ENVIRONMENT

Environment and poverty reduction

Natural resource base	Enhancing rural and urban livelihoods	
Access to water and sanitation		OPPORTUNITY
Air quality	Improving health	
Ecological stability	Reducing vulnerability to environmental change	SECURITY
Capacity to cope with natural disasters		
Property rights to natural resources	Increasing participation in decisionmaking	EMPOWERMENT
Access to environmental information		

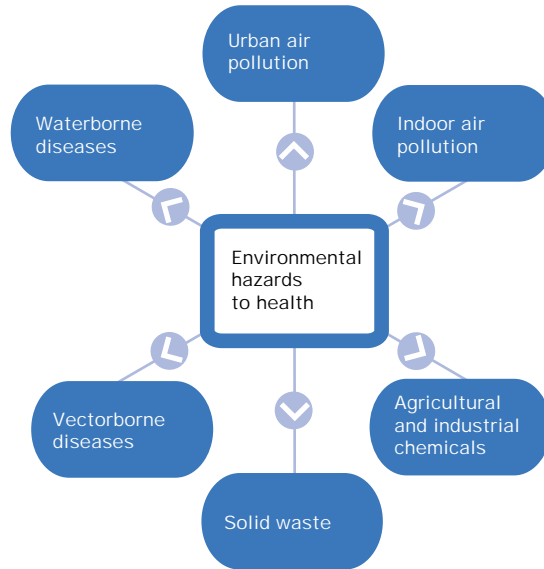## Environmental changes disproportionately affect poor people

Human development depends on the environment's providing a variety of goods and services—now and in the future. But the links between environmental conditions and human welfare are complex. Environmental changes can make poverty worse by compromising health, livelihoods, and protection from natural disasters. And economic growth can create new stresses on the environment as the demand for environmental resources rises and the damaging by-products of economic activity accumulate. But environmental resources are needed to promote economic growth and reduce poverty, and growth itself creates the means and the demand for an improved environment.

Long-term poverty reduction and sustainable economic growth are now being undermined by the continuing degradation of soils, the increasing scarcity of freshwater, the overexploitation of coastal ecosystems and fisheries, the loss of forest cover, long-term changes in the earth's climate, and the loss of biological diversity at the genetic, species, and ecosystem level. What is clear is that the roughly 2.8 billion poor and near-poor people in the world—those living on less than $2 a day—are disproportionately affected by these bad environmental conditions. They are particularly vulnerable to shocks from environmental change and natural catastrophes. Every year around 5 million people in developing countries die from waterborne diseases and polluted air. The livelihoods of around 1 billion rural people are at risk because of desertification and land degradation. And up to two-thirds of the world's people are likely to be affected by water scarcity.

Poverty, poor health, and environmental hazards

Diseases associated with environmental factors are highly concentrated among the poor.
• Sixty percent of all malaria deaths occur among the poorest fifth of the world's population.
• Half of all deaths from diarrhea also occur among the poorest fifth.
• Water-related diseases, such as cholera and diarrhea, claim an estimated 3 million lives in developing countries each year—the majority, children under five. In India alone,
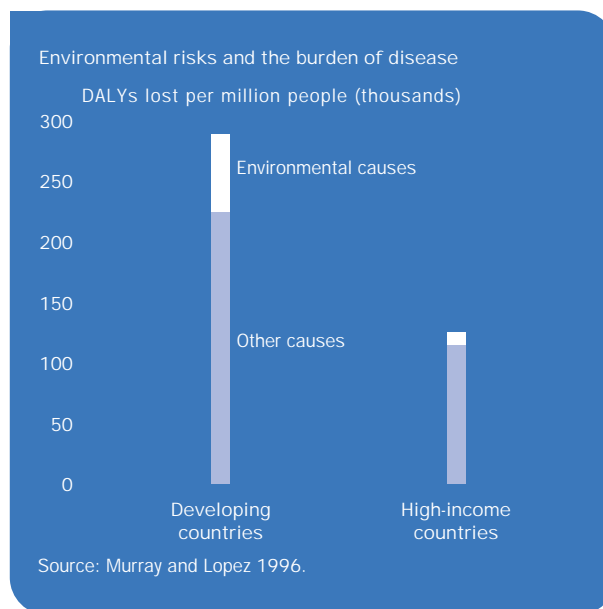
Urban air pollution

Waterborne diseases

Indoor air pollution

Environmental hazards to health

Vectorborne diseases

Agricultural and industrial chemicals

Solid waste

nearly 1 million people die annually from waterborne diseases.
• Nearly 2 million women and children die annually in developing countries from exposure to indoor air pollution, including about 500,000 in India and 700,000 in China.
• More than 70 percent of freshwater sources are seriously contaminated or degraded, and withdrawals of groundwater exceed natural recharge rates by 160 billion cubic meters a year.

The environment affects the health of the poor . . .

The poor, with less access to improved water supplies, are more prone to water-related diseases

Environmental health risks account for a fifth of the total burden of disease in the developing world. Most of those suffering from such health risks—malaria, limited water supply, indoor air pollution, lack of sanitation—live in rural areas. But as a result of rapid urbanization and

Environmental risks and the burden of disease

DALYs lost per million people (thousands)

300

250

200

150

100

50

0

Environmental causes

Other causes

Developing countries

High-income countries

Source: Murray and Lopez 1996.

uncontrolled growth of urban slums, these health risks also affect the urban and semiurban poor.

It is difficult to quantify the health impacts from exposure to environmental hazards. But a standard measure of the burden of disease—disability-adjusted life years, or DALYs—has been established that quantifies illness and death from various causes. The concept combines life years lost as a result of premature death and years of healthy life lost as a result of illness or disability.

Poverty, natural resources, and livelihoods

The majority of poor people in most developing countries live in rural areas and depend on natural systems for their income. The very poor are often small farmers, landless laborers, or agricultural workers, dependent on such natural resources as water, soil, and fisheries for subsistence and income.

Most agricultural land in developing countries, however, has soil that is low quality or prone to degradation. About 1.2 billion hectares—almost 11 percent of the earth's

Soil degradation threatens the world's ability to feed itself

Share of cropland degraded (%)
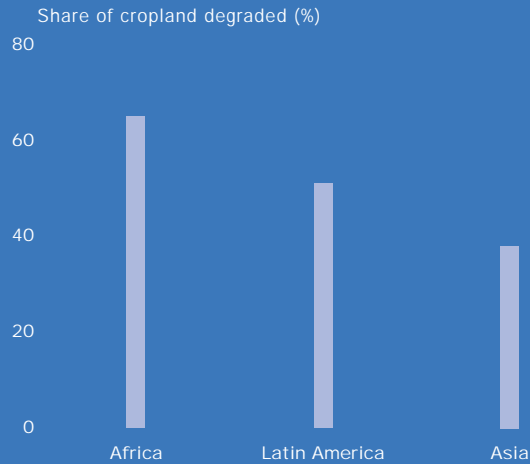
Source: IFPRI 1999.

vegetated surface—have been degraded by human activity over the past 45 years, and an estimated 5–12 million hectares are lost annually to severe degradation in developing countries.

Soil degradation affects more than 900 million people in 100 countries. It appears to be most extensive in Africa, where it affects 65 percent of cropland area, compared with 51 percent in Latin America and 38 percent in Asia. Because grain production provides more than three-quarters of the world's food supply, soil degradation threatens the world's ability to meet its food requirements, expected to double in the next three to four decades.

. . . and their livelihoods

Land quality and food supply will be affected by a host of environmental changes

Global environmental changes will have many effects on agricultural productivity, which is already limited by climatic factors such as water availability and the length of the growing season. Changes in the climate system and atmospheric concentrations of carbon dioxide may have large regional effects on agricultural productivity. While changes in temperature and precipitation
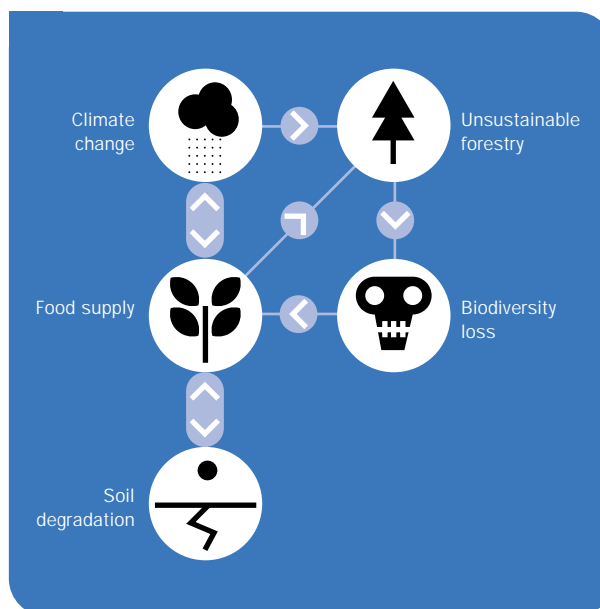
patterns may benefit agriculture in some areas, they may restrict it in others, increasing the risk of hunger and famine particularly in poor areas dependent on isolated agricultural systems, such as Sub-Saharan Africa, tropical areas of Latin America, some Pacific island nations, and South and East Asia.

Agriculture also faces a threat stemming from the need to feed a growing population: increasing need for cropland results in deforestation and loss of genetic diversity, with potentially harmful effects on agricultural sustainability.

Poverty and vulnerability

Poor countries, and poor people, are vulnerable to natural disasters, weather fluctuations, and changes in environmental conditions. Natural disasters such as floods, storms, droughts, and landslides affect poor people disproportionately. The poor tend to live in precarious housing, often located in environmentally vulnerable areas such as floodplains or steep slopes, putting them at greater risk from natural disasters and severe weather. More important, the poor have less capacity than the better-off to cope when disasters occur. They have less access to credit, and

Developing countries bore the brunt of natural disasters in 1990–98

Note: A disaster is classified as major if it caused more than 50 deaths or affected more than 100,000 people.
Source: World Bank 2000e.
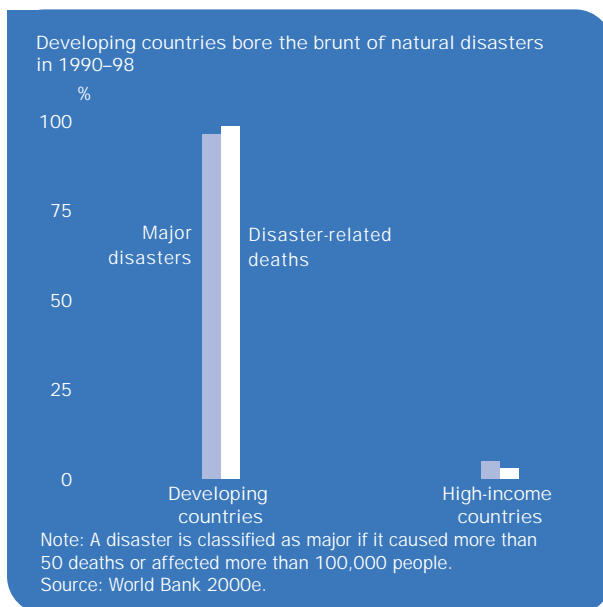
fewer assets to sell or consume in times of hardship. So the effects of natural disasters are often catastrophic for the poor.

People in low-income countries are four times as likely as people in high-income countries to die in a natural disaster. And the average costs of a natural disaster (as a share of GDP) are 20 percent higher in developing countries than in high-income economies.

Between 1990 and 1998, 94 percent of the world's 568 major natural disasters and more than 97 percent of all deaths related to natural disasters were in developing countries. The most densely populated areas of developing countries suffer the most.

The poor are more vulnerable to natural disasters, to weather fluctuations . . .

Natural disasters and the poor

Economic development is repeatedly interrupted by natural disasters—floods, droughts, landslides, windstorms, earthquakes, forest fires, and volcanic eruptions. Like economic crises, natural disasters can cause sharp increases in poverty and slow the pace of human development. And like economic crises, they hurt poor people in the short run and diminish their chances of escaping poverty in the long run.

In the past decade the incidence of natural disasters increased. Between 1988 and 1997 natural disasters claimed an estimated 50,000 lives a year and caused damage of more than $60 billion a year (World Bank 2000e). The full human and economic costs are even higher.

The heavily populated Asian region has suffered most, particularly in coastal areas. Between 1985 and 1999 Asia suffered 77 percent of all deaths, 90 percent of all homelessness, and 45 percent of all recorded economic losses due to disasters.

• In 1992 Hurricane Andrew hit the southeast coast of the United States and caused 32 deaths. In the same year a cyclone of similar intensity hit Bangladesh and caused 100,000 deaths.
• In October 1998 Hurricane Mitch—the deadliest Atlantic storm in 200 years—hit El Salvador, Guatemala, Honduras, and Nicaragua, dumping about 80 inches of rain. The hurricane caused some 10,000 deaths. The damage to the region is estimated at around $8.5 billion—more than the combined GDP of Honduras and Nicaragua.
• Over the past three decades disasters triggered by droughts, floods, and cyclones occurred five times as frequently, killed or affected 70 times as many peo-

ple, and caused twice as much damage worldwide as did earthquakes and volcanoes. The largest and best understood source of seasonal climate variation is El Niño and the Southern Oscillation (ENSO). The 1997–98 ENSO event was directly responsible for 22 disasters with total costs estimated at $25–36 billion. Whether the strong, frequent ENSO events of the 1990s signal the arrival of a new climate regime remains to be seen. But the capacity to predict natural disasters and mitigate their effects is typically limited in poor countries, exacerbating their impact.

Climate changes will affect human health

There is strong evidence that human-made pollution has contributed substantially to global warming and that the earth is likely to get hotter than previously predicted (IPCC 2001).

Long-term, human-induced changes in climate and associated rises in sea level are predicted to adversely affect human health, ecological systems, water resources, and socio-economic activities (including agriculture, forestry, fisheries, and human settlements).

Health impacts
• Mortality, infectious disease, respiratory disease

Species impacts
• Loss of habitat and species

Agricultural impacts
• Crop yields
• Irrigation demands

Human-induced climate change
• Temperature
• Precipitation
• Sea level rise

Coastal area impacts
• Erosion, inundation of coastal areas, more costly protection

Forest impacts
• Composition, geographic range, health, productivity

Water resource impacts
• Quantity and quality of supply
• Competition over resources

. . . and to human-induced environmental changes

Economies cannot remain healthy with an unhealthy environment

Real, lasting poverty reduction is possible only if the environment is able to provide the services people depend on and if natural resources are used in a way that does not undermine long-term development. It is therefore imperative to integrate environmental concerns into poverty reduction and economic development strategies.

The critical links between poverty and the environment mean that a sound strategy to ensure environmental sustainability must be an important part of a poverty-focused development strategy. A development strategy should aim to:

• Improve people's health by reducing their exposure to environmental hazards such as indoor and urban air pollution, waterborne and vectorborne diseases, and toxic substances.

• Enhance the livelihoods of poor people who depend on land, water, forests, and biodiversity by helping them secure access to resources and creating circumstances in which they can manage those resources sustainably.

• Reduce people's vulnerability to environmental risks such as natural disasters, severe weather fluctuations, and the impacts of climate change by getting information to governments, the private sector, and poor communities and empowering them to adapt.

	Watershed	Watershed area	Countries within the watershed	Average population density	Use of watershed[a]							Water available
		sq. km		people per sq. km	Crop-land %	Forest %	Grassland %	Built-up area %	Irrigated area %	Arid area %	Wetlands %	cu. m per capita per year
Asia	Amu Darya	534,739	5	39	22.4	0.1	57.3	3.7	7.5	72.0	0.0	3,211
	Amur	1,929,955	3	34	18.4	53.8	8.8	2.6	0.8	15.1	4.4	4,917
	Brahmaputra	651,355	4	178	29.4	18.5	44.7	2.4	3.7	0.0	20.7	..
	Ganges	1,016,124	4	398	72.4	4.2	13.4	6.3	22.7	26.0	17.7	..
	Huang He	944,970	1	157	29.5	1.5	60.0	5.9	7.2	37.5	1.1	361
	Indus	1,081,718	4	163	30.0	0.4	46.4	4.6	24.1	62.6	4.2	830
	Kolyma	679,934	1	<1	0.0	0.7	45.3	0.3	0.0	0.0	1.0	722,456
	Lake Balkhash	512,015	2	11	23.2	4.0	61.1	1.5	1.9	91.6	4.7	439
	Lena	2,306,743	1	1	1.7	64.7	11.4	0.4	0.0	0.7	0.6	161,359
	Mekong	805,604	6	71	37.8	41.5	17.2	2.1	2.9	0.0	8.7	8,934
	Ob	2,972,493	4	10	36.9	33.9	16.0	3.0	0.5	42.5	11.2	14,937
	Syr Darya	782,617	4	28	22.2	2.4	67.4	3.2	5.4	88.5	2.0	1,171
	Tarim	1,152,448	2	7	2.3	0.0	35.3	0.3	0.6	61.4	16.3	754
	Tigris and Euphrates	765,742	4	57	25.4	1.2	47.7	6.2	9.1	90.9	2.9	2,189
	Yangtze	1,722,193	1	212	47.6	6.3	28.2	3.0	7.1	0.0	3.0	2,265
	Yenisey	2,554,388	2	3	12.8	39.7	32.4	1.3	0.0	10.9	2.7	79,083
Europe	Danube	795,656	13	102	66.9	18.2	3.2	10.7	5.2	2.6	1.4	2,519
	Dnieper	533,966	3	62	86.5	2.2	1.3	8.8	1.8	3.4	5.9	1,552
	Volga	1,410,951	2	42	60.2	22.5	7.3	8.2	0.4	19.6	1.1	4,260
Africa	Congo	3,730,881	9	15	7.2	44.0	45.4	0.2	0.0	0.0	9.0	22,752
	Lake Chad	2,497,738	8	12	3.1	0.2	45.2	0.2	0.0	82.8	8.2	7,922
	Niger	2,261,741	10	32	4.4	0.9	68.6	0.5	0.1	65.4	4.1	4,076
	Nile	3,254,853	10	44	10.7	2.0	53.0	1.0	1.4	67.4	6.1	2,207
	Okavango	721,258	4	2	5.5	1.7	91.1	0.2	0.0	75.8	4.1	..
	Orange	941,351	4	11	6.0	0.2	85.0	2.2	0.5	77.0	0.8	1,050
	Zambezi	1,332,412	8	18	19.9	4.0	72.0	0.7	0.1	8.8	7.6	..
North and Central America	Colorado	703,148	2	10	0.9	17.0	74.9	6.9	2.0	89.1	2.5	2,105
	Columbia	657,501	2	9	6.4	50.0	35.5	7.3	3.6	48.7	6.3	39,474
	Mackenzie	1,706,388	1	<1	2.6	66.0	14.7	1.9	0.0	0.0	48.9	408,243
	Mississippi	3,202,185	2	22	35.8	22.2	28.5	12.6	3.1	35.5	20.0	8,973
	Nelson-Saskatchewan	1,093,141	2	5	47.4	31.9	6.1	7.1	0.5	21.5	86.8	15,167
	Rio Grande	607,965	2	18	5.2	7.5	80.9	6.0	2.6	96.0	2.1	621
	St. Lawrence	1,049,636	2	43	16.4	43.5	0.1	14.5	0.2	0.0	47.2	9,095
	Yukon	847,620	2	<1	0.0	64.0	27.6	0.4	0.0	0.0	27.8	1,249,932
South America	Amazon	6,145,186	7	4	14.1	73.4	10.2	0.6	0.1	4.0	8.3	273,767
	Orinoco	953,675	2	17	7.6	50.5	37.8	2.6	0.2	8.5	15.3	90,482
	Paraná	2,582,704	4	27	43.3	18.1	33.0	4.2	0.5	9.9	10.9	8,025
	São Francisco	617,814	1	19	60.2	3.1	31.8	2.8	0.3	32.0	9.7	8,261
	Tocantins	764,213	1	5	61.5	9.9	26.2	1.3	0.0	0.0	19.1	103,383
Oceania	Murray-Darling	1,050,116	1	2	28.4	8.0	62.1	1.2	1.6	67.1	3.4	11,549

Note: Only watersheds exceeding 500,000 square kilometers are shown. For a more comprehensive list and underlying assumptions see the source.

a. Shares do not sum to 100 percent because some areas fall into more than one category or into a category not shown.

Source: World Resources Institute, UNEP, UNDP, and World Bank, *World Resources 2000–01: A Guide to the Global Environment.*

Table 3b **Global marine fisheries**

	Average annual marine fish production								Year by which fully fished[c]	Discards
	Demersal[a] thousand metric tons				Pelagic[b] thousand metric tons					% of catch
	1965–67	1975–77	1985–87	1995–97	1965–67	1975–77	1985–87	1995–97		1988–92
Antarctic	5	83	73	11	0	0	1	0	1980	10
Arctic	0	0	0	0	..	..	..	..	..	..
Atlantic	7,816	9,009	8,718	7,445	9,181	12,305	9,864	10,528	1983	25
Indian	423	754	871	1,554	953	1,270	1,945	2,966	..	26
Mediterranean and the Black Sea	193	180	282	337	518	724	1,207	984	..	25
Pacific	3,953	8,481	10,910	10,078	14,638	13,044	24,783	28,356	1999	24
World	12,391	18,507	20,856	19,499	25,293	27,358	37,835	42,917	1999	25

Note: Production includes capture and aquaculture.
a. Demersal or bottom-dwelling fish species. b. Pelagic fish are those that live in ocean surface waters or open seas. c. Refers to the year in which the fishery yield reaches its peak.
Source: Food and Agriculture Organization data, as cited in World Resources Institute, UNEP, UNDP, and World Bank, *World Resources 2000–01: A Guide to the Global Environment.*

Table 3c **Atmospheric concentrations of greenhouse and ozone-depleting gases**

	Carbon dioxide	Methane	Nitrous oxide	Carbon tetra-chloride	Methyl chloro-form	CFC-11[a]	CFC-12[a]	CFC-113[a]	Total gaseous chlorine[b]
	parts per million	parts per billion	parts per billion	parts per trillion	parts per trillion	parts per trillion	parts per trillion	parts per trillion	parts per trillion
1980	339	..	299	89	69	158	293	..	1,624
1981	340	..	299	90	75	166	305	..	1,692
1982	341	..	301	92	81	175	325	26	1,865
1983	343	..	302	93	85	182	341	28	1,939
1984	344	..	303	94	88	190	355	31	2,016
1985	346	..	304	96	92	200	376	36	2,121
1986	347	1,600	305	97	96	210	394	40	2,216
1987	349	1,610	305	99	98	221	413	48	2,322
1988	351	1,619	306	100	103	231	433	53	2,425
1989	353	1,641	306	100	107	240	452	59	2,524
1990	354	1,645	306	101	110	249	470	66	2,620
1991	355	1,657	307	101	113	254	484	71	2,685
1992	356	1,673	308	101	116	259	496	77	2,751
1993	357	1,671	308	101	112	260	503	80	2,764
1994	359	1,674	309	100	106	261	512	81	2,769
1995	361	1,681	309	99	97	261	518	82	2,753
1996	363	1,684	310	98	85	261	523	82	2,725
1997	364	1,690	311	97	73	260	528	83	2,693
1998	367	1,693	311	96	64	259	530	82	2,664

Note: All estimates are by volume.
a. CFC-11 (CCl_3F), CFC-12 (CCl_2F_2), and CFC-113 ($C_2Cl_3F_3$) are all chlorofluorocarbons. b. Total gaseous chlorine is calculated by multiplying the number of chlorine atoms in a unit of the chlorine-containing gases by the concentration of that gas. Chlorine acts as a catalyst in the destruction of ozone.
Source: Carbon Dioxide Information Analysis Center data, as cited in World Resources Institute, UNEP, UNDP, and World Bank, *World Resources 2000–01: A Guide to the Global Environment.*

3.1 | Rural environment and land use

	Rural population			Rural population density	Land area	Land use					
	% of total		average annual % growth	people per sq. km of arable land	thousand sq. km	Arable land % of land area		Permanent cropland % of land area		Other % of land area	
	1980	1999	1980–99	1998	1998	1980	1998	1980	1998	1980	1998
Albania	66	59	0.6	345	27	21.4	21.1	4.3	4.5	74.4	74.5
Algeria	57	40	0.7	159	2,382	2.9	3.2	0.3	0.2	96.8	96.6
Angola	79	66	2.1	268	1,247	2.3	2.4	0.4	0.4	97.3	97.2
Argentina	17	10	–1.2	15	2,737	9.1	9.1	0.8	0.8	90.1	90.1
Armenia	34	30	0.4	234	28	..	17.6	..	2.3	..	80.1
Australia	14	15	1.7	5	7,682	5.7	7.0	0.0	0.0	94.2	93.0
Austria	35	35	0.4	205	83	18.6	16.9	1.2	1.0	80.2	82.1
Azerbaijan	47	43	0.9	205	87	..	19.3	..	3.0	..	77.7
Bangladesh	86	76	1.4	1,204	130	68.3	61.4	2.0	2.6	29.6	36.0
Belarus	44	29	–1.9	49	207	..	29.8	..	0.6	..	69.6
Belgium	5	3	–2.5	35	33 ª	23.2 ª	24.8 ª	0.4 ª	0.6 ª	76.4 ª	74.6 ª
Benin	73	58	1.8	207	111	13.6	15.4	0.8	1.4	85.7	83.3
Bolivia	55	38	0.3	156	1,084	1.7	1.8	0.2	0.2	98.1	98.0
Bosnia and Herzegovina	65	57	–0.9	436	51	..	9.8	..	2.9	..	87.3
Botswana	85	50	0.2	231	567	0.7	0.6	0.0	0.0	99.3	99.4
Brazil	34	19	–1.3	62	8,457	4.6	6.3	1.2	1.4	94.2	92.3
Bulgaria	39	31	–1.6	60	111	34.6	38.8	3.2	2.0	62.2	59.2
Burkina Faso	92	82	1.8	260	274	10.0	12.4	0.1	0.2	89.8	87.4
Burundi	96	91	2.3	779	26	35.8	30.0	10.1	12.9	54.0	57.2
Cambodia	88	84	2.7	263	177	11.3	21.0	0.4	0.6	88.3	78.4
Cameroon	69	52	1.3	127	465	12.7	12.8	2.2	2.6	85.1	84.6
Canada	24	23	0.8	15	9,221	4.9	4.9	0.0	0.0	95.0	95.0
Central African Republic	65	59	1.8	108	623	3.0	3.1	0.1	0.1	96.9	96.8
Chad	81	77	2.4	159	1,259	2.5	2.8	0.0	0.0	97.5	97.2
Chile	19	15	0.2	111	749	5.1	2.6	0.3	0.4	94.6	96.9
Chinaᵇ	80	68	0.4	689	9,327	10.4	13.3	0.4	1.2	89.3	85.5
Hong Kong, China	9	0	..	0	1	7.0	5.1	1.0	1.0	92.0	93.9
Colombia	36	27	0.4	529	1,039	3.6	2.0	1.4	2.0	95.0	96.0
Congo, Dem. Rep.	71	70	3.1	506	2,267	2.9	3.0	0.4	0.5	96.6	96.5
Congo, Rep.	59	38	0.6	630	342	0.4	0.5	0.1	0.1	99.5	99.4
Costa Rica	57	52	1.9	824	51	5.5	4.4	4.4	5.5	90.1	90.1
Côte d'Ivoire	65	56	2.6	290	318	6.1	9.3	7.2	13.8	86.6	76.9
Croatia	50	43	–1.0	133	56	..	26.1	..	2.3	..	71.6
Cuba	32	25	–0.6	77	110	23.9	33.1	6.4	7.6	69.7	59.3
Czech Republic	25	25	0.0	84	77	..	40.1	..	3.0	..	56.9
Denmark	16	15	–0.3	33	42	62.3	55.7	0.3	0.2	37.4	44.0
Dominican Republic	50	36	0.3	280	48	22.1	22.1	7.2	9.9	70.6	68.0
Ecuador	53	38	0.6	302	277	5.6	5.7	3.3	5.2	91.1	89.2
Egypt, Arab Rep.	56	55	2.1	1,197	995	2.3	2.8	0.2	0.5	97.5	96.7
El Salvador	58	54	1.1	582	21	26.9	27.0	11.7	12.1	61.4	60.9
Eritrea	87	82	2.4	638	101	..	4.9	..	0.0	..	95.0
Estonia	30	31	0.0	40	42	..	26.5	..	0.4	..	73.1
Ethiopia	90	83	2.3	513	1,000	..	9.9	..	0.6	..	89.4
Finland	40	33	–0.6	81	305	7.8	7.1	0.0	0.0	92.2	92.9
France	27	25	0.0	79	550	31.8	33.4	2.5	2.1	65.7	64.5
Gabon	50	20	–2.0	76	258	1.1	1.3	0.6	0.7	98.2	98.1
Gambia, The	80	68	2.7	430	10	15.5	19.5	0.4	0.5	84.1	80.0
Georgia	48	40	–0.7	279	70	..	11.3	..	4.1	..	84.6
Germany	17	13	–1.4	89	349	34.4	34.0	1.4	0.7	64.1	65.3
Ghana	69	62	2.4	319	228	8.4	15.8	7.5	7.5	84.2	76.7
Greece	42	40	0.2	149	129	22.5	22.1	7.9	8.5	69.6	69.4
Guatemala	63	61	2.4	482	108	11.7	12.5	4.4	5.0	83.9	82.4
Guinea	81	68	1.6	550	246	2.9	3.6	1.8	2.4	95.4	94.0
Guinea-Bissau	83	77	1.7	298	28	9.1	10.7	1.1	1.8	89.9	87.6
Haiti	76	65	1.1	895	28	19.8	20.3	12.5	12.7	67.7	67.0
Honduras	65	48	1.4	179	112	13.9	15.1	1.8	3.1	84.3	81.7

Rural environment and land use | 3.1

	Rural population			Rural population density	Land area	Land use					
	% of total		average annual % growth	people per sq. km of arable land	thousand sq. km	Arable land % of land area		Permanent cropland % of land area		Other % of land area	
	1980	1999	1980–99	1998	1998	1980	1998	1980	1998	1980	1998
Hungary	43	36	–1.2	76	92	54.4	52.2	3.3	2.4	42.2	45.4
India	77	72	1.6	438	2,973	54.8	54.3	1.8	2.7	43.4	43.0
Indonesia	78	60	0.4	695	1,812	9.9	9.9	4.4	7.2	85.6	82.9
Iran, Islamic Rep.	50	37	1.1	145	1,622	8.0	10.4	0.5	1.2	91.5	88.4
Iraq	35	24	1.0	104	437	12.0	11.9	0.4	0.8	87.6	87.3
Ireland	45	41	0.1	114	69	16.1	19.7	0.0	0.0	83.9	80.3
Israel	11	9	1.1	153	21	15.8	17.0	4.3	4.2	80.0	78.8
Italy	33	33	0.1	231	294	32.2	28.2	10.0	9.4	57.7	62.5
Jamaica	53	44	0.1	664	11	12.5	16.1	9.7	9.2	77.8	74.7
Japan	24	21	–0.2	599	377	12.9	12.0	1.6	1.0	85.5	87.0
Jordan	40	26	1.9	485	89	3.4	2.9	0.4	1.5	96.2	95.6
Kazakhstan	46	44	–0.3	22	2,671	..	11.2	..	0.1	..	88.7
Kenya	84	68	1.9	494	569	6.7	7.0	0.8	0.9	92.5	92.1
Korea, Dem. Rep.	43	40	1.1	548	120	13.4	14.1	2.4	2.5	84.2	83.4
Korea, Rep.	43	19	–3.3	532	99	20.9	17.3	1.4	2.0	77.8	80.7
Kuwait	10	3	–5.4	821	18	0.1	0.3	0.0	0.1	99.9	99.6
Kyrgyz Republic	62	66	1.9	235	192	..	7.0	..	0.4	..	92.6
Lao PDR	87	77	1.8	483	231	2.9	3.5	0.1	0.2	97.0	96.3
Latvia	32	31	–0.4	41	62	..	29.7	..	0.5	..	69.8
Lebanon	26	11	–2.9	262	10	20.5	17.6	8.9	12.5	70.6	69.9
Lesotho	87	73	1.4	466	30	9.6	10.7	..	..	..	..
Libya	31	13	–1.5	39	1,760	1.0	1.0	0.2	0.2	98.8	98.8
Lithuania	39	32	–0.6	40	65	..	45.4	..	0.9	..	53.6
Macedonia, FYR	47	38	–0.6	133	25	..	23.1	..	1.9	..	75.0
Madagascar	82	71	2.1	408	582	4.3	4.4	0.9	0.9	94.8	94.7
Malawi	91	76	2.0	437	94	16.1	19.9	0.9	1.3	83.0	78.7
Malaysia	58	43	1.1	537	329	3.0	5.5	11.6	17.6	85.4	76.9
Mali	82	71	1.7	160	1,220	1.6	3.8	0.0	0.0	98.3	96.2
Mauritania	73	44	0.0	233	1,025	0.2	0.5	0.0	0.0	99.8	99.5
Mauritius	58	59	1.1	684	2	49.3	49.3	3.4	3.0	47.3	47.8
Mexico	34	26	0.5	98	1,909	12.1	13.2	0.8	1.1	87.1	85.7
Moldova	60	54	–0.2	129	33	..	54.5	..	11.7	..	33.8
Mongolia	48	37	0.5	67	1,567	0.8	0.8	0.0	0.0	99.2	99.2
Morocco	59	45	0.5	140	446	16.9	20.2	1.1	2.1	82.0	77.6
Mozambique	87	61	0.0	339	784	3.7	4.0	0.3	0.3	96.0	95.7
Myanmar	76	73	1.3	340	658	14.6	14.5	0.7	0.9	84.8	84.6
Namibia	77	70	2.1	143	823	0.8	1.0	0.0	0.0	99.2	99.0
Nepal	94	88	2.2	700	143	16.0	20.3	0.2	0.5	83.8	79.2
Netherlands	12	11	0.1	186	34	23.3	26.7	0.9	1.0	75.8	72.3
New Zealand	17	14	0.2	35	268	9.3	5.8	3.7	6.4	86.9	87.8
Nicaragua	47	44	2.1	87	121	9.5	20.2	1.5	2.4	89.1	77.4
Niger	87	80	2.8	163	1,267	2.8	3.9	0.0	0.0	97.2	96.1
Nigeria	73	57	1.6	248	911	30.6	31.0	2.8	2.8	66.6	66.3
Norway	30	25	–0.4	123	307	2.7	3.0	..	..	..	..
Oman	69	18	–3.1	2,785	212	0.1	0.1	0.1	0.2	99.8	99.7
Pakistan	72	64	1.9	394	771	25.9	27.8	0.4	0.8	73.7	71.4
Panama	50	44	1.3	244	74	5.8	6.7	1.6	2.1	92.5	91.2
Papua New Guinea	87	83	2.0	6,379	453	0.0	0.1	1.1	1.3	98.9	98.5
Paraguay	58	45	1.5	108	397	4.1	5.5	0.3	0.2	95.6	94.2
Peru	35	28	0.7	189	1,280	2.5	2.9	0.3	0.4	97.2	96.7
Philippines	63	42	0.2	573	298	17.5	18.4	14.8	15.1	67.7	66.5
Poland	42	35	–0.5	97	304	48.0	46.0	1.1	1.2	50.9	52.8
Portugal	71	37	–3.3	206	92	26.5	20.5	7.8	7.7	65.7	71.8
Puerto Rico	33	25	–0.4	2,990	9	8.3	3.7	7.3	5.1	84.3	91.2
Romania	51	44	–0.7	106	230	42.7	40.5	2.9	2.2	54.4	57.3
Russian Federation	30	23	1.2	27	16,889	..	7.5	..	0.1	..	92.4

	Rural population			Rural population density	Land area	Land use					
	% of total		average annual % growth	people per sq. km of arable land	thousand sq. km	Arable land % of land area		Permanent cropland % of land area		Other % of land area	
	1980	1999	1980–99	1998	1998	1980	1998	1980	1998	1980	1998
Rwanda	95	94	2.4	929	25	30.8	33.2	10.3	10.1	58.9	56.6
Saudi Arabia	34	15	−0.3	82	2,150	0.9	1.7	0.0	0.1	99.1	98.2
Senegal	64	53	1.7	219	193	12.2	11.6	0.0	0.2	87.8	88.2
Sierra Leone	76	64	1.3	649	72	6.3	6.8	0.7	0.8	93.0	92.5
Singapore	0	0	..	0	1	3.3	1.6	9.8	0.0	86.9	98.4
Slovak Republic	48	43	−0.2	157	48	..	30.6	..	2.8	..	66.6
Slovenia	52	50	0.0	427	20	..	11.5	..	2.7	..	85.8
South Africa	52	50	2.0	140	1,221	10.2	12.1	0.7	0.8	89.1	87.1
Spain	27	23	−0.7	63	499	31.1	28.6	9.9	9.6	59.0	61.8
Sri Lanka	78	77	1.2	1,664	65	13.2	13.4	15.9	15.8	70.9	70.8
Sudan	80	65	1.2	112	2,376	5.2	7.0	0.0	0.1	94.8	92.9
Sweden	17	17	0.3	53	412	7.2	6.8	..	..	..	..
Switzerland	43	32	−0.9	553	40	9.9	10.5	0.5	0.6	89.6	88.9
Syrian Arab Republic	53	46	2.3	151	184	28.5	25.6	2.5	4.2	69.1	70.2
Tajikistan	66	73	2.9	583	141	..	5.4	..	0.9	..	93.7
Tanzania	85	68	1.8	595	884	3.5	4.2	1.0	1.0	95.5	94.7
Thailand	83	79	1.1	281	511	32.3	32.9	3.5	7.0	64.2	60.1
Togo	77	67	2.2	137	54	35.9	40.4	1.6	1.8	62.6	57.7
Trinidad and Tobago	37	26	−0.8	460	5	13.6	14.6	9.0	9.2	77.4	76.2
Tunisia	49	35	0.4	116	155	20.5	18.7	9.7	12.9	69.7	68.5
Turkey	56	26	−2.1	70	770	32.9	31.8	4.1	3.3	63.0	65.0
Turkmenistan	53	55	2.9	160	470	..	3.5	..	0.1	..	96.4
Uganda	91	86	2.4	357	200	20.4	25.3	8.0	8.8	71.6	65.9
Ukraine	38	32	−0.9	49	579	..	56.7	..	1.7	..	41.6
United Arab Emirates	29	15	1.7	1,017	84	0.2	0.5	0.1	0.5	99.7	99.0
United Kingdom	11	11	0.0	100	242	28.7	25.9	0.3	0.2	71.1	73.9
United States	26	23	0.4	36	9,159	20.6	19.3	0.2	0.2	79.2	80.5
Uruguay	15	9	−2.0	24	175	8.0	7.2	0.3	0.3	91.7	92.5
Uzbekistan	59	63	2.5	335	414	..	10.8	..	0.9	..	88.3
Venezuela, RB	21	13	−0.1	117	882	3.2	3.0	0.9	1.0	95.9	96.0
Vietnam	81	80	1.9	1,080	325	18.2	17.5	1.9	4.8	79.8	77.7
West Bank and Gaza	..	..	..	..	..	..	..	..	..	..	..
Yemen, Rep.	81	76	3.3	838	528	2.6	2.8	0.2	0.2	97.2	96.9
Yugoslavia, FR (Serb./Mont.)	54	48	−0.2	..	..	28.0	..	2.9	..	69.1	..
Zambia	60	60	2.9	111	743	6.9	7.1	0.0	0.0	93.1	92.9
Zimbabwe	78	65	1.9	240	387	6.5	8.3	0.3	0.3	93.3	91.3
World	**60 w**	**54 w**	**0.9 w**	**520 w**	**130,079 s**	**10.2 w**	**10.6 w**	**0.9 w**	**1.0 w**	**88.9 w**	**88.4w**
Low income	76	69	1.6	507	33,008	11.8	13.0	1.0	1.4	87.1	85.5
Middle income	62	50	0.3	584	66,146	7.9	8.9	1.0	1.0	91.0	90.1
Lower middle income	69	57	0.4	631	43,918	9.6	9.7	1.1	0.9	89.3	89.3
Upper middle income	36	25	−0.4	193	22,228	6.1	7.2	1.0	1.2	92.9	91.6
Low & middle income	68	59	1.0	542	99,154	9.5	10.3	1.0	1.2	89.4	88.5
East Asia & Pacific	78	66	0.5	691	15,969	10.1	12.0	1.5	2.6	88.4	85.4
Europe & Central Asia	41	33	−0.6	125	23,742	37.1	11.7	3.1	0.4	59.8	87.9
Latin America & Carib.	35	25	0.0	252	20,062	5.8	6.7	1.1	1.3	93.1	92.1
Middle East & N. Africa	52	42	1.4	534	10,995	4.5	5.2	0.4	0.7	94.9	93.9
South Asia	78	72	1.6	537	4,781	42.5	42.4	1.5	2.1	56.1	55.5
Sub-Saharan Africa	77	66	2.0	369	23,605	5.5	6.5	0.7	0.8	93.7	92.5
High income	25	23	−0.1	175	30,925	12.0	11.8	0.5	0.5	87.5	87.7
Europe EMU	26	22	−0.6	141	2,401	26.5	25.6	4.5	4.1	68.9	70.3

a. Includes Luxembourg. b. Includes Taiwan, China.

Rural environment and land use | 3.1

Indicators of rural development are sparse, as few indicators are disaggregated between rural and urban areas (for some that are, see tables 2.6, 3.5, and 3.10). This table shows indicators of rural population and land use. Rural population is approximated as the midyear nonurban population.

The data in the table show that land use patterns are changing. They also indicate major differences in resource endowments and uses among countries. True comparability of the data is limited, however, by variations in definitions, statistical methods, and the quality of data collection. Countries use different definitions of rural population and land use, for example. The Food and Agriculture Organization (FAO), the primary compiler of these data, occasionally adjusts its definitions of land use categories and sometimes revises earlier data. (In 1985, for example, the FAO began to exclude from cropland land used for shifting cultivation but currently lying fallow.) And following FAO practice, this year's edition of the *World Development Indicators,* like the previous two, breaks down the category *cropland,* used in earlier editions, into *arable land* and *permanent cropland.* Because the data reflect changes in data reporting procedures as well as actual changes in land use, apparent trends should be interpreted with caution.

Satellite images show land use that differs from that given by ground-based measures in both area under cultivation and type of land use. Furthermore, land use data in countries such as India are based on reporting systems that were geared to the collection of tax revenue. Because taxes on land are no longer a major source of government revenue, the quality and coverage of land use data (except for cropland) have declined. Data on forest area, aggregated in the category *other,* may be particularly unreliable because of differences in definitions and irregular surveys (see *About the data* for table 3.4).

Monitoring rural development

Successful development requires understanding where and how people live and work, gathering data and formulating strategies, and closely monitoring policy outcomes at both national and subnational levels. And monitoring requires meaningful data broken down along rural and urban lines.

Because the characteristics of urban and rural development differ, disaggregated data are also needed to inform the design and implementation of policies. But there are immense problems in the availability, quality, and reliability of rural data in most developing countries. Many countries have poor capacity for collecting and analyzing data, and the data that do exist are of poor quality and often not comparable.

Rural development is the outcome of all productive activities in rural areas—agricultural and nonagricultural—that improve the livelihood and well-being of rural people. Thus a comprehensive strategy is required that links rural development and rural well-being. The World Bank is preparing an update of its rural development strategy, which has as its overarching goal reducing rural poverty.

Progress in rural poverty reduction—as a proxy for rural well-being—will be monitored using a set of indicators consistent with the international development goals (see the *World view* section). The indicators capture different aspects of poverty, reflecting the need to tackle poverty not only by increasing incomes but also by enhancing equity and improving access to basic services. For some of these indicators data are not being collected or are not being disaggregated. So the challenge is to ensure systematic collection and disaggregation.

The indicators for monitoring progress in rural poverty reduction include the following:

- Rural headcount index (the percentage of the rural population in extreme poverty, living on less than $1 a day).
- Agricultural GDP.
- Rural gender development index (the percentage of rural women and girls with access to health services and the ability to read and write).
- Rural malnutrition rate (the percentage of rural children who are malnourished).
- Rural illiteracy rate (the percentage of rural people ages 15–50 who cannot read or write).
- Rural under-five mortality rate.
- Percentage of the rural population with access to potable water.
- Percentage of the rural population with access to sanitation.
- Rural roads usable for vehicles year-round.
- Percentage of rural households with access to credit services from financial institutions.

- **Rural population** is calculated as the difference between the total population and the urban population (see *Definitions* for tables 2.1 and 3.10). • **Rural population density** is the rural population divided by the arable land area. • **Land area** is a country's total area, excluding area under inland water bodies, national claims to continental shelf, and exclusive economic zones. In most cases the definition of inland water bodies includes major rivers and lakes. (See table 1.1 for the total surface area of countries.) • **Land use** is broken into three categories. • **Arable land** includes land defined by the FAO as land under temporary crops (double-cropped areas are counted once), temporary meadows for mowing or for pasture, land under market or kitchen gardens, and land temporarily fallow. Land abandoned as a result of shifting cultivation is excluded.
- **Permanent cropland** is land cultivated with crops that occupy the land for long periods and need not be replanted after each harvest, such as cocoa, coffee, and rubber. This category includes land under flowering shrubs, fruit trees, nut trees, and vines, but excludes land under trees grown for wood or timber.
- **Other land** includes forest and woodland as well as logged-over areas to be forested in the near future. Also included are uncultivated land, grassland not used for pasture, wetlands, wastelands, and built-up areas—residential, recreational, and industrial lands and areas covered by roads and other fabricated infrastructure.

The data on urban population shares used to estimate rural population come from the United Nations Population Division's *World Urbanization Prospects: The 1999 Revision.* The total population figures are World Bank estimates. The data on land area and land use are from the FAO's electronic files and are published in its *Production Yearbook.* The FAO gathers these data from national agencies through annual questionnaires and by analyzing the results of national agricultural censuses.

3.2 Agricultural inputs

	Arable land		Irrigated land		Land under cereal production		Fertilizer consumption		Agricultural machinery			
	hectares per capita		% of cropland		thousand hectares		hundreds of grams per hectare of arable land		Tractors per 1,000 agricultural workers		Tractors per 100 hectares of arable land	
	1979–81	1996–98	1979–81	1996–98	1979–81	1998–2000	1979–81	1996–98	1979–81	1996–98	1979–81	1996–98
Albania	0.22	0.17	53.0	48.5	367	214	1,556	212	15	10	173	141
Algeria	0.37	0.26	3.4	6.9	2,968	2,478	277	101	27	39	68	121
Angola	0.41	0.26	2.2	2.1	705	888	49	15	4	3	35	34
Argentina	0.89	0.70	5.7	5.7	11,067	10,261	46	330	132	190	73	112
Armenia	..	0.13	..	51.2	..	183	..	54	..	70	..	354
Australia	2.97	2.80	3.5	4.6	15,986	16,197	269	406	751	704	75	61
Austria	0.20	0.17	0.2	0.3	1,062	817	2,615	1,836	945	1,617	2,084	2,527
Azerbaijan	..	0.21	..	75.1	..	577	..	128	..	34	..	195
Bangladesh	0.10	0.06	17.1	44.8	10,823	11,227	459	1,460	0	0	5	7
Belarus	..	0.61	..	1.8	..	2,295	..	1,371	..	121	..	158
Belgium[a]	0.08	0.08	1.7	4.2	426	333	5,323	3,834	917	1,186	1,416	1,326
Benin	0.43	0.29	0.3	0.6	525	836	11	212	0	0	1	1
Bolivia	0.35	0.24	6.6	6.2	559	776	23	53	4	4	21	31
Bosnia and Herzegovina	..	0.14	..	0.3	..	370	..	326	..	270	..	580
Botswana	0.44	0.22	0.5	0.3	153	87	32	110	9	20	54	175
Brazil	0.32	0.33	3.3	4.1	20,612	16,908	915	1,020	31	58	139	151
Bulgaria	0.43	0.51	28.3	17.9	2,110	1,938	2,334	417	66	68	161	58
Burkina Faso	0.39	0.32	0.4	0.7	2,026	2,999	26	115	0	0	0	6
Burundi	0.22	0.12	4.5	6.7	203	202	11	25	0	0	1	2
Cambodia	0.29	0.33	5.8	7.1	1,241	2,010	45	26	0	0	6	3
Cameroon	0.68	0.43	0.2	0.5	1,021	1,045	56	63	0	0	1	1
Canada	1.86	1.52	1.3	1.6	19,561	17,444	416	591	824	1,678	144	156
Central African Republic	0.81	0.56	..	..	194	156	5	2	0	0	0	0
Chad	0.70	0.49	0.4	0.6	907	1,897	6	35	0	0	1	0
Chile	0.34	0.14	31.1	78.4	820	574	338	2,225	43	52	90	256
China	0.10	0.10	45.1	38.3	94,647	90,212	1,494	2,860	2	1	76	56
Hong Kong, China	0.00	0.00	*37.5*	31.0	0	0	..	..	0	0	10	7
Colombia	0.13	0.05	7.7	20.7	1,361	1,041	812	2,826	8	6	77	105
Congo, Dem. Rep.	0.25	0.14	0.1	0.1	1,115	2,118	12	3	0	0	3	4
Congo, Rep.	0.08	0.06	0.6	0.5	19	3	27	255	2	1	49	41
Costa Rica	0.12	0.06	12.1	24.9	136	91	2,650	7,972	22	22	210	311
Côte d'Ivoire	0.24	0.21	1.0	1.0	1,008	1,621	261	333	1	1	16	13
Croatia	..	0.30	..	0.2	..	608	..	1,606	..	13	..	21
Cuba	0.27	0.33	22.9	19.4	224	209	2,024	580	78	96	259	214
Czech Republic	..	0.30	..	0.7	..	1,614	..	1,048	..	167	..	275
Denmark	0.52	0.44	14.5	20.2	1,818	1,509	2,453	1,827	973	1,133	708	597
Dominican Republic	0.19	0.13	11.7	17.1	149	149	572	937	3	4	20	23
Ecuador	0.20	0.13	24.8	28.8	419	854	471	955	6	7	40	57
Egypt, Arab Rep.	0.06	0.05	100.0	99.8	2,007	2,631	2,864	3,858	4	11	158	318
El Salvador	0.12	0.10	4.3	4.4	422	457	1,376	1,619	5	4	61	61
Eritrea	..	0.11	..	5.3	..	412	..	140	..	0	..	11
Estonia	..	0.77	..	0.4	..	357	..	247	..	519	..	451
Ethiopia	..	0.17	..	1.8	..	6,852	..	159	..	0	..	3
Finland	0.50	0.42	2.5	3.0	1,190	1,160	2,022	1,442	721	1,196	892	907
France	0.32	0.31	4.6	9.7	9,804	9,141	3,260	2,708	737	1,256	836	698
Gabon	0.42	0.28	2.4	3.0	6	18	20	8	5	7	43	46
Gambia, The	0.26	0.16	0.6	1.0	54	122	136	59	0	0	3	2
Georgia	..	0.14	..	43.8	..	372	..	442	..	31	..	212
Germany	0.15	0.14	3.7	4.0	7,692	6,904	4,249	2,423	624	960	1,340	950
Ghana	0.18	0.19	0.2	0.2	902	1,317	104	54	1	1	19	11
Greece	0.30	0.27	24.2	35.2	1,600	1,286	1,927	1,811	120	289	485	843
Guatemala	0.19	0.13	5.0	6.6	716	686	726	1,604	3	2	32	32
Guinea	0.16	0.13	7.9	6.4	708	743	16	35	0	0	2	6
Guinea-Bissau	0.32	0.26	6.0	4.9	142	134	24	13	0	0	1	1
Haiti	0.10	0.07	7.9	8.2	416	448	62	165	0	0	3	2
Honduras	0.44	0.28	4.1	3.7	421	500	163	720	5	7	21	30

Agricultural inputs | 3.2

	Arable land		Irrigated land		Land under cereal production		Fertilizer consumption		Agricultural machinery			
									Tractors per 1,000 agricultural workers		Tractors per 100 hectares of arable land	
	hectares per capita		% of cropland		thousand hectares		hundreds of grams per hectare of arable land					
	1979–81	1996–98	1979–81	1996–98	1979–81	1998–2000	1979–81	1996–98	1979–81	1996–98	1979–81	1996–98
Hungary	0.47	0.47	3.6	4.2	2,878	2,598	2,906	929	59	162	111	191
India	0.24	0.17	22.8	33.6	104,349	101,190	345	976	2	6	24	91
Indonesia	0.12	0.09	16.2	15.5	11,825	15,298	645	1,434	0	1	5	39
Iran, Islamic Rep.	0.36	0.28	35.5	39.8	8,062	7,954	430	691	17	38	57	136
Iraq	0.40	0.24	32.1	63.6	2,159	2,927	172	702	23	74	44	95
Ireland	0.33	0.37	..	..	425	283	5,373	5,135	606	993	1,289	1,239
Israel	0.08	0.06	49.3	45.5	129	57	2,384	3,423	294	323	809	699
Italy	0.17	0.14	19.3	24.5	5,082	4,128	2,295	2,169	370	950	1,117	1,774
Jamaica	0.06	0.07	10.1	9.1	4	2	1,231	1,353	9	11	208	177
Japan	0.04	0.04	56.0	54.6	2,724	2,054	4,131	3,278	209	681	2,723	4,830
Jordan	0.14	0.06	11.0	19.4	158	76	404	890	48	30	153	188
Kazakhstan	..	1.98	..	7.3	..	11,466	..	29	..	70	..	34
Kenya	0.23	0.14	0.9	1.5	1,692	1,851	160	357	1	1	17	36
Korea, Dem. Rep.	0.09	0.07	58.9	73.0	1,625	1,330	4,688	826	13	19	275	441
Korea, Rep.	0.05	0.04	59.6	60.5	1,689	1,173	3,920	5,358	1	50	14	779
Kuwait	0.00	0.00	83.3	81.0	0	1	4,500	2,944	3	11	220	129
Kyrgyz Republic	..	0.29	..	75.4	..	645	..	293	..	36	..	142
Lao PDR	0.21	0.17	15.4	18.9	751	708	40	91	0	0	8	11
Latvia	..	0.72	..	1.1	..	434	..	191	..	330	..	326
Lebanon	0.07	0.04	28.3	37.6	34	39	1,663	3,249	28	111	141	300
Lesotho	0.22	0.16	..	..	203	178	150	182	6	6	47	62
Libya	0.58	0.35	10.7	22.2	538	319	357	320	101	296	134	187
Lithuania	..	0.79	..	0.3	..	1,046	..	448	..	294	..	267
Macedonia, FYR	..	0.30	..	8.5	..	222	..	747	..	398	..	902
Madagascar	0.28	0.18	21.5	35.0	1,309	1,373	31	45	1	1	11	14
Malawi	0.25	0.18	1.1	1.4	1,155	1,547	203	294	0	0	8	8
Malaysia	0.07	0.08	6.7	4.8	729	702	4,273	6,940	4	23	77	238
Mali	0.31	0.46	4.5	3.0	1,346	2,422	61	92	0	1	5	6
Mauritania	0.14	0.20	22.8	9.8	125	235	57	60	1	1	13	7
Mauritius	0.10	0.09	15.0	17.6	0	0	2,547	3,480	4	6	33	37
Mexico	0.34	0.27	20.3	23.8	9,356	11,061	570	658	16	20	54	68
Moldova	..	0.41	..	14.1	..	865	..	668	..	82	..	257
Mongolia	0.71	0.57	3.0	6.4	559	261	83	33	32	21	82	53
Morocco	0.39	0.33	15.0	12.7	4,414	5,166	268	357	7	10	34	47
Mozambique	0.24	0.19	2.1	3.2	1,077	1,816	107	21	1	1	20	18
Myanmar	0.28	0.22	10.4	15.5	5,133	6,302	111	182	1	0	9	9
Namibia	0.64	0.50	0.6	0.9	195	298		..	10	11	39	39
Nepal	0.16	0.13	22.5	38.2	2,251	3,283	98	383	0	0	10	16
Netherlands	0.06	0.06	58.5	60.4	225	203	8,620	5,547	561	603	2,238	1,789
New Zealand	0.80	0.41	5.2	8.7	193	130	1,965	4,218	619	437	367	488
Nicaragua	0.39	0.53	6.0	3.2	266	378	392	198	6	7	19	11
Niger	0.62	0.51	0.7	1.3	3,872	7,532	10	7	0	0	0	0
Nigeria	0.39	0.24	0.7	0.8	6,048	18,440	59	59	1	2	3	10
Norway	0.20	0.21	..	..	311	334	3,146	2,203	824	1,306	1,603	1,584
Oman	0.01	0.01	92.7	98.4	2	3	840	3,779	1	1	76	94
Pakistan	0.24	0.17	72.7	81.2	10,693	12,489	525	1,178	5	12	50	150
Panama	0.22	0.18	5.0	4.9	166	188	692	753	27	20	122	100
Papua New Guinea	0.01	0.01	..	..	2	2	3,827	2,283	1	1	699	193
Paraguay	0.52	0.43	3.4	2.9	307	554	44	233	14	24	45	75
Peru	0.19	0.15	32.3	28.9	732	1,091	381	498	5	3	37	25
Philippines	0.11	0.08	12.8	15.6	6,790	6,299	636	1,283	1	1	20	21
Poland	0.41	0.36	0.7	0.7	7,875	8,577	2,393	1,148	112	285	425	936
Portugal	0.25	0.19	20.1	24.0	1,099	590	1,113	1,288	72	219	351	802
Puerto Rico	0.02	0.01	27.2	51.3	1	0	..	..	..	..	..	..
Romania	0.44	0.41	21.9	30.6	6,340	5,496	1,448	392	39	88	150	176
Russian Federation	..	0.86	..	3.8	..	46,809	..	112	..	101	..	72

3.2 Agricultural inputs

	Arable land		Irrigated land		Land under cereal production		Fertilizer consumption		Agricultural machinery			
									Tractors per 1,000 agricultural workers		Tractors per 100 hectares of arable land	
	hectares per capita		% of cropland		thousand hectares		hundreds of grams per hectare of arable land					
	1979–81	1996–98	1979–81	1996–98	1979–81	1998–2000	1979–81	1996–98	1979–81	1996–98	1979–81	1996–98
Rwanda	0.15	0.10	0.4	0.4	239	219	3	4	0	0	1	1
Saudi Arabia	0.20	0.19	28.9	42.3	388	588	228	865	2	12	10	26
Senegal	0.42	0.25	2.6	3.1	1,216	1,218	104	108	0	0	2	2
Sierra Leone	0.14	0.10	4.1	5.4	434	279	58	62	0	0	6	2
Singapore	0.00	0.00	..	..	..	..	22,333	25,183	3	20	220	650
Slovak Republic	..	0.27	..	11.2	..	898	..	751	..	92	..	175
Slovenia	..	0.12	..	0.7	..	95	..	3,086	..	3,604	..	4,311
South Africa	0.45	0.36	8.4	8.5	6,760	4,742	874	534	94	60	140	68
Spain	0.42	0.36	14.8	19.0	7,391	6,652	1,012	1,474	200	576	335	583
Sri Lanka	0.06	0.05	28.3	32.1	864	890	1,800	2,517	4	2	141	81
Sudan	0.66	0.60	14.4	11.5	4,447	7,973	51	42	2	2	8	6
Sweden	0.36	0.32	..	..	1,505	1,221	1,654	1,068	715	989	623	590
Switzerland	0.06	0.06	6.2	5.6	172	188	4,623	4,529	494	635	2,428	2,675
Syrian Arab Republic	0.60	0.32	9.6	21.3	2,642	3,075	250	737	29	66	54	188
Tajikistan	..	0.13	..	80.9	..	405	..	841	..	37	..	395
Tanzania	0.16	0.12	3.1	3.3	2,834	3,201	110	86	1	1	35	20
Thailand	0.35	0.28	16.4	23.1	10,625	11,425	177	925	1	10	11	123
Togo	0.75	0.52	0.3	0.3	416	765	14	76	0	0	0	0
Trinidad and Tobago	0.06	0.06	1.7	2.5	4	4	1,064	1,406	50	53	337	358
Tunisia	0.51	0.31	4.9	7.7	1,416	1,273	212	365	30	38	79	121
Turkey	0.57	0.42	9.6	14.8	13,499	13,655	529	751	38	60	169	330
Turkmenistan	..	0.35	..	106.2	..	612	..	982	..	81	..	307
Uganda	0.32	0.25	0.1	0.1	752	1,382	1	2	0	1	6	9
Ukraine	..	0.65	..	7.3	..	12,040	..	165	..	87	..	109
United Arab Emirates	0.01	0.02	237.7	88.9	0	1	2,250	7,775	6	4	106	69
United Kingdom	0.12	0.11	2.0	1.7	3,930	3,290	3,185	3,588	726	898	742	800
United States	0.83	0.65	10.8	12.0	72,639	59,953	1,092	1,135	1,230	1,515	253	271
Uruguay	0.48	0.39	5.4	13.5	614	578	564	1,102	171	173	236	262
Uzbekistan	..	0.19	..	88.3	..	1,455	..	1,623	..	59	..	380
Venezuela, RB	0.19	0.12	10.0	15.4	814	668	711	1,058	50	59	133	185
Vietnam	0.11	0.07	25.6	42.0	5,962	8,228	302	2,933	1	4	38	206
West Bank and Gaza	..	..	..	..	..	..	..	..	..	..	..	..
Yemen, Rep.	0.16	0.09	19.9	31.0	865	694	93	111	3	2	33	40
Yugoslavia, FR (Serb./Mont.)	0.73	..	1.9	..	4,310	..	1,261	..	140	..	616	..
Zambia	0.89	0.56	0.4	0.9	595	693	145	94	3	2	9	11
Zimbabwe	0.36	0.28	3.1	3.5	1,633	1,784	610	537	7	6	66	69
World	0.25 w	0.24 w	17.7 w	19.5 w	588,514 s	679,938 s	870 w	988 w	19 w	20 w	172 w	187 w
Low income	0.22	0.18	19.9	26.1	199,694	258,543	290	632	2	5	20	69
Middle income	0.18	0.23	23.4	19.7	233,799	287,355	985	1,081	8	11	103	126
Lower middle income	0.14	0.21	31.1	22.7	169,290	225,384	1,004	1,135	5	7	83	96
Upper middle income	0.32	0.29	10.3	11.8	64,509	61,971	952	936	39	81	137	205
Low & middle income	0.20	0.21	21.7	22.4	433,493	545,899	645	891	5	8	62	102
East Asia & Pacific	0.12	0.11	36.9	37.1	141,593	143,963	1,155	2,332	2	2	55	72
Europe & Central Asia	0.16	0.59	10.6	10.4	37,380	115,149	1,445	339	..	100	223	167
Latin America & Carib.	0.32	0.27	11.8	13.7	49,759	47,697	586	811	25	35	95	118
Middle East & N. Africa	0.29	0.20	25.8	36.2	25,655	27,225	422	699	12	24	61	121
South Asia	0.23	0.16	28.7	40.8	132,128	131,768	360	975	2	5	25	89
Sub-Saharan Africa	0.32	0.25	4.0	4.2	46,978	80,097	158	135	3	2	23	17
High income	0.46	0.41	9.8	11.2	155,021	134,039	1,314	1,264	519	927	387	430
Europe EMU	0.23	0.21	12.5	16.3	34,399	30,223	2,739	2,295	452	855	896	953

a. Includes Luxembourg.

Agricultural inputs | 3.2

Agricultural activities provide developing countries with food and revenue, but they also can degrade natural resources. Poor farming practices can cause soil erosion and loss of fertility. Efforts to increase productivity through the use of chemical fertilizers, pesticides, and intensive irrigation have environmental costs and health impacts. Excessive use of chemical fertilizers can alter the chemistry of soil. Pesticide poisoning is common in developing countries. And salinization of irrigated land diminishes soil fertility. Thus inappropriate use of inputs for agricultural production has far-reaching effects.

This table provides indicators of major inputs to agricultural production: land, fertilizers, and agricultural machinery. There is no single correct mix of inputs: appropriate levels and application rates vary by country and over time, depending on the type of crops, the climate and soils, and the production process used.

The data shown here and in table 3.3 are collected by the Food and Agriculture Organization (FAO) through annual questionnaires. The FAO tries to impose standard definitions and reporting methods, but exact consistency across countries and over time is not possible. Data on agricultural employment in particular should be used with caution. In many countries much agricultural employment is informal and unrecorded, including substantial work performed by women and children.

Fertilizer consumption measures the quantity of plant nutrients in the form of nitrogen, potassium, and phosphorous compounds available for direct application. Consumption is calculated as production plus imports minus exports. Traditional nutrients— animal and plant manures—are not included. Because some chemical compounds used for fertilizers have other industrial applications, the consumption data may overstate the quantity available for crops.

To smooth annual fluctuations in agricultural activity, the indicators in the table have been averaged over three years.
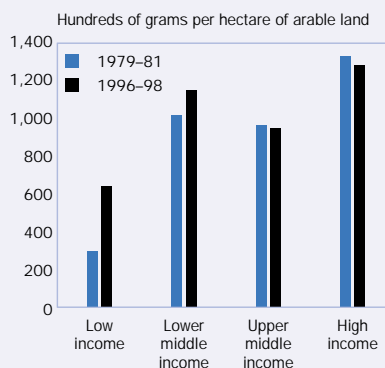
Figure 3.2a

Farm workers in developing countries must rely on their own labor

Tractors per 1,000 agricultural workers
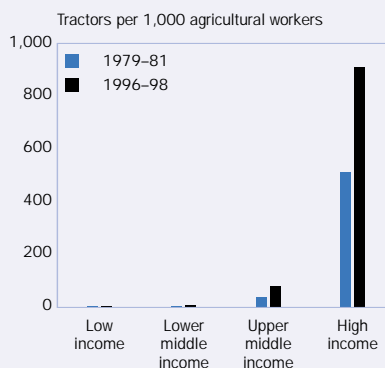
Source: Table 3.2.

Figure 3.2b

Fertilizer consumption is growing rapidly in low-income countries

Hundreds of grams per hectare of arable land

Source: Table 3.2.

• **Arable land** includes land defined by the FAO as land under temporary crops (double-cropped areas are counted once), temporary meadows for mowing or for pasture, land under market or kitchen gardens, and land temporarily fallow. Land abandoned as a result of shifting cultivation is excluded.   • **Irrigated land** refers to areas purposely provided with water, including land irrigated by controlled flooding. Cropland refers to arable land and land used for permanent crops (see table 3.1). • **Land under cereal production** refers to harvested areas, although some countries report only sown or cultivated area.   • **Fertilizer consumption** measures the quantity of plant nutrients used per unit of arable land. Fertilizer products cover nitrogenous, potash, and phosphate fertilizers (including ground rock phosphate). The time reference for fertilizer consumption is the crop year (July through June).   • **Agricultural machinery** refers to wheel and crawler tractors (excluding garden tractors) in use in agriculture at the end of the calendar year specified or during the first quarter of the following year.

The data are from electronic files that the FAO makes available to the World Bank. Data on arable land, irrigated land, and land under cereal production are published in the FAO's *Production Yearbook*.

	Crop production index		Food production index		Livestock production index		Cereal yield		Agricultural productivity	
	1989–91 = 100		1989–91 = 100		1989–91 = 100		kilograms per hectare		Agriculture value added per worker 1995 $	
	1979–81	1998–2000	1979–81	1998–2000	1979–81	1998–2000	1979–81	1998–2000	1979–81	1997–99
Albania	..	..	..	..	..	..	2,500	2,664	1,184	1,934
Algeria	77.5	125.8	67.6	131.1	55.0	125.3	656	761	1,416	1,876
Angola	101.9	148.1	90.0	144.0	83.8	135.6	526	646	..	126
Argentina	83.5	159.5	91.7	137.9	100.8	105.6	2,186	3,446	7,155	9,983
Armenia	..	97.4	..	78.0	..	64.8	..	1,536	..	5,180
Australia	79.8	163.9	92.0	137.7	85.6	111.4	1,321	2,031	19,914	*31,432*
Austria	92.8	102.4	92.2	106.0	94.5	107.8	4,131	5,654	15,422	28,410
Azerbaijan	..	45.8	..	63.1	..	74.1	..	2,000	..	837
Bangladesh	80.0	110.4	79.2	114.5	81.3	136.2	1,938	2,786	217	292
Belarus	..	86.3	..	61.7	..	60.9	..	1,949	..	3,744
Belgiumª	84.9	138.6	88.5	114.7	88.8	114.3	4,861	7,676	23,704	48,529
Benin	53.8	175.6	63.1	152.4	69.0	123.6	698	1,056	311	558
Bolivia	71.6	151.0	70.9	137.3	75.5	127.1	1,183	1,531	..	1,054
Bosnia and Herzegovina	..	..	..	..	..	..	..	3,490	..	8,471
Botswana	86.3	70.6	87.2	97.6	87.5	101.3	203	196	630	681
Brazil	75.3	121.6	69.5	136.8	67.9	149.9	1,496	2,660	2,048	4,300
Bulgaria	107.7	67.8	105.5	72.2	96.3	64.0	3,853	2,833	2,754	6,007
Burkina Faso	59.3	146.1	62.7	136.0	59.9	136.2	575	887	134	162
Burundi	79.9	89.7	79.9	90.3	82.3	81.6	1,081	1,283	177	140
Cambodia	55.2	136.0	48.9	139.2	27.3	149.1	1,025	1,867	..	*406*
Cameroon	87.3	124.6	80.5	126.2	61.1	119.6	849	1,395	834	1,072
Canada	77.6	128.9	79.6	128.8	88.4	132.8	2,173	3,034	14,161	*34,922*
Central African Republic	102.8	128.2	79.7	132.8	48.9	129.2	529	1,057	377	460
Chad	67.1	177.9	90.8	155.2	120.4	114.0	587	642	155	220
Chile	70.7	126.3	71.5	133.1	75.8	143.7	2,124	4,540	3,174	4,997
China	67.1	141.5	60.9	168.5	45.4	209.9	3,027	4,879	161	316
Hong Kong, China	133.6	59.3	99.8	49.5	194.3	44.6	1,712		..	..
Colombia	84.1	100.0	75.5	118.5	72.6	125.8	2,452	3,056	3,034	3,454
Congo, Dem. Rep.	73.0	89.0	72.2	92.1	77.7	103.7	807	781	270	*283*
Congo, Rep.	84.6	114.5	82.3	118.0	80.7	129.0	838	687	385	498
Costa Rica	70.6	133.6	73.0	132.3	77.2	120.9	2,498	3,350	3,130	4,973
Côte d'Ivoire	73.8	132.4	70.8	131.2	74.7	127.6	867	1,138	1,074	1,104
Croatia	..	87.2	..	72.8	..	54.4	..	4,445	..	7,123
Cuba	84.3	54.5	90.1	58.2	96.0	63.6	2,458	1,876	..	..
Czech Republic	..	90.3	..	83.6	..	76.6	..	4,174	..	5,091
Denmark	65.2	95.6	83.2	107.9	95.0	118.5	4,040	6,120	19,350	52,809
Dominican Republic	96.5	89.2	85.2	100.7	68.8	121.1	3,024	3,804	1,842	2,710
Ecuador	78.2	122.4	77.4	134.1	73.0	150.1	1,633	2,057	1,206	1,789
Egypt, Arab Rep.	75.5	141.4	68.2	149.5	66.5	156.0	4,053	7,041	721	1,222
El Salvador	120.4	108.5	90.8	121.2	88.8	127.9	1,702	1,966	1,925	1,690
Eritrea	..	174.1	..	133.9	..	105.7	..	794	..	..
Estonia	..	66.8	..	45.2	..	39.7	..	1,516	..	3,646
Ethiopia	..	121.6	..	119.9	..	116.2	..	1,141	..	144
Finland	76.3	86.4	93.5	89.7	107.1	93.3	2,511	2,763	18,547	36,384
France	87.4	112.1	93.8	107.6	97.8	105.0	4,700	7,272	19,318	*50,171*
Gabon	76.3	118.2	79.0	113.9	86.5	118.3	1,718	1,728	1,814	1,889
Gambia, The	79.5	114.1	82.8	115.9	94.4	117.3	1,284	1,101	325	222
Georgia	..	61.1	..	78.3	..	83.5	..	1,485	..	1,952
Germany	89.8	114.0	91.3	94.4	98.7	86.0	4,166	6,480	..	28,924
Ghana	67.0	174.1	68.7	163.5	79.7	101.8	807	1,306	670	554
Greece	86.8	107.0	91.2	100.1	99.9	97.8	3,090	3,512	8,600	*12,711*
Guatemala	89.6	120.9	69.7	124.5	76.0	129.0	1,578	1,726	2,143	2,099
Guinea	89.7	142.4	96.3	143.1	116.4	139.6	958	1,313	..	284
Guinea-Bissau	64.8	119.4	68.3	119.9	78.4	120.5	711	1,421	221	306
Haiti	103.4	86.6	101.3	95.4	100.2	128.8	1,009	914	578	392
Honduras	90.4	116.5	88.2	112.4	80.8	130.1	1,170	1,167	696	1,008

Agricultural output and productivity | 3.3

	Crop production index		Food production index		Livestock production index		Cereal yield		Agricultural productivity	
							kilograms per hectare		Agriculture value added per worker 1995 $	
	1989–91 = 100		1989–91 = 100		1989–91 = 100					
	1979–81	**1998–2000**	**1979–81**	**1998–2000**	**1979–81**	**1998–2000**	**1979–81**	**1998–2000**	**1979–81**	**1997–99**
Hungary	93.3	79.3	90.7	74.7	94.1	69.2	4,519	4,503	3,390	*4,860*
India	70.9	122.1	68.1	124.6	62.2	133.5	1,324	2,293	272	395
Indonesia	66.2	117.4	62.8	119.1	47.2	125.4	2,837	3,915	609	742
Iran, Islamic Rep.	56.7	151.3	61.1	151.4	68.2	146.1	1,108	1,959	2,197	3,679
Iraq	74.7	82.9	78.0	77.7	81.4	65.0	832	558	..	..
Ireland	93.9	110.0	83.3	110.3	83.3	110.6	4,733	6,883	..	..
Israel	98.2	105.6	85.6	110.7	78.4	116.0	1,840	1,373	..	..
Italy	106.1	105.6	101.4	104.8	93.0	104.2	3,548	5,040	10,016	23,906
Jamaica	98.6	122.9	86.0	120.8	73.9	119.6	1,667	1,197	893	1,229
Japan	107.9	88.3	94.0	92.4	85.1	94.2	5,252	5,971	15,698	*30,620*
Jordan	54.6	116.7	57.5	139.6	51.5	198.8	521	772	1,158	1,434
Kazakhstan	..	65.6	..	58.9	..	45.3	..	975	..	*1,414*
Kenya	74.5	107.1	67.6	104.5	60.2	104.1	1,364	1,411	262	226
Korea, Dem. Rep.	..	..	..	..	..	..	3,694	3,037	..	..
Korea, Rep.	87.8	106.4	77.6	112.3	52.6	150.3	4,986	6,400	3,800	12,252
Kuwait	37.1	163.8	91.4	185.7	106.6	180.5	3,124	2,556	..	..
Kyrgyz Republic	..	129.1	..	114.5	..	78.7	..	2,521	..	3,430
Lao PDR	73.5	139.5	70.3	144.3	56.0	161.6	1,402	2,925	..	*558*
Latvia	..	70.2	..	45.8	..	35.9	..	1,982	..	2,523
Lebanon	52.0	137.6	59.2	142.7	100.5	161.6	1,307	2,428	..	*28,243*
Lesotho	95.1	115.9	89.1	99.9	87.7	88.5	977	974	723	544
Libya	76.3	132.9	78.7	161.6	68.4	174.4	430	761	..	..
Lithuania	..	74.4	..	66.6	..	58.1	..	2,179	..	3,192
Macedonia, FYR	..	108.7	..	95.8	..	85.1	..	3,093	..	2,141
Madagascar	83.1	104.2	84.5	108.5	89.5	105.7	1,664	1,891	197	184
Malawi	85.7	149.1	93.2	153.2	78.2	112.4	1,161	1,514	109	138
Malaysia	74.7	111.2	55.4	134.1	41.4	149.1	2,828	2,826	3,939	6,578
Mali	54.5	145.1	76.7	127.2	94.5	123.3	804	1,163	241	279
Mauritania	62.1	152.3	86.5	107.3	89.4	100.9	384	928	299	469
Mauritius	93.3	93.3	89.7	103.1	64.0	135.3	2,536	5,193	3,087	5,330
Mexico	86.5	121.6	83.8	128.4	83.5	134.6	2,164	2,640	1,482	1,742
Moldova	..	54.7	..	45.2	..	36.3	..	2,485	..	1,277
Mongolia	44.6	35.4	88.1	87.8	93.2	92.3	573	735	932	1,193
Morocco	54.8	95.3	55.9	100.1	59.8	106.7	811	780	1,146	1,651
Mozambique	109.6	143.2	100.1	131.0	85.8	103.2	603	919	..	136
Myanmar	89.0	152.8	88.2	148.6	89.1	143.0	2,521	3,104	..	..
Namibia	80.2	111.6	107.2	97.3	115.6	95.5	377	296	862	1,248
Nepal	62.7	120.8	65.9	121.4	77.3	123.5	1,615	2,008	162	189
Netherlands	79.8	107.5	86.5	100.3	88.3	99.9	5,696	7,343	23,907	51,594
New Zealand	74.4	134.1	90.7	125.4	95.5	116.4	4,089	6,343	18,066	27,083
Nicaragua	124.1	134.2	117.8	131.2	139.7	116.7	1,475	1,694	1,620	1,919
Niger	90.1	151.3	97.9	140.1	109.7	120.4	440	377	222	205
Nigeria	51.4	155.4	57.2	152.2	84.3	125.6	1,265	1,208	414	641
Norway	91.2	87.8	92.1	96.3	95.2	100.1	3,634	4,002	17,013	32,848
Oman	60.4	113.8	62.5	114.9	61.6	104.0	982	2,173	..	..
Pakistan	65.6	125.4	66.4	143.3	59.5	150.4	1,608	2,255	394	626
Panama	97.1	97.2	85.6	107.2	71.3	121.9	1,524	1,971	2,122	2,580
Papua New Guinea	86.5	109.7	86.2	113.1	85.0	136.6	2,087	4,170	649	808
Paraguay	58.7	110.4	61.0	132.8	62.1	129.4	1,535	2,159	2,641	3,512
Peru	82.2	162.9	77.3	161.7	78.0	150.5	1,946	2,911	1,194	1,569
Philippines	88.4	112.9	86.1	128.4	73.3	173.5	1,611	2,420	1,347	1,342
Poland	84.6	85.8	87.9	88.7	98.0	87.2	2,345	2,885	..	1,554
Portugal	85.0	85.0	72.2	94.1	71.8	117.1	1,102	2,762	..	*7,621*
Puerto Rico	131.2	62.9	99.7	81.7	90.3	87.5	8,925	4,000	..	..
Romania	114.1	90.3	113.0	93.4	110.0	87.9	2,854	2,543	..	3,228
Russian Federation	..	66.8	..	60.8	..	51.6	..	1,181	..	2,282

	Crop production index 1989–91 = 100		Food production index 1989–91 = 100		Livestock production index 1989–91 = 100		Cereal yield kilograms per hectare		Agricultural productivity Agriculture value added per worker 1995 $	
	1979–81	1998–2000	1979–81	1998–2000	1979–81	1998–2000	1979–81	1998–2000	1979–81	1997–99
Rwanda	84.3	88.1	85.3	91.5	81.0	108.8	1,134	930	371	234
Saudi Arabia	27.2	94.3	26.7	88.5	32.8	147.7	820	4,147	2,167	*10,930*
Senegal	77.2	102.9	74.0	114.2	65.1	138.0	690	721	336	307
Sierra Leone	80.3	81.0	84.5	85.3	84.1	109.0	1,249	1,116	368	379
Singapore	595.0	48.2	154.3	41.5	173.7	39.5	..	..	13,937	42,903
Slovak Republic	..	..	..	..	..	..	..	4,225	..	*3,491*
Slovenia	..	93.5	..	104.6	..	108.7	..	5,379	..	30,136
South Africa	95.0	105.3	92.6	103.3	89.7	96.5	2,105	2,313	2,899	4,070
Spain	83.0	107.6	82.1	110.7	84.2	122.5	1,986	3,221	..	21,687
Sri Lanka	99.3	113.9	98.3	115.7	93.2	133.5	2,462	3,190	638	734
Sudan	131.1	162.0	105.4	155.9	89.3	146.3	645	519	..	..
Sweden	92.1	93.8	100.1	101.1	103.8	104.1	3,595	4,570	18,128	34,285
Switzerland	95.5	99.4	95.8	97.1	98.8	94.1	4,883	6,269	..	..
Syrian Arab Republic	100.4	158.4	94.2	150.5	72.2	133.0	1,156	1,331	..	..
Tajikistan	..	62.5	..	58.1	..	36.9	..	1,268	..	..
Tanzania	81.8	100.3	76.7	105.6	69.3	118.2	1,063	1,295	..	188
Thailand	78.9	112.9	80.0	113.1	64.9	127.0	1,911	2,442	634	939
Togo	70.4	148.1	77.0	140.7	51.9	128.8	729	931	345	543
Trinidad and Tobago	119.9	101.4	101.9	105.0	84.3	100.9	3,167	2,936	..	2,463
Tunisia	68.5	116.6	66.6	127.0	60.7	147.2	828	1,168	1,743	3,047
Turkey	76.6	114.7	75.8	113.0	80.4	109.1	1,869	2,287	1,860	1,858
Turkmenistan	..	80.3	..	132.1	..	134.4	..	2,514	..	856
Uganda	67.5	118.8	70.4	116.5	84.8	119.8	1,555	1,371	..	350
Ukraine	..	58.2	..	49.1	..	45.8	..	2,032	..	1,383
United Arab Emirates	38.9	275.3	48.8	250.6	45.3	170.8	2,224	1,455	..	..
United Kingdom	80.1	102.8	92.0	98.7	98.1	97.9	4,792	6,975	21,177	34,730
United States	98.6	121.9	94.5	122.9	89.0	120.0	4,151	5,794	..	..
Uruguay	86.8	149.7	87.0	137.8	85.9	122.2	1,644	3,456	6,240	8,679
Uzbekistan	..	88.4	..	116.5	..	115.8	..	2,585	..	1,621
Venezuela, RB	76.3	105.7	80.2	117.3	84.9	118.8	1,904	3,089	3,935	5,125
Vietnam	66.7	158.5	63.8	152.2	52.9	163.7	2,049	3,955	..	236
West Bank and Gaza	..	..	..	..	..	..	..	..	..	..
Yemen, Rep.	82.3	129.1	75.0	130.9	68.9	138.6	1,038	1,005	..	355
Yugoslavia, FR (Serb./Mont.)	96.3	..	94.3	..	94.2	..	3,601	..	..	..
Zambia	65.7	88.5	74.0	99.7	86.2	113.2	1,676	1,391	143	218
Zimbabwe	77.9	121.2	81.3	108.2	83.3	113.7	1,359	1,184	308	369
World	**79.1 w**	**123.6 w**	**78.8 w**	**127.9 w**	**79.6 w**	**129.4 w**	**1,608 w**	**2,067 w**	**.. w**	**.. w**
Low income	71.6	124.4	70.7	126.5	68.4	131.2	1,083	1,301	..	346
Middle income	74.5	128.2	72.0	141.4	69.3	153.7	1,844	2,390	..	..
Lower middle income	72.1	132.3	68.2	150.5	59.8	176.0	1,778	2,046	..	..
Upper middle income	80.7	117.3	79.5	122.7	82.3	122.8	1,936	2,800	..	..
Low & middle income	73.5	126.8	71.5	136.3	69.1	148.0	1,426	1,811	..	..
East Asia & Pacific	69.0	135.4	63.8	156.4	48.0	197.6	2,116	2,982	..	..
Europe & Central Asia	..	..	..	..	..	..	2,854	2,407	..	2,220
Latin America & Carib.	80.3	124.3	78.3	131.2	79.8	131.9	1,842	2,488	..	..
Middle East & N. Africa	66.1	131.3	64.8	134.0	64.1	136.8	965	1,411	..	..
South Asia	71.9	121.3	69.6	125.7	64.0	136.2	1,510	2,274	265	..
Sub-Saharan Africa	75.4	128.5	78.3	124.7	84.1	114.2	895	1,120	418	380
High income	93.5	115.7	92.1	112.9	91.1	109.9	3,253	4,002	..	..
Europe EMU	91.0	108.6	91.4	103.4	93.8	101.0	4,109	6,067	..	..

a. Includes Luxembourg.

Agricultural output and productivity | 3.3

The agricultural production indexes in the table are prepared by the Food and Agriculture Organization (FAO). The FAO obtains data from official and semiofficial reports of crop yields, area under production, and livestock numbers. If data are not available, the FAO makes estimates. The indexes are calculated using the Laspeyres formula: production quantities of each commodity are weighted by average international commodity prices in the base period and summed for each year. Because the FAO's indexes are based on the concept of agriculture as a single enterprise, estimates of the amounts retained for seed and feed are subtracted from the production data to avoid double counting. The resulting aggregate represents production available for any use except as seed and feed. The FAO's indexes may differ from other sources because of differences in coverage, weights, concepts, time periods, calculation methods, and use of international prices.

To ease cross-country comparisons, the FAO uses international commodity prices to value production. These prices, expressed in international dollars (equivalent in purchasing power to the U.S. dollar), are derived using a Geary-Khamis formula applied to agricultural outputs (see Inter-Secretariat Working Group on National Accounts 1993, sections 16.93–96). This method assigns a single price to each commodity so that, for example, one metric ton of wheat has the same price regardless of where it was produced. The use of international prices eliminates fluctuations in the value of output due to transitory movements of nominal exchange rates unrelated to the purchasing power of the domestic currency.
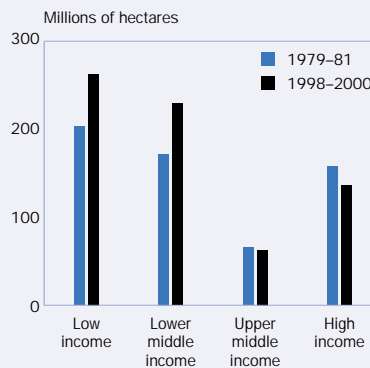
Data on cereal yield may be affected by a variety of reporting and timing differences. The FAO allocates production data to the calendar year in which the bulk of the harvest took place. But most of a crop harvested near the end of a year will be used in the following year. Cereal crops harvested for hay or harvested green for food, feed, or silage and those used for grazing are generally excluded. But millet and sorghum, which are grown as feed for livestock and poultry in Europe and North America, are used as food in Africa, Asia, and countries of the former Soviet Union. So some cereal crops are excluded from the data for some countries and included elsewhere, depending on their use.

Agricultural productivity is measured by value added per unit of input. (For further discussion of the calculation of value added in national accounts see *About the data* for tables 4.1 and 4.2.) Agricultural value added incl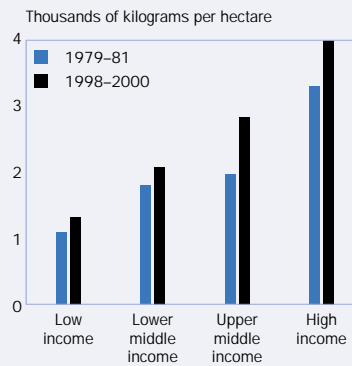udes that from forestry and fishing. Thus interpretations of land productivity should be made with caution. To smooth annual fluctuations in agricultural activity, the indicators in the table have been averaged over three years.

Figure 3.3

The land area under cereal production has grown in low-income countries . . .

Millions of hectares

Legend: 1979–81, 1998–2000. Categories: Low income, Lower middle income, Upper middle income, High income.

. . . but cereal yields, though growing worldwide, still lag

Thousands of kilograms per hectare

Legend: 1979–81, 1998–2000. Categories: Low income, Lower middle income, Upper middle income, High income.

Source: Tables 3.2 and 3.3.

• **Crop production index** shows agricultural production for each period relative to the base period 1989–91. It includes all crops except fodder crops. The regional and income group aggregates for the FAO's production indexes are calculated from the underlying values in international dollars, normalized to the base period 1989–91. The data in this table are three-year averages. However, missing observations have not been estimated or imputed. • **Food production index** covers food crops that are considered edible and that contain nutrients. Coffee and tea are excluded because, although edible, they have no nutritive value. • **Livestock production index** includes meat and milk from all sources, dairy products such as cheese, and eggs, honey, raw silk, wool, and hides and skins. • **Cereal yield,** measured in kilograms per hectare of harvested land, includes wheat, rice, maize, barley, oats, rye, millet, sorghum, buckwheat, and mixed grains. Production data on cereals refer to crops harvested for dry grain only. Cereal crops harvested for hay or harvested green for food, feed, or silage and those used for grazing are excluded. • **Agricultural productivity** refers to the ratio of agricultural value added, measured in constant 1995 U.S. dollars, to the number of workers in agriculture.

The agricultural production indexes are prepared by the FAO and published annually in its *Production Yearbook*. The FAO makes these data and the data on cereal yield and agricultural employment available to the World Bank in electronic files that may contain more recent information than the published versions. For sources of agricultural value added see table 4.2.

3.4 Deforestation and biodiversity

	Forest area		Average annual deforestation		Mammals		Birds		Higher plants[a]		Nationally protected areas	
	thousand sq. km 2000	% of total land area 2000	sq. km 1990–2000	Decline in forest area % 1990–2000	Species 1996[b]	Threatened species 2000[b]	Species 1996[b]	Threatened species 2000[b]	Species 1997[b]	Threatened species 1997[b]	thousand sq. km 1999[b]	% of total land area 1999[b]
Albania	10	36.2	78	0.8	68	3	230	3	3,031	79	0.8	2.9
Algeria	21	0.9	−266	−1.3	92	13	192	6	3,164	141	58.9	2.5
Angola	698	56.0	1,242	0.2	276	18	765	15	5,185	30	81.8	6.6
Argentina	346	12.7	2,851	0.8	320	32	897	39	9,372	247	46.6	1.7
Armenia	4	12.4	−42	−1.3	..	7	..	4	..	31	2.1	7.4
Australia	1,581	20.6	0	0.0	252	63	649	35	15,638	2,245	563.9	7.3
Austria	39	47.0	−77	−0.2	83	9	213	3	3,100	23	23.4	28.3
Azerbaijan	11	12.6	−130	−1.3	..	13	..	8	..	28	4.8	5.5
Bangladesh	13	10.2	−165	−1.3	109	21	295	23	5,000	24	1.0	0.8
Belarus	94	45.3	−2,562	−3.2	..	5	221	3	..	1	8.6	4.1
Belgium	7	22.2	13	0.2	58	11	180	2	1,550	2	0.8	..
Benin	27	24.0	699	2.3	188	7	307	2	2,201	4	7.8	7.1
Bolivia	531	48.9	1,611	0.3	316	23	..	27	17,367	227	156.0	14.4
Bosnia and Herzegovina	23	44.6	0	0.0	..	10	..	3	..	64	0.2	0.4
Botswana	124	21.9	1,184	0.9	164	5	386	7	2,151	7	105.0	18.5
Brazil	5,325	63.0	22,264	0.4	394	79	1,492	113	56,215	1,358	355.5	4.2
Bulgaria	37	33.4	−204	−0.6	81	15	240	10	3,572	106	4.9	4.4
Burkina Faso	71	25.9	152	0.2	147	7	335	2	..	..	28.6	10.5
Burundi	1	3.7	147	9.0	107	5	451	7	..	..	1.4	5.5
Cambodia	93	52.9	561	0.6	123	21	307	19	..	5	28.6	16.2
Cameroon	239	51.3	2,218	0.9	297	37	690	15	8,260	89	21.0	4.5
Canada	2,446	26.5	0	0.0	193	14	426	8	3,270	278	921.0	10.0
Central African Republic	229	36.8	300	0.1	209	12	537	3	3,602	1	51.1	8.2
Chad	127	10.1	817	0.6	134	17	370	5	1,600	12	114.9	9.1
Chile	155	20.7	203	0.1	91	21	296	21	5,284	329	141.3	18.9
China	1,635	17.5	−18,063	−1.2	394	76	1,100	73	32,200	312	598.1	6.4
Hong Kong, China	..	..	..	..	24	1	76	11	1,984	9	0.4	40.4
Colombia	496	47.8	1,905	0.4	359	36	1,695	77	51,220	712	93.6	9.0
Congo, Dem. Rep.	1,352	59.6	5,324	0.4	415	40	929	28	11,007	78	101.9	4.5
Congo, Rep.	221	64.6	175	0.1	200	12	449	4	6,000	3	15.4	4.5
Costa Rica	20	38.5	158	0.8	205	14	600	13	12,119	527	7.0	13.7
Côte d'Ivoire	71	22.4	2,649	3.1	230	17	535	12	3,660	94	19.9	6.3
Croatia	18	31.9	−20	−0.1	..	9	224	4	..	6	3.7	6.6
Cuba	23	21.4	−277	−1.3	31	11	137	18	6,522	888	19.1	17.4
Czech Republic	26	34.1	−5	0.0	..	8	199	2	..	81	12.2	15.8
Denmark	5	10.7	−10	−0.2	43	5	196	1	1,450	2	13.7	32.3
Dominican Republic	14	28.4	0	0.0	20	5	136	15	5,657	136	12.2	25.2
Ecuador	106	38.1	1,372	1.2	302	31	1,388	62	19,362	824	119.3	43.1
Egypt, Arab Rep.	1	0.1	−20	−3.4	98	12	153	7	2,076	82	7.9	0.8
El Salvador	1	5.8	72	4.6	135	2	251	0	2,911	42	0.1	0.5
Eritrea	16	15.7	54	0.3	112	12	319	7	..	..	5.0	5.0
Estonia	21	48.7	−125	−0.6	65	5	213	3	..	2	5.1	12.1
Ethiopia	46	4.6	403	0.8	255	34	626	16	6,603	163	55.2	5.5
Finland	219	72.0	−80	0.0	60	6	248	3	1,102	6	18.2	6.0
France	153	27.9	−616	−0.4	93	18	269	5	4,630	195	58.8	10.7
Gabon	218	84.7	101	0.0	190	15	466	6	6,651	91	7.2	2.8
Gambia, The	5	48.1	−45	−1.0	108	3	280	2	974	1	0.2	2.0
Georgia	30	42.9	0	0.0	..	14	..	3	..	29	1.9	2.7
Germany	107	30.7	0	0.0	76	12	239	5	2,682	14	94.2	27.0
Ghana	63	27.8	1,200	1.7	222	13	529	8	3,725	103	11.0	4.8
Greece	36	27.9	−300	−0.9	95	14	251	7	4,992	571	3.1	2.4
Guatemala	29	26.3	537	1.7	250	6	458	6	8,681	355	18.2	16.8
Guinea	69	28.2	347	0.5	190	11	409	10	3,000	39	1.6	0.7
Guinea-Bissau	22	77.8	216	0.9	108	2	243	0	..	..	0.0	0.0
Haiti	1	3.2	70	5.7	3	4	75	14	5,242	100	0.1	0.4
Honduras	54	48.1	590	1.0	173	9	422	5	5,680	96	11.1	9.9

Deforestation and biodiversity | 3.4

	Forest area		Average annual deforestation		Mammals		Birds		Higher plants[a]		Nationally protected areas	
	thousand sq. km 2000	% of total land area 2000	sq. km 1990–2000	Decline in forest area % 1990–2000	Species 1996[b]	Threatened species 2000[b]	Species 1996[b]	Threatened species 2000[b]	Species 1997[b]	Threatened species 1997[b]	thousand sq. km 1999[b]	% of total land area 1999[b]
Hungary	18	19.9	−72	−0.4	72	9	205	8	2,214	30	6.3	6.8
India	641	21.6	−381	−0.1	316	86	923	70	16,000	1,236	142.9	4.8
Indonesia	1,050	58.0	13,124	1.2	436	140	1,519	113	29,375	264	192.3	10.6
Iran, Islamic Rep.	73	4.5	0	0.0	140	23	323	13	8,000	2	83.0	5.1
Iraq	8	1.8	0	0.0	81	10	172	11	..	..	0.0	0.0
Ireland	7	9.6	−170	−3.0	25	5	142	1	950	1	0.6	0.9
Israel	1	6.4	−50	−4.9	92	14	180	12	2,317	32	3.1	15.0
Italy	100	34.0	−295	−0.3	90	14	234	5	5,599	311	21.5	7.3
Jamaica	3	30.0	54	1.5	24	5	113	12	3,308	744	0.0	0.0
Japan	241	64.0	−34	0.0	132	37	250	34	5,565	707	25.5	6.8
Jordan	1	1.0	0	0.0	71	8	141	8	2,100	9	3.0	3.4
Kazakhstan	121	4.5	−2,390	−2.2	..	18	..	15	..	71	73.4	2.7
Kenya	171	30.0	931	0.5	359	51	844	24	6,506	240	35.0	6.1
Korea, Dem. Rep.	82	68.2	0	0.0	..	13	115	19	2,898	4	3.1	2.6
Korea, Rep.	63	63.3	49	0.1	49	13	112	25	2,898	66	6.8	6.9
Kuwait	0	0.3	−2	−5.2	21	1	20	7	..	..	0.3	1.7
Kyrgyz Republic	10	5.2	−228	−2.6	..	7	..	4	..	34	6.9	3.6
Lao PDR	126	54.4	527	0.4	172	27	487	19	..	2	0.0	0.0
Latvia	29	47.1	−127	−0.4	83	5	217	3	..	..	7.8	12.6
Lebanon	0	3.5	1	0.3	54	6	154	7	3,000	5	0.0	0.0
Lesotho	0	0.5	0	0.0	33	3	58	7	1,591	21	0.1	0.3
Libya	4	0.2	−47	−1.4	76	9	91	1	1,825	57	1.7	0.1
Lithuania	20	30.8	−48	−0.2	68	5	202	4	..	1	6.5	10.0
Macedonia, FYR	9	35.6	0	0.0	..	11	..	3	..	..	1.8	7.1
Madagascar	117	20.2	1,174	0.9	148	50	256	27	9,505	306	18.2	3.1
Malawi	26	27.6	707	2.4	195	8	521	11	3,765	61	10.6	11.3
Malaysia	193	58.7	2,377	1.2	286	47	501	37	15,500	490	14.8	4.5
Mali	132	10.8	993	0.7	137	13	397	4	1,741	15	45.3	3.7
Mauritania	3	0.3	98	2.7	61	10	273	2	1,100	3	17.5	1.7
Mauritius	0	7.9	1	0.6	4	4	27	9	750	294	0.1	4.9
Mexico	552	28.9	6,306	1.1	450	69	769	39	26,071	1,593	71.0	3.7
Moldova	3	9.9	−7	−0.2	68	3	177	5	..	5	0.4	1.2
Mongolia	106	6.8	600	0.5	134	12	390	16	2,272	0	161.3	10.3
Morocco	30	6.8	12	0.0	105	16	210	9	3,675	186	3.2	0.7
Mozambique	306	39.0	637	0.2	179	15	498	16	5,692	89	47.8	6.1
Myanmar	344	52.3	5,169	1.4	251	36	867	35	7,000	32	1.7	0.3
Namibia	80	9.8	734	0.9	154	14	469	11	3,174	75	106.2	12.9
Nepal	39	27.3	783	1.8	167	27	611	26	6,973	20	11.1	7.8
Netherlands	4	11.1	−10	−0.3	55	11	191	4	1,221	1	2.4	7.1
New Zealand	79	29.7	−390	−0.5	10	8	150	62	2,382	211	63.3	23.6
Nicaragua	33	27.0	1,172	3.0	200	6	482	5	7,590	98	9.0	7.4
Niger	13	1.0	617	3.7	131	11	299	3	1,170	..	96.9	7.6
Nigeria	135	14.8	3,984	2.6	274	25	681	9	4,715	37	30.2	3.3
Norway	89	28.9	−310	−0.4	54	10	243	2	1,715	12	93.7	30.5
Oman	0	0.0	0	0.0	56	9	107	10	1,204	30	34.3	16.1
Pakistan	25	3.2	304	1.1	151	18	375	17	4,950	14	37.2	4.8
Panama	29	38.6	519	1.6	218	20	732	16	9,915	1,302	14.2	19.1
Papua New Guinea	306	67.6	1,129	0.4	214	58	644	32	11,544	92	0.1	0.0
Paraguay	234	58.8	1,230	0.5	305	9	556	26	7,851	129	14.0	3.5
Peru	652	50.9	2,688	0.4	344	47	1,538	73	18,245	906	34.6	2.7
Philippines	58	19.4	887	1.4	153	50	395	67	8,931	360	14.5	4.9
Poland	93	30.6	−110	−0.1	84	15	227	4	2,450	27	29.1	9.6
Portugal	37	40.1	−570	−1.7	63	17	207	7	5,050	269	5.9	6.4
Puerto Rico	2	25.8	5	0.2	16	2	105	8	2,493	223	0.1	1.1
Romania	64	28.0	−147	−0.2	84	17	247	8	3,400	99	10.7	4.6
Russian Federation	8,514	50.4	−1,353	0.0	269	42	628	38	..	214	516.7	3.1

	Forest area		Average annual deforestation		Mammals		Birds		Higher plants[a]		Nationally protected areas	
	thousand sq. km 2000	% of total land area 2000	sq. km 1990–2000	Decline in forest area % 1990–2000	Species 1996[b]	Threatened species 2000[b]	Species 1996[b]	Threatened species 2000[b]	Species 1997[b]	Threatened species 1997[b]	thousand sq. km 1999[b]	% of total land area 1999[b]
Rwanda	3	12.4	150	3.9	151	8	513	9	..	..	3.6	14.6
Saudi Arabia	15	0.7	0	0.0	77	7	155	15	2,028	7	49.6	2.3
Senegal	62	32.2	450	0.7	155	11	384	4	2,086	31	21.8	11.3
Sierra Leone	11	14.7	361	2.9	147	11	466	10	2,090	29	0.8	1.1
Singapore	0	3.3	0	0.0	45	3	118	7	2,168	29	0.0	0.0
Slovak Republic	20	42.5	–69	–0.3	..	9	209	4	..	65	10.5	21.8
Slovenia	11	55.0	–22	–0.2	69	9	207	1	..	13	1.1	5.5
South Africa	89	7.3	80	0.1	247	41	596	28	23,420	2,215	65.8	5.4
Spain	144	28.8	–860	–0.6	82	24	278	7	5,050	985	42.2	8.4
Sri Lanka	19	30.0	348	1.6	88	20	250	14	3,314	455	8.6	13.3
Sudan	616	25.9	9,589	1.4	267	24	680	6	3,137	10	86.4	3.6
Sweden	271	65.9	–6	0.0	60	8	249	2	1,750	13	36.2	8.8
Switzerland	12	30.3	–43	–0.4	75	6	193	2	3,030	30	7.1	18.0
Syrian Arab Republic	5	2.5	0	0.0	63	4	204	8	3,000	8	0.0	0.0
Tajikistan	4	2.8	–20	–0.5	..	9	..	7	..	50	5.9	4.2
Tanzania	388	43.9	913	0.2	316	43	822	33	10,008	436	138.2	15.6
Thailand	148	28.9	1,124	0.7	265	34	616	37	11,625	385	70.7	13.8
Togo	5	9.4	209	3.4	196	9	391	0	2,201	4	4.3	7.9
Trinidad and Tobago	3	50.5	22	0.8	100	1	260	1	2,259	21	0.2	3.9
Tunisia	5	3.3	–11	–0.2	78	11	173	5	2,196	24	0.4	0.3
Turkey	102	13.3	–220	–0.2	116	17	302	11	8,650	1,876	10.7	1.4
Turkmenistan	38	8.0	0	0.0	..	13	..	6	..	17	19.8	4.2
Uganda	42	21.0	913	2.0	338	19	830	13	5,406	15	19.1	9.6
Ukraine	96	16.5	–310	–0.3	..	17	263	8	..	52	9.0	1.6
United Arab Emirates	3	3.8	–78	–2.8	25	3	67	8	..	..	0.0	0.0
United Kingdom	26	10.7	–200	–0.8	50	12	230	2	1,623	18	50.6	20.9
United States	2,260	24.7	–3,880	–0.2	428	37	650	55	19,473	4,669	1,226.7	13.4
Uruguay	13	7.4	–501	–5.0	81	6	237	11	2,278	15	0.5	0.3
Uzbekistan	20	4.8	–46	–0.2	..	11	..	9	..	41	8.2	2.0
Venezuela, RB	495	56.1	2,175	0.4	305	25	1,181	24	21,073	426	319.8	36.3
Vietnam	98	30.2	–516	–0.5	213	37	535	35	10,500	341	9.9	3.0
West Bank and Gaza	..	..	..	..	..	1	..	1	..	..	..	..
Yemen, Rep.	4	0.9	92	1.8	66	4	143	12	..	..	0.0	0.0
Yugoslavia, FR (Serb./Mont.)	29	..	14	0.0	..	11	..	5	5,351	155	3.3	..
Zambia	312	42.0	8,509	2.4	229	12	605	11	4,747	12	63.6	8.6
Zimbabwe	190	49.2	3,199	1.5	270	12	532	10	4,440	100	30.7	7.9
World	**38,609 s**	**29.7 w**	**90,399 s**	**0.2 w**							**8,546.8 s**	**6.6 w**
Low income	8,840	26.8	71,466	0.8							1,852.4	5.6
Middle income	21,791	32.9	26,930	0.1							3,400.2	5.1
Lower middle income	13,966	31.7	–10,268	–0.1							2,098.8	4.8
Upper middle income	7,825	35.2	37,198	0.5							1,301.4	5.9
Low & middle income	30,630	30.9	98,396	0.3							5,252.6	5.3
East Asia & Pacific	4,341	27.2	7,048	0.2							1,102.2	6.9
Europe & Central Asia	9,464	39.7	–8,143	–0.1							771.3	3.2
Latin America & Carib.	9,440	47.1	45,878	0.5							1,456.3	7.3
Middle East & N. Africa	168	1.5	–239	–0.1							242.1	2.2
South Asia	782	16.3	889	0.1							213.0	4.5
Sub-Saharan Africa	6,436	27.3	52,963	0.8							1,467.7	6.2
High income	7,979	26.1	–7,997	–0.1							3,294.2	10.8
Europe EMU	898	37.4	–2,675	–0.3							270.2	11.4

a. Flowering plants only. b. Data may refer to earlier years. They are the most recent reported by the World Conservation Monitoring Centre in 2000.

Deforestation and biodiversity | 3.4

About the data

The estimates of forest area are from the Food and Agriculture Organization's (FAO) *State of the World's Forests 2001,* which provides information on forest cover as of 2000 and a revised estimate of forest cover in 1990. The current survey is the latest global forest assessment and the first to use a uniform global definition of forest. According to this assessment, the global rate of net deforestation has slowed to 9 million hectares a year, a rate 20 percent lower than that previously reported.

No breakdown of forest cover between natural forest and plantation is shown in the table because of space limitations. (This breakdown is provided by the FAO only for developing countries.) For this reason the deforestation data in the table may underestimate the rate at which natural forest is disappearing in some countries.

Deforestation is a major cause of loss of biodiversity, and habitat conservation is vital for stemming this loss. Conservation efforts traditionally have focused on protected areas, which have grown substantially in recent decades. Measures of species richness are one of the most straightforward ways to indicate the importance of an area for biodiversity. The number of small plants and animals is usually estimated by sampling of plots. It is also important to know which aspects are under the most immediate threat. This, however, requires a large amount of data and time-consuming analysis. For this reason global analyses of the status of threatened species have been carried out for few groups of organisms. Only for birds has the status of all species been assessed. An estimated 45 percent of mammal species remain to be assessed. For plants the World Conservation Union's (IUCN) *1997 IUCN Red List of Threatened Plants* provides the first-ever comprehensive listing of threatened species on a global scale, the result of more than 20 years' work by botanists from around the world. Nearly 34,000 plant species, 12.5 percent of the total, are threatened with extinction.

The table shows information on protected areas, numbers of certain species, and numbers of those species under threat. The World Conservation Monitoring Centre (WCMC) compiles these data from a variety of sources. Because of differences in definitions and reporting practices, cross-country comparability is limited. Compounding these problems, available data cover different periods.

Nationally protected areas are areas of at least 1,000 hectares that fall into one of five management categories defined by the WCMC:
- Scientific reserves and strict nature reserves with limited public access.
- National parks of national or international significance (not materially affected by human activity).
- Natural monuments and natural landscapes with unique aspects.
- Managed nature reserves and wildlife sanctuaries.
- Protected landscapes and seascapes (which may include cultural landscapes).

Designating land as a protected area does not necessarily mean that protection is in force, however. For small countries that may only have protected areas smaller than 1,000 hectares, this size limit in the definition will result in an underestimate of the extent and number of protected areas.

Threatened species are defined according to the IUCN's classification categories: endangered (in danger of extinction and unlikely to survive if causal factors continue operating), vulnerable (likely to move into the endangered category in the near future if causal factors continue operating), rare (not endangered or vulnerable, but at risk), indeterminate (known to be endangered, vulnerable, or rare but not enough information is available to say which), out of danger (formerly included in one of the above categories but now considered relatively secure because appropriate conservation measures are in effect), and insufficiently known (suspected but not definitely known to belong to one of the above categories).

Figures on species are not necessarily comparable across countries because taxonomic concepts and coverage vary. And while the number of birds and mammals is fairly well known, it is difficult to make an accurate count of plants. Although the data in the table should be interpreted with caution, especially for numbers of threatened species (where our knowledge is very incomplete), they do identify countries that are major sources of global biodiversity and show national commitments to habitat protection.

Definitions

- **Forest area** is land under natural or planted stands of trees, whether productive or not. • **Average annual deforestation** refers to the permanent conversion of natural forest area to other uses, including shifting cultivation, permanent agriculture, ranching, settlements, and infrastructure development. Deforested areas do not include areas logged but intended for regeneration or areas degraded by fuelwood gathering, acid precipitation, or forest fires. Negative numbers indicate an increase in forest area. • **Mammals** exclude whales and porpoises. • **Birds** are listed for countries included within their breeding or wintering ranges. • **Higher plants** refer to native vascular plant species. • **Threatened species** are the number of species classified by the IUCN as endangered, vulnerable, rare, indeterminate, out of danger, or insufficiently known. • **Nationally protected areas** are totally or partially protected areas of at least 1,000 hectares that are designated as national parks, natural monuments, nature reserves or wildlife sanctuaries, protected landscapes and seascapes, or scientific reserves with limited public access. The data do not include sites protected under local or provincial law. Total land area is used to calculate the percentage of total area protected (see table 3.1).

Data sources

The forestry data are from the FAO's *State of the World's Forests 2001.* The data on species are from the WCMC's *Biodiversity Data Sourcebook* (1994) and the IUCN's *2000 IUCN Red List of Threatened Animals* and *1997 IUCN Red List of Threatened Plants.* The data on protected areas are from the WCMC's Protected Areas Data Unit.

	Freshwater resources			Annual freshwater withdrawals					Access to an improved water source			
	Internal flows billion cu. m 1999	Flows from other countries billion cu. m 1999	Total resources per capita cu. m[a] 1999	billion cu. m[b]	% of total renewable resources[a,b]	% for agriculture[c]	% for industry[c]	% for domestic[c]	Urban % of population 1990	Urban % of population 2000	Rural % of population 1990	Rural % of population 2000
Albania	27	15.7	12,621	1.4	3.3	71	0	29	..	..	..	..
Algeria	14	0.4	477	4.5	31.5	60 [d]	15 [d]	25 [d]	..	98	..	88
Angola	184	..	14,890	0.5	0.3	76 [d]	10 [d]	14 [d]	..	34	..	40
Argentina	360	..	9,841	28.6	7.9	75	9	16	..	85	..	30
Armenia	9	1.5	2,783	2.9	27.6	66	4	30	..	..	..	..
Australia	352	0.0	18,559	15.1	4.3	70	6	12	100	100	100	100
Austria	55	29.0	10,381	2.2	2.7	9	60	31	100	100	100	100
Azerbaijan	8	22.2	3,796	16.5	54.6	70	25	5	..	..	..	..
Bangladesh	105	1,105.6	9,482	14.6	1.2	86	2	12	98	99	89	97
Belarus	37	20.8	5,781	2.7	4.7	35	43	22	..	100	..	100
Belgium	..	..	..	..	..	..	..	..	..	..	..	..
Benin	10	15.5	4,220	0.2	0.6	67 [d]	10 [d]	23 [d]	..	74	..	55
Bolivia	316	..	38,830	1.4	0.4	48	20	32	92	93	52	55
Bosnia and Herzegovina	36	2.0	9,662	..	..	..	..	..	..	..	..	..
Botswana	3	11.8	9,256	0.1	0.7	48 [d]	20 [d]	32 [d]	100	100	91	..
Brazil	5,418	..	32,256	54.9	1.0	61	18	21	93	95	50	54
Bulgaria	18	..	2,193	..	..	..	..	..	..	100	..	100
Burkina Faso	18	..	1,592	0.4	2.2	81 [d]	0 [d]	19 [d]	74	84	50	..
Burundi	4	..	539	0.1	2.8	64 [d]	0 [d]	36 [d]	94	96	63	..
Cambodia	121	355.6	40,505	0.5	0.1	94	1	5	..	53	..	25
Cameroon	268	0.0	18,243	0.4	0.1	35 [d]	19 [d]	46 [d]	76	82	36	42
Canada	2,740	52.0	91,567	45.1	1.6	9	80	11	100	100	99	99
Central African Republic	141	..	39,833	0.1	0.0	73 [d]	6 [d]	21 [d]	80	80	46	46
Chad	15	28.0	5,744	0.2	0.4	82 [d]	2 [d]	16 [d]	..	31	..	26
Chile	928	..	61,793	21.4	2.3	84	11	5	98	99	48	66
China	2,812	17.2	2,257	525.5	18.6	77	18	5	99	94	60	66
Hong Kong, China	..	..	..	..	..	..	..	..	..	..	..	..
Colombia	2,133	..	51,349	8.9	0.4	37	4	59	95	98	68	73
Congo, Dem. Rep.	935	84.0	20,472	0.4	0.0	23 [d]	16 [d]	61 [d]	..	89	..	26
Congo, Rep.	222	610.0	291,000	0.0	0.0	11 [d]	27 [d]	62 [d]	..	71	..	17
Costa Rica	112	..	31,318	5.8	5.1	80	7	13	..	98	..	98
Côte d'Ivoire	77	1.0	4,998	0.7	0.9	67 [d]	11 [d]	22 [d]	89	90	49	65
Croatia	38	33.7	15,995	0.1	0.1	..	50	50	..	..	..	..
Cuba	38	..	3,400	5.2	13.7	51	0	49	..	99	..	82
Czech Republic	15	1.0	1,557	2.5	15.8	1	57	39	..	..	..	..
Denmark	6	..	1,127	0.9	14.8	16	9	53	..	100	..	100
Dominican Republic	21	..	2,499	8.3	39.7	89	1	11	83	83	70	70
Ecuador	442	..	35,611	17.0	3.8	82	6	12	..	81	..	51
Egypt, Arab Rep.	2	56.0	930	55.1	94.5	86 [d]	8 [d]	6 [d]	97	96	91	94
El Salvador	18	..	2,876	0.7	4.1	46	20	34	..	88	47	61
Eritrea	3	6.0	2,205	..	..	..	..	..	..	63	..	42
Estonia	13	0.1	8,874	0.2	1.3	5	39	56	..	..	..	..
Ethiopia	110	0.0	1,752	2.2	2.0	86 [d]	3 [d]	11 [d]	77	77	13	13
Finland	107	3.0	21,293	2.4	2.2	0	82	17	100	100	100	100
France	180	11.0	3,258	40.6	21.3	12	73	15	..	..	..	..
Gabon	164	0.0	135,716	0.1	0.0	6 [d]	22 [d]	72 [d]	..	73	..	55
Gambia, The	3	5.0	6,395	0.0	0.4	91 [d]	2 [d]	7 [d]	..	80	..	53
Georgia	58	5.2	11,610	3.5	5.5	59	20	21	..	..	..	..
Germany	107	71.0	2,168	46.3	26.0	0	86	14	..	..	..	..
Ghana	30	22.9	2,832	0.3	0.6	52 [d]	13 [d]	35 [d]	83	87	43	49
Greece	54	15.0	6,548	7.0	10.2	81	3	16	..	..	..	..
Guatemala	134	..	12,121	1.2	0.9	74	17	9	88	97	72	88
Guinea	226	0.0	31,170	0.7	0.3	87 [d]	3 [d]	10 [d]	72	72	36	36
Guinea-Bissau	16	11.0	22,791	0.0	0.1	36 [d]	4 [d]	60 [d]	..	29	..	55
Haiti	12	..	1,551	1.0	8.1	94	1	5	55	49	42	45
Honduras	96	..	15,211	1.5	1.6	91	5	4	90	97	79	82

Freshwater | 3.5

	Freshwater resources			Annual freshwater withdrawals					Access to an improved water source			
	Internal flows billion cu. m 1999	Flows from other countries billion cu. m 1999	Total resources per capita cu. mᵃ 1999	billion cu. mᵇ	% of total renewable resourcesᵃ,ᵇ	% for agricultureᶜ	% for industryᶜ	% for domesticᶜ	Urban % of population 1990	2000	Rural % of population 1990	2000
Hungary	6	114.0	11,919	6.3	5.2	5	70	14	100	100	98	98
India	1,261	647.2	1,913	500.0	26.2	92	3	5	92	92	73	86
Indonesia	2,838	..	13,709	74.3	2.6	93	1	6	90	91	60	65
Iran, Islamic Rep.	129	..	2,040	70.0	54.5	92	2	6	95	99	75	89
Iraq	35	..	1,544	42.8	121.6	92	5	3	..	96	..	48
Ireland	49	3.0	13,859	1.2	2.3	15	21	40	..	..	..	..
Israel	1	0.3	180	1.7	155.5	64 ᵈ	7 ᵈ	29 ᵈ	..	..	..	..
Italy	161	6.8	2,906	57.5	34.4	45	37	18	..	..	..	..
Jamaica	9	..	3,618	0.9	9.6	77	7	15	..	81	..	59
Japan	430	0.0	3,397	91.4	21.3	64	17	19	..	..	..	..
Jordan	1	..	148	1.0	140.0	75	3	22	99	100	92	84
Kazakhstan	75	34.2	7,342	33.7	30.7	81	17	2	..	98	..	82
Kenya	20	10.0	1,027	2.0	6.8	76 ᵈ	4 ᵈ	20 ᵈ	89	87	25	31
Korea, Dem. Rep.	67	10.1	3,293	14.2	18.4	73	16	11	..	100	..	100
Korea, Rep.	65	4.9	1,490	23.7	33.9	63	11	26	..	97	..	71
Kuwait	0	0.0	0	0.5	..	60	2	37	..	..	..	..
Kyrgyz Republic	47	..	9,559	10.1	21.7	94	3	3	..	98	..	66
Lao PDR	190	91.2	55,251	1.0	0.4	82	10	8	..	59	..	100
Latvia	17	18.7	14,561	0.3	0.8	13	32	55	..	..	..	..
Lebanon	5	0.0	1,124	1.3	26.9	68	4	28	..	100	..	100
Lesotho	5	0.0	2,470	0.1	1.0	56 ᵈ	22 ᵈ	22 ᵈ	..	98	..	88
Libya	1	0.0	148	3.9	486.3	87 ᵈ	4 ᵈ	9 ᵈ	72	72	68	68
Lithuania	16	9.3	6,732	0.3	1.0	3	16	81	..	..	..	..
Macedonia, FYR	6	1.0	3,464	..	..	..	..	..	..	..	..	..
Madagascar	337	0.0	22,391	19.7	5.8	99 ᵈ	0 ᵈ	1 ᵈ	85	85	31	31
Malawi	18	1.1	1,724	0.9	5.1	86 ᵈ	3 ᵈ	10 ᵈ	90	95	43	44
Malaysia	580	..	25,539	12.7	2.2	76	13	11	..	..	..	94
Mali	60	40.0	9,449	1.4	1.4	97 ᵈ	1 ᵈ	2 ᵈ	65	74	52	61
Mauritania	0	11.0	4,387	16.3	143.0	92	2	6	34	34	40	40
Mauritius	2	0.0	1,873	0.4	16.4	77 ᵈ	7 ᵈ	16 ᵈ	100	100	100	100
Mexico	409	49.0	4,742	77.8	17.0	78	5	17	92	94	61	63
Moldova	1	10.7	2,733	3.0	25.3	26	65	9	..	100	..	100
Mongolia	35	..	14,632	0.4	1.2	53	27	20	..	77	..	30
Morocco	30	0.0	1,062	11.1	36.8	92 ᵈ	3 ᵈ	5 ᵈ	94	100	58	58
Mozambique	100	116.0	12,486	0.6	0.3	89	2 ᵈ	9 ᵈ	..	86	..	43
Myanmar	881	128.2	22,404	4.0	0.4	90	3	7	88	88	56	60
Namibia	6	39.3	26,744	0.3	0.5	68 ᵈ	3 ᵈ	29 ᵈ	98	100	63	67
Nepal	198	12.0	8,989	29.0	13.8	99	0	1	96	85	63	80
Netherlands	11	80.0	5,758	7.8	8.6	0	68	16	100	100	100	100
New Zealand	327	..	85,811	2.0	0.6	55	13	9	100	100	..	..
Nicaragua	190	..	38,668	1.3	0.7	84	2	14	93	95	44	59
Niger	4	29.0	3,097	0.5	1.5	82 ᵈ	2 ᵈ	16 ᵈ	65	70	51	56
Nigeria	221	59.0	2,260	4.0	1.4	54 ᵈ	15 ᵈ	31 ᵈ	78	81	33	39
Norway	382	11.0	88,117	2.0	0.5	3	68	27	100	100	100	100
Oman	1	..	426	1.2	120.0	94	2	5	41	41	30	30
Pakistan	85	170.3	1,892	155.6	61.0	97	2	2	96	96	79	84
Panama	147	..	52,437	1.6	1.1	70	2	28	..	88	..	86
Papua New Guinea	801	..	170,258	0.1	0.0	49	22	29	88	88	32	32
Paraguay	94	..	17,541	0.4	0.5	78	7	15	80	95	47	58
Peru	1,746	..	69,203	19.0	1.1	86	7	7	84	87	47	51
Philippines	479	..	6,450	55.4	11.6	88	4	8	94	92	81	80
Poland	55	8.0	1,630	12.1	19.2	3	67	20	..	..	..	..
Portugal	37	35.0	7,208	7.3	10.1	53	40	8	..	..	..	..
Puerto Rico	..	..	..	..	..	..	..	..	..	..	..	..
Romania	37	..	1,648	..	..	..	..	..	..	91	..	16
Russian Federation	4,314	184.5	30,767	77.1	1.7	20	62	19	..	100	..	96

	Freshwater resources			Annual freshwater withdrawals					Access to an improved water source			
	Internal flows billion cu. m **1999**	Flows from other countries billion cu. m **1999**	Total resources per capita cu. m[a] **1999**	billion cu. m[b]	% of total renewable resources[a,b]	% for agriculture[c]	% for industry[c]	% for domestic[c]	Urban % of population **1990**	**2000**	Rural % of population **1990**	**2000**
Rwanda	6	..	758	0.8	12.2	94 [d]	1 [d]	5 [d]	..	60	..	40
Saudi Arabia	2	0.0	119	17.0	708.3	90	1	9	..	100	..	64
Senegal	26	13.0	4,243	1.5	3.8	92 [d]	3 [d]	5 [d]	90	92	60	65
Sierra Leone	160	0.0	32,328	0.4	0.2	89 [d]	4 [d]	7 [d]	..	23	..	31
Singapore	..	..	..	..	..	..	..	..	100	100	..	..
Slovak Republic	13	70.0	15,382	1.4	1.7	8	50	39	..	100	..	100
Slovenia	19	0.0	9,318	0.5	2.7	..	50	50	100	100	100	100
South Africa	45	5.2	1,187	13.3	26.6	72 [d]	11 [d]	17 [d]	..	92	..	80
Spain	112	0.3	2,844	35.5	31.7	68	18	13	..	..	..	..
Sri Lanka	50	..	2,634	9.8	19.5	96	2	2	90	91	59	80
Sudan	35	119.0	5,312	17.8	11.6	94 [d]	1 [d]	5 [d]	86	86	60	69
Sweden	178	0.0	20,096	2.7	1.5	4	30	35	100	100	100	100
Switzerland	40	13.0	7,427	2.6	4.9	0	58	42	100	100	100	100
Syrian Arab Republic	7	37.7	2,845	14.4	32.2	94	2	4	..	94	..	64
Tajikistan	66	13.3	12,763	11.9	14.9	92	4	4	..	..	..	..
Tanzania	80	9.0	2,703	1.2	1.3	89 [d]	2 [d]	9 [d]	80	80	42	42
Thailand	210	199.9	6,804	33.1	8.1	91	4	5	83	89	68	77
Togo	12	0.5	2,628	0.1	0.8	25 [d]	13 [d]	62 [d]	82	85	38	38
Trinidad and Tobago	..	..	..	..	..	..	..	..	..	..	..	..
Tunisia	4	0.6	434	2.8	69.0	86 [d]	2 [d]	13 [d]	94	..	61	..
Turkey	196	7.6	3,162	35.5	17.4	73 [d]	11 [d]	16 [d]	82	82	76	84
Turkmenistan	1	44.1	9,520	23.8	52.3	98	1	1	..	..	..	..
Uganda	39	27.0	3,073	0.2	0.3	60	8	32	80	72	40	46
Ukraine	53	86.5	2,795	26.0	18.6	30	52	18	..	..	..	..
United Arab Emirates	0	0.0	71	2.1	1,055.0	67	9	24	..	..	..	..
United Kingdom	145	2.0	2,471	9.3	6.4	2	8	65	100	100	100	100
United States	2,460	18.0	8,906	447.7	18.1	27 [d]	65 [d]	8 [d]	100	100	100	100
Uruguay	59	..	17,809	4.2	7.1	91	3	6	..	98	..	93
Uzbekistan	16	..	668	58.0	356.1	94	2	4	..	96	..	78
Venezuela, RB	846	..	35,686	4.1	0.5	46	10	44	..	88	..	58
Vietnam	367	524.7	11,497	54.3	6.1	86	10	4	81	81	40	50
West Bank and Gaza	..	..	..	..	..	..	..	..	..	..	..	..
Yemen, Rep.	4	..	241	2.9	71.5	92	1	7	85	85	60	64
Yugoslavia, FR (Serb./Mont.)	44	144.0	17,709	..	..	..	..	..	..	..	..	..
Zambia	80	35.8	11,739	1.7	1.5	77 [d]	7 [d]	16 [d]	88	88	28	48
Zimbabwe	14	5.9	1,680	1.2	6.1	79 [d]	7 [d]	14 [d]	99	100	68	77
World	**42,809 s**	**5,979.4 s**	**8,241 w**	..	..	**70 w**	**22 w**	**8 w**	**94 w**	**93 w**	**64 w**	**71 w**
Low income	10,450	4,539.8	6,205	..	..	87	8	5	89	89	64	71
Middle income	24,227	1,088.5	9,537	..	..	74	13	12	95	93	62	68
Lower middle income	15,052	790.8	7,585	..	..	75	15	10	96	93	62	68
Upper middle income	9,175	297.7	16,744	..	..	73	10	17	..	94	..	68
Low & middle income	34,677	5,628.3	7,949	..	..	82	10	7	93	92	63	70
East Asia & Pacific	9,445	1,331.8	..	..	..	80	14	6	96	93	60	67
Europe & Central Asia	5,221	848.1	12,797	..	..	63	26	11	..	..	..	..
Latin America & Carib.	13,987	49.0	27,919	..	..	74	9	18	92	93	56	62
Middle East & N. Africa	235	94.7	1,145	..	..	89	4	6	93	96	76	80
South Asia	1,849	1,945.1	2,854	..	..	93	2	4	93	92	75	85
Sub-Saharan Africa	3,941	1,359.6	8,257	..	..	87	4	9	81	82	37	41
High income	8,132	351.1	..	..	..	30	59	11	..	..	..	..
Europe EMU	819	239.8	3,769	..	..	21	63	16	..	..	..	..

a. River flows from other countries are included when available, but river outflows are not, because of data unreliability. b. Data refer to any year from 1980 to 1999. c. Unless otherwise noted, sectoral withdrawal shares are estimated for 1987. d. Data refer to a year other than 1987 (see *Primary data documentation*).

Freshwater | 3.5

About the data

The data on freshwater resources are based on estimates of runoff into rivers and recharge of groundwater. These estimates are based on different sources and refer to different years, so cross-country comparisons should be made with caution. Because the data are collected intermittently, they may hide significant variations in total renewable water resources from one year to the next. The data also fail to distinguish between seasonal and geographic variations in water availability within countries. Data for small countries and countries in arid and semiarid zones are less reliable than those for larger countries and countries with greater rainfall. Finally, caution is also needed in comparing data on annual freshwater withdrawals, which are subject to variations in collection and estimation methods.

Figure 3.5a

Most people without access to an improved water source live in Asia

Rural population without access, 2000
Total: 926 million

2.5%
5.3%
27.6%
64.6%

Urban population without access, 2000
Total: 173 million

1.7%
16.8%
25.3%
56.3%

- ● Africa
- ● Asia
- ● Latin America & Caribbean
- ○ Europe

Source: World Health Organization data.

This year's table shows both internal freshwater resources and the river flows arising outside countries. Because the data on total freshwater resources include river flows entering a country while river flows out of the country are not deducted (because of data unreliability), they overestimate the availability of water from international river ways. This can be important in water-short countries, notably in the Middle East.

The data on access to an improved water source measure the share of the population with reasonable and ready access to an adequate amount of safe water for domestic purposes. An improved source can be any form of collection or piping used to make water regularly available. While information on access to an improved water source is widely used, it is extremely subjective, and such terms as *safe, improved, adequate,* and *reasonable* may have very different meanings in different countries despite official World Health Organization definitions (see *Definitions*). Even in high-income countries treated water may not always be safe to drink. While access to safe water is equated with connection to a public supply system, this does not take account of variations in the quality and cost (broadly defined) of the service once connected. Thus cross-country comparisons must be made cautiously. Changes over time within countries may result from changes in definitions or measurements.

Figure 3.5b

Agriculture accounts for most freshwater withdrawals in developing countries—industry in high-income countries

Freshwater withdrawals by sector (%)

- ■ Agriculture
- ■ Industry
- □ Domestic

Low income   Middle income   High income

Note: Data are for the most recent year available (see table 3.5).
Source: Table 3.5.

Definitions

- **Freshwater resources** refer to total renewable resources, broken down between internal flows of rivers and groundwater from rainfall in the country, and river flows from other countries. Freshwater resources per capita are calculated using the World Bank's population estimates (see table 2.1). • **Annual freshwater withdrawals** refer to total water withdrawal, not counting evaporation losses from storage basins. Withdrawals also include water from desalination plants in countries where they are a significant source. Withdrawal data are for single years between 1980 and 1999 unless otherwise indicated. Withdrawals can exceed 100 percent of total renewable resources where extraction from nonrenewable aquifers or desalination plants is considerable or where there is significant water reuse. Withdrawals for agriculture and industry are total withdrawals for irrigation and livestock production and for direct industrial use (including withdrawals for cooling thermoelectric plants). Withdrawals for domestic uses include drinking water, municipal use or supply, and use for public services, commercial establishments, and homes. For most countries sectoral withdrawal data are estimated for 1987. • **Access to an improved water source** refers to the percentage of the population with reasonable access to an adequate amount of water from an improved source, such as a household connection, public standpipe, borehole, protected well or spring, or rainwater collection. Unimproved sources include vendors, tanker trucks, and unprotected wells and springs. Reasonable access is defined as the availability of at least 20 liters a person a day from a source within one kilometer of the dwelling.
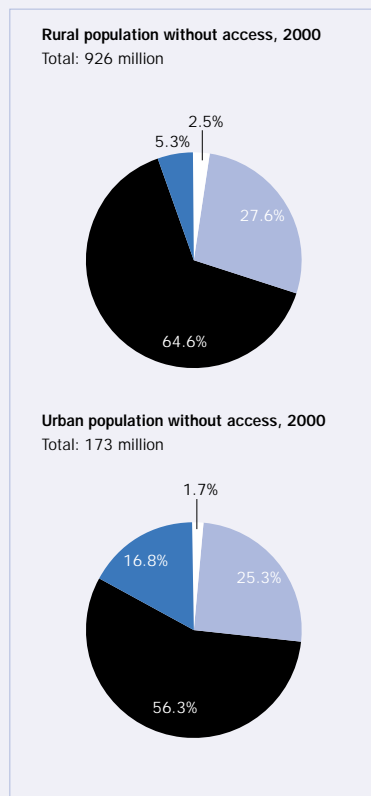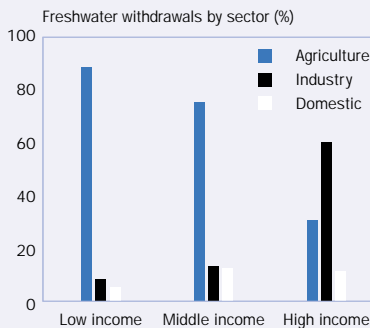
Data sources

The data on freshwater resources and withdrawals are compiled by the World Resources Institute from various sources and published in *World Resources 1998–99* and *World Resources 2000–01* (produced in collaboration with the United Nations Environment Programme, United Nations Development Programme, and World Bank). The data on access to an improved water source come from the World Health Organization.

3.6 | Water pollution

	Emissions of organic water pollutants				Industry shares of emissions of organic water pollutants							
	kilograms per day		kilograms per day per worker		Primary metals %	Paper and pulp %	Chemicals %	Food and beverages %	Stone, ceramics, and glass %	Textiles %	Wood %	Other %
	1980	1998[a]	1980	1998[a]	1998[a]	1998[a]	1998[a]	1998[a]	1998[a]	1998[a]	1998[a]	1998[a]
Albania	..	5,844	..	0.24	22.9	1.5	6.2	62.0	0.4	4.7	0.7	1.5
Algeria	60,290	102,969	0.19	0.25	44.6	..	3.8	40.8	0.4	8.0	2.5	..
Angola	..	1,472	..	0.20	7.6	3.0	9.1	65.9	0.3	5.5	4.4	4.1
Argentina	244,711	186,844	0.18	0.21	6.3	12.6	8.1	59.4	0.2	7.4	1.5	4.6
Armenia	..	12,858	..	0.23	..	..	..	..	..	..	..	..
Australia	204,333	173,269	0.18	0.19	12.4	22.8	6.7	43.5	0.2	5.3	2.8	6.3
Austria	108,416	78,040	0.16	0.14	13.1	19.5	9.1	36.1	0.3	6.7	4.3	10.9
Azerbaijan	..	45,025	..	0.17	11.6	2.5	12.0	49.0	0.2	18.1	1.0	5.6
Bangladesh	66,713	186,852	0.16	0.16	2.8	6.8	3.5	34.2	0.1	50.9	0.6	1.1
Belarus	..	..	..	..	..	..	..	..	..	..	..	..
Belgium	136,452	113,460	0.16	0.16	14.4	17.7	11.6	36.8	0.2	8.8	2.0	8.4
Benin	1,646	..	0.28	..	..	..	..	..	..	..	..	..
Bolivia	9,343	10,251	0.22	0.23	4.7	13.8	6.5	61.8	0.3	9.0	2.6	1.2
Bosnia and Herzegovina	..	8,903	..	0.18	20.5	13.1	6.6	33.3	0.2	17.6	5.8	2.8
Botswana	1,307	4,386	0.24	0.18	0.0	11.5	2.8	67.5	0.0	12.5	2.1	3.7
Brazil	866,790	690,876	0.16	0.19	19.0	12.6	9.3	41.6	0.2	10.9	1.6	4.8
Bulgaria	152,125	103,132	0.13	0.16	3.7	8.5	10.5	49.6	0.1	17.8	2.3	7.5
Burkina Faso	2,385	..	0.29	..	..	..	..	..	..	..	..	..
Burundi	769	1,644	0.22	0.24	0.0	8.3	4.7	67.8	0.1	16.7	1.6	0.8
Cambodia	..	12,078	..	0.16	0.0	3.4	3.3	59.2	0.6	24.7	5.8	3.1
Cameroon	14,569	12,367	0.29	0.23	3.1	5.9	21.9	61.2	0.0	3.2	4.4	0.3
Canada	330,241	298,209	0.18	0.17	9.6	29.6	9.2	34.2	0.1	5.6	3.8	8.0
Central African Republic	861	670	0.26	0.17	..	..	..	..	..	..	..	..
Chad	..	..	..	..	..	..	..	..	..	..	..	..
Chile	44,371	74,810	0.21	0.23	8.4	11.6	8.9	59.7	0.1	5.9	2.7	2.7
China	3,377,105	8,491,856	0.14	0.14	18.8	12.5	13.2	30.1	0.6	15.3	1.1	8.4
Hong Kong, China	102,002	35,961	0.11	0.15	1.4	36.0	4.2	20.6	0.1	29.9	0.2	7.6
Colombia	96,055	111,545	0.19	0.20	3.1	15.6	10.8	51.5	0.2	14.7	1.0	3.1
Congo, Dem. Rep.	..	..	..	..	..	..	..	..	..	..	..	..
Congo, Rep.	1,039	..	0.21	..	..	..	..	..	..	..	..	..
Costa Rica	..	32,658	..	0.21	1.1	10.5	6.6	61.7	0.1	15.8	1.5	2.6
Côte d'Ivoire	15,414	12,401	0.23	0.24	..	5.5	7.1	71.9	0.0	8.6	5.9	1.0
Croatia	..	48,447	..	0.17	7.2	14.4	8.6	45.2	0.2	14.6	3.8	6.0
Cuba	120,703	..	0.24	..	..	..	..	..	..	..	..	..
Czech Republic	..	165,993	..	0.14	16.3	6.4	7.9	43.8	0.3	10.5	3.8	11.0
Denmark	65,465	92,733	0.17	0.18	2.1	29.0	7.7	46.3	0.2	3.6	3.0	8.2
Dominican Republic	54,935	..	0.38	..	..	..	..	..	..	..	..	..
Ecuador	25,297	31,974	0.23	0.26	2.3	11.8	6.9	68.9	0.1	6.6	1.7	1.6
Egypt, Arab Rep.	169,146	225,843	0.19	0.18	13.0	6.5	11.3	46.3	0.3	18.0	0.6	4.1
El Salvador	9,390	21,833	0.24	0.19	1.9	8.9	7.0	47.0	0.1	33.1	0.5	1.5
Eritrea	..	..	..	..	..	..	..	..	..	..	..	..
Estonia	..	..	..	..	..	..	..	..	..	..	..	..
Ethiopia	16,754	..	0.22	..	..	..	..	..	..	..	..	..
Finland	92,275	63,662	0.17	0.19	9.0	41.6	5.6	30.2	0.2	3.0	3.9	6.5
France	729,776	585,382	0.14	0.15	11.6	21.2	10.8	37.7	0.2	6.0	1.8	10.8
Gabon	2,661	1,886	0.15	0.26	0.0	6.0	4.9	79.7	0.1	1.2	6.9	1.2
Gambia, The	549	832	0.30	0.34	0.0	15.3	1.9	77.8	0.1	2.6	1.9	0.4
Georgia	..	..	..	..	..	..	..	..	..	..	..	..
Germany	..	811,316	..	0.12	12.7	16.8	15.5	30.6	0.3	4.8	2.2	17.2
Ghana	15,868	14,449	0.20	0.17	9.8	16.9	10.5	39.5	0.2	9.1	12.4	1.7
Greece	65,304	58,134	0.17	0.20	6.0	12.4	8.8	53.6	0.3	14.1	1.4	3.5
Guatemala	20,856	18,728	0.25	0.28	5.1	7.1	6.1	72.7	0.1	7.1	0.8	1.0
Guinea	..	..	..	..	..	..	..	..	..	..	..	..
Guinea-Bissau	..	..	..	..	..	..	..	..	..	..	..	..
Haiti	4,734	..	0.19	..	..	..	..	..	..	..	..	..
Honduras	13,067	34,036	0.23	0.20	1.1	7.8	3.9	55.5	0.1	26.8	4.0	0.8

Water pollution | 3.6

	Emissions of organic water pollutants				Industry shares of emissions of organic water pollutants							
	kilograms per day		kilograms per day per worker		Primary metals %	Paper and pulp %	Chemicals %	Food and beverages %	Stone, ceramics, and glass %	Textiles %	Wood %	Other %
	1980	1998a	1980	1998a	1998a	1998a	1998a	1998a	1998a	1998a	1998a	1998a
Hungary	201,888	140,894	0.15	0.17	10.0	10.1	8.1	49.9	0.2	12.6	1.9	7.3
India	1,422,564	1,760,353	0.21	0.19	15.0	8.4	8.9	49.1	0.2	12.9	0.3	5.3
Indonesia	214,010	347,083	0.22	0.16	5.3	19.0	10.5	32.7	0.1	23.7	3.0	5.8
Iran, Islamic Rep.	72,334	101,900	0.15	0.17	20.6	8.0	8.0	39.7	0.5	17.3	0.7	5.4
Iraq	32,986	19,617	0.19	0.16	8.8	14.1	15.1	39.4	0.7	16.7	0.3	4.8
Ireland	43,544	34,176	0.19	0.16	1.8	17.3	11.3	51.3	0.2	6.2	2.0	10.0
Israel	39,113	54,149	0.15	0.16	3.7	19.7	9.4	43.9	0.2	12.1	1.8	9.3
Italy	442,712	359,578	0.13	0.13	12.1	16.0	11.8	28.7	0.3	16.1	2.5	12.6
Jamaica	11,123	17,507	0.25	0.29	6.9	7.2	3.8	70.8	0.1	9.8	1.3	..
Japan	1,456,016	1,391,281	0.14	0.14	8.4	22.0	8.8	39.5	0.2	6.4	1.8	12.9
Jordan	4,146	16,142	0.17	0.18	3.9	16.2	14.5	51.4	0.5	7.2	3.3	3.0
Kazakhstan	..	..	..	..	..	..	..	..	..	..	..	..
Kenya	26,834	49,125	0.19	0.24	4.1	12.2	5.9	68.4	0.1	8.8	1.9	..
Korea, Dem. Rep.	..	..	..	..	..	..	..	..	..	..	..	..
Korea, Rep.	281,900	317,903	0.14	0.12	11.9	17.6	11.6	26.4	0.3	15.8	1.5	14.9
Kuwait	6,921	8,303	0.16	0.15	3.2	4.6	13.9	51.3	0.5	16.6	3.7	6.2
Kyrgyz Republic	..	20,700	..	0.16	13.7	0.2	0.9	54.8	0.4	21.0	1.0	8.0
Lao PDR	..	..	..	..	..	..	..	..	..	..	..	..
Latvia	..	27,357	..	0.18	2.8	11.8	4.5	58.2	0.1	11.0	5.9	5.7
Lebanon	14,586	..	0.20	..	..	..	..	..	..	..	..	..
Lesotho	993	3,123	0.24	0.16	1.2	4.0	0.7	39.7	0.1	51.3	0.6	2.3
Libya	3,532	..	0.21	..	..	..	..	..	..	..	..	..
Lithuania	..	38,570	..	0.17	1.6	10.8	5.1	55.5	0.2	17.1	4.4	5.2
Macedonia, FYR	..	23,490	..	0.18	11.7	9.6	6.2	45.0	0.1	20.9	1.7	4.9
Madagascar	9,131	..	0.23	..	..	..	..	..	..	..	..	..
Malawi	12,224	9,055	0.32	0.26	0.0	12.6	5.1	67.7	0.1	11.6	1.7	1.1
Malaysia	77,215	166,577	0.15	0.12	6.7	14.5	16.7	31.8	0.3	8.2	6.7	15.2
Mali	..	..	..	..	..	..	..	..	..	..	..	..
Mauritania	..	..	..	..	..	..	..	..	..	..	..	..
Mauritius	9,224	16,524	0.21	0.16	1.1	5.7	2.3	38.0	0.1	50.8	0.8	1.2
Mexico	130,993	158,505	0.22	0.17	8.2	8.6	14.0	54.8	0.2	5.4	0.4	8.3
Moldova	..	34,234	..	0.29	0.2	4.0	1.4	81.7	0.2	10.8	1.3	0.5
Mongolia	9,254	7,939	0.19	0.18	1.8	4.3	0.9	64.2	0.3	24.6	4.9	..
Morocco	26,598	86,320	0.15	0.18	0.7	7.7	7.1	53.5	0.3	27.3	0.9	2.5
Mozambique	..	495	..	0.16	3.1	..	4.1	..	0.1	..	..	1.2
Myanmar	..	4,479	..	0.09	11.4	6.8	29.6	18.5	1.5	3.9	27.1	1.2
Namibia	..	7,350	..	0.35	0.0	5.0	1.6	90.4	0.1	1.2	0.9	0.8
Nepal	18,692	26,550	0.25	0.14	1.5	8.1	3.9	43.3	1.2	39.3	1.7	1.0
Netherlands	165,416	122,843	0.18	0.18	7.7	26.3	12.2	41.8	0.2	2.5	1.2	8.1
New Zealand	59,012	50,706	0.21	0.22	4.6	19.6	4.9	58.6	0.1	4.9	3.1	4.2
Nicaragua	9,647	..	0.28	..	..	..	..	..	..	..	..	..
Niger	372	..	0.19	..	..	..	..	..	..	..	..	..
Nigeria	72,082	53,646	0.17	0.18	0.9	31.2	6.5	37.4	0.2	10.6	10.4	2.9
Norway	67,897	52,745	0.19	0.21	6.3	35.4	3.4	43.6	0.1	1.8	3.4	6.2
Oman	..	4,602	..	0.17	5.5	14.8	6.5	50.7	0.8	14.5	3.7	3.5
Pakistan	75,125	114,726	0.17	0.18	14.1	5.8	7.3	39.5	0.2	30.1	0.3	2.7
Panama	8,121	11,754	0.26	0.31	1.6	11.1	5.5	75.3	0.2	5.6	0.5	0.3
Papua New Guinea	4,365	..	0.22	..	..	..	..	..	..	..	..	..
Paraguay	..	3,250	..	0.28	2.3	9.9	6.0	73.6	0.3	6.7	0.3	0.9
Peru	50,367	51,828	0.18	0.21	9.6	12.0	8.4	53.0	0.2	12.3	1.6	2.9
Philippines	182,052	178,239	0.19	0.18	5.2	9.8	7.3	54.5	0.2	16.4	2.0	4.6
Poland	580,869	386,376	0.14	0.16	14.9	4.7	6.6	49.7	0.4	13.0	1.9	8.7
Portugal	105,441	137,314	0.15	0.14	3.5	14.2	5.1	38.9	0.4	26.6	4.8	6.4
Puerto Rico	24,034	17,494	0.16	0.16	0.9	10.9	17.7	40.2	0.2	19.6	1.3	9.1
Romania	343,145	333,168	0.12	0.12	17.1	6.7	9.0	34.3	0.3	18.5	4.8	9.4
Russian Federation	..	1,531,501	..	0.16	18.0	6.9	9.5	46.6	0.4	7.5	2.5	8.6

	Emissions of organic water pollutants				Industry shares of emissions of organic water pollutants							
	kilograms per day		kilograms per day per worker		Primary metals %	Paper and pulp %	Chemicals %	Food and beverages %	Stone, ceramics, and glass %	Textiles %	Wood %	Other %
	1980	1998ᵃ	1980	1998ᵃ	1998ᵃ	1998ᵃ	1998ᵃ	1998ᵃ	1998ᵃ	1998ᵃ	1998ᵃ	1998ᵃ
Rwanda	..	..	..	..	..	..	..	..	..	..	..	..
Saudi Arabia	18,181	24,436	0.12	0.14	4.4	15.9	21.1	45.1	1.0	3.8	2.0	6.8
Senegal	9,865	10,488	0.31	0.31	0.0	6.3	8.8	78.8	0.0	4.6	0.1	1.3
Sierra Leone	1,612	4,170	0.24	0.32	..	9.6	3.0	82.3	0.1	2.0	2.2	0.8
Singapore	28,558	33,661	0.10	0.10	2.0	27.9	15.4	19.8	0.2	3.8	1.6	29.3
Slovak Republic	..	61,108	..	0.15	18.3	13.3	9.8	36.8	0.3	9.3	2.8	9.4
Slovenia	..	38,187	..	0.17	28.9	17.4	8.5	24.4	0.2	12.7	2.1	5.9
South Africa	237,599	241,922	0.17	0.17	11.6	16.4	9.1	42.4	0.2	10.5	3.3	6.4
Spain	376,253	348,262	0.16	0.16	6.4	18.7	8.7	45.0	0.3	9.4	3.7	7.8
Sri Lanka	30,086	83,850	0.18	0.17	1.0	6.5	6.0	47.5	0.2	36.6	1.0	1.2
Sudan	..	..	..	..	..	..	..	..	..	..	..	..
Sweden	130,439	91,248	0.15	0.16	10.9	37.7	7.7	27.3	0.1	1.5	3.2	11.6
Switzerland	..	123,752	..	0.17	24.9	23.6	10.4	25.0	0.2	3.2	4.2	8.7
Syrian Arab Republic	36,262	21,421	0.19	0.22	2.9	1.5	8.4	68.3	0.3	17.2	0.3	1.1
Tajikistan	..	..	..	..	..	..	..	..	..	..	..	..
Tanzania	21,084	32,508	0.21	0.26	4.7	10.8	5.0	65.2	0.1	11.8	1.4	1.2
Thailand	213,271	355,819	0.22	0.16	6.1	5.3	5.3	42.2	0.2	35.4	1.5	3.9
Togo	963	..	0.27	..	..	..	..	..	..	..	..	..
Trinidad and Tobago	7,835	11,787	0.18	0.28	4.4	10.9	6.7	72.6	0.1	2.9	1.3	1.2
Tunisia	20,294	45,613	0.16	0.16	5.5	7.2	6.4	41.4	0.3	34.2	1.5	3.4
Turkey	160,173	186,269	0.20	0.16	10.7	7.0	7.6	42.9	0.3	25.5	1.0	5.1
Turkmenistan	..	..	..	..	..	..	..	..	..	..	..	..
Uganda	..	..	..	..	..	..	..	..	..	..	..	..
Ukraine	..	518,996	..	0.17	22.2	3.3	6.9	51.4	0.4	5.9	1.8	8.2
United Arab Emirates	4,524	..	0.15	..	..	..	..	..	..	..	..	..
United Kingdom	964,510	611,743	0.15	0.15	7.6	28.0	11.8	32.7	0.2	6.6	2.4	10.7
United States	2,742,993	2,577,002	0.14	0.15	8.5	32.4	10.2	28.1	0.2	6.3	2.8	11.6
Uruguay	34,270	27,722	0.21	0.25	1.4	11.3	5.9	67.6	0.2	11.1	0.7	1.9
Uzbekistan	..	..	..	..	..	..	..	..	..	..	..	..
Venezuela, RB	84,797	92,026	0.20	0.21	14.1	11.5	9.9	51.8	0.2	7.3	1.7	3.4
Vietnam	..	..	..	..	..	..	..	..	..	..	..	..
West Bank and Gaza	..	..	..	..	..	..	..	..	..	..	..	..
Yemen, Rep.	..	7,823	..	0.25	0.0	9.1	12.9	71.1	0.3	4.9	1.0	0.9
Yugoslavia, FR (Serb./Mont.)	..	119,790	..	0.16	10.1	12.4	7.7	44.0	0.3	15.5	2.1	8.0
Zambia	13,605	11,433	0.23	0.22	3.4	10.8	7.3	63.6	0.2	9.3	2.9	2.4
Zimbabwe	32,681	32,956	0.20	0.20	13.6	11.3	5.6	48.0	0.2	15.2	2.9	3.1

Note: Industry shares may not sum to 100 percent because data may be from different years.
a. Data refer to any year from 1993 to 1998.

Water pollution | 3.6

Emissions of organic pollutants from industrial activities are a major cause of degradation of water quality. Water quality and pollution levels are generally measured in terms of concentration, or load—the rate of occurrence of a substance in an aqueous solution. Polluting substances include organic matter, metals, minerals, sediment, bacteria, and toxic chemicals. This table focuses on organic water pollution resulting from industrial activities. Because water pollution tends to be sensitive to local conditions, the national-level data in the table may not reflect the quality of water in specific locations.

The data in the table come from an international study of industrial emissions that may be the first to include data from developing countries (Hettige, Mani, and Wheeler 1998). Unlike estimates from earlier studies based on engineering or economic models, these estimates are based on actual measurements of plant-level water pollution. The focus is on organic water pollution measured in terms of biochemical oxygen demand (BOD) because the data for this indicator are the most plentiful and the most reliable for cross-country comparisons of emissions. BOD measures the strength of an organic waste in terms of the amount of oxygen consumed in breaking it down. A sewage overload in natural waters exhausts the water's dissolved oxygen content. Wastewater treatment, by contrast, reduces BOD.

Data on water pollution are more readily available than other emissions data because most industrial pollution control programs start by regulating emissions of organic water pollutants. Such data are fairly reliable because sampling techniques for measuring water pollution are more widely understood and much less expensive than those for air pollution.

In their study Hettige, Mani, and Wheeler (1998) used plant- and sector-level information on emissions and employment from 13 national environmental protection agencies and sector-level information on output and employment from the United Nations Industrial Development Organization (UNIDO). Their econometric analysis found that the ratio of BOD to employment in each industrial sector is about the same across countries. This finding allowed the authors to estimate BOD loads across countries and over time. The estimated BOD intensities per unit of employment were multiplied by sectoral employment numbers from UNIDO's industry database for 1980–98. The sectoral emissions estimates were then totaled to get daily emissions of organic water pollutants in kilograms per day for each country and year. The data in the table were derived by updating these estimates through 1998.
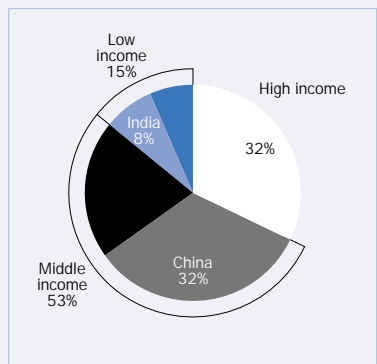
Figure 3.6

Emissions of organic water pollutants have been rising in developing countries . . .

Emissions of organic water pollutants (millions of kilograms a day)
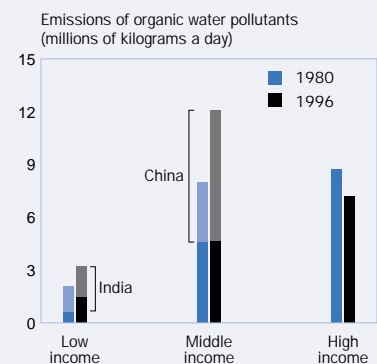
. . . with China and India making the biggest contributions

Contributions to global emissions of organic water pollutants, 1996

Source: Table 3.6 and World Bank database.

• **Emissions of organic water pollutants** are measured in terms of biochemical oxygen demand, which refers to the amount of oxygen that bacteria in water will consume in breaking down waste. This is a standard water treatment test for the presence of organic pollutants. Emissions per worker are total emissions divided by the number of industrial workers. • **Industry shares of emissions of organic water pollutants** refer to emissions from manufacturing activities as defined by two-digit divisions of the International Standard Industrial Classification (ISIC) revision 2: primary metals (ISIC division 37), paper and pulp (34), chemicals (35), food and beverages (31), stone, ceramics, and glass (36), textiles (32), wood (33), and other (38 and 39).

Indicators for 1980–93 were drawn from a 1998 study by Hemamala Hettige, Muthukumara Mani, and David Wheeler, "Industrial Pollution in Economic Development: Kuznets Revisited" (available on the Web at www.worldbank.org/nipr). These indicators were then updated through 1998 by the World Bank's Development Research Group using the same methodology as the initial study. Sectoral employment numbers are from UNIDO's industry database.

	Commercial energy production		Commercial energy use			Commercial energy use per capita			Net energy imports[a]	
	thousand metric tons of oil equivalent		thousand metric tons of oil equivalent		average annual % growth	kg of oil equivalent		average annual % growth	% of commercial energy use	
	1980	1998	1980	1998	1980–98	1980	1998	1980–98	1980	1998
Albania	3,428	864	3,049	947	–7.0	1,142	284	–8	–12	9
Algeria	66,741	132,332	12,089	26,506	3.7	648	898	1.0	–452	–399
Angola	11,301	43,035	4,437	7,147	2.9	632	595	–0.2	–155	–502
Argentina	38,813	80,657	41,868	62,349	2.3	1,490	1,726	0.9	7	–29
Armenia	1,263	547	1,070	1,939	..	346	511	..	..	72
Australia	86,096	212,012	70,372	105,009	2.4	4,790	5,600	1.0	–22	–102
Austria	7,655	8,999	23,450	28,815	1.5	3,105	3,567	1.1	67	69
Azerbaijan	14,821	16,178	15,001	12,372	..	2,433	1,564	..	..	–31
Bangladesh	9,234	16,725	10,930	19,965	3.6	126	159	1.4	16	16
Belarus	2,566	3,395	2,385	26,470	..	247	2,614	..	..	87
Belgium	7,986	12,810	46,100	58,349	1.8	4,682	5,719	1.5	83	78
Benin	1,212	1,947	1,363	2,240	2.6	394	377	–0.5	11	13
Bolivia	4,241	5,837	2,287	4,621	3.0	427	581	0.7	–85	–26
Bosnia and Herzegovina	..	684	..	1,950	..	..	517	..	..	65
Botswana	..	..	..	..	..	..	..	..	..	..
Brazil	62,083	126,065	111,262	174,964	2.6	914	1,055	0.9	44	28
Bulgaria	7,737	10,116	28,673	19,963	–2.5	3,235	2,418	–2.1	73	49
Burkina Faso	..	..	..	..	..	..	..	..	..	..
Burundi	..	..	..	..	..	..	..	..	..	..
Cambodia	..	..	..	..	..	..	..	..	..	..
Cameroon	6,707	12,965	3,676	6,183	2.6	425	432	–0.3	–82	–110
Canada	207,417	365,674	193,000	234,325	1.6	7,848	7,747	0.4	–7	–56
Central African Republic	..	..	..	..	..	..	..	..	..	..
Chad	..	..	..	..	..	..	..	..	..	..
Chile	5,801	7,905	9,662	23,630	5.8	867	1,594	4.1	40	67
China	608,625	1,020,270	593,118	1,031,410	3.8	604	830	2.4	–3	1
Hong Kong, China	39	48	5,439	16,593	5.9	1,079	2,497	4.5	99	100
Colombia	18,040	74,422	19,349	30,713	2.8	680	753	0.8	7	–142
Congo, Dem. Rep.	8,697	13,546	8,706	13,711	3.0	322	284	–0.3	0	1
Congo, Rep.	3,970	14,160	845	1,206	2.0	506	433	–0.8	–370	–1,074
Costa Rica	767	1,102	1,527	2,781	4.0	669	789	1.5	50	60
Côte d'Ivoire	..	..	..	..	..	..	..	..	..	..
Croatia	..	3,956	..	8,136	..	..	1,808	..	..	51
Cuba	4,227	4,448	14,910	11,858	–2.0	1,536	1,066	–2.8	72	62
Czech Republic	41,000	30,555	47,252	41,034	–1.1	4,618	3,986	–1.2	13	26
Denmark	896	20,177	19,734	20,804	0.9	3,852	3,925	0.7	95	3
Dominican Republic	1,332	1,433	3,464	5,583	2.4	608	676	0.3	62	74
Ecuador	11,755	22,514	5,191	8,973	2.6	652	737	0.3	–126	–151
Egypt, Arab Rep.	34,168	57,464	15,970	41,798	4.7	391	679	2.4	–114	–37
El Salvador	1,913	1,987	2,537	3,860	2.0	553	640	0.5	25	49
Eritrea	..	..	..	..	..	..	..	..	..	..
Estonia	6,951	2,920	6,275	4,835	..	4,240	3,335	..	..	40
Ethiopia	10,588	16,379	11,157	17,429	2.4	296	284	–0.4	5	6
Finland	6,912	13,591	25,413	33,459	1.7	5,317	6,493	1.3	73	59
France	46,829	125,528	190,111	255,674	2.0	3,528	4,378	1.6	75	51
Gabon	9,441	18,892	1,493	1,668	–0.4	2,160	1,413	–3.4	–532	–1,033
Gambia, The	..	..	..	..	..	..	..	..	..	..
Georgia	1,504	729	4,474	2,526	..	882	464	..	..	71
Germany	185,628	131,412	360,441	344,506	–0.1	4,603	4,199	–0.5	48	62
Ghana	3,305	5,705	4,027	7,270	3.7	375	396	0.6	18	22
Greece	3,696	9,892	15,960	26,976	3.1	1,655	2,565	2.6	77	63
Guatemala	2,503	4,739	3,754	6,258	3.1	550	579	0.5	33	24
Guinea	..	..	..	..	..	..	..	..	..	..
Guinea-Bissau	..	..	..	..	..	..	..	..	..	..
Haiti	1,877	1,626	2,099	2,072	–0.1	392	271	–2.0	11	22
Honduras	1,315	1,897	1,892	3,333	3.1	530	542	0.0	31	43

Energy production and use | 3.7

	Commercial energy production		Commercial energy use			Commercial energy use per capita			Net energy imports[a]	
	thousand metric tons of oil equivalent		thousand metric tons of oil equivalent		average annual % growth	kg of oil equivalent		average annual % growth	% of commercial energy use	
	1980	1998	1980	1998	1980–98	1980	1998	1980–98	1980	1998
Hungary	14,957	11,849	28,961	25,255	–1.0	2,705	2,497	–0.7	48	53
India	222,418	413,055	242,592	475,788	3.9	353	486	1.9	8	13
Indonesia	128,403	211,522	59,561	123,074	4.7	402	604	2.9	–116	–72
Iran, Islamic Rep.	84,001	232,481	38,918	102,148	6.1	995	1,649	3.5	–116	–128
Iraq	136,643	110,824	12,030	29,972	4.8	925	1,342	1.7	–1,036	–270
Ireland	1,894	2,465	8,485	13,251	2.5	2,495	3,570	2.2	78	81
Israel	153	619	8,563	18,873	5.2	2,208	3,165	2.6	98	97
Italy	19,644	29,049	138,629	167,933	1.4	2,456	2,916	1.3	86	83
Jamaica	224	655	2,378	4,058	3.8	1,115	1,575	2.8	91	84
Japan	43,247	109,965	346,492	510,106	2.7	2,967	4,035	2.3	88	78
Jordan	1	295	1,714	4,887	5.1	786	1,063	0.6	100	94
Kazakhstan	76,799	64,086	76,799	39,037	..	5,163	2,590	..	..	–64
Kenya	7,891	11,609	9,791	14,527	2.2	589	505	–0.9	19	20
Korea, Dem. Rep.	..	..	..	..	..	..	..	..	..	..
Korea, Rep.	9,644	27,738	41,238	163,375	9.5	1,082	3,519	8.3	77	83
Kuwait	91,636	114,225	12,248	14,598	–0.2	8,908	7,823	–0.7	–648	–682
Kyrgyz Republic	2,190	1,227	1,717	2,921	..	473	609	..	..	58
Lao PDR	..	..	..	..	..	..	..	..	..	..
Latvia	261	1,774	566	4,275	..	222	1,746	..	..	59
Lebanon	178	200	2,480	5,288	4.6	826	1,256	2.6	93	96
Lesotho	..	..	..	..	..	..	..	..	..	..
Libya	96,550	76,524	7,193	12,420	3.8	2,364	2,343	0.7	–1,242	–516
Lithuania	..	4,510	..	9,347	..	..	2,524	..	..	52
Macedonia, FYR	..	..	..	..	..	..	..	..	..	..
Madagascar	..	..	..	..	..	..	..	..	..	..
Malawi	..	..	..	..	..	..	..	..	..	..
Malaysia	18,202	74,912	12,215	43,623	7.9	888	1,967	5.1	–49	–72
Mali	..	..	..	..	..	..	..	..	..	..
Mauritania	..	..	..	..	..	..	..	..	..	..
Mauritius	..	..	..	..	..	..	..	..	..	..
Mexico	149,359	228,187	98,898	147,834	2.1	1,464	1,552	0.2	–51	–54
Moldova	35	63	..	4,053	..	..	943	..	..	98
Mongolia	..	..	..	..	..	..	..	..	..	..
Morocco	877	753	4,778	9,344	4.2	247	336	2.1	82	92
Mozambique	7,413	6,945	8,074	6,863	–1.0	668	405	–2.6	8	–1
Myanmar	9,513	12,405	9,430	13,631	2.0	279	307	0.5	–1	9
Namibia	..	..	..	..	..	..	..	..	..	..
Nepal	4,630	6,886	4,805	7,831	2.7	331	343	0.2	4	12
Netherlands	71,830	62,495	65,000	74,408	1.5	4,594	4,740	0.9	–11	16
New Zealand	5,488	13,837	9,251	17,159	3.8	2,972	4,525	2.7	41	19
Nicaragua	910	1,458	1,566	2,651	2.8	536	553	0.0	42	45
Niger	..	..	..	..	..	..	..	..	..	..
Nigeria	148,479	184,847	52,846	86,489	2.6	743	716	–0.3	–181	–114
Norway	55,716	206,667	18,792	25,423	1.7	4,593	5,736	1.3	–196	–713
Oman	15,090	52,202	996	7,285	11.5	905	3,165	7.0	–1,415	–617
Pakistan	20,997	42,351	25,472	57,854	4.8	308	440	2.2	18	27
Panama	529	642	1,865	2,383	1.7	957	862	–0.2	72	73
Papua New Guinea	..	..	..	..	..	..	..	..	..	..
Paraguay	1,605	6,868	2,089	4,277	4.5	671	819	1.5	23	–61
Peru	14,655	11,964	11,700	14,400	1.1	675	581	–0.9	–25	17
Philippines	10,670	17,818	21,212	38,313	3.7	439	526	1.4	50	53
Poland	121,848	86,703	123,465	96,440	–1.3	3,470	2,494	–1.8	1	10
Portugal	1,481	2,315	10,291	21,849	4.4	1,054	2,192	4.4	86	89
Puerto Rico	..	..	..	..	..	..	..	..	..	..
Romania	52,587	28,241	65,110	39,611	–3.0	2,933	1,760	–3.0	19	29
Russian Federation	748,647	928,987	763,707	581,774	..	5,494	3,963	..	..	–60

	Commercial energy production		Commercial energy use			Commercial energy use per capita			Net energy imports[a]	
	thousand metric tons of oil equivalent		thousand metric tons of oil equivalent		average annual % growth	kg of oil equivalent		average annual % growth	% of commercial energy use	
	1980	1998	1980	1998	1980–98	1980	1998	1980–98	1980	1998
Rwanda	..	..	..	..	..	..	..	..	..	..
Saudi Arabia	533,071	505,121	35,357	103,230	5.2	3,773	5,244	0.9	–1,408	–389
Senegal	1,046	1,653	1,921	2,822	2.2	347	312	–0.5	46	41
Sierra Leone	..	..	..	..	..	..	..	..	..	..
Singapore	..	24	6,062	24,299	9.8	2,656	7,681	7.8	..	100
Slovak Republic	3,416	4,833	20,810	16,906	–1.4	4,175	3,136	–1.8	84	71
Slovenia	1,623	2,891	4,313	6,649	..	2,269	3,354	..	..	57
South Africa	73,169	144,405	65,417	110,986	2.2	2,372	2,681	–0.1	–12	–30
Spain	15,644	31,920	68,583	112,782	3.1	1,834	2,865	2.8	77	72
Sri Lanka	3,209	4,319	4,536	7,300	2.3	308	389	0.9	29	41
Sudan	7,089	13,527	8,406	14,899	2.8	450	526	0.5	16	9
Sweden	16,133	34,155	40,984	52,472	1.3	4,932	5,928	0.8	61	35
Switzerland	7,030	11,163	20,861	26,605	1.5	3,301	3,742	0.8	66	58
Syrian Arab Republic	9,502	35,411	5,348	17,346	5.6	614	1,133	2.3	–78	–104
Tajikistan	1,986	1,268	1,650	3,255	..	416	532	..	..	61
Tanzania	9,502	13,931	10,280	14,660	2.0	553	456	–1.1	8	5
Thailand	11,182	39,347	22,808	68,971	7.9	488	1,153	6.4	51	43
Togo	..	..	..	..	..	..	..	..	..	..
Trinidad and Tobago	13,141	14,651	3,873	8,950	3.9	3,580	6,964	3.0	–239	–64
Tunisia	6,966	7,113	3,907	7,582	3.7	612	812	1.5	–78	6
Turkey	17,190	28,649	31,314	72,512	4.9	704	1,144	2.9	45	60
Turkmenistan	8,034	17,411	7,948	11,122	..	2,778	2,357	..	..	–57
Uganda	..	..	..	..	..	..	..	..	..	..
Ukraine	109,708	80,415	97,893	142,939	..	1,956	2,842	..	..	44
United Arab Emirates	89,716	144,935	6,112	27,336	8.7	5,860	10,035	3.1	–1,368	–430
United Kingdom	197,864	274,230	201,299	232,879	1.1	3,574	3,930	0.8	2	–18
United States	1,553,260	1,695,430	1,811,650	2,181,800	1.4	7,973	7,937	0.4	14	22
Uruguay	763	1,262	2,641	2,992	1.3	906	910	0.6	71	58
Uzbekistan	4,615	50,334	4,821	46,278	..	302	1,930	..	..	–9
Venezuela, RB	139,392	230,563	34,962	56,543	2.5	2,317	2,433	0.0	–299	–308
Vietnam	18,364	42,668	19,573	33,695	3.0	364	440	0.9	6	–27
West Bank and Gaza	..	..	..	..	..	..	..	..	..	..
Yemen, Rep.	60	19,565	1,424	3,333	4.5	167	201	0.5	96	–487
Yugoslavia, FR (Serb./Mont.)	..	..	..	..	..	..	..	..	..	..
Zambia	4,198	5,657	4,551	6,088	1.3	793	630	–1.6	8	7
Zimbabwe	5,793	8,235	6,570	10,065	2.8	937	861	–0.2	12	18
World	**6,882,644 s**	**9,611,004 s**	**6,902,381 t**	**9,345,307 t**	**2.9 w**	**1,627 w**	**1,659 w**	**0.9 w**	**.. w**	**.. w**
Low income	797,751	1,290,575	648,676	1,178,897	5.1	442	550	2.5	–23	–10
Middle income	3,302,896	4,605,397	2,481,018	3,409,502	4.4	1,246	1,311	2.3	–33	–35
Lower middle income	1,944,378	2,867,598	1,779,108	2,282,178	5.4	1,126	1,116	3.2	–9	–26
Upper middle income	1,358,518	1,737,798	701,910	1,127,324	2.7	1,713	2,025	1.0	–94	–54
Low & middle income	4,100,647	5,895,972	3,129,694	4,588,399	4.6	905	967	2.3	–31	–29
East Asia & Pacific	814,603	1,446,679	779,155	1,516,091	4.5	571	857	3.0	–5	5
Europe & Central Asia	1,241,543	1,380,292	1,332,941	1,215,898	7.8	3,349	2,637	..	7	–14
Latin America & Carib.	475,245	830,882	379,775	585,082	2.4	1,070	1,183	0.5	–24	–42
Middle East & N. Africa	988,969	1,237,344	145,929	378,338	5.1	838	1,344	2.3	–577	–228
South Asia	260,487	483,335	288,334	568,738	4.0	325	445	1.9	10	–15
Sub-Saharan Africa	319,801	517,440	203,560	324,252	2.3	727	700	–0.5	–57	–60
High income	2,781,997	3,715,032	3,772,688	4,756,908	1.7	4,796	5,366	1.0	27	22
Europe EMU	365,532	420,629	940,146	1,114,343	1.2	3,408	3,834	0.9	61	62

a. A negative value indicates that a country is a net exporter.

Energy production and use | 3.7

In developing countries growth in commercial energy use is closely related to growth in the modern sectors—industry, motorized transport, and urban areas—but commercial energy use also reflects climatic, geographic, and economic factors (such as the relative price of energy). Commercial energy use has been growing rapidly in low- and middle-income countries, but high-income countries still use more than five times as much on a per capita basis. Because commercial energy is widely traded, it is necessary to distinguish between its production and its use. Net energy imports show the extent to which an economy's use exceeds its domestic production. High-income countries are net energy importers; middle-income countries have been their main suppliers.

Energy data are compiled by the International Energy Agency (IEA) and the United Nations Statistics Division (UNSD). IEA data for non-OECD countries are based on national energy data adjusted to conform with annual questionnaires completed by OECD member governments. UNSD data are primarily from responses to questionnaires sent to national governments, supplemented by official national statistical publications and by data from intergovernmental organizations. When official data are not available, the UNSD prepares estimates based on the professional and commercial literature. This variety of sources affects the cross-country comparability of data.

Commercial energy use refers to the use of domestic primary energy before transformation to other end-use fuels (such as electricity and refined petroleum products). It includes energy from combustible renewables and waste, which comprises solid biomass and animal products, gas and liquid from biomass, industrial waste, and municipal waste. Biomass is defined as any plant matter used directly as fuel or converted into fuel, heat, or electricity. (The data series published in *World Development Indicators 1998* and earlier editions did not include energy from combustible renewables and waste.) All forms of commercial energy—primary energy and primary electricity—are converted into oil equivalents. To convert nuclear electricity into oil equivalents, a notional thermal efficiency of 33 percent is assumed; for hydroelectric power 100 percent efficiency is assumed.
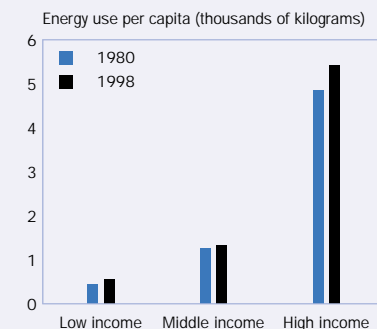
Figure 3.7a

High-income countries, with 15 percent of the world's population, use half its commercial energy . . .

Commercial energy use, 1998
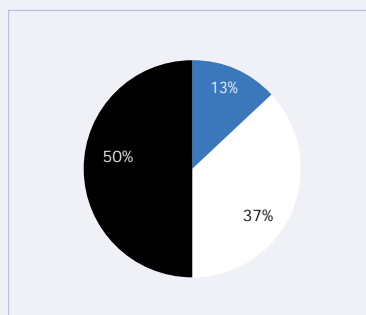
- Low income
- Middle income
- High income

. . . and 10 times as much per capita as low-income countries

Energy use per capita (thousands of kilograms)

Source: Table 3.7.

- **Commercial energy production** refers to commercial forms of primary energy—petroleum (crude oil, natural gas liquids, and oil from nonconventional sources), natural gas, and solid fuels (coal, lignite, and other derived fuels)—and primary electricity, all converted into oil equivalents (see *About the data*).
- **Commercial energy use** refers to apparent consumption, which is equal to indigenous production plus imports and stock changes, minus exports and fuels supplied to ships and aircraft engaged in international transport (see *About the data*). • **Net energy imports** are calculated as energy use less production, both measured in oil equivalents. A negative value indicates that the country is a net exporter.

The data on commercial energy production and use are primarily from IEA electronic files and from the United Nations Statistics Division's *Energy Statistics Yearbook.* The IEA's data are published in its annual publications, *Energy Statistics and Balances of Non-OECD Countries, Energy Statistics of OECD Countries,* and *Energy Balances of OECD Countries.*

Figure 3.7b

High-income countries depend on imports for roughly a quarter of their energy

Net energy imports (% of commercial energy use)

Source: Table 3.7.

	GDP per unit of energy use		Traditional fuel use		Carbon dioxide emissions					
	PPP $ per kg oil equivalent		% of total energy use		Total million metric tons		Per capita metric tons		kg per PPP $ of GDP	
	1980	1998	1980	1997	1980	1997	1980	1997	1980	1997
Albania	..	10.3	13.1	7.3	5.3	1.7	2.0	0.5	..	0.2
Algeria	5.0	5.4	1.9	1.5	68.2	98.7	3.7	3.4	1.1	0.7
Angola	..	3.8	64.9	69.7	5.4	5.3	0.8	0.5	..	0.2
Argentina	4.7	7.3	5.9	4.0	111.0	140.6	4.0	3.9	0.6	0.3
Armenia	..	4.3	..	0.0	..	2.9	..	0.8	..	0.4
Australia	2.1	4.1	3.8	4.4	205.5	319.6	14.0	17.2	1.4	0.8
Austria	3.5	6.7	1.2	4.7	55.1	62.6	7.3	7.8	0.7	0.3
Azerbaijan	..	1.5	..	0.0	..	32.0	..	4.1	..	1.9
Bangladesh	4.5	8.9	81.3	46.0	7.8	24.6	0.1	0.2	0.2	0.1
Belarus	..	2.5	..	0.8	..	62.3	..	6.1	..	1.0
Belgium	2.4	4.3	0.2	1.6	131.0	106.5	13.3	10.5	1.2	0.4
Benin	1.3	2.4	85.4	89.2	0.7	1.0	0.2	0.2	0.4	0.2
Bolivia	3.4	4.0	19.3	14.0	4.7	11.3	0.9	1.4	0.6	0.6
Bosnia and Herzegovina	..	..	..	10.1	..	4.5	..	1.2	..	..
Botswana	..	..	35.7	..	1.0	3.4	1.1	2.2	0.6	0.3
Brazil	4.4	6.5	35.5	28.7	197.0	307.2	1.6	1.9	0.4	0.3
Bulgaria	0.9	2.0	0.5	1.3	77.9	50.3	8.8	6.1	3.0	1.2
Burkina Faso	..	..	91.3	87.1	0.4	1.0	0.1	0.1	0.1	0.1
Burundi	..	..	97.0	94.2	0.1	0.2	0.0	0.0	0.1	0.1
Cambodia	..	..	100.0	89.3	0.3	0.5	0.0	0.0	..	0.0
Cameroon	2.8	3.5	51.7	69.2	4.1	2.7	0.5	0.2	0.4	0.1
Canada	1.5	3.2	0.4	4.7	426.1	496.6	17.3	16.6	1.5	0.7
Central African Republic	..	..	88.9	87.5	0.1	0.2	0.0	0.1	0.1	0.1
Chad	..	..	95.9	97.6	0.2	0.1	0.0	0.0	0.1	0.0
Chile	3.1	5.4	12.3	11.3	28.3	60.1	2.5	4.1	0.9	0.5
China	0.8	4.0	8.4	5.7	1,516.6	3,593.5	1.5	2.9	3.3	0.9
Hong Kong, China	6.4	8.5	0.9	0.7	17.1	23.8	3.4	3.7	0.5	0.2
Colombia	4.1	7.9	15.9	17.7	42.0	71.9	1.5	1.8	0.5	0.3
Congo, Dem. Rep.	3.5	2.8	73.9	91.7	3.7	2.3	0.1	0.1	0.1	0.1
Congo, Rep.	0.8	1.8	77.8	53.0	0.4	0.3	0.2	0.1	0.6	0.1
Costa Rica	5.7	9.5	26.3	54.2	2.7	5.4	1.2	1.6	0.3	0.2
Côte d'Ivoire	..	..	52.8	91.5	5.3	13.3	0.6	0.9	0.5	0.6
Croatia	..	3.9	..	3.2	..	20.1	..	4.4	..	0.6
Cuba	..	..	27.9	30.2	32.4	26.0	3.3	2.3	..	..
Czech Republic	..	3.2	0.6	1.6	..	125.2	..	12.2	..	0.9
Denmark	..	6.4	0.4	5.9	63.9	57.7	12.5	10.9	..	0.4
Dominican Republic	3.7	7.5	27.5	14.3	6.9	14.0	1.2	1.7	0.5	0.4
Ecuador	3.0	4.3	26.7	17.5	14.1	21.7	1.8	1.8	0.9	0.6
Egypt, Arab Rep.	3.5	4.7	4.7	3.2	46.7	118.3	1.1	2.0	0.8	0.6
El Salvador	4.3	6.5	52.9	34.5	2.4	5.9	0.5	1.0	0.2	0.2
Eritrea	..	..	..	96.0	..	..	..	..	..	..
Estonia	..	2.5	..	13.8	..	19.1	..	13.1	..	1.6
Ethiopia	*1.4*	2.1	89.6	95.9	1.9	3.8	0.0	0.1	*0.1*	0.1
Finland	1.8	3.4	4.3	6.5	55.8	56.6	11.7	11.0	1.2	0.5
France	2.9	5.0	1.3	5.7	497.2	349.8	9.2	6.0	0.9	0.3
Gabon	1.9	4.5	30.8	32.9	5.0	3.4	7.2	3.0	1.7	0.5
Gambia, The	..	..	72.7	78.6	0.2	0.2	0.2	0.2	0.3	0.1
Georgia	..	7.1	..	1.0	..	4.5	..	0.8	..	0.3
Germany	..	5.5	0.3	1.3	..	851.5	..	10.4	..	0.5
Ghana	2.9	4.6	43.7	78.1	2.6	4.8	0.2	0.3	0.2	0.1
Greece	4.2	5.7	3.0	4.5	58.1	87.2	6.0	8.3	0.9	0.6
Guatemala	4.1	6.1	54.6	62.0	4.8	8.3	0.7	0.8	0.3	0.2
Guinea	..	..	71.4	74.2	0.9	1.1	0.2	0.2	..	0.1
Guinea-Bissau	..	..	80.0	57.1	0.1	0.2	0.2	0.2	0.5	0.2
Haiti	3.7	5.3	80.7	74.7	0.9	1.4	0.2	0.2	0.1	0.1
Honduras	2.9	4.5	55.3	54.8	2.3	4.6	0.6	0.8	0.4	0.3

Energy efficiency and emissions | 3.8

	GDP per unit of energy use		Traditional fuel use		Carbon dioxide emissions					
	PPP $ per kg oil equivalent		% of total energy use		Total million metric tons		Per capita metric tons		kg per PPP $ of GDP	
	1980	1998	1980	1997	1980	1997	1980	1997	1980	1997
Hungary	2.0	4.3	2.0	1.6	84.8	59.6	7.9	5.9	1.4	0.6
India	1.9	4.3	31.5	20.7	356.1	1,065.4	0.5	1.1	0.8	0.5
Indonesia	2.2	4.6	51.5	29.3	97.5	251.5	0.7	1.3	0.8	0.4
Iran, Islamic Rep.	2.9	3.3	0.4	0.7	120.0	296.9	3.1	4.9	1.1	0.9
Iraq	..	..	0.3	0.1	46.7	92.3	3.6	4.2	..	..
Ireland	2.3	6.4	0.0	0.2	26.1	37.3	7.7	10.2	1.3	0.5
Israel	3.6	5.7	0.0	0.0	22.1	60.4	5.7	10.4	0.7	0.6
Italy	3.9	7.4	0.8	1.0	392.7	424.7	7.0	7.4	0.7	0.3
Jamaica	1.9	2.2	5.0	6.0	8.5	11.0	4.0	4.3	1.9	1.2
Japan	3.3	6.0	0.1	1.6	964.2	1,204.2	8.3	9.6	0.8	0.4
Jordan	3.3	3.6	0.0	0.0	5.2	15.7	2.4	3.5	0.9	0.9
Kazakhstan	..	1.8	..	0.2	..	123.0	..	8.0	..	1.7
Kenya	1.1	2.0	76.8	80.3	6.8	7.2	0.4	0.3	0.7	0.2
Korea, Dem. Rep.	..	..	3.1	1.4	128.9	260.5	7.3	11.4	..	..
Korea, Rep.	2.8	4.0	4.0	2.4	132.9	457.4	3.5	9.9	1.2	0.6
Kuwait	1.3	2.1	0.0	0.0	25.4	51.0	18.5	28.2	1.6	1.8
Kyrgyz Republic	..	4.0	..	0.0	..	6.8	..	1.4	..	0.6
Lao PDR	..	..	72.3	88.7	0.2	0.4	0.1	0.1	..	0.1
Latvia	19.6	3.4	..	26.2	..	8.3	..	3.3	..	0.6
Lebanon	..	3.7	2.4	2.5	6.9	17.7	2.3	4.3	..	1.0
Lesotho	..	..	..	..	..	..	..	..	..	..
Libya	..	..	2.3	0.9	28.5	43.5	9.4	8.4	..	..
Lithuania	..	2.7	..	6.3	..	15.1	..	4.1	..	0.6
Macedonia, FYR	..	..	..	6.1	..	10.9	..	5.5	..	1.2
Madagascar	..	..	78.4	84.3	1.6	1.2	0.2	0.1	0.3	0.1
Malawi	..	..	90.6	88.6	0.8	0.8	0.1	0.1	0.3	0.1
Malaysia	2.7	3.9	15.7	5.5	29.1	137.2	2.1	6.3	0.9	0.7
Mali	..	..	86.7	88.9	0.4	0.5	0.1	0.0	0.1	0.1
Mauritania	..	..	0.0	0.0	0.6	3.0	0.4	1.2	0.4	0.8
Mauritius	..	..	59.1	36.1	0.6	1.7	0.6	1.5	0.3	0.2
Mexico	3.1	5.2	5.0	4.5	259.6	379.7	3.8	4.0	0.8	0.5
Moldova	..	2.2	..	0.5	..	10.4	..	2.4	..	1.1
Mongolia	..	..	14.4	4.3	6.9	7.8	4.1	3.3	3.6	2.1
Morocco	6.8	10.2	5.2	4.0	17.7	35.9	0.9	1.3	0.5	0.4
Mozambique	0.6	2.0	43.7	91.4	3.3	1.2	0.3	0.1	0.7	0.1
Myanmar	..	..	69.3	60.5	5.0	8.8	0.1	0.2	..	..
Namibia	..	..	..	..	..	..	..	..	..	..
Nepal	1.5	3.5	94.2	89.6	0.6	2.2	0.0	0.1	0.1	0.1
Netherlands	2.2	4.9	0.0	1.1	154.5	163.6	10.9	10.5	1.1	0.5
New Zealand	..	4.0	0.2	0.8	17.9	31.6	5.8	8.4	..	0.5
Nicaragua	3.6	4.0	49.2	42.2	2.1	3.2	0.7	0.7	0.4	0.3
Niger	..	..	79.5	80.6	0.6	1.1	0.1	0.1	0.1	0.2
Nigeria	0.8	1.2	66.8	67.8	69.1	83.7	1.0	0.7	1.6	0.9
Norway	2.4	4.8	0.4	1.1	91.5	68.5	22.4	15.6	2.0	0.6
Oman	..	..	0.0	..	5.9	18.4	5.3	8.2	..	..
Pakistan	2.1	4.0	24.4	29.5	33.3	98.2	0.4	0.8	0.6	0.4
Panama	3.2	6.5	26.6	14.4	3.7	8.0	1.9	2.9	0.6	0.5
Papua New Guinea	..	..	65.4	62.5	1.8	2.5	0.6	0.5	0.5	0.2
Paraguay	4.2	5.4	62.0	49.6	1.6	4.1	0.5	0.8	0.2	0.2
Peru	4.6	7.8	15.2	24.6	24.7	30.1	1.4	1.2	0.5	0.3
Philippines	5.6	7.0	37.0	26.9	38.8	81.7	0.8	1.1	0.3	0.3
Poland	..	3.2	0.4	0.8	465.4	357.0	13.1	9.2	..	1.2
Portugal	5.6	7.0	1.2	0.9	29.9	53.8	3.1	5.4	0.5	0.4
Puerto Rico	..	..	0.0	..	14.7	17.1	4.6	4.5	..	..
Romania	1.6	3.5	1.3	5.7	199.6	111.3	9.0	4.9	1.9	0.8
Russian Federation	..	1.7	..	0.8	..	1,444.5	..	9.8	..	1.4

	GDP per unit of energy use		Traditional fuel use		Carbon dioxide emissions					
	PPP $ per kg oil equivalent		% of total energy use		Total million metric tons		Per capita metric tons		kg per PPP $ of GDP	
	1980	1998	1980	1997	1980	1997	1980	1997	1980	1997
Rwanda	..	..	89.8	88.3	0.3	0.5	0.1	0.1	0.1	0.1
Saudi Arabia	3.0	2.1	0.0	0.0	132.2	273.7	14.1	14.3	1.2	1.3
Senegal	2.3	4.4	50.8	56.2	3.0	3.5	0.5	0.4	0.7	0.3
Sierra Leone	..	..	90.0	86.1	0.6	0.5	0.2	0.1	0.3	0.2
Singapore	2.3	3.1	0.4	0.0	31.1	81.9	12.9	21.9	2.2	1.1
Slovak Republic	..	3.2	..	0.5	..	38.1	..	7.1	..	0.7
Slovenia	..	4.4	..	1.5	..	15.5	..	7.8	..	0.5
South Africa	2.7	3.3	4.9	43.4	214.9	321.5	7.8	7.9	1.2	0.9
Spain	3.8	5.9	0.4	1.3	214.0	257.7	5.7	6.6	0.8	0.4
Sri Lanka	3.5	8.0	53.5	46.5	3.7	8.1	0.3	0.4	0.2	0.1
Sudan	..	..	86.9	75.1	3.4	3.8	0.2	0.1	..	..
Sweden	2.1	3.6	7.7	17.9	72.6	48.6	8.7	5.5	0.8	0.3
Switzerland	4.4	7.0	0.9	6.0	43.0	42.6	6.8	6.0	0.5	0.2
Syrian Arab Republic	2.9	3.3	0.0	0.0	20.3	49.9	2.3	3.3	1.3	1.0
Tajikistan	..	..	..	..	..	5.6	..	0.9	..	..
Tanzania	..	1.1	92.0	91.4	2.0	2.9	0.1	0.1	..	0.2
Thailand	3.0	5.1	40.3	24.6	42.7	226.8	0.9	3.8	0.6	0.6
Togo	..	..	35.7	71.9	0.8	1.0	0.3	0.2	0.2	0.2
Trinidad and Tobago	1.3	1.1	1.4	0.8	16.8	22.3	15.5	17.4	3.4	2.4
Tunisia	4.0	6.9	16.1	12.5	10.3	18.8	1.6	2.0	0.7	0.4
Turkey	3.6	5.8	20.5	3.1	82.8	216.0	1.9	3.5	0.7	0.5
Turkmenistan	..	1.2	..	..	..	31.0	..	6.7	..	2.5
Uganda	..	..	93.6	89.7	0.6	1.2	0.1	0.1	0.1	0.1
Ukraine	..	1.2	..	0.5	..	370.5	..	7.3	..	2.1
United Arab Emirates	4.4	1.8	0.0	..	37.1	82.5	35.6	32.0	1.4	1.6
United Kingdom	..	5.4	0.0	3.3	591.2	527.1	10.5	8.9	..	0.4
United States	1.6	3.8	1.3	3.8	4,609.4	5,467.1	20.3	20.1	1.6	0.7
Uruguay	5.0	9.9	11.1	21.0	6.2	5.7	2.1	1.8	0.5	0.2
Uzbekistan	..	1.1	..	0.0	..	104.8	..	4.4	..	2.1
Venezuela, RB	1.7	2.4	0.9	0.7	92.0	191.2	6.1	8.4	1.5	1.4
Vietnam	..	4.0	49.1	37.8	17.1	45.5	0.3	0.6	..	0.4
West Bank and Gaza	..	..	..	..	..	..	..	..	..	..
Yemen, Rep.	..	3.7	0.0	1.4	..	16.7	..	1.0	..	1.3
Yugoslavia, FR (Serb./Mont.)	..	..	..	1.5	..	50.2	..	4.7	..	..
Zambia	0.9	1.2	37.4	72.7	3.6	2.6	0.6	0.3	0.9	0.4
Zimbabwe	1.5	3.3	27.6	25.2	9.9	18.8	1.4	1.6	1.0	0.6
World	**2.1 w**	**4.2 w**	**7.4 w**	**8.2 w**	**14,014.6 s**	**23,868.2 s**	**3.5 w**	**4.1 w**	**1.2 w**	**0.6 w**
Low income	..	3.4	46.4	29.8	794.9	2,527.5	0.5	1.1	0.7	0.6
Middle income	2.2	3.9	10.4	7.3	4,304.9	10,006.0	2.4	3.8	1.3	0.8
Lower middle income	1.6	3.6	10.7	5.7	2,457.8	6,957.9	1.7	3.4	1.7	0.9
Upper middle income	3.3	4.3	8.6	10.6	1,847.0	3,048.1	4.6	5.5	1.0	0.6
Low & middle income	..	3.7	18.5	12.9	5,099.8	12,533.6	1.5	2.5	1.2	0.7
East Asia & Pacific	..	..	15.1	9.7	2,019.6	5,075.6	1.4	2.8	2.0	0.8
Europe & Central Asia	..	2.3	3.2	1.3	915.8	3,285.6	..	6.9	2.1	1.2
Latin America & Carib.	3.7	5.7	18.4	16.0	884.7	1,356.4	2.5	2.8	0.6	0.4
Middle East & N. Africa	3.4	3.5	1.6	1.1	517.8	1,113.6	3.1	4.0	1.1	0.9
South Asia	2.0	4.5	34.2	23.8	403.4	1,200.5	0.4	0.9	0.7	0.5
Sub-Saharan Africa	..	..	47.2	63.5	358.4	501.8	1.0	0.8	0.9	0.6
High income	2.2	4.6	1.0	3.4	8,914.8	11,334.6	12.6	12.8	1.2	0.5
Europe EMU	3.1	5.6	0.7	2.5	1,569.7	2,378.6	7.9	8.2	0.9	0.4

Energy efficiency and emissions | 3.8

The ratio of GDP to energy use provides a measure of energy efficiency. To produce comparable and consistent estimates of real GDP across countries relative to physical inputs to GDP—that is, units of energy use—GDP is converted to international dollars using purchasing power parity (PPP) rates. Differences in this ratio over time and across countries reflect in part structural changes in the economy, changes in the energy efficiency of particular sectors, and differences in fuel mixes.

The data on traditional fuel are from the United Nations Statistics Division's *Energy Statistics Yearbook.* This series differs from those published in *World Development Indicators 1999* and previous editions, which came from other sources.

Carbon dioxide (CO_2) emissions, largely a by-product of energy production and use (see table 3.7), account for the largest share of greenhouse gases, which are associated with global warming. Anthropogenic CO_2 emissions result primarily from fossil fuel combustion and cement manufacturing. In combustion, different fossil fuels release different amounts of CO_2 for the same level of energy use. Burning oil releases about 50 percent more CO_2 than burning natural gas, and burning coal releases about twice as much. Cement manufacturing releases about half a metric ton of CO_2 for each ton of cement produced.
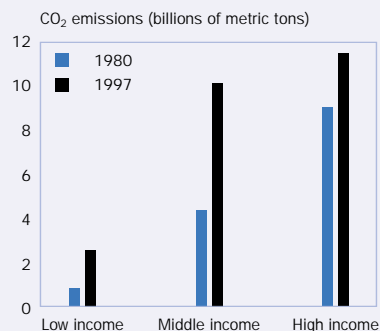
The Carbon Dioxide Information Analysis Center (CDIAC), sponsored by the U.S. Department of Energy, calculates annual anthropogenic emissions of CO_2. These calculations are derived from data on fossil fuel consumption, based on the World Energy Data Set maintained by the United Nations Statistics Division, and from data on world cement manufacturing, based on the Cement Manufacturing Data Set maintained by the U.S. Bureau of Mines. Emissions of CO_2 are often calculated and reported in terms of their content of elemental carbon. For this table these values were converted to the actual mass of CO_2 by multiplying the carbon mass by 3.664 (the ratio of the mass of carbon to that of CO_2).

Although the estimates of global CO_2 emissions are probably within 10 percent of actual emissions (as calculated from global average fuel chemistry and use), country estimates may have larger error bounds. Trends estimated from a consistent time series tend to be more accurate than individual values. Each year the CDIAC recalculates the entire time series from 1950 to the present, incorporating its most recent findings and the latest corrections to its database. Estimates do not include fuels supplied to ships and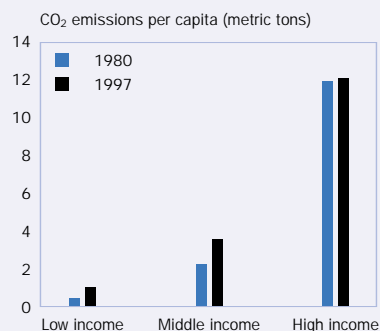 aircraft engaged in international transport because of the difficulty of apportioning these fuels among the countries benefiting from that transport.
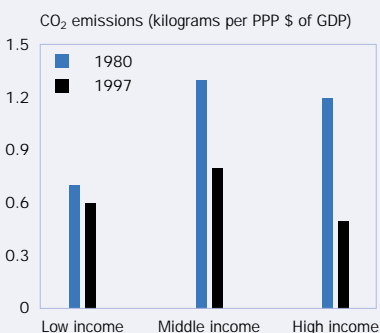
Figure 3.8

Carbon dioxide emissions have been rising globally . . .

CO$_2$ emissions (billions of metric tons)

. . . even on a per capita basis . . .

CO$_2$ emissions per capita (metric tons)

. . . but production is becoming cleaner

CO$_2$ emissions (kilograms per PPP $ of GDP)

Source: Table 3.8.

• **GDP per unit of energy use** is the PPP GDP per kilogram of oil equivalent of commercial energy use. PPP GDP is gross domestic product converted to international dollars using purchasing power parity rates. An international dollar has the same purchasing power over GDP as a U.S. dollar has in the United States. • **Traditional fuel use** includes estimates of the consumption of fuelwood, charcoal, bagasse, and animal and vegetable wastes. Total energy use comprises commercial energy use (see table 3.7) and traditional fuel use. • **Carbon dioxide emissions** are those stemming from the burning of fossil fuels and the manufacture of cement. They include carbon dioxide produced during consumption of solid, liquid, and gas fuels and gas flaring.

Data sources

The underlying data on commercial energy production and use are from electronic files of the International Energy Agency. The data on traditional fuel use are from the United Nations Statistics Division's *Energy Statistics Yearbook.* The data on CO_2 emissions are from the Carbon Dioxide Information Analysis Center, Environmental Sciences Division, Oak Ridge National Laboratory, in the U.S. state of Tennessee.

| | Electricity production (billion kwh) | | Sources of electricity[a] | | | | | | | | | |
| | | | Hydropower % | | Coal % | | Oil % | | Gas % | | Nuclear power % | |
	1980	1998	1980	1998	1980	1998	1980	1998	1980	1998	1980	1998
Albania	3.7	5.1	79.4	95.9	..	..	20.6	4.1	..	..	..	..
Algeria	7.1	23.6	3.6	3.2	..	..	12.2	3.5	84.1	93.3	..	..
Angola	0.7	1.1	88.1	90.0	..	..	11.9	10.0	..	..	..	..
Argentina	39.7	74.2	38.1	35.9	2.1	1.9	31.6	5.3	22.0	46.6	5.9	10.0
Armenia	13.0	6.2	12.0	24.8	..	..	54.8	0.3	..	49.5	33.2	25.7
Australia	95.2	194.3	13.6	8.1	73.3	80.0	5.4	1.1	7.3	9.0	..	..
Austria	41.6	55.9	69.1	66.5	7.0	9.1	14.0	5.6	9.2	15.8	..	..
Azerbaijan	15.0	18.0	7.3	10.8	..	..	92.7	69.5	..	19.7	..	..
Bangladesh	2.4	12.9	24.8	6.7	..	..	26.6	8.7	48.6	84.6	..	..
Belarus	34.1	25.3	0.1	0.1	..	..	99.9	14.8	..	85.1	..	..
Belgium	53.1	82.1	0.5	0.5	29.4	20.6	34.7	3.1	11.2	18.3	23.6	56.2
Benin	0.0	0.1	..	3.2	..	..	100.0	96.8	..	..	..	..
Bolivia	1.6	3.7	68.2	41.2	..	..	10.3	2.2	18.4	54.8	..	..
Bosnia and Herzegovina	..	2.5	..	61.2	..	33.7	..	5.1	..	..	..	..
Botswana	..	..	..	..	..	..	..	..	..	..	..	..
Brazil	139.4	321.6	92.5	90.6	2.4	2.2	3.8	3.9	..	0.3	..	1.0
Bulgaria	34.8	41.5	10.7	7.5	49.2	44.8	22.5	2.2	..	4.9	17.7	40.7
Burkina Faso	..	..	..	..	..	..	..	..	..	..	..	..
Burundi	..	..	..	..	..	..	..	..	..	..	..	..
Cambodia	..	..	..	..	..	..	..	..	..	..	..	..
Cameroon	1.5	3.3	93.9	98.9	..	..	6.1	1.1	..	..	..	..
Canada	373.3	561.7	67.3	59.1	16.0	19.1	3.7	3.3	2.5	4.6	10.2	12.7
Central African Republic	..	..	..	..	..	..	..	..	..	..	..	..
Chad	..	..	..	..	..	..	..	..	..	..	..	..
Chile	11.8	35.5	67.0	47.0	16.1	32.9	14.7	5.1	1.3	11.8	..	..
China	300.6	1,166.2	19.4	17.8	59.9	75.9	20.5	4.5	0.2	0.6	..	1.2
Hong Kong, China	12.6	31.4	..	..	22.6	65.1	100.0	1.1	..	33.8	..	..
Colombia	20.4	45.9	70.0	67.0	7.7	8.8	1.8	0.7	19.3	22.0	..	..
Congo, Dem. Rep.	4.4	5.7	95.5	97.8	..	..	4.5	2.2	..	..	..	..
Congo, Rep.	0.2	0.3	62.2	99.4	..	..	35.9	0.3	1.9	0.3	..	..
Costa Rica	2.2	5.8	95.2	81.6	..	..	4.3	6.8	..	..	..	..
Côte d'Ivoire	..	..	..	..	..	..	..	..	..	..	..	..
Croatia	..	10.9	..	50.2	..	4.9	..	32.5	..	12.3	..	..
Cuba	9.9	14.1	1.0	0.7	..	..	89.7	93.7	..	0.2	..	..
Czech Republic	52.7	64.6	4.6	2.2	84.8	71.6	9.6	1.0	1.1	3.2	..	20.4
Denmark	26.8	41.1	0.1	0.1	81.8	57.6	18.0	12.1	..	19.9	..	..
Dominican Republic	3.3	7.6	18.8	18.8	..	4.5	78.8	76.3	..	..	..	..
Ecuador	3.4	9.9	25.9	66.0	..	..	74.1	34.0	..	..	..	..
Egypt, Arab Rep.	18.9	63.0	51.8	19.4	..	..	27.7	30.2	20.5	50.4	..	..
El Salvador	1.5	3.8	63.7	40.8	..	..	2.7	46.8	..	..	..	..
Eritrea	..	..	..	..	..	..	..	..	..	..	..	..
Estonia	18.9	8.5	..	0.0	..	93.5	100.0	2.9	..	3.4	..	..
Ethiopia	0.7	1.6	70.2	97.0	..	..	27.6	3.0	..	..	..	..
Finland	40.7	70.2	25.1	21.4	42.6	19.3	10.8	1.6	4.2	12.6	17.2	31.1
France	256.9	506.9	26.9	12.2	27.2	7.4	18.9	2.3	2.7	1.0	23.8	76.5
Gabon	0.5	1.0	49.1	71.3	..	..	50.9	18.4	..	10.3	..	..
Gambia, The	..	..	..	..	..	..	..	..	..	..	..	..
Georgia	14.7	8.1	..	79.0	..	..	..	2.9	..	18.1	..	..
Germany	466.3	552.4	4.1	3.1	62.9	54.2	5.7	1.2	14.2	9.8	11.9	29.3
Ghana	5.3	7.3	99.2	99.6	..	..	0.8	0.4	..	..	..	..
Greece	22.7	46.2	15.0	8.0	44.8	70.3	40.1	17.5	..	3.7	..	..
Guatemala	1.8	4.5	12.9	77.1	..	..	70.5	22.9	..	..	..	..
Guinea	..	..	..	..	..	..	..	..	..	..	..	..
Guinea-Bissau	..	..	..	..	..	..	..	..	..	..	..	..
Haiti	0.3	0.7	70.1	46.2	..	..	26.1	53.8	..	..	..	..
Honduras	0.9	3.5	86.3	55.4	..	..	13.7	44.6	..	..	..	..

Sources of electricity 3.9

	Electricity production		Hydropower %		Coal %		Oil %		Gas %		Nuclear power %	
	billion kwh											
	1980	1998	1980	1998	1980	1998	1980	1998	1980	1998	1980	1998
Hungary	23.9	37.2	0.5	0.4	50.4	26.0	13.9	16.0	35.2	20.0	0.0	37.5
India	119.3	494.0	39.0	16.8	51.2	75.4	6.4	0.7	0.8	4.7	2.5	2.3
Indonesia	8.4	77.9	16.0	12.4	..	28.8	84.0	21.1	..	34.4	..	..
Iran, Islamic Rep.	22.4	103.4	25.1	6.8	..	..	50.1	13.7	24.8	79.5	..	..
Iraq	11.4	30.3	6.1	1.9	..	..	93.9	98.1	..	..	..	..
Ireland	10.6	20.9	7.9	4.4	16.4	40.4	60.4	23.2	15.2	30.8	..	..
Israel	12.4	38.0	0.0	0.1	18.1	69.8	100.0	30.1	..	0.1	..	..
Italy	183.5	253.6	24.7	16.3	9.9	11.0	57.0	42.3	5.0	27.9	1.2	..
Jamaica	1.5	6.5	8.3	1.4	..	..	87.9	92.9	..	..	..	..
Japan	572.5	1,036.2	15.4	8.9	9.6	19.1	46.2	16.4	14.2	21.1	14.4	32.1
Jordan	1.1	6.7	..	0.2	..	..	100.0	89.6	..	10.2	..	..
Kazakhstan	61.5	49.1	9.3	12.5	..	72.0	90.7	7.3	..	8.2	..	..
Kenya	1.5	4.8	71.1	68.2	..	..	28.9	24.2	..	..	..	..
Korea, Dem. Rep.	..	..	..	..	..	..	..	..	..	..	..	..
Korea, Rep.	37.2	235.3	5.3	1.8	6.7	42.8	78.7	6.1	..	11.2	9.3	38.1
Kuwait	9.0	30.0	..	..	..	..	20.1	70.1	79.9	29.9	..	..
Kyrgyz Republic	9.2	11.6	..	85.6	..	..	..	..	..	..	..	..
Lao PDR	..	..	..	..	..	..	..	..	..	..	..	..
Latvia	4.7	5.7	..	75.2	..	1.7	..	5.3	..	17.7	..	..
Lebanon	2.8	8.4	30.9	9.4	..	..	69.1	90.6	..	..	..	..
Lesotho	..	..	..	..	..	..	..	..	..	..	..	..
Libya	4.8	19.5	..	..	..	..	100.0	100.0	..	..	..	..
Lithuania	11.7	17.2	4.0	2.4	..	..	96.0	16.9	..	1.7	..	79.0
Macedonia, FYR	..	..	..	..	..	..	..	..	..	..	..	..
Madagascar	..	..	..	..	..	..	..	..	..	..	..	..
Malawi	..	..	..	..	..	..	..	..	..	..	..	..
Malaysia	10.0	60.7	13.9	8.0	..	3.2	84.9	19.0	1.2	69.8	..	..
Mali	..	..	..	..	..	..	..	..	..	..	..	..
Mauritania	..	..	..	..	..	..	..	..	..	..	..	..
Mauritius	..	..	..	..	..	..	..	..	..	..	..	..
Mexico	67.0	182.3	25.2	13.5	0.0	9.8	57.9	55.4	15.5	13.1	..	5.1
Moldova	15.4	4.6	2.6	1.8	..	10.9	97.4	4.8	..	82.4	..	..
Mongolia	..	..	..	..	..	..	..	..	..	..	..	..
Morocco	5.2	14.1	28.9	12.4	19.5	55.3	51.6	32.3	..	..	..	..
Mozambique	0.5	6.9	65.2	99.4	17.5	..	17.3	0.5	..	0.0	..	..
Myanmar	1.5	4.6	53.5	31.8	2.0	..	31.3	7.1	13.2	61.0	..	..
Namibia	..	..	..	..	..	..	..	..	..	..	..	..
Nepal	0.2	1.3	94.4	90.5	..	..	5.6	9.5	..	..	..	..
Netherlands	64.8	91.2	..	0.1	13.7	29.9	38.4	3.9	39.8	57.0	6.5	4.2
New Zealand	22.6	37.6	83.6	64.9	1.9	3.9	0.2	0.0	7.5	23.2	..	..
Nicaragua	1.1	2.3	51.3	13.1	..	..	45.3	73.8	..	..	..	..
Niger	..	..	..	..	..	..	..	..	..	..	..	..
Nigeria	7.1	15.7	39.0	35.6	0.4	..	45.1	24.6	15.5	39.8	..	..
Norway	83.8	116.1	99.8	99.4	0.0	0.2	0.1	0.0	..	0.2	..	..
Oman	0.8	8.2	..	..	..	..	21.5	16.6	78.5	83.4	..	..
Pakistan	15.0	62.2	58.2	35.5	0.2	0.7	1.1	38.2	40.5	25.0	0.0	0.6
Panama	2.0	4.4	49.4	48.7	..	..	48.4	50.7	..	..	..	..
Papua New Guinea	..	..	..	..	..	..	..	..	..	..	..	..
Paraguay	0.8	50.9	80.0	99.9	..	..	11.1	0.0	..	..	..	..
Peru	10.0	18.6	69.8	74.3	..	..	27.4	21.0	1.7	4.0	..	..
Philippines	18.0	41.2	19.6	12.3	1.0	22.9	67.9	43.1	..	0.1	..	..
Poland	120.9	140.8	1.9	1.6	94.7	96.3	2.9	1.3	0.1	0.2	..	..
Portugal	15.2	38.9	52.7	33.4	2.3	31.0	42.9	27.5	..	5.2	..	..
Puerto Rico	..	..	..	..	..	..	..	..	..	..	..	..
Romania	67.5	53.5	18.7	35.3	31.4	28.0	9.6	7.7	40.2	19.0	..	9.9
Russian Federation	804.9	826.2	16.1	19.2	..	19.4	77.2	6.1	..	42.7	6.7	12.6

| | Electricity production | | Sources of electricity[a] | | | | | | | | | |
| | billion kwh | | Hydropower % | | Coal % | | Oil % | | Gas % | | Nuclear power % | |
	1980	1998	1980	1998	1980	1998	1980	1998	1980	1998	1980	1998
Rwanda	..	..	..	..	..	..	..	..	..	..	..	..
Saudi Arabia	20.5	116.5	..	..	..	..	58.5	62.8	41.5	37.2	..	..
Senegal	0.6	1.3	..	..	..	..	100.0	94.9	..	5.1	..	..
Sierra Leone	..	..	..	..	..	..	..	..	..	..	..	..
Singapore	7.0	28.6	..	..	..	..	100.0	82.1	..	17.0	..	..
Slovak Republic	20.0	25.2	11.3	17.1	37.9	23.5	17.9	4.9	10.2	9.4	22.7	45.2
Slovenia	8.0	13.7	..	25.1	..	35.5	..	2.6	..	0.1	..	36.7
South Africa	99.0	202.8	1.0	0.7	99.0	92.6	0.0	..	..	..	..	6.7
Spain	109.2	193.5	27.1	17.6	30.0	32.6	35.2	9.0	2.7	8.4	4.7	30.5
Sri Lanka	1.7	5.7	88.7	68.9	..	..	11.3	31.1	..	..	..	..
Sudan	0.8	2.0	70.0	53.0	..	..	30.0	47.0	..	..	..	..
Sweden	96.3	158.2	61.1	47.0	0.2	2.0	10.4	2.1	..	0.3	27.5	46.5
Switzerland	48.2	61.7	68.1	54.2	0.1	..	1.0	0.6	0.6	1.4	29.8	41.9
Syrian Arab Republic	4.0	18.3	64.7	41.1	..	..	31.9	26.4	3.4	32.4	..	..
Tajikistan	13.6	14.4	93.4	98.1	..	..	6.6	..	..	1.9	..	..
Tanzania	0.8	2.2	86.4	96.5	..	..	13.6	3.5	..	..	..	..
Thailand	14.4	90.1	8.8	5.7	9.8	18.3	81.4	20.7	9.9	51.7	..	..
Togo	..	..	..	..	..	..	..	..	..	..	..	..
Trinidad and Tobago	2.0	5.2	..	..	..	..	2.3	..	96.5	99.7	..	..
Tunisia	2.9	9.1	0.8	0.8	..	..	64.5	14.5	34.7	84.7	..	..
Turkey	23.3	111.0	48.8	38.0	25.6	32.1	25.1	7.1	..	22.4	..	..
Turkmenistan	6.7	9.4	0.1	0.1	..	..	99.9	..	..	99.9	..	..
Uganda	..	..	..	..	..	..	..	..	..	..	..	..
Ukraine	236.0	172.8	5.7	9.2	..	26.5	88.3	4.0	..	16.8	6.0	43.5
United Arab Emirates	6.3	33.4	..	..	..	..	3.7	7.9	96.3	92.1	..	..
United Kingdom	284.1	356.6	1.4	1.5	73.2	34.5	11.7	1.6	0.7	32.5	13.0	28.1
United States	2,427.3	3,803.7	11.5	7.7	51.2	52.7	10.8	3.9	15.3	14.7	11.0	18.8
Uruguay	4.6	9.6	76.3	95.7	..	..	23.5	4.0	..	..	..	..
Uzbekistan	33.9	45.9	..	12.5	..	4.1	..	11.9	..	71.5	..	..
Venezuela, RB	35.8	80.9	40.7	71.6	..	..	32.4	3.3	26.9	25.1	..	..
Vietnam	3.6	21.7	41.8	51.2	39.9	16.1	18.3	16.9	0.4	15.9	..	..
West Bank and Gaza	..	..	..	..	..	..	..	..	..	..	..	..
Yemen, Rep.	0.5	2.5	..	..	..	..	100.0	100.0	..	..	..	..
Yugoslavia, FR (Serb./Mont.)	..	..	..	..	..	..	..	..	..	..	..	..
Zambia	9.5	7.9	98.8	99.5	0.7	0.5	0.5	0.0	..	..	..	..
Zimbabwe	4.5	6.6	88.3	28.5	11.7	71.5	..	..	..	..	..	..
World	**8,176.6 s**	**14,223.4 s**	**20.4 w**	**17.8 w**	**33.2 w**	**38.4 w**	**28.3 w**	**8.9 w**	**8.8 w**	**16.2 w**	**8.7 w**	**17.2 w**
Low income	547.8	1,037.4	25.0	22.5	11.5	43.5	57.8	8.4	1.7	16.6	3.9	8.6
Middle income	2,227.4	4,544.3	21.7	23.4	23.1	37.9	47.1	12.1	4.6	18.9	3.2	6.9
Lower middle income	1,511.1	2,883.7	18.7	21.1	15.1	41.2	58.6	9.8	3.2	22.0	4.0	5.3
Upper middle income	716.3	1,660.7	28.0	27.3	39.8	32.2	22.9	16.1	7.4	13.7	1.4	9.7
Low & middle income	2,775.2	5,581.8	22.4	23.2	20.8	39.0	49.2	11.4	4.0	18.5	3.3	7.2
East Asia & Pacific	393.8	1,697.6	17.8	14.7	47.1	61.2	33.4	7.9	0.3	9.2	0.9	6.1
Europe & Central Asia	1,640.1	1,715.3	13.5	18.0	13.6	30.3	65.4	6.6	2.3	30.0	5.1	14.9
Latin America & Carib.	360.7	891.3	60.3	61.2	2.1	4.7	25.7	18.4	9.8	11.3	0.6	2.2
Middle East & N. Africa	104.6	431.2	20.4	7.1	1.0	1.8	52.5	43.2	26.2	47.9	..	..
South Asia	138.5	575.9	41.6	19.3	44.1	64.7	6.3	5.3	5.9	8.7	2.2	2.1
Sub-Saharan Africa	137.6	270.4	23.3	18.3	71.7	71.2	4.2	2.9	0.8	2.4	..	5.0
High income	5,401.4	8,641.6	19.4	14.2	39.5	38.0	17.6	7.2	11.3	14.8	11.5	23.6
Europe EMU	1,242.9	1,866.0	17.0	11.9	37.2	27.4	22.9	9.0	10.0	12.8	11.9	36.5

a. Shares may not sum to 100 percent because other sources of generated electricity (such as geothermal, solar, and wind) are not shown.

Sources of electricity | 3.9

Use of energy in general, and access to electricity in particular, are important in improving people's standard of living. But electricity generation also can damage the environment. Whether such damage occurs depends largely on how electricity is generated. For example, burning coal releases twice as much carbon dioxide—a major contributor to global warming—as does burning an equivalent amount of natural gas (see *About the data* for table 3.8). Nuclear energy does not generate carbon dioxide emissions, but it produces other dangerous waste products. The table provides information on electricity production by source. Shares may not sum to 100 percent because some sources of generated electricity (such as geothermal, solar, and wind) are not shown.

The International Energy Agency (IEA) compiles data on energy inputs used to generate electricity. IEA data for non-OECD countries are based on national energy data adjusted to conform with annual questionnaires completed by OECD member governments. In addition, estimates are sometimes made to complete major aggregates from which key data are missing, and adjustments are made to compensate for differences in definitions. The IEA makes these estimates in consultation with national statistical offices, oil companies, electricity utilities, and national energy experts.

The IEA occasionally revises its time series to reflect political changes. Since 1990, for example, it has constructed energy statistics for countries of the former Soviet Union. In addition, energy statistics for other countries have undergone continuous changes in coverage or methodology as more detailed energy accounts have become available in recent years. Breaks in series are therefore unavoidable.

Figure 3.9

The gap in electricity production is widening

Electricity production per capita
(thousands of kilowatt-hours)
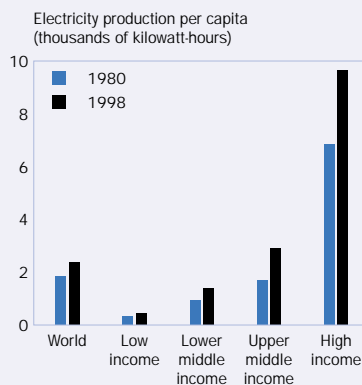
Source: Tables 2.1 and 3.9.

Electricity production per person in high-income countries was 20 times as much as in low-income countries in 1980—and 22 times as much in 1998.

• **Electricity production** is measured at the terminals of all alternator sets in a station. In addition to hydropower, coal, oil, gas, and nuclear power generation, it covers generation by geothermal, solar, wind, and tide and wave energy, as well as that from combustible renewables and waste. Production includes the output of electricity plants designed to produce electricity only as well as that of combined heat and power plants. • **Sources of electricity** refer to the inputs used to generate electricity: hydropower, coal, oil, gas, and nuclear power. Hydropower refers to electricity produced by hydroelectric power plants, oil refers to crude oil and petroleum products, gas refers to natural gas but not natural gas liquids, and nuclear power refers to electricity produced by nuclear power plants.

The data on electricity production are from the IEA's electronic files and its annual publications, *Energy Statistics and Balances of Non-OECD Countries, Energy Statistics of OECD Countries,* and *Energy Balances of OECD Countries.*

	Urban population				Population in urban agglomerations of more than one million			Population in largest city		Access to improved sanitation facilities			
	millions		% of total population		% of total population			% of urban population		Urban % of population		Rural % of population	
	1980	1999	1980	1999	1980	2000	2015	1980	2000	1990	2000	1990	2000
Albania	0.9	1.4	34	41	..	..	..	..	..	..	..	..	..
Algeria	8.1	17.8	44	60	8	6	7	17	10	..	90	..	47
Angola	1.5	4.1	21	34	13	21	26	63	62	..	70	..	30
Argentina	23.3	32.8	83	90	42	41	40	43	38	..	89	..	48
Armenia	2.0	2.7	66	70	34	34	35	51	48	..	..	..	..
Australia	12.6	16.1	86	85	61	56	55	26	23	100	100	100	100
Austria	4.9	5.2	65	65	27	26	26	42	40	100	100	100	100
Azerbaijan	3.3	4.5	53	57	26	24	25	48	42	..	..	..	..
Bangladesh	12.5	30.6	14	24	6	13	18	26	39	78	82	27	44
Belarus	5.4	7.1	57	71	14	18	20	24	25	..	..	..	..
Belgium	9.4	9.9	95	97	12	11	11	13	11	..	..	..	..
Benin	0.9	2.5	27	42	..	..	..	..	..	46	46	6	6
Bolivia	2.4	5.0	46	62	14	18	20	30	27	77	82	28	38
Bosnia and Herzegovina	1.5	1.7	36	43	..	..	..	..	..	..	..	..	..
Botswana	0.1	0.8	15	50	..	..	..	..	..	84	..	44	..
Brazil	80.5	135.6	66	81	32	34	34	16	13	84	85	37	40
Bulgaria	5.4	5.7	61	69	12	15	16	20	21	..	100	..	100
Burkina Faso	0.6	2.0	9	18	..	..	..	44	54	88	88	14	16
Burundi	0.2	0.6	4	9	..	..	..	..	..	67	79	90	..
Cambodia	0.8	1.8	12	16	..	..	..	44	51	..	58	..	10
Cameroon	2.7	7.1	31	48	11	21	27	19	23	99	99	79	85
Canada	18.6	23.5	76	77	32	37	38	16	20	100	100	99	99
Central African Republic	0.8	1.4	35	41	..	..	..	..	..	43	43	23	23
Chad	0.8	1.8	19	23	..	..	..	40	57	70	81	4	13
Chile	9.0	12.8	81	85	33	36	37	41	43	98	98	93	93
China	192.3	396.4	20	32	13	14	17	6	3	57	68	18	24
Hong Kong, China	4.6	6.7	92	100	91	100	100	100	100	..	..	..	..
Colombia	18.2	30.5	64	73	26	32	35	20	20	95	97	53	51
Congo, Dem. Rep.	7.8	14.9	29	30	8	10	12	28	33	..	53	..	6
Congo, Rep.	0.7	1.8	41	62	27	42	46	65	67	..	14	..	..
Costa Rica	1.0	1.7	43	48	..	..	..	61	52	..	98	..	96
Côte d'Ivoire	2.8	7.1	35	46	15	21	26	44	47	78	..	30	..
Croatia	2.3	2.6	50	57	..	..	..	28	41	72	..	28	..
Cuba	6.6	8.4	68	75	20	20	20	29	27	..	96	..	91
Czech Republic	7.6	7.7	75	75	12	12	12	15	16	..	..	..	..
Denmark	4.3	4.5	84	85	27	26	26	32	30	..	..	..	..
Dominican Republic	2.9	5.4	51	64	34	60	65	50	65	66	75	52	64
Ecuador	3.7	8.0	47	64	23	32	37	29	29	..	70	..	37
Egypt, Arab Rep.	17.9	28.2	44	45	23	23	24	38	37	96	98	80	91
El Salvador	1.9	2.8	42	46	16	22	25	39	48	..	88	..	78
Eritrea	0.3	0.7	14	18	..	..	..	..	..	..	66	..	1
Estonia	1.0	1.0	70	69	..	..	..	..	..	..	93	..	..
Ethiopia	4.0	10.8	11	17	3	4	6	30	23	58	58	6	6
Finland	2.9	3.4	60	67	13	23	25	22	33	100	100	100	100
France	39.5	44.2	73	75	21	21	20	23	22	..	..	..	..
Gabon	0.3	1.0	50	80	..	..	..	..	..	..	25	..	4
Gambia, The	0.1	0.4	20	32	..	..	..	..	..	..	41	..	35
Georgia	2.6	3.3	52	60	22	24	26	42	40	..	..	..	..
Germany	64.7	71.7	83	87	39	41	43	10	9	..	..	..	..
Ghana	3.4	7.1	31	38	9	10	14	30	27	59	62	61	64
Greece	5.6	6.3	58	60	31	30	30	54	49	..	..	..	..
Guatemala	2.6	4.4	37	40	11	28	32	29	70	94	98	66	76
Guinea	0.9	2.3	19	32	12	25	32	65	75	94	94	41	41
Guinea-Bissau	0.1	0.3	17	23	..	..	..	..	..	..	88	..	34
Haiti	1.3	2.7	24	35	13	22	29	55	62	48	50	15	16
Honduras	1.2	3.3	35	52	..	..	..	33	28	85	94	..	57

Urbanization | 3.10

	Urban population				Population in urban agglomerations of more than one million			Population in largest city		Access to improved sanitation facilities			
	millions		% of total population		% of total population			% of urban population		Urban % of population		Rural % of population	
	1980	1999	1980	1999	1980	2000	2015	1980	2000	1990	2000	1990	2000
Hungary	6.1	6.4	57	64	19	18	19	34	28	100	100	98	98
India	158.8	280.1	23	28	8	10	12	5	6	58	73	8	14
Indonesia	32.9	82.5	22	40	8	10	12	18	13	76	87	44	52
Iran, Islamic Rep.	19.7	39.7	50	63	21	23	23	26	18	86	86	74	74
Iraq	8.5	17.4	66	76	29	31	34	39	27	..	93	..	31
Ireland	1.9	2.2	55	59	..	..	..	48	44	..	..	..	..
Israel	3.4	5.6	89	91	37	35	33	41	38	..	..	..	..
Italy	37.6	38.6	67	67	24	19	21	14	11	..	..	..	..
Jamaica	1.0	1.4	47	56	..	..	..	..	..	..	98	..	65
Japan	89.0	99.6	76	79	34	38	39	25	26	..	..	..	..
Jordan	1.3	3.5	60	74	29	29	32	49	39	100	100	95	98
Kazakhstan	8.0	8.4	54	56	6	8	8	12	15	..	100	..	98
Kenya	2.7	9.5	16	32	5	8	10	32	23	94	96	81	81
Korea, Dem. Rep.	10.1	14.0	57	60	10	14	15	18	22	..	99	..	100
Korea, Rep.	21.7	38.0	57	81	40	47	45	38	26	..	76	..	4
Kuwait	1.2	1.9	90	97	60	60	53	67	61	100	..	100	..
Kyrgyz Republic	1.4	1.6	38	34	..	..	..	..	..	83	100	..	100
Lao PDR	0.4	1.2	13	23	..	..	..	..	..	..	84	..	34
Latvia	1.7	1.7	68	69	..	..	..	49	46	93	..	..	..
Lebanon	2.2	3.8	74	89	40	47	48	55	53	..	100	..	87
Lesotho	0.2	0.6	13	27	..	..	..	..	..	..	93	..	92
Libya	2.1	4.7	69	87	26	33	32	38	38	97	97	96	96
Lithuania	2.1	2.5	61	68	..	..	..	..	..	..	..	..	..
Macedonia, FYR	1.0	1.2	54	62	..	..	..	..	..	..	..	..	..
Madagascar	1.6	4.4	18	29	6	10	13	33	33	70	70	25	30
Malawi	0.6	2.5	9	24	..	..	..	..	..	96	96	70	70
Malaysia	5.8	12.9	42	57	7	6	6	16	10	..	..	..	98
Mali	1.2	3.1	19	29	..	..	..	40	35	95	93	62	58
Mauritania	0.4	1.5	27	56	..	..	..	..	..	44	44	19	19
Mauritius	0.4	0.5	42	41	..	..	..	..	..	100	100	100	99
Mexico	44.8	71.7	66	74	28	28	25	31	25	85	87	28	32
Moldova	1.6	2.0	40	46	..	..	..	..	..	..	100	..	..
Mongolia	0.9	1.5	52	63	..	..	..	..	..	..	46	..	2
Morocco	8.0	15.6	41	55	15	18	20	26	22	95	100	31	42
Mozambique	1.6	6.7	13	39	6	17	21	47	43	..	69	..	26
Myanmar	8.1	12.3	24	27	7	9	11	27	33	65	65	38	39
Namibia	0.2	0.5	23	30	..	..	..	..	..	84	96	14	17
Nepal	0.9	2.7	7	12	..	..	..	..	..	68	75	16	20
Netherlands	12.5	14.1	88	89	14	14	14	8	8	100	100	100	100
New Zealand	2.6	3.3	83	86	..	..	..	30	34	100	..	..	..
Nicaragua	1.5	2.7	50	56	..	..	..	36	34	97	96	53	68
Niger	0.7	2.1	13	20	..	..	..	..	..	71	79	4	5
Nigeria	19.1	53.4	27	43	8	12	15	23	24	77	85	51	45
Norway	2.9	3.4	71	75	..	..	..	22	29	100	..	..	..
Oman	0.3	1.9	32	82	..	..	..	..	..	98	98	61	61
Pakistan	23.2	49.1	28	36	15	21	25	22	23	78	94	13	42
Panama	1.0	1.6	50	56	..	..	..	62	71	100	99	68	87
Papua New Guinea	0.4	0.8	13	17	..	..	..	..	..	92	92	80	80
Paraguay	1.3	3.0	42	55	22	23	26	52	41	92	95	87	95
Peru	11.2	18.3	65	72	25	29	30	39	40	81	90	26	40
Philippines	18.1	42.8	38	58	14	16	17	33	25	85	92	64	71
Poland	20.7	25.2	58	65	18	18	18	16	14	..	..	..	..
Portugal	2.9	6.3	29	63	19	57	68	46	59	..	..	..	..
Puerto Rico	2.1	2.9	67	75	34	35	36	51	47	..	..	..	..
Romania	10.9	12.6	49	56	9	9	10	18	16	..	86	..	10
Russian Federation	97.0	113.1	70	77	18	19	21	8	8	..	..	..	..

	Urban population				Population in urban agglomerations of more than one million			Population in largest city		Access to improved sanitation facilities			
	millions		% of total population		% of total population			% of urban population		Urban % of population		Rural % of population	
	1980	1999	1980	1999	1980	2000	2015	1980	2000	1990	2000	1990	2000
Rwanda	0.2	0.5	5	6	..	..	..	..	..	..	12	..	8
Saudi Arabia	6.2	17.2	66	85	19	25	24	16	19	*100*	100	..	100
Senegal	2.0	4.3	36	47	17	22	26	48	46	86	94	38	48
Sierra Leone	0.8	1.8	24	36	..	..	..	..	..	..	23	..	31
Singapore	2.3	3.9	100	100	100	100	100	100	100	100	100	..	..
Slovak Republic	2.6	3.1	52	57	..	..	..	..	..	..	100	..	100
Slovenia	0.9	1.0	48	50	..	..	..	..	..	100	..	..	..
South Africa	13.3	21.1	48	50	27	32	36	12	14	..	99	..	73
Spain	27.2	30.5	73	77	20	17	18	16	13	..	..	..	..
Sri Lanka	3.2	4.4	22	23	..	..	..	..	..	93	91	79	83
Sudan	3.7	10.2	20	35	6	9	11	31	25	87	87	48	48
Sweden	6.9	7.4	83	83	17	18	19	20	21	100	100	100	100
Switzerland	3.6	4.8	57	68	..	..	..	20	20	100	100	100	100
Syrian Arab Republic	4.1	8.5	47	54	28	28	31	34	27	..	98	..	81
Tajikistan	1.4	1.7	34	28	..	..	..	..	..	..	..	..	..
Tanzania	2.7	10.4	15	32	5	12	18	30	25	97	98	86	86
Thailand	7.9	12.8	17	21	10	12	15	59	56	97	97	83	96
Togo	0.6	1.5	23	33	..	..	..	..	..	71	69	24	17
Trinidad and Tobago	0.7	1.0	63	74	..	..	..	..	..	*100*	..	97	..
Tunisia	3.3	6.1	52	65	18	20	21	35	30	97	..	48	..
Turkey	19.5	47.7	44	74	19	27	30	23	19	98	98	70	70
Turkmenistan	1.3	2.1	47	45	..	..	..	..	..	..	..	..	..
Uganda	1.1	3.0	9	14	..	..	..	42	39	96	96	82	72
Ukraine	30.9	33.9	62	68	14	15	17	7	8	..	..	..	..
United Arab Emirates	0.7	2.4	72	85	..	..	..	31	37	*100*	..	77	..
United Kingdom	50.0	53.2	89	89	25	23	23	15	14	100	100	100	100
United States	167.6	214.2	74	77	38	38	37	9	8	100	100	100	100
Uruguay	2.5	3.0	85	91	42	37	35	49	41	..	96	..	89
Uzbekistan	6.5	9.1	41	37	11	9	8	28	23	..	100	..	100
Venezuela, RB	12.0	20.5	79	87	28	29	30	21	15	..	75	..	69
Vietnam	10.3	15.2	19	20	14	13	14	34	30	86	86	70	70
West Bank and Gaza	..	..	..	..	..	..	..	..	..	..	..	..	..
Yemen, Rep.	1.6	4.2	19	24	..	..	..	15	30	80	87	27	31
Yugoslavia, FR (Serb./Mont.)	4.5	5.5	46	52	11	14	15	24	27	..	..	..	..
Zambia	2.3	3.9	40	40	9	16	22	23	37	86	99	48	64
Zimbabwe	1.6	4.1	22	35	9	14	20	39	41	98	99	51	51
World	**1,748.5 s**	**2,776.6 s**	**39 w**	**46 w**	**.. w**	**.. w**	**.. w**	**18 w**	**17 w**	**78 w**	**84 w**	**29 w**	**36 w**
Low income	389.7	760.0	24	31	..	..	..	16	18	68	79	25	31
Middle income	775.8	1,328.1	38	50	..	..	..	19	16	75	82	29	38
Lower middle income	506.2	897.0	31	43	..	..	..	16	14	70	80	29	36
Upper middle income	269.6	431.2	64	75	..	..	..	25	21	..	87	..	54
Low & middle income	1,165.5	2,088.1	32	41	..	..	..	18	17	72	81	27	34
East Asia & Pacific	310.2	633.0	22	34	..	..	..	15	10	63	74	28	35
Europe & Central Asia	249.3	315.5	59	67	..	..	..	15	15	..	..	..	..
Latin America & Carib.	233.5	380.7	65	75	29	32	32	27	25	85	87	39	49
Middle East & N. Africa	83.8	169.0	48	58	21	22	23	30	25	92	94	63	67
South Asia	201.2	372.7	22	28	8	12	14	9	12	63	76	12	21
Sub-Saharan Africa	87.5	217.3	23	34	..	..	..	28	29	80	81	47	41
High income	583.0	688.5	75	77	..	..	..	17	17	..	..	..	..
Europe EMU	204.5	227.8	74	78	26	27	28	16	15	..	..	..	..

Urbanization | 3.10

About the data

The population of a city or metropolitan area depends on the boundaries chosen. For example, in 1990 Beijing, China, contained 2.3 million people in 87 square kilometers of "inner city" and 5.4 million in 158 square kilometers of "core city." The population of "inner city and inner suburban districts" was 6.3 million, and that of "inner city, inner and outer suburban districts, and inner and outer counties" was 10.8 million. (For most countries, the last definition is used.)

Estimates of the world's urban population would change significantly if China, India, and a few other populous nations were to change their definition of urban centers. According to China's State Statistical Bureau, by the end of 1996 urban residents accounted for about 43 percent of China's population, while in 1994 only 20 percent of the population was considered urban. Besides the continuous migration of people from rural to urban areas, one of the main reasons for this shift was the rapid growth in the hundreds of towns reclassified as cities in recent years. Because the estimates in the table are based on national definitions of what constitutes a city or metropolitan area, cross-country comparisons should be made with caution.

To estimate urban populations, the United Nations' ratios of urban to total population were applied to the World Bank's estimates of total population (see table 2.1).

The urban population with access to improved sanitation facilities is defined as those with access to at least adequate excreta disposal facilities that can effectively prevent human, animal, and insect contact with excreta. The rural population with access is included to allow comparison of rural and urban access. This definition and the definition of urban areas vary, however, so comparisons between countries can be misleading (see *Definitions* for table 2.16).

Definitions

• **Urban population** is the midyear population of areas defined as urban in each country and reported to the United Nations (see *About the data*). • **Population in urban agglomerations of more than one million** is the percentage of a country's population living in metropolitan areas that in 1990 had a population of more than one million. • **Population in largest city** is the percentage of a country's urban population living in that country's largest metropolitan area. • **Access to improved sanitation facilities** refers to the percentage of the urban or rural population with access to at least adequate excreta disposal facilities (private or shared, but not public) that can effectively prevent human, animal, and insect contact with excreta. Improved facilities range from simple but protected pit latrines to flush toilets with a sewerage connection. To be effective, facilities must be correctly constructed and properly maintained.

Data sources

The data on urban population and the population in urban agglomerations and in the largest city come from the United Nations Population Division's *World Urbanization Prospects: The 1999 Revision.* The total population figures are World Bank estimates. The data on access to sanitation in urban and rural areas are from the World Health Organization.

Figure 3.10

Most without access to improved sanitation facilities live in Asia
Population without access to improved sanitation facilities

1990

Rural
Total: 1,946 million
Europe 0%
Latin America & Caribbean 4%
Africa 11%
Asia 85%

Urban
Total: 415 million
Europe 0%
Latin America & Caribbean 11%
Africa 7%
Asia 82%

2000

Rural
Total: 2,000 million
Europe 2%
Latin America & Caribbean 3%
Africa 13%
Asia 82%

Urban
Total: 403 million
Europe 2%
Latin America & Caribbean 13%
Africa 11%
Asia 74%
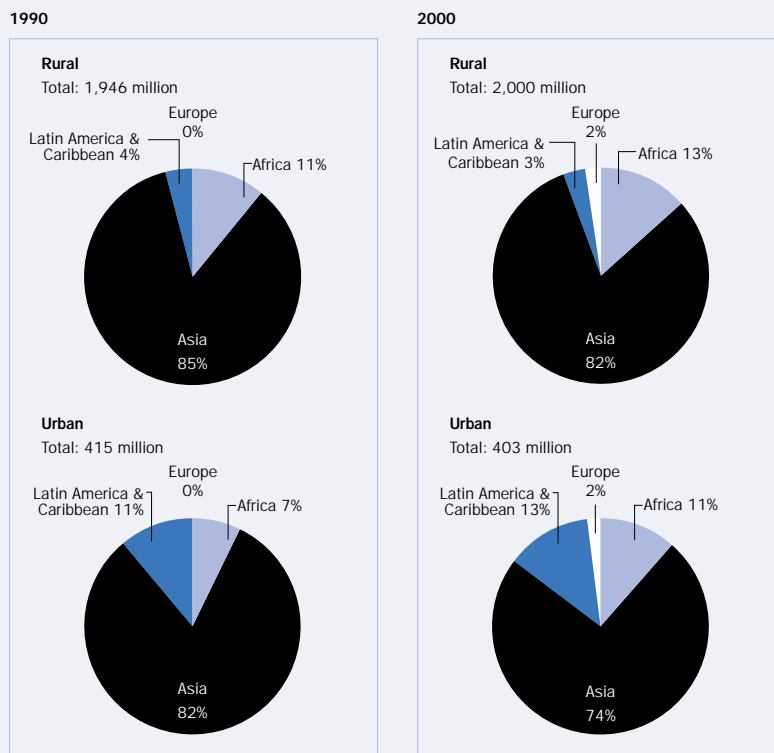
Source: World Health Organization data.

Many more people gained access to improved sanitation facilities between 1990 and 2000—the number with access rose from 2.9 billion to 3.7 billion. But 2.4 billion still lack access, most of them in Asia. To reach the target of universal coverage by 2025, additional sanitation services will need to be provided for more than 4 billion people.

3.11 Urban environment

	City	Urban population	Average house-hold income	House price to income ratio	Work trips by public trans-portation	Travel time to work	Households with access to services				Wastewater treated
							Potable water %	Sewerage connection %	Electricity %	Telephone %	
		thousands 1998	$ 1998a	1998a	% 1998a	minutes 1998a	1998a	1998a	1998a	1998a	% 1998a
Algeria	Algiers	2,562	..	..	..	75	..	..	..	..	80
Argentina	Buenos Aires	2,996	13,026	5.1	59	42	100	98	100	70	0
	Córdoba	132	6,448	6.8	44	32	99	40	99	80	49
	Rosario	1,248	7,500	5.7	..	22	98	67	93	76	1
Armenia	Yerevan	1,250	1,205	4.0	84	30	98	98	100	88	36
Bangladesh	Chittagong	2,301	1,875	8.1	27	45	44	..	95	0	0
	Dhaka	10,000	1,920	16.7	9	45	60	22	90	7	..
	Sylhet	242	1,584	6.0	10	50	29	0	93	40	0
	Tangail	152	1,500	13.9	..	30	12	0	90	12	0
Barbados	Bridgetown	..	17,179	4.4	..	..	98	5	99	78	7
Belize	Belize City	55	660	..	..	..	..	..	..	..	..
Bolivia	Santa Cruz de la Sierra	1,065 b	2,987	29.3	..	29	53	33	98	59	53
Bosnia and Herzegovina	Sarajevo	522 b	..	..	100	12	95	90	100	..	..
Brazil	Belém	1,638 b	..	..	..	..	..	..	..	..	..
	Icapui	..	1,357	4.5	..	30	88	..	90	33	..
	Maranguape	..	..	..	30	20	73	..	..	..	..
	Porto Alegre	3	..	..	..	..	99	87	100	..	..
	Recife	3,088	4,115	12.5	46	35	89	41	100	29	33
	Rio de Janeiro	10,192	..	..	..	..	88	80	10	..	..
	Santo André	1,658	1,516	23.4	43	40	98	95	100	79	..
Bulgaria	Bourgas	..	1,815	5.1	61	32	100	93	100	..	93
	Sofia	1,200	1,518	13.2	79	32	95	91	100	89	94
	Troyan	24	2,492	3.7	44	22	99	82	100	45	..
	Veliko Tarnovo	..	2,243	5.4	46	30	98	98	100	96	50
Burkina Faso	Bobo-Dioulasso	..	..	..	..	..	24	..	29	6	..
	Koudougou	..	..	..	..	..	30	..	26	7	0
	Ouagadougou	1,130 b	..	..	2	..	30	..	47	11	19
Burundi	Bujumbura	373	1,342	..	48	25	26	62	57	19	21
Cambodia	Phnom Penh	1,000	3,584	8.9	0	45	45	75	76	40	0
Cameroon	Douala	1,148	850	13.4	..	40	34	1	95	9	5
	Yaoundé	968	..	..	42	45	34	1	95	9	24
Canada	Hull	254	..	..	16	..	100	100	100	100	100
Central African Rep.	Bangui	..	167	..	66	60	31	..	18	11	0
Chad	N'Djamena	998 b	..	..	35	..	42	0	13	6	21
Chile	Gran Concepción	..	..	..	57	35	100	91	95	69	6
	Santiago de Chile	5,737	..	..	60	38	100	99	99	73	3
	Tome	..	..	..	..	..	92	52	98	58	57
	Valparaiso	851	..	..	55	..	98	92	97	63	100
	Viña del Mar	851	..	..	..	..	97	97	98	65	93
Colombia	Armenia	..	3,429	5.0	42	60	90	50	99	97	0
	Marinilla	170	1,848	8.5	18	15	98	93	100	65	..
	Medellín	2,901	..	..	38	35	100	99	100	87	..
Congo, Dem. Rep.	Kinshasa	5,398	..	..	72	57	72	0	66	1	..
Congo, Rep.	Brazzaville	989	..	..	55	20	56	0	52	18	..
Côte d'Ivoire	Abidjan	3,201	3,440	14.5	..	45	26	15	41	5	45
Croatia	Zagreb	1,164	7,674	7.8	56	31	98	97	100	94	..
Cuba	Baracoa	..	..	..	..	..	83	3	93	32	..
	Camagüey	..	..	..	2	60	72	47	97	..	..
	Cienfuegos	..	1,848	4.0	..	80	100	73	100	9	2
	Havana	..	1,800	8.5	58	83	100	85	100	14	..
	Pinar del Río	..	..	..	..	80	97	48	100	..	..
	Santa Clara	..	..	..	7	48	95	42	100	43	..
Czech Republic	Brno	..	..	..	50	25	100	96	100	69	100
	Prague	1,193	6,880	..	55	22	99	100	100	100	..
Dominican Republic	Santiago de los Caballeros	691	..	..	..	30	75	80	..	71	80
Ecuador	Ambato	286	..	..	..	..	90	81	91	87	0

Urban environment | 3.11

	City	Urban population	Average house-hold income	House price to income ratio	Work trips by public trans-portation	Travel time to work	Households with access to services				Wastewater treated
							Potable water	Sewerage connection	Electricity	Telephone	
		thousands 1998	$ 1998[a]	1998[a]	% 1998[a]	minutes 1998[a]	% 1998[a]	% 1998[a]	% 1998[a]	% 1998[a]	% 1998[a]
	Cuenca	..	2,160	4.6	..	25	97	92	97	48	82
	Guayaquil	2,317	5,391	3.4	89	45	70	42	..	44	9
	Manta	126	..	..	..	30	70	52	98	40	..
	Puyo	40	3,972	2.1	..	15	80	30	90	60	..
	Quito	1,531	3,760	2.4	..	33	85	70	96	55	..
	Tena	..	960	6.3	..	5	80	60	..	..	0
El Salvador	San Salvador	1,863	6,080	3.5	..	..	82	80	98	70	..
Estonia	Riik	..	..	..	..	..	92	90	98	55	..
	Tallin	397 [b]	5,825	6.4	..	35	98	98	100	86	100
Gabon	Libreville	523 [b]	375	..	80	30	55	0	95	45	44
Gambia, The	Banjul	50	900	11.4	55	22	23	12	24	..	..
Georgia	Tbilisi	1,310 [b]	915	9.4	..	..	..	98	100	58	0
Ghana	Accra	1,500	825	14.0	54	21	..	..	..	..	0
	Kumasi	780	795	13.7	51	21	65	..	95	51	..
Guatemala	Quezaltenango	333	4,645	4.3	..	15	60	55	80	40	..
Guinea	Conakry	1,824 [b]	..	..	26	45	30	32	54	6	..
Indonesia	Jakarta	9,489	1,366	14.6	..	..	50	65	99	..	16
	Semarang	1,076	756	..	..	..	34	..	85	..	0
	Surabaya	2,373	1,167	3.4	18	35	41	56	89	71	0
Iraq	Baghdad	4,797 [b]	..	..	..	..	..	..	..	..	..
Italy	Aversa	..	..	..	..	..	..	..	..	..	90
Jamaica	Kingston	655 [b]	..	..	..	..	97	..	88	..	20
	Montego Bay	..	..	..	..	..	78	..	86	..	15
Jordan	Amman	1,621	5,801	6.1	21	25	98	81	99	62	54
Kenya	Kisumu	134	1,365	8.5	43	24	38	31	49	..	65
	Mombasa	..	..	..	47	20	..	..	..	..	50
	Nairobi	2,310 [b]	..	..	71	57	89	..	..	..	52
Korea, Rep.	Hanam	124	19,933	3.7	..	..	81	68	100	100	81
	Pusan	3,843	19,933	4.0	39	42	98	69	100	100	69
	Seoul	10,389	23,500	5.7	71	60	100	99	100	..	99
Kuwait	Kuwait City	1,165 [b]	38,700	6.5	21	10	100	98	100	98	..
Kyrgyz Republic	Bishkek	619	..	..	95	35	30	23	100	20	15
Lao PDR	Vientiane	562	1,077	23.2	2	27	87	..	100	87	20
Latvia	Riga	775 [b]	3,206	15.6	..	..	95	93	100	70	..
Lebanon	Sin El Fil	..	7,200	8.3	50	10	80	30	98	80	..
Liberia	Monrovia	651	1,250	28.0	80	60	..	..	..	..	0
Libya	Tripoli	1,773	48,073	0.8	18	20	97	90	99	6	40
Lithuania	Vilnius	578	3,754	20.0	52	37	89	89	100	77	54
Madagascar	Antananarivo	1,507 [b]	..	..	..	..	..	..	..	..	..
Malawi	Lilongwe	765 [b]	..	..	27	5	65	12	50	10	0
Malaysia	Penang	..	3,193	7.2	55	40	99	..	100	98	20
Mauritania	Nouakchott	881 [b]	1,600	5.4	45	50	..	..	..	..	..
Mexico	Ciudad Juarez	1,018	..	..	24	23	89	77	96	45	..
Moldova	Chisinau	..	..	..	80	23	100	95	100	83	71
Mongolia	Ulaanbaatar	627	991	7.8	80	30	60	60	100	90	96
Morocco	Casablanca	3,292	..	..	..	30	83	93	91	..	..
	Rabat	646	..	..	40	20	93	97	52	..	..
Myanmar	Yangon	3,692	..	8.3	69	45	78	81	85	17	0
Nicaragua	Leon	..	..	..	..	15	78	..	84	21	..
Niger	Niamey	731 [b]	..	..	..	30	33	0	51	4	..
Nigeria	Ibadan	1,731 [b]	..	..	46	45	26	12	41	..	..
	Lagos	13,427 [b]	..	..	48	60	..	..	41	..	..
Oman	Muscat	887	..	..	..	20	80	90	89	53	..
Panama	Colón	132	2,820	14.2	..	15	..	..	..	..	0
Paraguay	Asunción	1,262 [b]	13,279	10.7	..	25	46	8	86	17	0
Peru	Cajamarca	..	5,160	3.9	..	20	86	69	81	38	62

	City	Urban population	Average house-hold income	House price to income ratio	Work trips by public trans-portation	Travel time to work	Households with access to services				Wastewater treated
							Potable water	Sewerage connection	Electricity	Telephone	
		thousands **1998**	$ **1998ᵃ**	**1998ᵃ**	% **1998ᵃ**	minutes **1998ᵃ**	% **1998ᵃ**	% **1998ᵃ**	% **1998ᵃ**	% **1998ᵃ**	% **1998ᵃ**
	Huanuco	747	500	30.0	..	20	57	28	80	32	..
	Huaras	54	1,200	6.7	..	15	..	..	71	..	..
	Iquitos	347	3,600	5.6	25	10	73	60	82	62	..
	Lima	7,431	3,179	10.4	82	..	75	71	99	..	4
	Tacna	..	2,000	4.0	..	25	65	58	74	16	64
	Tumbes	..	..	..	..	20	60	35	80	25	..
Philippines	Cebu	2,189	490	13.3	..	35	41	92	80	25	..
Poland	Bydgoszcz	..	4,730	4.3	35	18	95	87	100	85	28
	Gdansk	893 ᵇ	5,200	4.4	56	20	99	94	100	56	100
	Katowice	3,487 ᵇ	7,818	1.7	29	36	99	94	100	75	67
	Poznan	..	6,918	5.8	51	25	95	96	100	86	78
Qatar	Doha	391 ᵇ	..	..	..	..	..	..	..	..	..
Russian Federation	Astrakhan	..	1,614	5.0	66	35	81	79	100	51	92
	Belgorod	..	2,072	4.0	..	25	90	89	100	51	96
	Kostroma	..	1,505	6.9	68	20	88	84	100	46	96
	Moscow	9,321 ᵇ	5,251	5.1	85	62	100	100	100	100	98
	Nizhny Novgorod	1,458 ᵇ	1,811	6.9	79	35	98	98	100	64	98
	Novomoscowsk	..	1,693	4.2	61	25	99	93	100	62	97
	Omsk	1,216 ᵇ	2,346	3.9	86	43	87	87	100	41	89
	Pushkin	..	2,680	9.6	60	15	99	99	100	89	100
	Surgut	..	5,602	4.5	81	57	98	98	100	50	93
	Veliky Novgorod	..	2,420	3.4	75	30	97	97	100	51	95
Rwanda	Kigali	358	2,336	11.4	32	45	36	20	57	6	20
Samoa	Apia	34	3,000	10.0	..	..	60	0	98	96	0
Singapore	Singapore	3,164	27,047	3.1	53	30	100	100	100	100	100
Slovenia	Ljubljana	273	10,320	7.8	20	30	100	100	100	97	98
Spain	Madrid	4,577	..	..	16	32	..	..	..	..	100
	Pamplona	..	..	..	..	..	100	..	100	..	79
Sweden	Amal	13	16,720	2.9	..	..	100	100	100	..	100
	Stockholm	736	21,430	6.0	48	28	100	100	100	..	100
	Umea	104	18,200	5.3	..	16	100	100	100	..	100
Switzerland	Basel	170	42,000	12.3	..	..	100	100	100	99	100
Syrian Arab Republic	Damascus	2,335	1,061	10.3	33	40	98	71	95	10	3
Thailand	Bangkok	5,647	8,521	8.8	28	60	99	100	100	60	..
	Chiang Mai	499	3,384	6.8	5	30	95	60	100	75	70
Togo	Lomé	663	..	..	40	30	..	70	51	18	..
Trinidad and Tobago	Port of Spain	..	..	..	44	..	..	..	..	..	..
Tunisia	Tunis	2,023	6,286	5.0	..	..	75	47	95	27	83
Turkey	Ankara	2,837	4,677	4.5	..	32	97	98	100	..	80
Uganda	Entebbe	65	960	10.4	65	20	48	13	42	0	30
	Jinja	92	650	15.4	49	12	65	43	55	5	30
Uruguay	Montevideo	1,670	14,748	5.6	60	45	98	79	100	75	34
West Bank and Gaza	Gaza	367	4,620	5.4	..	..	85	38	99	38	..
Yemen, Rep.	Aden	1,200	..	..	78	20	..	..	96	..	30
	Sana'a	1,200	..	..	78	20	30	9	96	..	30
Yugoslavia, FR (Serb./Mont.)	Belgrade	1,182	2,922	13.5	72	40	95	86	100	86	20
Zimbabwe	Bulawayo	900	..	..	75	15	100	100	98	..	80
	Chegutu	..	1,445	3.4	20	22	100	68	9	3	69
	Gweru	..	..	..	..	15	100	100	90	61	95
	Harare	1,634	..	..	32	45	100	100	88	42	..
	Mutare	149	..	..	70	20	88	88	74	4	100

a. Data are preliminary. b. Data refer to 2000 and are from the United Nations Population Division's *World Urbanization Prospects: The 1999 Revision.*

Urban environment | 3.11

About the data

Despite the importance of cities and urban agglomerations as home to almost half the world's people, data on many aspects of urban life are sparse. Compiling comparable data has been difficult, and the available indicators have been scattered among international agencies with different mandates. Even within cities it is difficult to assemble an integrated data set. Urban areas are often spread across many jurisdictions, with no single agency responsible for collecting and reporting data for the entire area. Adding to the difficulties of data collection are gaps and overlaps in the data collection and reporting responsibilities of different administrative units. Creating a comprehensive, comparable international data set is further complicated by differences in the definition of an urban area and by uneven data quality.

The United Nations Global Plan of Action calls for monitoring the changing role of the world's cities and human settlements. The international agency with the mandate to assemble information on urban areas is the United Nations Centre for Human Settlements (UNCHS, or Habitat). Its Urban Indicators Programme is intended to provide data for monitoring and evaluating the performance of urban areas and for developing government policies and strategies. These data are collected through questionnaires completed by city officials in more than a hundred countries. The table shows selected indicators for more than 160 cities from the UNCHS data set. A few more indicators are included on the *World Development Indicators* CD-ROM. These data are still preliminary and are undergoing further validation.

The UNCHS selection of cities does not reflect population weights or the economic importance of cities and is therefore biased toward smaller cities. Moreover, it is based on demand for participation in the Urban Indicators Programme. As a result, the database excludes a large number of major cities. The table reflects this bias, as well as the criterion of data availability for the indicators shown in the table.

The data should be used with care. Because different data collection methods and definitions may have been used, comparisons can be misleading. In addition, the definitions used here for urban population and access to potable water are more stringent than those used for tables 3.5 and 3.10 (see *Definitions*).

Table 3.11a

Population of the world's 10 largest metropolitan areas in 1000, 1900, 2000, and 2015
Millions

1000		1900		2000		2015	
City	Population	City	Population	City	Population	City	Population
Cordova	0.45	London	6.5	Tokyo	26.4	Tokyo	26.4
Kaifeng	0.40	New York	4.2	Mexico City	18.1	Mumbai	26.1
Constantinople	0.30	Paris	3.3	Mumbai	18.1	Lagos	23.2
Angkor	0.20	Berlin	2.7	São Paulo	17.8	Dhaka	21.1
Kyoto	0.18	Chicago	1.7	New York	16.6	São Paulo	20.4
Cairo	0.14	Vienna	1.7	Lagos	13.4	Karachi	19.2
Baghdad	0.13	Tokyo	1.5	Los Angeles	13.1	Mexico City	19.2
Nishapur	0.13	St. Petersburg	1.4	Calcutta	12.9	New York	17.4
Hasa	0.11	Manchester	1.4	Shanghai	12.9	Jakarta	17.3
Anhilvada	0.10	Philadelphia	1.4	Buenos Aires	12.6	Calcutta	17.3

Source: O'Meara 1999; and United Nations Population Division 2000.

Definitions

- **Urban population** refers to the population of the urban agglomeration, a contiguous inhabited territory without regard to administrative boundaries. • **Average household income** is the average of the household income in all five quintiles, based on survey data. It is the total income of all household members from all sources, including wages, pensions or benefits, business earnings, rents, and the value of any business or subsistence products consumed (for example, foodstuffs). • **House price to income ratio** is the average house price divided by the average household income. • **Work trips by public transportation** are the percentage of trips to work made by bus or minibus, tram, or train. Buses or minibuses refer to road vehicles other than cars taking passengers on a fare-paying basis. Other means of transport commonly used in developing countries, such as taxi, ferry, rickshaw, or animal, are not included. • **Travel time to work** is the average time in minutes, for all modes, for a one-way trip to work. Train and bus times include average walking and waiting times, and car times include parking and walking to the workplace. • **Households with access to services** are the percentage of households in formal settlements with access to potable water and connections to sewerage, electricity, and telephone. Households with access to potable water are those having access to safe or potable drinking water within 200 meters of the dwelling. Potable water is water that is free from contamination and safe to drink without further treatment. • **Wastewater treated** is the percentage of all wastewater undergoing some form of treatment.

Data sources

The data in the table are from the Global Urban Indicators database of the UNCHS.

3.12 Traffic and congestion

	Motor vehicles				Passenger cars		Two-wheelers		Road traffic		Fuel prices	
	per 1,000 people		per kilometer of road		per 1,000 people		per 1,000 people		million vehicle kilometers		Super $ per liter	Diesel $ per liter
	1990	1999	1990	1999	1990	1999	1990	1999	1990	1999	2000	2000
Albania	11	44	3	8	2	29	3	1	..	..	0.57	0.30
Algeria	..	53	..	14	..	25	..	..	..	..	0.27	0.15
Angola	19	20	..	3	15	18	..	..	..	..	0.30	0.15
Argentina	181	181	27	30	134	140	1	1	43,119	27,458	1.07	0.52
Armenia	..	..	..	..	..	..	..	..	..	..	0.55	0.31
Australia	530	601	11	12	450	485	18	16	138,501	..	0.57	0.57
Austria	421	536	30	22	387	496	71	77	..	..	0.82	0.74
Azerbaijan	52	49	7	14	36	38	5	1	..	..	0.46	0.22
Bangladesh	1	1	0	1	0	0	1	1	..	..	0.46	0.29
Belarus	60	136	13	21	59	135	..	53	10,026	5,462	0.34	0.13
Belgium	423	497	30	34	385	448	14	25	..	158,759	0.96	0.78
Benin	3	8	2	7	2	7	34	44	..	..	0.48	0.39
Bolivia	41	48	6	7	25	29	9	9	1,139	1,730	0.80	0.50
Bosnia and Herzegovina	114	30	24	5	101	27	..	..	..	..	0.68	0.57
Botswana	18	70	3	11	10	30	..	1	..	..	0.42	0.39
Brazil	88	79	8	6	..	..	..	..	..	..	0.92	0.34
Bulgaria	163	266	39	58	146	233	55	63	..	..	0.70	0.58
Burkina Faso	4	6	3	5	2	4	9	10	..	..	0.68	0.46
Burundi	..	..	..	..	..	..	..	..	..	..	1.01	0.71
Cambodia	1	6	0	2	0	5	9	41	314	1,407	0.61	0.44
Cameroon	10	12	3	..	6	7	..	..	..	..	0.56	0.47
Canada	605	581	20	19	468	459	12	11	..	..	0.58	0.47
Central African Republic	1	1	0	0	1	0	0	0	1,494	1,250	0.81	0.65
Chad	2	4	0	1	1	2	0	1	..	..	0.68	0.60
Chile	81	135	13	26	52	88	2	2	..	..	0.64	0.47
China	5	8	4	7	1	3	3	8	..	..	0.40	0.45
Hong Kong, China	66	78	253	276	42	58	4	5	8,192	10,781	1.46	0.80
Colombia	..	51	..	19	..	43	8	12	50,945	41,587	0.49	0.35
Congo, Dem. Rep.	..	..	..	..	..	..	..	..	..	..	1.00	0.93
Congo, Rep.	18	20	3	4	12	14	..	..	..	..	0.53	0.30
Costa Rica	88	138	7	14	56	91	14	23	..	507,796	0.65	0.44
Côte d'Ivoire	24	32	6	9	15	20	..	..	..	..	0.76	0.51
Croatia	..	..	..	..	..	..	..	..	..	..	0.76	0.60
Cuba	37	32	16	6	18	16	19	16	..	..	0.50	0.18
Czech Republic	246	363	46	29	228	335	113	78	..	..	0.77	0.68
Denmark	368	411	27	31	320	352	9	12	36,304	44,845	1.01	0.90
Dominican Republic	74	47	48	30	21	28	..	..	..	..	0.71	0.39
Ecuador	35	46	8	13	31	41	2	2	10,306	16,335	0.31	0.18
Egypt, Arab Rep.	29	30	33	28	21	23	6	7	..	..	0.26	0.10
El Salvador	33	61	14	36	17	30	0	5	2,002	4,244	0.67	0.40
Eritrea	1	2	1	1	1	2	..	..	..	..	0.56	0.33
Estonia	211	378	22	11	154	318	66	1	..	5,982	0.60	0.55
Ethiopia	1	1	2	3	1	1	0	0	..	4	0.46	0.27
Finland	441	462	29	31	386	403	12	35	39,750	46,010	1.06	0.84
France	494	564	32	37	405	469	55	..	422,000	516,300	0.99	0.82
Gabon	31	36	4	5	19	22	..	..	..	..	0.53	0.37
Gambia, The	13	15	5	7	7	8	..	..	..	..	0.64	0.47
Georgia	107	58	27	16	89	45	5	1	4,620	..	0.46	0.25
Germany	405	529	53	66	386	508	18	36	446,000	583,100	0.91	0.78
Ghana	..	8	..	4	..	5	..	..	..	..	0.20	0.19
Greece	248	348	22	28	171	254	120	203	..	..	0.72	0.71
Guatemala	..	57	..	45	..	52	..	12	..	4,547	0.53	0.42
Guinea	4	5	1	1	2	2	..	..	..	..	0.85	0.69
Guinea-Bissau	7	11	2	3	4	6	..	..	..	..	..	..
Haiti	..	7	..	13	..	4	..	..	..	..	0.64	0.35
Honduras	22	61	9	28	..	52	..	14	3,288	..	0.62	0.46

Traffic and congestion | 3.12

	Motor vehicles				Passenger cars		Two-wheelers		Road traffic		Fuel prices	
	per 1,000 people		per kilometer of road		per 1,000 people		per 1,000 people		million vehicle kilometers		Super $ per liter	Diesel $ per liter
	1990	1999	1990	1999	1990	1999	1990	1999	1990	1999	2000	2000
Hungary	212	272	21	15	188	238	16	14	22,898	..	0.81	0.79
India	4	8	2	3	2	5	15	27	..	..	0.60	0.39
Indonesia	16	25	10	14	7	14	34	62	..	..	0.17	0.06
Iran, Islamic Rep.	34	41	14	15	25	30	36	43	..	..	0.05	0.02
Iraq	14	51	6	23	1	36	..	..	..	..	0.03	0.01
Ireland	270	305	10	12	227	272	6	6	24,205	28,390	0.72	0.72
Israel	210	270	74	102	174	220	8	12	18,212	34,344	1.14	0.64
Italy	529	591	99	52	476	539	45	66	344,726	..	0.97	0.83
Jamaica	..	50	..	7	..	41	..	..	..	..	0.62	0.49
Japan	469	560	52	61	283	395	146	115	628,581	746,054	1.06	0.76
Jordan	60	68	26	44	..	49	0	0	1,098	2,154	0.45	0.15
Kazakhstan	76	86	8	12	50	66	..	10	18,248	3,215	0.36	0.29
Kenya	12	13	5	6	10	10	1	1	5,170	6,200	0.71	0.60
Korea, Dem. Rep.	..	..	..	..	..	..	..	..	..	..	0.73	0.41
Korea, Rep.	79	238	60	120	48	167	32	59	30,464	67,266	0.92	0.66
Kuwait	..	408	..	156	..	317	..	..	..	..	0.21	0.18
Kyrgyz Republic	44	39	10	9	44	39	..	1	5,220	..	0.44	0.33
Lao PDR	9	4	3	1	6	3	18	49	..	..	0.41	0.32
Latvia	135	258	6	9	106	216	76	8	3,932	..	0.67	0.58
Lebanon	321	336	183	205	300	313	13	15	..	..	0.53	0.31
Lesotho	10	19	4	8	3	6	..	..	..	..	0.50	0.47
Libya	..	230	..	48	..	159	..	0	..	..	0.25	0.16
Lithuania	159	322	12	16	132	294	52	5	..	..	0.66	0.55
Macedonia, FYR	132	153	30	35	121	139	1	1	3,102	4,247	0.76	0.56
Madagascar	6	8	2	2	4	4	..	..	41,500	..	0.76	0.45
Malawi	4	6	4	4	2	3	..	..	..	..	0.69	0.68
Malaysia	124	200	26	69	101	170	167	224	..	..	0.28	0.16
Mali	3	5	2	3	2	3	..	..	..	..	0.70	0.43
Mauritania	9	12	3	4	6	8	..	..	..	..	0.67	0.40
Mauritius	59	98	35	60	44	73	54	96	..	..	..	..
Mexico	119	151	41	44	82	102	3	3	55,095	..	0.61	0.45
Moldova	53	70	17	24	48	54	45	25	..	538	0.45	0.40
Mongolia	21	30	1	1	6	17	22	11	340	38	0.38	0.38
Morocco	37	52	15	26	28	41	1	1	..	..	0.82	0.53
Mozambique	4	1	2	0	3	0	..	..	1,889	..	0.56	0.54
Myanmar	..	2	..	2	..	1	..	..	..	..	..	..
Namibia	72	85	1	2	40	47	1	1	1,896	2,317	0.47	0.44
Nepal	..	..	..	..	..	..	..	..	..	..	0.63	0.37
Netherlands	405	427	58	58	368	383	44	25	90,150	109,955	1.03	0.78
New Zealand	524	540	19	22	436	481	24	12	..	..	0.48	0.34
Nicaragua	19	10	5	8	10	3	3	2	108	523	0.62	0.54
Niger	6	6	4	5	5	4	..	..	178	240	0.68	0.48
Nigeria	30	24	21	14	12	8	5	4	..	..	0.27	0.27
Norway	458	505	22	25	380	407	48	54	..	30,152	1.19	1.15
Oman	130	142	9	9	83	97	3	2	..	..	0.31	0.29
Pakistan	6	8	4	4	4	5	8	15	18,933	218,779	0.53	0.27
Panama	75	113	18	27	60	83	2	3	..	..	0.53	0.41
Papua New Guinea	..	26	..	6	..	7	..	..	..	..	0.53	0.34
Paraguay	..	24	..	4	..	14	..	..	..	..	0.72	0.34
Peru	..	43	..	13	..	27	..	..	..	..	0.80	0.54
Philippines	10	31	4	11	7	10	6	14	6,189	9,548	0.37	0.28
Poland	168	286	18	29	138	240	36	37	59,608	174,000	0.76	0.65
Portugal	222	348	34	..	162	310	5	77	28,623	93,020	0.77	0.54
Puerto Rico	..	282	..	74	..	232	..	..	..	..	0.34	0.32
Romania	72	154	11	17	56	133	13	14	23,907	36,884	0.46	0.35
Russian Federation	87	153	14	39	65	120	..	..	..	63,450	0.33	0.29

	Motor vehicles				Passenger cars		Two-wheelers		Road traffic		Fuel prices	
	per 1,000 people		per kilometer of road		per 1,000 people		per 1,000 people		million vehicle kilometers		Super $ per liter	Diesel $ per liter
	1990	1999	1990	1999	1990	1999	1990	1999	1990	1999	2000	2000
Rwanda	2	4	1	2	1	2	..	..	..	..	0.89	0.84
Saudi Arabia	165	157	19	20	98	93	0	0	..	..	0.24	0.10
Senegal	11	14	6	8	8	10	0	0	..	..	0.73	0.52
Sierra Leone	10	6	4	2	7	4	2	2	996	529	0.00	0.00
Singapore	146	164	142	170	101	119	45	41	..	..	0.84	0.38
Slovak Republic	194	260	57	33	163	229	61	8	..	10,387	0.69	0.68
Slovenia	306	455	42	45	289	418	8	5	5,620	9,042	0.63	0.66
South Africa	139	143	26	..	97	94	8	4	..	..	0.50	0.50
Spain	360	472	43	53	309	389	79	34	100,981	201,896	0.73	0.65
Sri Lanka	20	34	4	56	6	15	23	40	3,468	15,630	0.66	0.27
Sudan	9	12	21	28	8	10	..	..	..	..	0.28	0.24
Sweden	464	478	29	20	426	437	11	29	61,040	66,806	0.94	0.80
Switzerland	491	527	46	53	449	486	114	104	48,660	54,112	0.78	0.84
Syrian Arab Republic	26	30	10	11	10	9	..	..	..	..	0.44	0.13
Tajikistan	3	1	1	1	0	0	..	..	..	..	0.45	0.55
Tanzania	5	5	2	2	1	1	..	..	..	..	0.75	0.73
Thailand	46	106	36	97	14	28	86	174	45,769	99,900	0.39	0.35
Togo	23	27	11	15	15	19	8	14	..	..	0.48	0.40
Trinidad and Tobago	..	115	..	18	..	96	..	..	..	..	0.39	0.20
Tunisia	48	64	19	25	23	30	..	..	..	..	0.49	0.29
Turkey	50	85	8	14	34	63	10	15	27,041	49,846	0.88	0.66
Turkmenistan	..	..	..	..	..	..	..	..	..	..	0.02	0.02
Uganda	2	6	..	..	1	2	0	3	..	..	0.86	0.75
Ukraine	63	93	19	27	63	104	..	49	59,500	61,200	0.37	0.30
United Arab Emirates	121	103	52	52	97	82	..	..	..	..	0.25	0.26
United Kingdom	400	418	64	67	341	373	14	12	399,000	404,500	1.17	1.22
United States	758	760	30	32	573	478	17	14	2,527,441	2,536,555	0.47	0.48
Uruguay	138	174	45	63	122	158	74	110	..	..	1.19	0.53
Uzbekistan	..	..	..	..	..	..	..	..	..	..	0.43	0.28
Venezuela, RB	..	88	..	21	..	68	..	..	..	563	0.12	0.08
Vietnam	..	..	..	..	..	..	45	45	..	..	0.38	0.27
West Bank and Gaza	..	..	..	..	..	..	..	..	..	..	0.01	0.00
Yemen, Rep.	34	34	8	8	14	15	..	..	8,681	11,476	0.21	0.06
Yugoslavia, FR (Serb./Mont.)	137	190	31	42	133	176	3	4	..	..	0.56	0.56
Zambia	14	26	3	4	8	17	..	..	..	..	1.00	1.00
Zimbabwe	..	32	..	19	..	29	..	32	..	..	0.85	0.72
World	**118** w	**122** w			**91** w	**90** w					**0.54** m	**0.35** m
Low income	9	10	..	..	4	5	..	..	..	..	0.49	0.31
Middle income	41	59	..	..	24	37	..	..	..	..	0.48	0.32
Lower middle income	17	35	..	..	11	22	..	..	..	..	0.49	0.30
Upper middle income	123	147	..	..	99	119	..	..	..	..	0.47	0.35
Low & middle income	26	38	..	..	16	24	..	..	..	..	0.49	0.31
East Asia & Pacific	11	22	..	..	4	7	..	..	..	..	0.31	0.25
Europe & Central Asia	97	154	..	..	82	128	..	..	..	..	0.51	0.35
Latin America & Carib.	100	91	..	..	..	68	..	..	..	..	0.47	0.30
Middle East & N. Africa	48	59	..	..	32	40	..	..	..	..	0.31	0.17
South Asia	4	7	..	..	2	4	..	..	..	..	0.57	0.25
Sub-Saharan Africa	21	23	..	..	14	14	..	..	..	..	0.59	0.43
High income	527	582	..	..	396	415	..	..	..	..	0.86	0.69
Europe EMU	435	513	..	..	387	409	..	..	..	..	1.04	0.79

Traffic and congestion | 3.12

Traffic congestion in urban areas constrains economic productivity, damages people's health, and degrades the quality of their lives. The particulate air pollution emitted by motor vehicles—the dust and soot in exhaust—is proving to be far more damaging to human health than was once believed. (For information on suspended particulates and other air pollutants see table 3.13.)

In recent years ownership of passenger cars has increased, and the expansion of economic activity has led to the transport by road of more goods and services over greater distances (see table 5.8). These developments have increased demand for roads and vehicles, adding to urban congestion, air pollution, health hazards, traffic accidents, and injuries.

Congestion, the most visible cost of expanding vehicle ownership, is reflected in the indicators in the table. Other relevant indicators—such as average vehicle speed in major cities or the cost of traffic congestion, which takes a heavy toll on economic productivity—are not included here because data are incomplete or difficult to compare.

The data in the table—except for those on fuel prices—are compiled by the International Road Federation (IRF) through questionnaires sent to national organizations. The IRF uses a hierarchy of sources to gather as much information as possible. The primary sources are national road associations. Where such an association is lacking or does not respond, other agencies are contacted, including road directorates, ministries of transport or public works, and central statistical offices. As a result, the compiled data are of uneven quality. The coverage of each indicator may differ across countries because of differences in definitions. Comparability also is limited when time-series data are reported. Moreover, the data do not capture the quality or age of vehicles or the condition or width of roads. Thus comparisons over time and between countries should be made with caution.

The data on fuel prices are compiled by the German Agency for Technical Cooperation (GTZ) from its global network of regional offices and representatives, as well as other sources, including the Allgemeiner Deutscher Automobil Club (for Europe) and a project of the Latin American Energy Organization (OLADE, for Latin America). Local prices have been converted to U.S. dollars using the exchange rate on the survey date as listed in the international monetary table of the *Financial Times*. For countries with multiple exchange rates, the market, parallel, or black market rate was used rather than the official exchange rate.

• **Motor vehicles** include cars, buses, and freight vehicles but not two-wheelers. Population figures refer to the midyear population in the year for which data are available. Roads refer to motorways, highways, main or national roads, and secondary or regional roads. A motorway is a road specially designed and built for motor traffic that separates the traffic flowing in opposite directions. • **Passenger cars** refer to road motor vehicles, other than two-wheelers, intended for the carriage of passengers and designed to seat no more than nine people (including the driver). • **Two-wheelers** refer to mopeds and motorcycles. • **Road traffic** is the number of vehicles multiplied by the average distances they travel. • **Fuel prices** refer to the pump prices of the most widely sold grade of gasoline and of diesel fuel. Prices have been converted from the local currency to U.S. dollars (see *About the data*).

The data on vehicles and traffic are from the IRF's electronic files and its annual *World Road Statistics*. The data on fuel prices are from the GTZ's *Fuel Prices and Taxation* (1999) and the electronic update for 2000.

Table 3.12a

The top 10 vehicle-owning economies in 1999

	Vehicles per 1,000 people
United States	760
Australia	601
Italy	591
Canada	581
France	564
Japan	560
New Zealand	540
Austria	536
Germany	529
Switzerland	527
World	122
Low income	10
Middle income	59
High income	582
Europe EMU	513

Source: Table 3.12.

Table 3.12b

The 10 economies with the highest fuel prices in 2000—and the 10 with the lowest
$ per liter of super grade gasoline

	Fuel price		Fuel price		Fuel price
Hong Kong, China	1.46	Turkmenistan	0.02	World (median)	0.54
Norway	1.19	Iraq	0.03	Low income	0.49
Uruguay	1.19	Iran, Islamic Rep.	0.05	Middle income	0.48
United Kingdom	1.17	Venezuela, RB	0.12	High income	0.86
Israel	1.14	Indonesia	0.17	Europe EMU	1.04
Argentina	1.07	Ghana	0.20		
Finland	1.06	Kuwait	0.21		
Japan	1.06	Yemen, Rep.	0.21		
Netherlands	1.03	Saudi Arabia	0.24		
Burundi	1.01	United Arab Emirates	0.25		

Source: Table 3.12.

3.13 | Air pollution

	City	City population	Total suspended particulates	Sulfur dioxide	Nitrogen dioxide
		thousands 2000	micrograms per cubic meter 1995[a]	micrograms per cubic meter 1998[b]	micrograms per cubic meter 1998[b]
Argentina	Córdoba	1,423	97	..	97
Australia	Melbourne	3,187	35	0	30
	Perth	1,313	45	5	19
	Sydney	3,664	54	28	81
Austria	Vienna	2,070	47	14	42
Belgium	Brussels	1,122	78	20	48
Brazil	Rio de Janeiro	10,582	139	129	..
	São Paulo	17,755	86	43	83
Bulgaria	Sofia	1,192	195	39	122
Canada	Montreal	3,448	34	10	42
	Toronto	4,651	36	17	43
	Vancouver	2,033	29	14	37
Chile	Santiago	5,538	..	29	81
China	Anshan	1,453	305	115	88
	Beijing	10,839	377	90	122
	Changchun	3,093	381	21	64
	Chengdu	3,294	366	77	74
	Chongqing	5,312	320	340	70
	Dalian	2,628	185	61	100
	Guangzhu	3,893	295	57	136
	Guiyang	2,533	330	424	53
	Harbin	2,928	359	23	30
	Jinan	2,568	472	132	45
	Kunming	1,701	253	19	33
	Lanzhou	1,730	732	102	104
	Liupanshui	2,023	408	102	..
	Nanchang	1,722	279	69	29
	Pinxiang	1,502	276	75	..
	Quingdao	2,316	..	190	64
	Shanghai	12,887	246	53	73
	Shenyang	4,828	374	99	73
	Taiyuan	2,415	568	211	55
	Tianjin	9,156	306	82	50
	Urumqi	1,643	515	60	70
	Wuhan	5,169	211	40	43
	Zhengzhou	2,070	474	63	95
	Zibo	2,675	453	198	43
Colombia	Bogotá	6,288	120	..	..
Croatia	Zagreb	1,060	71	31	..
Cuba	Havana	2,256	..	1	5
Czech Republic	Prague	1,226	59	14	33
Denmark	Copenhagen	1,388	61	7	54
Ecuador	Guayaquil	2,293	127	15	..
	Quito	1,754	175	22	..
Egypt, Arab Rep.	Cairo	10,552	..	69	..
Finland	Helsinki	1,167	40	4	35
France	Paris	9,624	14	14	57
Germany	Berlin	3,324	50	18	26
	Frankfurt	3,687	36	11	45
	Munich	2,294	45	8	53
Ghana	Accra	1,976	137	..	..
Greece	Athens	3,116	178	34	64
Hungary	Budapest	1,825	63	39	51
Iceland	Reykjavik	168	24	5	42
India	Ahmedabad	4,160	299	30	21
	Bangalore	5,561	123	..	..

Air pollution 3.13

Country	City	City population thousands 2000	Total suspended particulates micrograms per cubic meter 1995[a]	Sulfur dioxide micrograms per cubic meter 1998[b]	Nitrogen dioxide micrograms per cubic meter 1998[b]
	Calcutta	12,918	375	49	34
	Chennai	6,002	130	15	17
	Delhi	11,695	415	24	41
	Hyderabad	6,842	152	12	17
	Kanpur	2,450	459	15	14
	Lucknow	2,568	463	26	25
	Mumbai	18,066	240	33	39
	Nagpur	2,062	185	6	13
	Pune	3,489	208	..	..
Indonesia	Jakarta	11,018	271	..	..
Iran, Islamic Rep.	Tehran	7,225	248	209	..
Ireland	Dublin	985	..	20	..
Italy	Milan	4,251	77	31	248
	Rome	2,688	73	..	..
	Torino	1,294	151	..	..
Japan	Osaka	11,013	43	19	63
	Tokyo	26,444	49	18	68
	Yokohama	3,178	..	100	13
Kenya	Nairobi	2,310	69	..	..
Korea, Rep.	Pusan	3,830	94	60	51
	Seoul	9,888	84	44	60
	Taegu	2,675	72	81	62
Malaysia	Kuala Lumpur	1,378	85	24	..
Mexico	Mexico City	18,131	279	74	130
Netherlands	Amsterdam	1,144	40	10	58
New Zealand	Auckland	1,102	26	3	20
Norway	Oslo	970	15	8	43
Philippines	Manila	10,870	200	33	..
Poland	Lodz	1,055	..	21	43
	Warsaw	2,269	..	16	32
Portugal	Lisbon	3,826	61	8	52
Romania	Bucharest	2,054	82	10	71
Russian Federation	Moscow	9,321	100	109	..
	Omsk	1,216	100	20	34
Singapore	Singapore	3,567	..	20	30
Slovak Republic	Bratislava	460	62	21	27
South Africa	Cape Town	2,993	..	21	72
	Durban	1,335	..	31	..
	Johannesburg	2,335	..	19	31
Spain	Barcelona	2,819	117	11	43
	Madrid	4,072	42	24	66
Sweden	Stockholm	1,583	9	3	20
Switzerland	Zurich	983	31	11	39
Thailand	Bangkok	7,281	223	11	23
Turkey	Ankara	3,203	57	55	46
	Istanbul	9,451	..	120	..
Ukraine	Kiev	2,670	100	14	51
United Kingdom	Birmingham	2,272	..	9	45
	London	7,640	..	25	77
	Manchester	2,252	..	26	49
United States	Chicago	6,951	..	14	57
	Los Angeles	13,140	..	9	74
	New York	16,640	..	26	79
Venezuela, RB	Caracas	3,151	53	33	57

a. Data are for the most recent year available in 1990–95. Most are for 1995. b. Data are for the most recent year available in 1990–98. Most are for 1995.

Definitions

• **City population** is the number of residents of the city as defined by national authorities and reported to the United Nations. • **Total suspended particulates** refer to smoke, soot, dust, and liquid droplets from combustion that are in the air. Particulate levels indicate the quality of the air people are breathing and the state of a country's technology and pollution controls. • **Sulfur dioxide** (SO_2) is an air pollutant produced when fossil fuels containing sulfur are burned. It contributes to acid rain and can damage human health, particularly that of the young and the elderly. • **Nitrogen dioxide** (NO_2) is a poisonous, pungent gas formed when nitric oxide combines with hydrocarbons and sunlight, producing a photochemical reaction. These conditions occur in both natural and anthropogenic activities. NO_2 is emitted by bacteria, nitrogenous fertilizers, aerobic decomposition of organic matter in oceans and soils, combustion of fuels and biomass, and motor vehicles and industrial activities.

Data sources

The data in the table are from the WHO's Healthy Cities Air Management Information System and the World Resources Institute, which relies on various national sources as well as, among others, the United Nations Environment Programme and WHO's *Urban Air Pollution in Megacities of the World* (1992), the Organisation for Economic Co-operation and Development's *OECD Environmental Data: Compendium 1999,* the U.S. Environmental Protection Agency's *National Air Quality and Emissions Trends Report 1995* and AIRS Executive International database, the *China Environmental Yearbook 1997,* and the United Nations Centre for Human Settlements' (UNCHS) Urban Indicators database.

	Environmental strategy or action plan	Country environmental profile	Biodiversity assessment, strategy, or action plan	Participation in treaties[a]				
				Climate change	Ozone layer	CFC control	Law of the Sea[b]	Biological diversity
Albania	1993	..	..	1995	2000	2000	..	1994
Algeria	..	..	..	1994	1993	1993	1996	1995
Angola	..	..	..	2000 c	2000	2000	1994	1998
Argentina	1992	..	..	1994	1990	1990	1996	1995
Armenia	..	..	..	1994	2000	2000	..	1993
Australia	1992	..	1994	1994	1987	1989	1995	1993
Austria	..	..	..	1994	1987	1989	1995	1994
Azerbaijan	..	..	..	1995	1996	1996	..	2000 c
Bangladesh	1991	1989	1990	1994	1990	1990	..	1994
Belarus	..	..	..	2000 c	1986	1989	..	1993
Belgium	..	..	..	1996	1989	1989	..	1997
Benin	1993	..	..	1994	1993	1993	..	1994
Bolivia	1994	1986	1988	1995	1995	1995	1995	1995
Bosnia and Herzegovina	..	..	..	..	1992	1992	1994	..
Botswana	1990	1986	1991	1994	1992	1992	1994	1996
Brazil	..	..	1988	1994	1990	1990	1994	1994
Bulgaria	..	..	1994	1995	1991	1991	1996	1996
Burkina Faso	1993	1994	..	1994	1989	1989	..	1993
Burundi	1994	1981	1989	1997	1997	1997	..	1997
Cambodia	1999	..	..	1996	..	..	..	1995
Cameroon	..	1989	1989	1995	1989	1989	1994	1995
Canada	1990	..	1994	1994	1986	1988	..	1993
Central African Republic	..	..	..	1995	1993	1993	..	1995
Chad	1990	1982	..	1994	1989	1994	..	1994
Chile	..	1987	1993	1995	1990	1990	..	1994
China	1994	..	1994	1994	1989	1991	1996	1993
Hong Kong, China	..	..	..	..	..	..	..	..
Colombia	..	1990	1988	1995	1990	1994	..	1995
Congo, Dem. Rep.	..	1986	1990	1995	1995	1995	1994	1995
Congo, Rep.	..	..	1990	1997	1995	1995	..	1996
Costa Rica	1990	1987	1992	1994	1991	1991	1994	1994
Côte d'Ivoire	1994	..	1991	1995	1993	1993	1994	1995
Croatia	..	..	..	1996	1992	1992	1994	1997
Cuba	..	..	..	1994	1992	1992	1994	1994
Czech Republic	1994	..	..	1994	1993	1993	1996	1994
Denmark	1994	..	..	1994	1988	1989	..	1994
Dominican Republic	..	1984	1995	1999	1993	1993	..	1996
Ecuador	1993	1987	1995	1994	1990	1990	..	1993
Egypt, Arab Rep.	1992	1992	1988	1995	1988	1988	1994	1994
El Salvador	1994	1985	1988	1996	1993	1993	..	1994
Eritrea	1995	..	..	1995	..	..	..	1996
Estonia	1998	..	..	1994	1997	1997	..	1994
Ethiopia	1994	..	1991	1994	1995	1995	..	1994
Finland	1995	..	..	1994	1986	1989	1996	1994
France	1990	..	..	1994	1988	1989	1996	1994
Gabon	..	..	1990	1998	1994	1994	..	1997
Gambia, The	1992	1981	1989	1994	1990	1990	1994	1994
Georgia	1998	..	..	1994	1996	1996	1996	1994
Germany	..	..	..	1994	1988	1989	1994	1994
Ghana	1992	1985	1988	1995	1989	1989	1994	1994
Greece	..	..	..	1994	1989	1989	1995	1994
Guatemala	1994	1984	1988	1996	1987	1990	..	1995
Guinea	1994	1983	1988	1994	1992	1992	1994	1993
Guinea-Bissau	1993	..	1991	1996	..	..	1994	1996
Haiti	..	1985	..	1996	2000	2000	1996	1996
Honduras	1993	1989	..	1996	1994	1994	1994	1995

Table 3.14a

Status of national environmental action plans

Completed

Albania	Guinea	Niger
Armenia	Guinea-Bissau	Nigeria
Azerbaijan	Guyana	Pakistan
Bangladesh	Haiti	Papua New Guinea
Belarus	Honduras	Philippines
Benin	Hungary	Poland
Bhutan	India	Romania
Bolivia	Indonesia	Russian Federation
Botswana	Iran, Islamic Rep.	Rwanda
Bulgaria	Kazakhstan	São Tomé and Principe
Burkina Faso	Kenya	Senegal
Burundi	Kiribati	Seychelles
Cambodia	Kyrgyz Rep.	Sierra Leone
Cameroon	Lao PDR	Slovak Rep.
Cape Verde	Latvia	Slovenia
China	Lebanon	Solomon Islands
Comoros	Lesotho	South Africa
Congo, Dem. Rep.	Lithuania	Sri Lanka
Congo, Rep.	Macedonia, FYR	St. Kitts and Nevis
Costa Rica	Madagascar	Swaziland
Côte d'Ivoire	Malawi	Syrian Arab Rep.
Czech Republic	Maldives	Tanzania
Egypt, Arab Rep.	Mali	Togo
El Salvador	Mauritania	Tonga
Equatorial Guinea	Mauritius	Tunisia
Eritrea	Mexico	Turkey
Estonia	Moldova	Uganda
Ethiopia	Mongolia	Ukraine
Gabon	Montserrat	Uzbekistan
Gambia, The	Mozambique	Vanuatu
Georgia	Namibia	Vietnam
Ghana	Nepal	Yemen, Rep.
Grenada	Nicaragua	Zambia

Being prepared

Central African Rep.	Ecuador	Tajikistan
	Korea, Rep.	Turkmenistan
Croatia	Malaysia	Zimbabwe
Dominican Rep.	Paraguay	

Note: Status is as of December 2000.

Source: World Bank regional data; and World Resources Institute, International Institute for Environment and Development, and IUCN, *1996 World Directory of Country Environmental Studies.*

Government commitment | 3.14

	Environmental strategy or action plan	Country environmental profile	Biodiversity assessment, strategy, or action plan	Participation in treaties[a]				
				Climate change	Ozone layer	CFC control	Law of the Sea[b]	Biological diversity
Hungary	1995	..	..	1994	1988	1989	..	1994
India	1993	1989	1994	1994	1991	1992	1995	1994
Indonesia	1992	1994	1993	1994	1992	1992	1994	1994
Iran, Islamic Rep.	..	..	..	1996	1991	1991	..	1996
Iraq	..	..	..	..	..	..	1994	..
Ireland	..	..	..	1994	1988	1989	..	1996
Israel	..	..	..	1994	1992	1992	..	1995
Italy	..	..	..	1994	1988	1989	1995	1994
Jamaica	1994	1987	..	1995	1993	1993	1994	1995
Japan	..	..	..	1994	1988	1988	1996	1993
Jordan	1991	1979	..	1994	1989	1989	1995	1994
Kazakhstan	..	..	..	1995	1998	1998	..	1994
Kenya	1994	1989	1992	1994	1989	1989	1994	1994
Korea, Dem. Rep.	..	..	..	1995	1995	1995	..	1995
Korea, Rep.	..	..	..	1994	1992	1992	1996	1995
Kuwait	..	..	..	1995	1993	1993	1994	..
Kyrgyz Republic	1995	..	..	2000[c]	2000	2000	..	1996
Lao PDR	1995	..	..	1995	1998	1998	..	1996
Latvia	..	..	..	1995	1995	1995	..	1996
Lebanon	..	..	..	1995	1993	1993	1995	1995
Lesotho	1989	1982	..	1995	1994	1994	..	1995
Libya	..	..	..	1999[c]	1990	1990	..	..
Lithuania	..	..	..	1995	1995	1995	..	1996
Macedonia, FYR	1997	..	..	1998	1994	1994	1994	1997[c]
Madagascar	1988	..	1991	1996	1997	1997	..	1996
Malawi	1994	1982	..	1994	1991	1991	..	1994
Malaysia	1991	1979	1988	1994	1989	1989	1997	1994
Mali	..	1991	1989	1995	1995	1995	1994	1995
Mauritania	1988	1984	..	1994	1994	1994	1996	1996
Mauritius	1990	..	..	1994	1992	1992	1994	1993
Mexico	..	..	1988	1994	1987	1988	1994	1993
Moldova	..	..	..	1995	1997	1997	..	1996
Mongolia	1995	..	..	1994	1996	1996	..	1993
Morocco	..	1980	1988	1996	1996	1996	..	1995
Mozambique	1994	..	..	1995	1994	1994	..	1995
Myanmar	..	1982	1989	1995	1994	1994	1996	1995
Namibia	1992	..	..	1995	1993	1993	1994	1997
Nepal	1993	1983	..	1994	1994	1994	..	1994
Netherlands	1994	..	..	1994	1988	1989	1996	1994
New Zealand	1994	..	..	1994	1987	1988	1996	1993
Nicaragua	1994	1981	..	1996	1993	1993	..	1996
Niger	..	1985	1991	1995	1993	1993	..	1995
Nigeria	1990	..	1992	1994	1989	1989	1994	1994
Norway	..	..	1994	1994	1986	1988	1996	1993
Oman	..	1981	..	1995	1999	1999	1994	1995
Pakistan	1994	1994	1991	1994	1993	1993	..	1994
Panama	1990	1980	..	1995	1989	1989	1996	1995
Papua New Guinea	1992	1994	1993	1994	1993	1993	..	1993
Paraguay	..	1985	..	1994	1993	1993	1994	1994
Peru	..	1988	1988	1994	1989	1993	..	1993
Philippines	1989	1992	1989	1994	1991	1991	1994	1994
Poland	1993	..	1991	1994	1990	1990	..	1996
Portugal	1995	..	..	1994	1989	1989	..	1994
Puerto Rico	..	..	..	..	..	..	..	..
Romania	..	..	..	1994	1993	1993	1997	1994
Russian Federation	..	..	1994	1995	1986	1989	..	1995

Table 3.14b

States that have signed the Convention on Climate Change

Antigua and Barbuda[a]	Greece	Palau[a]
Argentina	Guatemala[a]	Panama[a]
Australia	Guinea[a]	Papua New Guinea
Austria	Honduras	Paraguay[a]
Azerbaijan[a]	Indonesia	Peru
Bahamas, The[a]	Ireland	Philippines
Barbados[a]	Israel	Poland
Belgium	Italy	Portugal
Bolivia[a]	Jamaica[a]	Romania
Brazil	Japan	Russian Federation
Bulgaria	Kazakhstan	Samoa
Canada	Kiribati[a]	Seychelles
Chile	Korea, Rep.	Slovak Republic
China	Latvia	Slovenia
Cook Islands	Liechtenstein	Solomon Islands
Costa Rica	Lithuania	Spain
Croatia	Luxembourg	St. Lucia
Cuba	Malaysia	St. Vincent and the
Cyprus[a]	Maldives[a]	Grenadines
Czech Republic	Mali	Sweden
Denmark	Malta	Switzerland
Ecuador	Marshall	Thailand
Egypt, Arab Rep.	Islands	Trinidad and Tobago[a]
El Salvador[a]	Mexico	Turkmenistan[a]
Equatorial	Micronesia[a]	Tuvalu[a]
Guinea[a]	Monaco	Ukraine
Estonia	Mongolia[a]	United Kingdom
Fiji[a]	Netherlands	United States
Finland	New Zealand	Uruguay
France	Nicaragua[a]	Uzbekistan[a]
Georgia[a]	Niger	Vietnam
Germany	Niue[a]	Zambia
	Norway	

Note: Status is as of November 2000.

a. Ratification or accession signed.

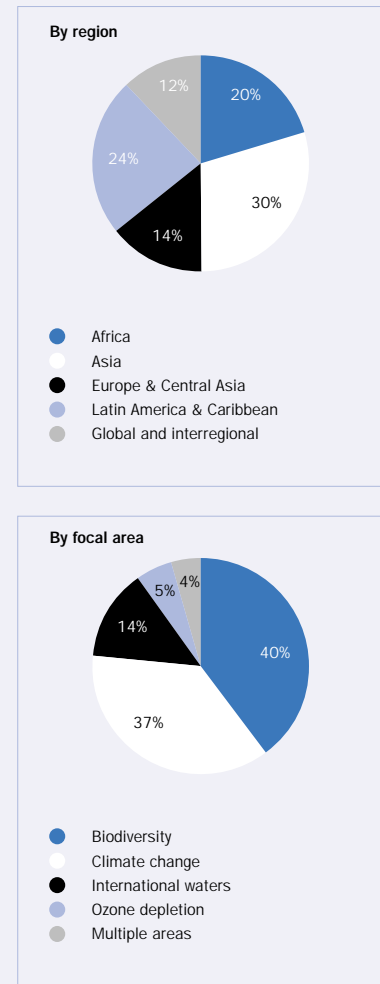Source: Secretariat of the United Nations Framework Convention on Climate Change.

	Environmental strategy or action plan	Country environmental profile	Biodiversity assessment, strategy, or action plan	Participation in treaties[a]				
				Climate change	Ozone layer	CFC control	Law of the Sea[b]	Biological diversity
Rwanda	1991	1987	..	1998	..	..	..	1996
Saudi Arabia	..	..	..	1995	1993	1993	..	..
Senegal	1984	1990	1991	1995	1993	1993	1994	1995
Sierra Leone	1994	..	..	1995	..	..	1995	1995
Singapore	1993	1988	1995	1997	1989	1989	1994	1996
Slovak Republic	..	..	..	1994	1993	1993	1996	1994
Slovenia	..	..	..	1996	1992	1992	1994	1996
South Africa	1993	..	..	1997	1990	1990	1994	1996
Spain	..	..	..	1994	1988	1989	..	1994
Sri Lanka	1994	1983	1991	1994	1990	1990	1994	1994
Sudan	..	1989	..	1994	1993	1993	1994	1996
Sweden	..	..	..	1994	1987	1988	1996	1994
Switzerland	..	..	..	1994	1988	1989	..	1995
Syrian Arab Republic	..	1981	..	1996	1990	1990	..	1996
Tajikistan	..	..	..	1998	1996	1998	..	1997
Tanzania	1994	1989	1988	1996	1993	1993	1994	1996
Thailand	..	1992	..	1995	1989	1989	..	..
Togo	1991	..	..	1995	1991	1991	1994	1996
Trinidad and Tobago	..	..	..	1994	1989	1989	1994	1996
Tunisia	1994	1980	1988	1994	1989	1989	1994	1993
Turkey	1998	1982	..	..	1991	1991	..	1997
Turkmenistan	..	..	..	1995	1994	1994	..	1996
Uganda	1994	1982	1988	1994	1988	1988	1994	1993
Ukraine	..	..	..	1997	1986	1988	..	1995
United Arab Emirates	..	..	..	1996	1990	1990	..	2000[c]
United Kingdom	1995	..	1994	1994	1987	1989	..	1994
United States	1995	..	1995	1994	1986	1988	..	1993
Uruguay	..	..	..	1994	1989	1991	1994	1994
Uzbekistan	1999	..	..	1994	1993	1993	..	1995
Venezuela, RB	..	..	..	1995	1988	1989	..	1994
Vietnam	1996	..	1993	1995	1994	1994	1994	1995
West Bank and Gaza	..	..	..	..	..	..	..	..
Yemen, Rep.	..	1990	1992	1996	1996	1996	1994	1996
Yugoslavia, FR (Serb./Mont.)	..	..	..	1997	1990	1991	..	..
Zambia	1994	1988	..	1994	1990	1990	1994	1993
Zimbabwe	1987	1982	..	1994	1993	1993	1994	1995

a. The years shown refer to the year the treaty entered into force in the country. b. Convention became effective 16 November 1994. c. Ratification of the treaty.

Figure 3.14

A global focus on biodiversity and climate change

Allocation of funds by the Global Environment Facility, February 1995–June 2000
Total allocation: $2,937 million

By region

- Africa
- Asia
- Europe & Central Asia
- Latin America & Caribbean
- Global and interregional

20%, 30%, 14%, 24%, 12%

By focal area

- Biodiversity
- Climate change
- International waters
- Ozone depletion
- Multiple areas

40%, 37%, 14%, 5%, 4%

Source: Global Environment Facility data.

Government commitment | 3.14

National environmental strategies and participation in international treaties on environmental issues provide some evidence of government commitment to sound environmental management. But the signing of these treaties does not always imply ratification. Nor does it guarantee that governments will comply with treaty obligations.

In many countries efforts to halt environmental degradation have failed, primarily because governments have neglected to make this issue a priority, a reflection of competing claims on scarce resources. To address this problem, many countries are preparing national environmental strategies—some focusing narrowly on environmental issues, others integrating environmental, economic, and social concerns. Among such initiatives are conservation strategies and environmental action plans. Some countries have also prepared country environmental profiles and biological diversity strategies and profiles.

National conservation strategies—promoted by the World Conservation Union (IUCN)—provide a comprehensive, cross-sectoral analysis of conservation and resource management issues to help integrate environmental concerns with the development process. Such strategies discuss current and future needs, institutional capabilities, prevailing technical conditions, and the status of natural resources in a country.

National environmental action plans (NEAPs), supported by the World Bank and other development agencies, describe a country's main environmental concerns, identify the principal causes of environmental problems, and formulate policies and actions to deal with them (table 3.14a). The NEAP is a continuing process in which governments develop comprehensive environmental policies, recommend specific actions, and outline the investment strategies, legislation, and institutional arrangements required to implement them.

Country environmental profiles identify how national economic and other activities can stay within the constraints imposed by the need to conserve natural resources. Some profiles consider issues of equity, justice, and fairness. Biodiversity profiles—prepared by the World Conservation Monitoring Centre and the IUCN—provide basic background on species diversity, protected areas, major ecosystems and habitat types, and legislative and administrative support. In an effort to establish a scientific baseline for measuring progress in biodiversity conservation, the United Nations Environment Programme (UNEP) coordinates global biodiversity assessments.

To address global issues, many governments have also signed international treaties and agreements launched in the wake of the 1972 United Nations Conference on Human Environment in Stockholm and the 1992 United Nations Conference on Environment and Development (the Earth Summit) in Rio de Janeiro:

- The Framework Convention on Climate Change aims to stabilize atmospheric concentrations of greenhouse gases at levels that will prevent human activities from interfering dangerously with the global climate.
- The Vienna Convention for the Protection of the Ozone Layer aims to protect human health and the environment by promoting research on the effects of changes in the ozone layer and on alternative substances (such as substitutes for chlorofluorocarbons) and technologies, monitoring the ozone layer, and taking measures to control the activities that produce adverse effects.
- The Montreal Protocol for CFC Control requires that countries help protect the earth from excessive ultraviolet radiation by cutting chlorofluorocarbon consumption by 20 percent over their 1986 level by 1994 and by 50 percent over their 1986 level by 1999, with allowances for increases in consumption by developing countries.
- The United Nations Convention on the Law of the Sea, which became effective in November 1994, establishes a comprehensive legal regime for seas and oceans, establishes rules for environmental standards and enforcement provisions, and develops international rules and national legislation to prevent and control marine pollution.
- The Convention on Biological Diversity promotes conservation of biodiversity among nations through scientific and technological cooperation, access to financial and genetic resources, and transfer of ecologically sound technologies.

To help developing countries comply with their obligations under these agreements, the Global Environment Facility (GEF) was created to focus on global improvement in biodiversity, climate change, international waters, and ozone layer depletion. The UNEP, United Nations Development Programme (UNDP), and World Bank manage the GEF according to the policies of its governing body of country representatives. The World Bank is responsible for the GEF Trust Fund and is chair of the GEF.

- **Environmental strategies and action plans** provide a comprehensive, cross-sectoral analysis of conservation and resource management issues to help integrate environmental concerns with the development process. They include national conservation strategies, national environmental action plans, national environmental management strategies, and national sustainable development strategies. The year shown for a country refers to the year in which a strategy or action plan was adopted. • **Country environmental profiles** identify how national economic and other activities can stay within the constraints imposed by the need to conserve natural resources. The year shown for a country refers to the year in which a profile was completed.
- **Biodiversity assessments, strategies, and action plans** include biodiversity profiles (see *About the data*).
- **Participation in treaties** covers five international treaties (see *About the data*). • **Climate change** refers to the Framework Convention on Climate Change (signed in New York in 1992). • **Ozone layer** refers to the Vienna Convention for the Protection of the Ozone Layer (signed in 1985). • **CFC control** refers to the Montreal Protocol for CFC Control (formally, the Protocol on Substances That Deplete the Ozone Layer, signed in 1987). • **Law of the Sea** refers to the United Nations Convention on the Law of the Sea (signed in Montego Bay, Jamaica, in 1982). • **Biological diversity** refers to the Convention on Biological Diversity (signed at the Earth Summit in Rio de Janeiro in 1992). The year shown for a country refers to the year in which a treaty entered into force in that country.

The data are from the Secretariat of the United Nations Framework Convention on Climate Change; the Ozone Secretariat of the UNEP; the World Resources Institute; the UNEP; the U.S. National Aeronautics and Space Administration's Socioeconomic Data and Applications Center (SEDAC), Center for International Earth Science Information Network (CIESIN); the World Resources Institute, International Institute for Environment and Development, and IUCN's *1996 World Directory of Country Environmental Studies;* and the World Bank's *1998 Catalog: Operational Documents as of July 31, 1998.*

	Gross domestic savings	Consumption of fixed capital	Net domestic savings	Education expenditure	Energy depletion	Mineral depletion	Net forest depletion	Carbon dioxide damage	Genuine domestic savings
	% of GDP 1999	% of GDP 1999	% of GDP 1999	% of GDP 1999	% of GDP 1999	% of GDP 1999	% of GDP 1999	% of GDP 1999	% of GDP 1999
Albania	−1.7	8.5	−10.1	2.9	0.7	0.0	0.0	0.3	−8.3
Algeria	31.7	8.9	22.8	4.3	19.8	0.1	0.0	1.2	6.0
Angola	32.5	7.9	24.6	1.5	17.5	0.0	0.0	0.4	8.2
Argentina	17.2	10.9	6.2	3.1	0.8	0.1	0.0	0.3	8.2
Armenia	−9.3	7.4	−16.7	1.9	0.0	0.0	0.0	1.1	−15.9
Australia	22.1	14.0	8.1	5.3	0.5	1.2	0.0	0.5	11.2
Austria	23.9	12.4	11.4	4.9	0.0	0.0	0.0	0.2	16.1
Azerbaijan	22.8	11.1	11.7	2.6	33.3	0.0	0.0	5.4	−24.4
Bangladesh	16.7	6.3	10.4	1.8	0.2	0.0	2.0	0.3	9.6
Belarus	21.1	9.6	11.5	5.5	0.0	0.0	0.0	1.5	15.5
Belgium	25.2	9.9	15.3	3.1	0.0	0.0	0.0	0.3	18.1
Benin	6.4	7.2	−0.8	2.7	0.0	0.0	0.3	0.3	1.3
Bolivia	9.2	8.4	0.8	5.4	1.3	0.7	0.0	0.8	3.4
Bosnia and Herzegovina	0.1	8.5	−8.4	..	0.0	0.0	..	0.9	..
Botswana	14.2	14.9	−0.7	7.4	0.0	0.2	0.0	0.3	6.2
Brazil	19.3	10.2	9.1	4.7	0.8	0.6	0.0	0.2	12.2
Bulgaria	11.3	8.9	2.4	3.2	0.9	0.3	0.0	2.3	2.0
Burkina Faso	9.8	6.5	3.2	1.4	0.0	0.0	3.9	0.2	0.4
Burundi	−0.4	5.6	−6.0	3.0	0.0	0.2	4.0	0.2	−7.3
Cambodia	5.5	6.7	−1.2	1.8	0.0	0.0	..	0.1	..
Cameroon	18.9	7.8	11.2	2.2	5.2	0.0	0.0	0.2	7.9
Canada	23.1	12.2	11.0	6.3	2.6	0.1	0.0	0.5	14.0
Central African Republic	7.2	6.8	0.4	1.6	0.0	0.0	0.0	0.1	1.8
Chad	−3.0	6.4	−9.4	2.0	0.0	0.0	0.0	0.0	−7.4
Chile	23.0	10.3	12.7	3.3	0.0	4.2	0.0	0.4	11.3
China	40.1	8.3	31.8	2.0	1.4	0.3	0.3	2.5	29.4
Hong Kong, China	30.6	12.3	18.3	2.8	0.0	0.0	0.0	0.1	21.0
Colombia	11.3	9.5	1.8	3.0	5.2	0.1	0.0	0.4	−0.9
Congo, Dem. Rep.	9.0	5.7	3.3	..	0.0	0.0	..	..	..
Congo, Rep.	29.7	8.0	21.7	4.9	25.6	0.0	0.0	0.3	0.7
Costa Rica	23.8	10.2	13.6	4.5	0.0	0.0	0.8	0.2	17.1
Côte d'Ivoire	23.1	8.0	15.1	4.2	0.0	0.0	0.1	0.7	18.5
Croatia	15.8	10.4	5.4	..	0.5	0.0	0.0	0.6	..
Cuba	..	..	..	..	0.0	0.0	0.0	..	..
Czech Republic	26.9	10.5	16.4	4.5	0.1	0.0	0.0	1.3	19.5
Denmark	23.8	14.2	9.6	8.1	0.1	0.0	0.0	0.2	17.4
Dominican Republic	16.7	5.9	10.8	2.0	0.0	0.5	0.0	0.5	11.8
Ecuador	24.2	8.9	15.3	3.0	10.3	0.0	0.0	0.7	7.2
Egypt, Arab Rep.	14.4	8.8	5.6	4.5	2.2	0.1	0.1	0.8	7.0
El Salvador	4.2	9.4	−5.3	2.1	0.0	0.0	1.3	0.3	−4.6
Eritrea	−21.3	6.1	−27.4	1.6	0.0	0.0	0.0	..	−25.8
Estonia	18.8	10.0	8.9	6.2	0.0	0.0	0.0	2.2	12.9
Ethiopia	2.7	5.5	−2.8	2.7	0.0	0.0	10.8	0.4	−11.3
Finland	27.7	15.4	12.3	6.9	0.0	0.0	0.0	0.3	18.9
France	21.5	12.4	9.2	5.6	0.0	0.0	0.0	0.1	14.6
Gabon	34.8	10.0	24.9	1.9	15.2	0.0	0.0	0.4	11.1
Gambia, The	1.7	6.9	−5.2	3.5	0.0	0.0	2.8	0.3	−4.8
Georgia	−2.2	7.8	−10.0	0.0	0.0	0.0	0.0	0.9	−10.9
Germany	23.3	12.4	10.8	4.3	0.0	0.0	0.0	0.2	14.9
Ghana	6.2	7.2	−1.0	4.3	0.0	1.0	3.1	0.4	−1.1
Greece	15.8	6.4	9.4	2.3	0.0	0.0	0.0	0.4	11.2
Guatemala	9.1	9.0	0.1	1.5	0.7	0.0	1.7	0.3	−1.0
Guinea	15.4	7.5	7.9	0.0	0.0	2.6	1.3	0.2	3.8
Guinea-Bissau	−2.2	6.2	−8.4	2.5	0.0	0.0	0.0	0.5	−6.4
Haiti	−4.2	1.8	−6.0	1.6	0.0	0.0	4.6	0.2	−9.1
Honduras	19.1	5.4	13.7	3.4	0.0	0.2	0.0	0.5	16.5

Toward a measure of genuine savings | 3.15

	Gross domestic savings	Consumption of fixed capital	Net domestic savings	Education expenditure	Energy depletion	Mineral depletion	Net forest depletion	Carbon dioxide damage	Genuine domestic savings
	% of GDP 1999	% of GDP 1999	% of GDP 1999	% of GDP 1999	% of GDP 1999	% of GDP 1999	% of GDP 1999	% of GDP 1999	% of GDP 1999
Hungary	26.3	10.4	15.9	4.4	0.2	0.0	0.0	0.8	19.4
India	20.0	9.4	10.6	3.3	1.3	0.3	1.7	1.5	9.0
Indonesia	31.6	7.9	23.8	0.6	6.1	1.0	0.6	0.9	15.8
Iran, Islamic Rep.	22.9	9.3	13.6	3.2	20.6	0.2	0.0	1.5	−5.5
Iraq	..	..	..	..	0.0	0.0	0.0	..	..
Ireland	37.1	9.3	27.8	4.8	0.0	0.1	0.0	0.3	32.2
Israel	11.4	13.9	−2.5	6.1	0.0	0.0	0.0	0.3	3.2
Italy	22.3	12.1	10.2	4.6	0.0	0.0	0.0	0.2	14.5
Jamaica	16.6	9.7	6.9	6.5	0.0	1.7	0.0	0.8	10.9
Japan	27.7	16.0	11.8	4.7	0.0	0.0	0.0	0.2	16.3
Jordan	2.6	9.0	−6.5	5.5	0.0	0.9	0.0	1.1	−3.0
Kazakhstan	22.8	8.6	14.2	4.4	21.6	0.0	0.0	5.2	−8.2
Kenya	6.8	7.1	−0.2	6.0	0.0	0.0	4.8	0.4	0.6
Korea, Dem. Rep.	..	..	..	..	0.0	0.0	0.0	..	..
Korea, Rep.	33.6	11.1	22.6	0.0	0.0	0.0	0.0	0.6	21.9
Kuwait	22.3	11.8	10.5	1.7	41.7	0.0	0.0	..	−29.5
Kyrgyz Republic	3.2	6.7	−3.5	5.1	0.0	0.0	0.0	3.2	−1.5
Lao PDR	13.4	6.8	6.6	1.8	0.0	0.1	..	0.2	..
Latvia	15.4	9.5	5.9	6.2	0.0	0.0	0.0	0.9	11.2
Lebanon	−12.8	10.3	−23.1	1.4	0.0	0.0	0.0	..	..
Lesotho	−34.6	7.3	−41.9	8.1	0.0	0.0	4.1	..	..
Libya	..	..	..	..	0.0	0.0	0.0	..	..
Lithuania	12.6	9.7	2.9	5.2	0.0	0.0	0.0	0.8	7.2
Macedonia, FYR	7.1	9.0	−1.9	..	0.0	0.0	0.0	1.9	..
Madagascar	5.0	6.6	−1.6	1.8	0.0	0.0	0.0	0.2	0.0
Malawi	−0.6	6.1	−6.7	3.8	0.0	0.0	5.7	0.3	−9.0
Malaysia	47.3	9.9	37.4	4.0	5.7	0.0	0.6	0.9	34.1
Mali	10.1	6.6	3.6	2.2	0.0	0.0	0.0	0.1	5.6
Mauritania	7.2	7.1	0.1	3.6	0.0	18.0	0.0	1.9	−16.3
Mauritius	22.7	10.0	12.7	3.2	0.0	0.0	0.0	0.2	15.6
Mexico	21.9	10.5	11.4	4.4	4.0	0.1	0.0	0.5	11.3
Moldova	7.3	6.7	0.5	8.7	0.0	0.0	0.0	4.6	4.6
Mongolia	20.8	7.0	13.8	..	0.0	7.3	0.0	5.2	..
Morocco	20.1	8.6	11.5	4.6	0.0	0.6	0.0	0.6	14.8
Mozambique	6.7	6.5	0.2	3.5	0.0	0.0	2.1	0.2	1.3
Myanmar	10.2	2.5	7.7	..	0.0	0.0	..	..	..
Namibia	9.3	14.3	−5.1	8.6	0.0	0.3	0.0	..	3.3
Nepal	13.3	4.4	8.9	2.1	0.0	0.0	9.7	0.2	1.1
Netherlands	26.7	12.4	14.3	5.1	0.0	0.0	0.0	0.3	19.2
New Zealand	19.7	9.5	10.2	6.3	0.6	0.1	0.0	0.3	15.4
Nicaragua	−12.0	7.7	−19.7	2.4	0.0	0.1	0.0	0.9	−18.3
Niger	3.8	6.3	−2.5	3.0	0.0	0.0	4.2	0.3	−4.0
Nigeria	18.4	6.8	11.7	0.7	28.5	0.0	0.8	1.5	−18.3
Norway	30.3	16.2	14.2	6.8	1.5	0.0	0.0	0.3	19.2
Oman	..	10.8	..	3.5	31.9	0.0	0.0	..	..
Pakistan	10.1	7.4	2.7	2.4	1.9	0.0	1.6	1.0	0.6
Panama	24.0	6.9	17.1	4.4	0.0	0.0	0.0	0.4	21.2
Papua New Guinea	20.9	8.3	12.6	..	10.0	8.6	0.0	0.4	..
Paraguay	9.3	8.8	0.5	3.5	0.0	0.0	0.0	0.3	3.7
Peru	19.7	9.3	10.4	2.5	0.5	0.8	0.0	0.3	11.3
Philippines	19.6	8.4	11.3	3.0	0.0	0.1	1.3	0.6	12.3
Poland	20.0	10.1	9.9	5.0	0.3	0.2	0.1	1.5	12.9
Portugal	16.2	5.1	11.1	5.5	0.0	0.0	0.1	0.3	16.3
Puerto Rico	..	6.8	..	..	0.0	0.0	0.0	..	..
Romania	15.7	8.9	6.8	3.3	2.3	0.1	0.0	1.7	6.1
Russian Federation	33.0	9.6	23.4	3.7	12.8	0.0	0.0	2.0	12.2

	Gross domestic savings	Consumption of fixed capital	Net domestic savings	Education expenditure	Energy depletion	Mineral depletion	Net forest depletion	Carbon dioxide damage	Genuine domestic savings
	% of GDP 1999	% of GDP 1999	% of GDP 1999	% of GDP 1999	% of GDP 1999	% of GDP 1999	% of GDP 1999	% of GDP 1999	% of GDP 1999
Rwanda	−1.3	6.5	−7.9	3.3	0.0	0.0	3.0	0.2	−7.8
Saudi Arabia	31.3	10.7	20.6	6.4	39.1	0.0	0.0	1.1	−13.3
Senegal	12.6	7.5	5.1	3.4	0.0	0.2	0.0	0.5	7.8
Sierra Leone	−6.0	6.2	−12.2	1.0	0.0	0.1	2.9	0.3	−14.5
Singapore	51.7	12.5	39.3	2.4	0.0	0.0	0.0	0.5	41.2
Slovak Republic	26.5	10.0	16.5	4.2	0.0	0.0	0.0	1.2	19.6
Slovenia	23.9	17.6	6.3	5.2	0.0	0.0	0.0	0.5	11.1
South Africa	18.2	11.7	6.5	6.8	0.0	0.9	0.6	1.4	10.4
Spain	23.4	11.8	11.7	4.5	0.0	0.0	0.0	0.3	15.9
Sri Lanka	19.8	5.1	14.7	2.6	0.0	0.0	1.5	0.3	15.5
Sudan	..	7.0	..	..	0.0	0.1	0.0	0.2	..
Sweden	22.4	12.5	9.9	7.3	0.0	0.1	0.0	0.1	17.1
Switzerland	25.0	12.8	12.2	5.1	0.0	0.0	0.0	0.1	17.2
Syrian Arab Republic	18.2	3.5	14.7	2.0	19.0	0.1	0.0	1.6	−3.9
Tajikistan	13.5	7.2	6.3	2.0	0.2	0.0	0.0	..	..
Tanzania	2.2	6.7	−4.5	3.4	0.0	0.1	0.2	0.2	−1.5
Thailand	33.4	9.2	24.1	3.3	0.1	0.0	0.7	0.9	25.8
Togo	3.6	7.2	−3.6	4.3	0.0	0.7	0.3	0.4	−0.7
Trinidad and Tobago	26.6	10.5	16.1	3.2	12.6	0.0	0.0	2.0	4.8
Tunisia	24.4	9.4	15.1	6.3	1.9	0.6	0.3	0.6	18.1
Turkey	19.6	6.5	13.1	3.2	0.2	0.0	0.0	0.6	15.4
Turkmenistan	26.0	8.1	17.9	..	44.0	0.0	0.0	6.1	..
Uganda	4.9	6.8	−2.0	2.2	0.0	0.0	2.2	0.1	−2.1
Ukraine	20.9	8.0	12.8	5.9	6.1	0.0	0.0	5.2	7.5
United Arab Emirates	..	11.9	..	1.8	23.9	0.0	0.0	0.9	..
United Kingdom	15.9	12.4	3.5	4.7	0.3	0.0	0.0	0.2	7.7
United States	18.4	12.8	5.6	4.7	0.7	0.0	0.0	0.4	9.2
Uruguay	13.6	10.7	3.0	3.0	0.0	0.0	0.6	0.2	5.2
Uzbekistan	15.8	7.9	7.8	7.7	16.6	0.0	0.0	3.6	−4.6
Venezuela, RB	22.2	6.8	15.4	4.9	17.4	0.3	0.0	1.0	1.7
Vietnam	23.2	7.1	16.1	2.8	4.0	0.1	2.5	0.9	11.4
West Bank and Gaza	−18.7	8.9	−27.6	..	0.0	0.0	0.0	..	..
Yemen, Rep.	11.8	7.2	4.6	5.1	27.6	0.0	0.0	1.5	−19.4
Yugoslavia, FR (Serb./Mont.)	..	..	..	..	0.0	0.0	0.0	..	..
Zambia	−1.1	6.9	−8.1	1.9	0.0	2.1	0.0	0.5	−8.7
Zimbabwe	11.0	7.4	3.6	7.0	0.1	2.8	0.6	2.0	5.1
World	**24.7 w**	**12.3 w**	**12.3 w**	**4.5 w**	**1.3 w**	**0.1 w**	**0.1 w**	**0.5 w**	**15.0 w**
Low income	20.3	8.3	12.0	2.9	3.8	0.3	1.5	1.4	7.8
Middle income	26.1	9.6	16.6	3.5	4.2	0.3	0.1	1.1	14.3
Lower middle income	29.8	8.6	21.2	2.9	4.5	0.2	0.2	1.7	17.5
Upper middle income	23.4	10.4	13.0	3.9	3.9	0.3	0.1	0.6	12.0
Low & middle income	25.2	9.4	15.9	3.4	4.1	0.3	0.4	1.2	13.3
East Asia & Pacific	36.1	9.0	27.1	1.7	1.3	0.2	0.4	1.7	25.2
Europe & Central Asia	24.6	9.1	15.6	4.1	6.0	0.0	0.0	1.7	11.9
Latin America & Carib.	19.2	10.0	9.1	4.1	2.8	0.4	0.0	0.4	9.6
Middle East & N. Africa	24.2	9.3	15.0	4.7	19.7	0.1	0.0	1.1	−1.3
South Asia	18.3	8.8	9.5	3.1	1.0	0.2	1.8	1.3	8.3
Sub-Saharan Africa	15.3	9.3	6.0	4.7	4.2	0.6	1.1	0.9	3.9
High income	22.7	13.1	9.6	4.8	0.5	0.0	0.0	0.3	13.5
Europe EMU	23.2	12.1	11.1	4.8	..	0.0	0.0	0.2	..

Toward a measure of genuine savings | 3.15

Genuine domestic savings are derived from standard national accounting measures of gross domestic savings by making four types of adjustments. First, estimates of capital consumption of produced assets are deducted to obtain net domestic savings. Then current expenditures on education are added to net domestic savings as an approximate value of investments in human capital (in standard national accounting these expenditures are treated as consumption). Next, estimates of the depletion of a variety of natural resources are deducted to reflect the decline in asset values associated with their extraction and harvest. Finally, a deduction is made for damage from carbon dioxide emissions.

There are important gaps in the accounting of natural resource depletion and costs of pollution. Key estimates missing on the resource side include the value of fossil water extracted from aquifers, depletion and degradation of soils, and net depletion of fish stocks. The most important pollutants affecting human health and economic assets are also excluded, because no internationally comparable data are widely available on damage from particulate emissions, ground-level ozone, or acid rain.

Estimates of resource depletion are based on the calculation of unit resource rents. An economic rent represents an excess return to a given factor of production—that is, in this case the returns from resource depletion are higher than the normal rate of return on capital. Because natural resources are fixed in extent (at least for a given state of technology), resource rents will persist over time; in contrast, for produced goods and services competitive forces will expand supply until economic profits are driven to zero. For each type of resource and each country, unit resource rents are derived by taking the difference between world prices and the average unit extraction or harvest costs (including a "normal" return on capital). Unit rents are then multiplied by the physical quantity extracted or harvested in order to arrive at a depletion figure. This figure is one of a range of depletion estimates that are possible, depending on the assumptions made about future quantities, prices, and costs, and there is reason to believe that it is at the high end of the range. Some of the largest depletion estimates in the table should therefore be viewed with caution.

A positive depletion figure for forest resources implies that the harvest rate exceeds the rate of natural growth, and a negative figure that growth exceeds harvest. In principle, there should be an addition to savings in countries where growth exceeds harvest, but there is good reason to believe that most of this net growth is in forested areas that cannot be exploited economi-

cally at present. The average world prices used to estimate unit rents on timber are probably too high for countries with low-grade timber resources, so some of the net forest depletion estimates, especially those for Sub-Saharan Africa, should be viewed with caution. In addition, because the depletion estimates reflect only timber values, they ignore all the external benefits associated with standing forests.

Pollution damage is calculated as the marginal social cost associated with a unit of pollution multiplied by the increase in the stock of pollutant in the receiving medium. For carbon dioxide the unit damage figure represents the present value of damage to economic assets and decline in human welfare over the time the unit of pollution remains in the atmosphere.

Figure 3.15

Genuine domestic savings—a proxy for economic sustainability

% of GDP, 1999

- Gross domestic savings
- Net domestic savings
- Genuine domestic savings
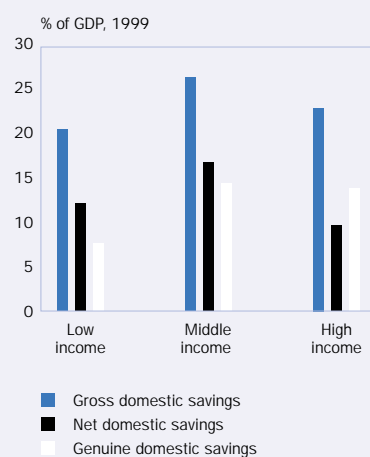
Source: Table 3.15.

When expenditure on education, depletion of natural resources, and damage from carbon dioxide are accounted for in estimating domestic savings, the results are lower than traditional estimates, particularly for low- and middle-income countries, where expenditure on education is relatively low. This measure of genuine domestic savings can serve as a proxy for the sustainability of economic activities.

- **Gross domestic savings** are calculated as the difference between GDP and public and private consumption. • **Consumption of fixed capital** represents the replacement value of capital used up in the process of production. • **Net domestic savings** are equal to gross domestic savings less the value of consumption of fixed capital. • **Education expenditure** refers to the current operating expenditures in education, including wages and salaries and excluding capital investments in buildings and equipment. • **Energy depletion** is equal to the product of unit resource rents and the physical quantities of energy extracted. It covers crude oil, natural gas, and coal. • **Mineral depletion** is equal to the product of unit resource rents and the physical quantities of minerals extracted. It refers to bauxite, copper, iron, lead, nickel, phosphate, tin, gold, and silver. • **Net forest depletion** is calculated as the product of unit resource rents and the excess of roundwood harvest over natural growth. • **Carbon dioxide damage** is estimated to be $20 per ton of carbon (the unit damage) times the number of tons of carbon emitted. • **Genuine domestic savings** are equal to net domestic savings plus education expenditure and minus energy depletion, mineral depletion, net forest depletion, and carbon dioxide damage.

Gross domestic savings are derived from the World Bank's national accounts data files, described in the *Economy* section. Consumption of fixed capital is from the United Nations Statistics Division's *National Accounts Statistics: Main Aggregates and Detailed Tables, 1997,* extrapolated to 1999. The education expenditure data are from the United Nations Statistics Division's *Statistical Yearbook 1997,* extrapolated to 1999. The wide range of data sources and estimation methods used to arrive at resource depletion estimates are described in a World Bank working paper, "Estimating National Wealth" (Kunte and others 1998). The unit damage figure for carbon dioxide emissions is from Fankhauser (1995).