



## *Population, Natural Resources, and Environment*

Asia has a wealth of natural resources and ecological and biological diversity. Yet population growth and economic development are threatening the region's rich heritage through the expansion and intensification of agriculture, the uncontrolled growth of industrialization, the destruction of natural habitats, and urban sprawl.

The interplay between population growth, resource depletion, and environmental degradation has been a matter of debate for decades. For the most part, the argument has been between those who view population numbers per se as the main culprit in increasing pressure on the environment and those who place more blame on economic development, nonsustainable agricultural and industrial practices, and excessive or wasteful consumption. In fact, both population growth and nonsustainable development are cause for concern in Asia.

### *Rising population numbers*

---

Clearly there is a relationship between population growth and environmental stress, but very little empirical evidence exists to prove or disprove the effects of population on the environment. Available sources of information on population and the environment in Asia even define the region differently. Broadly defined, Asia includes some 56 percent of the earth's population, depending on only 31 percent of the planet's arable land.

Although fertility is declining everywhere in the region, Asian populations will continue to grow for many decades to come, increasing pressure on the region's natural resources. Between 2000 and 2050, national populations are expected to grow in every country of East, Southeast, and South and Central Asia except Japan and Kazakhstan (Appendix Table 2). Populations will double or nearly double in Pakistan, Nepal, Bangladesh, Afghanistan, Cambodia, and Laos. Growth rates will also be particularly high in India, Indonesia, Iran, Malaysia, Mongolia, Myanmar, the Philippines, and Vietnam.

Much of the population growth projected for the next few decades will occur in countries that are least capable of coping with additional stress on land, water, and other natural resources. According to a recent study (Prescott-Allan 2001), the countries where population is projected to grow fastest have some of the lowest income levels in the world. These countries already rank high in terms of environmental stress.

### *Changing consumption patterns*

---

Economically and industrially, Asia is the fastest-growing region in the world. This economic and industrial development is inevitably accompanied by changing patterns of consumption. The number of motor vehicles in the region provides one useful indicator of expanding consumption and economic growth.

Today, the total number of cars, trucks, and buses in Asia is doubling every seven years, producing more air pollution, fuel consumption, traffic jams, and demands for road construction—often at the expense of prime agricultural land. And what does the future hold? Over the next 20 years, the number of motor vehicles is projected to increase at least fivefold in Asia's two most populous countries, India and China.

The population of India in 2000 was just over 1 billion, and there were about 10 motor vehicles for every 1,000 people (Energy Information Administration 2001), or a total of roughly 10 million motor vehicles in the country. In 2020, the population of India will be about 1.3 billion, and there will be about 44 motor vehicles for every 1,000 people, making a total of about 57 million vehicles. A similar calculation shows the number of motor vehicles in China rising from 15 million in 2000 to 75 million in 2020.

These are realistic projections. If, by contrast, the Indians and Chinese come to own three motor vehicles for every four people—as Americans do today—there will be more than two billion cars, trucks, and buses in India and China in 2020, or about eight times the number projected (266 million) for the United States.

### *Persistent poverty*

---

Ironically, another source of environmental stress is the persistence of poverty in the region. An estimated 900 million people in Asia survive on incomes of less than US\$1 per day (measured in terms of purchasing power parity). Poor slum dwellers in cities, who lack the most basic sanitation facilities, do not have the luxury of worrying about environmental pollution. In rural areas, poor farmers tend to live in the most marginal, fragile environments where they may be forced to sacrifice long-term sustainability for short-term survival, overexploiting croplands, pastures, and forests (UNFPA 2001). Per Pinstrup-Anderson and Rajul Pandya-Lorch (1994) maintain that “The most serious environmental threat in low-income developing countries is poverty.” In the long run, however, the contribution of the poor to environmental degradation in the region as a whole may be small compared to the impact of large-scale agro-business and rich consumers.

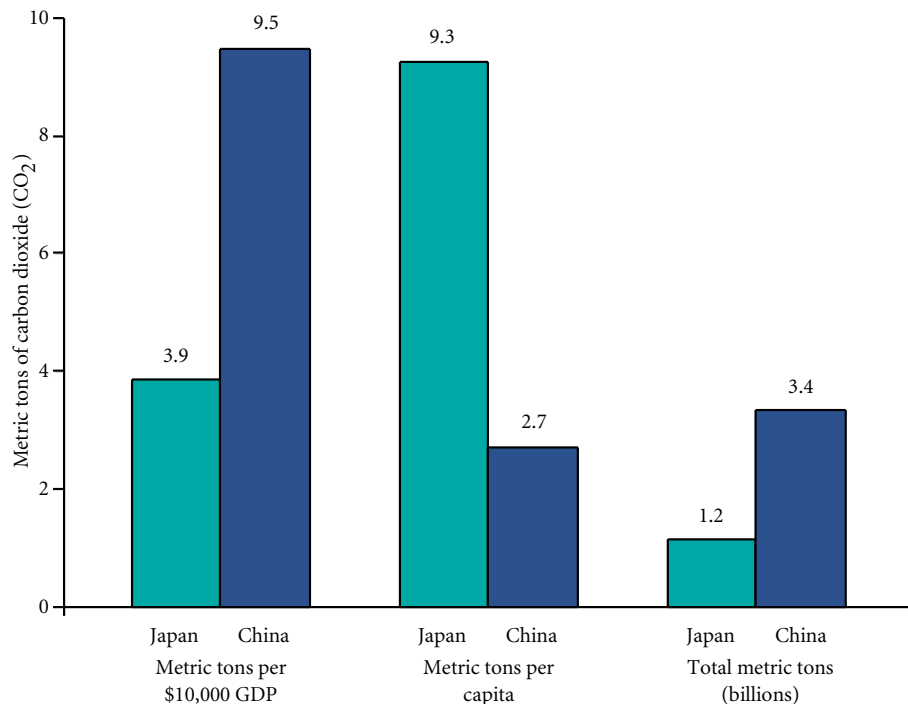
## Rising demand for energy

Increasing population numbers and growing affluence have already resulted in rapid growth of energy consumption in Asia, and this trend can only be expected to accelerate in the future. Energy use (mostly fossil fuels) in the world as a whole has increased by nearly 85 percent in the past 30 years, but the increase has been more than 300 percent in Asia (Energy Information Administration 2001).

Over the next 20 years, the demand for energy will grow more quickly in Asia than in any other region of the world. The fastest growth will be in Asia's developing countries. Energy use in the developed countries of the world is projected to increase by about 29 percent between 1999 and 2020, while energy use in the developing countries of Asia will increase by about 129 percent. Within Asia, China will lead the demand for energy (see box).

In addition to depleting natural resources, rising energy use results in environmental pollution, particularly when countries are unable or unwilling to insist on energy-efficient, nonpolluting technology. China, for example, generates more than twice as much carbon (CO<sub>2</sub>) per unit of gross domestic product (GDP) as does Japan (Figure 1), indicating that industries in China use much less efficient production technologies than Japanese industries. Carbon emissions per person, by contrast, are more than three times as high in Japan, indicating much higher consumption levels by the Japanese.

Figure 1. Comparison of carbon dioxide (CO<sub>2</sub>) emissions (metric tons) in Japan and China, 1996



Source: World Resources Institute (2001).

Note: GDP is expressed in terms of current purchasing power parity.

## ECONOMIC DEVELOPMENT FUELS CHINA'S GROWING DEMAND FOR ENERGY

Over the next few decades, China's energy demands are likely to grow faster than those of any other country in the world. In 1999, China's total energy consumption was less than half that of Western Europe, but by 2020, energy consumption in China is expected to surpass consumption in Western Europe (see figure), coming second only to energy consumption in the United States. This increase in energy demand will be fueled primarily by economic development and changing consumption patterns and not so much by population growth.

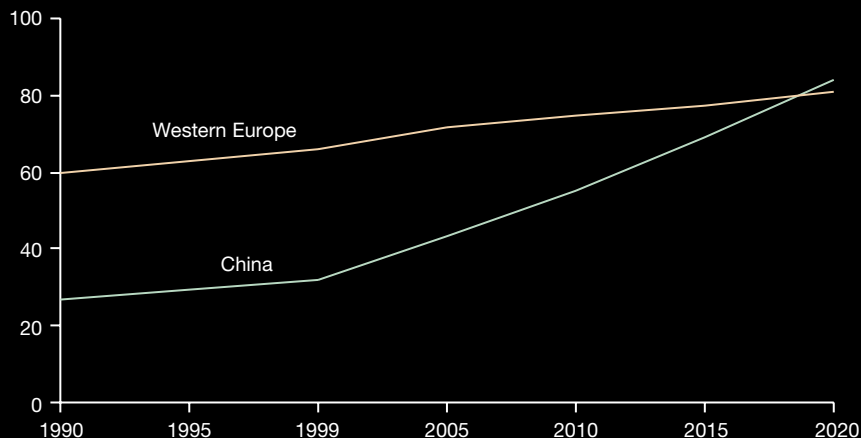
China's expanding demand for energy is linked to the projected growth of the country's gross domestic product (GDP). Energy consumption per unit of GDP will be particularly high because production technologies in China are much less energy efficient than technologies in most industrialized nations.

Between 1999 and 2020, China's demand for oil and coal is projected to increase by 4 percent a year. The demand for natural gas will increase by 10 percent a year, for nuclear energy by 12 percent, and for hydroelectricity and other renewable energy by 5 percent. China's heavy reliance on coal is of particular concern from the environmental standpoint because coal tends to burn less efficiently than other fossil fuels. In 2020, China's coal consumption is projected to exceed that of all industrialized countries of North America, Western Europe, and Asia combined, helping to make China the second largest producer of greenhouse gases in the world (after the United States) (Energy Information Administration 2001).

The image that appears here in the printed version of this publication was not made available for use on the internet.

*China's increasing energy demands are fueled primarily by economic development and changing consumption patterns rather than by population growth (Chongqing, China)*  
© Keren Su/Corbis

Projected growth of China's total energy demand (quadrillion btu) compared with that of Western Europe: 1990–2020



Source: Energy Information Administration (2001).

## *Unplanned urbanization*

---

Primarily as a result of rural-to-urban migration, Asia is the fastest urbanizing region in the world. According to United Nations estimates, the urban population in Asia will nearly double in the next 30 years. By 2030, more than half of Asia's population will live in cities—some 2.6 billion people. The urban population of Asia will be larger than the urban population of all the other regions of the world combined (United Nations 2001b).

In 2025, the proportion urban is projected to be 52 percent in East Asia, 53 percent in Southeast Asia, and 45 percent in South and Central Asia. More than half of national populations will be urban in Brunei, China, Indonesia, Iran, Japan, Kazakhstan, Malaysia, Mongolia, North Korea, Pakistan, the Philippines, Singapore, South Korea, and Turkmenistan (Appendix Table 2).

This urbanization of national populations is reflected in the growth of Asia's largest cities. In 1975, there were only five megacities (with populations of more than 10 million) in the world, and only two of these were in Asia (Table 1) (United Nations 2001b). In 2015, 15 of the world's 23 megacities will be in Asia. This rapid—largely unplanned—expansion of urban areas has robbed many Asian countries of some of their most productive agricultural land and has resulted in serious problems of air, soil, and water pollution.

Despite rapid urbanization, Asia's rural population is also projected to grow, although not as quickly. Most of the region's rural areas are already densely populated, however, and many are characterized by high rates of underemployment, so that any increase in rural population, however small, will pose impediments to modernizing agriculture and raising rural living standards.

## *Environmental challenges*

---

Population growth and economic development are contributing to many serious environmental problems in Asia. These include pressure on land, habitat destruction and loss of biodiversity, water scarcity and water pollution, air pollution, and global warming and climate change.

***Pressure on land.*** Asia faces the most acute pressure on agricultural land of any region in the world. Over the past 30 years, while Asia's total population increased by about 68 percent, the total area of land under cultivation increased by only 21 percent—from 355 to 430 million hectares. This expansion has been largely at the expense of lowland forests. Today, there are very few possibilities for further expansion—almost all the suitable land in the region is already under cultivation.

Despite past expansion of the area under cultivation, less agricultural land is available to feed each person in Asia (0.16 hectares per person) than in the world as a whole (0.26 hectares per person) (World Resources Institute 2001).

**Table 1. Population of cities with 10 million or more inhabitants: 1975, 2000, and 2015**

Population in 1975 (millions)		Population in 2000 (millions)		Population in 2015 (millions)	
Tokyo	19.8	Tokyo	26.4	Tokyo	26.4
New York	15.9	Mexico City	18.1	Mumbai	26.1
Shanghai	11.4	Mumbai	18.1	Lagos	23.2
Mexico City	11.2	Sao Paulo	17.8	Dhaka	21.1
Sao Paulo	10.0	New York	16.6	Sao Paulo	20.4
		Lagos	13.4	Karachi	19.2
		Los Angeles	13.1	Mexico City	19.2
		Calcutta	12.9	New York	17.4
		Shanghai	12.9	Jakarta	17.3
		Buenos Aires	12.6	Calcutta	17.3
		Dhaka	12.3	Delhi	16.4
		Karachi	11.8	Metro Manila	14.8
		Delhi	11.7	Shanghai	14.6
		Jakarta	11.0	Los Angeles	14.1
		Osaka	11.0	Buenos Aires	14.1
		Metro Manila	10.9	Cairo	13.8
		Beijing	10.8	Istanbul	12.5
		Rio de Janeiro	10.6	Beijing	12.3
		Cairo	10.6	Rio de Janeiro	11.9
				Osaka	11.0
				Tianjin	10.7
				Hyderabad	10.5
				Bangkok	10.1

Source: United Nations (2001b).

The shortage of land combined with Asia's growing population has resulted, and will continue to result, in greater intensification of land use (see box). Pastures are overgrazed, rivers, lakes, and coastal areas are overfished, and more crops are produced from the same fields every year, using more irrigation water and more chemical fertilizers and pesticides.

Every year, some of the land currently under cultivation is degraded through nonsustainable farming practices, and some is lost to industrial and infrastructure development and urban sprawl. As a result, the area of productive farmland in Asia may actually decrease in coming decades. Even if the absolute area under cultivation does not go down, projected population growth will substantially reduce the amount of arable land available for each person who needs to be fed.

Over the past 40 years, agricultural inputs plus new, high-yielding seed varieties have resulted in tremendous gains in food production throughout the region. Yet experts predict that it will not be possible to sustain this pace of

**POPULATION GROWTH IS A MAJOR CAUSE OF LAND-USE CHANGES IN INDIA**



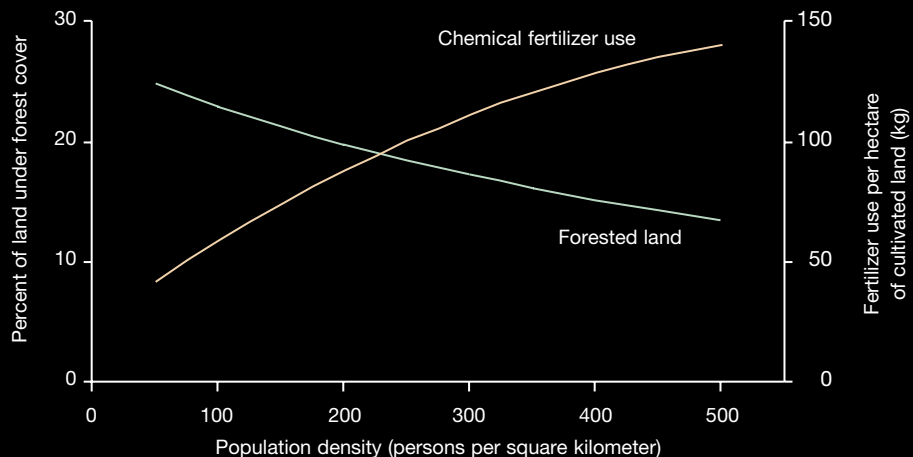
*Population growth has been the main force behind agricultural intensification in India (Kashmir, India)*  
© Steve McCurry/Magnum

India provides a clear example of the impact of population growth on land use. The population of India accounts for 16 percent of the world's total, and it is growing at about 2 percent a year. Yet India accounts for only 2.3 percent of the world's land area and only 1.7 percent of its forest resources. Population density has increased from 117 persons per square kilometer in 1951, to 274 in 1991, to 324 in 2001. This increase in population density has been accompanied by shrinking

forests and pasturelands and more intensified use of agricultural land, including increased cropping frequency and greater use of irrigation and chemical fertilizers.

Cross-sectional and longitudinal analyses of district-level data for 1951–91 show that population growth has been the main force behind these land-use changes, above and beyond any effects of agro-climatic conditions or changes in key socioeconomic factors. This is illustrated in the figure, which shows the estimated effects of population pressure in 1991 on the proportion of land under forest cover and on the use of chemical fertilizers per hectare of cultivated land. The effects of population pressure are estimated after statistically controlling for the effects of several relevant agro-climatic and socioeconomic variables (Mishra 1996).

Estimated effects of population pressure on forest cover and chemical fertilizer use in India, 1991



Source: Mishra (1996).

productivity increase in the future (Rosegrant et al. 2001). At the same time, demand continues to rise, fueled both by the expanding population and the increasing demand for meat, requiring large amounts of grain to feed livestock. The global demand for cereal has been projected to rise from 1,847 million metric tons in 1997 to 2,497 million metric tons in 2020. China alone will account for more than one-fourth of this demand. By 2020, it is projected that China and South Asia will be forced to more than quadruple their grain imports over current levels.

In the shadow of growing demand for food, productivity losses due to land degradation take on heightened urgency. Throughout Asia, it is estimated that about one-third of all cropland has already been damaged by agricultural practices that are not sustainable. In South Asia alone, land degradation is causing more than US\$10 billion in economic losses every year (United Nations 2001a). And countries with high population growth rates are likely to experience the greatest land degradation in the coming decades.

*Habitat destruction and loss of biodiversity.* Preservation of the earth's biological diversity is an important goal in its own right. In addition, the diversity of plant and animal species provides a key input for medical and agricultural research. The greatest threat to biodiversity is not destruction of plants and animals per se, but rather the destruction of their habitat.

Asia is home to diverse ecosystems that host many plant and animal species. More than two-thirds of the planet's biological resources are found in 17 countries, and five of these—China, India, Indonesia, Malaysia, and the Philippines—are in Asia. Indonesia alone is home to more than 30,000 plant species.

Population growth leads to expanding human settlements and increasing demand for food, fuel, and building materials. Due in part to population pressure, forests and wetlands that were once home to indigenous species in South, Southeast, and East Asia have been cleared and drained. As a result, an estimated 70 to 90 percent of the region's original wildlife habitat has been lost (United Nations 2001a).

Modernization of agriculture also threatens potentially valuable local crops. In Indonesia alone, some 1,500 local varieties of rice have disappeared in the past two to three decades as farmers plant a single, improved variety. In addition, habitat destruction and pollution threaten fresh-water and marine fish and coral reefs in the region.

*Water scarcity and water pollution.* Over the past 50 years, water use in Asia has more than tripled. Out of total water consumption, by far the largest share goes to agriculture—at 84 percent. Industrial use accounts for another 10 percent and domestic use 6 percent. Agriculture—as it is practiced in much of Asia—wastes large quantities of water. With current irrigation practices, an estimated 60 percent of water is lost.



Over the past century, the use of fresh water increased more rapidly in Asia than in any other region of the world (ADB 2001). Today, Asia has the least fresh water available per person of any region. The amount of water available per person has declined in recent decades—primarily because of population growth—and water scarcity is projected to worsen in the future.

Water pollution is also a serious problem, mainly caused by the disposal of untreated sewage and industrial waste, urban and agricultural runoff, and the intrusion of seawater. Levels of suspended solids in Asia's rivers have grown more than fourfold since the early 1970s and are now about four times the world average and about 20 times the levels typically found in developed countries. Lakes and other water systems are also heavily polluted.

Largely because of widespread pollution, one out of three Asians does not have access to safe drinking water, defined as a reliable source within 200 meters of the home. Polluted, unsafe water causes millions of deaths every year, particularly among infants and young children.

**Air pollution.** Asian cities are among the most polluted in the world (ADB 2001). Of the 15 large cities on the planet with the worst air pollution (measured in terms of suspended particulate levels), 12 are in Asia. Suspended particulate levels in Delhi, Beijing, Karachi, and Jakarta are many times higher than recommended by the World Health Organization (WHO). Other types of air pollution, including emissions of sulfur dioxide (SO<sub>2</sub>) and nitrogen dioxide (NO<sub>2</sub>), are also far above levels recommended by WHO.

*Asian cities are among the most polluted in the world (Ketapang, Kalimantan, Indonesia)*  
© Michael S. Yamashita/Corbis

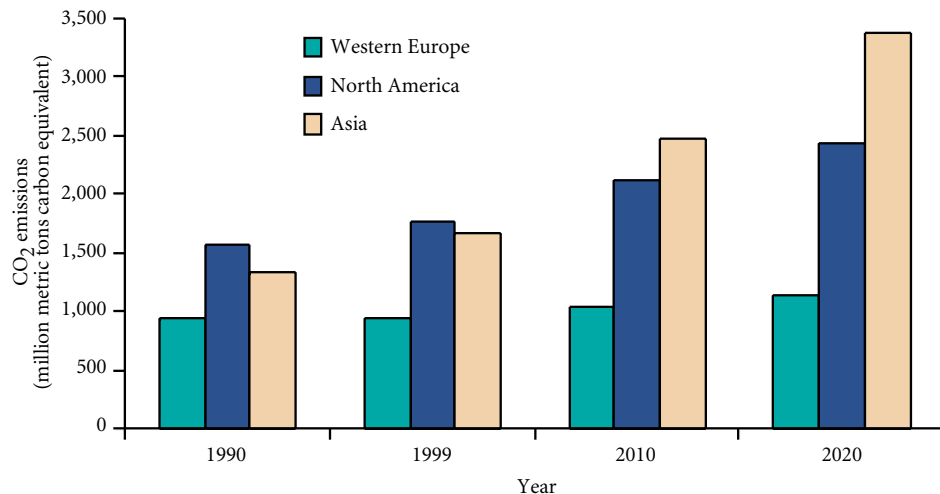
The image that appears here in the printed version of this publication was not made available for use on the internet.

In the countryside, nitrates from animal waste and chemical fertilizers pollute the soil and water, and in the cities, the air is contaminated with lead from vehicle exhaust. In India's largest cities—Mumbai and Delhi—about one-half of children under age 3 show signs of harmful exposure to lead, defined as 10 or more micrograms of lead per deciliter of blood (IIPS and ORC Macro 2000). Such elevated levels of lead in the blood can be harmful to the developing brain and central nervous system of young children and can cause damage to other body organs (CDC 1991).

In the poorest countries of Asia, indoor air pollution may pose an even greater hazard for human health. Cooking and heating with wood, crop residues, animal dung, and low-quality coal produce smoke that contains dangerous particles and gases. When fuels such as these are burned indoors, using inefficient stoves and poor ventilation, they can cause tuberculosis, other serious respiratory diseases, and blindness (Mishra, Retherford, and Smith 1999). In fact, indoor air pollution from cooking and heating with unsafe fuels has been designated by the World Bank as one of the four most critical environmental problems in developing countries.

**Global warming and climate change.** The emission of greenhouse gases, such as carbon dioxide (CO<sub>2</sub>), methane, nitrous oxide, and chlorofluorocarbons, is much lower per person in Asia than in the industrialized nations, but—given Asia's large population and rapidly increasing energy use—the region plays an important and growing role in global warming. In the 1950s, Asian countries produced about one-fifth of the CO<sub>2</sub> emissions (the most important greenhouse gas) produced by Europe, but by the mid-1980s carbon emissions from Asia surpassed those from Europe (Figure 2). If current trends continue, CO<sub>2</sub> emissions from Asia will double between 2000 and 2020, growing at more than three times the rate of emissions from industrialized countries (Energy

Figure 2. Growth of carbon dioxide (CO<sub>2</sub>) emissions (million metric tons equivalent) in Western Europe, North America, and Asia, 1990–2020



The image that appears here in the printed version of this publication was not made available for use on the internet.

*In many Asian countries, indoor air pollution from unsafe fuels poses critical health problems (Zhejiang, China) © Keren Su/Corbis*

Information Administration 2001). By 2020, Asia will be the leading producer of CO<sub>2</sub> in the world.

There is growing evidence that atmospheric concentrations of CO<sub>2</sub> and other greenhouse gases have been rising as a result of population growth, changing consumption patterns, and expansion of economic activity. If current trends continue, the average surface temperature of the earth is projected to increase by 1.4–5.8 degrees Celsius by 2100. A recent assessment by the Intergovernmental Panel on Climate Change (IPCC) suggests that the adverse effects of global warming—including rising sea levels and changes in rainfall, vegetation, wind, and pest/disease patterns—will be felt most severely in the poor countries of Asia and Africa (IPCC 2001).

### *Policy implications*

---

Projections of future resource requirements and environmental stress in Asia are worrying—even alarming—whether the focus is on population numbers alone or on the effects of poorly planned economic development. It is not easy to predict the future magnitude of environmental problems in the region, but issues of land degradation, habitat destruction, loss of biodiversity, water scarcity, and water and air pollution have already reached crisis proportions in some places.

Unless significant measures are taken to incorporate environmental concerns into agricultural development, urban planning, technological innovation, industrial growth, and resource management, the situation is likely to worsen in the future. At the international level, technological innovation and the transfer of technical and management skills will play a major role in alleviating Asia's environmental problems. At the national level, political and economic priority setting will be essential.

And finally, slowing down population growth—as soon as possible—will be a key component of any effort to protect Asia's natural resources and environment. Population growth continues for many years after fertility reaches replacement level, so the sooner fertility can be brought down the sooner the process toward stabilizing population numbers can begin. When looking at current and future environmental concerns in Asia, the number of people to be fed, clothed, housed, transported, educated, and employed may not be the only issue, but it is an issue that cannot be ignored.