquifers are severely polluted.

In many cities, between 30 and 50 per cent of the garbage goes uncollected. Even more-developed regions find it difficult to keep up

with the steady increase in waste that accompanies rising consumption. In the countries of the former Soviet Union, reductions in collection and disposal systems have outstripped consumption declines. In the Russian Federation, of the 130 million cubic metres of municipal solid household waste collected in 1997, only 3 per cent reached processing plants and incinerators.

LOSS OF FARMLAND

Urbanization also affects food production by removing agricultural land from cultivation, as cities expand, and by reducing the number of family farms, as more farmers move to the cities. Between 1987 and 1992, for instance, China lost close to 1 million hectares of farmland each year to urbanization and the expansion of roads and industries. In the United States, urban sprawl takes over nearly 400,000 hectares of farmland each year.²³ At the same time, people are growing more and more food in urban areas. Worldwide, some 200 million city dwellers are growing food, providing about 1 billion people with at least part of their food supply. In Accra, Ghana, for example, urban gardens supply the city with 90 per cent of its vegetables. In Dar-es-Salaam, United Republic of Tanzania, one adult in every five grows fruits or vegetables.

Garden plots and roof top vegetation can have additional benefits. They reduce light and heat reflection and mitigate the trapping of heat. They can help remove pollu-

TABLE 1: WORLD MEGACITIES 1975, 2000 AND (PROJECTED) 2015: POPULATION IN MILLIONS

1975	2000	2015
Tokyo (19.8), New York (15.9), Shanghai (11.4), Mexico City (11.2), and São Paulo (10)	Tokyo (26.4), Mexico City (18.1), Mumbai (18.1), São Paulo (17.8), Shanghai (17), New York (16.6), Lagos (13.4), Los Angeles (13.1), Kolkata (12.9), Buenos Aires (12.6), Dhaka (12.3), Karachi (11.8), Delhi (11.7), Jakarta (11), Osaka (11), Metro Manila (10.9), Beijing (10.8), Rio de Janeiro (10.6), and Cairo (10.6)	Tokyo (26.4), Mumbai (26.1), Lagos (23.2), Dhaka (21.1), São Paulo (20.4), Karachi (19.2), Mexico City (19.2), New York (17.4), Jakarta (17.3), Kolkata (17.3), Delhi (16.8), Metro Manila (14.8), Shanghai (14.6), Los Angeles (14.1), Buenos Aires (14.1), Cairo (13.8), Istanbul (12.5), Beijing (12.3), Rio de Janeiro (11.9), Osaka (11.0), Tianjin (10.7), Hyderabad (10.5), and Bangkok (10.1)

tants produced by motor vehicles, industry and energy production.

Urban areas also affect regional and global environments through their production of greenhouse gases and generation of components of acid rain.

Natural conditions like climate, altitude, topography, wind and precipitation patterns affect cities' ability to disperse atmospheric contaminants and determine their impact on their immediate environments. Air pollution episodes in Santiago are as severe and intense as in much larger São Paulo even though emissions are only about a tenth as large.

PROBLEMS OF GROWTH

Some of the world's largest cities are growing more slowly than in the past, yet their environmental impact increases and their local conditions worsen. Some rapidly growing cities (e.g., Curitiba and Porto Alegre in Brazil) have adopted policies that have improved and protected their environmental conditions. However, most rapidly growing cities face serious environmental health challenges and worsening conditions, particularly in newly settled areas and where institutions to manage and regulate growth are weak.

The growth of small and medium-sized cities in Africa, Asia and Latin America poses special problems, particularly in water provision, sanitation and garbage collection.²⁴ The planning and regulatory systems of such cities are often rudimentary. They do not receive the government investments and attention that large cities can command, and they are unable to achieve comparable economies of scale—in service provision, land use, transport and water and energy provision.

In most developing countries, rapid urban growth, fuelled by both in-migration and natural population increase, is outstripping capacity to provide health services. Young women are increasingly migrating from rural to urban areas, seeking

among other things for better health care, and increasing the pressure on reproductive health services in particular.²⁵

United Nations projections suggest that by 2020, there will be more urban than rural women aged 15 to 39. In Kenya, 35 per cent of rural women are aged 15-39; among urban women, 53 per cent are 15-39; similar gaps are found in Bangladesh, Haiti, Indonesia, Nicaragua, and Yemen.

Urban women generally want fewer children than rural women, but access to family planning services is failing to meet those desires. Peri-urban areas are often poorly served by reproductive health services. Clinics in central cities may not be open at times convenient to many residents of the wider local area and to workers.

WASTEFUL CONSUMPTION PATTERNS

Consumption is a critical factor in the relationship between population and environmental stress. Almost all human activities put demands on natural resources: food, housing, clothing and transportation use resources like arable land, water, oil, gas and wood. Most human activities also produce wastes that are released back into air, water and soil, often with little or no treatment to mitigate their environmental impact.

While population growth puts increased demands on resources, the environmental impact of a given population depends on a combination of human numbers, levels of consumption and the extractive and regenerative technologies available.²⁶

In the 20th century, consumption of goods and services rose to unprecedented levels—powering the expansion of the global economy and changing the realities of billions of people's lives. But vast numbers of people have been left out of the consumption boom. Currently a huge "consumption

gap" exists: globally, the 20 per cent of the world's people who live in the highest-income countries account for 86 per cent of total private consumption expenditures; the poorest 20 per cent, by contrast, account for just 1.3 per cent.²⁷

A child born today in an industrialized country will add more to consumption and pollution over his or her lifetime than 30 to 50 children born in developing countries.²⁸ Currently, the fifth of the world's people who live in industrialized nations produce over half of the carbon dioxide emitted into the atmosphere, while the poorest fifth produce only 3 per cent.²⁹ The United States alone, with only 4.6 per cent of the global population, emits nearly 25 per cent of global greenhouse gases.³⁰

Consumption in industrialized nations directly impacts the developing world. For example, almost a billion people in 40 developing countries risk losing access to their primary source of protein, fish, as over-fishing driven by demand for animal feed and oils in industrialized nations adds pressure to already declining fish stocks.³¹ And the estimated 111 million people who will be added to the U.S. population over the next 50 years will expand energy demands by more than the current energy consumption of Africa and Latin America combined.³²

Vast amounts of natural resources are required to produce the goods used in industrialized countries. The impacts are often felt in regions far from home where metals are mined, oil is extracted, timber harvested and food grown. Transporting these goods also consumes substantial amounts of energy resources.³³

As individuals and countries grow more affluent, their demands move beyond basic needs—magnifying the impact of population growth even in poor regions. And with the globalization of Western consumer culture, demands for a range of products, including cars, computers and air conditioners will only increase—adding pressure on natu-

ral resources and ecosystems' capacity to absorb waste.³⁴

Despite the linked challenges of rapidly taming excess consumption and ending the privation of under-consumption, there are some signs of positive change. Governments and industries are increasing their use of renewable resources and less- or non-polluting technologies and are exploring future potentials. Sustainable management programmes are being attempted in a growing share of forest lands. Public debate about the various environmental topics (including energy and land use policies) is intensifying, and international agreements are under discussion.

Still, what the economist Herman Daly wrote nearly 30 years ago seems relevant today: a sustainable economy "would make fewer demands on our environmental resources but much greater demands on our moral resources".³⁵

HUMANITY'S 'ECOLOGICAL FOOTPRINT'

To measure people's impact on the environment, some scientists have devised an "ecological footprint"³⁶ indicator (Figure 7). It shows which regions are the heaviest consumers of specific resources, on a per capita basis as well as in absolute terms.

The footprint estimates a population's consumption of food, materials and energy in terms of the area of biologically productive land or sea required to produce those natural resources or, in the case of energy, to absorb the corresponding carbon dioxide emissions. Measurement is in "area units". One area unit is equivalent to one hectare of world average productivity.

Each region is represented by a rectangle in which the width is proportional to the population, the height represents per capita resource consumption, and the area represents the region's total consumption. Thus, Asia, which has a population over ten times the size of North America's but a per capita

resource consumption level only one sixth as large, has a footprint only slightly bigger than North America.

Such an analysis captures the two most important dimensions of the challenge of sustainability—per capita resource consumption and population growth.

This indicator also identifies areas of high and low natural biological capacity and regions responsible for "ecological deficits", where resource consumption exceeds sustainable use levels. According to the *Living Planet 2000* report, global consumption in 1996 stood at 2.85 area units per person, 30 per cent more than biological availability (2.18 units).

The wealthy countries in the Organization for Economic Cooperation and Development (OECD) had a total ecological footprint of 7.22 area units per person in 1996, more than twice the biological capacity of 3.42 units. Non-OECD countries had a total ecologic footprint of 1.81 area units per person, slightly less than the biological capacity of 1.82 units.

Africa had an ecological surplus in 1996 of 0.40 area units per person (a footprint of 1.33 units and an available biological capacity of 1.73 area units). Many African countries enjoyed large ecological surpluses and very few countries had deficits in excess of 1 area unit per person.

However these surpluses result from extensive poverty rather than beneficial management.

Latin America and the Caribbean had the world's highest ecological surplus, 3.93 area units per person, due to its high natural biological availability (6.39 units) and relatively low resource consumption (2.46 units). The highest per capita surpluses were found in Bolivia, Brazil and Peru.

The Middle East and Central Asia had an ecological deficit of 1.82 area units per person, largely due to its low biological capacity (0.91 units). The total ecological footprint of the area was 2.73 area units per person. Wealthy oil economies such as the United Arab Emirates and Kuwait had the highest deficits.

Asia and the Pacific's ecological deficit of 0.67 area units per person is partly attributable to its high population, which reduces biological capacity to 1.11 units. The total ecological footprint of the area was 1.78 area units per person in 1996. Singapore, Japan and South Korea had the highest deficits.

North America had the world's highest ecological deficit (5.64 area units per person) in 1996, despite having the second highest biological capacity (6.13 units). The United States registered an ecological deficit of 6.66 area units per person.

Western Europe had an ecologi-

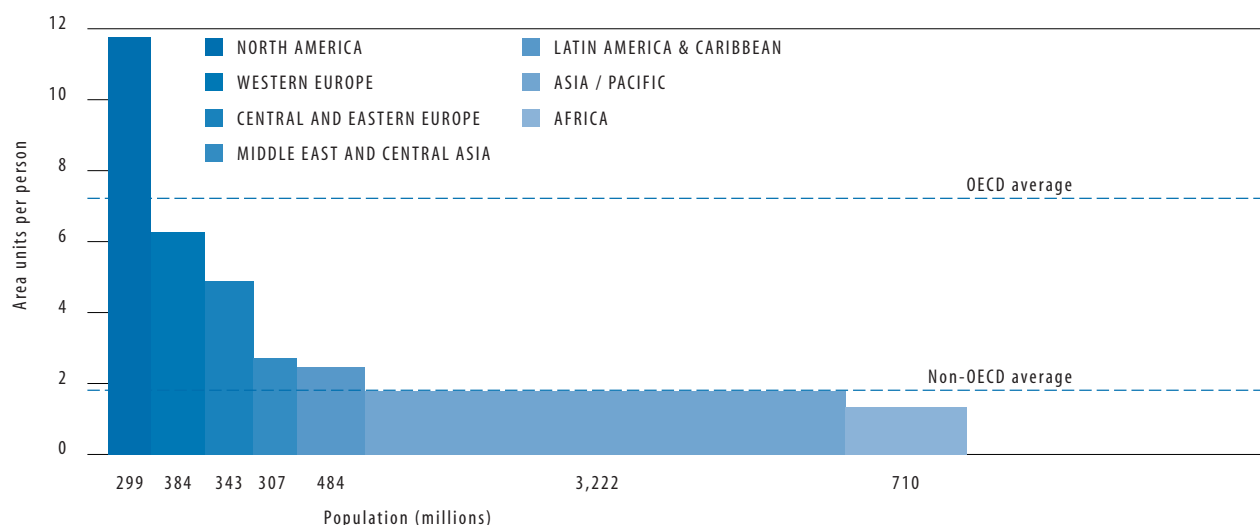
TABLE 2: GROWTH IN TOTAL CONSUMPTION EXPENDITURES, 1970 TO 1995, IN TRILLIONS OF U.S. DOLLARS (1995 PRICES)³⁷

	1970	1980	1990	1995
Industrialized countries	8.3	11.4	15.7	16.5
Developing countries	1.9	3.6	4.3	5.2

TABLE 3: CONSUMPTION LEVELS, FROM WEALTHIEST TO POOREST³⁸

	per cent consumed by people in industrialized countries	per cent consumed by the poorest 20% of people in developing countries
Total energy resources	58	< 4
Meat and fish	45	5
Paper	84	1.1
Vehicles	87	< 1
Telephone lines	74	1.5

FIGURE 7: ECOLOGICAL FOOTPRINT BY REGION, 1996



Source: World Wide Fund for Nature (WWF), United Nations Environment Programme World Conservation Monitoring Centre, Redefining Progress, Center for Sustainability Studies, and Norwegian School of Management. 2000. Living Planet Report 2000. Gland, Switzerland: World Wide Fund for Nature

cal deficit of 3.35 area units per person, the second highest in the world. The ecological footprint was 6.28 units against a biological capacity of 2.93 units. The United Kingdom, Switzerland and Denmark registered the highest deficits.

Central and Eastern Europe had an ecological footprint of 4.89 area units per person, a biological capacity of 3.14 area units and a deficit of 1.75 units in 1996. The Czech Republic and Estonia had the highest deficits.

Living Planet 2000 also reports five components of the ecological footprint: cropland, grazing land, forest (fuel-wood and wood products, including paper), fishing ground (marine fish and seafood products including fish-meal and oils fed to animals) and carbon dioxide (fossil fuel consumption plus the net energy required to make imported manufactured products).³⁹ These also show a big consumption gap between developed and developing regions.

For example, North America's cropland footprint (1.44 area units per person) was more than twice the world average (0.69 units). The fishing ground footprint of consumers in OECD countries was three

times that in non-OECD countries. The OECD consumer's average carbon dioxide footprint in 1996 was more than five times that of the non-OECD consumer. North America's carbon dioxide footprint, 7 area units per person, was five times the global average and more than seven times the averages of Latin America and the Caribbean, Asia and the Pacific, and Africa.

ENVIRONMENTAL REFUGEES

Population displacement due to environmental degradation (due to natural disasters, war or over-exploitation) is not a recent phenomenon. What is recent is the potential for large movements of people resulting from a combination of resource depletion, the irreversible destruction of the environment and population growth, among other factors.⁴⁰ When a tidal wave hit the shores of Papua New Guinea in 1998, the death toll was in the thousands because human settlements dotted the coastline and the banks of lagoons. When the Yangtze caused massive flooding in China, the disaster was exacerbated by deforesta-

tion and erosion due to overpopulation along the riverbanks.

In January and February of 2001, thousands of people were uprooted when powerful earthquakes struck El Salvador, causing deadly landslides on mountain slopes cleared for subsistence agriculture.

The World Bank estimates that in 1998 there were 25 million people displaced by environmental degradation, outnumbering war-related refugees for the first time in history.

Displaced refugees often threaten the areas where they are staying. The 1994 crisis in Rwanda led to the influx of more than 600,000 people into north-west United Republic of Tanzania, where they caused considerable environmental damage by harvesting firewood and building poles, poaching in game reserves, and putting land under cultivation.

Environmental refugees have significant economic, sociocultural and political consequences. Currently, developed nations pay \$8 billion each year to accommodate refugees, one seventh of the foreign aid supplied to developing countries.

CHAPTER 4

WOMEN AND THE ENVIRONMENT



Bangladeshi woman cooks with crop residue. Indoor air pollution kills more than 2.2 million people each year in developing countries.
Shehzad Noorani, Still Pictures

“Advancing gender equality, through reversing the various social and economic handicaps that make women voiceless and powerless, may also be one of the best ways of saving the environment, and countering the dangers of overcrowding and other adversities associated with population pressure. The voice of women is critically important for the world’s future—not just for women’s future.”

—Amartya Sen¹

The direct and critical relationship between women and natural resources draws its strength not from biology—that is, not because women are born female—but from gender, and the socially created roles and responsibilities that continue to fall to women in house-

holds, communities and ecosystems throughout the world.

Women have primary responsibility for rearing children, and for ensuring sufficient resources to meet children’s needs for nutrition, health care and schooling. In the rural areas of developing countries, they are also the main managers of essential household resources like clean water, fuel for cooking and heating and fodder for domestic animals. Women grow vegetables, fruit and grain for home consumption and also for sale—often, as in much of Africa, producing most of the staple crops. In South-east Asia, women provide 90 per cent of the labour for rice cultivation.

Women are more than half (51 per cent) of the world’s agricultural work force.² As economic opportu-

nities open up, women in developing countries are growing, processing and marketing non-food products made from natural resources, for consumption at home and, increasingly, overseas.

In Burkina Faso, for example, women are producing hundreds of tons of shea butter each year, selling much of it to European cosmetic markets.³ In Colombia, thousands of female workers are tending flowers for sale in the United States. But such livelihoods can also present new environmental and health risks: it is estimated that flower workers in Colombia are exposed to 127 different types of chemicals, many of which have been banned in the United States and the United Kingdom.⁴



*Woman collects garbage in Mali dump. Women face a variety of health risks from toxic chemicals in the air, water and earth.
Erik Just, Denmark*

Many of these activities take place in the interstices of men's use of resources. Women occupy niches allowed by traditional gender structures or opened up by economic and social change. In coastal Mozambique, women are not allowed to come close to the boats men use for ocean fishing, or to do such fishing themselves, although they process and market the men's catch. Their aquatic space is close to the shore, where they harvest and sell shellfish, crabs and other small sea creatures—women's work that provides about 20 per cent of average monthly household income according to a recent study.⁵

As poverty persists and, in

many parts of the world, deepens, women's income from such activities becomes critical to family survival—reinforcing the importance of the environment in women's lives (and increasing the dangers posed by degraded environments). In the growing number of female-headed households, this work is essential, particularly for children; women already head almost a quarter of rural households in the world's poorest countries.⁶ Women's income can also create the conditions for expanded opportunities, choices and autonomy—all of which advance the larger goal of gender equity and equality.

HOW ENVIRONMENTAL DEGRADATION AFFECTS WOMEN

Women have the responsibility for managing household resources, but they typically do not have managerial control. Given the variety of women's daily interactions with the environment, they are the most keenly affected by its degradation. For example:

- Deforestation or contamination increases the time women must spend seeking fuelwood or safe, clean water, and increase women's risk of water-borne disease. In the state of Gujarat, India, women now spend four or five hours a day collecting fuelwood, where previously they would have done so once every four to five days.⁷
- Soil erosion, water shortage and crop failures reduce harvest yields; soil exhausted from over-use reduces the productivity of household gardens.
- Toxic chemicals and pesticides in air, water and earth are responsible for a variety of women's health risks. They enter body tissues and breast milk, through which they are passed on to infants.⁸ In a village in China's Gansu province, discharges from a state-run fertilizer factory have been linked to a high number of stillbirths and miscarriages. Water pollution in three Russian rivers is a factor in the doubling of bladder and kidney disorders in pregnant women, and in Sudan a link has been established between exposure to pesticides and perinatal mortality—with the risk higher among women farmers.⁹
- In urban settings in particular, air and water pollution can be extreme, and sanitation and waste treatment poor or non-existent, presenting new threats to health, particularly for women, who have the highest levels of exposure. In the Indian cities of Delhi and Agra,

for example, drinking water comes from rivers heavily polluted by DDT and other pesticides.¹⁰

Degraded environments mean that women must spend more time and effort to find fuel or produce food, but their other responsibilities, for meeting household needs and ensuring family health, do not diminish. Gendered divisions of labour have so far resisted real change. In many countries, women already work 12 hours or more a day in and out of the home; in Africa and Asia, women work an average of 13 hours more each week than do men.¹¹

POWERLESSNESS AND ITS IMPACT

At the same time, women have little power over the conditions of their lives. Decision makers often overlook this reality, even though women's use and management of local environmental resources is fundamental to household and community well-being.¹² Agricultural extension services are heavily biased towards men. Education and outreach efforts in support of sustainable farming and land management methods often pass them by.

National law or local customs often effectively deny women the right to secure title or inherit land, which means they have no collateral on which to raise credit. Poverty, precarious land tenure and lack of expert support discourage women from investing in newer technologies or long-term strategies such as crop rotation, fallow periods, sustainable levels of cultivation or reforestation. On the contrary, these factors encourage fast-growing cash crops such as cotton, which quickly exhaust the land, and woodland clearance for short-term income.

Such pressures on limited land resources deplete nutrients and degrade soils. Land degradation reduces yields, leading to a spiral of more intensive use, further degradation and still lower yields. Farmers may seek new land, but often find it only in frontier or marginal areas,

especially if they are women and cannot close a sale or negotiate a loan.

In the worst-affected countries, HIV/AIDS has increased poverty and decreased choices, forcing people to fall back on natural resources to meet basic needs. In South Africa, large numbers of poor people, particularly women, are trying to produce food and fuel on marginal lands, increasing the pressure on fragile ecosystems.¹³

Unsustainable land use can often be traced to denial of technical and financial resources. Given the opportunity, women may well have a predisposition to practice sustainable agriculture and maintain overall land quality—precisely because of their strong reliance on natural resources. A World Bank study in Ghana found that women's plots had a lower rate of decline in soil fertility than men's—even in the same household.¹⁴

In India, women are leading rural movements to promote sustainable farming practices and resist large-scale agricultural operations that rely on intensive chemical fertilizers and pesticides. And in the United Kingdom, where farming is male-dominated, half of all organic farmers are women—10 times the proportion in the farming industry overall.¹⁵

Women who lack rights to own and manage natural resources often lack rights in other aspects of their lives, reinforcing gender inequalities. Like millions of women throughout the world, women in the strongly patriarchal rural communities of south-east Madagascar have no access to the resources that bring status—property, cattle and farmland. As a result, they have little part in community or household decisions. This includes decisions about reproduction (fertility is high), marriage (early marriage is common) and education for themselves and their children (education rates for boys are low and for girls lower still).¹⁶

In the past, large families were common in rural communities: children were important to agricultural productivity (especially on

large land tracts), often joining their mothers (and at times fathers) in fields or household gardens, tending domestic animals and assisting with household resource needs—fetching water, and foraging for fuelwood and edible and medicinal plants. Rural women married young and had many pregnancies.

One legacy of high fertility, lower infant mortality and a limited supply of land is fragmentation.¹⁷ As they passed from one generation of sons to another, plots were divided again and again. Eventually the plots were simply not big enough to provide enough food for family or market. Pressures to increase yields have intensified, and men have left in search of non-farm employment. Without them, women's family burdens and responsibilities have increased, though urban relatives often send money to improve the remaining land, as well as for housing, education and health care.

Urbanization offers a series of risks and opportunities to women. Urban growth and poverty produces new environmental threats that increase health risks. Again, those most exposed are women and their children.¹⁸

On the other hand, pregnancy and childbirth are generally safer in urban areas, where health care is more likely to be accessible. City life also offers women a broader range of choices for education, employment and marriage, but it also carries heightened risk of sexual violence, abuse and exploitation. For poor women, urbanization means less physical labour to find fuel, food and water, but they often lose direct control over quality or quantity. For the very poor, these basic resources are more expensive—in absolute as well as relative terms—than for better-off groups. In environmental terms, what urbanization offers the poor with one hand, it takes away with the other. The very poor in urban areas, for example those who live on and off garbage dumps, are arguably the most deprived on the planet, in human as well as economic terms.

As women join the migration from rural to urban areas, they are vulnerable to economic and sexual exploitation—sweatshop labour, trafficking, abuse or violence; factory workers face possible exposure to chemicals, dust or other forms of pollution.

Along with the risks, however, go new economic opportunities. Freedom from the social and gender hierarchies of rural communities may also open up chances to go to school, college or university, to acquire marketable skills and to choose whether, when and whom to marry. Urban women are more likely to be able to decide when, if and how many children to bear, both because of changing gender relations and because they have easier access to reproductive health information and services.

To be effective managers of household and other resources,

both rural and urban women need a range of options: choices over family size and spacing; health care, including reproductive health; education; and partnership with men. There are many examples of programmes to empower women that reinforce both their management of resources and their reproductive health. Extension programmes can typically provide aspects of reproductive health care together with information and assistance for resources management.

INVOLVING WOMEN IN ENVIRONMENTAL AND HEALTH DECISIONS

Sustainable development demands recognition and value for the multitude of ways in which women's lives intertwine with environmental realities. Women's right to own

and inherit land should be enforced; individual and communal security of land tenure should be guaranteed; women should have access to credit, and to agricultural extension and resource management services, and they should be included in decisions about the services' organization and content.

Women's involvement must extend to information, education and services for reproductive health and rights. Choice about fertility is a step towards equality: women thus empowered can intervene in other decisions in the household and the community, for example, education and health care for girl children; the use of common resources and the development of economic opportunities. Women's involvement in health and environmental decisions works to the benefit of individuals, society and the environment itself.

In fact, as a growing body of experience shows, reproductive health and environmental services can work very profitably together, if they are designed to meet communities' own priorities. Integration eliminates the need to duplicate outreach, and responds to women's interrelated needs.

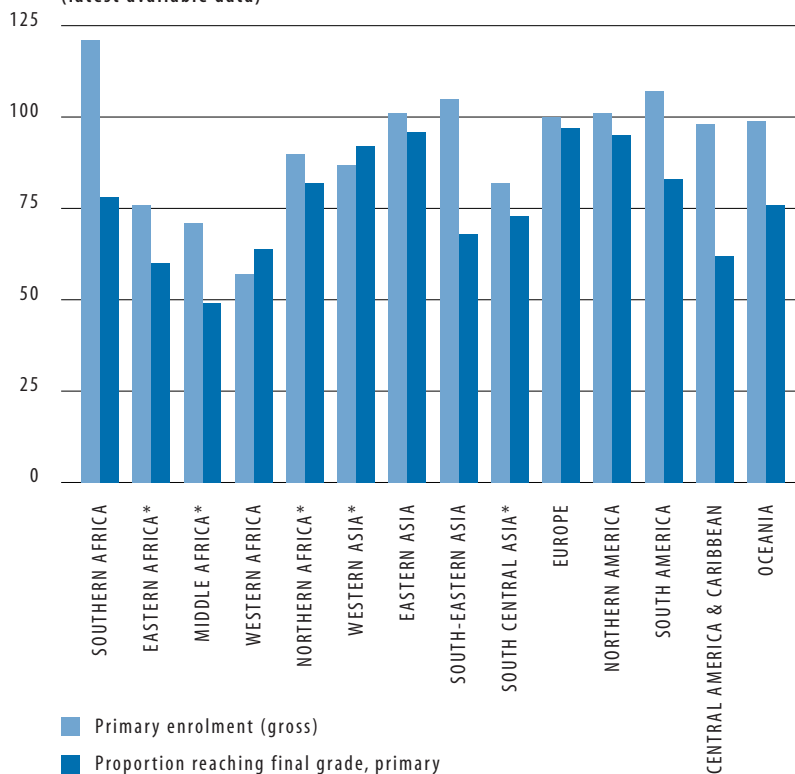
Trust is key in such efforts: in one Latin American project, a female staff member of an environmental organization who developed considerable rapport with local village residents was inundated with requests for reproductive health information and care. At the same time, a government health worker without similar rapport received few such requests. Not surprisingly, studies have also found that the most critical element of the success of integrated reproductive health and environmental services is the active engagement of women.¹⁹

Shifting environmental conditions can begin new and more intense gender conflicts, but can also bring opportunities for women and men to negotiate gender equality.

For example, in Newfoundland, Canada, the collapse of North Atlantic fish stocks has brought

FIGURE 8: PROPORTION OF GIRLS ENTERING AND COMPLETING PRIMARY SCHOOL, BY SUBREGION

(latest available data)



* In these subregions boys' enrolment exceeds girls' by at least 10 per cent.

Source: UNESCO (see Technical Notes).

mass unemployment to communities that once relied almost wholly on fish. Before the crisis, men did the fishing and women worked in fish processing plants. But with men and women both at home during the day, domestic conflict increased. Women wanted more help in the house, but also felt invaded; men often felt emasculated by their demands. Alcohol use and conflict with men outside the home also increased. Young women began to see husbands and boyfriends as undesirable, the number of female-headed households rose, and levels of migration for both women and men, especially those with more education, increased significantly.²⁰

A more positive response to a changed environment can be seen among salt miners in Bilma, Niger. For hundreds of years, large numbers of men crisscrossed the Sahara for months at a time, transporting and trading salt for fruit, grain and gold. In recent years, the value of salt has fallen and lorries have taken over much of the trade from camels, forcing most men into a more sedentary existence. In response, men and women have created new forms of partnership. Many women now work alongside their husbands scooping salt from pits—something not possible a generation ago. In those days, when a father died his daughters could not maintain his pits; boys or men were required. But today, when a woman marries she can join her new husband in the mine. Several couples also mine together, and the salt miners even include unmarried women.²¹

Environmental change imposes new stresses and choices on women's and men's lives. Evolution in gender roles induced by environmental change can mean better communication and shared decision-making; but negotiating new roles and responsibilities can be a painful process. It is important to maximize social flexibility and the resources women and men can bring to negotiations with each other and with the natural world.

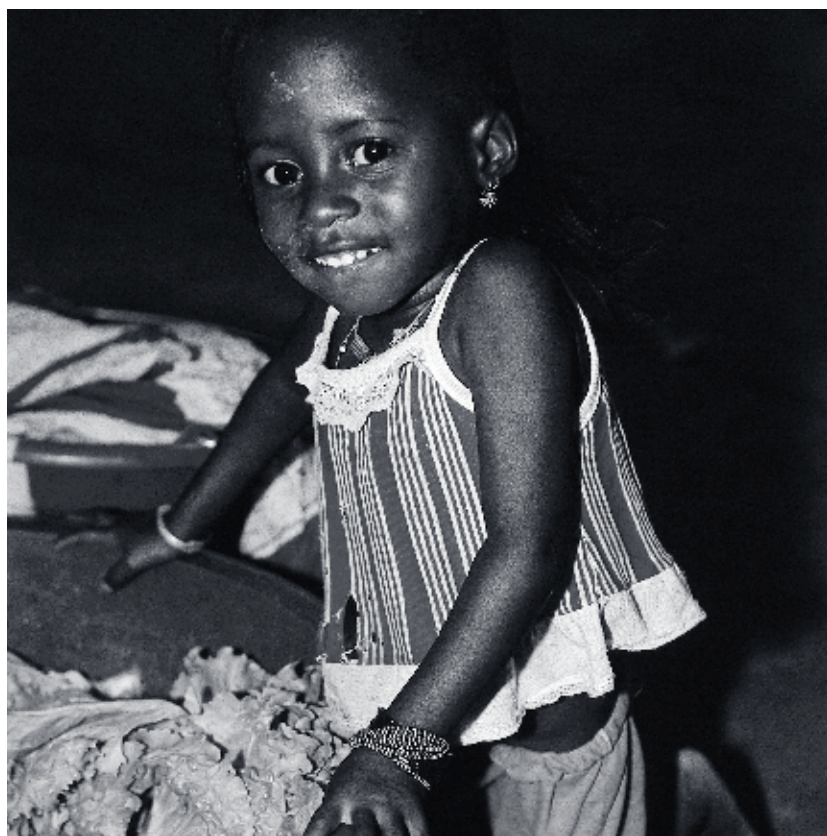
FORGING NEW RELATIONSHIPS

Successful negotiation between women and men will be helped by having access to information and education, and to agricultural and reproductive health services. The support of laws and policies on women's rights and equality and on the sustainable use and protection of natural resources are also essential. With such support women and men can create a virtuous circle of sustainability and equity. Without it they are trapped in a vicious spiral of continuing environmental degradation, poverty, high fertility and limited opportunity, leading to environmental and social collapse.

Women's groups are organizing to integrate women fully into the political process, so they can take their full part in making policy decisions affecting their lives, including policies on: the use of land and water resources for agriculture; power, drinking water and

energy supply; health and education services; and economic opportunities. In many countries, they are succeeding.

A successful outcome will depend on forging new relationships between women and the environment, and between women and the world at large. Wangari Maathai is a Kenyan environmentalist and founder of the Green Belt Movement, which works with women in 20 countries to plant trees. As she suggests, such social and ecological transformations are well under way: "Implicit in the action of planting trees," she says, "is a civic education, a strategy to empower people and to give them a sense of taking their destiny into their own hands, removing their fear so they can stand up for their environmental rights. So that they [women] can control the direction of their own lives."²²



Girl in Mali watches while the women cook. Support for women's rights can break the cycle of poverty, powerlessness and environmental degradation.
Erik Just, Denmark

CHAPTER 5

HEALTH AND THE ENVIRONMENT



Women in India carrying pots. Rural poor women often carry heavy loads over long distances, contributing to ill-health.
Martha Cooper, Still Pictures

Environmental conditions help determine whether people are healthy or not, and how long they live. They can affect reproductive health and choices, and they can help determine prospects for social cohesion and economic growth, with further effects on health. Changes in the environment—pollution and degradation, climate change, extremes of weather—also change prospects for health and development.

Environmental conditions contribute significantly to communicable diseases, which account for about 20-25 per cent of deaths annually worldwide. The illnesses most closely related to environmental conditions—infectious and parasitic diseases and respiratory infections and diseases—endanger development prospects, particular-

ly in poor countries and among poor people in any country. Unclean water and associated poor sanitation kill over 12 million people each year. Air pollution kills nearly 3 million more.

Changes in land use can create new breeding grounds. Irrigation or dam construction, for example, can encourage waterborne diseases: schistosomiasis established itself in Egypt and Sudan after the building of the Aswan dam. The clearing of tropical forest creates hardpan on which rainwater can collect and mosquitoes can breed. Malaria results in over 1 million deaths each year and accounts for some 300 million new clinical cases each year. Malaria causes 10 per cent of the total deaths in sub-Saharan Africa.¹

It has been estimated that roughly 60 per cent of the global burden of disease from acute respiratory infections, 90 per cent from diarrhoeal disease, 50 per cent from chronic respiratory conditions and 90 per cent from malaria could be avoided by simple environmental interventions.²

In more-developed countries, these conditions contribute a lower proportion of the total burden of illness but still are responsible for outbreaks, especially in communities poorly served by sanitation and other clean-water services. Outbreaks of diphtheria in Central and Eastern Europe reflect poorer public health services (including low levels of vaccination) and greater migration of infected and susceptible populations in the wake of political change.³

Changes in health conditions directly affect development prospects and the chances for eradicating poverty. These are affected by a wide variety of conditions in the human and social environment.

DEMOGRAPHIC CHANGE AND HEALTH

Environmental change can dramatically improve urban health, as in European cities in the 19th century, when piped water and treated sewage eliminated the ancient threat of cholera. In Sri Lanka and other Asian countries in the 1940s a combination of spraying DDT and removing mosquito breeding places temporarily wiped out malaria. Such public health interventions hold down the burden of disease in many developing countries, especially in great cities, but they often fight a losing battle against growing populations, polluting industry, deteriorating infrastructure and housing stock, and shortage of resources.

Crowded living conditions, particularly in urban areas, spread infection. People living in poverty are the most crowded because of the cost of housing and the larger size of their families. Infants in poorer and more crowded portions of cities are at least four times more likely to die than infants in more affluent neighbourhoods. Environmentally related diseases, notably tuberculosis and typhoid, contribute to these differentials.

Trade links between large cities and the surrounding rural areas and smaller cities are accelerating with the integration of economies into the global system. Better transport to centralized markets has helped spread sexually transmitted diseases, including HIV/AIDS. Infection rates are markedly higher along lorry routes and at border towns where drivers congregate.

Ease of transport also allows diseases to travel between regions or continents within human hosts, other animals or cargo. Cholera has travelled from Bangladesh to Chile in the ballast tanks of a freighter.

Cholera outbreaks following disasters in India have been spread by infected people leaving the area.

Migration to newly opened lands, sometimes as part of government-approved and -assisted colonization programmes,⁴ often removes settlers from the reach of health systems, including reproductive health services. Incentives for doctors and nurses to move to rural locations are generally insufficient and ineffective. Equipping and re-supply of remote facilities is difficult and their inadequacies deter settlers from using them.

Health services in settlements around cities are similarly poor. Mortality rates for the young can be higher than in more-established rural settlements.

Maternal mortality, though difficult to measure, is clearly much higher in rural areas—where fewer births are attended by trained staff and transport in case of pregnancy complications is difficult—than in cities, and higher still in new rural settlements.

Large families in new settlements also have a greater effect on their immediate environment than smaller ones. Their needs for food, fuel and water are greater and, with additional resource scavengers, so are their impacts.

POLLUTION AND HEALTH THREATS

Air pollution kills an estimated 2.7 million to 3.0 million people every year, about 90 per cent of them in the developing world. The most critical components include: sulphur dioxide (from the burning of oil and high-sulphur coal); particulate matter (from domestic fires, power and industrial plants, and diesel engines); carbon monoxide and nitrogen dioxide (from petrol fumes from motor vehicles); ozone (from the effect of sunlight on vehicle emission-generated smog), and atmospheric lead (from burning leaded petrol or coal).

Outdoor air pollution harms more than 1.1 billion people and kills an estimated half million peo-

ple per year, mostly in cities.⁵ Nearly 30 per cent of these deaths are in developed countries. Fine particulate pollution is responsible for up to 10 per cent of respiratory infections in European children (and twice as much in the most-polluted cities).⁶ The situation is particularly serious in the former Soviet Union where, despite reduced levels of industrial output, automobile transport has increased markedly.

Densely populated and rapidly growing megacities in developing countries subject their populations to levels of air pollution exposure far in excess of allowances recommended by the World Health Organization.⁷

The one hour per year maximum for specific concentrations (greater than 0.1 parts per million) and 30 days per year limit on generally high ozone exposure are exceeded in Mexico City regularly. The specific limits were exceeded for more than 1,400 hours over only 145 days in 1991. Similar excessive exposures are common in Santiago and São Paulo.

Asian megacities do better in ozone exposure, but worse with respect to WHO standards for suspended particulate matter and sulphur dioxide (for example in Beijing, Delhi, Jakarta, Kolkata and Mumbai). Cairo, Lagos and Tehran also show high exposure concentrations.

Automobile ownership is expanding rapidly in many developing countries. In Beijing, more than three quarters of survey respondents expect to purchase a car in the near future.⁸ India has recognized the growing contribution of automotive exhaust to city pollution. However, efforts in Mumbai to mandate use of liquid propane to power taxis have met strong opposition from drivers and fleet owners. (Similarly, efforts to regulate industrial emissions have generated a counter-response from small businessmen.)

Indoor air pollution—soot from the burning of wood, dung, crop residues and coal for cooking and heating—affects about 2.5 billion people, mostly women and girls, and

is estimated to kill more than 2.2 million each year, over 98 per cent of them in developing countries.⁹

Air pollution's impact extends beyond direct health effects. Acid rain results from chemicals dissolved in precipitation. It increases the corrosive effect of rainfall on buildings and structures and makes the lands and waterways that receive it less productive. Alterations in the chemical balance of soils and water have widespread effects on plant and animal life. Air pollution also reduces food production and timber harvests by impairing photosynthesis. An estimate for Germany suggests that \$4.7 billion in agricultural production is lost due to high levels of sulphur, nitrogen oxides and ozone.¹⁰

HEAVY METALS

Heavy metals¹¹ are released into the environment by metal smelters and other industrial activities, unsafe disposal of industrial wastes, and the use of lead in water pipes and petrol. The most dangerous metals, when concentrated above naturally occurring levels, include lead, mercury, cadmium, arsenic, copper, zinc and chromium. These have diverse effects relating to cancers (arsenic and cadmium), genetic damage (mercury) and brain and bone damage (copper, lead and mercury).

Lead pollution from leaded petrol (phased out in the United States and the European Community over the past three decades), worsened by use in inefficient or poorly maintained engines, causes widespread health problems in some countries. It contributes to lower levels of intelligence among exposed children and later loss of productivity in adulthood.

NUCLEAR CONTAMINATION

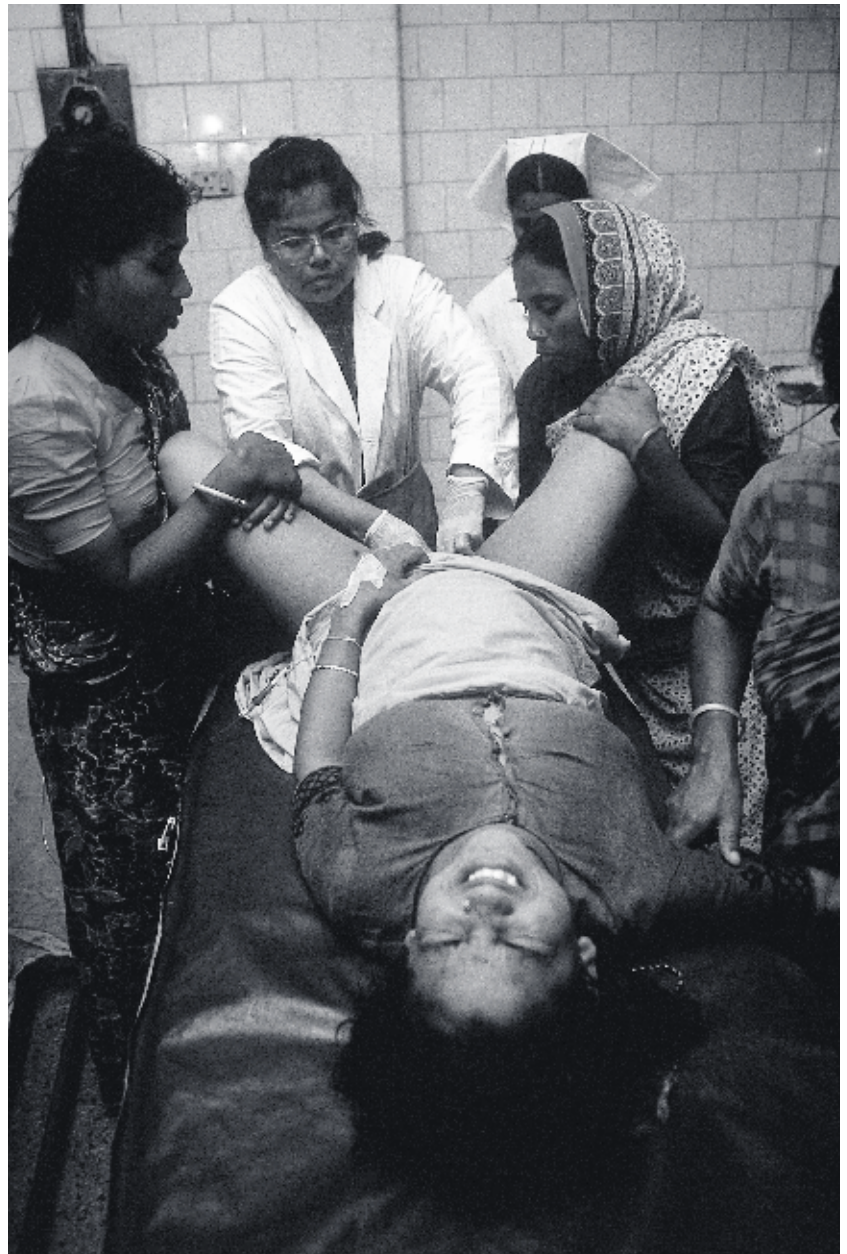
The contaminated areas around the Chernobyl nuclear facility in the Ukraine provide one of the starkest examples of the catastrophic dangers of unsafe nuclear power use.¹² Over 2 million people were imme-

diately affected, including 500,000 children. There has been a great increase in thyroid cancers, in some areas over a 100-fold higher incidence than expected. The full impact in thyroid and other cancers will develop over the coming years. The 600,000 soldiers and civilians who worked to clean up the site over several years will also bear the burden of radiation exposure. The 50,000 who worked on top of the

reactor building to put out the fire and build its new concrete containment were most seriously exposed and affected. Research suggests that some 30 per cent suffer from reproductive disorders (including higher levels of infertility and birth defects).

Many area residents are afraid to have children from fear of defects, fears that are complicated by the continuing decline in the ca-

Bangladeshi woman giving birth. Women weakened by environment-related health problems are more vulnerable in pregnancy and childbirth.
Shehzad Noorani, Still Pictures



capacity of the health system. Observed effects are clearly related to proximity and exposure. Malformations (including cleft palate, Down's syndrome and deformed limbs and organs) increased 83 per cent in severely contaminated areas, 30 per cent in mildly contaminated areas and 24 per cent in "clean" areas. The worst-affected region in neighbouring Belarus has seen increases in childhood cancers (more than 60 per cent), blood diseases (54 per cent) and digestive organ diseases (85 per cent).

Contamination of the land has restricted agricultural production, killed trees and polluted waters. Close attention will be required to monitor and prevent contamination of nearby waterways that supply 35 million people.

With growing awareness of the health and climate impacts of oil-, gas- and coal-fuelled power plants, reliance on nuclear power for electrical generation may increase. Many countries still do not have the capacity to run and regulate these facilities properly, or to prepare and implement emergency plans to handle accidents.

REPRODUCTIVE HEALTH AND THE ENVIRONMENT

Environmental factors have a direct effect on individuals' reproductive health and communities' response to reproductive health conditions. They also affect service access and quality. They have their most serious impacts among the poor, who are more likely to live near sources of pollution and use polluted resources.

Impacts start at or before birth. Exposure to some agricultural and industrial chemicals and organic pollutants are associated with pregnancy failures and with infant and childhood developmental difficulties, illness and mortality. Exposure to nuclear radiation and some heavy metals has genetic impacts. Exposure to new interactions, with reproductive risks stretching down

the generations, is increasing.

Anaemia is common among ill-nourished girls and women and can affect the age at menarche. Frequent childbearing intensifies the incidence and severity of anaemia.

Rural poor women frequently carry large loads of water and household fuel (wood, charcoal and other bio-matter), often for long distances. In many communities environmental damage has greatly increased the distance women must go for fuel or water. In addition to their general effect on health and the possibility of injury, these heavy loads contribute to low weight and proportions of body fat among women. Below certain levels low body weight contributes to the cessation of menses and reduced fertility.

Women weakened by general ill-health, and by infectious and respiratory diseases, are much more vulnerable in pregnancy and childbirth, especially if they are very young, near the end of their reproductive years, or have had many children. They may also be more vulnerable to HIV infection.

REPRODUCTIVE HEALTH SERVICE CHALLENGES

Peri-urban and marginal land use.

The unplanned development of land around cities and the opening of new, often marginal, rural lands increases the number of people in areas without health delivery infrastructures. The reduced availability of reproductive health services in these areas increases the risks of maternal mortality and unwanted pregnancy.

Water availability. In poor countries and countries in transition with shrinking health budgets, lack of water or clean water at health facilities is a serious problem. Quality health care, including reproductive health care, is impossible without adequate supplies of clean water.

Seasonality burdens. Cases of many diseases increase when seasonal conditions favour their spread. This is true, for example, of

water-borne and insect-borne diseases during and after rainy seasons; and infectious diseases in cooler times when more people are indoors or in overcrowded schools. Pregnancies similarly may follow a pattern related to breaks in the agricultural work schedule or certain holidays, for example. These patterns affect the flow of visitors to clinics and hospitals. Improved flow management and staff training are required to maintain appropriate service quality, including sufficient time for counselling and follow-up, throughout the year.

EXPOSURE TO PERSISTENT ORGANIC POLLUTANTS

Pollution from emissions, industrial processes, fertilizers, pesticides and waste is exposing people to higher levels and a broader range of chemicals than ever before. Many chemicals that did not exist 50 to 100 years ago are now widely dispersed throughout our environment.

People are at the top of their food chain (living on agricultural products and on animals, birds and fish which themselves consume affected organisms, water and prey) and are exposed to concentrated levels of pollutants. Most of these chemicals have not been studied, either individually or in combination, for their health effects. Many questions remain about their possible impacts on early foetal and childhood development in particular.¹³

Developed countries, the major producers of the new substances, vary dramatically in their concern and attention to the issue. The European Community, for example, tends to take a more cautious approach to the regulation of new chemicals than does the United States.

Since 1900, industrialization has introduced almost 100,000 previously unknown chemicals into the environment. Many have found their way into the air, water, soil and food—and human beings. One category of these chemicals, endocrine disrupters, is now suspected as an important cause of human

reproductive disorders and infertility.¹⁴

An endocrine disrupter is a synthetic chemical that, when absorbed into the body, interferes with normal hormone function, sometimes altering the amount of hormones inappropriately, sometimes mimicking or blocking their action. This interference can undermine intelligence, decrease disease resistance, or impair reproduction.

Virtually every person on earth has been exposed to endocrine disrupters—through direct contact with pesticides and other chemicals or through ingestion of contaminated water, food or air. Many are persistent, accumulating in fat and other tissues, so human exposure may increase from eating fatty foods or contaminated fish.

Assumed endocrine-disrupting chemicals include some of the most commonly used substances in the developed and developing worlds. For example:

- **Phthalates**—plasticizers found in polyvinyl chloride, used in plastic bags and intravenous equipment, as well as in soaps, hair sprays, nail polishes and cosmetics.
- **PCBs**—formerly used in electrical equipment and still found in contaminated watersheds, landfills and other disposal sites.
- **Dioxins**—produced during waste incineration and by industrial processes such as paper production.
- At least 84 **pesticides**—some of the most common are DDT, lindane, vinclozolin, dieldrin, atrazine, 2-4 D (agent orange), 2,4,5-t, some pyrethroids and malathion. Many have been banned in the United States and Europe, but are still exported to and used in the developing world. In fact, pesticide use and human exposure are rapidly growing worldwide.

Research about the effects of these ubiquitous chemicals is not conclusive, but mounting evidence links

endocrine disrupters to a range of problems, including: infertility among women; miscarriage; declining sperm counts; testicular and prostate cancer; and other reproductive disorders such as hypospadias (malformed penises), cryptorchidism (undescended testes) and early puberty in girls; endometriosis; and breast, ovarian and uterine cancers. Children exposed in utero are more likely to suffer development problems and difficulties in learning or cognition.

Some recent research findings:

- A February 2001 University of North Carolina (U.S.) study found that foetal deaths are almost twice as likely among pregnant women in California farming communities who live near areas where certain pesticides were sprayed. Deaths appeared to be a result of exposure during the first trimester of pregnancy. These findings are relevant to developing countries where regulation of chemical application is less stringent and where even more dangerous chemicals banned in the developed world are still used in agriculture and disease control.
- A 1996 study in the Great Lakes region of the United States and Canada found that children born of women who had eaten fish from the lakes, which contain extremely high levels of PCBs, showed delayed motor development and dramatically lower levels of intelligence. PCBs are ubiquitous around the globe, particularly in poorer nations.
- In 1997 the International Association for Research on Cancer found high levels of dioxin in human breast milk in 29 of 32 countries studied, including France, Pakistan, the Russian Federation, the United States and Viet Nam. WHO has called for measures to control and reduce dioxin and other organochlorines in the environment to eliminate or minimize exposure.

- A controversial set of studies of U.S. girls points to a nationwide trend towards earlier and earlier puberty. Other studies show that girls exposed to high levels of PCBs and DDE (a product resulting from the breakdown of DDT) in utero entered puberty 11 months earlier than did those without such exposure.

Existing evidence points to the need for more extensive and rigorous testing of chemicals, as currently proposed by the European Union; effective “right-to-know” laws that inform individuals about the chemicals to which they are exposed; better detection of exposures; and reducing and eliminating exposure in the first place.

In an important step towards achieving the latter, the United Nations Treaty on Persistent Organic Pollutants, signed in May 2000 and set to go into effect when ratified by 50 countries, is intended to control or eliminate 12 toxic substances, all of which are endocrine disrupters.

HIV/AIDS AND THE ENVIRONMENT

The causes and consequences of the HIV/AIDS crisis are closely linked to wider development issues, including poverty, malnutrition, exposure to other infections, gender inequality and insecure livelihoods. The epidemic, with its direct and devastating impact on health and the family, complicates the problem of environmental protection, intensifies agricultural labour problems and adds to the burdens of women in rural settings.

The Food and Agriculture Organization of the United Nations has pointed to the impact of the epidemic on agricultural sustainability. Tenuous land rights and low access to resources already limit rural women’s choices. These disadvantages are heightened by the death from AIDS of male heads of farm households.

The loss of labour to the epidemic cripples the household. Infection rates are higher among women, who comprise most of the agricultural labour force, produce more than 80 per cent of household food and gather and manage other vital resources for their families.

The impacts are most severe in poorer communities, where farming is labour-intensive with little mechanization and few modern inputs. Land falls out of cultivation; tilling, planting and weeding are delayed; pests become more virulent. A farm may shift to crops needing less labour, and from cash to subsistence production. The loss of experienced farmers and agricultural extension workers deprives the community of their knowledge and management skills.

In severely affected areas, the numbers of surviving children and the elderly overload the community's systems of social support. Families are hard put to keep farms afloat, including their share of communal responsibility for land management, to feed and educate the children, or to care for the elderly. Loss

of the male landholder may put even the survivors' tenure in question.

The impact of the pandemic in urban centres limits prospects for development, including programmes for environmental protection. By killing workers in mid-life, including employees of productive industries and the public-sector workers such as doctors, nurses and teachers, the pandemic can negate a generation of investment in economic and social development.

BIODIVERSITY LOSS AND HEALTH

Most of the world's most effective pharmaceutical products have been discovered from compounds derived from plants or animals. These are frequently found in tropical climates, where biodiversity is greatest, and often in "biodiversity hotspots" subject to increasing human pressure.

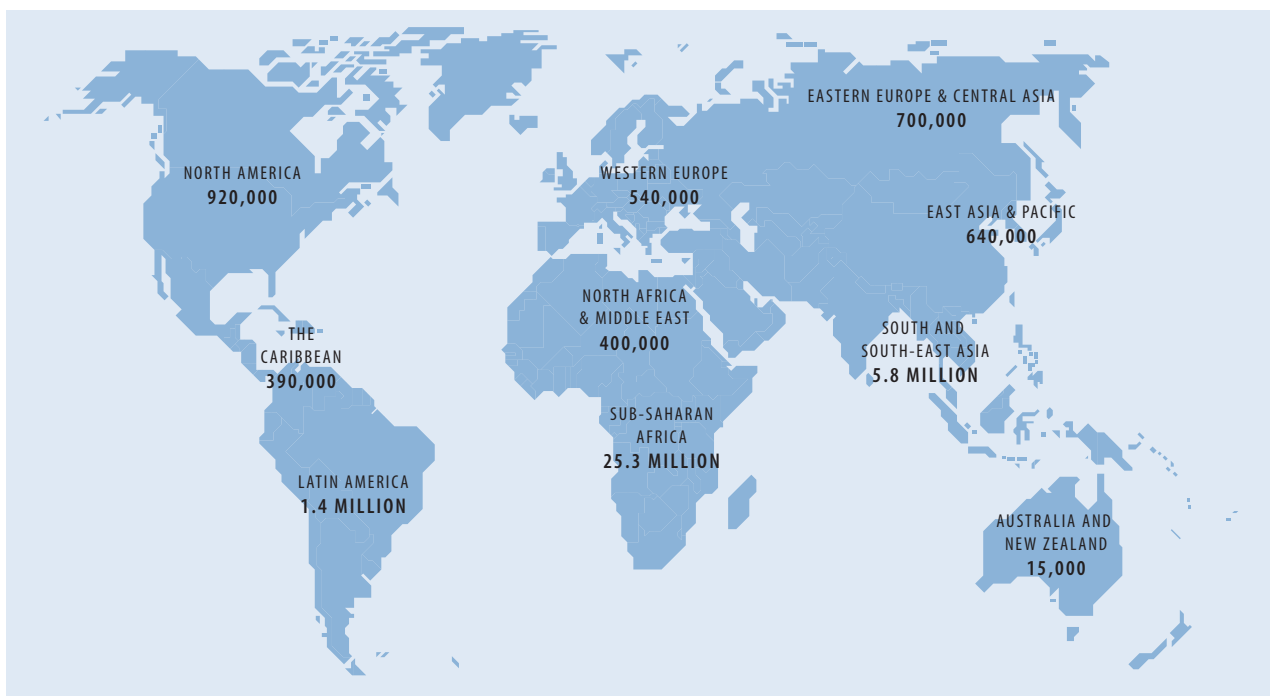
Decreased genetic variability in agricultural crops also increases the vulnerability of the food supply to

new pathogens. Resistance to pests and climate variation decrease without enough diversity in the strains of common food crops under cultivation. If crops were adversely affected, widespread hunger and disease would surely follow.

Ecologists have also rediscovered what many indigenous cultures and agriculturalists already knew—greater diversity among plants in a field can significantly increase their yields and resistance to pests. Population pressures, increasing consumption and the drive for cheap food have led to the intensification of agriculture. This change has often been achieved at the cost of a greater homogenization of cropping practices. Continuation of this trend could increase the risks to food security.

Great hopes have been placed on the development of genetically engineered crops suited to survive in difficult habitats (whether due to soil conditions, climate or pests). Slower population growth, consistent with the voluntary choices of women and men, could allow more time for the research, distribution

FIGURE 9: ADULTS AND CHILDREN LIVING WITH HIV/AIDS, DECEMBER 2000



Source: UNAIDS/WHO. 2000. AIDS Epidemic Update: December 2000. Geneva: UNAIDS.

and education efforts needed to ensure that such crops are safe and pose no long-term threats to sustainability; relaxing population pressure would also soften the blow of possible failures or reversals of progress.

EFFECTS OF CLIMATE CHANGE

There is no certainty about the effects climate change due to global warming might have on health, but what data there are suggest that countries should invest more in public health to meet possible hazards. Environmental change can increase the location, spread and intensity of insect- and water-borne diseases. Epidemics can develop when disease-carrying insects or animals reproduce out of control, or move to new locations where people have not developed immunities.

Higher temperatures may encourage insect hosts to breed and to move further up hillsides and mountains. They could also lead to changes in the geographical range

of insect hosts as previously cooler areas become more hospitable. Exposure of new populations without prior immunity could lead to virulent outbreaks.¹⁵

Temperature variation could also shift the timing of seasons and the seasonal transmission of diseases. Changes in the timing of seasonal activities (e.g., harvest or planting times) could interact in complex ways to shift exposures and risks related to disease.

Higher rainfall could trigger mosquito-borne disease outbreaks, increase flooding (spreading parasitic diseases), increase the contamination of water supplies with human or animal wastes and increase exposures to run-off of pesticides and other chemicals.¹⁶ Studies in a lake region of Kenya show that malaria, acute respiratory infections and diarrhoeal diseases increase dramatically two or three months after heavy rainfalls.¹⁷

Global warming will also increase the risks and danger of exposure to heat stress, especially in urban areas, which act as local heat traps because of their interference with air flow patterns, greater

reflective surface area and local heat generation.¹⁸

Extreme weather events have a variety of effects on reproductive health, including an immediate short-term decline in fertility. This is largely the result of postponement or cancellation of marriages, decreased frequency of sexual relations and an increase in temporary separations. Fertility may subsequently increase as couples take up postponed or interrupted relationships, or respond to improving conditions and hopes.

Disasters also disrupt health services as infrastructure, equipment and drugs are lost, access becomes more difficult, and other immediate priorities supervene. Reproductive health, including safe motherhood, is an immediate victim, since pregnancy is not regarded as an emergency and contraception is not given priority in relief efforts. Extended settlement in temporary shelters or refugee camps exposes women and girls to sexual abuse, sexually transmitted diseases and unwanted pregnancies.¹⁹



Geothermal plant in Iceland produces power without contributing to global warming. Climate change could increase outbreaks of various diseases.
Arnaud Greth, Still Pictures

CHAPTER 6

ACTION FOR SUSTAINABLE AND EQUITABLE DEVELOPMENT



*Tuareg nomad plants tree seedling as part of a reforestation project in Mauritania.
Jorgen Schytte/Still Pictures*

A NEW CONSENSUS

At one time, “development” was understood to mean improvements in economic indicators such as gross national product, brought about by investment, aid, and other economic actions, largely by developed countries. Concerns such as individual well-being, the status of women, the health of children, and the state of the environment were considered secondary.

Today, however, the international community recognizes that economic development; the state of the environment; the health of men, women, and children; and the status of women are all intricately intertwined. Development requires improvements in the lives of indi-

viduals, usually by their own hand, the status of women powerfully determines the state of development, and women require good reproductive health care for their status to improve.

This understanding has been articulated in consensus documents negotiated at a series of global meetings convened in the 1990s. These meetings dealt with environment and development in 1992, with population and development in 1994, and, in 1995, with social development and with women’s rights. The consensus agreements are grounded in a series of international human rights treaties, starting with the Universal Declaration of Human Rights (See Appendix).

MULTILATERAL ENVIRONMENTAL AGREEMENTS

Countries have entered into over 30 multilateral agreements addressing environment and the natural resource base. Arguably the most successful was the 1987 Montreal Protocol on Substances that Deplete the Ozone Layer, which mandated the phasing out of the manufacture and use of hydrochloroflourocarbon (HCFC) gases. After agreements on further details, two thirds of countries are on track to meet negotiated benchmarks. If current progress continues, the damage HCFC gases have caused to the atmosphere’s ozone layer could be reversed within 50 years.

Other agreements have addressed

hazardous waste management, oil pollution, desertification, endangered species, trade in ivory, fur seals, fisheries, tuna and whaling, among others. The most recent agreement (signed by 127 countries in May 2001 and up for ratification) seeks to stop or regulate the production and use of 12 specific persistent organic pollutants.

Agreements have had some success where technical and financial support has been mobilized, enforcement has been strict, loopholes under-exploited and political will strong. Many of the agreements, however, have not given due consideration to the how demographic trends will affect their implementation or to steps needed to empower and involve local people, particularly women, in finding solutions.

INITIATIVES LINKING POPULATION AND THE ENVIRONMENT

Around the world, a variety of organizations are engaged in activities that address both population and environmental concerns, by incorporating reproductive health information and services into existing environmental protection efforts, for instance, or including environmental education in reproductive health or population education programmes. Researchers are mapping the connections between a number of variables—environmental stress, fertility, migration, women’s health and education status, and the push/pull effects of economic decisions, for example. Partnerships and collaboration, among governments, international and local NGOs, international development agencies, and in some cases, the private sector, are increasingly important.

AFRICA

Burkina Faso, with assistance from UNFPA, has created a programme to increase awareness of sustainability issues, including population education, among school staff and trained 1,000 secondary school

teachers in use of the sustainability curriculum in secondary schools. One school has built a fish-breeding pond, a grove and a market garden, and created a project to measure pollution levels in regional waters and inform the public and authorities about its findings.¹

In **Kenya**, World Neighbors is working with farmers and village community development committees to increase awareness and use of family planning, prevent sexually transmitted diseases, and improve food security through training in seed selection, soil conservation and other aspects of agricultural production. World Neighbors has helped one community establish a pharmacy, promote the growth and conservation of indigenous fruit trees, and establish a community cereal bank.²

In **Madagascar**, one of the 26 global “biodiversity hotspots”, Conservation International, the World Wide Fund for Nature (WWF), Wildlife Conservation

BOX 13 RIO+10

Representatives of governments, United Nations agencies, multilateral financial institutions, the private sector and other major actors will meet in Johannesburg in September 2002 to review progress since the 1992 United Nations Conference on Environment and Development (UNCED) and spell out further actions and priorities.

The World Summit on Sustainable Development, also known as Rio+10, will examine efforts to define and implement national sustainable development strategies called for in the UNCED action plan, Agenda 21. It will also review national action to ratify various instruments related to the environment and development. These include conventions to ensure women’s rights and to prevent biodiversity loss, and agreements under UNCED’s Framework Convention on Climate Change and other multilateral environmental agreements.

The Rio+10 meeting will present an opportunity to incorporate the social agenda endorsed by the ICPD and other 1990s conferences into sustainable development initiatives—a chance to mobilize more political will, resources and action to foster sustainable development by empowering women, investing in human capital (particularly in the education of girls) and expanding and improving the quality of reproductive health services.

New issues that have emerged since UNCED will also be discussed, including advances in technology, biology and communications, and the impact of globalization.

Society, CARE International and UNESCO have participated in implementing integrated conservation and development projects around the Andohahela National Park, in partnership with a regional NGO, *Action Santé Organisation Secours* (ASOS). Family planning education and services, community-based health clinics and mobile health service units are being supported along with forest and water management, eco-tourism, beekeeping, training in improved rice production methods, and environmental education. The project has also trained environmental educators and conservation agents to link family planning and environmental messages. In place of the earlier message that population growth undermines conservation, educators now stress that child spacing is important to health—a link with more relevance to individual women and communities.³

WWF has also developed a broader, regional partnership with

ASOS, helping ASOS deliver primary health care and family planning services, along with environmental messages, in areas of the Spiny Forest ecoregion in the south of the country where population pressures are significant and deforestation considerable.

Another WWF initiative, using global information system technology, has mapped national population data with ecological data to determine linkages in the Spiny Forest among population growth, density and distribution (rural/urban) and forest cover levels.⁴ This work confirmed a relationship between low rates of female literacy and high population growth, and between high cattle densities and high losses of soil fertility. They also helped identify areas likely to experience high rates of deforestation, given migration and maize production patterns.

In **United Republic of Tanzania**, the Jane Goodall Institute is working to stem deforestation and soil erosion and meet local needs for health, education and employment in villages surrounding Gombe National Park where there is high population growth and little economic development. The Institute is teaching women to be more effective household and resource managers as well as entrepreneurs, providing conservation education in schools and villages, training women in planting and managing fruit and palm oil trees (nurseries now exist in 27 villages), establishing woodlots that reduce the distance women have to walk for fuelwood, and offering technical support in sustainable farming practices. In cooperation with regional health authorities, preventive health care, family planning services and HIV/AIDS education are offered in the villages surrounding Gombe, and a micro-credit programme provides women with loans to start small, environmentally sustainable businesses.⁵

ASIA

In the southern Himalayas of **Nepal**, the *Tamakoshi Sewa Samiti* project offers reproductive health counsel-

ling and care, environmental services, a micro-credit programme and other income-generating activities, including vegetable cultivation and sale, in 25 villages. Over 100 drinking water systems have been created, and more than 200,000 trees planted. Surveys in 1996 and 1998 found infant mortality in the project area to be 19 deaths for every 1,000 live births, compared to 79 nationally. Under five mortality is also lower: 38 per 1,000 children in the project area and 118 nationally. And contraceptive prevalence is higher: 36.2 per cent in the villages served vs. 26.5 per cent throughout rural Nepal.⁶

LATIN AMERICA

In **Ecuador**, CEMOPLAF, an Ecuadorian NGO, with support from U.S.-based World Neighbors, has joined reproductive health and family planning services with agricultural and resource management efforts in 20 poor, indigenous rural communities where homes are built on steep hillsides, making delivery of services a challenge. As a result, the number of farmers practising soil conservation has doubled, to 50 per cent, and use of modern contraceptive methods has increased from 12 per cent to 41 per cent; 65 per cent of the users of the project's agricultural management services are women.⁷

In the Maya Biosphere Reserve in northern **Guatemala**, Conservation International is working to meet reproductive health information and care needs in 16 communities where the fertility rate is nearly 40 per cent above the national average. The *Remedios* project began in 1998 and has trained 45 community-based midwives and 16 rural regional health promoters in reproductive health, including birth attendance, family planning, and prevention of STDs including HIV. Community-based contraceptive distribution programmes are being established in each community. Educational materials incorporate traditions of the region's indigenous and mestizo populations.⁸ In Guanajuato State, **Mexico**, the

Centro Para Los Adolescentes de San Miguel de Allende, an NGO working to improve adolescent reproductive health, runs a maternity and community health care hospital for low-income patients and also provides family planning counselling and contraceptives to rural communities. Environmental education and management—including construction of fuel-efficient stoves and latrines, reforestation, and preparation of medicinal herbs—have been integrated into in-school peer counselling.⁹ In 17 Mexican states, a government health agency, the Instituto Mexicano del Seguro Social, gives demonstrations on herb and vegetable garden cultivation, use of fuel-efficient wood stoves, composting and other environmentally friendly technologies at its comprehensive reproductive health clinics.¹⁰

NORTH AMERICA

The World Wildlife Fund (as WWF is known in the United States) is working to mitigate the impacts of rapid growth around Nashville, Tennessee, and Birmingham, Alabama, on river ecosystems.¹¹ In the wake of a summer 2000 drought that dried up portions of the Cahaba River, the source of drinking water for Birmingham and its fast-growing suburbs, WWF is sponsoring a study of the river's nutrient levels and how they affect threatened and endangered aquatic life, including fish and mussels.

The drought led to severe water rationing and higher nutrient levels in the Cahaba—devastating to the river's species. These high nutrient levels stemmed from lax state water quality standards and poorly designed sewage treatment plants.

Results will be used to encourage Alabama to develop policies and standards on nutrient levels that will minimize the impacts of human population growth on the Cahaba River ecosystem. WWF is also partnering with a Tennessee-based conservation group to establish voluntary standards and best-management practices that contrac-

tors can use to protect aquatic biodiversity by reducing sediment that enters streams from construction of new homes, businesses and roads.

NEEDED RESOURCES AND TECHNICAL ASSISTANCE

As the 1994 International Conference on Population and Development emphasized, “Efforts to slow down population growth, to reduce poverty, to achieve economic progress, to improve environmental protection, and to reduce unsustainable consumption and production patterns are mutually reinforcing.”¹² Mobilizing the resources needed to implement the ICPD Programme of Action is therefore a key action to protect the environment, as well as to promote women’s rights and sustainable development.

The ICPD estimated the annual resources needed to implement a basic package of population and reproductive health programmes in developing countries.

Reproductive health and family planning programmes were estimated to require \$15.2 billion in 2000, rising to \$19.9 billion in 2015. Selected HIV/AIDS prevention efforts were estimated to require \$1.3 billion in 2000 and \$1.5 billion in 2010 and 2015. Basic research, data and policy analysis were estimated to average over \$400 million per year between 2000 and 2015 (varying widely in relation to the timing of censuses).

Total requirements were estimated at \$17.0 billion in 2000 and \$21.7 billion in 2015. Up to two thirds of these costs were expected to be met by developing countries, with the remainder to come from international development assistance.

These estimates included some HIV/AIDS prevention; it was recognized that additional funds were needed, including funds for treatment and care of people living with HIV. However, the epidemic has advanced faster and farther than the ICPD anticipated, and consider-

ably more resources will be required to ameliorate the impact.

Other reproductive health service needs remain substantial as well. Maternal mortality has not declined at the rate proposed at the ICPD. Just under half of all births are still not assisted by a trained birth attendant. Funds are needed for transport in difficult cases and emergency obstetric care. There is also recognition of the need for higher priority to programmes for adolescent sexual and reproductive health, and the incorporation of men as clients and supportive partners in reproductive health care.

Estimates of resources needed to expand reproductive health services reflect projected increases in contraceptive demand. These were based on the growing number of people of reproductive age and continued reductions in unmet need—the number of women and couples who wish to delay or prevent a birth but are not using contraceptives.¹³ At the five-year review of ICPD implementation, a new goal was set—elimination of unmet need by 2015. This will require further resources and national and international effort.

Eliminating unmet need involves more than physical access to services. Many women do not practise contraception due to fears of side-effects of available methods, cultural concerns related to specific methods (e.g., changes in menstrual bleeding) or the disapproval of

BOX 14

ENSURING AVAILABILITY OF REPRODUCTIVE HEALTH SUPPLIES

In September 2000, UNFPA launched a new global strategy to counter a global shortfall in reproductive health commodities including contraceptives and condoms for HIV/AIDS prevention. The strategy is designed to build national capacity and sustainable approaches to contraceptive supply and delivery through public, private and non-governmental partnerships. The Netherlands and the United Kingdom have each provided nearly \$40 million to support the effort.

spouses or communities. Addressing these concerns will require investments to make a wide range of method choices universally available, support research to reduce side-effects of existing methods, and provide better training of counsellors.

ASSESSING THE COSTS OF INACTION

Resources available for reproductive health and population programmes are well below the \$17 billion the ICPD said would be needed in 2000. While developing countries are providing most of their share of needed resources, support from international donors is less than half of the \$5.7 billion called for in 2000.

Shortfalls in resources for population have also started to affect data collection and research efforts, which are needed to allow countries to assess the impacts of development policies, monitor progress and prioritize programming.

The funding shortfall is already showing its effects: fertility declines have been slower than would be expected if more couples and individuals could have the family size they desire. The costs of delaying action will increase rapidly over time.

ENVIRONMENTAL PAYBACKS FROM POPULATION-RELATED INVESTMENTS

Programmes addressing population issues, women's empowerment, poverty eradication and environmental protection have important benefits; progress has been made in quantifying some of these. Policy makers need information on the returns to their investments in such programmes to set priorities for resource allocation.

Environmental returns from policies and investments in the social sector cannot be predicted with much precision, because of the difficulty of predicting the demographic, social, and economic consequences of a given policy and its interaction with other factors. For example, better female education is known to be closely linked with a range of social and economic benefits, but it is hard to be specific about how better education might change female labour force participation or economic growth rates.

Research in this area has focused primarily on policies that tend to reduce fertility, where the resulting slowing of population growth is seen as easing human stress on the environment. Some studies have tried to estimate the additional environmental impact of a single birth and its descendants. Others have contrasted the expected environmental impacts associated with diverging demographic scenarios.

ENVIRONMENTAL 'EXTERNALITIES' TO CHILD-BEARING

An "externality" is a cost or benefit to society at large of an action taken by an individual. The concept is most commonly applied to economic activity. For example, if a factory pollutes a river and the owner is not held responsible, the environmental cost to society is

"external" to the owner's decision about how much to produce, and therefore how much pollution is produced.

Externalities can also be positive. For example, investment in research and development in one industry can benefit other industries. If investors cannot capture these benefits, it will lead to underinvestment in research and development. Externalities are a useful guide to policy-making; in the examples used here, they might motivate a tax on pollution or public investment in research.

The externality concept can also be applied to child-bearing.¹⁴ The birth of an additional child results in costs and benefits to society, above and beyond those considered by the parents. Possible external benefits include a larger tax base to help pay for public pensions to the elderly or to share the costs of goods like national defence whose costs are relatively insensitive to population size. External costs might include additional public expenditures on education or health care, or a per capita reduction in the value of national assets like fishing or mineral rights.

A number of recent studies have estimated environmental externalities to child-bearing, all using global climate change as an illustrative example. While results vary widely, on balance they indicate that, in addition to other positive development impacts, environmental benefits from policies leading to lower fertility may rival the costs of the policies themselves.

The activities of each person, and their descendants, give rise to greenhouse gas emissions through direct or indirect use of energy and land. Each birth averted—all else being equal—may reduce the cost of climate change to society in two ways. First, total greenhouse gas emissions may fall, reducing the magnitude of future climate change and the resulting damage to society. Second, smaller populations should make it easier to comply with caps on emissions like those envisioned for industrialized countries by the

Kyoto Protocol to the Framework Convention on Climate Change.

Estimates of the climate-related costs of child-bearing range from several hundred to several thousand dollars per birth.¹⁵ Their values depend on a wide range of factors. For example, a birth in a developing country where per capita greenhouse gas emissions rates are relatively low has, on average, a smaller impact than a birth in an industrialized country where per capita emissions are higher. For example, a birth in Africa might lead to climate-related costs of about \$100, while a birth in the United States might lead to costs of about \$4,000.¹⁶

Since the future costs of an additional birth are spread out over time—decades or even centuries—analysts must decide how much to value future costs relative to costs today. Future costs are generally discounted, but the appropriate discount rate is controversial. One study¹⁷ found that if a typical discount rate of 3 per cent per year were used (which reduces the cost to each succeeding generation by nearly half), the externality associated with a birth in the developing regions would be about \$300. However if costs were valued equally in all years, the total externality would exceed \$4,000 by the year 2100.

Other assumptions affecting the outcome include future emissions reduction requirements, the cost of reducing emissions, and projected population growth. Despite these uncertainties, it is clear that the costs of an additional birth will be substantial. One reason is that stabilizing the atmospheric concentration of greenhouse gases will eventually require steep and expensive emissions reductions,¹⁸ while a smaller future population size would inevitably reduce the need for the most expensive reductions.

In comparison, the costs of social programmes, when converted into estimated costs per birth averted, are generally in the range of several hundred dollars or less. For example, one estimate¹⁹

puts the cost of education programmes in developing countries at less than \$200 per birth averted. Estimates for voluntary family planning programmes range from \$30 to \$330 per birth averted.²⁰

Expressing programme costs in per birth terms does not imply that fertility reduction is, or should be, their main objective.²¹ It simply provides a means to compare costs of an easily measurable component of comprehensive reproductive health programmes with potential environmental benefits. While there is considerable uncertainty in such estimates, it appears that costs are, at most, roughly the same as, and possibly less than, their potential climate-related returns.

Climate change lends itself to population externality studies because it is long-term, the impacts of emissions are independent of their geographical origin, and integrated economic-environmental models of the problem have been developed for two decades. Other environmental issues are much more dependent on regional particularities. For example, the effects of air pollution depend very much on local climate conditions, other pollutants in the air, and the characteristics of surrounding ecosystems and human populations.

ALTERNATIVE SCENARIOS

A number of studies have analysed the likely impact of population-related policies on climate change by comparing alternative future scenarios. Here again the focus has been on the demographic consequences of population policy rather than broader economic and social consequences. Models of energy use and greenhouse gas emissions have been used to compare likely results under alternative population scenarios. These studies also indicate that policies resulting in more rapid demographic transition are likely to significantly reduce greenhouse gas emissions in the long run.

Some analyses start with a set of alternative scenarios for four broad factors which together determine

BOX 15

MORTALITY DECLINE AND FERTILITY DECISIONS

As infant and child mortality has declined, so has the "insurance effect"—parents having more children than they want to make sure they have living children to support them in their old age. But local mortality decline is not obvious to individuals, and there is a time-lag before people recognize and act on it. And many parents remain concerned about support in their old age; this uncertainty may lead to a resurgence of the insurance effect.

Increases in infant and child mortality related to worsening environmental conditions will increase personal insecurity and could affect family-size decisions.

carbon dioxide emissions: population, economic output per person, the amount of energy required to produce a unit of economic output, and the amount of carbon release per unit of energy used. Central "best guess" assumptions for the last three factors are considered with a range of scenarios for population, to calculate how much difference the variation in population paths makes to total carbon emissions. This result is then compared with similar sensitivity analyses on other variables.

Studies of this kind invariably conclude that emissions are most sensitive to assumptions about growth in per capita output, along with factors such as the carbon content of energy in industrialized countries. Population is found to be a major contributor to emissions over time frames of 50 years or more.²²

The results depend on how different the alternative scenarios are from the central assumptions. If it is assumed that population is unlikely to differ substantially from the central path, then emissions will not appear to be sensitive to population.

On the other hand, holding other variables equal when considering alternative population paths may ignore important interactions between demographics, economic conditions and technological development. In particular, slower population growth may stimulate eco-

nomical growth, leading to increased emissions that would offset reductions predicted by a simple population/emissions analysis.

However, a study²³ examining historical data on population, income, and emissions found that, controlling for economic and technological conditions, population size did in fact appear to have a roughly proportional effect on emissions. Other studies have found that the relationship between population growth and economic growth would have to be implausibly strong to alter the basic conclusions of simpler analyses.²⁴

CHANGES IN AGE STRUCTURE

Few analyses consider the effects of population ageing on future consumption and emissions. As populations grow older, the average household size tends to fall. Smaller households use energy at a higher rate per person than larger households use. Models based on numbers of households project higher carbon emissions than those based on numbers of people, as much as 30 per cent higher by 2100.²⁵ But even such studies conclude that a more slowly growing population will lead to a substantial reduction in emissions.

Ageing may also influence emissions by affecting economic growth. There is a general consensus that an ageing population will place considerable strains on public pension

and health systems.²⁶ Researchers have found little evidence, however, that an ageing work force would be less productive than a young one.²⁷

Analysis of recent experience in Asia supports the view that changes in age structure can have considerable impacts on economic growth.²⁸ When the labour force must support many dependants (children and elderly), savings and economic growth rates are depressed. When fertility declines, workers may have fewer dependants to support, leading to a window of opportunity during which savings can increase, stimulating economic growth—if the country has an economic and institutional environment that allows it to take advantage of the opportunity.²⁹ Over time, as the population grows older, the ratio of dependants to workers will increase again, ending the conditions that can provide an economic bonus.

In East Asia, for example, a rapid decline in the dependency ratio since 1975 is likely to have contributed substantially to the region's rapid growth.³⁰ Slower falls in fertility and dependency ratios in South and South-east Asia have contributed to more moderate economic growth. In South Asia and South America, economic activity in 2025 could be 25 per cent higher than would be expected without considering age structure effects. In Sub-Saharan Africa, this "demographic bonus" could be up 50 per cent.³¹ Dependency ratios are likely to begin rising again in East Asia in 2010, and in South and South-east Asia by 2030, leading to slower growth.

The fact that policies that tend to lower fertility are also likely to substantially reduce climate change costs does not mean that slowing population growth is the most effective or most equitable means of mitigating climate change. Reductions in per capita emissions can be made through a variety of means, and are generally considered the most important and direct measures for reducing future emissions.

Nonetheless, slower population growth would make the climate problem easier to solve, and capturing these long-term benefits requires investments in population policies in the immediate future.³²

RECOMMENDATIONS FOR ACTION

Additional investments are needed to foster positive synergies in population, environment and development trends. Some priority actions are outlined below.

1. Implement the global consensus agreement of the International Conference on Population and Development.

The ICPD in 1994 reached agreement on action in the area of population and development; to promote sustainable economic growth, guarantee human rights, including the right to reproductive health, and protect the environment on which all life depends. The drive for full implementation will give an impetus to economic and social development that will directly and indirectly promote sustainable development and improve the quality of life of everyone.

Promoting women's social, economic and political participation advances human rights and equity, increases investment in health and education, strengthens civil society institutions, promotes economic growth, accelerates the stabilization of the world population and reduces pressures on natural resources. Ensuring women's participation in the design, implementation and monitoring of programmes is crucial.

Access to reproductive health services—including family planning, safe motherhood, and prevention of sexually transmitted diseases including HIV/AIDS—needs to be expanded, particularly on the frontier of development—including migrant communities and underserved urban and peri-urban settle-

ments, and in sensitive ecosystems—where they have been historically lacking, and to local groups active in environmental management.

Securing reproductive health and rights will enhance efforts to provide women with education and employment opportunities. This will benefit both individuals and society. Educated women have more options—in employment, marriage and child-bearing—and more control over their lives. They also tend to have fewer children, and the children they have are healthier and better educated, planting the seeds for generations to come.³³ Similarly, increasing women's economic opportunity and control of assets like land and credit is a key step in working towards gender equity and equality, and a clear route out of the cycle of poverty, high fertility and powerlessness that continues to afflict women throughout the world.

Slowing population growth by meeting the ICPD's goals would also provide essential time to find solutions to environmental problems—to, for example, bring on line and make widely available less-destructive sources of energy than fossil fuels and forest-cutting; to expand crop yields in environmentally sustainable ways; to provide clean water and sanitation to all who need it while not harming the water table or underground aquifers; to develop and share "green" consumer products that are less materials- and waste-intensive; and to both mitigate wasteful consumption patterns and increase the consumption levels of the billions of people whose basic needs are still not met.³⁴ Slower population growth would also give governments and civil society more time to plan for the needs of coming generations for health care, education, employment, sanitation and housing, along with clean environments.³⁵

And the beneficial effects will multiply and accelerate if action to achieve slower population growth is combined with direct interven-

BOX 16
VALUING ECOSYSTEMS

Over the past decade, much work has been devoted to coming up with a way to put a price tag on ecosystems. Natural resource accounting has progressed to such an extent that some countries, including Sweden, Norway, Germany and the Netherlands, are attempting to take account of resource depletion when measuring GDP. Still, valuing ecosystems remains very controversial.

One of the most comprehensive studies estimated that the world's ecosystems provide goods and services worth at least \$33 trillion a year, of which 63 per cent or \$21 trillion is contributed by the world's oceans. Over half of the oceans' contribution to planetary wealth is accounted for by coastal ecosystems, such as mangrove swamps, coral reefs and sea-grass beds.

Though there is little agreement among the scientific community on the "value" of ecosystem services and natural capital, these estimates nonetheless illustrate the relative magnitude of these resources. More importantly, economists and planners can at least get a rough idea, in economic terms, of what they are losing through non-sustainable development.

Source: R. Costanza, et al. "The Value of the World's Ecosystem Services and Natural Capital." *Nature* 387:253-260, 1997.

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tions to support the environment, like conservation of key areas of biodiversity; increased protection for threatened species; promotion of organic agriculture; reductions in excess consumption by individuals and institutions; policies that limit pollution and waste; and development of "green taxes" and elimination of environmentally destructive subsidies.³⁶

2. Provide incentives for the dissemination, further development and use of more sustainable production processes.

Neither industrial nor developing countries make full use of available lower-impact "green" technologies in agriculture and industry. Extraction of mineral wealth is also accompanied by environmental destruction, which offsets at least part of its value.

No agreed standard exists for assessing environmental costs, partly because of the long time frames involved and partly because the costs are diffused in complex ways. Transition to sustainable

technologies is often seen as costly and disruptive, and the benefits are discounted as slow or uncertain. Even when the environmental cost clearly outweighs transition costs, developing countries face resource constraints.

Combining subsidies with standards for industries and communities can amplify the economic signals that already promote cleaner and more-efficient production. Many developing countries and countries in transition need stronger fiscal and political structures to allow this process to operate. In other countries, however, competitive pressures are already stimulating producers and governments to promote more environmentally friendly policies. Subsidies that encourage environmental should be ended.

Providing countries with the information and technical assistance needed to adopt new technologies could significantly improve health, productivity and environmental quality at relatively low cost.

In developed countries, policy

makers and the public need to be better informed of the local and global impacts of their production technologies and consumption choices, and the benefits gained from supporting sustainable development in developing countries.

Both consumers and producers need the incentives and options to move towards sustainable, less environmentally harmful consumption patterns.³⁷ Goods and services should be produced in harmony with natural systems (e.g., products made from sustainably grown natural resources).

Environmental taxes—charging for pollution, congestion and depletion—have proved highly effective in both industrial and developing countries. Swedish air pollution taxes, Malaysia's effluent charges and Singapore's automobile taxes are well established and effective.

The greatest benefits would come from a shared North-South commitment to a sustainable world, with the industrialized countries accepting their share of responsibility for the consumption/environment dilemma and taking steps to mitigate it, both at home and abroad, through partnerships with developing nations.³⁸

Among the major components of such an effort would be³⁹:

- **Ensuring minimum consumption requirements and basic social services for all, as an explicit policy objective in all countries.**
- **Developing and using technologies and methods that are environmentally sustainable for both poor and affluent consumers, including products that have low impacts, and clean energy sources (e.g., solar power and hydrogen fuel cells) in place of fossil fuels.⁴⁰**
- **Promoting awareness about the content and ecological and social impacts of goods, so consumers can make informed choices about what they buy.**

BOX 17
PROGRESS SINCE THE ICPD

A 1999 review of progress in implementing the Cairo agreement ("ICPD+5") found that the goals and approach of the International Conference on Population and Development remained valid, that many governments had made changes in their health and population programmes to conform more closely with the Cairo emphasis on individual choices and rights, that a handful of issues had grown in importance since 1994, and that funding was falling alarmingly short of hopes and goals expressed in Cairo.

In the five years after the ICPD, almost half of all countries reviewed their policies in light of the Programme of Action's new approach; more than a third revised their population policies to be consistent with the ICPD or integrated gender or health issues into their development plans; and two thirds launched gender equity or women's empowerment measures.

After decades of numerical population and contraceptive targets, India abandoned them in 1996 and adopted a policy of decentralized programmes with a reproductive health approach. Gaps remain between rhetoric and practice, but the policy change is significant. Brazil, building on a pre-Cairo women's health care programme, stepped up its attention to sex education in schools, adolescent health, post-abortion care, and reducing the country's heavy reliance on sterilization. Nigeria is working to bring sexuality education and reproductive health education and services to adolescents.

Civil society groups, particularly women's organizations, are working to make reproductive health programmes more women-centred and creating them where none existed before.

Despite this progress, illness and death from pregnancy and reproductive disorders continue to compromise women's lives; hundreds of millions of women do not have access to high-quality reproductive health care or, indeed, any reproductive health care at all; unsafe abortions kill 70,000 women yearly; violence against women pervades most societies; HIV/AIDS infection rates are rising alarmingly; the reproductive health needs of adolescents are widely unmet; and international development assistance has fallen.

In the "Key Actions" document adopted at the review session, governments reaffirmed their commitment to the principles, goals and objectives of the Programme of Action, while putting somewhat more emphasis on reproductive health information and care for adolescents; the HIV/AIDS epidemic; the need to ensure the safety and accessibility of abortion services where those services are not against the law; and access to the widest range of contraceptive methods, including "new options and underutilized methods."

The document also called on governments to ensure that structural adjustment programmes take environmental concerns into account; strengthen infant and child health programmes by, among other things, attending to clean water, reducing exposure to toxic substances and improving household sanitation; and improve food security—actions intertwined with the health of the natural environment.

Source: Key Actions for the Further Implementation of the Programme of Action of the International Conference on Population and Development, adopted by the 21st Special Session of the General Assembly, New York, June 30–July 2, 1999 (New York: United Nations, 2000).

- **Strengthening international agreements on managing consumption's global impacts**, including ratifying accords on climate change and biodiversity—and ensuring sufficient funding to implement them effectively.

3. Improve the information base for more-sustainable population, development and environment practices.

Policy priorities can be clarified when needs are documented and the returns for particular interventions and costs of inaction are clear. Information about available resources can speed implementation.

Better information about the true environmental costs of development activities and production methods, and the incorporation of some externalized costs into prices, would enable managers, policy makers and consumers to make decisions that are both economically and environmentally sensible. Subsidies protecting wasteful or destructive resource use could be eliminated and subsidies promoting sustainability could be advanced.⁴¹

For example, providing water at low prices for industries, which then return polluted water to the environment, has multiple negative effects. Low prices encourage wasteful use; the costs of pollution are

paid by other industries dependent on clean water and eventually by the community in health losses; and the costs of clean-up are passed on to succeeding generations.

Economic analyses of population and reproductive health programmes have consistently found very favourable returns. Such analyses need to be improved, to include the returns from better education, lower infant, child and maternal mortality, poverty reduction, and greater economic and social participation by women.

- **Databases for population and development planning need to be further developed.** These should

include indicators of population levels and dynamics, and the use, availability and distribution of general medical and reproductive health services, clean water, sanitation and energy.

- **Community members should be involved in collecting local data** on environmental conditions, resource use and service availability. One benefit of such efforts will be to incorporate local perspectives into programme monitoring.

The United Nations is helping to develop worldwide databases on environmental conditions. Indicators for monitoring the balance between population growth and development, including environmental impacts, have been adopted as part of the Common Country Assessment procedure for more coordinated assistance to developing countries.

Regional monitoring programmes can measure the impacts of resource use and pollution that cross national boundaries. Population and envi-

ronment ministries, NGOs and agencies need to share information and improve coordination to attain their common goals.

- **Global information systems (GIS)** are being increasingly used to monitor changes in land use, resource availability and population distributions. Increased investment in these technologies will greatly advance understanding of environmental trends, vulner-

able areas and the relations between population and the environment.

- **Modelling methods for population and environmental dynamics** need to be further developed in the light of new information and improved computing technology. The Threshold 21 (T21) model, supported in part by UNFPA, has helped governments highlight key population, economic and environmental relationships.⁴²

Studies of land use choices and environment impacts will also provide information for formulating strategies to improve resource use.⁴³

4. Implement internationally agreed actions to reduce poverty and promote social development.

There is a global consensus on some key elements for progress: encouraging local participation in decision-making; addressing equity concerns, including gender equity and income differentials; and creating partnerships that include the private and the public sectors, NGOs and other representatives of civil society.

Rural development policies can reduce rural-to-urban migration and help mitigate the environmental impact of new rural settlements. Changes in land tenure policies can ensure equity, reduce resource and migration pressures and limit the clearing of new land for agriculture.

BOX 18

DONORS SUPPORT ENVIRONMENTAL ASSESSMENT

In June 2001, the United Nations Foundation announced it would contribute \$4 million to assess environmental damage from rapid consumption of natural resources, joining a coalition that includes the World Resources Institute (a major organizer), the Global Environment Facility, the David and Lucille Packard Foundation and the World Bank. The United Nations Environment Programme will coordinate project activities. The project is expected to cost \$21 million; \$17 million is already pledged. It is hoped that voluntary contributions from the international science community will make up the difference.



*Workers with different rice varieties at rice research institute in Viet Nam.
Jorgen Schytte, Still Pictures*

APPENDIX: GLOBAL AGREEMENTS ON HUMAN RIGHTS, ENVIRONMENT AND DEVELOPMENT, REPRODUCTIVE HEALTH AND GENDER EQUALITY

HUMAN RIGHTS TREATIES

The international consensus agreements of the 1990s, themselves advisory rather than binding, are grounded in legally binding human rights treaties: the Universal Declaration of Human Rights (adopted in 1948); the International Covenant on Civil and Political Rights (which entered into force in 1976); the International Covenant on Economic, Social and Cultural Rights (1976); the Convention on the Elimination of All Forms of Discrimination against Women of (1981); and the Convention on the Rights of the Child (1990).

All member states accede to the Universal Declaration of Human Rights, which affirms, "All human beings are born free and equal in dignity and rights." The Declaration also refers to "the dignity and worth of the human person and ... the equal rights of men and women."¹

About two dozen specific rights are named, from the right to life, liberty, and security of person through legal and judicial rights to the right to education and work.² The Declaration also calls for social security and conditions that allow an individual to realize economic, social and cultural rights necessary to dignity and for a standard of living adequate to one's health and well-being.³ Declaration language also specifies that "everyone is entitled to all the rights and freedoms set forth in this Declaration, without distinction of any kind," including sex.⁴

The Covenant on Economic, Social and Cultural Rights states that every human being has the right to "freely determine their political status and freely pursue their economic, social and cultural

development", and that states must ensure that men and women enjoy these rights equally. The Covenant also recognizes people's rights "to be free from hunger," to be educated, and to enjoy "the highest attainable standard of physical and mental health." To achieve the latter, the Covenant lists, in addition to prevention and treatment of disease and the provision of medical services, "improvement in all aspects of environmental and industrial hygiene," an early reference to the link between the environment and health.⁵

The International Covenant on Civil and Political Rights states that protection of laws and freedom of expression apply equally to women and men. It states that every citizen, without regard to sex, has the right to take part in public affairs, to vote, to be elected, and to have the opportunity "on general terms of equality to public service".⁶

The Convention on the Elimination of All Forms of Discrimination against Women (CEDAW), which had 168 states parties as of June 2001, constitutes an international bill of rights for women. Referring to pre-existing treaties that call for "the equal rights of men and women to enjoy all economic, social, cultural, civil and political rights," the Convention declares that "the full and complete development of a country, the welfare of the world and the cause of peace require the maximum participation of women on equal terms with men in all fields."⁷

In addition to dealing with unequal treatment of women in law, cultural patterns of discrimination, women's rights to participate in public life, equality of educational and employment opportunities,

discrimination against women in the provision of health care, and the special problems of women in rural poverty, CEDAW refers to women's reproductive rights. The education article refers to access to "information and advice on family planning;" articles on health care, rural development, and equality in marriage also mention family planning services. The last states that women are to have "the same rights to decide freely and responsibly on the number and spacing of their children and to have access to the information, education and means to enable them to exercise these rights".⁸

In the article on women in rural areas, CEDAW makes an oblique reference to the environment when it calls on states to ensure that rural women "enjoy adequate living conditions, particularly in relation to housing, sanitation, electricity and water supply, transport and communications."⁹

In December 2000 the "Optional Protocol" to CEDAW went into force. This instrument establishes communication and monitoring procedures to advance implementation of the Convention. As of June 2000 there were 67 signatories and 21 states parties to this mechanism.

UN CONFERENCE ON ENVIRONMENT AND DEVELOPMENT

Heads of state met in Rio de Janeiro in 1992 to make a broad inquiry into environmental degradation, which had become increasingly important to the international community since the 1960s both on their own terms and as a constraint on development. The United Nations Conference on Environ-

ment and Development (UNCED) was the 20-year follow-up to the first global meeting on the environment, held in Stockholm in 1972.

Rio linked environment and development as international agreements had not done before. The watchword was “sustainable development”, economic development to meet the needs of current generations without undermining the environment and compromising future generations’ ability to meet their needs. Rio also declared that both poverty and wealth stress the environment, that industrial societies must lessen their environmental impact through “sustainable patterns of production and consumption,” and that developing countries need assistance in building their economies to be environmentally benign.¹⁰

In addition to conventions on forests, climate change, and biological diversity, Rio produced a comprehensive guide to sustainable development, Agenda 21. Faced with “worsening poverty, hunger, ill health, illiteracy, and the continuing deterioration of ecosystems,” this document asserts, “the only way to assure ourselves of a safer, more prosperous future is to deal with environment and development issues together in a balanced manner.”¹¹

Agenda 21’s four main sections deal with social and economic dimensions of sustainable development, conservation and management of resources, strengthening the role of major groups in sustainable development, and implementation.

Nine paragraphs in the first section address “Population and Sustainability”. They state that “the world’s growing population and production” increasingly stress the earth’s resources; urge development strategies that deal with the combined effects of population growth, ecosystem health, technology, and access to resources; urge the development of “population goals” and the integration of population concerns into national strategies for sustainability; call for coun-

tries to calculate their “national population carrying capacity;” state that “sustainable development will require reproductive health programmes to reduce maternal and infant mortality, and provide men and women with the information and means to plan family size”; and declare that population programmes require broad support as well as “adequate funding, including support to developing countries”.¹²

A chapter on women in the section on “major groups” states that “women have considerable knowledge and experience in managing and conserving natural resources,” but “discrimination and lack of access to schooling, land and equal employment” have constrained their role in achieving sustainable development.¹³ It calls on governments to:

- Eliminate legal, cultural, social, and other barriers to women’s full participation “in sustainable development and public life”.
- Increase women’s participation in environmental decision-making as officials, scientists, technical advisers and extension workers.
- Improve women’s education from illiteracy eradication to post-secondary study in the sciences.
- Create conditions to enable women to play an enhanced role in sustainable development, such as better health care—including maternal and child health care and family planning—a reduced workload, better access to credit, property rights, eliminating violence against women and counting unpaid work in official economic measures.
- Educate women, particularly in the industrialized world, to engage in environmentally sustainable consumption.¹⁴

While Agenda 21 links population growth and resource use, and recognizes women’s role in the environment and their need for education, health care and credit, the population section is mainly demographic in focus and lacks the

broader reproductive health and women’s rights approach to population adopted at the ICPD two years later.

INTERNATIONAL CONFERENCE ON POPULATION AND DEVELOPMENT

The ICPD Programme of Action, negotiated in Cairo in September 1994, is a far-reaching yet practical roadmap for expanding individual choice, by making critical investments in reproductive health care and education, providing expanded economic opportunities for women, and creating the conditions—legal, political, social and economic—for true gender equality and equity. The Conference recognized that these actions are both just and humane in their own right, and if implemented would also contribute to stabilizing population and advancing environmental security.

The Programme specifies that “reproductive health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity, in all matters relating to the reproductive system and to its function and processes.” Reproductive rights “embrace certain human rights that are already recognized in national laws, international human rights documents and other consensus documents.”¹⁵

One of the principal goals of the Programme of Action is ensuring universal access to reproductive health care as soon as possible, and by 2015 at the latest. Essential components of reproductive health care include: family planning; maternal health; preventing abortion and managing the complications of unsafe abortion; preventing and treating sexually transmitted diseases, including HIV/AIDS; and eliminating traditional practices like female genital mutilation that harm women’s reproductive health and well-being.

Also central to the ICPD approach is the collection of rights, defined in the human rights treaties, that will permit women to

realize their dignity—economically, socially, and culturally. “The empowerment and autonomy of women,” the Programme states, “is a highly important end in itself. In addition, it is essential for the achievement of sustainable development.” It adds, “Experience shows that population and development programmes are most effective when steps have simultaneously been taken to improve the status of women.” Thus the Programme of Action calls for education for women and girls, access to “secure livelihoods and economic resources,” and full participation in public life.¹⁶

Chapter III of the Programme of Action deals with the interactions among population, economic growth and sustainable development. This chapter reinforces many of the principles articulated at UNCED. “Meeting the basic human needs of growing populations is dependent on a healthy environment,” it notes. The document avoids demographic targets or goals, and stresses that poverty and gender inequities affect and are affected by population growth, age structure and distribution. In turn, it states, “unsustainable consumption and production patterns” overuse natural resources, degrade the environment, and reinforce gender inequality and poverty.

“Integrating population into economic and development strategies,” the agreement adds, will accelerate progress toward sustainability, alleviating poverty, slowing population growth, and improving quality of life. And it calls for “implementation of effective population policies in the context of sustainable development, including reproductive health and family planning programmes.”¹⁷

FOURTH WORLD CONFERENCE ON WOMEN

The Platform for Action adopted in 1995 at the Fourth World Conference on Women in Beijing built on the progress achieved in Cairo a year earlier. It reaffirmed the

international community’s commitment to women’s rights and equal participation “in all spheres of society” as a prerequisite “for people-centred development”.¹⁸

The Platform for Action strengthened the ICPD’s commitment to women’s reproductive health. “In most countries,” the Platform states, “the neglect of women’s reproductive rights severely limits their opportunities in public and private life, including opportunities for education and economic and political empowerment. The ability of women to control their own fertility forms an important basis for the enjoyment of other rights.”

The Beijing document, citing Agenda 21, also pointed out that women are disproportionately harmed by environmental degradation and have a powerful, as yet largely untapped, part in protecting and restoring the environment: “Women have an essential role to play in the development of sustainable and ecologically sound consumption and production patterns and approaches to natural resource management.”¹⁹

In June 2000, a General Assembly special session to review implementation of the Beijing Platform for Action adopted a Political Declaration reaffirming the commitments made in Beijing and agreed on priority actions, including the need to address: gender aspects of HIV/AIDS and other sexually-transmitted infections; the disproportionate effect on women and girls of malaria and tuberculosis; the mental health of women and girls; and care for women and girls who experience violence.²⁰

WORLD SUMMIT ON SOCIAL DEVELOPMENT

“Economic development, social development and environmental protection are interdependent and mutually reinforcing components of sustainable development,” international leaders declared in March 1995 at the World Summit on Social Development, designed to “place people at the centre of development

and direct our economies to meet human needs more effectively.”

Gender equality was a central goal of the Copenhagen summit. It adopted a Declaration emphasizing that “social and economic development cannot be secured in a sustainable way without the full participation of women” and that “equality and equity between women and men ... must be at the centre of economic and social development.”²¹ The Declaration notes that women constitute the majority of people living “in abject poverty” and carry “a disproportionate share of the problems of coping with poverty;” that gender equality is intertwined with continued population growth and poverty; and that “empowering people, particularly women, to strengthen their own capacities is a main objective of development and its principal resource.”²²

THE MILLENNIUM DECLARATION

In September 2000, heads of state and government met in New York to negotiate a Millennium Declaration committing the United Nations to achieving “a just and lasting peace all over the world”, and rededicating the organization to “respect for the equal rights of all without distinction as to race, sex, language, or religion.”²³

The Declaration affirms that “the equal rights and opportunities of women and men must be assured”; and states that “prudence must be shown in the management of all living species and natural resources, in accordance with the precepts of sustainable development.” It calls on states to: “promote gender equality and the empowerment of women as effective ways to combat poverty, hunger and disease and to stimulate development that is truly sustainable;” “combat all forms of violence against women and to implement the Convention on the Elimination of All Forms of Discrimination against Women;” and “adopt in all our environmental actions a new ethic of conservation and stewardship.”²⁴

NOTES

CHAPTER 1

1. Polemics against such simplistic positions are still being written. See, for example: Food and Agriculture Organization of the United Nations. 1999. *The State of the World's Forests*. Rome: Food and Agriculture Organization of the United Nations; and Templeton, Scott R., and Sara J. Scherr. 1999. "Effects of Demographic and Related Microeconomic Change on Land Quality in Hills and Mountains of Developing Countries." *World Development* 27(6): 903-918.
2. UNFPA. 1999. *The State of World Population 1999: 6 Billion: A Time for Choices*. New York: UNFPA; and UNFPA. 2000. *The State of World Population 2000: Lives Together, Worlds Apart*. New York: UNFPA.
3. Cincotta, R.P., and R. Engelman. 2000. *Nature's Place: Human Population and the Future of Biological Diversity*. Washington, D.C.: Population Action International.
4. United Nations. 2001. *World Population Prospects: The 2000 Revision: Highlights*. New York: Population Division, Department of Economic and Social Affairs, New York: United Nations.
5. Replacement-level fertility is the level necessary to ensure that the population replaces itself over the longrun. For most populations, replacement is ensured with a fertility of 2.1 children per woman.
6. Most notably in the principles and orientation of Agenda 21 (United Nations. 1993. *Earth Summit Agenda 21: The United Nations Programme for Sustainable Development*. New York: Division for Sustainable Development, United Nations.); its antecedents in the Brundtland Commission (World Commission on Environment and Development. 1987. *Our Common Future: The Report of the World Commission on Environment and Development*. Oxford: Oxford University Press.); and its influence in later international conference documents.
7. Mackeen, Dawn. 6 May 2001. "The Global Medicine Cabinet." *The New York Times Magazine*.
8. Coe, Michael T., and Jonathan A. Foley. 2001. "Human and Natural Impacts on the Water Resources of the Lake Chad Basin." *Journal of Geophysical Research* 106(D4): 3349.
9. United Nations Environment Programme. (Forthcoming.) *Demise of an Ecosystem: Disappearance of the Mesopotamian Marshlands*. Nairobi, Kenya: United Nations Environment Programme.
10. Ezzell, Carol. 2001 "The Himba and the Dam." *Scientific American* 284(6): 80-89.
11. Onishi, Norimitsu. 8 January 2001. "Timia Journal: A Nomad Deserts the Desert: His Garden Blooms." *The New York Times*.

CHAPTER 2

1. There are an estimated 9-14 thousand cubic kilometres of fresh water available each year in the form of run-off (e.g., in streams and rivers) and water returned to underground aquifers (Falkenmark, M. 1994. "Population, Environment and Development: A Water Perspective." In: *Population, Environment and Development: Proceedings of the United Nations Expert Group Meeting on Population, Environment and Development, New York, New York, 20-24 January 1992*, pp. 99-116, by the United Nations. 1994. New York: United Nations; and Cohen, Joel E. 1996. *How Many People Can the Earth Support?* New York: W. W. Norton and Company.). A quantity of fresh water falls as rain that is contributed to this total. However, the direct capture of rainfall depends on where it occurs and the technologies available for its use.
2. Water resources per capita in more developed regions are 10,852 cubic metres, compared to 6,196 and 7,065 in less developed regions and least developed countries, respectively. See: United Nations. 2001. *Population, Environment and Development 2001*. Wallchart. New York: Population Division, Department of Economic and Social Affairs, United Nations.
3. Postel, Sandra. 2001. "Growing More Food with Less Water." *Scientific American* 284(2): 46.
4. Falkenmark 1994.
5. Soil quality, agricultural efficiency and land pattern use may lead to food purchases ("virtual water" imports) where these can be afforded. This also poses allocation decisions among alternate uses of scarce funds.
6. Gardner-Outlaw, Tom, and Robert Engleman. 1997. *Sustaining Water, Easing Scarcity: A Second Update: Revised Data for the Population Action International Report: Sustaining Water: Population and the Future of Renewable Water Supplies*. Washington, D.C.: Population Action International.
7. "Access to Safe Water: Fundamental Human Need, Basic Human Right, Says Secretary-General in Message on World Water Day." 12 March 2001. United Nations press release (SG/SM/7738).
8. See: Gleick, Peter. 1996. "Basic Water Requirements for Human Activities: Meeting Basic Needs." *Water International* 21: 83-92; and Gleick, Peter. 1999. "The Human Right to Water." *Water Policy* 1(5): 487-503. This measure refers to domestic consumption amounts, unlike the water system flow measures discussed above.

9. An example is water mining in the Libyan Arab Jamahiriya.
10. United Nations Educational, Scientific and Cultural Organization. 2000. *Global Issues and Sustainability: Critical Thinking/Problem Solving Approach*. Draft publication of the UNESCO Global-problematique Education Network Initiative (GENIE), supported in part by the David and Lucile Packard Foundation. Geneva: United Nations Educational, Scientific and Cultural Organization.
11. World Health Organization. 2001. *Global Water Supply and Sanitation Assessment 2000 Report*. Geneva: World Health Organization.
12. Different animals have different grain requirements (cattle having among the highest). The range of water inputs for different animals and other details of dietary impacts of food consumption are reviewed in: Cohen 1996.
13. Nichiporuk, Brian. 2000. *Security Dynamics of Demographic Factors*. Population Matters. A RAND Program of Policy-Relevant Research Communication. Santa Monica, California: Arroyo Center, Army Research Division, RAND Corporation; and Central Intelligence Agency. 2001. *Global Trends 2015: A Dialogue about the Future with Nongovernment Experts*. Washington, D.C.: Central Intelligence Agency. Web site: www.cia.gov/cia/publications/globaltrends2015/index.html.
14. Food and Agriculture Organization of the United Nations. 1999. *The State of Food Insecurity in the World*. Rome: Food and Agriculture Organization of the United Nations.
15. Food and Agriculture Organization of the United Nations. 1996a. *Food for All*. Rome: Food and Agriculture Organization of the United Nations.
16. Brown, L., G. Gardner, and B. Halweil. 1999. *Beyond Malthus: Nineteen Dimensions of the Population Challenge*. Worldwatch Institute. New York: W. W. Norton and Company; Brown, L., and J. Mitchell. 1997. *The Agricultural Link: How Environmental Deterioration could Disrupt Economic Progress*. Worldwatch Paper. No. 136. Washington, D.C.: Worldwatch Institute; Ehrlich, A. 1994. "Building a Sustainable Food System." In: *The World at the Crossroads: Towards a Sustainable, Equitable and Livable World*, edited by P. Smith. London: Earthscan Publications; and International Food Policy Research Institute (IFPRI). 1995. *A 2020 Vision for Food, Agriculture, and the Environment: The Vision, Challenge and Recommended Action*. Washington, D.C.: International Food Policy Research Institute.
17. Food and Agriculture Organization of the United Nations. 1996b. *FAO Production Yearbook 1995*. Rome: Food and Agriculture Organization of the United Nations.
18. Ibid.; and UNFPA. 1997. *Population and Sustainable Development: Five Years After Rio*. New York: UNFPA.
19. Brown and Mitchell 1997.
20. UNFPA 1997.
21. Pinstrip-Andersen, P., R. Pandya-Lorch and M. Rosegrant. 1999. *World Food Prospects: Critical Issues for the Early Twenty-first Century*. Washington, D.C.: International Food Policy Research Institute.
22. Food and Agriculture Organization of the United Nations. 1995. *Dimensions of Need: An Atlas of Food and Agriculture*. Rome: Food and Agriculture Organization of the United Nations; and Food and Agriculture Organization of the United Nations 1996a.
23. Fort, Matthew. 25 February 2001. "Paying the Price for Cheaper Food." *Guardian Unlimited* (London). Web site: <http://www.guardian.co.uk/>
24. Carroll, Rory. 19 February 1999. "Gene Crops could Spell Extinction for Birds." *Guardian* (London).
25. Food and Agriculture Organization of the United Nations 1996a; and Food and Agriculture Organization of the United Nations 1999.
26. Food and Agriculture Organization of the United Nations 1999.
27. Food and Agriculture Organization of the United Nations. 1996a.
28. International Food Policy Research Institute 1995.
29. Doos, B. 1994. "Environmental Degradation, Global Food Production and Risk for Large-scale Migration." *Ambio* 23(3): 124-130; and Food and Agriculture Organization of the United Nations 1995.
30. Food and Agriculture Organization of the United Nations 1995; and Repetto, R. 1996. "The 'Second India' Revisited: Population Growth, Poverty and the Environment over Two Decades." In: *Population, Environment, and Development*, edited by R. K. Pachauri and Lubina F. Qureshy. 1997. New Delhi: Tata Energy Research Institute (TERI).
31. Bojo, J. 1991. "Economics and Land Degradation." *Ambio* 20(2): 75-79; and Food and Agriculture Organization of the United Nations 1995.
32. Food and Agriculture Organization of the United Nations 1995.
33. Brown and Mitchell 1997.
34. Food and Agriculture Organization of the United Nations 1995.
35. Abramovitz, J. 1996. *Imperiled Waters, Impoverished Future: The Decline of Freshwater Ecosystems*. Worldwatch Paper. No. 128. Washington, D.C.: Worldwatch Institute.
36. Reuters World Report. 9 August 2000. "Six Killed as Chinese Officials Fight over Water." London: Reuters News Service.
37. Pimentel, D., et al. 1997. "Water Resources: Agriculture, the Environment and Society." *Bioscience* 46(2): 97-105.
38. Postel, S. 1999. *Pillar of Sand: Can the Irrigation Miracle Last?* New York: W. W. Norton and Company.
39. Food and Agriculture Organization of the United Nations 1995.
40. Ibid.; and Postel, S. 1997. *Last Oasis: Facing Water Scarcity*. New York: W. W. Norton and Company.
41. Food and Agriculture Organization of the United Nations 1995.
42. Postel 1997.
43. Brown and Mitchell 1997.
44. "Vietnam: Food Security a Strategic Issue." 7 November 1998. *The Saigon Times Magazine*.

45. The World Bank. 1996. *Biodiversity and Agriculture Intensification*. Washington, D.C.: The World Bank; Food and Agriculture Organization of the United Nations 1995; and Food and Agriculture Organization of the United Nations 1996a.
46. Ponting, C. 1991. *A Green History of the World*. New York: Penguin Books.
47. Food and Agriculture Organization of the United Nations 1995.
48. Food and Agriculture Organization of the United Nations. 1993. *Harvesting Nature's Diversity*, pp. 7-25. Rome: Food and Agriculture Organization of the United Nations.
49. International Center for Agricultural Research in the Dry Areas (ICARDA). 1996. *Biodiversity: A Key to Food Security*, pp. 5-18. Aleppo, Syria: International Center for Agricultural Research in the Dry Areas.
50. Engelman, R., et al. 2000. *People in the Balance: Population and Natural Resources at the Turn of the Millennium*. Washington, D.C.: Population Action International.
51. Source for this section: Pinstrup-Andersen, Pandya-Lorch, and Rosegrant 1999.
52. Cohen 1996.
53. Food and Agriculture Organization of the United Nations 1995; and Food and Agriculture Organization of the United Nations 1996a.
54. Mydans, S. 6 April 1997. "Scientists Developing Super Rice to Feed Asia." *The New York Times*; and Pearce, F. 23 November 1996. "To Feed the World, Talk to the Farmers." *New Scientist*: 6-7.
55. Grier, P. 13 July 1994. "Hardier Corn can Feed More Hungry People." *Christian Science Monitor*, p. 8.
56. Pearce, F. 9 November 1996. "Crop Gurus Sow Some Seeds of Hope." *New Scientist*: 6.
57. Food and Agriculture Organization of the United Nations 1995; Postel 1999; and Pimentel, et al. 1997.
58. Marland, G., T. A. Boden, and R. J. Andres. 2000. "Global, Regional, and National CO₂ Emissions." In: *Trends: A Compendium of Data on Global Change*. Oak Ridge, Tennessee: Carbon Dioxide Information Analysis Center, Oak Ridge National Laboratory, U.S. Department of Energy. Web site: <http://cdiac.esd.ornl.gov>.
59. Meyerson, F. A. B. 2001a. "Population and Climate Change Policy." In: *Climate Change Policy: A Survey*, edited by S. Schneider, A. Rosencranz, and J. Niles. (Forthcoming.) Washington, D.C.: Island Press.
60. Intergovernmental Panel on Climate Change (IPCC). 2001. *Summary for Policymakers: Climate Change 2001: Impacts, Adaptation and Vulnerability*. Geneva: Intergovernmental Panel on Climate Change.
61. See Chapter 7 of: Houghton, J. T., et al. (eds.). 1996. *Climate Change 1995: The Science of Climate Change*. Cambridge: Cambridge University Press. (The 2001 updated assessment will contain a slightly lower estimate.)
62. Henderson-Sellers, A., et al. 1998. "Tropical Cyclones and Global Climate Change: A Post-IPCC Assessment." *Bulletin of the American Meteorological Society* 79: 19-38; and Mahlman, J. D. 1997. "Uncertainties in Projections of Human-caused Climate Warming." *Science* 278: 1416-1417.
63. Rosenzweig, C., and D. Hillel. 1998. *Climate Change and the Global Harvest: The Potential Impacts of the Greenhouse Effect on Agriculture*. New York: Oxford University Press.
64. Mendelsohn, R., and J. R. Neumann (eds.). 1999. *The Impact of Climate Change on the United States Economy*. Cambridge: Cambridge University Press.
65. Meyerson 2001a.
66. Hadley Centre for Climate Prediction and Research. 1998. *Climate Change and Its Impacts*. London: The United Kingdom Meteorological Office and Department of the Environment, Transport and the Regions.
67. Epstein, P. R., et al. 1998. "Biological and Physical Signs of Climate Change: Focus on Mosquito-Borne Diseases." *Bulletin of the American Meteorological Society* 79: 409-417.
68. In the view of many ecologists, current global population and consumption patterns are already unsustainable in terms of maintaining biodiversity and the habitat that supports it. See, e.g.: Meffe, G. K., A. H. Ehrlich, and D. Ehrenfeld. 1993. "Human Population Control: The Missing Agenda." *Conservation Biology* 7: 1-3; and Wilson, E. O. 1992. *The Diversity of Life*. New York: W. W. Norton and Company. See also: Root, T. L., and S. H. Schneider. 1995. "Ecology and Climate: Research Strategies and Implications." *Science* 269: 331-341.
69. For discussion of the history and potential for environmental refugees, see: Ramlogan, R. 1996. "Environmental Refugees: A Review." *Environmental Conservation* 23: 81-88; and Myers, N. 1993. "Environmental Refugees in a Globally Warmed World." *Bioscience* 43(11): 752-761.
70. Meyerson 2001a.
71. Meyerson, F. A. B. 1998a. "Population, Carbon Emissions, and Global Warming: The Forgotten Relationship at Kyoto." *Population and Development Review* 24(1): 115-130; and Marland, Boden, and Anders 2000.
72. See: Dietz, T., and E. A. Rosa. 1997. "Effects of Population and Affluence on CO₂ Emissions." *Proceedings of the National Academy of Sciences USA* 94: 175-179. See also Chapter 3 of: O'Neill, B. C., F. L. MacKellar, and W. Lutz. 2000. *Population and Climate Change*. Cambridge: Cambridge University Press.
73. The formula used in the Kyoto Protocol is a measurement of the average national emission for the years 2008-2012. See: United Nations. 1998. *Report of the Conference of the Parties on Its Third Session, Held at Kyoto from 1 to 11 December 1997: Addendum Part Two: Action Taken by the Conference of the Parties at Its Third Session (FCCC/CP/1997/7/Add.1)*. New York: United Nations. The year 2010 will be used as the reference year here, to facilitate analysis of demographically related issues.
74. United Nations 1997.
75. Meyerson 2001a.
76. Meyerson, F. 10 November 1997. "Pollution and Our People Problem." *The Washington Post*
77. Source for this section: United Nations. 2001. *World Population Prospects: The 2000 Revision: Highlights*. New York: Population Division, Department of Economic and Social Affairs, New York: United Nations.
78. Meyerson 1998a; and Marland, Boden, and Andres 2000.
79. Marland, Boden, and Andres 2000.
80. See Chapter 2 of: O'Neill, MacKellar, and Lutz 2000.
81. See: O'Neill, MacKellar, and Lutz 2000; and Meyerson, F. A. B. 2001b. "Replacement Migration: A Questionable Tactic for Delaying the Inevitable Effects of Fertility Transition." *Population and Environment* 22: 401-409. Note also that urbanization is an additional factor related to both household size and ageing that affects emissions. The urban proportion of the world's population increased from 30 per cent in 1950 to about 50 per cent in 2000 and is projected to exceed 60 per cent by 2030. See: United Nations. 1999. *World Urbanization Prospects: The 1999 Revision*. New York: Population Division, Department of Economic and Social Affairs, United Nations. The effect on emissions is complex, because urbanization tends to increase per capita income, and economies and diseconomies of scale in, e.g., energy use, change as city size increases. For a brief discussion, see Chapter 2 of: O'Neill, MacKellar, and Lutz 2000.
82. Engelman, R. 1998. *Profiles in Carbon: An Update on Population, Consumption and Carbon Dioxide Emissions*. Washington, D.C.: Population Action International. Disparities among individual countries are even greater. For instance, the average person in the United States contributed 5.3 metric tons of fossil fuel carbon emissions to the atmosphere in 1995, more than 16,000 times as much as the average Somali, and almost five times as much as the average Mexican. Within individual countries, unequal wealth distribution may also mean that a small percentage of the population may be responsible for a large share of greenhouse gas emissions.
83. Between 1990 and 2000, the United States population increased by 32.7 million, the greatest addition in any decade in U.S. history. See: United States Census Bureau. 2000. *First Census 2000 Results: Resident Population and Apportionment Counts*. Washington, D.C.: United States Census Bureau. Web site: <http://www.census.gov/main/www/cen2000.html>.
84. Meyerson, F. A. B. 1998b. "Toward a Per Capita-based Climate Treaty: Reply." *Population and Development Review* 24(4): 804-810.
85. Vitousek, P. M., et al. 1997. "Human Domination of the Earth's Ecosystems." *Science* 277: 494-499.
86. Bryant, D., et al. 1997. *The Last Frontier Forests: Ecosystems and Economies on the Edge*. Washington, D.C.: World Resources Institute.
87. Gardner-Outlaw, T., and R. Engelman. 1999. *Forest Futures: Population, Consumption and Wood Resources*. Washington, D.C.: Population Action International.
88. Wilson 1992; and Myers, N., et al. 2000. "Biodiversity Hotspots for Conservation Priorities." *Nature* 403: 853-858.
89. Terborgh, J. 1999. *Requiem for Nature*. Washington, D.C.: Island Press.
90. Sala, O. E., et al. 2000. "Global Biodiversity Scenarios for the Year 2100." *Science* 287: 1770-1774; Mooney, H. A., et al. 1995. "Biodiversity and Ecosystem Functioning: Basic Principles." In: *Global Biodiversity Assessment*, pp. 275-325, edited by V. H. Heywood and R. T. Watson. Cambridge: United Nations Environment Programme and Cambridge University Press; Diamond, J. M. 1985. "A Discipline with a Time Limit." *Nature* 317: 111-112; and Diamond, J. M. 1989. "The Present, Past and Future of Human-caused Extinction." *Philosophical Transactions of the Royal Society of London* 325: 469-477.
91. United Nations Environment Programme World Conservation Monitoring Centre. 1997. *United Nations List of Protected Areas*. Cambridge: United Nations Environment Programme World Conservation Monitoring Centre.
92. Western, D., and R. W. Wright (eds.). 1994. *Natural Connections: Perspectives in Community-Based Conservation*. Washington, D.C.: Island Press; and Terborgh 1999.
93. Bruner, A. G., et al. 2001. "Effectiveness of Parks in Protecting Tropical Biodiversity." *Science* 291: 125-128.
94. Oates, J. F. 1999. *Myth and Reality in the Rain Forest: How Conservation Strategies are Failing in West Africa*. Berkeley, California: University of California Press; Redford, K. H. 1992. "The Empty Forest." *Bioscience* 42: 412-422; Terborgh 1999; Brandon, K., K. H. Redford, and S. E. Sanderson (eds.). 1998. *Parks in Peril: People, Politics, and Protected Areas*. Washington, D.C.: Island Press; Kramer, R., C. van Schaik, and J. Johnson (eds.). 1997. *Last Stand: Protected Areas and the Defense of Tropical Biodiversity*. New York: Oxford University Press; and Bowles, I. A., et al. 2000. "Logging and Tropical Conservation." *Science* 280: 1899.
95. Meyerson, F. A. B. 1997. "Potential Threats to the Selva Maya Biosphere Reserves: Demographic and Land Use Data and Projections 1950-2050." In: *Maya Forest Biodiversity Workshop: Inventorying and Monitoring: Report on the Maya Forest Biodiversity Monitoring Workshop: Mexico, Guatemala, Belize, Flores, El Petén, Guatemala, October 1997*, pp 26-31, edited by O. Herrera-MacBryde. 1998. Washington, D.C.: Smithsonian Institution, U.S. MAB/TED/WCS/CCB-Stanford/CECON; Meyerson, F. A. B. 2000. "Human Population Growth, Deforestation, and Protected Areas Management: Rethinking Conservation and Demographic Policy for the Maya Biosphere Reserve in Guatemala." Ph.D. thesis. New Haven, Connecticut: Yale School of Forestry and Environmental Studies, Yale University.
96. Cincotta, R. P., and R. Engelman. 2000. *Nature's Place: Human Population and the Future of Biological Diversity*. Washington, D.C.: Population Action International; and Gardner-Outlaw and Engelman 1999.

97. Meyerson 2000.
98. Ibid.; and Fearnside, P. M. 1997. "Human Carrying Capacity Estimation in Brazilian Amazonia as a Basis for Sustainable Development." *Environmental Conservation* 24: 271-282.
99. Meyerson 2000.
100. United Nations Environment Programme. 2000. *Global Environment Outlook 2000*. Nairobi, Kenya: United Nations Environment Programme. Web site: <http://www.unep.org/Geo2000/>.
101. Ibid.
102. The World Conservation Union (IUCN). 2000. *2000 IUCN Red List of Threatened Species*. Gland, Switzerland: Species Survival Commission, The World Conservation Union. Web site: <http://www.redlist.org/>.
103. United Nations Environment Programme 2000.
104. Sources: United Nations Development Programme, United Nations Environment Programme, and World Resources Institute. 2000. *World Resources 2000-2001: People and Ecosystems: The Fraying Web of Life*. Washington, D.C.: World Resources Institute; Hinrichsen, Don, and Bryant Robey. 2000. "Population and the Environment: The Global Challenge." *Population Reports*. Series M. No. 15. Baltimore, Maryland: Population Information Program, Johns Hopkins University School of Public Health; and United Nations Environment Programme 2000.
105. United Nations Environment Programme 2000.
106. The Arabian Peninsula includes Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, the United Arab Emirates and Yemen. The Mashriq includes Iraq, Jordan, Lebanon and Syria and the Occupied Palestinian Territory (West Bank and Gaza).
- ### CHAPTER 3
1. See: Marguette, Catherine, and Richard Bilsborrow. 1997. "Population and Environment Relationships in Developing Countries: A Select Review of Approaches and Methods." In: *The Population, Environment, Security Equation*, by B. Baudot and W. Moomaw. 1997. New York: Macmillan; and McNicoll, Geoffrey. 2000. "Managing Population-Environment Systems: Problems of Institutional Design." Population Council Policy Research Division Working Paper. No. 139. New York: The Population Council.
 2. The formula was developed in the early 1970s as part of a debate over the contribution of population to air pollution in the United States. It reached explicit mathematical formulation in: Ehrlich, P. R., and J. Holdren. 1971. "Impact of Population Growth." *Science* 171: 1212-1217.
 3. Some widely distributed examples include: Hinrichsen, Don, and Bryant Robey. 2000. "Population and the Environment: The Global Challenge." *Population Reports*. Series M. No. 15. Baltimore, Maryland: Population Information Program, Johns Hopkins University School of Public Health; Harrison, P. 1992. *The Third Revolution: Environment, Population and a Sustainable World*. London: I.D. Tauris and Company in association with Penguin Books; and UNFPA. 1992. *The State of World Population 1992: A World in Balance*. New York: UNFPA.
 4. Harrison 1992; and Shaw, R. P. 1993. Review of Harrison 1992. *Population and Development Review* 12(1): 189-192.
 5. Meyerson, F. A. B. 1998a. "Population, Carbon Emissions, and Global Warming: The Forgotten Relationship at Kyoto." *Population and Development Review* 24(1): 115-130; Meyerson, F. A. B. 1998b. "Toward a Per Capita-based Climate Treaty: Reply." *Population and Development Review* 24(4): 804-810; and Meyerson, F. A. B. 2001a. "Population and Climate Change Policy." In: *Climate Change Policy: A Survey*, edited by S. Schneider, A. Rosencranz, and J. Niles. (Forthcoming.) Washington, D.C.: Island Press.
 6. Regional analyses were produced by: O' Neill, B. C. 1996. "Greenhouse Gases: Timescales, Response Functions, and the Role of Population Growth in Future Emissions." Ph.D. dissertation. New York: Earth Systems Group, Department of Applied Science, New York University.
 7. The World Bank. 2000. *World Development Report 2000/2001: Attacking Poverty*. New York: Oxford University Press.
 8. Ibid.
 9. United Nations Development Programme. 1998. *Human Development Report 1998: Consumption for Human Development*. New York: United Nations Development Programme.
 10. For example, Reed, David, and Herman Rosa. 1999. *Economic Reforms, Globalization, Poverty and the Environment*. New York: United Nations Development Programme. Web site: <http://www.undp.org/seed/pei/publication/economic.html>
 11. The World Bank 2000.
 12. Sen, Amartya. 1999. *Development as Freedom*. New York: Knopf.
 13. These pollutants include small soot particles, carbon monoxide, benzene and formaldehyde (United Nations Development Programme. 1997. *Energy After Rio: Prospects and Challenges*. New York: United Nations Development Programme. Cited in "Energy as it Relates to Poverty Alleviation and Environmental Protection," by Sudhir Chella Rajan and Ellen Morris. 1999. Poverty and Environment Initiative Publication Series. New York: United Nations Development Programme. Web site: www.undp.org/seed/pei/publication/energy.PDF.)
 14. Smith, K. R. 1990. "Health Effects in Developing Countries." In: J. Pasztor, Janos, and L. Kristoferson (eds.). *Bioenergy and the Environment*. Boulder, Colorado: Westview Press.
 15. United Nations Development Programme 1997.
 16. Haile, F. 1991. *Women Fuelwood Carriers in Addis Ababa and the Peri-Urban Forest*. Geneva: International Labour Organization. Cited in: Rajan and Morris 1999.
 17. A study in Pakistan showed that on average the poorest fifth of households spent over 3 hours per week collecting wood or dung. (Pakistan Living Standards Measurement Survey, 1991. Cited in Rajan and Morris 1999.) In even drier and more over-exploited settings, such as the Horn of Africa, the time is considerably longer. For families living in poverty, additional effort is required for other environmental services like fetching water. Most of this burden is borne by women and children.
 18. This was the central thesis of Boserup's seminal analysis. Her work has been reprinted in: Boserup, Ester. 1990. *Economic and Demographic Relationships in Development: Essays Selected and Introduced by T. Paul Schultz*. Baltimore, Maryland: Johns Hopkins University Press.
 19. The work of Sara J. Scherr provides numerous examples. This analyst writes to counter a facile imputation of a negative impact to population growth, but provides valuable insights into the delicate conditions that must be met to ensure more successful outcomes. See: Scherr, Sara J. 1999. "Poverty-Environment Interactions in Agriculture: Key Factors and Policy Implications." Paper prepared for the United Nations Development Programme and the European Commission Expert Workshop on Poverty and the Environment, Brussels, Belgium, 20-21 January 1999. New York: United Nations Development Programme; Scherr, Sara J. 2000. "A Downward Spiral: Research Evidence on the Relationship between Poverty and Natural Resource Degradation." *Food Policy* 25: 479-498; and Templeton, Scott R., and Sara J. Scherr. 1999. "Effects of Demographic and Related Microeconomic Change on Land Quality in Hills and Mountains of Developing Countries." *World Development* 27(6): 903-918. See also: Leach, Melissa, and James Fairhead. 2000. "Challenging Neo-Malthusian Deforestation Analyses in West Africa's Dynamic Forest Landscapes." *Population and Development Review* 26(1): 17-43.
 20. Rosenzweig, Mark. 2000. "Study of the Demographic Effects of the Green Revolution in India." Paper presented at the RAND Workshop on Population, Health and the Environment, Santa Monica, California, 11-13 January 2001; and Rosenzweig, Mark. 2001. "Population Growth, Economic Change and Forest Degradation in India." Paper presented at the Annual Meeting of the Population Association of America, Washington, D.C., 29 March 2001.
 21. See: Lee, Ronald D. 1991. "Comment: The Second Tragedy of the Commons." In: *Resources, Environment, and Population: Present Knowledge, Future Options*. A Supplement to Vol. 16: 1990: *Population and Development Review*, edited by Kingsley Davis and Mikhail S. Bernstam. 1991. New York: The Population Council.
 22. O'Meara, M. 1999. *Reinventing Cities for People and the Planet*. Washington, D.C.: Worldwatch Institute.
 23. Kolankiewicz, Leon, and Roy Beck. 2001. *Weighing Sprawl Factors in Large U.S. Cities*. Arlington, Virginia.: NumbersUSA.
 24. See: United Nations. 2001. *World Population Monitoring 2001: Population, Environment and Development (EAS/P/WP.164)*, pp. 95f. Draft. New York: Population Division, Department of Economic and Social Affairs, United Nations.
 25. This section relies on analyses in: Brockerhoff, Martin P. 2000. "An Urbanizing World." *Population Bulletin* 55(3). Washington, D.C.: The Population Reference Bureau.
 26. United Nations Development Programme 1998.
 27. Ibid.; and Brown, L., et al. 2001. *State of the World 2001*. Worldwatch Institute. New York: W. W. Norton.
 28. United Nations Development Programme 1998.
 29. Ibid.
 30. Brown, L., G. Gardner, and B. Halweil. 1999. *Beyond Malthus: Nineteen Dimensions of the Population Challenge*. Worldwatch Institute. New York: W. W. Norton and Company.
 31. United Nations Development Programme 1998.
 32. This point was originally noted for earlier (and lower) U.S. population projections by: Brown, Gardner, and Halweil 1999.
 33. World Resources Institute. 1999. *World Resources 1998-1999*. Washington, D.C.: World Resources Institute.
 34. Abramovitz, Janet N., et al. 2000. *Vital Signs 2000: The Environmental Trends that are Shaping Our Future*. Worldwatch Institute. New York: W. W. Norton; and Brown, et al. 2001.
 35. Daly, Herman E. 1971. "Toward a Stationary State Economy." In: *Patient Earth*, edited by John Harte and Robert Socolow. 1971. New York: Holt, Rinehart and Winston, Inc.
 36. The ecological footprint approach was pioneered by Mathis Wackernagel and colleagues. See: Wackernagel, Mathis, and William Rees. 1996. *Our Ecological Footprint: Reducing Human Impact on the Earth*. Gabriola Island, British Columbia: New Society Publishers. Further references and details are in: World Wide Fund for Nature (WWF), United Nations Environment Programme World Conservation Monitoring Centre, Redefining Progress, Center for Sustainability Studies, and Norwegian School of Management. 2000. *Living Planet Report 2000*. Gland, Switzerland: World Wide Fund for Nature.
 37. United Nations Development Programme 1998.
 38. Ibid.
 39. As with other indicators that combine diverse components, technical details (such as how the elements are weighted) can affect aggregate conclusions. The components identify particular vulnerabilities and strengths more directly.
 40. This section relies on: Myers, N. 1993. "Environmental Refugees in a Globally Warmed World." *Bioscience* 43(11): 752-761; and Lonergan, Steve. 1998. "The Role of Environmental Degradation in Population Displacement." *Environmental Change and Security Project Report*, no. 4.: 5-15. Washington, D.C.: The Woodrow Wilson Center.

CHAPTER 4

1. Sen, Amartya. 2000. "Population and Gender Equity." *The Nation* (July 24/31): 16-18.
2. Food and Agriculture Organization of the United Nations. 2000. "Gender and Food Security: Division of Labour." Fact sheet 6. Rome: Food and Agriculture Organization of the United Nations. Web site: www.fao.org/Gender/en/lab-e.htm.
3. United Nations Development Fund for Women (UNIFEM). 2000. *UNIFEM Annual Report 1999*. New York: United Nations Development Fund for Women.
4. Women's Environment and Development Organization (WEDO). 1999. *Rights, Risks and Reforms: A 50-Country Survey Assessing Government Actions Five Years After the International Conference on Population and Development*. New York: Women's Environment and Development Organization.
5. Tique, César, and Joana Mahumane. 2000. "Gender Assessment of Mozambique Marine Ecoregion." Draft prepared for the World Wide Fund for Nature (WWF). Maputo, Mozambique: World Wide Fund for Nature.
6. Food and Agricultural Organization of the United Nations 2000. Web site: www.fao.org/Gender/en/lab2-e.htm.
7. Buckingham-Hatfield, Susan. 2000. *Gender and Environment*. London: Routledge.
8. Ibid.
9. Women's Environment and Development Organization 1999.
10. Ibid.
11. Food and Agriculture Organization of the United Nations 2000. Web site: www.fao.org/Gender/en/lab2-e.htm.
12. Buckingham-Hatfield 2000.
13. Van Zuydman, Jacques. 2001. Statement of Jacques Van Zuydman, South African Representative to the 34th Session of the Commission on Population and Development, United Nations, New York, New York, 2 April 2001.
14. Khandker, Shahidur R., and Udry, Christopher. 1997. *Gender, Property Rights, and Resource Management in Ghana*. World Bank Research Program. (Project reference. no. 681-47.) Washington, D.C.: The World Bank.
15. Koziell, S. Poklewski. 1999. "Two Women of the Soil." *Resurgence*, no. 195. Quoted in Buckingham-Hatfield 2000.
16. World Wide Fund for Nature (WWF). 2001. *Population and Conservation Realities and Responses in Madagascar's Spiny Forest Ecoregion: The WWF Experience*. Washington, D.C.: World Wide Fund for Nature.
17. UNFPA, United Nations Environment Programme, and World Conservation Union (IUCN). 1999. *Report of the International Workshop on Population-Poverty-Environment Linkages: Key Results and Policy Actions, Gland, Switzerland, 23-25 September 1998*. Gland, Switzerland, New York and Geneva: UNFPA and World Conservation Union.
18. See: Women's Environment and Development Organization 1999; and Buckingham-Hatfield 2000.
19. Van Zuydman 2001.
20. Davis, Dona. 2000. "Gendered Cultures of Conflict and Discontent: Living 'the Crisis' in a Newfoundland Community." *Women's Studies International Forum* 23(3): 343-353.
21. Onishi, Norimitsu. 13 February 2001. "In Sahara Salt Mine, Life's Not Too Grim." *The New York Times*, p. A4.
22. Cuomo, Kerry Kennedy. 2001. *Speak Truth to Power: Human Rights Defenders Who Are Changing Our World*. New York: Crown Publishers/Random House.
9. For an overview of health effects on women and children, see: Gopalan, H. N. B., and Sumeet Saksena (eds.). 1999. *Domestic Environment and Health of Women and Children*. Supported by the United Nations Environmental Programme and Tata Energy Research Institute (TERI). Delhi: Replika Press.
10. United Nations Development Programme. 1998. *Human Development Report 1998: Consumption for Human Development*. New York: United Nations Development Programme. Cited in: Hinrichsen and Robey 2000, p. 7.
11. This section relies on: Hinrichsen and Robey 2000, p. 7.
12. For a detailed discussion, see: International Federation of Red Cross and Red Crescent Societies (IFRC). 2000. *World Disasters Report: Focus on Public Health*, Chapter 5. Geneva: International Federation of Red Cross and Red Crescent Societies.
13. See: United Nations Children's Fund. 2001. *State of the World's Children 2001*. New York: United Nations Children's Fund.
14. Colborn, Theo, Diane Dumanoski, and John Peterson Myers. 1997. *Our Stolen Future: Are We Threatening Our Fertility, Intelligence, and Survival: A Scientific Detective Story*. New York: Plume Books; Bell, E. M., I. Hertz-Picciotto, and J. J. Beaumont. 2001. "A Case-Control Study of Pesticides and Fetal Death due to Congenital Anomalies." *Epidemiology* 12: 148-156; Solomon, Gina M., and Ted Schettler. 2000. "Environment and Health: 6: Endocrine Disruption and Potential Human Health Implications." *Canadian Medical Association Journal* 163(11): 1471-1476; Herman-Giddens, M. E., et al. 1997. "Secondary Sexual Characteristics and Menses in Young Girls Seen in Office Practice: A Study from the Pediatric Research in Office Settings Network." *Pediatrics* 99: 505-512; and Boyce, N. 1997. "Growing Up too Soon." *New Scientist* (August 2, 1997): 5.
15. See: "Global Climate Change: Beyond Sunburn." 1994. *Environmental Health Perspectives* 102(5): 440-443.
16. See: Kovats, R. Sari, et al. 2000. *Climate Change and Human Health: Impact and Adaptation* (WHO/SDE/OEH/00.4). Geneva: World Health Organization.
17. Balk, Deborah, et al. 2001. "Disease Climate and Land Use Change in Kenya." Paper presented at the Annual Meeting of the Population Association of America, Washington, D.C., 29-31 March 2001.
18. O'Neill, Brian, F. L. MacKellar, and Wolfgang Lutz. 2000. *Population and Climate Change*. Cambridge: Cambridge University Press.
19. Martine, George, and Jose Miguel Guzman. 2000. "Population, Poverty and Vulnerability: Mitigating the Effects of Natural Disasters." Unpublished paper of the Mexico City UNFPA Country Support Team.

CHAPTER 5

1. United Nations. 2001. *World Population Monitoring 2001: Population, Environment and Development* (ESA/P/WP.164). Draft. New York: Population Division, Department of Economic and Social Affairs, United Nations.
2. World Health Organization. 1997. *Health and Environment in Sustainable Development: Five Years after the Earth Summit*. Geneva: World Health Organization.
3. Detailed references to localized outbreaks in more developed countries and conditions in transition states can be found in: United Nations 2001.
4. See: Bilsborrow, Richard E. 1998. "Population, Development and the Environment in the Northern Ecuadorian Amazon: Policy Issues." Draft. Chapel Hill, North Carolina: Carolina Population Center, University of North Carolina at Chapel Hill.
5. Roodman, David Malin. 1998. *The Natural Wealth of Nations: Harnessing the Market for Environmental Protection and Economic Strength*. The Worldwatch Environmental Alert Series. New York: W. W. Norton and Company. Cited in: "Population and the Environment: The Global Challenge," by Don Hinrichsen and Bryant Robey. 2000. *Population Reports*. Series M. No. 15. Baltimore, Maryland: Population Information Program, Johns Hopkins University School of Public Health.
6. United Nations 2001, p. 99.
7. Ibid.
8. United Nations Educational, Scientific and Cultural Organization. 2000. "Global Issues and Sustainability: Critical Thinking/Problem Solving Approach: UNESCO Global-problematique Education Network Initiative (GENIE)." Draft. Geneva: United Nations Educational, Scientific and Cultural Organization.
1. Barboza, Nathalie. 2000. "Educating for a Sustainable Future: Africa in Action." *Prospects* 30(1): 71-85. Paris: United Nations Educational, Scientific and Cultural Organization.
2. Gibb-Vogel, Carolyn, and Robert Engelman. 1999. *Forging the Link: Emerging Accounts of Population and Environment Work in Communities*. Washington, D.C.: Population Action International.
3. Engelman, Robert. 1998. *Plan and Conserve: A Source Book on Linking Population and Environmental Services in Communities*. Washington, D.C.: Population Action International; and Gibb-Vogel and Engelman 1999.
4. World Wildlife Fund-U.S. 2001. *Disappearing Landscapes: The Population/Environment Connection*. Washington, D.C.: Conservation Strategies Unit, Center for Conservation Innovation, World Wildlife Fund-U.S.
5. Goodall, Jane, with Philip Berman. 1999. *Reason for Hope: A Spiritual Journey*. New York: Warner Books. The Jane Goodall Institute web site: www.janegoodall.org/inst/inst_tacare_hist.html; and Engelman 1998.
6. Gibb-Vogel and Engelman 1999.
7. Ibid.
8. Conservation International. 2000. Report to the Summit Foundation. Washington, D.C.: Conservation International; Williams, John, Population-Environment Fellow, Conservation International. 2001. Personal communication; and Gibb-Vogel and Engleman 1999.
9. Schlangen, Rhonda. 1999. "Making the Connection: The Cairo ICPD and the Environment." *Population and Habitat Update* 11(2): 6-7. Washington, D.C.: Population and Habitat Campaign, National Audubon Society; and Engelman 1998.
10. Engelman 1998.
11. World Wildlife Fund-U.S. 2001.
12. United Nations. 1995. *Population and Development*, vol. 1: *Programme of Action adopted at the International Conference on Population and Development: Cairo: 5-13 September 1994*, paragraph 3.14. New York: Department of Economic and Social Information and Policy Analysis, United Nations.
13. Currently estimated at over 100 million. This number could increase as the largest ever cohort of adolescents, 1.1 billion strong, ages into the peak reproductive years—many in countries with challenged health infrastructures, low public sector expenditures on health and under-developed markets to meet increasing demand.
14. Lee, Ronald D. 1991. "Comment: The Second Tragedy of the Commons." In: *Resources, Environment, and Population: Present Knowledge, Future Options*. A Supplement to Vol. 16: *Population and Development Review*, edited by Kingsley Davis and Mikhail S. Bernstam. 1991. New York: The Population Council; Lee, R. D. and T. Miller. 1991. "Population Growth, Externalities to Childbearing, and Fertility Policy in Developing Countries." *Proceedings of the World Bank Annual Conference on Development Economics 1990*, pp. 275-304. Washington, D.C.: The World Bank; and

- Willis, R. J. 1987. "Externalities and Population." In: *Population Growth and Economic Development: Issues and Evidence*, edited by R. D. Lee and D. G. Johnson. 1987. Madison, Wisconsin: University of Wisconsin Press.
15. Birdsall, N. 1994. "Another Look at Population and Global Warming." In: *Population, Environment and Development: Proceedings of the United Nations Expert Group Meeting on Population, Environment and Development, New York, New York, 20-24 January 1992*, pp. 39-54. New York: United Nations; Cline, W. R. 1992. *The Economics of Global Warming*. Washington, D.C.: Institute for International Economics; Wexler, L. 1996. "The Greenhouse Externality to Childbearing." Unpublished manuscript; Nordhaus, W. D., and J. Boyer. 1998. "What are the External Costs of More Rapid Population Growth? Theoretical Issues and Empirical Estimates." Paper presented at the 150th Anniversary Meetings of the American Association for the Advancement of Science, Philadelphia, Pennsylvania, 15 February 1998. Revised 25 February 1998; and O'Neill, B. C., and L. Wexler. 2000. "The Greenhouse Externality to Childbearing: A Sensitivity Analysis." *Climatic Change* 47: 283-324.
 16. Nordhaus and Boyer 1998.
 17. O'Neill and Wexler 2000.
 18. Albritton, Daniel L., et al. 2001. *Climate Change 2001: The Scientific Basis: Summary for Policymakers: A Report of Working Group I of the Intergovernmental Panel on Climate Change*. Geneva: Intergovernmental Panel on Climate Change. Web site: <http://www.ipcc.ch/>; and Hourcade, J. C. 1996. "Estimating the Costs of Mitigating Greenhouse Gases." In: *Climate Change 1995: Economic and Social Dimensions of Climate Change*, pp. 263-296, edited by J. P. Bruce, H. Lee, and E. F. Haites. 1996. Cambridge: Cambridge University Press.
 19. Summers, L. H. 1994. *Investing in All the People: Educating Women in Developing Countries*. Economic Development Institute (EDI) Seminar Paper. No. 45. Washington, D.C.: The World Bank.
 20. Pritchett, Lant H. 1994. "Desired Fertility and the Impact of Population Policies." *Population and Development Review* 20(1): 1-55.
 21. Actions to reduce maternal, infant and child mortality and to stop the HIV/AIDS pandemic are central components of comprehensive reproductive health, notwithstanding their immediate contribution to population growth.
 22. Yang, C., and S. Schneider. 1998. "Global Carbon Dioxide Emission Scenarios: Sensitivity to Social and Technological Factors in Three Regions." *Mitigation and Adaptation Strategies for Global Change* 3(4): 805-819; and O'Neill, B. C., F. L. MacKellar, and W. Lutz. 2000. *Population and Climate Change*. Cambridge: Cambridge University Press.
 23. Dietz, T., and E. A. Rosa. 1997. "Effects of Population and Affluence on CO₂ Emissions." *Proceedings of the National Academy of Sciences USA* 94, pp. 175-179.
 24. O'Neill, MacKellar, and Lutz 2000.
 25. *Ibid.*
 26. MacKellar, F. L. 2000. "The Predicament of Population Aging: A Review Essay." *Population and Development Review* 26(2): 365-397.
 27. Jackson, W. A. 1998. *The Political Economy of Population Aging*. Cheltenham, United Kingdom: Edward Elgar.
 28. Bloom, D. E., and J. G. Williamson. 1998. "Demographic Transitions and Economic Miracles in Emerging Asia." *World Bank Economic Review* 12: 419-455.
 29. Higgins, Matthew, and Jeffrey G. Williamson. 1997. "Age Structure Dynamics in Asia and Dependence on Foreign Capital." *Population and Development Review* 23(2): 261-293.
 30. Bloom and Williamson 1998.
 31. Bloom and Williamson (1998) estimated potential changes in economic growth rates due to age structure effects over the period 1990-2025 for several world regions. Using the World Bank's outlook for economic growth rates over the next decade (The World Bank. 2001. *Global Economic Prospects and the Developing Countries 2001*. Washington, D.C.: The World Bank.) as an illustrative baseline through 2025, their results can be translated into impacts on the level of gross domestic product in 2025.
 32. O'Neill, B. C. 2000. "Cairo and Climate Change: A Win-win Opportunity." *Global Environmental Change: Human and Policy Dimensions* 10(2): 93-96.
 33. United Nations Children's Fund. 1999. *State of the World's Children 1999*. New York: United Nations Children's Fund.
 34. Brown, L., et al. 2001. *State of the World 2001*. Worldwatch Institute. New York: W. W. Norton and Company; and Abramovitz, Janet N., et al. 2000. *Vital Signs 2000: The Environmental Trends that are Shaping Our Future*. Worldwatch Institute. New York: W. W. Norton.
 35. Brown, L., G. Gardner, and B. Halweil. 1999. *Beyond Malthus: Nineteen Dimensions of the Population Challenge*. Worldwatch Institute. New York: W. W. Norton and Company.
 36. Brown, et al. 2001; and Abramovitz, et al. 2000.
 37. United Nations Development Programme. 1998. *Human Development Report 1998: Consumption for Human Development*. New York: United Nations Development Programme.
 38. Brown, et al. 2001.
 39. United Nations Development Programme 1998; Abramovitz, et al. 2000; and Brown, et al. 2001.
 40. See: www.globalgreendeal.org.
 41. Environmental accounting has grown into a substantial research effort in recent decades (for a recent overview see: Stavins, Robert. 2000. *Economics of the Environment: Selected Readings*. Fourth Edition. New York: W. W. Norton and Company; and related papers searchable at: www.ksg.harvard.edu/research/working_papers/index.htm). Critics raise questions, including how to sensibly draw boundaries in time and space around impacts, but increased discussion and a political process can ensure that important negative effects bear some level of costs, even in the costs needed to reduce waste and pollution below targeted standards.
42. See citation in: UNFPA, United Nations Environment Programme, and World Conservation Union (IUCN). 1999. *Report of the International Workshop on Population-Poverty-Environment Linkages: Key Results and Policy Actions, Gland, Switzerland, 23-25 September 1998*. Gland, Switzerland, New York and Geneva: UNFPA and World Conservation Union.
 43. An example of an application in an industrialized country setting is: Palmer, Margaret A., et al. (Forthcoming.) "The Ecological Consequences of Changing Land Use for Running Waters with a Case Study of Urbanizing Watersheds in Maryland." Special issue (edited by Karin M. Krchnak) of the Bulletin Series, Yale School of Forestry and Environmental Studies, with papers from the Human Population and Freshwater Workshop, New Haven, Connecticut, 22-23 March 2001, organized by the Center for Environment and Population (CEP), the National Wildlife Federation (NWF), and the Population Resources Center PRC). New Haven, Connecticut: Yale University.

APPENDIX

1. United Nations. "Universal Declaration on Human Rights: Adopted by the General Assembly in its Resolution 217a (III) of 10 December 1948," Preamble. In: *The United Nations and the Advancement of Women 1945-1996*. The United Nations Blue Book Series, vol. 6, by the United Nations. 1996. New York: Department of Information, United Nations.
2. *Ibid.*, Articles 3-28.
3. *Ibid.*, Articles 22 and 25.
4. *Ibid.*, Article 2.
5. *International Covenant on Economic, Social and Cultural Rights*, Articles 3, 10, 11, 12, and 13. In: United Nations. 1967. *International Covenant on Economic, Social and Cultural Rights and International Convention on Civil and Political Rights: General Assembly Resolution 2200 (XXI): 21st Session; Supplement No. 16 (A/6316)*. New York: United Nations. Text is also available from the web site of the United Nations High Commissioner for Human Rights: www.unhcr.ch/html/.
6. *International Covenant on Civil and Political Rights*, Articles 2, 23, 24, and 25. In: United Nations 1967. Text is also available from the web site of the United Nations High Commissioner for Human Rights: www.unhcr.ch/html/.
7. United Nations. 1980. *Convention on the Elimination of All Forms of Discrimination against Women: General Assembly Resolution 25 (XLIV): 44th Session; Supplement No. 49 (A/RES/44/25)*, reprinted in 28 I.L.M.1448), Preamble. The Convention's text is available from the web site of the United Nations High Commissioner for Human Rights: www.unhcr.ch.
8. *Ibid.*, Articles 10, 12, 14, and 16.
9. *Ibid.*, Article 14.
10. General information on the Earth Summit available from the United Nations web page: www.un.org.
11. United Nations. 1993. *Earth Summit Agenda 21: The United Nations Programme for Sustainable Development*, Chapter 1: preamble. New York: Division for Sustainable Development, United Nations. The entire text of Agenda 21 as negotiated is available at: www.un.org/esa/sustdev/agenda21.htm.
12. *Ibid.*, Chapter 5.
13. *Ibid.*, Chapter 24.
14. *Ibid.*, Chapter 24.
15. United Nations. 1995. *Population and Development, vol. 1: Programme of Action adopted at the International Conference on Population and Development: Cairo, 5-13 September 1994*, Paragraph 3.14. New York: Department of Economic and Social Information and Policy Analysis, United Nations
16. *Ibid.*, Paragraphs 4.1 and 4.2.
17. *Ibid.*, Paragraphs 3.1, 3.3, 3.24, and 3.27.
18. United Nations. 1996. *The Beijing Declaration and the Platform for Action: Fourth World Conference on Women: Beijing, China: 4-15 September 1995 (DPI/1766/Wom)*. New York: Department of Public Information, United Nations.
19. *Ibid.*, paragraph 246.
20. United Nations. 2000. "Preliminary Analysis of the Beijing+Five Document." New York: Division for the Advancement of Women, United Nations. The entire text of the Political Declaration is contained in: United Nations. 2000. *Report of the Ad Hoc Committee of the Whole of the Twenty-third Special Session of the General Assembly*. General Assembly Official Records, Twenty-third Special Session, Supplement No. 3 (A/S-23/10/Rev.1). New York: United Nations.
21. United Nations. 1995. "Copenhagen Declaration on Social Development and Programme of Action of the World Summit for Social Development," Paragraphs 6 and 7. *Report of the World Summit for Social Development (A/CONF.166/9)*. New York: Department of Economic and Social Affairs, United Nations.
22. *Ibid.*, Paragraphs 15, 16, and 26.
23. United Nations. 2000. *Resolution adopted by the General Assembly: 55/2: United Nations Millennium Declaration (A/RES/55/2)*, Paragraphs 2 and 4. Information about the Millennium Assembly is available at: www.un.org/millennium/.
24. *Ibid.*, Paragraphs 6, 20, 23, and 25.

MONITORING ICPD GOALS – SELECTED INDICATORS

	Indicators of Mortality			Indicators of Education				Reproductive Health Indicators			
	Infant Mortality Total per 1,000 live births	Life expectancy M/F	Maternal mortality ratio	Primary enrolment (gross) M/F	Proportion reaching final grade, M/F	Secondary enrolment (gross) M/F	% Illiterate (>15 years) M/F	Births per 1,000 women aged 15-19	Contraceptive prevalence Any method	Modern methods	HIV prevalence rate (%) (15-24) M/F
World Total	55	63.9 / 68.1	400					50	62	56	
More developed regions (*)	8	71.9 / 79.3	21					27	70	59	
Less developed regions (+)	59	62.5 / 65.7	440					54	60	55	
Least developed countries (‡)	92	50.6 / 52.2	1,000					127			
Africa (1)	83	50.5 / 52.1	1,000					108	25	20	
Eastern Africa	94	44.8 / 46.0	1,300					112	20	15	
Burundi	111	39.8 / 41.4	1,900	55 / 46	74 / 73	8 / 5	43 / 58	60	9	1	5.69 / 11.60
Eritrea	82	51.1 / 53.7	1,100	59 / 48	73 / 67	24 / 17	32 / 54	112	5	4	
Ethiopia	106	42.8 / 43.8	1,800	55 / 30	47 / 46	14 / 10	56 / 65	78	8	6	7.50 / 11.86
Kenya	59	48.7 / 49.9	1,300	85 / 85		26 / 22	11 / 23	90	39	32	6.39 / 13.02
Madagascar	91	52.5 / 54.8	580	92 / 91	49 / 33	16 / 16	26 / 39	136	19	10	0.04 / 0.13
Malawi	130	39.6 / 39.0	580	140 / 127	42 / 35	21 / 12	25 / 52	152	22	14	7.04 / 15.26
Mauritius (2)	16	68.4 / 75.8	45	106 / 106	96 / 98	63 / 66	12 / 18	34	75	49	0.04 / 0.04
Mozambique	128	37.3 / 38.6	980	70 / 50	52 / 39	9 / 5	39 / 70	129	6	5	6.73 / 14.74
Rwanda	119	40.2 / 41.7	2,300	82 / 80		12 / 9	25 / 38	60	14	7	5.22 / 10.63
Somalia	113	47.4 / 50.5	1,600					213			
Uganda	94	45.3 / 46.8	1,100	81 / 68		15 / 9	22 / 42	211	15	8	3.84 / 7.82
United Republic of Tanzania	73	50.1 / 52.0	1,100	67 / 66	68 / 75	6 / 5	15 / 31	92	24	16	3.96 / 8.06
Zambia	80	42.6 / 41.7	870	91 / 86		34 / 21	14 / 27	146	25	14	8.20 / 17.77
Zimbabwe	55	43.3 / 42.4	610	115 / 111	76 / 76	52 / 45	7 / 14	105	54	50	11.31 / 24.50
Middle Africa (3)	87	48.8 / 51.1	1,000					204	10	3	
Angola	118	44.5 / 47.1	1,300	95 / 88				229			1.25 / 2.72
Cameroon	79	49.3 / 50.6	720	93 / 84		32 / 22	17 / 29	127	19	7	3.82 / 7.78
Central African Republic	93	42.7 / 46.0	1,200	69 / 45		15 / 6	39 / 64	141	15	3	6.91 / 14.07
Chad	116	45.1 / 47.5	1,500	76 / 39	53 / 41	15 / 4	47 / 64	195	4	1	1.92 / 3.03
Congo, Democratic Republic of (4)	77	51.0 / 53.3	940	86 / 59	67 / 45	32 / 19	26 / 48	230	8	2	2.49 / 5.07
Congo, Republic of	66	49.6 / 53.7	1,100	120 / 109	25 / 56	62 / 45	12 / 24	146			3.17 / 6.46
Gabon	80	51.8 / 54.0	620		50 / 52			161			2.32 / 4.72
Northern Africa (5)	49	64.8 / 68.0	450						48	44	
Algeria	43	68.7 / 71.8	150	113 / 102	89 / 92	65 / 62	21 / 42	20	52	49	
Egypt	40	66.7 / 69.9	170	108 / 94		83 / 73	33 / 55	34	47	46	
Libyan Arab Jamahiriya	25	69.2 / 73.3	120	110 / 111			9 / 30	35	40	26	
Morocco	42	66.8 / 70.5	390	97 / 74	69 / 68	44 / 34	37 / 63	28	50	42	
Sudan	78	55.6 / 58.4	1,500	55 / 47	78 / 82	23 / 20	29 / 52	57	8	7	
Tunisia	26	69.6 / 72.2	70	122 / 114	84 / 87	66 / 63	18 / 38	17	60	51	
Southern Africa	63	45.6 / 47.1	360						52	50	
Botswana	67	36.5 / 35.6	480	107 / 108	81 / 91	61 / 68	25 / 19	63	33	32	15.84 / 34.31
Lesotho	111	40.9 / 39.6	530	102 / 114	58 / 77	25 / 36	27 / 6	67	23	19	12.05 / 26.40
Namibia	65	44.3 / 44.1	370	129 / 132	63 / 70	58 / 67	17 / 18	81	29	26	9.14 / 19.80
South Africa	59	46.5 / 48.3	340	135 / 131	63 / 73	88 / 103	14 / 15	73	56	55	11.34 / 24.82
Western Africa (6)	87	50.7 / 51.8	1,100					123	14	8	
Benin	81	52.5 / 55.7	880	98 / 57	54 / 45	26 / 11	42 / 74	113	16	3	0.89 / 2.24
Burkina Faso	87	47.0 / 49.0	1,400	48 / 31	77 / 76	11 / 6	65 / 85	151	12	5	2.31 / 5.79
Côte d'Ivoire	81	47.7 / 48.1	1,200	82 / 60	77 / 67	34 / 16	44 / 60	121	11	4	3.78 / 9.51
Ghana	62	56.0 / 58.5	590	84 / 74	80 / 76	44 / 28	19 / 36	78	22	13	1.36 / 3.42
Guinea	114	48.0 / 49.0	1,200	68 / 41	79 / 52	20 / 7		168	6	4	0.57 / 1.43
Guinea-Bissau	121	44.0 / 46.9	910	79 / 45			39 / 80	195			0.99 / 2.48
Liberia	79	54.6 / 56.7	1,000				29 / 61	230	6	6	0.85 / 2.15
Mali	120	51.1 / 53.0	630	58 / 40	86 / 61	17 / 8	50 / 64	195	7	5	1.31 / 2.07
Mauritania	97	50.9 / 54.1	870	84 / 75	56 / 62	21 / 11	47 / 67	147	3	1	0.37 / 0.59
Niger	126	45.9 / 46.5	920	36 / 23	66 / 68	9 / 5	76 / 91	233	8	5	0.95 / 1.50
Nigeria	79	52.0 / 52.2	1,100	109 / 87		36 / 30	27 / 43	104	6	4	2.52 / 5.12
Senegal	57	52.5 / 56.2	1,200	78 / 65	87 / 80	20 / 12	52 / 71	100	13	8	0.71 / 1.60
Sierra Leone	146	39.2 / 41.8	2,100	60 / 41		22 / 13		212			1.16 / 2.92
Togo	75	51.1 / 53.3	980	140 / 99	71 / 47	40 / 14	25 / 58	93	24	7	2.20 / 5.53
Asia	53	65.8 / 69.2	280⁷						66	61	
Eastern Asia (8)	34	69.9 / 74.9	55						82	80	
China	37	69.1 / 73.5	60	122 / 123	93 / 94	74 / 66	8 / 23	5	83	83	0.12 / 0.02
Democratic People's Republic of Korea	39	62.5 / 68.0	35					2	62	53	
Hong Kong SAR, China (9)	4	77.3 / 82.8		93 / 95	99	71 / 76	3 / 9	7	86	80	0.10 / 0.05
Japan	3	77.8 / 85.0	12 ¹⁰	101 / 101	100 / 100	103 / 104		4	59	53	0.03 / 0.01

MONITORING ICPD GOALS – SELECTED INDICATORS

	Indicators of Mortality			Indicators of Education				Reproductive Health Indicators			
	Infant Mortality Total per 1,000 live births	Life expectancy M/F	Maternal mortality ratio	Primary enrolment (gross) M/F	Proportion reaching final grade, M/F	Secondary enrolment (gross) M/F	% Illiterate (>15 years) M/F	Births per 1,000 women aged 15-19	Contraceptive prevalence Any method	Modern methods	HIV prevalence rate (%) (15-24) M/F
Mongolia	58	61.9 / 65.9	65	86 / 91	89 / 92	48 / 65		53	61	25	
Republic of Korea	7	71.8 / 79.1	20	94 / 95	98 / 98	102 / 102	1 / 3	3	81	67	0.02 / 0.00
South-eastern Asia	41	64.8 / 69.2	300						58	50	
Cambodia	73	53.6 / 58.6	590	123 / 104	42 / 36	31 / 17	20 / 41	97	13	7	2.36 / 3.51
Indonesia	40	65.3 / 69.3	470	115 / 110	82 / 84	55 / 48	8 / 17	53	57	55	0.03 / 0.03
Lao People's Democratic Republic	88	53.3 / 55.8	650	123 / 101	57 / 54	34 / 23	35 / 65	91	19	15	0.04 / 0.05
Malaysia	10	70.6 / 75.5	39	101 / 101	96 / 99	59 / 69	8 / 16	18	55	30	0.57 / 0.09
Myanmar	87	53.8 / 58.8	170	122 / 117		29 / 30	11 / 19	29	33	28	1.04 / 1.72
Philippines	29	68.0 / 72.0	240	115 / 113		77 / 78	4 / 5	33	46	28	0.03 / 0.06
Singapore	5	75.9 / 80.3	9	95 / 93		74 / 70	4 / 11	7	74	73	0.22 / 0.16
Thailand	21	67.9 / 73.8	44	98 / 96		38 / 37	3 / 6	51	72	70	1.18 / 2.32
Viet Nam	34	66.9 / 71.6	95	115 / 111		48 / 46	4 / 8	20	75	56	0.27 / 0.09
South Central Asia	69	62.7 / 64.1	410						48	41	
Afghanistan	161	43.0 / 43.5	820	64 / 32		32 / 12	47 / 77	111	2	2	
Bangladesh	67	60.6 / 60.8	600	77 / 66		25 / 13	47 / 69	125	54	43	0.01 / 0.01
Bhutan	54	62.0 / 64.5	500		69 / 74			57	19	19	
India	65	63.6 / 64.9	440	109 / 90	61 / 55	59 / 39	31 / 54	44	48	43	0.36 / 0.61
Iran (Islamic Republic of)	36	68.8 / 70.8	130	102 / 95	92 / 89	81 / 73	16 / 29	28	73	56	
Nepal	71	60.1 / 59.6	830	129 / 96	52 / 52	51 / 33	40 / 75	124	29	26	0.14 / 0.20
Pakistan	87	61.2 / 60.9	200	87 / 42		33 / 17	39 / 68	50	24	17	0.06 / 0.04
Sri Lanka	20	69.9 / 75.9	60	110 / 108	92 / 93	72 / 78	5 / 11	23	66	44	0.04 / 0.05
Western Asia	39	68.0 / 72.1	230						48	29	
Iraq	64	63.5 / 66.5	370	92 / 78		51 / 32	34 / 53	41	14	10	
Israel	6	77.1 / 81.0	8	96 / 96		89 / 87	2 / 6	17			0.06 / 0.06
Jordan	23	69.7 / 72.5	41	94 / 95	76 / 82		5 / 15	38	53	38	
Kuwait	11	74.9 / 79.0	25	78 / 77	94 / 97	64 / 66	15 / 19	28	50	47	
Lebanon	17	71.9 / 75.1	130	113 / 108		78 / 84	8 / 19	25	61	37	
Occupied Palestinian Territory	21	70.8 / 74.0			73 / 82			94			
Oman	23	70.2 / 73.2	120	78 / 74	94 / 93	68 / 66	19 / 37	89	24	18	
Saudi Arabia	21	71.1 / 73.7	23	77 / 75	87 / 89	65 / 57	15 / 32	48	32	29	
Syrian Arab Republic	22	70.6 / 73.1	200	106 / 96	89 / 89	45 / 40	11 / 38	38	36	28	
Turkey (11)	39	68.0 / 73.2	55	111 / 104	93 / 96	68 / 48	6 / 23	51	64	38	
United Arab Emirates	11	74.1 / 78.4	30	91 / 87	95 / 96	77 / 82	26 / 20	64	28	24	
Yemen	62	60.7 / 62.9	850	100 / 40		53 / 14	32 / 73	125	21	10	
Europe	9	69.6 / 77.9	28					21	70	55	
Eastern Europe	15	63.1 / 73.8	50						63	35	
Bulgaria	15	67.1 / 74.8	23	100 / 98	90 / 89	77 / 76	1 / 2	41	86	46	
Czech Republic	5	72.1 / 78.7	14	105 / 103	98 / 98	97 / 100		17	69	45	0.06 / 0.03
Hungary	9	67.8 / 76.1	23	104 / 102	93	96 / 99	1 / 1	21	77	68	0.08 / 0.02
Poland	9	69.8 / 78.0	12	97 / 95	95	98 / 97	0 / 0	16	49	19	
Romania	22	66.5 / 73.3	60	104 / 103	95	79 / 78	1 / 3	37	64	30	0.02 / 0.02
Slovakia	8	69.8 / 77.6	14	102 / 102	96 / 97	92 / 96		24	74	41	0.02 / 0.01
Northern Europe (12)	5	74.9 / 80.5	12					20	78	76	
Denmark	5	74.2 / 79.1	15	102 / 101	100 / 99	120 / 122		7	78	72	0.16 / 0.08
Estonia	10	65.8 / 76.4	80	95 / 93	96 / 97	100 / 108		27	70	56	
Finland	4	74.4 / 81.5	6	98 / 99	99 / 100	110 / 125		7	77	75	0.03 / 0.02
Ireland	6	74.4 / 79.6	9	105 / 104	99 / 100	113 / 122		16			0.06 / 0.05
Latvia	14	65.7 / 76.2	70	98 / 93	97	82 / 85	0 / 0	21	48	39	0.18 / 0.06
Lithuania	9	67.6 / 77.7	27	99 / 96	99 / 98	85 / 88	0 / 0	27	59	40	
Norway	5	76.0 / 81.9	9	100 / 100	100 / 100	121 / 116		10	74	69	0.06 / 0.03
Sweden	3	77.6 / 82.6	8	106 / 107	97 / 97	128 / 153		5	78	72	0.06 / 0.04
United Kingdom	5	75.7 / 80.7	10	115 / 116		120 / 139		24	82	82	0.09 / 0.05
Southern Europe (13)	7	74.4 / 80.8	12					11	67	45	
Albania	25	70.9 / 76.7	31	106 / 108	77 / 83	37 / 38	8 / 22	16			
Bosnia & Herzegovina	14	71.3 / 76.7	15					23			
Croatia	8	70.3 / 78.1	18	88 / 87	100 / 100	81 / 83	1 / 3	19			0.02 / 0.01
Greece	6	75.9 / 81.2	2	93 / 93	99 / 100	95 / 96	1 / 4	10			0.12 / 0.05
Italy	5	75.5 / 81.9	11	101 / 100	98 / 99	94 / 95	1 / 2	6	78	32	0.29 / 0.24
Macedonia (Former Yugoslav Republic of)	16	71.4 / 75.8	17	100 / 98	87 / 89	64 / 62		26			
Portugal	6	72.6 / 79.6	12	131 / 124		106 / 116	5 / 10	17	66	33	0.57 / 0.25
Slovenia	6	72.3 / 79.6	17	98 / 98	100 / 100	90 / 93	0 / 0	8			0.03 / 0.01

MONITORING ICPD GOALS – SELECTED INDICATORS

	Indicators of Mortality			Indicators of Education				Reproductive Health Indicators			
	Infant Mortality Total per 1,000 live births	Life expectancy M/F	Maternal mortality ratio	Primary enrolment (gross) M/F	Proportion reaching final grade, M/F	Secondary enrolment (gross) M/F	% Illiterate (>15 years) M/F	Births per 1,000 women aged 15-19	Contraceptive prevalence Any method	Modern methods	HIV prevalence rate (%) (15-24) M/F
Spain	5	75.4 / 82.3	8	109 / 108	98 / 99	116 / 123	1 / 3	6	81	67	0.48 / 0.22
Yugoslavia	13	70.9 / 75.6	15	69 / 70		60 / 64		25	55	12	
Western Europe (14)	5	75.2 / 81.7	14					9	75	71	
Austria	5	75.4 / 81.5	11	100 / 100		105 / 102		12	51	47	0.19 / 0.10
Belgium	4	75.7 / 81.9	8	104 / 102		142 / 151		8	78	74	0.11 / 0.11
France	5	75.2 / 82.8	20	106 / 104	96	112 / 111		9	75	69	0.33 / 0.23
Germany	5	75.0 / 81.1	12	104 / 104	99 / 100	105 / 103		11	75	72	0.09 / 0.04
Netherlands	5	75.6 / 81.0	10	109 / 107		134 / 129		4	79	76	0.18 / 0.08
Switzerland	5	75.9 / 82.3	8					5	82	78	0.37 / 0.33
Latin America & Caribbean	32	67.2 / 73.6	190					71	69	60	
Caribbean (15)	35	65.4 / 70.9	400					68	59	56	
Cuba	7	74.8 / 78.7	24	108 / 104	100	76 / 85	3 / 3	65	70	67	0.06 / 0.02
Dominican Republic	36	64.4 / 70.1	110	94 / 94		47 / 61	16 / 16	93	64	59	2.58 / 2.78
Haiti	61	50.2 / 56.5	1,100	49 / 46		21 / 20	47 / 51	64	28	22	4.88 / 2.91
Jamaica	20	73.7 / 77.8	120	100 / 99		63 / 67	17 / 9	46	66	63	0.59 / 0.40
Puerto Rico	10	71.2 / 80.1	30				6 / 6	63	78	68	
Trinidad & Tobago	13	72.5 / 77.2	65	99 / 98		72 / 75	1 / 2	34	53	44	0.84 / 0.59
Central America	30	69.1 / 74.7	110					63	55		
Belize	30	73.0 / 75.9	140	123 / 119	57 / 58	47 / 52	6 / 7	79	47	42	2.17 / 0.88
Costa Rica	11	75.0 / 79.7	35	104 / 103	81 / 85	47 / 52	4 / 4	81	75	65	0.65 / 0.28
El Salvador	26	67.7 / 73.7	180	98 / 96	49 / 49	35 / 39	18 / 23	87	60	54	0.68 / 0.27
Guatemala	41	63.0 / 68.9	270	93 / 82	46 / 42	27 / 25	23 / 38	111	38	31	1.16 / 0.92
Honduras	33	63.2 / 69.1	220	110 / 112	54	29 / 37	25 / 25	103	50	41	1.40 / 1.66
Mexico	28	70.4 / 76.4	65	116 / 113	82 / 84	64 / 64	6 / 10	64	67	58	0.40 / 0.06
Nicaragua	36	67.2 / 71.9	250	100 / 102	51 / 55	52 / 62	33 / 29	138	60	57	0.22 / 0.06
Panama	19	72.6 / 77.3	100	108 / 104		60 / 65	7 / 9	75	58	54	1.65 / 1.36
South America (16)	33	66.7 / 73.6	200					70	73	63	
Argentina	20	70.6 / 77.7	85	114 / 113		73 / 81	3 / 3	61			0.86 / 0.29
Bolivia	56	61.9 / 65.3	550	99 / 90		40 / 34	8 / 20	75	48	25	0.13 / 0.03
Brazil	38	64.7 / 72.6	260		38		15 / 14	71	77	70	0.70 / 0.28
Chile	12	73.0 / 79.0	33	103 / 100	94 / 99	72 / 78	4 / 4	44			0.29 / 0.08
Colombia	26	69.2 / 75.3	120	113 / 112	70 / 76	64 / 69	8 / 8	80	77	64	0.44 / 0.10
Ecuador	41	68.3 / 73.5	210	134 / 119	84 / 86	50 / 50	7 / 10	66	66	52	0.37 / 0.08
Paraguay	37	68.6 / 73.1	170	112 / 109	71 / 74	46 / 48	5 / 8	75	57	48	0.13 / 0.04
Peru	37	67.3 / 72.4	240	125 / 121		72 / 67	5 / 14	53	64	41	0.39 / 0.17
Uruguay	13	71.6 / 78.9	50	109 / 108	94 / 97	75 / 90	3 / 2	70			0.41 / 0.21
Venezuela	19	70.9 / 76.7	43	90 / 93	49 / 64	33 / 46	7 / 7	95	49	38	0.65 / 0.15
Northern America (17)	7	74.7 / 80.5	11					46	76	71	
Canada	5	76.2 / 81.8	6	103 / 101		105 / 105		19	75	73	0.29 / 0.07
United States of America	7	74.6 / 80.4	12	102 / 101		98 / 97		49	76	71	0.50 / 0.23
Oceania	24	72.0 / 76.9	260 ⁷					39	65	61	
Australia-New Zealand	5	76.2 / 81.8	8 ¹⁰						76	72	
Australia (18)	5	76.4 / 82.0	6 ¹⁰	101 / 101		150 / 155		18	76	72	0.14 / 0.02
Melanesia (19)	52	59.5 / 61.9	310								
New Caledonia	7	72.5 / 77.7	10	127 / 123		95 / 106		31			
New Zealand	6	75.3 / 80.7	15 ¹⁰	101 / 101		110 / 116		31	75	72	0.05 / 0.02
Papua New Guinea	62	56.8 / 58.7	390	87 / 74	65 / 67	17 / 11	29 / 42	84	26	20	0.08 / 0.25
Vanuatu	29	67.5 / 70.5	32	101 / 94	89 / 85	23 / 18		54			
Countries with Economies in Transition of the Former USSR (20)											
Armenia	15	70.3 / 76.2	29	87 / 91	100	100 / 79	1 / 2	32			
Azerbaijan	29	68.7 / 75.5	37	108 / 105	93	73 / 81		26			
Belarus	12	62.8 / 74.4	33	100 / 96	98 / 98	91 / 95	0 / 1	29	50	42	0.40 / 0.19
Georgia	18	69.5 / 77.6	22	89 / 88	98	78 / 76		33	41	20	
Kazakhstan	42	59.6 / 70.7	80	97 / 98	92	82 / 91		45	66	53	0.07 / ..
Kyrgyzstan	37	64.8 / 72.3	80	105 / 103	97	75 / 83		29	60	49	
Republic of Moldova	20	62.8 / 70.3	65	98 / 97	93 / 97	79 / 82	0 / 2	43	74	50	0.28 / 0.11
Russian Federation	17	60.0 / 72.5	75	108 / 107	96 / 97	83 / 91	0 / 1	32	73	53	0.25 / 0.12
Tajikistan	53	65.2 / 70.8	120	96 / 94		83 / 74	0 / 1	24			
Turkmenistan	49	63.9 / 70.4	65					18			
Ukraine	15	62.7 / 73.5	45	87 / 86		88 / 94	0 / 0	39	68	38	1.29 / 0.79
Uzbekistan	37	66.8 / 72.5	60	79 / 76		100 / 88	6 / 15	51	56	51	

DEMOGRAPHIC, SOCIAL AND ECONOMIC INDICATORS

	Total population (millions) (2001)	Projected population (millions) (2050)	Ave. pop. Growth rate (%) (2000-2005)	% urban (2000)	Urban growth rate (2000-2005)	Population/ha arable & perm. crop land	Total fertility rate (2000-2005)	% births with skilled attendants	GNI per capita PPP\$ (1999)	% central gov. expenditures Education	Health	External population assistance (US\$,000)	Under 5 mortality M/F	Per capita energy consumption	Access to safe water
World Total	6,134.1	9,322.3	1.2	47	2.0		2.68					(1,680,520)	79 / 79		
More developed regions (*)	1,193.9	1,181.1	0.2	76	0.5		1.50						10 / 9		
Less developed regions (+)	4,940.3	8,141.1	1.5	40	2.7		2.92	54					86 / 86		
Least developed countries (#)	675.0	1,829.5	2.5	26	4.5		5.24	30					154 / 147		
Africa (1)	812.6	2,000.4	2.3	38	3.7		4.97	43				468,618 ²¹	143 / 134		
Eastern Africa	256.7	691.1	2.4	26	4.6		5.83	34					168 / 155		
Burundi	6.5	20.2	3.0	9	5.9	5.3	6.80	24	570	3.5	0.6	1,601	207 / 188		
Eritrea	3.8	10.0	4.2	19	4.6	5.6	5.28	21	1,040	1.5	2.9	4,043	149 / 134		46
Ethiopia	64.5	186.5	2.4	18	5.0	4.7	6.75	10	620	3.9	1.7	22,209	190 / 175	284	24
Kenya	31.3	55.4	1.9	33	4.1	4.9	4.15	44	1,010	6.5	2.4	29,047	109 / 98	505	49
Madagascar	16.4	47.0	2.8	30	4.8	3.6	5.68	47	790	1.9	1.1	9,625	150 / 144		47
Malawi	11.6	31.1	2.2	25	7.3	4.1	6.34	55	570	5.0	2.8	22,148	224 / 223		57
Mauritius (2)	1.2	1.4	0.8	41	1.6	1.3	1.90	97	8,950	4.7	1.8	254	21 / 15		100
Mozambique	18.6	38.8	1.8	40	4.1	4.3	5.86	44	810		2.8	20,853	236 / 212	405	60
Rwanda	7.9	18.5	2.1	6	4.2	5.6	5.77	26	880		2.0	7,886	206 / 186		41
Somalia	9.2	40.9	4.2	28	5.2	6.3	7.25						193 / 178		
Uganda	24.0	101.5	3.2	14	5.7	2.4	7.10	38	1,160	2.4	1.9	43,324	167 / 151		50
United Republic of Tanzania	36.0	82.7	2.3	33	5.4	5.5	5.03	35	500		1.3	42,070	122 / 111	456	54
Zambia	10.6	29.3	2.1	40	2.6	1.2	5.66	47	720	2.1	3.6	17,636	143 / 144	630	64
Zimbabwe	12.9	23.5	1.7	35	2.9	2.2	4.50	84	2,690		2.9	21,891	112 / 104	861	85
Middle Africa (3)	98.2	340.6	3.0	35	4.3		6.33	41					155 / 139		
Angola	13.5	53.3	3.0	34	4.9	2.5	7.20		1,100		3.9	6,778	211 / 191	595	38
Cameroon	15.2	32.3	2.1	49	4.0	1.1	4.70	55	1,490		1.0	4,175	138 / 127	432	62
Central African Republic	3.8	8.2	1.6	41	3.0	1.3	4.92	46	1,150		2.0	1,211	172 / 141		60
Chad	8.1	27.7	3.1	24	4.2	1.6	6.65	15	840	1.7	2.3	2,602	207 / 190		27
Congo, Democratic Republic of (4)	52.5	203.5	3.3	30	4.5	4.0	6.70					1,006	136 / 120	284	45
Congo, Republic of	3.1	10.7	3.0	63	3.7	5.4	6.29		540	8.6	2.0	1,244	136 / 108	433	51
Gabon	1.3	3.2	2.5	81	3.1	1.0	5.40		5,280	3.2	2.1	555	139 / 125	1,413	70
Northern Africa (5)	177.4	303.6	1.8	51	2.9		3.13	68				68,729 ²²	68 / 63		
Algeria	30.8	51.2	1.8	60	3.2	0.9	2.79	77	4,840	5.3	2.6	852	50 / 44	898	94
Egypt	69.1	113.8	1.7	45	2.3	7.6	2.88	61	3,460	4.9	1.8	35,510	49 / 49	679	95
Libyan Arab Jamahiriya	5.4	10.0	2.2	88	2.6	0.2	3.31	94				28 / 28	2,343	72	
Morocco	30.4	50.4	1.8	56	2.8	1.1	3.03	40	3,320	5.2	1.2	22,489	58 / 46	336	82
Sudan	31.8	63.5	2.3	36	4.5	1.1	4.47	86		0.9	0.7	4,081	126 / 118	526	75
Tunisia	9.6	14.1	1.1	66	2.3	0.5	2.10	81	5,700	8.1	2.2	2,636	32 / 29	812	
Southern Africa	50.1	56.9	0.8	48	1.5		3.03	81					115 / 104		
Botswana	1.6	2.1	0.5	50	2.2	2.0	3.94	87	6,540	10.1	2.5	1,590	146 / 137		
Lesotho	2.1	2.5	0.7	28	4.6	2.4	4.45	50	2,350	6.4	3.4	984	182 / 180		91
Namibia	1.8	3.7	1.7	31	2.8	1.0	4.87	68	5,580	8.7	4.1	2,498	123 / 118		77
South Africa	43.8	47.3	0.8	50	1.3	0.4	2.85	84	8,710	7.8	3.3	21,286	107 / 95	2,681	86
Western Africa (6)	230.3	608.1	2.7	40	4.2		5.57	34					148 / 144		
Benin	6.4	18.1	2.8	42	4.4	1.7	5.68	60	920	3.2	1.6	6,469	141 / 123	377	63
Burkina Faso	11.9	46.3	3.0	19	5.6	3.0	6.80	31	960	1.5	1.4	9,078	151 / 141		
Côte d'Ivoire	16.3	32.2	2.1	46	3.4	1.0	4.64	47	1,540	5.4	1.2	5,874	144 / 131		77
Ghana	19.7	40.1	2.2	38	4.2	2.0	4.22	44	1,850	4.3	1.8	17,551	106 / 93	396	64
Guinea	8.3	20.7	1.5	33	4.5	4.2	5.83	35	1,870	1.9	2.2	5,325	188 / 191		48
Guinea-Bissau	1.2	3.3	2.4	24	4.0	2.8	5.99	25	630		1.1	1,272	219 / 196		49
Liberia	3.1	14.4	5.5	45	4.9	4.7	6.80					994	118 / 106		
Mali	11.7	41.7	2.9	30	4.6	1.9	7.00	24	740	2.3	5.1	14,660	240 / 232		65
Mauritania	2.7	8.5	3.0	58	4.3	2.7	6.00	40	1,550	4.8	1.4	1,045	163 / 150		37
Niger	11.2	51.9	3.6	21	5.5	1.8	8.00	18	740	2.4	1.2	8,814	207 / 213		59
Nigeria	116.9	278.8	2.6	44	4.1	1.2	5.42	31	770	0.8	0.8	21,698	130 / 130	716	57
Senegal	9.7	22.7	2.5	47	4.0	3.0	5.11	47	1,400	3.8	2.6	14,762	107 / 102	312	78
Sierra Leone	4.6	14.4	4.5	37	4.0	5.4	6.50		440		0.9	1,579	266 / 242		28
Togo	4.7	11.8	2.6	33	4.2	1.2	5.36	51	1,380	4.5	1.3	2,964	132 / 116		54
Asia	3,720.7	5,428.2	1.3	37	2.5		2.54	53				405,287	68 / 73		
Eastern Asia (8)	1,491.8	1,665.2	0.7	39	1.9		1.76	68					35 / 42		
China	1,285.0	1,462.1	0.7	32	2.3	6.3	1.80	67	3,550	2.4	2.0	6,693	38 / 45	830	75
Democratic People's Republic of Korea	22.4	28.0	0.7	60	1.6	3.7	2.07					676	52 / 48		100
Hong Kong SAR, China (9)	7.0	9.6	1.2	100	1.1	5.7	1.17		22,570	2.8	2.1		5 / 5	2,497	
Japan	127.3	109.2	0.1	79	0.3	1.2	1.33	100	25,170	3.9	5.9	88,879 ²³	5 / 4	4,035	
Mongolia	2.6	4.1	1.1	64	2.3	0.5	2.32	93	1,610	5.6	4.3	3,229	88 / 83		60
Republic of Korea	47.1	51.6	0.7	82	1.4	2.4	1.51	98	15,530	3.8	2.3	203	10 / 9	3,519	92

DEMOGRAPHIC, SOCIAL AND ECONOMIC INDICATORS

	Total population (millions) (2001)	Projected population (millions) (2050)	Ave. pop. Growth rate (%) (2000-2005)	% urban (2000)	Urban growth rate (2000-2005)	Population/ha arable & perm. crop land	Total fertility rate (2000-2005)	% births with skilled attendants	GNI per capita PPP\$ (1999)	% central gov't. expenditures Education	Health	External population assistance (US\$,000)	Under 5 mortality M/F	Per capita energy consumption	Access to safe water
South-eastern Asia	529.8	800.3	1.4	37	3.2		2.52	60					60 / 48		
Cambodia	13.4	29.9	2.4	16	4.2	2.0	4.77	33	1,350	3.0	0.6	21,806	110 / 98		30
Indonesia	214.8	311.3	1.2	41	3.6	3.0	2.27	56	2,660	1.6	0.7	32,848	55 / 43	604	76
Lao People's Democratic Republic	5.4	11.4	2.3	24	4.9	4.7	4.80	14	1,430	2.1	1.2	3,542	144 / 137		90
Malaysia	22.6	37.8	1.7	57	2.8	0.5	2.90	96	7,640	5.1	1.4	251	15 / 11	1,967	
Myanmar	48.4	68.5	1.2	28	2.9	3.1	2.80	56		[1.2]	0.2	2,424	141 / 124	307	68
Philippines	77.1	128.4	1.9	59	3.1	3.0	3.24	56	3,990	3.4	1.7	46,625	40 / 30	526	87
Singapore	4.1	4.6	1.7	100	1.0	6.0	1.45	100	22,310	2.7	1.2	0	6 / 6	6,285	100
Thailand	63.6	82.5	1.1	22	2.7	1.5	2.00		5,950	5.0	1.9	4,249	32 / 19	1,153	80
Viet Nam	79.2	123.8	1.3	20	2.2	7.3	2.25	77	1,860	3.0	0.8	20,616	52 / 37	440	56
South Central Asia	1,506.7	2,538.8	1.7	31	3.0		3.25	40					89 / 100		
Afghanistan	22.5	72.3	3.7	22	6.9	1.8	6.80					813	278 / 281		13
Bangladesh	140.4	265.4	2.1	25	4.0	8.6	3.56	13	1,530	2.2	1.7	87,699	88 / 97	159	97
Bhutan	2.1	5.6	2.6	7	6.0	11.8	5.10	15	1,260			924	82 / 78		62
India	1,025.1	1,572.1	1.5	28	2.8	3.2	2.97	43	2,230	3.2	0.8	58,134	79 / 92	486	88
Iran (Islamic Republic of)	71.4	121.4	1.4	62	1.8	1.0	2.76	86	5,520	3.9	1.7	2,127	40 / 45	1,649	95
Nepal	23.6	52.4	2.3	12	5.1	7.2	4.48	9	1,280	3.1	1.3	22,051	91 / 106	343	81
Pakistan	145.0	344.2	2.5	37	4.1	3.5	5.08	18	1,860	2.5	0.9	28,561	121 / 135	440	88
Sri Lanka	19.1	23.1	0.9	24	2.8	4.6	2.09	94	3,230	3.5	1.4	3,942	30 / 16	389	83
Western Asia	192.4	423.9	2.1	70	2.8		3.57	71				35,060	53 / 47		
Iraq	23.6	53.6	2.7	77	3.3	0.4	4.77	54			3.8	1,004	79 / 76	1,342	85
Israel	6.2	10.1	2.0	91	1.8	0.4	2.70		18,070	7.7	6.0	21	9 / 9	3,165	
Jordan	5.1	11.7	2.8	74	3.5	1.5	4.31	97	3,880	7.1	5.3	10,911	29 / 27	1,063	96
Kuwait	2.0	4.0	2.6	98	2.3	2.6	2.66	98		[5.0]	2.9	341	13 / 13	7,823	
Lebanon	3.6	5.0	1.6	90	1.7	0.4	2.18	98		2.7	2.2	1,134	22 / 17	1,256	100
Occupied Palestinian Territory	3.3	11.8	3.6	95	4.1		5.60	95				2,101	27 / 21		
Oman	2.6	8.8	3.3	84	4.4	14.2	5.46	91		[4.5]	2.9		29 / 25	3,165	39
Saudi Arabia	21.0	59.7	3.1	86	3.4	0.6	5.54	91	11,050	7.5	6.4		26 / 23	5,244	95
Syrian Arab Republic	16.6	36.3	2.5	55	3.3	0.8	3.65	76	3,450	4.0	0.8	3,463	28 / 25	1,133	80
Turkey (11)	67.6	98.8	1.3	75	2.6	0.8	2.30	81	6,440	2.2	2.9	8,235	56 / 42	1,144	83
United Arab Emirates	2.7	3.7	1.7	86	2.0	1.5	2.86	99		[1.8]	0.8	7	16 / 14	10,035	
Yemen	19.1	102.4	4.1	25	4.7	5.5	7.60	22	730	7.8	4.8	7,830	87 / 83	201	69
Europe	726.3	603.3	-0.2	75	0.3		1.34						13 / 10		
Eastern Europe	302.6	222.7	-0.5	71	0.2		1.17					26,859 ^{22,24}	21 / 16		
Bulgaria	7.9	4.5	-1.0	70	-0.1	0.2	1.10		5,070	3.4	3.8	361	22 / 16	2,418	100
Czech Republic	10.3	8.4	-0.1	75	0.0	0.3	1.16		12,840	5.3	7.0		7 / 7	3,986	
Hungary	9.9	7.5	-0.5	64	-0.0	0.3	1.20		11,050	4.8	5.2		12 / 10	2,497	99
Poland	38.6	33.4	-0.1	66	0.7	0.6	1.26		8,390	7.4	4.5	187	11 / 10	2,494	
Romania	22.4	18.1	-0.3	56	0.2	0.4	1.32		5,970	3.7	2.6	1,986	29 / 25	1,760	58
Slovakia	5.4	4.7	0.1	57	0.5	0.3	1.28		10,430	4.8	5.7		10 / 10	3,136	100
Northern Europe (12)	95.2	92.8	0.1	84	0.3		1.57						7 / 6		
Denmark	5.3	5.1	0.2	85	0.2	0.1	1.65	100	25,600	8.3	6.7	(60,114)	7 / 6	3,925	100
Estonia	1.4	0.8	-1.1	69	-1.0	0.1	1.20		8,190	7.7	5.5	38	14 / 10	3,335	
Finland	5.2	4.7	0.1	67	0.9	0.2	1.55	100	22,600	7.6	5.2	(23,114)	5 / 4	6,493	100
Ireland	3.8	5.4	1.0	59	1.2	0.3	2.02	99	22,460	6.9	4.5		8 / 8	3,570	
Latvia	2.4	1.7	-0.6	69	-1.0	0.2	1.10	95	6,220	6.6	4.3	285	19 / 15	1,746	
Lithuania	3.7	3.0	-0.2	68	-0.1	0.2	1.20	95	6,490	5.9	4.8	42	14 / 10	2,524	
Norway	4.5	4.9	0.4	76	0.9	0.3	1.70	100	28,140	7.6	7.4	(71,394)	6 / 5	5,736	100
Sweden	8.8	7.8	-0.1	83	0.3	0.1	1.29	100	22,150	8.3	6.7	(78,270)	5 / 4	5,928	100
United Kingdom	59.5	58.9	0.2	90	0.2	0.2	1.61	98	22,220	5.5	5.9	(125,934)	7 / 6	3,930	100
Southern Europe (13)	145.1	116.9	0.0	66	0.4		1.29						10 / 9		
Albania	3.1	3.9	0.6	42	2.0	2.2	2.27		3,240	3.7	3.5	2,515	37 / 31	284	
Bosnia & Herzegovina	4.1	3.5	1.1	43	2.3	0.3	1.30					736	17 / 14	517	
Croatia	4.7	4.2	0.0	58	0.6	0.3	1.70		7,260	5.3	8.1		10 / 8	1,808	
Greece	10.6	9.0	0.0	60	0.4	0.4	1.24		15,800	3.0	4.7		8 / 7	2,565	
Italy	57.5	43.0	-0.1	67	0.1	0.3	1.20		22,000	4.9	5.6	(6,385)	7 / 6	2,916	
Macedonia (Former Yugoslav Republic of)	2.0	1.9	0.3	62	1.3	0.5	1.48		4,590	5.3	5.5		19 / 18		
Portugal	10.0	9.0	0.1	64	1.7	0.6	1.45		15,860	5.9	5.2	(1,244)	9 / 8	2,192	
Slovenia	2.0	1.5	-0.1	50	0.3	0.2	1.14		16,050	5.8	6.6		8 / 7	3,354	100
Spain	39.9	31.3	0.0	78	0.2	0.2	1.13		17,850	5.1	5.4	(4,320)	7 / 6	2,865	
Yugoslavia	10.5	9.0	-0.1	52	0.6	0.6	1.55					75	17 / 14		

DEMOGRAPHIC, SOCIAL AND ECONOMIC INDICATORS

	Total population (millions) (2001)	Projected population (millions) (2050)	Ave. pop. Growth rate (%) (2000-2005)	% urban (2000)	Urban growth rate (2000-2005)	Population/ha arable & perm. crop land	Total fertility rate (2000-2005)	% births with skilled attendants	GNI per capita PPP\$ (1999)	% central gov. expenditures Education	Health	External population assistance (US\$,000)	Under 5 mortality M/F	Per capita energy consumption	Access to safe water
Western Europe (14)	183.4	170.9	0.1	83	0.4		1.50						6 / 6		
Austria	8.1	6.5	-0.1	65	0.5	0.3	1.24	100	24,600	5.5	6.0	(1,784)	6 / 5	3,567	100
Belgium	10.3	9.6	0.1	97	0.1	0.3 ²⁵	1.48	100	25,710	3.1	7.9	(10,148)	6 / 6	5,719	
France	59.5	61.8	0.4	76	0.6	0.1	1.80	99	23,020	6.0	7.3	(16,500)	6 / 6	4,378	
Germany	82.0	70.8	0.0	88	0.2	0.2	1.29	100	23,510	4.8	7.9	(124,806) ²⁶	6 / 6	4,199	
Netherlands	15.9	15.8	0.3	89	0.3	0.6	1.50	100	24,410	5.0	6.0	(119,230)	7 / 6	4,740	100
Switzerland	7.2	5.6	-0.1	68	0.6	1.1	1.38	99	28,760	5.1	7.6	(17,818)	7 / 5	3,742	100
Latin America & Caribbean	526.5	805.6	1.4	75	1.9		2.50	83				237,075	45 / 36		
Caribbean (15)	38.3	49.8	1.0	63	1.6		2.41	69					60 / 50		
Cuba	11.2	10.8	0.3	75	0.5	0.4	1.55	100		[6.7]	8.2	782	12 / 8	1,066	95
Dominican Republic	8.5	12.0	1.5	65	2.3	1.0	2.71	99	5,210	2.5	1.9	7,061	57 / 47	676	79
Haiti	8.3	14.0	1.6	36	3.4	5.6	3.98	21	1,470	1.4	20,144		111 / 96	271	46
Jamaica	2.6	3.8	0.9	56	1.7	2.0	2.37	95	3,390	8.1	3.2	5,588	28 / 21	1,575	71
Puerto Rico	4.0	4.8	0.9	75	1.2	1.6	1.90						14 / 11		
Trinidad & Tobago	1.3	1.4	0.5	74	1.1	1.0	1.53		7,690	4.1	2.5	175	17 / 12	6,964	86
Central America	137.5	220.2	1.6	67	2.0		2.76	79					41 / 34		
Belize	0.2	0.4	1.9	54	3.4	0.8	2.89	77	4,750			112	39 / 38		76
Costa Rica	4.1	7.2	2.0	48	2.6	1.7	2.67	98	7,880	6.4	5.2	239	15 / 11	789	98
El Salvador	6.4	10.9	1.8	47	2.7	2.6	2.88	90	4,260	2.6	2.6	7,045	38 / 31	640	74
Guatemala	11.7	26.6	2.6	40	3.4	2.9	4.41	41	3,630	1.6	2.1	9,980	58 / 51	579	92
Honduras	6.6	12.8	2.3	53	4.2	1.1	3.72	55	2,270	4.0	3.9	8,118	55 / 44	542	90
Mexico	100.4	146.7	1.4	74	1.7	0.9	2.49	86	8,070	5.5	2.8	28,948	37 / 31	1,552	86
Nicaragua	5.2	11.5	2.6	56	3.4	0.4	3.82	65	2,060	4.4	8.3	15,974	50 / 40	553	79
Panama	2.9	4.3	1.4	56	2.0	1.0	2.42	90	5,450	5.6	4.9	382	26 / 22	862	87
South America (16)	350.7	535.5	1.4	80	1.9		2.41	87					45 / 35		
Argentina	37.5	54.5	1.2	90	1.5	0.1	2.44	98	11,940	3.5	4.9	1,239	26 / 21	1,726	79
Bolivia	8.5	17.0	2.2	63	3.0	1.6	3.92	59	2,300	5.0	4.1	28,818	80 / 70	581	79
Brazil	172.6	247.2	1.2	81	1.8	0.4	2.15	92	6,840	5.2	2.9	17,684	50 / 38	1,055	87
Chile	15.4	22.2	1.2	86	1.5	1.0	2.35	100	8,410	3.5	2.7	1,091	15 / 12	1,594	94
Colombia	42.8	70.9	1.6	74	2.2	2.2	2.62	85	5,580	4.0	5.2	2,297	35 / 30	753	91
Ecuador	12.9	21.2	1.7	65	3.0	1.2	2.76	71	2,820	3.9	1.7	7,640	60 / 49	737	71
Paraguay	5.6	12.6	2.5	56	3.6	1.0	3.84	71	4,380	3.7	1.7	3,392	51 / 39	819	79
Peru	26.1	42.1	1.6	73	2.1	1.9	2.64	56	4,480	2.8	2.4	28,296	61 / 50	581	77
Uruguay	3.4	4.2	0.7	91	0.9	0.3	2.30	100	8,750	3.4	1.9	832	18 / 13	910	98
Venezuela	24.6	42.2	1.8	87	2.1	0.7	2.72	95	5,420	6.1	2.6	619	25 / 20	2,433	84
Northern America (17)	317.1	437.6	0.9	77	1.0		1.90						8 / 8		
Canada	31.0	40.4	0.8	77	1.1	0.0	1.58	100	25,440	7.1	6.3	(38,568)	7 / 6	7,747	100
United States of America	285.9	397.1	0.9	77	1.0	0.0	1.93	99	31,910	5.5	5.8	(619,729)	8 / 8	7,937	100
Oceania	30.9	47.2	1.2	70	1.2		2.39						32 / 33		
Australia-New Zealand	23.1	30.9	0.9	85	1.0		1.79						7 / 6		
Australia (18)	19.3	26.5	1.0	85	0.9	0.0	1.75	100	23,850	5.5	5.9	(44,562)	7 / 6	5,600	100
Melanesia (19)	6.6	14.2	2.2	24	3.7		4.14						68 / 74		
New Caledonia	0.2	0.4	1.9	77	2.8		2.47		21,130				9 / 10		
New Zealand	3.8	4.4	0.7	86	1.0	0.1	1.97	95	17,630	7.5	6.2	(2,316)	8 / 7	4,525	
Papua New Guinea	4.9	11.0	2.2	17	4.0	5.4	4.32	53	2,260		2.5	6,312	81 / 88		42
Vanuatu	0.2	0.5	2.5	20	4.0		4.26	87	2,880			32	32 / 39		88
Countries with Economies in Transition of the Former USSR (20)															
Armenia	3.8	3.2	0.1	70	0.8	0.9	1.10	97	2,360	1.9	3.1	3,164	19 / 17	511	
Azerbaijan	8.1	8.9	0.6	57	1.5	1.1	1.51	100	2,450	3.3	1.2	1,160	41 / 38	1,564	
Belarus	10.1	8.3	-0.4	71	0.3	0.2	1.20		6,880	6.0	4.9	125	18 / 13	2,614	100
Georgia	5.2	3.2	-0.5	61	0.8	1.0	1.39	95	2,540	4.2	0.5	205	25 / 18	464	
Kazakhstan	16.1	15.3	-0.4	56	0.2	0.1	1.95	98	4,790	3.7	3.5	2,418	62 / 42	2,590	91
Kyrgyzstan	5.0	7.5	1.2	33	0.9	0.9	2.34	98	2,420	4.6	2.9	1,324	50 / 42	609	77
Republic of Moldova	4.3	3.6	-0.3	46	0.3	0.5	1.40		2,100	8.3	6.4	1,126	28 / 22	943	100
Russian Federation	144.7	104.3	-0.6	78	0.2	0.1	1.14		6,990	4.3	4.6	2,927	24 / 18	3,963	99
Tajikistan	6.1	9.8	0.7	28	1.3	2.4	2.87	79		2.4	5.2	568	82 / 70	532	
Turkmenistan	4.8	8.4	1.9	45	2.1	0.9	3.17	96	3,340		4.1	730	74 / 61	2,357	
Ukraine	49.1	30.0	-0.9	68	-0.1	0.3	1.10		3,360	6.7	3.6	4,140	22 / 16	2,842	
Uzbekistan	25.3	40.5	1.4	37	1.6	1.4	2.29	98	2,230	7.8	3.4	2,350	56 / 48	1,930	85

SELECTED INDICATORS FOR LESS POPULOUS COUNTRIES/TERRITORIES

Monitoring ICPD Goals – Selected Indicators

	Indicators of Mortality			Indicators of Education		Reproductive Health Indicators			
	Infant mortality Total per 1,000 live births	Life expectancy M/F	Maternal Mortality Ratio	Primary enrolment (gross) M/F	Secondary enrolment (gross) M/F	Births per 1,000 women aged 15-19	Contraceptive prevalence		HIV prevalence rate (%) (15-24) M/F
							Any method	Modern methods	
Bahamas	17	65.2 / 73.9	10	97 / 97	90 / 90	61	62	60	3.85 / 2.67
Bahrain	14	72.1 / 76.3	38	105 / 106	91 / 98	18	62	31	
Barbados	11	74.5 / 79.5	33	90 / 90		43	55	53	1.21 / 0.84
Brunei Darussalam	9	74.2 / 78.9	22	109 / 104	72 / 82	30			
Cape Verde	50	67.0 / 72.8	190	150 / 147	54 / 56	72	53	46	
Comoros	67	59.4 / 62.2	570	84 / 69	24 / 19	77	21	11	
Cyprus	8	76.0 / 80.5		100 / 100	95 / 99	10			0.10 / 0.07
Djibouti	117	39.4 / 41.6	520	44 / 33	17 / 12	65			8.80 / 13.92
East Timor	121	49.2 / 50.9	850			27			
Equatorial Guinea	99	50.4 / 53.6	1,400			192			0.27 / 0.55
Fiji	17	68.1 / 71.5	20	128 / 128	64 / 65	54	41	35	
French Polynesia	9	70.7 / 75.8	20	118 / 113	69 / 86	58			
Gambia	115	45.7 / 48.5	1,100	87 / 67	30 / 19	139	12	7	0.86 / 2.17
Guadaloupe	7	74.8 / 81.7	5			18	44	31	
Guam	10	72.4 / 77.0	12			109			
Guyana	52	58.0 / 66.9	150	97 / 96	71 / 76	64	31	28	3.87 / 2.30
Iceland	5	77.1 / 81.8	16	98 / 98	109 / 108	18			0.10 / 0.06
Luxembourg	6	74.6 / 80.9		87 / 94	85 / 90	9			
Maldives	37	68.3 / 67.0	390	130 / 127	67 / 71	53			
Malta	7	75.9 / 81.0		108 / 107	86 / 82	12			
Martinique	7	75.8 / 82.3	4			27	51	38	
Micronesia (27)	19	71.0 / 75.5				78			
Netherlands Antilles	13	73.3 / 79.2	20			45			
Polynesia (28)	17	69.2 / 74.8	33			53			
Qatar	11	69.4 / 72.1	41	87 / 86	80 / 79	36	43	32	
Reunion	8	70.6 / 79.1	39			20	67	62	
Samoa	26	66.9 / 73.5	15	101 / 100	59 / 66	46			
Solomon Islands	21	67.9 / 70.7	60	103 / 89	21 / 14	87			
Suriname	26	68.5 / 73.7	230			16			1.33 / 0.79
Swaziland	92	38.1 / 38.1	370	120 / 114	55 / 54	81	20	17	13.03 / 28.53

Demographic, Social and Economic Indicators

	Total population (thousands) 2001	Projected population (thousands) 2050	% urban (2000)	Urban growth rate (2000-2005)	Population/ ha arable & perm. crop land	Total fertility rate (2000-2005)	% births with skilled attendants	GNI per capita PPPS (1999)	Under 5 mortality M/F
Bahamas	308	449	88.5	1.9	1.1	2.31	100	15,500	26 / 20
Bahrain	652	1,008	92.2	1.8	1.2	2.28	98		22 / 15
Barbados	268	263	50.0	1.5	0.8	1.50	100	14,010	13 / 11
Brunei Darussalam	335	565	72.2	2.4	0.4	2.53	98		10 / 10
Cape Verde	437	807	62.2	4.0	2.4	3.24	54	4,450	60 / 53
Comoros	727	1,900	33.2	4.4	4.2	4.96	52	1,430	96 / 87
Cyprus	790	910	56.8	1.7	0.5	1.92	100	19,080	8 / 8
Djibouti	644	1,068	83.3	2.4		5.77			210 / 194
East Timor	750	1,410	7.5	2.2	8.8	3.85			182 / 174
Equatorial Guinea	470	1,378	48.2	4.5	1.3	5.89	5	3,910	167 / 153
Fiji	823	916	49.4	2.9	1.1	2.98	100	4,780	20 / 24
French Polynesia	237	372	52.7	1.6		2.47		22,200	11 / 11
Gambia	1,337	2,605	32.5	4.5	4.9	4.79	44	1,550	205 / 185
Guadaloupe	431	479	99.7	1.2	0.7	2.02			11 / 8
Guam	158	307	39.2	2.5		3.95			13 / 10
Guyana	763	504	38.2	2.3	0.3	2.31	95	3,330	80 / 60
Iceland	281	333	92.5	1.0	4.0	1.90		27,210	7 / 5
Luxembourg	442	715	91.5	1.1	0.3 ²⁵	1.76		41,230	7 / 7
Maldives	300	868	26.1	3.5	26.3	5.37	90		38 / 56
Malta	392	400	90.5	0.9	0.6	1.77			9 / 8
Martinique	386	413	94.9	0.9	0.8	1.70			9 / 8
Micronesia (27)	528	1,080	45.1	3.4		4.11			24 / 23
Netherlands Antilles	217	259	70.4	1.4	0.1	2.09			17 / 11
Polynesia (28)	613	958	40.3	2.3		3.01	76		22 / 20
Qatar	575	831	92.5	1.7	0.5	3.34	98		16 / 11
Reunion	732	1,002	70.9	1.9	0.7	2.14			12 / 10
Samoa	159	223	21.5	2.8		4.24	76	4,070	34 / 29
Solomon Islands	463	1,458	19.7	5.6	5.1	5.26	85	2,050	31 / 30
Suriname	419	418	74.2	1.3	1.2	2.05		3,780	35 / 23
Swaziland	938	1,391	26.4	4.0	1.9	4.44	56	4,380	178 / 163

NOTES FOR INDICATORS

The designations employed in this publication do not imply the expression of any opinion on the part of the United Nations Population Fund concerning the legal status of any country, territory or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.

Data for small countries or areas, generally those with population of 200,000 or less in 1990, are not given in this table separately. They have been included in their regional population figures.

- (*) More-developed regions comprise North America, Japan, Europe and Australia-New Zealand.
- (+) Less-developed regions comprise all regions of Africa, Latin America and Caribbean, Asia (excluding Japan), and Melanesia, Micronesia and Polynesia.
- (#) Least-developed countries according to standard United Nations designation.
- (1) Including British Indian Ocean Territory and Seychelles.
- (2) Including Agalesa, Rodrigues and St. Brandon.
- (3) Including Sao Tome and Principe.
- (4) Formerly Zaire.
- (5) Including Western Sahara.
- (6) Including St. Helena, Ascension and Tristan da Cunha.
- (7) Regional averages and totals exclude Japan and Australia-New Zealand.
- (8) Including Macau.
- (9) On 1 July 1997, Hong Kong became a Special Administrative Region (SAR) of China.
- (10) This entry is included in the more developed regions aggregate but not in the estimate for the geographical region.
- (11) Turkey is included in Western Asia for geographical reasons. Other classifications include this country in Europe.
- (12) Including Channel Islands, Faeroe Islands and Isle of Man.
- (13) Including Andorra, Gibraltar, Holy See and San Marino.

- (14) Including Liechtenstein and Monaco.
- (15) Including Anguilla, Antigua and Barbuda, Aruba, British Virgin Islands, Cayman Islands, Dominica, Grenada, Montserrat, Netherlands Antilles, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Turks and Caicos Islands, and United States Virgin Islands.
- (16) Including Falkland Islands (Malvinas) and French Guiana.
- (17) Including Bermuda, Greenland, and St. Pierre and Miquelon.
- (18) Including Christmas Island, Cocos (Keeling) Islands and Norfolk Island.
- (19) Including New Caledonia and Vanuatu.
- (20) The successor States of the former USSR are grouped under existing regions. Eastern Europe includes Belarus, Republic of Moldova, Russian Federation and Ukraine. Western Asia includes Armenia, Azerbaijan and Georgia. South Central Asia includes Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan. Regional total, excluding subregion reported separately below.
- (21) Regional total, excluding subregion reported separately below.
- (22) These subregions are included in the UNFPA Arab States and Europe region.
- (23) Estimates based on previous years' reports. Updated data are expected.
- (24) Total for Eastern Europe includes some South European Balkan States and Northern European Baltic States.
- (25) This figure includes Belgium and Luxembourg.
- (26) More recent reports suggest this figure might have been higher. Future publications will reflect the evaluation of this information.
- (27) Comprising Federated States of Micronesia, Guam, Kiribati, Marshall Islands, Nauru, Northern Mariana Islands, Pacific Islands (Palau) and Wake Island.
- (28) Comprising American Samoa, Cook Islands, Johnston Island, Pitcairn, Samoa, Tokelau, Tonga, Midway Islands, Tuvalu, and Wallis and Futuna Islands.

TECHNICAL NOTES

The statistical tables in this year's State of World Population report once again give special attention to indicators that can help track progress in meeting the quantitative and qualitative goals of the International Conference on Population and Development in the areas of mortality reduction, access to education, and access to reproductive health services, including family planning. This year we have added indicators of HIV/AIDS prevalence among young people, reflecting the heightened global priority to stemming the pandemic. Several changes have been made in other indicators, as noted below. Future reports will include different process measures when these become available, as ICPD follow-up efforts lead to improved monitoring systems. Improved monitoring of the financial contributions of governments, non-governmental organizations and the private sector should also allow better future reporting of expenditures and resource mobilization for ICPD implementation efforts. The sources for the indicators and their rationale for selection follow, by category.

MONITORING ICPD GOALS

INDICATORS OF MORTALITY

Infant mortality, male and female life expectancy at birth. Source: United Nations Population Division. 2001. *World Population Prospects: The 2000 Revision* (Data diskettes, "Demographic Indicators 1950-2050"). New York: United

Nations. These indicators are measures of mortality levels, respectively, in the first year of life (which is most sensitive to development levels) and over the entire lifespan.

Maternal mortality ratio. Source: Kenneth Hill, Carla AbouZahr, & Tessa Wardlaw. "Estimates of Maternal Mortality for 1995." *Bulletin of the World Health Organization* 79(3): 182-193. Geneva: World Health Organization. These are consensus estimates of WHO, UNICEF and UNFPA. This indicator presents the number of deaths to women per 100,000 live births which result from conditions related to pregnancy, delivery and related complications. Precision is difficult, though relative magnitudes are informative. Estimates below 50 are not rounded; those 50-100 are rounded to the nearest 5; 100-1,000, to the nearest 10; and above 1,000, to the nearest 100. Several of the estimates differ from official government figures. The estimates are based on reported figures wherever possible, using approaches to improve the comparability of information from different sources. See the source for details on the origin of particular national estimates. Estimates and methodologies are regularly reviewed by WHO, UNICEF, UNFPA, academic institutions and other agencies and are revised where necessary, as part of the ongoing process of improving maternal mortality data. Because of changes in methods, prior estimates for 1990 levels may not be strictly comparable with these estimates.

INDICATORS OF EDUCATION

Male and female gross primary enrolment ratios, male and female gross secondary enrolment ratios. Source: Spreadsheets provided by UNESCO; *1999 UNESCO Statistical Yearbook* and *World Education Report 2000*. Paris: UNESCO Institute for Statistics. Gross enrolment ratios indicate the number of students enrolled in a level in the education system per 100 individuals in the appropriate age group. They do not correct for individuals who are older than the level-appropriate age due to late starts, interrupted schooling or grade repetition.

Male and female adult illiteracy. Source: Spreadsheets provided by UNESCO (data from February 2000 assessment, to be published in the *Education for All: Status and Trends* series. Paris: UNESCO). Illiteracy definitions are subject to variation in different countries; three widely accepted definitions are in use. In so far as possible, data refer to the proportion who cannot, with understanding, both read and write a short simple statement on everyday life. Adult illiteracy (rates for persons above 15 years of age) reflects both recent levels of educational enrolment and past educational attainment. The above education indicators have been updated using the UN Population Division estimates from *World Population Prospects: The 1998 Revision*. Education data are most recent, ranging from 1982-1998.

Per cent reaching final grade of primary education. Source: Spreadsheets provided by UNESCO; data are published in the *World Education Report* series. Paris: UNESCO Institute for Statistics. This year we report the proportion reaching the final grade, rather than the proportion reaching grade 5. Data are most recent within the years 1980-1998. For countries with only one figure, sex disaggregation was unavailable.

INDICATORS OF REPRODUCTIVE HEALTH

Contraceptive knowledge. Previously reported indicators on knowledge of contraceptive methods and sources have been dropped since most countries have reached high levels. Process indicators relating to availability of a range of methods will be reported in the future when databases are improved.

Births per 1,000 women aged 15-19. Source: United Nations Population Division. 2001. *World Population Prospects: The 2000 Revision* (Data diskettes, "Demographic Indicators 1950-2050"); and United Nations Population Division. 2000. *Age Patterns of Fertility: The 2000 Revision*. New York: United Nations. This is an indicator of the burden of fertility on young women. Since it is an annual level summed over all women in the age cohort, it does not reflect fully the level of fertility for women during their youth. Since it indicates the annual average number of births per woman per year, one could multiply it by five to approximate the number of births to 1,000 young women during their late teen years. The measure does not indicate the full dimensions of teen pregnancy as only live births are included in the numerator. Stillbirths and spontaneous or induced abortions are not reflected.

Contraceptive prevalence. Source: United Nations Population Division. 2001. Database on Contraceptive Use (updated March 2001). New York: United Nations. These data are derived from sample survey reports and estimate the proportion of married women (including women in consensual unions) currently using, respectively, any method or modern methods of contraception. Modern or clinic and supply methods include male and female sterilization, IUD, the pill, injectables, hormonal implants, condoms and female barrier methods. These numbers are roughly but not completely comparable across countries due to variation in populations surveyed by age (15- to 49-year-old women being most common; nearly two thirds of the database), in the timing of the surveys, and in the details of the questions. All of the data were collected in 1972 or later.

The most recent survey data available are cited; 80 per cent of the data refer to the period 1990-2000.

HIV prevalence rate, M/F, 15-24. Source: UNAIDS. 2000. Country HIV/AIDS information spreadsheet on UNAIDS website. These data derive from surveillance system reports and model estimates. Data provided for men and women aged 15-24 are, respectively, averages of High and Low Estimates for each country. The reference year is 1999. Male-female differences reflect physiological and social vulnerability to the illness and are affected by age differences between sexual partners.

DEMOGRAPHIC, SOCIAL AND ECONOMIC INDICATORS

Total population 2001, projected population 2050, average annual population growth rate for 2000-2005. Source: United Nations Population Division. 2001. *World Population Prospects: The 2000 Revision* (Data diskettes, "Demographic Indicators 1950-2050"); and United Nations Population Division. 2001. *Annual Populations 1950-2050: The 2000 Revision*. New York: United Nations. These indicators present the size, projected future size and current period annual growth of national populations.

Per cent urban, urban growth rates. Source: United Nations Population Division. 2000. *World Urbanization Prospects: The 1999 Revision* (Data sets POP/DB/WUP/Rev.1999/1/F4 and F6.) New York: United Nations. These indicators reflect the proportion of the national population living in urban areas and the growth rate in urban areas projected for 2000-2005.

Agricultural population per hectare of arable and permanent crop land. Source: Data provided by Food and Agriculture Organization, using agricultural population data based on the total populations from United Nations Population Division. 1999. *World Population Prospects: The 1998 Revision*. New York: United Nations. This indicator relates the size of the agricultural population to the land suitable for agricultural production. It is responsive to changes in both the structure of national economies (proportions of the workforce in agriculture) and in technologies for land development. High values can be related to stress on land productivity and to fragmentation of land holdings. However, the measure is also sensitive to differing development levels and land use policies. Data refer to the year 1998.

Total fertility rate (period: 2000-2005). Source: United Nations Population Division. 2000. *World Population Prospects: The 2000 Revision* (Data diskettes, "Demographic Indicators 1950-2050"). New York: United Nations. The measure indicates the number of children a woman would have during her reproductive years if she bore children at the rate estimated for different age groups in the specified time period. Countries may reach the projected level at different points within the period.

Births with skilled attendants. Source: World Health Organization; updated information provided by WHO. Data for less developed countries/regions from WHO, in AbouZahr, C., and T. Wardlaw. 2001. "Maternal Mortality at the End of the Decade: What Signs of Progress?" (Forthcoming in *Bulletin of the World Health Organization*.) Data for more developed countries from Population Action International. 2001. *A World of Difference: Sexual and Reproductive Health & Risks* (wallchart). This indicator is based on national reports of the proportion of births attended by "skilled health personnel or skilled attendant: doctors (specialist or non-specialist) and/or persons with midwifery skills who can diagnose and manage obstetrical complications as well as normal deliveries". Data for more developed countries reflect their higher levels of skilled delivery attendance. Because of assumptions of full coverage, data (and coverage) deficits of marginalized populations and the impacts of chance and transport delays may not be fully

reflected in official statistics. Data estimates are the most recent available.

Gross national income per capita. Source: 1999 figures from: The World Bank. 2001. *World Development Indicators 2001*. Washington, D.C.: The World Bank. This indicator (formerly referred to as gross national product [GNP] per capita) measures the total output of goods and services for final use produced by residents and non-residents, regardless of allocation to domestic and foreign claims, in relation to the size of the population. As such, it is an indicator of the economic productivity of a nation. It differs from gross domestic product (GDP) by further adjusting for income received from abroad for labour and capital by residents, for similar payments to non-residents, and by incorporating various technical adjustments including those related to exchange rate changes over time. This measure also takes into account the differing purchasing power of currencies by including purchasing power parity (PPP) adjustments of "real GNP". Some PPP figures are based on regression models; others are extrapolated from the latest International Comparison Programme benchmark estimates; see original source for details.

Central government expenditures on education and health. Source: The World Bank. 2001. *World Development Indicators 2001*. Washington, D.C.: The World Bank. These indicators reflect the priority afforded to education and health sectors by a country through the government expenditures dedicated to them. They are not sensitive to differences in allocations within sectors, e.g., primary education or health services in relation to other levels, which vary considerably. Direct comparability is complicated by the different administrative and budgetary responsibilities allocated to central governments in relation to local governments, and to the varying roles of the private and public sectors. Reported estimates are presented as shares of GDP (except figures in brackets which are per cent of GNI) rather than as per capita PPP dollar amounts (as in prior reports). On-going methodological work must be completed before such conversions are justified. Great caution is also advised about cross-country comparisons because of varying costs of inputs in different settings and sectors. Data refer to the most recent estimates 1990-1999.

External assistance for population. Source: UNFPA. 2000. *Financial Resource Flows for Population Activities in 1998*. New York: UNFPA. This figure provides the amount of external assistance expended in 1998 for population activities in each country. External funds are disbursed through multilate-

ral and bilateral assistance agencies and by non-governmental organizations. Donor countries are indicated by their contributions being placed in parentheses. Future editions of this report will use other indicators to provide a better basis for comparing and evaluating resource flows in support of population and reproductive health programmes from various national and international sources. Regional totals include both country-level projects and regional activities (not otherwise reported in the table).

Under-5 mortality. Source: United Nations Population Division, special tabulation based on United Nations. 2001. *World Population Prospects: The 2000 Revision*. New York: United Nations. This indicator relates to the incidence of mortality to infants and young children. It reflects, therefore, the impact of diseases and other causes of death on infants, toddlers and young children. More standard demographic measures are infant mortality and mortality rates for 1 to 4 years of age, which reflect differing causes of and frequency of mortality in these ages. The measure is more sensitive than infant mortality to the burden of childhood diseases, including those preventable by improved nutrition and by immunization programmes. Under-5 mortality is here expressed as deaths to children under 5 per 1,000 live births in a given year. The estimate refers to the period 2000-2005.

Per capita energy consumption. Source: The World Bank. 2001. *World Development Indicators 2001*. Washington, D.C.: The World Bank. This indicator reflects annual consumption of commercial primary energy (coal, lignite, petroleum, natural gas and hydro, nuclear and geothermal electricity) in kilograms of oil equivalent per capita. It reflects the level of industrial development, the structure of the economy and patterns of consumption. Changes over time can reflect changes in the level and balance of various economic activities and changes in the efficiency of energy use (including decreases or increases in wasteful consumption). Data are for 1998.

Access to safe water. Source: WHO/UNICEF. 2001. *Global Water Supply and Sanitation Assessment 2000 Report* (available on the UNICEF website). This indicator reports the percentage of the population with *access* to an *adequate* amount of safe drinking water located within a *convenient distance* from the user's dwelling. The italicized words use country-level definitions. It is related to exposure to health risks, including those resulting from improper sanitation. Data are estimates for the year 2000.

THE STATE OF WORLD POPULATION 2001

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