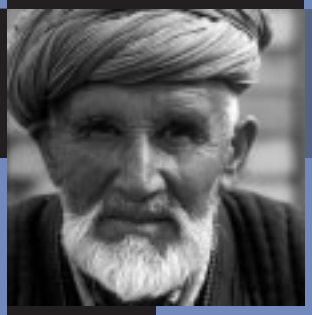
3 ENVIRONMENT



Economic development has led to dramatic improvements in the quality of life in developing countries, producing gains unparalleled in human history. But the picture is far from entirely positive. Gains have been unevenly distributed, and a large part of the world's population remains desperately poor. At the same time, natural resources—land, water, and forests—are being degraded at alarming rates in many countries, and environmental factors such as indoor and outdoor air pollution, waterborne diseases, and exposure to toxic chemicals threaten the health of millions of people. Addressing these concerns, successive international conferences, including the latest World Summit on Sustainable Development, have reaffirmed the commitment to eliminate poverty through environmentally sound and socially responsible economic development.

If the vision of a world without poverty is to be realized, sustainable development is the key. A healthy environment is central to the international development agenda and an integral part of meeting the Millennium Development Goals (see section 1, *World View*). The Millennium Development Goals call for integrating principles of environmental sustainability into country policies and programs and reversing environmental losses. This requires measuring and monitoring the state of the environment and its changes as well as the links between the economy and the environment.

Given such close links, there is a strong argument for developing indicators that integrate economic activity and environmental change. One approach that appears to hold much promise is environmental accounting. Aimed at deriving "greener" measures of national income, savings, and wealth, environmental accounting adds natural resources and pollutants to the assets and liabilities measured in the standard national accounts. But preparing full-fledged integrated environmental and economic accounts is costly, and not all countries are doing so. In the absence of such integrated accounts, physical indicators and descriptive statistics can provide useful information for monitoring the state of the environment.

Many such indicators are presented here, but despite greater awareness of the importance of environmental issues and efforts to improve environmental data, information on many aspects of the environment remains sparse. The available data are often of uneven quality,

relate to different periods, and are sometimes out of date. The lack of adequate data hampers efforts to measure the state of the environment and design sound policies. Another problem is that many environmental indicators are not meaningful at the national level. Climate change has impacts that go beyond national boundaries. Other environmental factors such as air and water pollution may have relevance only to the locality where they are measured. So global, regional, or city (tables 3.11 and 3.13) indicators are often more meaningful than national aggregates.

Fragile land and increasing demand for food

Almost three of every five people in developing countries—some 3 billion—live in rural areas (table 3.1). In many of these countries agriculture is still the main source of employment. But most of the land available to meet current and future food requirements is already in production; any further expansion must necessarily involve fragile and marginal lands. This is particularly so in developing countries where population growth is high, poverty is endemic, and existing institutional capacities for land management are weak. Because land resources are finite, fragile, and nonrenewable, countries must meet their increased need for food and other agricultural products mainly by raising and sustaining crop and livestock yields and by using land more intensively. Low-income countries are increasing the land under cereal production, but their use of agricultural machinery lags far behind that in other countries (table 3.2). These countries, where current cereal yields are a third those in high-income countries, will have to expand their arable land—a strategy that cannot be sustained for long (table 3.3).

Shrinking forests and threatened biodiversity

A substantial number of the world's 1.2 billion extremely poor people—those living on less than $1 a day—depend for their livelihoods on forests and forest products . But the forests are shrinking, as is the diversity of the plants and animals they support. With growth and development, forests are being converted to agricultural land and urban areas. At the beginning of the 20th century the earth had about 5 billion hectares of forested area. Now it has less than 4 billion hectares. The loss has been concentrated in developing countries, driven by the growing demand for timber and agricultural land, exacerbated by weak monitoring institutions. Low-income countries lost some 73 million hectares—about 8 percent of their forest—in the 1990s. By contrast, high-income countries reforested about 8 million hectares of forest in the same period (table 3.4).

Closely linked to changes in land use is biodiversity, another important dimension of environmental sustainability. Many countries have designated a share of their land as protected areas (table 3.4). But even where protected areas are increased and environmental protections are effectively respected, losses of biologically diverse areas cannot be reversed. About 12 percent of the world's nearly 10,000 bird species are vulnerable or in immediate danger of extinction, as are 24 percent of the world's 4,800 mammal species and an estimated 30 percent of all fish species.

A thirsty planet—and getting thirstier

Water is crucial to economic growth and development—and to the survival of both terrestrial and aquatic systems. But more than 1 billion people lack access to safe water, and more than 430 million live in countries facing chronic and widespread water shortages—with water stress (less than 1,700 cubic meters of freshwater available per person a year) or water scarcity (less than 1,000 cubic meters; table 3.5).

Global per capita water supplies are declining, further growth in population and economic activity will add to the demand for water, and by 2050 the share of the world's population facing water stress could increase more than fivefold. These trends pose a significant challenge for meeting the Millennium Development Goal of halving the proportion of people without sustainable access to safe drinking water by 2015.

Energy use improves welfare, but has its consequences

The use of energy, especially electricity, is important in raising people's standard of living. High-income countries use more than five times as much energy as developing countries on a per capita basis, and with only 15 percent of the world's population they use more than half its energy (table 3.7 and figure 3a).

At the same time, energy use and electricity generation also have environmental consequences. Generating energy produces emissions of carbon dioxide, the main greenhouse gas contributing to global warming. Anthropogenic (human caused) carbon dioxide emissions result primarily from fossil fuel combustion and cement manufacturing, with high-income countries contributing half (table 3.8), Among countries in all income groups, per capita emissions vary widely (figure 3b). The extent of environmental damage depends largely on how energy is generated. For example, burning coal releases twice as much carbon dioxide as does burning an equivalent amount of natural gas (see *About the data* for table 3.8).

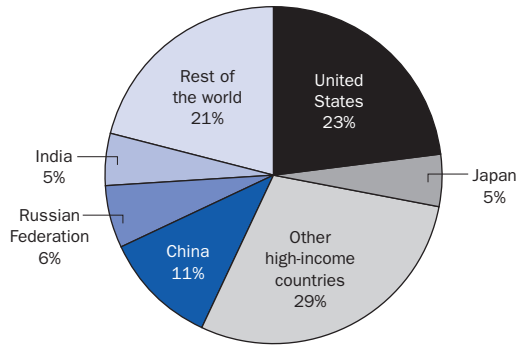
More urban—and more polluted

The world is become increasingly urban. Now urban areas are home to 48 percent of the world's population—two of five people in low- and middle-income countries and almost four of five in high-income countries. Most of Latin America is as urbanized as Europe, with 76 percent of the population living in urban areas. Asia is urbanizing rapidly. Even such traditionally rural countries as

3a

High-income countries use more than half the world's energy

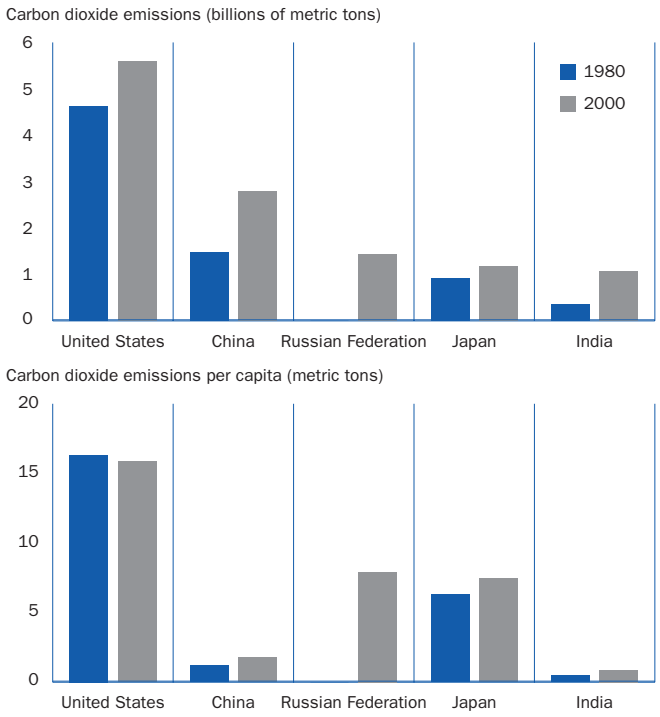
Global energy use, 2001



Source: Table 3.7.

3b

Emissions of carbon dioxide vary widely, even among the five largest producers of emissions



Note: No data for 1980 are available for the Russian Federation.
Source: Table 3.8 and World Bank staff estimates.

China, India, and Indonesia now have hundreds of millions of people living in urban areas, with both the number of people and the share of the population in cities growing rapidly (table 3.10). Urbanization can yield important social benefits, improving access to public services such as education, health care, and cultural facilities (table 3.11).

Urbanization can also lead to adverse environmental effects that require policy responses. Greater urbanization usually means greater pollution, which can overwhelm the natural capacities of air and water to absorb pollutants. The costs of controlling pollution can be enormous. And pollution exposes people to severe health hazards. Several major urban air pollutants—lead, sulfur dioxide, suspended particulate matter—are known to harm human health (table 3.13). A big source of urban air pollution is motor vehicles, whose numbers are strongly linked to rising income. The number of passenger cars in developing countries has increased from 16 cars per 1,000 people in 1990 to 28 in 2001. At the same time, the number of passenger cars in high-income countries has increased from 400 per 1,000 people to 440 (table 3.12).

Commitment to change—necessary, but not sufficient

The strength of environmental policies in any country reflects the priority its government gives to problems of environmental degradation—and that priority reflects the benefits expected from using scarce resources that have competing uses. But measuring governments' commitment to these goals is difficult. The indicators of government commitment in table 3.14 are imperfect, measuring the existence of policy instruments more than their effectiveness. Still, making a formal commitment is an essential first step toward taking action.

Beyond national environmental problems, governments are increasingly concerned about global environmental issues. To address these issues, countries have reached agreements and signed treaties on areas relating to the quality of life on earth (for example, figure 3c shows the decline in chlorofluorocarbons as a result of such agreements). Many of these agreements resulted from the 1992 United Nations Conference on Environment and Development in Rio de Janeiro, which produced Agenda 21—an array of actions to address environmental challenges. But 10 years after Rio the World Summit on Sustainable Development recognized that many of the proposed actions have yet to materialize.

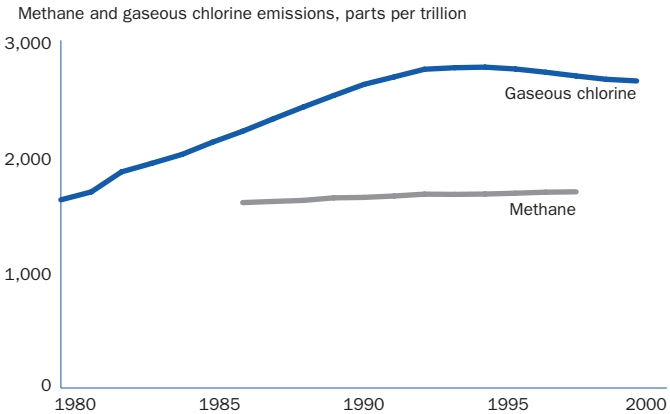
Adjusted net savings—moving toward a measure of sustainability

The question of an economy's sustainability can be reduced to the question of whether welfare is expected to decline along the future development path as a result of decisions made today. Because flows of income and well-being are ultimately derived from the stocks of produced, natural, and human assets, a drop in the aggregate value of these stocks must eventually lead to a decline in welfare. One measure of change in total assets is provided by net adjusted savings—a measure of savings that accounts not only for a country's economic surplus but also for its depletion of natural resources, accumulation of pollutants and their damages, and investments in human capital. The data limitations and the approximations used in calculating net adjusted savings mean that these estimates still must be used with caution (for more details on the assumptions made, see *About the data* for table 3.15).

Many developing countries have low or negative adjusted net savings. Broadly speaking, the lowest adjusted savings rates are recorded for countries that depend heavily on resource rents, particularly those endowed with minerals and fossil fuels. These rents account for a sizable share of GDP in many countries, suggesting that managing natural resources and resource revenues should receive even more attention as these countries strive to ensure the sustainability of their economies and the welfare of future generations.

3c

Emissions of some greenhouse and ozone-depleting gases have begun to fall or slow since Rio



Source: World Research Institute 2002.

3.1 Rural environment and land use

	Rural population			Rural population density	Land area	Land use					
			average annual %	people per sq. km	thousand			% of land area			
	% of total		growth	of arable land	sq. km	Arable land		Permanent cropland		Other land	
	1980	2002	1980–2002	2001	2001	1980	2001	1980	2001	1980	2001
Afghanistan	84	77	2.2	268	652	12.1	12.1	0.2	0.2	87.7	87.6
Albania	66	56	0.0	309	27	21.4	21.1	4.3	4.4	74.4	74.5
Algeria	56	42	1.0	170	2,382	2.9	3.2	0.3	0.2	96.8	96.5
Angola	79	65	1.9	277	1,247	2.3	2.4	0.4	0.2	97.3	97.4
Argentina	17	12	–0.4	13	2,737	10.6	12.3	0.4	0.5	89.0	87.2
Armenia	34	33	–0.3	204	28	..	17.6	..	2.3	..	80.1
Australia	14	9	–1.0	3	7,682	5.7	6.5	0.0	0.0	94.2	93.4
Austria	33	32	0.2	187	83	18.6	16.9	1.2	0.9	80.2	82.2
Azerbaijan	47	48	1.4	230	87	..	19.6	..	2.7	..	77.7
Bangladesh	85	74	1.5	1,228	130	68.3	62.1	2.0	3.1	29.6	34.8
Belarus	43	30	–1.5	49	207	..	29.5	..	0.6	..	69.9
Belgium	5	3	–2.4	32	33 [a]	23.2 [a]	25.7 [a]	0.4 [a]	0.7 [a]	76.4 [a]	73.6 [a]
Benin	73	56	1.7	182	111	13.6	18.1	0.8	2.4	85.7	79.5
Bolivia	55	37	0.4	110	1,084	1.8	2.7	0.1	0.2	98.1	97.1
Bosnia and Herzegovina	64	56	–0.6	333	51	..	13.6	..	3.0	..	83.4
Botswana	82	50	0.7	232	567	0.7	0.7	0.0	0.0	99.3	99.3
Brazil	33	18	–1.2	54	8,457	5.3	7.0	0.9	0.9	93.7	92.1
Bulgaria	39	32	–1.3	59	111	34.6	40.0	3.2	1.9	62.2	58.1
Burkina Faso	92	83	2.0	243	274	10.0	14.4	0.1	0.2	89.8	85.4
Burundi	96	90	2.2	699	26	36.2	35.0	12.5	14.0	51.3	50.9
Cambodia	88	82	2.5	274	177	11.3	21.0	0.4	0.6	88.3	78.4
Cameroon	69	50	1.2	130	465	12.7	12.8	2.2	2.6	85.1	84.6
Canada	24	21	0.4	14	9,221	4.9	5.0	0.0	0.0	95.0	95.0
Central African Republic	65	58	1.8	114	623	3.0	3.1	0.1	0.1	96.9	96.8
Chad	81	75	2.5	171	1,259	2.5	2.9	0.0	0.0	97.5	97.1
Chile	19	14	0.1	108	749	5.1	2.6	0.3	0.4	94.6	96.9
China [b]	80	62	0.1	561	9,327	10.4	15.4	0.4	1.2	89.3	83.4
Hong Kong, China	9	0	..	..	..	7.0	..	*1.0*	..	*92.0*	..
Colombia	37	24	–0.1	420	1,039	3.6	2.4	1.4	1.7	95.0	95.9
Congo, Dem. Rep.	..	..	..	..	2,267	2.9	3.0	0.4	0.5	96.6	96.5
Congo, Rep.	58	33	0.7	690	342	0.4	0.5	0.1	0.1	99.5	99.4
Costa Rica	53	40	1.2	697	51	5.5	4.4	4.4	5.9	90.1	89.7
Côte d'Ivoire	65	56	2.5	292	318	6.1	9.7	7.2	13.8	86.6	76.4
Croatia	50	41	–1.0	128	56	..	26.1	..	2.3	..	71.6
Cuba	32	24	–0.6	76	110	23.9	33.1	6.4	7.6	69.7	59.3
Czech Republic	25	25	–0.0	85	77	..	39.8	..	3.1	..	57.1
Denmark	16	15	–0.2	35	42	62.3	54.0	0.3	0.2	37.4	45.8
Dominican Republic	49	33	0.1	263	48	22.1	22.7	7.2	10.3	70.6	67.0
Ecuador	53	36	0.4	285	277	5.6	5.9	3.3	4.9	91.1	89.2
Egypt, Arab Rep.	56	57	2.3	1,306	995	2.3	2.9	0.2	0.5	97.5	96.6
El Salvador	56	38	–0.3	370	21	26.9	31.9	11.7	12.1	61.4	56.1
Eritrea	86	80	2.4	679	101	..	5.0	..	0.0	..	95.0
Estonia	30	31	–0.3	62	42	..	16.0	..	0.4	..	83.5
Ethiopia	90	84	2.3	517	1,000	..	10.7	..	0.8	..	88.5
Finland	40	41	0.5	97	305	7.8	7.2	0.0	0.0	92.2	92.8
France	27	24	0.0	78	550	31.8	33.5	2.5	2.1	65.7	64.4
Gabon	50	17	–2.0	71	258	1.1	1.3	0.6	0.7	98.2	98.1
Gambia, The	80	68	2.8	372	10	15.5	25.0	0.4	0.5	84.1	74.5
Georgia	48	43	–0.4	286	69	..	11.4	..	3.9	..	84.7
Germany	17	12	–1.4	86	349	34.5	33.9	1.4	0.6	64.1	65.6
Ghana	69	63	2.4	343	228	8.4	16.3	7.5	9.7	84.2	74.1
Greece	42	39	0.1	154	129	22.5	21.1	7.9	8.8	69.6	70.1
Guatemala	63	60	2.3	516	108	11.7	12.5	4.4	5.0	83.9	82.4
Guinea	81	72	2.0	614	246	2.9	3.6	1.8	2.6	95.4	93.8
Guinea-Bissau	83	67	1.8	317	28	9.1	10.7	1.7	8.8	89.2	80.5
Haiti	76	63	1.1	664	28	28.3	28.3	11.6	11.6	60.1	60.1

Rural environment and land use 3.1

	Rural population			Rural population density	Land area	Land use					
			average annual % growth	people per sq. km of arable land	thousand sq. km	Arable land		% of land area Permanent cropland		Other land	
	% of total 1980	2002	1980–2002	2001	2001	1980	2001	1980	2001	1980	2001
Honduras	65	45	1.3	288	112	13.3	9.5	2.4	3.2	84.3	87.2
Hungary	43	35	–1.2	78	92	54.4	50.1	3.3	2.1	42.2	47.8
India	77	72	1.6	460	2,973	54.8	54.4	1.8	2.7	43.4	42.9
Indonesia	78	57	0.2	591	1,812	9.9	11.3	4.4	7.2	85.6	81.5
Iran, Islamic Rep.	50	35	0.6	160	1,636	7.9	8.7	0.4	1.4	91.6	89.9
Iraq	34	32	2.5	134	437	12.0	13.1	0.4	0.8	87.6	86.1
Ireland	45	40	0.2	150	69	16.1	15.2	0.0	0.0	83.9	84.8
Israel	11	8	0.8	157	21	15.8	16.4	4.3	4.2	80.0	79.4
Italy	33	33	0.0	232	294	32.2	27.8	10.0	9.5	57.7	62.7
Jamaica	53	43	–0.0	648	11	12.5	16.1	9.7	10.2	77.8	73.8
Japan	24	21	–0.2	603	365	13.3	12.2	1.6	1.0	85.1	86.8
Jordan	40	21	1.0	449	89	3.4	2.7	0.4	1.8	96.2	95.5
Kazakhstan	46	44	–0.2	31	2,700	..	8.0	..	0.1	..	92.0
Kenya	84	65	1.7	439	569	6.7	8.1	0.8	1.0	92.5	90.9
Korea, Dem. Rep.	43	39	0.8	353	120	19.0	20.8	2.4	2.5	78.6	76.7
Korea, Rep.	43	17	–3.2	491	99	20.9	17.2	1.4	2.0	77.8	80.9
Kuwait	9	4	–1.6	684	18	0.1	0.7	0.0	0.1	99.9	99.2
Kyrgyz Republic	62	66	1.7	232	192	..	7.3	..	0.3	..	92.4
Lao PDR	88	80	2.1	495	231	3.4	3.8	0.1	0.4	96.5	95.8
Latvia	32	40	0.6	51	62	..	29.7	..	0.5	..	69.9
Lebanon	26	10	–2.8	257	10	20.5	16.6	8.9	14.0	70.6	69.4
Lesotho	87	71	0.6	380	30	9.6	10.9	0.1	0.1	90.2	89.0
Liberia	65	54	1.7	461	96	3.9	3.9	2.1	2.3	94.0	93.8
Libya	31	12	–1.7	36	1,760	1.0	1.0	0.2	0.2	98.8	98.8
Lithuania	39	31	–0.9	37	65	..	45.2	..	0.9	..	53.9
Macedonia, FYR	47	40	–0.3	146	25	..	22.3	..	1.8	..	75.9
Madagascar	81	69	2.1	378	582	4.4	5.1	0.9	1.0	94.8	93.9
Malawi	91	85	2.2	406	94	16.1	23.4	0.9	1.5	83.0	75.1
Malaysia	58	41	1.0	554	329	3.0	5.5	11.6	17.6	85.4	76.9
Mali	82	68	1.7	165	1,220	1.6	3.8	0.0	0.0	98.3	96.1
Mauritania	72	40	–0.2	228	1,025	0.2	0.5	0.0	0.0	99.8	99.5
Mauritius	58	58	1.1	701	2	49.3	49.3	3.4	3.0	47.3	47.8
Mexico	34	25	0.5	102	1,909	12.1	13.0	0.8	1.3	87.1	85.7
Moldova	60	58	0.1	137	33	..	55.3	..	10.8	..	33.9
Mongolia	48	43	1.3	87	1,567	0.8	0.8	0.0	0.0	99.2	99.2
Morocco	59	43	0.5	146	446	16.9	19.6	1.1	2.2	82.0	78.2
Mozambique	87	66	0.6	302	784	3.7	5.1	0.3	0.3	96.0	94.6
Myanmar	76	71	1.4	346	658	14.6	15.2	0.7	1.0	84.8	83.8
Namibia	77	68	2.5	164	823	0.8	1.0	0.0	0.0	99.2	99.0
Nepal	93	87	2.0	668	143	16.0	21.7	0.2	0.6	83.8	77.7
Netherlands	12	10	0.1	184	34	23.3	26.7	0.9	1.0	75.7	72.3
New Zealand	17	14	0.3	36	268	9.8	5.6	3.4	7.0	86.8	87.4
Nicaragua	50	43	2.1	117	121	8.8	15.9	1.4	1.9	89.7	82.1
Niger	87	78	2.8	195	1,267	2.8	3.5	0.0	0.0	97.2	96.4
Nigeria	73	54	1.5	251	911	30.6	31.3	2.8	3.0	66.6	65.7
Norway	29	25	–0.3	128	307	2.7	2.9	..	..	..	..
Oman	68	23	–1.2	1,533	310	0.1	0.1	0.1	0.1	99.8	99.7
Pakistan	72	66	2.2	438	771	25.9	27.9	0.4	0.9	73.7	71.3
Panama	50	43	1.2	230	74	5.8	7.4	1.6	2.0	92.5	90.7
Papua New Guinea	87	82	2.3	2,060	453	0.4	0.5	1.1	1.4	98.5	98.1
Paraguay	58	43	1.2	77	397	4.1	7.6	0.3	0.2	95.6	92.2
Peru	35	27	0.7	191	1,280	2.5	2.9	0.3	0.4	97.2	96.7
Philippines	63	40	0.3	564	298	17.5	18.9	14.8	16.8	67.7	64.3
Poland	42	37	–0.2	104	304	48.0	45.9	1.1	1.1	50.9	53.0
Portugal	71	33	–3.2	176	92	26.5	21.7	7.8	7.8	65.7	70.4
Puerto Rico	33	24	–0.6	2,681	9	8.3	3.9	7.3	5.5	84.3	90.5

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	% of land area					
	Arable land		Permanent cropland			Other land					
	1980	2002	1980–2002	2001	2001	1980	2001	1980	2001	1980	2001
Romania	51	45	–0.6	107	230	42.7	40.8	2.9	2.3	54.4	56.9
Russian Federation	30	27	–0.3	32	16,889	..	7.3	..	0.1	..	92.6
Rwanda	95	94	2.0	743	25	30.8	40.5	10.3	12.2	58.9	47.3
Saudi Arabia	34	13	–0.6	79	2,150	0.9	1.7	0.0	0.1	99.1	98.2
Senegal	64	51	1.6	203	193	12.2	12.8	0.0	0.2	87.8	87.0
Serbia and Montenegro	54	48	–1.3	..	..	28.0	..	2.9	..	69.1	..
Sierra Leone	76	62	1.3	644	72	6.3	7.0	0.7	0.9	93.0	92.1
Singapore	0	0	..	0	1	3.3	1.6	9.8	0.0	86.9	98.4
Slovak Republic	48	42	–0.3	*158*	*48*	..	*30.4*	..	*2.8*	..	*66.8*
Slovenia	52	51	0.0	581	20	..	8.6	..	1.5	..	89.9
Somalia	78	72	1.3	622	627	1.6	1.7	0.0	0.0	98.4	98.3
South Africa	52	42	1.3	129	1,221	10.2	12.1	0.7	0.8	89.1	87.1
Spain	27	22	–0.6	69	499	31.1	26.1	9.9	9.9	59.0	64.1
Sri Lanka	78	77	1.1	1,607	65	13.2	13.9	15.9	15.7	70.9	70.4
Sudan	80	62	1.2	125	2,376	5.2	6.8	0.0	0.2	94.8	93.0
Swaziland	82	73	2.4	440	17	10.8	10.3	0.2	0.7	89.0	89.0
Sweden	17	17	0.3	55	412	7.2	6.5	0.0	0.0	92.8	93.4
Switzerland	43	33	–0.6	571	40	9.9	10.4	0.5	0.6	89.6	89.0
Syrian Arab Republic	53	48	2.6	173	184	28.5	25.2	2.5	4.4	69.1	70.3
Tajikistan	66	72	2.5	485	141	..	6.6	..	0.9	..	92.5
Tanzania	85	66	1.7	575	884	3.5	4.5	1.0	1.1	95.5	94.4
Thailand	83	80	1.1	326	511	32.3	29.4	3.5	6.5	64.2	64.2
Togo	77	66	2.2	123	54	35.9	46.1	1.6	2.2	62.6	51.6
Trinidad and Tobago	37	25	–0.9	441	5	13.6	14.6	9.0	9.2	77.4	76.2
Tunisia	48	33	0.2	118	155	20.5	17.9	9.7	13.7	69.7	68.4
Turkey	56	33	–0.3	97	770	32.9	30.9	4.1	3.3	63.0	65.8
Turkmenistan	53	55	2.5	148	470	..	3.7	..	0.1	..	96.1
Uganda	91	85	2.7	401	197	20.7	25.9	8.1	10.7	71.2	63.5
Ukraine	38	32	–1.0	48	579	..	56.2	..	1.6	..	42.2
United Arab Emirates	29	12	1.3	773	84	0.2	0.6	0.1	2.2	99.7	97.2
United Kingdom	11	10	–0.1	109	241	28.7	23.5	0.3	0.2	71.0	76.3
United States	26	22	0.3	37	9,159	20.6	19.1	0.2	0.2	79.2	80.6
Uruguay	15	8	–2.3	20	175	8.0	7.4	0.3	0.2	91.7	92.3
Uzbekistan	59	63	2.4	352	414	..	10.8	..	0.8	..	88.3
Venezuela, RB	21	13	0.1	122	882	3.4	2.9	0.8	0.9	95.8	96.1
Vietnam	81	75	1.5	923	325	18.2	20.0	1.9	6.0	79.8	74.1
West Bank and Gaza	..	..	..	..	..	..	..	..	..	..	..
Yemen, Rep.	81	75	3.2	923	528	2.6	2.8	0.2	0.2	97.2	97.0
Zambia	60	60	2.6	115	743	6.9	7.1	0.0	0.0	93.1	92.9
Zimbabwe	78	63	1.8	255	387	6.5	8.3	0.3	0.3	93.3	91.3
World	**61 w**	**52 w**	**0.8 w**	**476 w**	**130,145 s**	**10.3 w**	**10.8 w**	**0.8 w**	**1.0 w**	**88.9 w**	**88.2 w**
Low income	78	69	1.6	510	32,424	11.7	12.5	1.0	1.5	87.3	86.0
Middle income	61	47	0.2	473	66,725	8.2	9.6	0.9	1.0	90.9	89.5
Lower middle income	65	51	0.2	492	54,034	8.6	9.9	1.0	0.9	90.3	89.2
Upper middle income	34	25	0.1	190	12,691	7.0	8.0	0.7	1.0	92.3	90.9
Low & middle income	68	58	0.9	494	99,149	9.6	10.5	1.0	1.1	89.4	88.3
East Asia & Pacific	79	62	0.3	568	15,885	10.1	13.3	1.5	2.7	88.5	84.0
Europe & Central Asia	41	36	–0.1	124	23,722	37.1	11.2	3.1	0.4	59.8	88.4
Latin America & Carib.	35	24	0.0	203	20,053	6.4	7.4	0.9	1.0	92.8	91.6
Middle East & N. Africa	52	42	1.5	601	11,105	4.4	4.9	0.4	0.8	95.2	94.4
South Asia	78	72	1.7	553	4,781	42.5	42.5	1.5	2.2	56.1	55.3
Sub-Saharan Africa	79	67	1.8	350	23,603	5.5	6.7	0.7	0.9	93.8	92.4
High income	27	22	–0.3	205	30,996	12.1	11.6	0.5	0.5	87.4	87.9
Europe EMU	27	22	–0.5	139	2,436	27.3	25.7	4.8	4.6	67.9	69.7

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

Rural environment and land use 3.1

About the data

Indicators of rural development are sparse, as few indicators are disaggregated between rural and urban areas (for some that are, see tables 2.5, 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 the land used for shifting cultivation but currently lying fallow.) And following FAO practice, this year's edition of *World Development Indicators,* like the previous five, breaks down the category *cropland,* used in the earliest 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. Moreover, land use data in countries such as India are based on reporting systems that were designed for 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).

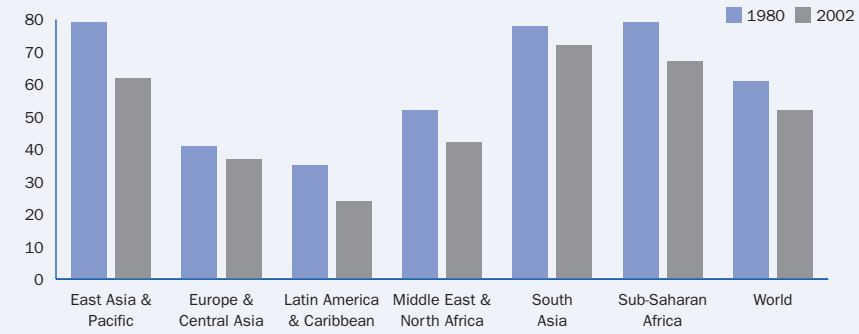
Definitions

• **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 the 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.

3.1a

All regions are becoming less rural

Rural population as a share of total population, by region (%)



Source: Table 3.1.

Data sources

The data on urban population shares used to estimate rural population come from the United Nations Population Division's *World Urbanization Prospects: The 2001 Revision.* The total population figures are World Bank estimates. The data on land area and land use are from the FAO's electronic files, which may contain more recent information than those 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		thousands of hectares		hundreds of grams per hectare of arable land		tractors per 1,000 agricultural workers		tractors per 100 sq. km of arable land	
	1979–81	1999–2001	1979–81	1999–2001	1979–81	2000–02	1979–81	1999–2001	1979–81	1999–2001	1979–81	1999–2001
Afghanistan	0.50	0.30	31.1	29.6	3,037	2,302	62	12	0	0	1	1
Albania	0.22	0.19	53.0	48.6	367	183	1,556	277	15	11	173	140
Algeria	0.37	0.25	3.4	6.8	2,968	1,770	277	126	27	37	68	122
Angola	0.41	0.24	2.2	2.3	705	928	49	5	4	2	35	34
Argentina	1.03	0.91	5.2	4.5	11,154	10,714	39	253	132	205	63	89
Armenia	..	0.16	..	51.3	..	191	..	122	..	74	..	369
Australia	2.97	2.58	3.5	4.7	15,986	17,097	269	478	751	705	75	64
Austria	0.20	0.17	0.2	0.3	1,062	821	2,615	1,591	945	1,737	2,084	2,371
Azerbaijan	..	0.21	..	74.8	..	735	..	58	..	31	..	178
Bangladesh	0.10	0.06	17.1	49.6	10,823	11,712	459	1,662	0	0	5	7
Belarus	..	0.61	..	2.1	..	2,491	..	1,288	..	102	..	118
Belgium [a]	0.08	0.08	1.7	4.7	426	336	5,323	3,549	917	1,299	1,416	1,266
Benin	0.43	0.31	0.3	0.5	525	921	11	211	0	0	1	1
Bolivia	0.36	0.35	6.6	4.2	559	754	22	25	4	4	21	20
Bosnia and Herzegovina	..	0.17	..	0.4	..	381	..	581	..	304	..	433
Botswana	0.44	0.22	0.5	0.3	153	177	32	128	9	20	54	166
Brazil	0.37	0.34	3.0	4.4	20,612	17,799	777	1,103	31	61	118	139
Bulgaria	0.43	0.54	28.3	17.4	2,110	1,988	2,334	328	66	86	161	57
Burkina Faso	0.39	0.34	0.4	0.6	2,026	3,061	26	96	0	0	0	5
Burundi	0.23	0.13	4.2	5.9	203	205	11	41	0	0	1	2
Cambodia	0.29	0.31	5.8	7.1	1,264	2,014	45	0	0	0	6	5
Cameroon	0.67	0.39	0.2	0.5	1,021	747	56	83	0	0	1	1
Canada	1.86	1.48	1.3	1.6	19,561	17,106	416	550	827	1,870	144	160
Central African Republic	0.81	0.52	..	..	194	180	5	3	0	0	0	0
Chad	0.70	0.45	0.4	0.6	907	1,900	6	49	0	0	1	0
Chile	0.34	0.13	31.1	82.7	820	626	338	2,421	43	55	90	273
China	0.10	0.11	45.1	36.3	94,647	83,012	1,494	2,562	2	2	76	70
Hong Kong, China	0.00	..	*37.5*	..	0	..	..	..	0	..	10	..
Colombia	0.13	0.06	7.7	20.2	1,361	1,147	812	2,397	8	6	77	80
Congo, Dem. Rep.	0.24	0.14	0.1	0.1	1,115	2,043	12	2	0	0	3	4
Congo, Rep.	0.08	0.05	0.6	0.5	19	10	27	286	2	1	49	40
Costa Rica	0.12	0.06	12.1	20.6	136	68	2,650	7,096	22	21	210	311
Côte d'Ivoire	0.24	0.19	1.0	1.0	1,008	1,381	261	217	1	1	16	12
Croatia	..	0.33	..	0.2	..	710	..	1,445	..	13	..	16
Cuba	0.27	0.32	22.9	19.5	224	202	2,024	447	78	100	259	215
Czech Republic	..	0.30	..	0.7	..	1,615	..	1,075	..	192	..	293
Denmark	0.52	0.43	14.5	19.5	1,818	1,550	2,453	1,516	973	1,132	708	547
Dominican Republic	0.19	0.13	11.7	17.2	149	168	572	869	3	3	20	17
Ecuador	0.20	0.13	24.8	29.0	419	867	471	1,177	6	11	40	90
Egypt, Arab Rep.	0.06	0.04	100.0	100.0	2,007	2,700	2,864	4,401	4	10	158	307
El Salvador	0.12	0.10	4.6	5.0	422	363	1,376	1,189	5	4	61	53
Eritrea	..	0.12	..	4.2	..	293	..	212	..	0	..	10
Estonia	..	0.71	..	0.4	..	290	..	393	..	602	..	575
Ethiopia	..	0.16	..	1.7	..	7,440	..	150	..	0	..	3
Finland	0.49	0.42	2.5	2.9	1,190	1,170	2,024	1,384	721	1,355	893	889
France	0.32	0.31	7.2	13.4	9,804	9,106	3,260	2,367	737	1,411	836	687
Gabon	0.42	0.26	2.4	3.0	6	17	20	9	5	7	43	46
Gambia, The	0.26	0.18	0.6	0.8	54	137	136	40	0	0	3	2
Georgia	..	0.15	..	44.2	..	338	..	521	..	33	..	221
Germany	0.15	0.14	3.7	4.0	7,692	7,001	4,249	2,367	624	1,018	1,340	873
Ghana	0.17	0.19	0.2	0.2	902	1,425	104	34	1	1	19	10
Greece	0.30	0.26	24.2	37.3	1,600	1,287	1,927	1,635	120	323	485	912
Guatemala	0.19	0.12	5.0	6.8	716	660	726	1,449	3	2	32	32
Guinea	0.16	0.12	7.9	6.3	708	742	16	36	0	0	2	6
Guinea-Bissau	0.32	0.22	5.6	3.1	142	154	24	60	0	0	1	1
Haiti	0.15	0.10	6.4	6.8	416	448	43	158	0	0	2	2

Agricultural inputs 3.2

	Arable land		Irrigated land		Land under cereal production		Fertilizer consumption		Agricultural machinery			
	hectares per capita		% of cropland		thousands of hectares		hundreds of grams per hectare of arable land		tractors per 1,000 agricultural workers		tractors per 100 sq. km of arable land	
	1979–81	1999–2001	1979–81	1999–2001	1979–81	2000–02	1979–81	1999–2001	1979–81	1999–2001	1979–81	1999–2001
Honduras	0.42	0.19	4.1	5.2	421	399	171	1,408	5	7	22	44
Hungary	0.47	0.46	3.6	4.6	2,878	2,936	2,906	835	59	209	111	228
India	0.24	0.16	22.8	32.2	104,350	97,956	345	1,074	2	6	24	94
Indonesia	0.12	0.10	16.2	14.4	11,825	15,004	645	1,243	0	1	5	35
Iran, Islamic Rep.	0.36	0.24	35.5	44.2	8,062	7,740	430	905	17	37	57	158
Iraq	0.40	0.24	32.1	60.8	2,159	2,526	172	668	23	91	44	107
Ireland	0.33	0.28	..	..	425	287	5,373	5,871	607	1,031	1,289	1,586
Israel	0.08	0.05	49.3	46.0	129	84	2,384	2,696	304	350	809	728
Italy	0.17	0.14	19.3	24.2	5,082	4,187	2,295	2,078	370	1,219	1,117	1,973
Jamaica	0.06	0.07	10.1	8.8	4	2	1,231	1,095	9	12	208	177
Japan	0.04	0.04	56.0	54.7	2,724	2,017	4,131	3,162	209	745	2,723	4,601
Jordan	0.14	0.05	11.0	19.3	158	52	404	913	47	32	153	234
Kazakhstan	..	1.44	..	10.8	..	13,082	..	19	..	36	..	24
Kenya	0.23	0.15	0.9	1.7	1,692	2,017	160	322	1	1	17	27
Korea, Dem. Rep.	0.13	0.11	44.0	52.1	1,625	1,278	3,346	1,061	12	20	196	280
Korea, Rep.	0.05	0.04	59.6	60.4	1,689	1,177	3,920	4,539	1	80	14	1,112
Kuwait	0.00	0.00	83.3	85.8	0	2	4,500	1,002	3	10	220	94
Kyrgyz Republic	..	0.28	..	74.2	..	618	..	157	..	46	..	186
Lao PDR	0.24	0.17	13.3	18.2	751	765	35	107	0	1	7	12
Latvia	..	0.78	..	1.1	..	440	..	305	..	350	..	302
Lebanon	0.07	0.04	28.3	32.0	34	53	1,663	3,105	28	177	141	453
Lesotho	0.23	0.19	0.3	0.3	203	236	150	247	6	6	47	61
Liberia	0.20	0.12	0.3	0.5	203	141	123	0	0	0	8	9
Libya	0.58	0.35	10.7	21.9	538	342	357	363	101	319	134	187
Lithuania	..	0.84	..	0.2	..	938	..	533	..	429	..	347
Macedonia, FYR	..	0.28	..	9.0	..	207	..	665	..	449	..	948
Madagascar	0.29	0.19	21.2	31.0	1,309	1,412	30	27	1	1	10	12
Malawi	0.25	0.21	1.1	1.3	1,155	1,602	203	195	0	0	8	7
Malaysia	0.07	0.08	6.7	4.8	729	705	4,273	6,695	4	25	77	239
Mali	0.31	0.43	4.5	3.0	1,346	2,769	61	95	0	1	5	6
Mauritania	0.13	0.18	22.8	9.8	125	185	57	30	1	1	13	8
Mauritius	0.10	0.08	15.0	19.5	0	0	2,547	3,667	4	6	33	37
Mexico	0.34	0.25	20.3	23.1	9,356	10,322	570	736	16	37	54	131
Moldova	..	0.42	..	14.1	..	989	..	25	..	84	..	230
Mongolia	0.71	0.50	3.0	7.1	559	196	83	26	32	16	82	42
Morocco	0.39	0.31	15.0	13.5	4,414	5,181	268	415	7	10	34	49
Mozambique	0.24	0.22	2.1	2.6	1,077	1,894	107	40	1	1	20	15
Myanmar	0.28	0.21	10.4	18.3	5,133	6,880	111	180	1	1	9	11
Namibia	0.64	0.43	0.6	0.9	195	292	0	4	11	11	39	39
Nepal	0.16	0.13	22.5	36.2	2,251	3,308	98	260	0	0	10	15
Netherlands	0.06	0.06	58.5	59.9	225	223	8,620	4,755	560	603	2,238	1,644
New Zealand	0.84	0.39	5.2	8.6	193	141	1,879	5,317	619	448	352	501
Nicaragua	0.38	0.37	6.2	4.5	266	464	415	159	6	7	20	15
Niger	0.62	0.42	0.7	1.5	3,872	7,693	10	10	0	0	0	0
Nigeria	0.39	0.22	0.7	0.8	6,048	19,783	59	68	1	2	3	11
Norway	0.20	0.20	..	..	311	326	3,146	2,196	824	1,263	1,603	1,511
Oman	0.02	0.02	74.5	78.2	2	2	475	1,690	1	1	43	40
Pakistan	0.24	0.15	72.7	81.6	10,693	12,300	525	1,362	5	13	50	150
Panama	0.22	0.19	5.0	5.1	166	123	692	584	27	20	122	93
Papua New Guinea	0.05	0.04	..	..	2	3	452	530	1	1	82	56
Paraguay	0.52	0.55	3.4	2.2	307	638	44	227	14	23	45	57
Peru	0.19	0.14	32.3	28.4	732	1,217	381	715	5	4	37	36
Philippines	0.11	0.07	12.8	14.6	6,790	6,514	636	1,337	1	1	20	20
Poland	0.41	0.36	0.7	0.7	7,875	8,643	2,393	1,110	112	302	425	933
Portugal	0.25	0.20	20.1	24.0	1,099	543	1,113	1,146	72	260	351	848
Puerto Rico	0.02	0.01	27.2	47.6	1	1	..	..	..	..	..	..

3.2 Agricultural inputs

	Arable land		Irrigated land		Land under cereal production		Fertilizer consumption		Agricultural machinery			
	hectares per capita		% of cropland		thousands of hectares		hundreds of grams per hectare of arable land		tractors per 1,000 agricultural workers		tractors per 100 sq. km of arable land	
	1979–81	1999–2001	1979–81	1999–2001	1979–81	2000–02	1979–81	1999–2001	1979–81	1999–2001	1979–81	1999–2001
Romania	0.44	0.42	21.9	31.2	6,340	5,696	1,448	309	39	100	150	174
Russian Federation	..	0.85	..	3.6	..	41,919	..	117	..	96	..	63
Rwanda	0.15	0.12	0.4	0.4	239	298	3	3	0	0	1	1
Saudi Arabia	0.20	0.17	28.9	42.8	388	615	228	1,036	2	16	10	27
Senegal	0.42	0.25	2.6	2.9	1,216	1,174	104	162	0	0	2	3
Serbia and Montenegro	0.73	..	1.9	..	4,310	..	1,261	..	140	..	616	..
Sierra Leone	0.14	0.10	4.1	5.4	434	213	58	4	0	0	6	2
Singapore	0.00	0.00	..	..	..	..	22,333	30,423	3	22	220	650
Slovak Republic	..	*0.27*	..	*11.2*	..	..	..	*610*	..	..	..	*164*
Slovenia	..	0.09	..	1.3	..	102	..	4,384	..	..	..	..
Somalia	0.15	0.12	13.3	18.7	638	671	9	5	1	1	17	17
South Africa	0.45	0.34	8.4	9.2	6,760	4,633	874	510	92	43	140	50
Spain	0.42	0.33	14.8	20.1	7,391	6,658	1,012	1,674	200	686	335	668
Sri Lanka	0.06	0.05	28.3	33.6	864	809	1,800	2,768	4	2	141	90
Sudan	0.64	0.52	14.4	11.7	4,447	7,468	51	32	2	2	8	7
Swaziland	0.30	0.17	34.0	36.8	70	56	1,050	343	29	34	173	219
Sweden	0.36	0.31	2.4	4.2	1,505	1,163	1,654	1,055	715	1,108	623	616
Switzerland	0.06	0.06	6.2	5.7	172	177	4,623	2,277	494	700	2,428	2,710
Syrian Arab Republic	0.60	0.29	9.6	22.5	2,642	3,028	250	731	29	68	54	212
Tajikistan	..	0.15	..	68.3	..	376	..	114	..	37	..	325
Tanzania	0.16	0.12	3.1	3.3	2,834	2,980	110	56	1	1	35	19
Thailand	0.35	0.25	16.4	27.1	10,625	11,257	177	1,120	1	10	11	147
Togo	0.77	0.55	0.3	0.4	416	703	14	74	0	0	0	0
Trinidad and Tobago	0.06	0.06	2.9	3.3	4	3	1,064	1,163	50	54	337	360
Tunisia	0.51	0.30	4.8	7.7	1,416	782	212	389	30	37	79	123
Turkey	0.57	0.36	9.6	16.9	13,499	13,946	529	825	38	65	169	391
Turkmenistan	..	0.37	..	100.1	..	819	..	603	..	73	..	289
Uganda	0.32	0.22	0.1	0.1	752	1,395	1	11	0	1	6	9
Ukraine	..	0.66	..	7.2	..	13,436	..	136	..	90	..	101
United Arab Emirates	0.01	0.02	237.7	32.6	0	0	2,250	7,090	6	5	106	68
United Kingdom	0.12	0.10	2.0	1.8	3,930	3,203	3,191	3,251	726	931	744	860
United States	0.83	0.62	10.8	12.6	72,639	55,818	1,092	1,097	1,230	1,586	253	272
Uruguay	0.48	0.39	5.4	13.5	614	522	564	846	171	174	236	255
Uzbekistan	..	0.18	..	88.6	..	1,581	..	1,637	..	57	..	380
Venezuela, RB	0.19	0.11	10.1	16.9	814	928	696	1,012	50	61	131	189
Vietnam	0.11	0.08	25.6	37.6	5,962	8,301	302	3,407	1	6	38	254
West Bank and Gaza	..	..	..	..	..	..	..	..	..	..	..	..
Yemen, Rep.	0.16	0.09	19.9	30.2	865	654	93	102	3	2	33	41
Zambia	0.89	0.53	0.4	0.9	595	641	145	65	2	2	9	11
Zimbabwe	0.35	0.25	3.1	3.5	1,633	1,685	610	520	7	7	66	75
World	**0.25 w**	**0.23 w**	**17.5 w**	**19.6 w**	**588,621 s**	**666,427 s**	**860 w**	**988 w**	**19 w**	**20 w**	**173 w**	**189 w**
Low income	0.23	0.17	19.8	26.4	199,719	244,864	289	717	2	4	20	66
Middle income	0.18	0.24	22.6	19.4	232,191	289,922	941	1,020	8	12	110	127
Lower middle income	0.16	0.22	25.8	20.5	196,509	249,113	962	1,063	6	9	104	103
Upper middle income	0.36	0.32	11.5	13.4	35,682	40,809	871	804	50	117	133	253
Low & middle income	0.20	0.20	21.2	22.1	431,910	534,786	625	903	5	8	66	103
East Asia & Pacific	0.12	0.11	36.3	35.5	139,927	135,938	1,113	2,145	2	2	55	76
Europe & Central Asia	..	0.56	..	10.9	..	114,548	..	335	..	102	..	171
Latin America & Carib.	0.36	0.29	10.8	12.5	49,845	48,623	536	815	25	40	87	119
Middle East & N. Africa	0.29	0.19	25.8	37.9	25,653	25,446	421	808	12	25	61	131
South Asia	0.23	0.15	28.7	39.9	132,128	128,481	360	1,081	2	5	25	92
Sub-Saharan Africa	0.32	0.24	4.0	4.2	46,978	81,750	158	128	3	1	23	15
High income	0.44	0.37	10.2	12.1	156,711	131,641	1,327	1,238	430	895	385	439
Europe EMU	0.23	0.21	14.1	19.4	35,996	31,617	2,703	2,170	427	911	879	984

a. Includes Luxembourg.

Agricultural inputs 3.2

About the data

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 soil 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, fertilizer, 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. Consumption is calculated as production plus imports minus exports. 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.

Definitions

• **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 permanent cropland (see table 3.1). • **Land under cereal production** refers to harvested areas, although some countries report only sown or cultivated area. • **Fertilizer consumption** is the quantity of plant nutrients used per unit of arable land. Fertilizer products cover nitrogenous, potash, and phosphate fertilizers (including ground rock phosphate). Traditional nutrients—animal and plant manures—are not included. 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. • **Agricultural workers** refer to all economically active people engaged principally in agriculture, forestry, hunting, or fishing.

3.2a

The 10 countries with the most arable land per person in 1999–2001—and the 10 with the least

Ares per capita

Country	Arable land	Country	Arable land
Australia	258.1	Singapore	0.0
Canada	148.2	Kuwait	0.5
Kazakhstan	143.6	Puerto Rico	0.9
Argentina	90.6	Oman	1.6
Russian Federation	85.5	United Arab Emirates	1.8
Lithuania	83.7	Japan	3.5
Latvia	77.8	Korea, Rep.	3.6
Estonia	71.0	Papua New Guinea	4.0
Ukraine	65.9	Lebanon	4.2
United States	62.5	Egypt, Arab Rep.	4.4

Note: An are equals 100 square meters or 0.01 hectare.
Source: Table 3.2.

Data sources

The data are from electronic files that the FAO makes available to the World Bank and that may contain more recent information than those published in the FAO's *Production Yearbook.*

3.3 Agricultural output and productivity

	Crop production index		Food production index		Livestock production index		Cereal yield		Agricultural productivity	
							kilograms		Agriculture value added	
	1989–91 = 100		1989–91 = 100		1989–91 = 100		per hectare		per worker 1995 $	
	1979–81	2000–02	1979–81	2000–02	1979–81	2000–02	1979–81	2000–02	1979–81	2000–02
Afghanistan	..	..	..	..	..	..	1,337	1,533	..	..
Albania	..	..	..	..	..	..	2,500	3,154	1,184	1,868
Algeria	77.4	128.0	68.8	136.2	54.6	128.9	656	1,343	1,357	1,919
Angola	101.9	195.7	89.9	172.5	83.8	137.2	526	606	..	137
Argentina	83.6	165.2	91.7	142.5	100.9	108.8	2,184	3,374	7,148	10,317
Armenia	..	99.8	..	79.3	..	67.9	..	2,049	..	2,827
Australia	79.9	152.2	91.3	138.8	85.6	116.1	1,321	1,758	20,872	36,327
Austria	92.8	103.6	92.2	104.7	94.5	103.2	4,131	5,589	11,082	33,828
Azerbaijan	..	63.4	..	83.7	..	81.8	..	2,583	..	1,029
Bangladesh	80.2	135.6	79.3	138.3	81.3	142.1	1,938	3,312	232	318
Belarus	..	90.3	..	62.1	..	58.4	..	2,369	..	3,038
Belgium [a]	84.9	143.9	88.5	113.5	88.8	109.8	4,861	8,002	21,861	57,462
Benin	53.8	195.6	66.8	173.9	93.2	116.7	698	1,077	311	621
Bolivia	71.9	177.2	71.5	151.6	75.5	129.7	1,183	1,786	693	754
Bosnia and Herzegovina	..	..	..	..	..	..	..	3,186	..	*7,634*
Botswana	86.4	89.8	87.3	89.8	87.6	89.7	203	156	657	575
Brazil	75.4	135.8	69.5	153.2	67.9	169.8	1,496	3,081	2,049	4,899
Bulgaria	107.7	66.9	105.5	68.2	96.3	62.9	3,853	2,961	2,754	8,282
Burkina Faso	59.3	166.8	62.7	157.9	59.9	147.8	575	968	133	185
Burundi	79.9	92.7	79.9	93.2	82.3	76.1	1,081	1,325	177	151
Cambodia	55.0	147.2	48.9	152.0	27.3	166.9	1,006	1,978	..	422
Cameroon	87.3	141.6	80.6	138.3	61.3	121.8	849	1,696	826	1,213
Canada	77.6	106.7	79.7	123.5	88.3	142.2	2,173	2,521	16,002	43,064
Central African Republic	102.9	136.6	79.7	146.5	48.9	147.4	529	1,069	380	502
Chad	66.8	160.8	79.8	151.2	89.2	122.2	587	697	160	211
Chile	70.7	132.6	71.5	140.2	75.8	151.4	2,124	5,235	3,488	6,226
China	67.1	155.6	60.8	185.9	45.4	226.7	3,027	4,845	161	338
Hong Kong, China	133.6	..	99.8	..	194.3	..	1,712	..	..	..
Colombia	84.1	106.4	75.5	120.3	72.6	122.4	2,452	3,411	3,034	3,619
Congo, Dem. Rep.	73.0	83.2	72.8	86.3	83.5	98.3	807	774	241	212
Congo, Rep.	86.4	127.9	83.8	130.3	81.6	135.5	838	779	385	469
Costa Rica	66.2	147.0	69.5	150.0	77.1	136.6	2,498	3,968	3,139	5,270
Côte d'Ivoire	73.7	133.8	70.6	136.5	73.9	139.3	867	1,213	945	1,046
Croatia	..	90.6	..	68.5	..	55.2	..	4,748	..	9,741
Cuba	84.1	66.3	90.1	70.9	96.0	71.6	2,458	2,519	..	..
Czech Republic	..	88.6	..	78.0	..	70.8	..	4,297	..	6,382
Denmark	65.2	89.9	83.3	106.0	95.0	118.6	4,040	5,912	19,350	63,131
Dominican Republic	96.5	89.6	85.2	107.8	68.8	138.2	3,024	4,525	2,129	3,458
Ecuador	78.2	143.2	77.4	153.8	73.0	170.1	1,633	2,122	3,839	3,310
Egypt, Arab Rep.	75.5	154.9	68.5	158.2	67.0	165.9	4,053	7,244	721	1,316
El Salvador	120.4	98.9	88.9	111.7	86.5	116.3	1,702	2,264	1,925	1,678
Eritrea	..	121.9	..	116.3	..	112.0	..	351	..	68
Estonia	..	76.8	..	39.8	..	33.8	..	2,028	..	3,650
Ethiopia	..	160.6	..	152.6	..	129.8	..	1,293	..	154
Finland	76.3	99.7	93.8	93.7	107.5	91.8	2,511	3,219	17,885	42,306
France	87.4	107.0	93.6	104.3	97.8	105.5	4,700	6,796	19,318	59,243
Gabon	76.2	121.4	79.0	116.7	86.6	118.9	1,718	1,652	1,814	2,102
Gambia, The	79.2	132.8	82.4	127.2	93.7	102.7	1,284	1,231	325	307
Georgia	..	43.7	..	74.9	..	93.8	..	2,004	..	..
Germany	90.0	118.2	91.4	97.1	98.7	87.7	4,166	6,355	9,119	33,686
Ghana	67.0	190.0	68.5	181.2	78.7	127.3	807	1,191	671	571
Greece	86.8	110.6	91.2	101.3	99.9	94.0	3,090	3,555	8,600	13,860
Guatemala	85.8	131.8	68.0	136.2	76.9	130.3	1,578	1,758	2,143	2,115
Guinea	89.7	158.7	93.1	161.8	91.7	188.8	958	1,403	..	286
Guinea-Bissau	64.9	147.2	68.3	142.2	78.0	127.2	711	972	237	324
Haiti	103.4	87.2	101.2	101.7	100.2	156.2	1,009	840	..	..

Agricultural output and productivity

3.3

	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	**2000–02**	**1979–81**	**2000–02**	**1979–81**	**2000–02**	**1979–81**	**2000–02**	**1979–81**	**2000–02**
Honduras	90.4	114.1	88.3	121.1	81.0	153.8	1,170	1,382	696	1,037
Hungary	93.3	79.7	90.7	79.5	94.1	73.3	4,519	4,026	3,390	5,625
India	70.9	124.2	68.2	131.8	62.6	149.8	1,324	2,390	269	401
Indonesia	65.9	122.9	63.1	123.6	51.0	124.7	2,837	4,141	604	748
Iran, Islamic Rep.	57.5	151.5	61.2	154.8	68.0	158.3	1,108	2,163	2,165	3,737
Iraq	74.7	76.7	77.3	77.5	81.2	67.9	832	945	..	..
Ireland	93.6	111.3	83.5	106.7	83.5	107.7	4,733	7,053	..	..
Israel	99.8	97.4	85.0	115.3	78.4	127.6	1,840	2,853	..	..
Italy	106.1	101.9	101.4	102.3	93.0	105.1	3,548	4,815	11,090	27,064
Jamaica	101.4	127.5	93.6	125.9	85.5	126.2	1,667	1,002	1,123	1,487
Japan	108.3	87.1	94.1	91.6	85.1	93.2	5,252	5,879	17,378	33,077
Jordan	54.6	132.6	57.4	147.4	51.5	167.7	521	1,301	1,141	1,145
Kazakhstan	..	89.5	..	73.5	..	46.7	..	1,149	..	1,753
Kenya	70.2	123.1	65.6	122.2	60.5	118.0	1,364	1,516	265	213
Korea, Dem. Rep.	..	..	..	..	..	..	3,694	3,189	..	..
Korea, Rep.	87.8	114.3	77.5	132.3	52.4	159.9	4,986	6,118	3,765	14,251
Kuwait	37.1	198.1	81.0	229.0	94.5	211.2	3,124	2,206	..	..
Kyrgyz Republic	..	153.2	..	132.5	..	80.7	..	2,742	..	1,861
Lao PDR	73.5	177.5	70.3	186.4	56.0	188.8	1,402	3,140	..	621
Latvia	..	78.7	..	42.4	..	31.1	..	2,189	..	2,773
Lebanon	49.9	100.4	60.6	108.9	95.0	157.0	1,307	2,575	..	29,874
Lesotho	98.2	147.9	96.6	111.6	96.6	87.2	977	926	611	575
Liberia	..	..	..	..	..	..	1,251	983	..	..
Libya	76.3	129.4	78.7	134.1	68.4	134.9	430	631	..	..
Lithuania	..	76.5	..	64.7	..	52.6	..	2,807	..	3,431
Macedonia, FYR	..	94.9	..	89.5	..	89.9	..	2,642	..	4,243
Madagascar	83.1	108.5	83.8	115.8	87.7	114.2	1,664	2,007	158	155
Malawi	85.7	156.0	93.1	174.0	78.4	125.4	1,161	1,134	96	124
Malaysia	75.3	119.4	55.6	142.1	41.0	142.1	2,828	3,132	3,939	6,912
Mali	54.5	143.9	77.2	128.6	95.6	123.2	804	943	242	274
Mauritania	62.1	126.2	86.5	108.3	89.4	107.0	384	860	289	447
Mauritius	93.3	98.1	89.6	109.0	64.0	145.3	2,536	7,577	2,891	5,494
Mexico	86.5	123.6	85.3	135.7	86.2	150.1	2,164	2,870	1,482	1,813
Moldova	..	61.9	..	51.1	..	32.9	..	2,345	..	971
Mongolia	44.6	29.7	88.1	91.9	93.2	97.4	573	751	*994*	1,444
Morocco	54.8	91.8	55.8	103.6	59.8	124.6	811	1,129	1,146	1,513
Mozambique	109.9	141.1	100.7	127.5	85.8	103.9	603	848	..	136
Myanmar	89.0	178.5	88.2	176.5	89.1	169.4	2,521	3,453	..	..
Namibia	80.1	126.9	107.6	96.8	116.0	93.3	377	400	1,064	1,545
Nepal	61.9	137.9	65.4	135.8	77.3	129.3	1,615	2,178	156	203
Netherlands	79.8	111.7	86.5	98.4	88.3	96.5	5,696	7,531	24,360	59,476
New Zealand	74.4	142.9	90.7	135.2	95.5	123.9	4,089	6,230	16,637	28,740
Nicaragua	124.1	141.3	117.8	154.3	139.7	148.1	1,475	1,761	1,549	1,618
Niger	89.2	147.5	97.5	140.1	110.0	128.9	440	417	229	197
Nigeria	51.7	156.0	57.2	155.8	83.3	145.3	1,265	1,105	417	729
Norway	94.8	77.6	93.9	91.0	96.2	97.4	3,634	3,760	17,138	37,073
Oman	60.1	160.3	62.1	163.1	61.5	144.5	982	2,319	..	..
Pakistan	65.6	122.8	66.3	152.7	59.5	171.9	1,608	2,266	416	716
Panama	96.9	83.3	85.5	105.8	71.3	138.6	1,524	2,753	2,122	2,967
Papua New Guinea	86.5	120.7	86.1	124.3	84.9	146.0	2,087	3,919	692	823
Paraguay	58.7	115.5	60.8	141.0	62.1	136.9	1,535	2,034	2,641	3,318
Peru	82.1	180.3	77.3	175.0	78.0	159.1	1,946	3,302	1,299	1,863
Philippines	88.3	123.1	86.1	137.1	73.8	177.8	1,611	2,692	1,381	1,458
Poland	84.6	84.0	87.9	86.0	98.0	83.3	2,345	3,072	..	1,637
Portugal	85.0	91.7	72.2	102.2	71.8	122.3	1,102	2,702	3,796	7,567
Puerto Rico	131.3	67.9	99.8	84.0	90.3	89.4	7,970	1,731	..	..

3.3 Agricultural output and productivity

	Crop production index		Food production index		Livestock production index		Cereal yield		Agricultural productivity	
							kilograms per hectare		Agriculture value added per worker	
	1989–91 = 100		1989–91 = 100		1989–91 = 100				1995 $	
	1979–81	**2000–02**	**1979–81**	**2000–02**	**1979–81**	**2000–02**	**1979–81**	**2000–02**	**1979–81**	**2000–02**
Romania	114.1	91.0	113.0	87.1	110.0	80.7	2,854	2,562	1,397	3,588
Russian Federation	..	86.1	..	66.6	..	52.6	..	1,846	..	3,822
Rwanda	84.9	115.4	85.8	117.3	80.3	112.3	1,134	1,011	271	254
Saudi Arabia	27.2	84.2	26.7	98.5	32.7	152.6	820	3,818	2,152	15,796
Senegal	77.2	111.0	74.1	122.4	65.7	147.0	690	755	345	354
Serbia and Montenegro	96.3	..	94.3	..	94.2	..	3,601	..	..	..
Sierra Leone	80.3	75.4	84.5	84.0	84.1	126.6	1,249	1,234	674	359
Singapore	595.0	48.2	154.3	31.9	173.7	31.8	..	..	16,664	42,920
Slovak Republic	..	..	..	..	..	..	..	..	..	..
Slovenia	..	81.9	..	100.9	..	108.7	..	5,452	..	37,671
Somalia	..	..	..	..	..	..	474	547	..	..
South Africa	94.9	110.1	90.5	111.1	86.0	104.3	2,105	2,633	2,857	4,072
Spain	83.0	115.8	81.9	120.1	83.9	134.2	1,986	3,091	7,556	22,412
Sri Lanka	99.3	114.8	98.1	117.2	92.0	147.7	2,462	3,520	642	725
Sudan	127.1	165.9	105.2	167.5	89.3	161.1	645	600	..	..
Swaziland	72.5	85.2	81.1	99.9	99.9	126.4	1,345	1,512	1,752	1,936
Sweden	93.1	89.3	100.6	96.0	103.8	100.2	3,595	4,878	20,865	40,368
Switzerland	95.5	89.6	95.8	95.6	98.8	94.9	4,883	6,466	..	..
Syrian Arab Republic	100.7	177.2	93.6	163.6	72.1	136.1	1,156	2,114	2,206	2,636
Tajikistan	..	62.2	..	60.5	..	41.6	..	1,561	..	728
Tanzania	80.5	107.7	75.4	112.8	69.2	126.9	1,063	1,438	..	187
Thailand	79.1	124.3	79.7	123.5	64.5	135.3	1,911	2,654	616	863
Togo	70.6	138.0	78.3	131.4	56.2	115.2	729	1,008	365	503
Trinidad and Tobago	121.5	87.9	111.1	127.8	96.9	157.3	3,167	2,807	3,536	3,034
Tunisia	68.1	98.4	66.3	115.0	60.3	164.4	828	2,218	1,743	3,115
Turkey	76.6	118.8	75.8	114.6	80.4	103.9	1,869	2,176	1,872	1,848
Turkmenistan	..	77.7	..	131.6	..	138.0	..	2,621	..	690
Uganda	67.5	138.9	69.7	136.7	81.9	130.6	1,555	1,651	..	346
Ukraine	..	71.3	..	52.4	..	45.7	..	2,399	..	1,576
United Arab Emirates	38.9	659.7	42.7	549.9	42.2	200.6	2,224	414	..	..
United Kingdom	80.1	97.2	92.2	92.4	98.1	93.1	4,792	6,841	20,326	32,918
United States	98.6	118.3	94.5	122.5	89.0	123.6	4,151	5,830	20,672	53,907
Uruguay	86.8	135.3	87.1	124.8	85.9	110.4	1,644	3,243	6,563	8,177
Uzbekistan	..	89.0	..	122.3	..	114.8	..	3,644	..	1,449
Venezuela, RB	76.3	119.3	80.2	135.0	84.9	138.8	1,904	3,278	3,935	5,399
Vietnam	65.8	180.3	62.5	171.4	50.1	193.8	2,049	4,375	..	256
West Bank and Gaza	..	..	..	..	..	..	..	..	..	..
Yemen, Rep.	82.3	133.6	74.8	142.6	68.9	160.4	1,038	966	..	412
Zambia	64.6	96.2	73.0	107.2	86.2	130.2	1,676	1,481	186	194
Zimbabwe	77.8	113.9	83.3	108.6	89.7	121.5	1,359	872	310	355
World	**79.1 w**	**131.5 w**	**78.8 w**	**133.1 w**	**79.6 w**	**136.4 w**	**1,605 w**	**2,233 w**	**.. w**	**.. w**
Low income	71.7	134.0	70.7	135.1	68.4	146.8	1,090	1,321	..	415
Middle income	74.3	147.0	71.8	150.3	69.6	164.4	1,759	2,497	..	820
Lower middle income	72.5	154.2	68.8	158.0	60.8	181.9	1,682	2,181	..	713
Upper middle income	79.4	116.2	78.8	118.6	82.8	114.0	1,842	2,926	..	3,937
Low & middle income	73.3	142.7	71.5	145.2	69.3	159.9	1,397	1,966	..	626
East Asia & Pacific	68.5	166.1	63.4	170.6	47.9	214.6	2,034	3,147	..	..
Europe & Central Asia	..	..	..	..	..	..	2,854	2,640	..	2,353
Latin America & Carib.	80.3	138.6	78.3	141.9	79.8	144.8	1,786	2,804	2,239	3,570
Middle East & N. Africa	66.0	136.4	64.8	137.1	64.1	145.3	925	1,726	..	2,340
South Asia	71.9	131.6	69.6	133.3	64.0	154.3	1,510	2,222	285	412
Sub-Saharan Africa	75.4	132.3	78.3	133.5	84.1	124.4	895	1,064	419	360
High income	93.4	112.5	91.9	113.2	90.6	112.5	3,274	3,746	..	..
Europe EMU	90.7	105.3	91.4	105.2	93.9	101.9	4,035	5,517	..	30,154

a. Includes Luxembourg.

Agricultural output and productivity 3.3

About the data

The agricultural production indexes in the table are prepared by the Food and Agriculture Organization (FAO). The FAO obtains data from official and semi-official 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 includes 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.

Definitions

• **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. • **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.

3.3a The 15 countries with the highest cereal yield in 2001–03—and the 15 with the lowest

Kilograms per hectare of arable land

Country	Cereal yield	Country	Cereal yield
Belgium [a]	8,002	Botswana	156
Mauritius	7,577	Eritrea	351
Netherlands	7,531	Namibia	400
Egypt, Arab Rep.	7,244	United Arab Emirates	414
Ireland	7,053	Niger	417
United Kingdom	6,841	Somalia	547
France	6,796	Sudan	600
Switzerland	6,466	Angola	606
Germany	6,355	Libya	631
New Zealand	6,230	Chad	697
Korea, Rep.	6,118	Mongolia	751
Denmark	5,912	Senegal	755
Japan	5,879	Congo, Dem. Rep.	774
United States	5,830	Congo, Rep.	779
Austria	5,589	Haiti	840

a. Includes Luxembourg.
Source: Table 3.3.

Data sources

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 data on agricultural value added, see *Data sources* for table 4.2.

3.4 Deforestation and biodiversity

	Forest area		Average annual deforestation		Mammals		Birds		Higher plants [a]		Nationally protected areas	
	thousand sq. km	% of total land area	sq. km	%	Species	Threatened species	Species	Threatened species	Species	Threatened species	thousand sq. km	% of total land area
	2000	**2000**	**1990–2000**	**1990–2000**	**2002**	**2002**	**2002**	**2002**	**2002**	**2002**	**2003 [b]**	**2003 [b]**
Afghanistan	14	2.1	..	..	119	13	181	11	4,000	1	2.0	0.3
Albania	10	36.2	78	0.8	68	3	193	3	3,031	0	1.0	3.8
Algeria	21	0.9	–266	–1.3	92	13	183	6	3,164	2	119.1	5.0
Angola	698	56.0	1,242	0.2	276	19	265	15	5,185	19	82.3	6.6
Argentina	346	12.7	2,851	0.8	320	34	362	39	9,372	42	180.6	6.6
Armenia	4	12.4	–42	–1.3	84	11	236	4	3,553	1	2.1	7.6
Australia	1,581	20.6	0	0.0	252	63	497	37	15,638	38	1,029.4	13.4
Austria	39	47.0	–77	–0.2	83	7	230	3	3,100	3	27.3	33.0
Azerbaijan	11	12.6	–130	–1.3	99	13	229	8	4,300	0	5.3	6.1
Bangladesh	13	10.2	–165	–1.3	125	23	166	23	5,000	12	1.0	0.8
Belarus	94	45.3	–2,562	–3.2	74	7	194	3	2,100	0	13.1	6.3
Belgium	7 [c]	22.2 [c]	–10 [c]	–0.2 [c]	58	11	191	2	1,550	0	*0.9*	*2.6*
Benin	27	24.0	699	2.3	188	8	112	2	2,500	11	12.6	11.4
Bolivia	531	48.9	1,611	0.3	316	24	504	28	17,367	70	145.3	13.4
Bosnia and Herzegovina	23	44.8	0	0.0	72	10	205	3	..	1	0.3	0.5
Botswana	124	21.9	1,184	0.9	164	6	184	7	2,151	0	104.8	18.5
Brazil	5,325	63.0	22,264	0.4	394	81	686	114	56,215	..	566.6	6.7
Bulgaria	37	33.4	–204	–0.6	81	14	248	10	3,572	0	5.0	4.5
Burkina Faso	71	25.9	152	0.2	147	7	138	2	1,100	2	31.5	11.5
Burundi	1	3.7	147	9.0	107	6	145	7	2,500	2	1.5	5.7
Cambodia	93	52.9	561	0.6	123	24	183	19	..	29	32.7	18.5
Cameroon	239	51.3	2,218	0.9	409	40	165	15	8,260	155	20.9	4.5
Canada	2,446	26.5	0	0.0	193	14	310	8	3,270	1	1,023.5	11.1
Central African Republic	229	36.8	300	0.1	209	14	168	3	3,602	10	54.2	8.7
Chad	127	10.1	817	0.6	134	17	141	5	1,600	2	114.6	9.1
Chile	155	20.7	203	0.1	91	21	157	22	5,284	40	141.5	18.9
China	1,589	17.0	–13,483	–0.9	394	79	618	74	32,200	168	727.5	7.8
Hong Kong, China	..	..	..	..	..	1	..	11	..	..	*0.5*	..
Colombia	496	47.8	1,905	0.4	359	41	708	78	51,220	213	105.9	10.2
Congo, Dem. Rep.	1,352	59.6	5,324	0.4	200	15	130	3	6,000	33	113.4	5.0
Congo, Rep.	221	64.6	175	0.1	450	40	345	28	11,007	55	22.2	6.5
Costa Rica	20	38.5	158	0.8	205	14	279	13	12,119	109	11.7	23.0
Côte d'Ivoire	71	22.4	2,649	3.1	230	19	252	12	3,660	101	19.1	6.0
Croatia	18	31.9	–20	–0.1	76	9	224	4	4,288	0	4.2	7.5
Cuba	23	21.4	–277	–1.3	31	11	86	18	6,522	160	75.9	69.1
Czech Republic	26	34.1	–5	–0.0	81	8	205	2	1,900	4	12.4	16.1
Denmark	5	10.7	–10	–0.2	43	5	196	1	1,450	3	14.4	34.0
Dominican Republic	14	28.4	0	0.0	20	5	79	15	5,657	29	25.1	51.9
Ecuador	106	38.1	1,372	1.2	302	33	640	62	19,362	197	50.7	18.3
Egypt, Arab Rep.	1	0.1	–20	–3.4	98	13	123	7	2,076	2	96.6	9.7
El Salvador	1	5.8	72	4.6	135	2	141	0	2,911	23	0.1	0.4
Eritrea	16	15.7	54	0.3	112	12	138	7	..	3	4.3	4.3
Estonia	21	48.7	–125	–0.6	65	4	204	3	1,630	0	5.0	11.8
Ethiopia	46	4.6	403	0.8	277	35	262	16	6,603	22	169.0	16.9
Finland	219	72.0	–80	–0.0	60	5	243	3	1,102	1	28.3	9.3
France	153	27.9	–616	–0.4	93	18	283	5	4,630	2	73.2	13.3
Gabon	218	84.7	101	0.0	190	15	156	5	6,651	71	1.8	0.7
Gambia, The	5	48.1	–45	–1.0	117	3	154	2	974	3	0.2	2.3
Georgia	30	43.0	0	0.0	107	13	208	3	4,350	..	1.6	2.3
Germany	107	30.8	0	0.0	76	11	247	5	2,682	12	113.8	31.9
Ghana	63	27.8	1,200	1.7	222	14	206	8	3,725	115	12.7	5.6
Greece	36	27.9	–300	–0.9	95	13	255	7	4,992	2	4.6	3.6
Guatemala	29	26.3	537	1.7	250	6	221	6	8,681	77	21.7	20.0
Guinea	69	28.2	347	0.5	190	12	109	10	3,000	21	1.7	0.7
Guinea-Bissau	22	77.8	216	0.9	108	3	235	0	1,000	4	..	..
Haiti	1	3.2	70	5.7	20	4	62	14	5,242	27	0.1	0.4

3.4 Deforestation and biodiversity

	Forest area		Average annual deforestation		Mammals		Birds		Higher plants [a]		Nationally protected areas	
	thousand sq. km	% of total land area	sq. km	%	Species	Threatened species	Species	Threatened species	Species	Threatened species	thousand sq. km	% of total land area
	2000	2000	1990–2000	1990–2000	2002	2002	2002	2002	2002	2002	2003 [b]	2003 [b]
Honduras	54	48.1	590	1.0	173	10	232	5	5,680	108	7.2	6.4
Hungary	18	19.9	–72	–0.4	83	9	208	8	2,214	1	6.5	7.0
India	641	21.6	–381	–0.1	390	88	458	72	18,664	244	154.6	5.2
Indonesia	1,050	58.0	13,124	1.2	515	147	929	114	29,375	384	373.2	20.6
Iran, Islamic Rep.	73	4.5	0	0.0	140	22	293	13	8,000	1	78.5	4.8
Iraq	8	1.8	0	0.0	81	11	140	11	..	0	0.0	0.0
Ireland	7	9.6	–170	–3.0	25	5	143	1	950	1	1.2	1.7
Israel	1	6.4	–50	–4.9	116	14	162	12	2,317	0	3.3	15.8
Italy	100	34.0	–295	–0.3	90	14	250	5	5,599	3	23.2	7.9
Jamaica	3	30.0	54	1.5	24	5	75	12	3,308	206	..	..
Japan	241	66.1	–34	–0.0	188	37	210	34	5,565	11	24.8	6.8
Jordan	1	1.0	0	0.0	71	10	117	8	2,100	0	3.0	3.4
Kazakhstan	121	4.5	–2,390	–2.2	178	16	379	15	6,000	1	72.9	2.7
Kenya	171	30.0	931	0.5	359	51	344	24	6,506	98	45.5	8.0
Korea, Dem. Rep.	82	68.2	0	0.0	..	13	150	19	2,898	3	3.1	2.6
Korea, Rep.	63	63.3	49	0.1	49	13	138	25	2,898	0	6.8	6.9
Kuwait	0	0.3	–2	–5.2	21	1	35	7	234	0	0.3	1.5
Kyrgyz Republic	10	5.2	–228	–2.6	83	7	168	4	4,500	1	28.9	12.5
Lao PDR	126	54.4	527	0.4	172	31	212	20	8,286	18	6.9	3.6
Latvia	29	47.1	–127	–0.4	83	4	216	3	1,153	0	8.3	13.4
Lebanon	0	3.5	1	0.3	57	5	116	7	3,000	0	0.1	0.5
Lesotho	0	0.5	0	0.0	33	3	123	7	1,591	0	0.1	0.2
Liberia	35	36.1	760	2.0	193	17	146	11	2,200	46	1.6	1.7
Libya	4	0.2	–47	–1.4	76	8	76	1	1,825	1	1.8	0.1
Lithuania	20	30.8	–48	–0.2	68	5	201	4	1,796	0	6.7	10.3
Macedonia, FYR	9	35.6	0	0.0	78	11	199	3	3,500	0	1.8	7.1
Madagascar	117	20.2	1,174	0.9	141	50	172	27	9,505	162	25.0	4.3
Malawi	26	27.6	707	2.4	195	8	219	11	3,765	14	10.5	11.2
Malaysia	193	58.7	2,377	1.2	300	50	254	37	15,500	681	18.7	5.7
Mali	132	10.8	993	0.7	137	13	191	4	1,741	6	45.1	3.7
Mauritania	3	0.3	98	2.7	61	10	172	2	1,100	0	17.4	1.7
Mauritius	0	7.9	1	0.6	..	3	..	9	..	..	*0.2*	*7.8*
Mexico	552	28.9	6,306	1.1	491	70	440	39	26,071	..	194.7	10.2
Moldova	3	9.9	–7	–0.2	68	6	175	5	1,752	0	0.5	1.4
Mongolia	106	6.8	600	0.5	133	14	274	16	2,823	0	180.1	11.5
Morocco	30	6.8	12	0.0	105	16	206	9	3,675	2	3.1	0.7
Mozambique	306	39.0	637	0.2	179	14	144	16	5,692	36	65.9	8.4
Myanmar	344	52.3	5,169	1.4	300	39	310	35	7,000	37	2.0	0.3
Namibia	80	9.8	734	0.9	250	15	201	11	3,174	5	112.0	13.6
Nepal	39	27.3	783	1.8	181	31	274	25	6,973	6	12.7	8.9
Netherlands	4	11.1	–10	–0.3	55	10	192	4	1,221	0	4.8	14.2
New Zealand	79	29.7	–390	–0.5	..	8	..	63	..	..	79.3	29.6
Nicaragua	33	27.0	1,172	3.0	200	6	215	5	7,590	39	21.6	17.8
Niger	13	1.0	617	3.7	131	11	125	3	1,460	2	97.5	7.7
Nigeria	135	14.8	3,984	2.6	274	27	286	9	4,715	119	30.1	3.3
Norway	89	28.9	–310	–0.4	54	10	241	2	1,715	2	20.9	6.8
Oman	0	0.0	0	0.0	56	9	109	10	1,204	6	43.3	14.0
Pakistan	25	3.2	304	1.1	188	19	237	17	4,950	2	37.8	4.9
Panama	29	38.6	519	1.6	218	20	302	16	9,915	193	16.2	21.7
Papua New Guinea	306	67.6	1,129	0.4	214	58	414	32	11,544	142	10.4	2.3
Paraguay	234	58.8	1,230	0.5	305	10	233	26	7,851	10	13.9	3.5
Peru	652	50.9	2,688	0.4	460	49	695	76	17,144	269	78.1	6.1
Philippines	58	19.4	887	1.4	153	50	404	67	8,931	193	17.0	5.7
Poland	93	30.6	–110	–0.1	84	15	233	4	2,450	4	37.7	12.4
Portugal	37	40.1	–570	–1.7	63	17	235	7	5,050	15	6.0	6.6
Puerto Rico	2	25.8	5	0.2	..	2	..	8	..	..	*0.3*	*3.5*

3.4 Deforestation and biodiversity

	Forest area		Average annual deforestation		Mammals		Birds		Higher plants [a]		Nationally protected areas	
	thousand sq. km	% of total land area	sq. km	%	Species	Threatened species	Species	Threatened species	Species	Threatened species	thousand sq. km	% of total land area
	2000	2000	1990–2000	1990–2000	2002	2002	2002	2002	2002	2002	2003 [b]	2003 [b]
Romania	64	28.0	–147	–0.2	84	17	257	8	3,400	1	10.8	4.7
Russian Federation	8,514	50.4	–1,353	–0.0	269	45	528	38	11,400	7	1,317.3	7.8
Rwanda	3	12.4	150	3.9	151	9	200	9	2,288	3	1.5	6.2
Saudi Arabia	15	0.7	0	0.0	77	8	125	15	2,028	3	823.3	38.3
Senegal	62	32.2	450	0.7	192	12	175	4	2,086	7	22.3	11.6
Serbia and Montenegro	29	..	14	0.0	96	12	238	5	4,082	1	..	3.3
Sierra Leone	11	14.7	361	2.9	147	12	172	10	2,090	43	1.5	2.1
Singapore	0	3.3	0	0.0	85	3	142	7	2,282	54	0.0	4.9
Slovak Republic	20	42.5	–69	–0.3	85	9	199	4	3,124	2	*11.0*	22.8
Slovenia	11	55.0	–22	–0.2	75	9	201	1	3,200	0	1.2	6.0
Somalia	75	12.0	769	1.0	171	19	179	10	3,028	17	5.0	0.8
South Africa	89	7.3	80	0.1	247	42	304	28	23,420	45	67.2	5.5
Spain	144	28.8	–860	–0.6	82	24	281	7	5,050	14	42.5	8.5
Sri Lanka	19	30.0	348	1.6	88	22	126	14	3,314	280	8.7	13.5
Sudan	616	25.9	9,589	1.4	267	23	280	6	3,137	17	123.6	5.2
Swaziland	5	30.3	–58	–1.2	..	4	..	5	..	..	*0.6*	*3.5*
Sweden	271	65.9	–6	–0.0	60	7	259	2	1,750	3	37.5	9.1
Switzerland	12	30.3	–43	–0.4	75	5	199	2	3,030	2	11.9	30.0
Syrian Arab Republic	5	2.5	0	0.0	63	4	145	8	3,000	0	..	..
Tajikistan	4	2.8	–20	–0.5	84	9	210	7	5,000	2	5.9	4.2
Tanzania	388	43.9	913	0.2	316	42	229	33	10,008	236	263.3	29.8
Thailand	148	28.9	1,124	0.7	265	37	285	37	11,625	78	71.0	13.9
Togo	5	9.4	209	3.4	196	9	117	0	3,085	9	4.3	7.9
Trinidad and Tobago	3	50.5	22	0.8	100	1	131	1	2,259	1	0.3	6.0
Tunisia	5	3.3	–11	–0.2	78	11	165	5	2,196	0	0.5	0.3
Turkey	102	13.3	–220	–0.2	116	17	278	11	8,650	3	12.3	1.6
Turkmenistan	38	8.0	0	0.0	103	13	204	6	..	0	19.7	4.2
Uganda	42	21.3	913	2.0	345	20	243	13	4,900	33	48.5	24.6
Ukraine	96	16.5	–310	–0.3	108	16	245	8	5,100	1	22.6	3.9
United Arab Emirates	3	3.8	–78	–2.8	25	3	34	8	..	0	0.0	0.0
United Kingdom	26	10.7	–200	–0.8	50	12	229	2	1,623	13	50.3	20.9
United States	2,260	24.7	–3,880	–0.2	428	37	508	55	19,473	..	2,372.2	25.9
Uruguay	13	7.4	–501	–5.0	81	6	115	11	2,278	1	0.5	0.3
Uzbekistan	20	4.8	–46	–0.2	97	9	203	9	4,800	1	8.3	2.0
Venezuela, RB	495	56.1	2,175	0.4	323	26	547	24	21,073	67	562.7	63.8
Vietnam	98	30.2	–516	–0.5	213	40	262	37	10,500	126	12.0	3.7
West Bank and Gaza	..	..	..	..	..	1	..	1	..	..	..	..
Yemen, Rep.	4	0.9	92	1.8	66	5	93	12	1,650	52	..	..
Zambia	312	42.0	8,509	2.4	233	*12*	252	11	4,747	8	237.1	31.9
Zimbabwe	190	49.2	3,199	1.5	270	*12*	229	10	4,440	14	46.8	12.1
World	**38,480 s**	**29.7 w**	**95,009 s**	**0.2 w**							**13,750.0 s**	**10.7 w**
Low income	9,031	27.1	73,087	0.8							2,665.5	8.4
Middle income	21,493	32.7	29,869	0.1							6,073.9	9.1
Lower middle income	19,065	31.8	14,730	–0.1							3,891.0	7.2
Upper middle income	2,428	34.5	15,139	0.5							2,183.0	*17.3*
Low & middle income	30,525	30.9	102,956	0.3							8,739.5	8.9
East Asia & Pacific	4,238	27.2	11,613	0.2							1,454.8	*9.2*
Europe & Central Asia	9,464	39.7	–8,143	–0.1							1,610.2	6.8
Latin America & Carib.	9,438	47.1	45,873	0.5							2,237.8	11.2
Middle East & N. Africa	168	1.5	–239	–0.1							1,169.3	11.3
South Asia	782	16.3	889	0.1							228.6	4.8
Sub-Saharan Africa	6,436	27.3	52,963	0.8							2,038.8	8.7
High income	7,955	26.1	–7,947	–0.1							5,010.5	*19.5*
Europe EMU	846	37.0	–2,978	–0.3							324.9	13.5

a. Flowering plants only. b. Data may refer to earlier years. They are the most recent reported by the World Conservation Monitoring Center in 2003. c. Includes Luxembourg.

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 2003,* which provides information on forest cover in 2000 and an 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 9.5 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 among 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 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. 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 knowledge is very incomplete), they do identify countries that are major sources of global biodiversity and show national commitments to habitat protection.

The dataset on protected areas is tentative and is being revised. Due to variations in consistency and methodology of collection, the quality of the data are highly variable across countries. Some countries update their information more frequently than others, some may have more accurate data on extent of coverage, and many underreport the number or extent of protected areas.

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** refer to breeding species and are listed for countries included within their breeding 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 scientific reserves with limited public access, national parks, natural monuments, nature reserves or wildlife sanctuaries, and protected landscapes and seascapes. 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 2003.* The data on species are from the WCMC's electronic files and the IUCN's *2002 IUCN Red List of Threatened Animals* and *1997 IUCN Red List of Threatened Plants.* The data on protected areas are from the United Nations Environment Programme and WCMC.

3.5 Freshwater

	Renewable freshwater resources			Annual freshwater withdrawals					Access to improved water source			
	Internal flows billion cu. m 2000	Net flows from other countries billion cu. m 2000	Total resources per capita cu. m [a] 2000	billion cu. m 1980–2000 [b]	% of total resources 1980–2000 [a,b]	% for agriculture 1987	% for industry 1987	% for domestic 1987	% of urban population 1990	% of urban population 2000	% of rural population 1990	% of rural population 2000
Afghanistan	55	10.0	2,322	26.1	40.2	99 [c]	0 [c]	1 [c]	..	19	..	11
Albania	27	15.7	13,524	1.4	3.3	71	0	29	..	99	..	95
Algeria	14	0.4	457	5.0	35.0	52 [c]	14 [c]	34 [c]	..	94	..	82
Angola	184	..	14,023	0.5	0.3	76 [c]	10 [c]	14 [c]	..	34	..	40
Argentina	276	623.0	23,693	28.6	3.2	75	9	16	..	97	..	73
Armenia	9	1.5	3,455	2.9	27.4	66	4	30	..	87	..	45
Australia	492	0.0	25,022	14.6	3.0	33	2	65	100	100	100	100
Austria	55	29.0	10,437	2.4	2.9	9	58	33	100	100	100	100
Azerbaijan	8	21.0	3,561	16.5	56.7	70	25	5	..	93	..	58
Bangladesh	105	1,105.6	8,922	14.6	1.2	86	2	12	99	99	93	97
Belarus	37	20.8	5,844	2.7	4.7	35	43	22	..	100	..	100
Belgium	12	4.0	1,548	..	..	..	..	..	..	..	..	..
Benin	10	15.5	3,938	0.1	0.4	67 [c]	10 [c]	23 [c]	..	74	..	55
Bolivia	304	7.2	35,271	1.2	0.4	87	3	10	91	95	47	64
Bosnia and Herzegovina	36	2.0	9,120	1.0	2.7	60	10	30	..	..	..	..
Botswana	3	11.8	8,586	0.1	0.7	48 [c]	20 [c]	32 [c]	100	100	88	90
Brazil	5,418	1,900.0	41,941	54.9	0.8	61	18	21	93	95	54	53
Bulgaria	21	0.2	2,662	13.9	65.6	22	75	3	..	100	..	100
Burkina Faso	13	2.0	1,226	0.4	2.8	81 [c]	0 [c]	19 [c]	..	66	..	37
Burundi	4	..	509	0.1	2.8	64 [c]	0 [c]	36 [c]	96	91	67	77
Cambodia	121	355.6	38,136	0.5	0.1	94	1	5	..	54	..	26
Cameroon	273	0.0	17,312	0.4	0.1	35 [c]	19 [c]	46 [c]	78	78	32	39
Canada	2,850	52.0	92,532	45.1	1.6	12	70	18	100	100	99	99
Central African Republic	141	..	36,911	0.1	0.1	74 [c]	5 [c]	21 [c]	71	89	35	57
Chad	15	28.0	5,155	0.2	0.5	82 [c]	2 [c]	16 [c]	..	31	..	26
Chile	884	0.0	56,707	20.3	2.3	84	11	5	98	99	49	58
China	2,812	17.2	2,210	525.5	18.6	78	18	5	99	94	60	66
Hong Kong, China	..	..	..	..	..	..	..	..	..	..	..	..
Colombia	2,112	0.0	48,293	8.9	0.4	37	4	59	98	99	84	70
Congo, Dem. Rep.	900	313.0	23,517	0.4	0.0	23 [c]	16 [c]	61 [c]	..	89	..	26
Congo, Rep.	222	610.0	227,509	0.0	0.0	11 [c]	27 [c]	62 [c]	..	71	..	17
Costa Rica	112	..	28,513	5.8	5.2	80	7	13	..	99	..	92
Côte d'Ivoire	77	..	4,645	0.7	0.9	67 [c]	11 [c]	22 [c]	97	92	69	72
Croatia	38	33.7	15,991	0.8	1.1	0	50	50	..	..	..	..
Cuba	38	0.0	3,383	5.2	13.6	51	0	49	..	95	..	77
Czech Republic	13	1.0	1,391	2.7	19.0	2	57	41	..	..	..	..
Denmark	6	..	1,116	1.2	20.0	43	27	30	..	100	..	100
Dominican Republic	21	..	2,438	8.3	39.5	89	0	11	92	90	71	78
Ecuador	432	0.0	33,703	17.0	3.9	82	6	12	82	90	58	75
Egypt, Arab Rep.	2	66.7	1,032	66.0	96.4	82 [c]	11 [c]	7 [c]	97	99	92	96
El Salvador	18	..	2,774	0.7	3.9	46	20	34	88	91	48	64
Eritrea	3	6.0	2,048	..	..	..	..	..	..	63	..	42
Estonia	13	0.1	9,426	0.2	1.6	5	39	56	..	..	..	..
Ethiopia	110	0.0	1,636	2.2	2.0	86 [c]	3 [c]	11 [c]	80	81	17	12
Finland	107	3.0	21,158	2.2	2.0	3	85	12	100	100	100	100
France	179	11.0	3,186	32.3	17.0	10	72	18	..	..	..	..
Gabon	164	0.0	124,715	0.1	0.1	6 [c]	22 [c]	72 [c]	..	95	..	47
Gambia, The	3	5.0	5,760	0.0	0.0	91 [c]	2 [c]	7 [c]	..	80	..	53
Georgia	58	8.4	12,845	3.5	5.3	59	20	21	..	90	..	61
Germany	107	71.0	2,158	46.3	26.0	20	69	11	..	..	..	..
Ghana	30	22.9	2,624	0.3	0.6	52 [c]	13 [c]	35 [c]	85	91	36	62
Greece	58	15.0	6,867	8.7	11.9	87	3	10	..	..	..	..
Guatemala	109	0.0	9,106	1.2	1.1	74	17	9	88	98	69	88
Guinea	226	0.0	29,184	0.7	0.3	87 [c]	3 [c]	10 [c]	72	72	36	36
Guinea-Bissau	16	11.0	18,659	0.0	0.0	36 [c]	4 [c]	60 [c]	..	79	..	49
Haiti	13	..	1,569	1.0	7.7	94	1	5	59	49	50	45

Freshwater 3.5

	Renewable freshwater resources			Annual freshwater withdrawals					Access to improved water source			
	Internal flows billion cu. m 2000	Net flows from other countries billion cu. m 2000	Total resources per capita cu. m [a] 2000	billion cu. m 1980–2000 [b]	% of total resources 1980–2000 [a,b]	% for agriculture 1987	% for industry 1987	% for domestic 1987	% of urban population 1990	% of urban population 2000	% of rural population 1990	% of rural population 2000
Honduras	96	0.0	14,109	1.5	1.6	91	5	4	89	95	78	81
Hungary	6	114.0	11,812	6.8	5.7	36	55	9	100	100	98	98
India	1,261	647.2	1,819	500.0	26.2	92	3	5	88	95	61	79
Indonesia	2,838	..	13,405	74.3	2.6	93	1	6	92	90	62	69
Iran, Islamic Rep.	129	..	1,961	70.0	54.5	92	2	6	..	98	..	83
Iraq	35	75.9	4,596	42.8	38.5	92	5	3	..	96	..	48
Ireland	49	3.0	13,265	0.8	1.5	10	74	16	..	..	..	..
Israel	1	0.9	259	1.6	94.1	54 [c]	7 [c]	39 [c]	..	..	..	..
Italy	183	6.8	3,281	42.0	22.2	48	34	19	..	..	..	..
Jamaica	9	..	3,592	0.9	9.6	77	7	15	98	98	87	85
Japan	430	0.0	3,382	91.4	21.3	64	17	19	..	..	..	..
Jordan	1	..	135	1.0	..	75	3	22	99	100	92	84
Kazakhstan	75	34.2	7,368	33.7	30.7	81	17	2	..	98	..	82
Kenya	20	10.0	963	2.0	6.6	76 [c]	4 [c]	20 [c]	91	88	31	42
Korea, Dem. Rep.	67	10.1	3,428	14.2	18.4	73	16	11	..	100	..	100
Korea, Rep.	65	4.9	1,465	23.7	34.0	63	11	26	..	97	..	71
Kuwait	0	0.0	..	0.5	..	60	2	37	..	..	..	..
Kyrgyz Republic	47	0.0	9,293	10.1	21.7	94	3	3	..	98	..	66
Lao PDR	190	143.1	60,307	1.0	0.3	82	10	8	..	61	..	29
Latvia	17	18.7	15,141	0.3	0.8	13	32	55	..	..	..	..
Lebanon	5	0.0	1,081	1.3	27.1	68	6	27	..	100	..	100
Lesotho	5	0.0	2,926	0.1	1.9	56 [c]	22	22 [c]	..	88	..	74
Liberia	200	32.0	70,410	0.1	0.0	60 [c]	13 [c]	27 [c]	..	..	..	..
Libya	1	..	110	4.5	..	84 [c]	3 [c]	13 [c]	72	72	68	68
Lithuania	16	9.3	7,178	0.3	1.2	3	16	81	..	..	..	..
Macedonia, FYR	5	1.0	3,140	1.9	29.7	74	15	12	..	..	..	..
Madagascar	337	0.0	20,503	16.3	4.8	99 [c]	.. [c]	1 [c]	85	85	31	31
Malawi	16	1.1	1,601	0.9	5.2	86 [c]	3 [c]	10 [c]	90	95	43	44
Malaysia	580	..	23,863	12.7	2.2	77	13	11	..	..	..	94
Mali	60	40.0	8,792	1.4	1.4	97 [c]	1 [c]	2 [c]	65	74	52	61
Mauritania	0	11.0	4,093	1.6	14.0	92	2	6	34	34	40	40
Mauritius	2	0.0	1,815	..	..	77 [c]	7 [c]	16 [c]	100	100	100	100
Mexico	409	49.0	4,543	77.8	17.0	78	5	17	90	95	52	69
Moldova	1	10.7	2,750	3.0	25.6	26	65	9	..	97	..	88
Mongolia	35	..	14,210	0.4	1.1	53	27	20	..	77	..	30
Morocco	29	0.0	978	11.5	39.7	89 [c]	2 [c]	10 [c]	94	98	58	56
Mozambique	99	111.0	11,390	0.6	0.3	89 [c]	2 [c]	9 [c]	..	81	..	41
Myanmar	881	165.0	21,432	4.0	0.4	90	3	7	..	89	..	66
Namibia	6	39.3	22,922	0.2	0.4	68 [c]	3 [c]	29 [c]	98	100	63	67
Nepal	198	12.0	8,713	29.0	13.8	99	0	1	93	94	64	87
Netherlands	11	80.0	5,637	7.8	8.6	34	61	5	100	100	100	100
New Zealand	327	0.0	83,016	2.0	0.6	44	10	46	100	100	..	..
Nicaragua	190	0.0	35,511	1.3	0.7	84	2	14	93	91	44	59
Niger	4	29.0	2,845	0.5	1.5	82 [c]	2 [c]	16 [c]	65	70	51	56
Nigeria	221	59.0	2,109	3.6	1.3	54 [c]	15 [c]	31 [c]	83	78	37	49
Norway	382	11.0	86,602	2.0	0.5	8	72	20	100	100	100	100
Oman	1	..	394	1.2	..	94	2	5	41	41	30	30
Pakistan	52	170.3	1,534	155.6	70.0	97	2	2	96	95	77	87
Panama	147	..	50,136	1.6	1.1	70	2	28	..	99	..	79
Papua New Guinea	801	..	148,940	0.1	0.0	49	22	29	88	88	32	32
Paraguay	94	..	17,060	0.4	0.4	78	7	15	80	93	46	59
Peru	1,616	144.0	65,797	19.0	1.1	86	7	7	88	87	42	62
Philippines	479	0.0	5,992	55.4	11.6	88	4	8	93	91	82	79
Poland	54	8.0	1,595	12.3	20.0	11	76	13	..	..	..	..
Portugal	38	35.0	7,173	7.3	10.0	48	37	15	..	..	..	..
Puerto Rico	..	..	..	..	..	..	..	..	..	..	..	..

3.5 Freshwater

	Renewable freshwater resources			Annual freshwater withdrawals					Access to improved water source			
	Internal flows billion cu. m 2000	Net flows from other countries billion cu. m 2000	Total resources per capita cu. m [a] 2000	billion cu. m 1980–2000 [b]	% of total resources 1980–2000 [a,b]	% for agriculture 1987	% for industry 1987	% for domestic 1987	% of urban population 1990	% of urban population 2000	% of rural population 1990	% of rural population 2000
Romania	42	170.0	9,520	26.0	12.2	59	33	8	..	91	..	16
Russian Federation	4,313	185.5	31,222	77.1	1.7	20	62	19	..	100	..	96
Rwanda	5	..	637	0.8	15.4	94 [c]	2 [c]	5 [c]	..	60	..	40
Saudi Arabia	2	..	110	17.0	..	90	1	9	..	100	..	64
Senegal	26	13.0	4,009	1.4	3.6	92 [c]	3 [c]	5 [c]	90	92	60	65
Serbia and Montenegro	44	144.0	23,039	13.0	6.9	8 [c]	86 [c]	6 [c]	..	99	..	97
Sierra Leone	160	0.0	30,564	0.4	0.3	89	4	7	..	75	..	46
Singapore	..	..	..	..	..	4	51	45	100	100	100	..
Slovak Republic	13	70.0	15,356	1.8	2.2	..	..	..	..	100	..	100
Slovenia	19	0.0	9,521	1.3	7.0	1 [c]	80 [c]	20 [c]	100	100	100	100
Somalia	6	9.7	1,685	0.8	5.1	97 [c]	0 [c]	3 [c]	..	..	..	..
South Africa	45	5.2	1,103	13.3	26.6	72	11	17	99	99	73	73
Spain	111	0.3	2,725	35.2	31.6	68	19	13	..	..	..	..
Sri Lanka	50	0.0	2,636	9.8	19.6	96 [c]	2 [c]	2 [c]	91	98	62	70
Sudan	30	119.0	4,544	17.8	11.9	94 [c]	1 [c]	4 [c]	86	86	60	69
Swaziland	3	1.9	4,136	..	..	96	2	2	..	..	..	..
Sweden	171	12.2	20,529	2.9	1.6	9	55	36	100	100	100	100
Switzerland	40	13.0	7,325	1.2	2.2	4	73	23	100	100	100	100
Syrian Arab Republic	7	37.7	2,632	12.0	26.8	90	2	8	..	94	..	64
Tajikistan	66	13.3	12,706	11.9	14.9	92 [c]	4 [c]	3 [c]	..	93	..	47
Tanzania	82	9.0	2,587	1.2	1.3	89	2	9	76	90	28	57
Thailand	210	199.9	6,653	33.1	8.1	91 [c]	4 [c]	5 [c]	87	95	78	81
Togo	12	0.5	2,521	0.1	0.8	25	13	62	82	85	38	38
Trinidad and Tobago	4	..	2,914	0.3	7.9	6 [c]	26 [c]	68 [c]	..	..	..	..
Tunisia	4	0.4	470	2.8	60.9	86 [c]	1 [c]	13 [c]	91	92	54	58
Turkey	227	7.6	3,369	35.5	15.1	73	12	16	83	81	72	86
Turkmenistan	1	59.5	12,706	23.8	39.1	98	1	1	..	..	..	..
Uganda	39	27.0	2,683	0.2	0.3	60	8	32	81	80	40	47
Ukraine	53	86.5	2,866	26.0	18.6	30	52	18	..	100	..	94
United Arab Emirates	0	..	62	2.1	..	67	9	24	..	..	..	..
United Kingdom	145	2.0	2,482	11.8	8.0	3 [c]	77 [c]	20 [c]	100	100	100	100
United States	2,800	18.0	9,772	467.3	16.6	42	45	13	100	100	100	100
Uruguay	59	74.0	39,572	0.7	0.5	91	3	6	..	98	..	93
Uzbekistan	16	98.1	4,527	58.1	50.8	94	2	4	..	94	..	79
Venezuela, RB	723	..	28,796	4.1	0.6	46	10	44	..	85	..	70
Vietnam	367	524.7	11,081	54.3	6.1	87	10	4	86	95	48	72
West Bank and Gaza	..	..	..	..	..	..	..	..	..	..	..	..
Yemen, Rep.	4	..	220	2.9	70.7	92	1	7	..	74	..	68
Zambia	80	35.8	11,324	1.7	1.5	77 [c]	7 [c]	16 [c]	88	88	28	48
Zimbabwe	14	..	1,085	1.2	8.5	79 [c]	7 [c]	14 [c]	99	100	69	73
World	**42,900 s**	**9,463.8 s**	**8,513 w**	**3,325 s**	**6 w**	**71 w**	**20 w**	**10 w**	**94 w**	**94 w**	**62**	**71 w**
Low income	11,185	4,815.6	6,416	1,041	7	92	4	5	88	90	59	70
Middle income	22,898	4,275.4	9,938	1,430	5	73	18	9	95	95	63	70
Lower middle income	19,341	3,260.3	9,401	1,229	5	73	19	9	96	95	63	70
Upper middle income	3,556	1,015.2	13,848	201	4	71	14	15	..	..	..	77
Low & middle income	34,082	9,091.0	8,258	2,471	6	81	12	7	93	93	61	70
East Asia & Pacific	9,454	1,415.6	6,020	776	7	81	14	5	97	93	61	67
Europe & Central Asia	5,255	1,134.8	13,511	387	6	57	33	10	..	96	..	83
Latin America & Carib.	13,429	2,833.8	30,925	263	2	74	9	18	92	94	58	65
Middle East & N. Africa	234	183.1	1,377	238	57	88	5	7	..	96	..	78
South Asia	1,816	1,945.1	2,684	735	20	94	3	4	90	94	66	80
Sub-Saharan Africa	3,895	1,578.7	7,951	73	1	85	6	10	86	83	40	46
High income	8,818	372.8	..	854	9	42	42	16	..	..	..	..
Europe EMU	910	258.8	3,826	185	16	38	47	15	..	..	..	..

a. River flows from other countries and river outflows are included when available. b. Data are for the most recent year available. c. Data refer to a year other than 1987 (see *Primary data documentation*).

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.

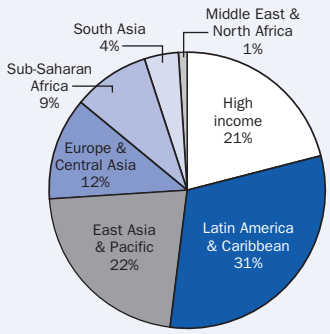
The table shows both internal freshwater resources and river flows arising outside countries. River outflows are also taken into account. However, because inflows and outflows may be estimated at different times and with different levels of quality and precision, these data must be used with caution, particularly in case of 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 an improved water source is equated with connection to a public supply system, this does not take into account 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. The definition in this table and in table 2.15 differs from that used for the city-level data shown in table 3.11, which is more stringent.

3.5a

The distribution of freshwater resources is uneven

Internal freshwater flows, 2000

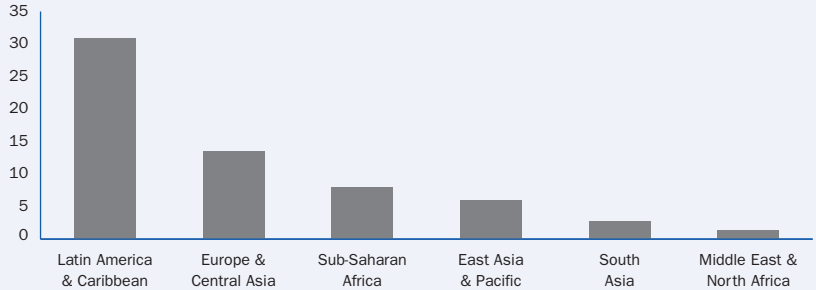


Source: Table 3.5.

3.5b

Latin America and the Caribbean has more than 20 times the freshwater resources per capita as the Middle East and North Africa

Total freshwater resources per capita, 2000 (thousands of cubic meters)



Source: Table 3.5.

Definitions

• **Renewable freshwater resources** refer to total renewable resources, broken down between internal flows (internal river flows and groundwater from rainfall) in the country and net river flows from other countries. • **Net flows from other countries** refer to river flows arising outside countries minus river outflows, when these data are available. • **Freshwater resources per capita** are calculated using the World Bank's population estimates (see table 2.1). • **Annual freshwater withdrawals** refer to total water withdrawals, not counting evaporation losses from storage basins. Withdrawals also include water from desalination plants in countries where they are a significant source. 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. • **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 1 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 2000–01* and *World Resources 2002–03* (produced in collaboration with the United Nations Environment Programme, United Nations Development Programme, and World Bank). These are supplemented by the Food and Agriculture Organization's AQUASTAT data. 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		% of total							
	1980	2000 [a]	1980	2000 [a]	Primary metals 2000 [a]	Paper and pulp 2000 [a]	Chemicals 2000 [a]	Food and beverages 2000 [a]	Stone, ceramics, and glass 2000 [a]	Textiles 2000 [a]	Wood 2000 [a]	Other 2000 [a]
Afghanistan	6,680	..	0.17	..	..	..	..	..	..	..	..	..
Albania	..	*6,512*	..	*0.29*	*14.3*	*0.9*	*5.5*	*73.5*	*0.3*	*4.6*	*0.0*	*0.8*
Algeria	60,290	*45,645*	0.19	*0.24*	*23.4*	*2.0*	*3.3*	*59.5*	*0.7*	*7.6*	*0.8*	*–0.0*
Angola	..	*1,472*	..	*0.20*	*7.6*	*3.0*	*9.1*	*65.9*	*0.3*	*5.5*	*4.4*	*4.1*
Argentina	244,711	*177,882*	0.18	*0.21*	*6.5*	*12.5*	8.0	*59.4*	*0.1*	*7.4*	*1.5*	*4.5*
Armenia	..	*10,014*	..	..	..	*3.9*	..	*72.5*	..	..	..	..
Australia	204,333	95,369	0.18	0.21	..	..	6.5	81.7	0.1	2.8	3.1	..
Austria	108,416	80,789	0.16	0.13	14.9	18.2	11.1	32.8	0.4	5.1	5.3	12.1
Azerbaijan	..	*45,025*	..	*0.17*	*11.6*	*2.5*	*12.0*	*49.0*	*0.2*	*18.1*	*1.0*	*5.6*
Bangladesh	66,713	*273,082*	0.16	*0.14*	*1.8*	*6.8*	6.6	*23.2*	*0.1*	*64.1*	*0.5*	..
Belarus	..	..	..	..	..	..	..	..	..	..	..	..
Belgium	136,452	*102,460*	0.16	*0.17*	*13.7*	*18.0*	10.5	*40.4*	*0.2*	*6.0*	*2.0*	*7.5*
Benin	1,646	..	0.28	..	..	..	1.2	..	..	..	..	..
Bolivia	9,343	12,759	0.22	0.25	0.9	20.5	6.6	61.4	0.3	7.1	2.4	0.9
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	*4,635*	0.24	*0.20*	*1.7*	*15.8*	0.8	*56.4*	*0.2*	*17.2*	*1.4*	*1.8*
Brazil	866,790	*629,406*	0.16	*0.20*	*17.7*	*12.9*	7.6	*44.4*	*0.1*	*9.8*	*1.4*	*4.5*
Bulgaria	152,125	*107,945*	0.13	*0.17*	*11.7*	*7.9*	8.2	*48.1*	*0.1*	*17.0*	*2.0*	*6.6*
Burkina Faso	2,385	*2,598*	0.29	*0.22*	*3.5*	*1.1*	5.8	*73.8*	*0.1*	*4.1*	*10.1*	*1.9*
Burundi	769	*1,644*	0.22	*0.24*	*0.0*	*8.3*	*5.1*	*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	*10,714*	0.29	*0.20*	*3.1*	*6.3*	3.6	*52.7*	*0.0*	*3.6*	*5.6*	*0.4*
Canada	330,241	307,325	0.18	0.15	10.8	23.9	9.8	34.8	0.1	5.4	5.1	10.0
Central African Republic	861	*670*	0.26	*0.17*	*0.0*	..	*4.0*	*62.0*	*0.0*	*13.8*	*19.6*	..
Chad	..	..	..	..	..	..	..	..	..	..	..	..
Chile	44,371	72,850	0.21	0.24	6.9	11.3	8.9	62.7	0.1	5.0	2.6	2.5
China	3,377,105	6,204,237	0.14	0.14	20.6	10.8	*15.3*	28.4	0.5	14.8	0.8	8.9
Hong Kong, China	102,002	35,649	0.11	0.18	0.9	43.6	4.2	27.4	0.1	17.9	0.1	6.0
Colombia	96,055	93,879	0.19	0.21	3.1	16.2	10.3	53.2	0.2	14.2	1.0	2.4
Congo, Dem. Rep.	..	..	..	..	..	..	..	..	..	..	..	..
Congo, Rep.	*1,039*	..	*0.21*	..	..	..	..	..	..	..	..	..
Costa Rica	..	32,914	..	0.21	1.8	10.0	*7.1*	62.2	0.1	13.9	1.7	2.9
Côte d'Ivoire	15,414	*12,401*	0.23	*0.24*	..	*5.5*	5.0	*71.9*	*0.0*	*8.6*	*5.9*	..
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	316,429	*258,413*	0.13	*0.13*	*23.2*	*9.5*	*7.9*	*31.5*	*0.4*	*12.2*	*2.0*	*12.8*
Denmark	65,465	*83,591*	0.17	*0.17*	*4.4*	*29.1*	7.0	*44.2*	*0.2*	*2.2*	*3.5*	*8.6*
Dominican Republic	54,935	..	0.38	..	..	..	1.9	..	..	..	..	..
Ecuador	25,297	*32,266*	0.23	*0.27*	*2.3*	*10.8*	7.1	*71.8*	*0.1*	*6.0*	*1.5*	*1.3*
Egypt, Arab Rep.	169,146	*203,633*	0.19	*0.20*	*11.8*	*7.9*	8.3	*49.8*	*0.3*	*18.9*	*0.4*	*2.9*
El Salvador	9,390	*22,760*	0.24	*0.18*	*2.1*	*10.2*	7.1	*43.5*	*0.1*	*34.1*	*0.5*	*1.4*
Eritrea	..	..	..	..	..	..	..	..	..	..	..	..
Estonia	..	..	..	..	..	..	..	..	..	..	..	..
Ethiopia	16,754	21,533	0.22	0.23	1.9	10.8	..	61.5	0.2	18.7	1.6	0.8
Finland	92,275	62,610	0.17	0.19	9.8	43.3	2.2	30.2	0.2	2.8	4.4	7.0
France	729,776	*278,878*	0.14	*0.10*	*14.9*	*30.9*	10.3	*37.7*	*0.3*	*9.7*	*2.7*	..
Gabon	2,661	*1,886*	0.15	*0.26*	*0.0*	*6.0*	5.0	*79.7*	*0.1*	*1.2*	*6.9*	*1.2*
Gambia, The	549	*832*	0.30	*0.34*	..	..	1.7	..	..	..	..	..
Georgia	..	..	..	..	..	..	..	..	..	..	..	..
Germany	..	*792,194*	..	*0.13*	*11.2*	*22.3*	*9.8*	*34.4*	*0.2*	*3.2*	*2.3*	*16.5*
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	57,178	0.17	0.20	6.3	11.8	9.1	54.0	0.2	13.2	1.5	3.8
Guatemala	20,856	*19,253*	0.25	*0.28*	*4.9*	*7.2*	8.1	*72.8*	*0.1*	*6.9*	*0.8*	..
Guinea	..	..	..	..	..	..	..	..	..	..	..	..
Guinea-Bissau	..	..	..	..	..	..	..	..	..	..	..	..
Haiti	4,734	..	0.19	..	..	..	..	..	..	..	..	..

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		% of total							
	1980	2000 [a]	1980	2000 [a]	Primary metals 2000 [a]	Paper and pulp 2000 [a]	Chemicals 2000 [a]	Food and beverages 2000 [a]	Stone, ceramics, and glass 2000 [a]	Textiles 2000 [a]	Wood 2000 [a]	Other 2000 [a]
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*
Hungary	201,888	152,531	0.15	0.17	8.0	12.1	7.9	48.0	0.2	14.1	2.4	7.3
India	1,422,564	1,582,285	0.21	0.20	13.9	6.6	9.6	52.2	0.2	13.1	0.3	4.2
Indonesia	214,010	752,834	0.22	0.18	2.8	8.6	8.6	50.1	*0.1*	22.0	5.3	*4.5*
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	49,144	0.19	0.15	1.3	14.2	11.4	56.4	0.2	3.1	1.6	11.8
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	495,411	0.13	0.13	9.5	16.9	10.8	30.3	0.3	16.0	3.7	12.5
Jamaica	11,123	*17,507*	0.25	*0.29*	*6.9*	*7.2*	*3.8*	*70.8*	*0.1*	*9.8*	*1.3*	*0.0*
Japan	1,456,016	1,332,302	0.14	0.15	7.4	21.8	8.9	41.7	0.2	5.4	1.7	12.7
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	53,029	0.19	0.25	*4.1*	11.9	*5.8*	70.0	0.1	8.5	1.8	..
Korea, Dem. Rep.	..	..	..	..	..	..	..	..	..	..	..	..
Korea, Rep.	281,900	303,091	0.14	0.12	12.2	17.0	12.4	26.0	0.2	15.7	1.3	15.3
Kuwait	6,921	*11,412*	0.16	*0.17*	*2.5*	*16.4*	*10.9*	*49.4*	*0.4*	*12.1*	*2.9*	*5.8*
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	..	25,106	..	0.19	*2.8*	8.7	*0.8*	64.5	0.1	11.5	9.7	..
Lebanon	14,586	*14,899*	0.20	*0.19*	*0.9*	*15.6*	3.3	*60.7*	*0.5*	*10.2*	*4.6*	*3.4*
Lesotho	*993*	*3,123*	*0.24*	*0.16*	*1.2*	*4.0*	*0.7*	*39.7*	*0.1*	*51.3*	*0.6*	*2.3*
Liberia	..	..	..	..	..	..	..	..	..	..	..	..
Libya	3,532	..	0.21	..	..	..	*11.0*	..	..	..	*6.0*	..
Lithuania	..	35,689	..	0.18	1.2	11.2	*5.0*	55.6	0.2	17.6	*0.4*	..
Macedonia, FYR	..	*23,490*	..	*0.18*	*11.7*	*9.6*	*6.2*	*45.0*	*0.1*	*20.9*	..	..
Madagascar	9,131	..	0.23	..	..	..	2.5	..	..	..	*1.7*	..
Malawi	12,224	*11,805*	0.32	*0.29*	*0.0*	*16.0*	*3.7*	*70.0*	*0.0*	*7.8*	*7.0*	..
Malaysia	77,215	*158,761*	0.15	*0.12*	*6.5*	*14.5*	16.5	*34.1*	*0.2*	*7.5*	*3.2*	*19.7*
Mali	..	..	..	..	..	..	..	..	..	..	..	..
Mauritania	..	..	..	..	..	..	..	..	..	..	..	..
Mauritius	9,224	*17,700*	0.21	*0.15*	*0.9*	*6.6*	*2.6*	*32.8*	*0.1*	*55.4*	0.9	*0.8*
Mexico	130,993	296,093	0.22	0.20	7.8	12.5	10.4	55.6	0.2	7.5	*1.3*	*3.7*
Moldova	..	*34,234*	..	*0.29*	*0.2*	*4.0*	*1.4*	*81.7*	*0.2*	*10.8*	*4.9*	..
Mongolia	9,254	*7,939*	0.19	*0.18*	*1.8*	*4.3*	2.9	*64.2*	*0.3*	*24.6*	0.9	..
Morocco	26,598	88,779	0.15	0.18	0.7	7.0	9.7	54.4	0.4	27.2	1.4	..
Mozambique	..	10,230	..	0.31	1.1	7.1	*4.1*	81.2	0.1	5.8	*2.9*	..
Myanmar	..	*3,356*	..	*0.13*	*14.0*	*9.0*	*40.5*	*27.0*	*0.5*	*4.9*	*0.9*	..
Namibia	..	*7,350*	..	*0.35*	*0.0*	*5.0*	*1.6*	*90.4*	*0.1*	*1.2*	*1.7*	*0.4*
Nepal	*18,692*	*26,550*	*0.25*	*0.14*	*1.5*	*8.1*	*3.9*	*43.3*	*1.2*	*39.3*	1.2	*1.6*
Netherlands	165,416	124,182	0.18	0.18	7.3	26.7	11.3	43.0	0.2	2.3	*2.1*	*7.4*
New Zealand	59,012	46,099	0.21	0.22	3.2	21.7	5.2	57.3	0.1	4.6	..	..
Nicaragua	9,647	..	0.28	..	..	..	5.1	..	..	..	..	..
Niger	372	..	0.19	..	..	..	..	..	..	..	*4.7*	..
Nigeria	72,082	*82,477*	0.17	*0.17*	*1.4*	*15.4*	*11.3*	*40.2*	*0.1*	*23.5*	3.0	*5.1*
Norway	67,897	55,439	0.19	0.20	8.7	31.7	4.9	42.9	0.1	1.4	3.8	6.5
Oman	..	5,789	..	0.16	6.1	13.1	*6.9*	50.4	0.8	14.1	*0.3*	*5.9*
Pakistan	75,125	*100,821*	0.17	*0.18*	*11.6*	*7.0*	8.1	*39.9*	*0.2*	*30.3*	*0.5*	*2.1*
Panama	8,121	*11,462*	0.26	*0.31*	*1.6*	*13.7*	3.8	*74.6*	*0.2*	*4.2*	..	..
Papua New Guinea	4,365	..	0.22	..	..	..	0.9	..	..	..	*0.3*	..
Paraguay	..	*3,250*	..	*0.28*	*2.3*	*9.9*	*6.0*	*73.6*	*0.3*	*6.7*	*2.0*	..
Peru	50,367	*52,644*	0.18	*0.21*	*8.1*	*13.5*	10.5	*52.8*	*0.2*	*11.7*	*2.0*	*2.8*
Philippines	182,052	*201,952*	0.19	*0.18*	*5.2*	*9.8*	*7.3*	*54.5*	*0.2*	*16.4*	2.6	*4.3*
Poland	580,869	388,153	0.14	0.16	13.8	6.2	6.8	48.8	0.4	13.6	5.4	5.1
Portugal	105,441	121,013	0.15	0.14	4.0	17.4	4.5	33.6	0.4	27.4	1.4	11.1
Puerto Rico	24,034	15,367	0.16	0.14	1.9	14.9	*19.5*	34.4	0.2	15.5	..	..

3.6 Water pollution

	Emissions of organic water pollutants				Industry shares of emissions of organic water pollutants							
					% of total							
	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	2000 [a]	1980	2000 [a]	2000 [a]	2000 [a]	2000 [a]	2000 [a]	2000 [a]	2000 [a]	2000 [a]	2000 [a]
Romania	343,145	*333,168*	0.12	*0.14*	*17.1*	*6.7*	8.3	*34.3*	*0.3*	*18.5*	*4.8*	*9.4*
Russian Federation	..	*1,485,833*	..	*0.16*	*17.7*	*7.4*	*9.3*	*46.8*	*0.3*	*6.9*	*2.1*	*9.5*
Rwanda	..	..	..	..	..	..	..	..	..	..	..	..
Saudi Arabia	*18,181*	*24,436*	*0.12*	*0.14*	*4.4*	*15.9*	*5.8*	*45.1*	*1.0*	*3.8*	*2.0*	*6.8*
Senegal	9,865	6,643	0.31	0.36	*0.0*	6.6	4.0	87.0	0.1	1.8	0.2	*0.7*
Serbia and Montenegro	..	101,535	..	0.16	9.5	12.0	*8.0*	46.9	0.3	13.3	2.2	7.7
Sierra Leone	*1,612*	*4,170*	*0.24*	*0.32*	..	*9.6*	5.5	*82.3*	*0.1*	*2.0*	*2.2*	..
Singapore	28,558	32,119	0.10	0.09	1.4	26.2	16.0	21.6	0.1	4.0	1.4	28.6
Slovak Republic	..	*57,970*	..	*0.15*	*17.2*	*12.7*	*7.9*	*37.5*	*0.3*	*11.9*	*2.7*	*9.9*
Slovenia	..	38,601	..	0.17	32.3	15.6	*8.5*	24.4	0.2	11.1	2.1	5.9
Somalia	..	..	..	..	..	..	..	..	..	..	..	..
South Africa	237,599	234,012	0.17	0.17	13.7	16.3	9.1	40.3	0.2	10.2	3.4	6.8
Spain	376,253	374,589	0.16	0.15	6.7	19.8	8.9	42.5	0.3	9.3	4.0	8.6
Sri Lanka	30,086	*83,058*	0.18	*0.18*	*0.6*	*7.4*	9.8	*52.6*	*0.2*	*29.8*	*1.1*	..
Sudan	..	..	..	..	..	..	..	..	..	..	..	..
Swaziland	2,826	*2,009*	0.26	*0.23*	..	*79.8*	*0.3*	..	*0.2*	*16.5*	*2.0*	..
Sweden	130,439	103,913	0.15	0.14	11.3	35.0	7.8	26.6	0.1	1.3	3.0	14.9
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	*15,115*	0.19	*0.20*	*4.1*	*1.5*	8.3	*69.8*	*0.9*	*19.4*	*0.2*	..
Tajikistan	..	..	..	..	..	..	..	..	..	..	..	..
Tanzania	21,084	*35,155*	0.21	*0.25*	*1.5*	*9.4*	4.9	*69.3*	*0.1*	*14.0*	*1.5*	*1.4*
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	..	..	..	*2.3*	..	..	..	..	..
Trinidad and Tobago	7,835	*11,787*	0.18	*0.28*	*4.4*	*10.9*	18.3	*72.6*	*0.1*	*2.9*	*1.3*	..
Tunisia	20,294	46,052	0.16	0.16	5.8	8.0	*6.5*	41.1	0.4	33.5	1.5	3.3
Turkey	160,173	170,685	0.20	0.17	11.0	7.1	7.6	44.5	0.3	23.6	1.1	5.0
Turkmenistan	..	..	..	..	..	..	..	..	..	..	..	..
Uganda	..	..	..	..	..	..	..	..	..	..	..	..
Ukraine	..	*499,886*	..	*0.18*	*22.8*	*3.4*	*6.6*	*51.6*	*0.3*	*5.8*	*1.6*	*7.9*
United Arab Emirates	*4,524*	..	*0.15*	..	..	..	..	..	..	..	..	..
United Kingdom	964,510	569,736	0.15	0.15	7.2	30.4	10.0	32.1	0.2	5.6	2.5	12.0
United States	2,742,993	1,968,196	0.14	0.12	10.5	11.0	13.8	38.4	0.2	7.1	4.1	14.9
Uruguay	34,270	*17,972*	0.21	*0.28*	*1.2*	*11.1*	6.7	*71.2*	*0.1*	*8.5*	*0.7*	*1.8*
Uzbekistan	..	..	..	..	..	..	..	..	..	..	..	..
Venezuela, RB	84,797	*94,175*	0.20	*0.21*	*13.7*	*10.4*	9.8	*53.1*	*0.3*	*7.5*	*1.5*	*3.3*
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*
Zambia	13,605	*11,433*	0.23	*0.22*	*3.4*	*10.8*	6.9	*63.6*	*0.2*	*9.3*	*2.9*	*2.4*
Zimbabwe	32,681	*26,810*	0.20	*0.19*	*5.2*	*10.2*	4.6	*54.2*	*0.3*	*16.3*	*2.8*	*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 2000.

About the data

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). These data were updated through 2000 by the World Bank's Development Research Group. 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 caused by organic waste, 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.

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 estimates of sectoral emissions 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 2000.

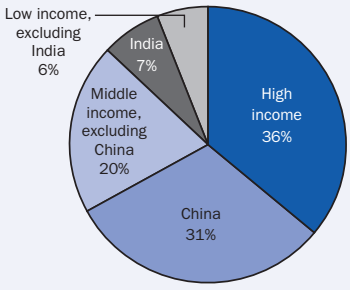
Definitions

• **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).

3.6a

High- and middle-income countries account for most water pollution from organic waste

Emissions of organic water pollutants, 1998



Source: World Bank staff estimates.

Data sources

The data come from a 1998 study by Hemamala Hettige, Muthukumara Mani, and David Wheeler, "Industrial Pollution in Economic Development: Kuznets Revisited" (available at http://www.worldbank.org/nipr). These data were updated through 2000 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.

3.7 Energy production and use

	Total energy production		Energy use					Energy use per capita		
	thousands of metric tons of oil equivalent		Total thousands of metric tons of oil equivalent		Combustible renewables and waste % of total		average annual % growth	kg of oil equivalent		average annual % growth
	1990	2001	1990	2001	1990	2001	1990–2001	1990	2001	1990–2001
Afghanistan	..	..	..	..	..	..	..	..	..	..
Albania	2,449	673	2,662	1,715	13.6	7.5	–1.6	812	548	–1.0
Algeria	104,559	144,330	23,926	29,438	0.1	0.3	1.6	956	955	–0.3
Angola	28,652	43,559	6,280	8,454	68.8	68.7	2.7	672	663	–0.1
Argentina	47,384	82,862	45,039	57,601	3.8	5.2	2.9	1,395	1,593	1.6
Armenia	*263*	602	*4,298*	2,297	*0.0*	0.0	–2.3	*1,231*	744	–0.9
Australia	157,712	250,436	87,536	115,627	4.5	4.5	2.7	5,130	5,956	1.5
Austria	8,080	9,717	25,042	30,721	9.8	10.4	1.6	3,241	3,825	1.3
Azerbaijan	*18,150*	19,581	*16,675*	11,582	*0.0*	0.0	–4.0	*2,259*	1,428	–5.0
Bangladesh	10,747	16,200	12,937	20,410	53.0	37.9	4.3	118	153	2.5
Belarus	*4,103*	3,533	*39,703*	24,415	*1.5*	4.3	–3.9	*3,886*	2,449	–3.6
Belgium	12,490	12,967	48,685	59,001	1.4	1.6	1.8	4,885	5,735	1.6
Benin	1,774	1,483	1,678	2,028	93.2	71.2	1.5	356	318	–1.2
Bolivia	4,923	6,938	2,774	4,271	27.2	16.8	5.7	422	496	3.1
Bosnia and Herzegovina	*3,642*	3,277	*4,474*	4,359	*3.6*	4.1	5.1	*1,086*	1,074	4.7
Botswana	..	..	..	..	..	..	..	..	..	..
Brazil	97,069	145,933	132,985	185,083	31.0	23.4	3.6	899	1,074	2.1
Bulgaria	9,613	10,297	28,820	19,476	0.6	2.8	–2.6	3,306	2,428	–2.0
Burkina Faso	..	..	..	..	..	..	..	..	..	..
Burundi	..	..	..	..	..	..	..	..	..	..
Cambodia	..	..	..	..	..	..	..	..	..	..
Cameroon	12,090	12,485	5,031	6,445	75.9	79.0	2.4	431	417	–0.2
Canada	273,680	379,207	209,090	248,184	3.9	4.2	1.8	7,524	7,985	0.8
Central African Republic	..	..	..	..	..	..	..	..	..	..
Chad	..	..	..	..	..	..	..	..	..	..
Chile	7,641	8,673	13,630	23,801	19.6	17.7	6.1	1,041	1,545	4.6
China	902,689	1,138,617	870,441	1,139,369	23.0	19.0	2.8	767	896	1.8
Hong Kong, China	43	48	10,662	16,278	0.5	0.3	3.9	1,869	2,421	2.1
Colombia	48,445	73,920	25,014	29,245	23.3	17.9	1.5	715	680	–0.4
Congo, Dem. Rep.	12,027	15,707	11,911	15,039	83.9	93.0	2.2	319	300	–0.5
Congo, Rep.	9,005	13,668	1,056	931	69.4	64.9	–2.8	423	262	–5.8
Costa Rica	1,032	1,733	2,025	3,481	36.6	11.0	4.8	664	899	2.6
Côte d'Ivoire	3,395	6,177	4,420	6,497	71.9	66.6	4.1	375	402	1.1
Croatia	*4,346*	3,720	*6,714*	7,904	*3.8*	3.7	2.1	*1,405*	1,771	3.1
Cuba	6,271	6,656	16,524	13,651	33.7	24.4	–0.5	1,555	1,216	–1.0
Czech Republic	38,474	30,489	47,401	41,396	*1.2*	1.7	–1.0	4,574	4,049	–0.9
Denmark	9,835	27,171	17,609	19,783	6.6	9.2	0.7	3,426	3,692	0.3
Dominican Republic	1,031	1,485	4,139	7,810	24.2	18.4	6.5	586	921	4.7
Ecuador	16,400	22,872	6,054	8,727	13.6	8.4	3.4	590	692	1.4
Egypt, Arab Rep.	54,869	59,301	32,024	48,012	3.3	2.8	3.9	611	737	1.9
El Salvador	1,722	2,329	2,535	4,269	48.2	32.9	4.5	496	677	2.4
Eritrea	..	..	..	..	..	..	..	..	..	..
Estonia	*4,118*	2,989	*6,271*	4,697	*2.9*	11.5	–2.2	*4,091*	3,444	–1.0
Ethiopia	14,158	18,000	15,151	19,161	92.8	93.1	2.4	296	291	0.1
Finland	12,081	15,156	29,171	33,815	15.6	19.7	1.7	5,851	6,518	1.3
France	111,278	132,709	227,114	265,570	4.8	4.5	1.2	4,003	4,487	0.8
Gabon	14,630	14,788	1,287	1,702	57.7	55.7	2.4	1,350	1,322	–0.4
Gambia, The	..	..	..	..	..	..	..	..	..	..
Georgia	*1,470*	1,265	*8,762*	2,413	*7.7*	..	–11.7	*1,612*	462	–11.4
Germany	186,157	133,745	356,218	351,092	1.3	2.3	–0.0	4,485	4,264	–0.3
Ghana	4,392	5,995	5,337	8,180	73.1	66.3	4.1	349	410	1.6
Greece	9,200	9,965	22,181	28,704	4.0	3.5	2.4	2,183	2,710	2.1
Guatemala	3,390	5,230	4,477	7,313	67.9	53.3	4.8	512	626	2.1
Guinea	..	..	..	..	..	..	..	..	..	..
Guinea-Bissau	..	..	..	..	..	..	..	..	..	..
Haiti	1,253	1,542	1,585	2,088	76.5	72.7	3.5	245	257	1.3

3.7 Energy production and use

	Total energy production		Energy use					Energy use per capita		
	thousands of metric tons of oil equivalent		Total thousands of metric tons of oil equivalent		Combustible renewables and waste % of total		average annual % growth	kg of oil equivalent		average annual % growth
	1990	2001	1990	2001	1990	2001	1990–2001	1990	2001	1990–2001
Honduras	1,694	1,535	2,416	3,236	62.0	41.1	2.6	496	488	–0.2
Hungary	14,239	10,824	28,467	25,340	1.3	1.6	–0.7	2,746	2,487	–0.4
India	333,978	438,099	363,153	531,453	48.4	38.5	3.6	427	515	1.8
Indonesia	161,518	234,314	92,815	152,304	43.9	31.5	4.4	521	729	2.9
Iran, Islamic Rep.	179,738	246,644	68,775	120,000	1.0	0.7	5.2	1,264	1,860	3.6
Iraq	106,715	123,296	20,841	28,476	0.1	0.1	4.2	1,153	1,202	1.6
Ireland	3,467	1,729	10,575	14,981	1.0	1.2	3.6	3,016	3,876	2.7
Israel	433	685	12,112	21,193	0.0	0.0	5.3	2,599	3,291	2.4
Italy	25,547	26,264	152,552	171,998	0.6	1.4	1.2	2,690	2,981	1.0
Jamaica	485	487	2,943	4,009	16.2	11.9	3.0	1,231	1,545	2.2
Japan	73,209	104,006	436,523	520,729	1.0	1.0	1.8	3,534	4,099	1.5
Jordan	162	280	3,499	5,116	0.1	0.1	3.7	1,104	1,017	–0.1
Kazakhstan	*89,007*	83,752	*79,661*	40,324	*0.1*	0.2	–7.7	*4,823*	2,705	–6.6
Kenya	10,272	12,644	12,479	15,377	78.4	78.2	2.2	534	500	–0.4
Korea, Dem. Rep.	28,725	19,251	32,874	20,440	2.9	4.9	–5.1	1,647	914	–6.1
Korea, Rep.	21,908	34,207	92,578	194,780	*0.3*	1.2	7.1	2,160	4,114	6.1
Kuwait	48,519	108,851	8,413	16,368	0.1	..	9.9	3,959	7,195	6.3
Kyrgyz Republic	*1,818*	1,353	*5,066*	2,235	*0.1*	0.2	–6.4	*1,114*	451	–7.5
Lao PDR	..	..	..	..	..	..	..	..	..	..
Latvia	*794*	1,717	*5,979*	4,297	*8.1*	..	–3.4	*2,272*	1,822	–2.2
Lebanon	143	161	2,309	5,434	4.5	2.3	8.0	635	1,239	6.1
Lesotho	..	..	..	..	..	..	..	..	..	..
Liberia	..	..	..	..	..	..	..	..	..	..
Libya	73,173	74,363	11,541	15,992	1.1	0.9	2.1	2,680	2,994	0.1
Lithuania	*4,189*	4,144	*11,077*	8,023	*1.5*	8.2	–2.5	*2,994*	2,304	–1.9
Macedonia, FYR	..	..	..	..	..	..	..	..	..	..
Madagascar	..	..	..	..	..	..	..	..	..	..
Malawi	..	..	..	..	..	..	..	..	..	..
Malaysia	48,727	77,623	22,455	51,608	9.5	4.6	7.2	1,234	2,168	4.6
Mali	..	..	..	..	..	..	..	..	..	..
Mauritania	..	..	..	..	..	..	..	..	..	..
Mauritius	..	..	..	..	..	..	..	..	..	..
Mexico	194,454	230,236	124,028	152,273	5.9	5.4	1.8	1,490	1,532	0.2
Moldova	*58*	62	*6,884*	3,140	*0.5*	1.9	–8.3	*1,582*	735	–8.1
Mongolia	..	..	..	..	..	..	..	..	..	..
Morocco	773	583	6,725	11,006	4.7	4.0	4.4	280	377	2.6
Mozambique	6,846	7,560	7,203	7,687	94.4	88.3	0.0	509	425	–2.2
Myanmar	10,651	15,275	10,683	12,159	84.4	77.4	1.7	264	252	0.1
Namibia	*218*	294	*652*	1,159	*16.0*	15.2	5.3	*445*	596	2.5
Nepal	5,501	7,338	5,806	8,416	93.4	85.2	3.4	320	357	0.9
Netherlands	60,316	60,437	66,491	77,214	1.1	1.6	1.1	4,447	4,814	0.5
New Zealand	12,256	14,932	14,016	18,294	4.9	6.4	2.8	4,065	4,714	1.6
Nicaragua	1,495	1,540	2,118	2,792	53.3	48.2	2.6	554	536	–0.2
Niger	..	..	..	..	..	..	..	..	..	..
Nigeria	150,453	207,024	70,905	95,444	79.8	77.5	2.5	737	735	–0.3
Norway	120,304	226,570	21,492	26,607	4.8	5.6	1.9	5,066	5,896	1.3
Oman	38,312	64,534	4,562	9,984	..	..	5.4	2,804	4,029	1.8
Pakistan	34,360	48,606	43,424	64,506	43.2	37.2	3.8	402	456	1.3
Panama	612	678	1,490	3,180	28.3	14.6	6.1	621	1,098	4.3
Papua New Guinea	..	..	..	..	..	..	..	..	..	..
Paraguay	4,578	6,077	3,089	3,756	72.1	58.0	2.8	744	697	0.4
Peru	10,596	9,363	9,952	12,113	26.9	18.7	2.6	461	460	0.8
Philippines	15,901	20,006	28,292	42,151	34.8	23.1	4.2	463	538	1.9
Poland	99,228	79,861	99,847	90,570	2.2	4.8	–0.7	2,619	2,344	–0.8
Portugal	2,805	3,396	17,158	24,732	11.0	8.3	3.7	1,734	2,435	3.4
Puerto Rico	..	..	..	..	..	..	..	..	..	..

3.7 Energy production and use

	Total energy production		Energy use					Energy use per capita		
	thousands of metric tons of oil equivalent		Total thousands of metric tons of oil equivalent		Combustible renewables and waste % of total		average annual % growth	kg of oil equivalent		average annual % growth
	1990	2001	1990	2001	1990	2001	1990–2001	1990	2001	1990–2001
Romania	40,834	28,222	62,403	36,841	1.0	6.4	–3.8	2,689	1,644	–3.5
Russian Federation	*1,118,707*	996,161	*774,823*	621,349	*1.6*	1.1	–2.4	*5,211*	4,293	–2.1
Rwanda	..	..	..	..	..	..	..	..	..	..
Saudi Arabia	368,753	476,831	60,834	110,586	0.0	0.0	4.3	3,850	5,195	1.6
Senegal	1,362	1,765	2,238	3,179	60.6	55.5	3.4	305	325	0.8
Serbia and Montenegro	*11,835*	10,774	*15,002*	16,061	*5.0*	5.0	1.8	*1,435*	1,508	1.6
Sierra Leone	..	..	..	..	..	..	..	..	..	..
Singapore	..	64	13,357	29,158	..	..	5.8	4,384	7,058	2.8
Slovak Republic	5,273	6,550	21,426	18,717	0.8	1.9	–0.9	4,056	3,480	–1.1
Slovenia	*2,765*	3,161	*5,008*	6,838	*5.3*	6.6	3.3	*2,508*	3,459	3.3
Somalia	..	..	..	..	..	..	..	..	..	..
South Africa	114,534	145,287	91,229	107,738	11.4	11.7	1.9	2,592	2,404	–0.3
Spain	34,648	33,022	91,209	127,381	4.5	3.2	3.1	2,349	3,127	2.7
Sri Lanka	4,191	4,462	5,516	7,923	71.0	52.9	3.8	339	423	2.5
Sudan	8,775	21,551	10,627	13,525	81.8	80.3	4.2	426	421	1.7
Swaziland	..	..	..	..	..	..	..	..	..	..
Sweden	29,754	34,377	46,667	51,054	11.8	16.0	0.7	5,452	5,740	0.4
Switzerland	9,831	12,367	25,106	28,019	4.1	6.0	0.8	3,740	3,875	0.2
Syrian Arab Republic	22,570	34,377	11,928	13,955	0.0	0.0	2.6	984	841	–0.3
Tajikistan	*1,553*	1,267	*9,087*	3,036	..	..	–8.9	*1,631*	487	–10.1
Tanzania	9,063	13,001	9,808	13,917	91.0	91.5	3.2	385	404	0.4
Thailand	25,908	40,059	43,215	75,542	33.9	17.1	5.2	777	1,235	4.4
Togo	778	1,056	1,001	1,422	77.7	74.3	4.5	290	305	1.6
Trinidad and Tobago	12,612	18,385	5,795	8,693	0.8	0.3	3.8	4,770	6,708	3.2
Tunisia	6,127	6,886	5,536	8,243	18.7	15.2	3.9	679	852	2.3
Turkey	25,857	26,154	53,005	72,458	13.6	8.7	3.8	944	1,057	2.0
Turkmenistan	*48,822*	50,443	*11,307*	15,309	..	..	2.4	*2,912*	3,244	0.3
Uganda	..	..	..	..	..	..	..	..	..	..
Ukraine	*110,170*	83,428	*218,376*	141,577	*0.1*	0.2	–4.5	*4,187*	2,884	–3.8
United Arab Emirates	108,472	144,566	17,611	32,624	*0.2*	0.1	5.3	9,550	10,860	1.2
United Kingdom	207,007	261,939	212,176	235,158	0.3	1.0	0.8	3,686	3,982	0.6
United States	1,650,408	1,711,814	1,927,572	2,281,414	3.2	3.1	1.7	7,728	7,996	0.4
Uruguay	1,149	1,211	2,251	2,703	24.3	15.6	2.4	725	809	1.7
Uzbekistan	*40,461*	55,630	*44,994*	50,650	..	..	1.7	*2,098*	2,029	–0.0
Venezuela, RB	148,854	216,020	43,918	54,856	1.2	1.0	2.2	2,252	2,227	0.1
Vietnam	24,988	50,346	24,690	39,356	76.5	58.3	4.5	373	495	2.8
West Bank and Gaza	..	..	..	..	..	..	..	..	..	..
Yemen, Rep.	9,792	22,687	2,626	3,560	2.9	2.2	2.2	221	197	–1.1
Zambia	4,923	6,052	5,469	6,423	73.5	81.5	1.3	703	638	–1.0
Zimbabwe	8,250	8,531	9,084	9,882	52.0	57.4	0.7	887	769	–1.3
World	**8,711,744 t**	**10,140,706 t**	**8,572,434 t**	**10,009,627 t**	**10.9 w**	**10.6 w**	**1.5 w**	**1,677 w**	**1,686 w**	**0.1 w**
Low income	980,692	1,330,614	923,451	1,233,424	52.0	46.2	2.7	480	518	0.7
Middle income	4,481,928	4,952,955	3,400,356	3,641,578	10.8	10.4	0.7	1,417	1,339	–0.4
Lower middle income	3,356,996	3,544,563	2,825,424	2,929,430	12.0	11.9	0.4	1,337	1,226	–0.7
Upper middle income	1,124,932	1,408,392	572,246	709,943	4.1	4.2	1.9	2,027	2,176	0.6
Low & middle income	5,462,620	6,283,569	4,311,187	4,850,856	18.9	18.9	1.1	1,012	966	–0.4
East Asia & Pacific	1,219,107	1,595,491	1,138,460	1,550,628	26.4	21.0	3.1	715	854	1.9
Europe & Central Asia	1,860,581	1,516,768	1,716,074	1,273,037	1.9	2.3	–3.0	3,681	2,684	–3.1
Latin America & Carib.	613,090	845,705	455,450	595,827	18.2	14.5	2.8	1,051	1,151	1.2
Middle East & N. Africa	965,686	1,254,273	257,289	413,276	1.4	1.1	4.1	1,087	1,383	2.0
South Asia	388,777	514,705	437,361	642,291	48.9	39.2	3.6	391	469	1.7
Sub-Saharan Africa	415,379	556,627	321,164	405,176	56.7	57.6	2.3	693	661	–0.3
High income	3,249,124	3,857,137	4,287,850	5,187,992	2.9	3.0	1.8	4,847	5,423	1.1
Europe EMU	466,100	439,167	1,049,967	1,189,043	3.1	3.5	1.1	3,580	3,904	0.8

Energy production and use 3.7

About the data

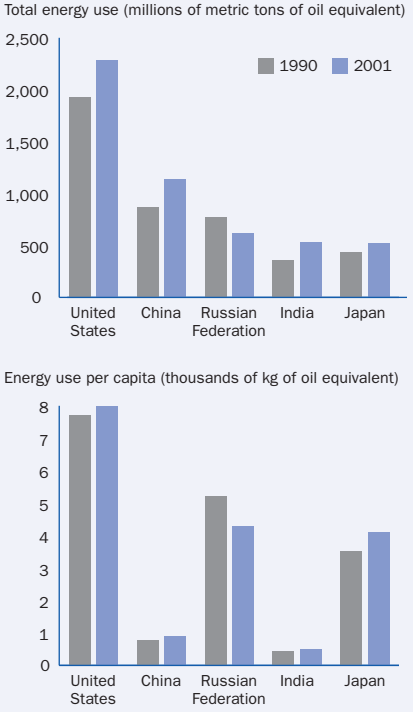
In developing countries growth in energy use is closely related to growth in the modern sectors—industry, motorized transport, and urban areas—but energy use also reflects climatic, geographic, and economic factors (such as the relative price of energy). Energy use has been growing rapidly in low- and middle-income countries, but high-income countries still use more than five times as much on a per capita basis.

Energy data are compiled by the International Energy Agency (IEA). IEA data for countries that are not members of the Organisation for Economic Co-operation and Development (OECD) are based on national energy data adjusted to conform to annual questionnaires completed by OECD member governments.

Total 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—solid biomass and animal products, gas and liquid from biomass, and industrial 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.) Data for combustible renewables and waste are often based on small surveys or other incomplete information. Thus the data give only a broad impression of developments and are not strictly comparable between countries. The IEA reports (see *Data sources*) include country notes that explain some of these differences. All forms of 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.

3.7a

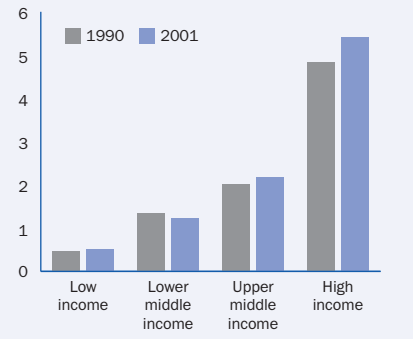
Energy use varies by country, even among the five largest energy users



Source: Table 3.7.

3.7b

People in high-income countries use more than five times as much energy as do people in low-income countries



Source: Table 3.7.

Definitions

• **Total energy production** refers to forms of primary energy—petroleum (crude oil, natural gas liquids, and oil from nonconventional sources), natural gas, solid fuels (coal, lignite, and other derived fuels), and combustible renewables and waste—and primary electricity, all converted into oil equivalents (see *About the data*). • **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*). • **Combustible renewables and waste** comprise solid biomass, liquid biomass, biogas, industrial waste, and municipal waste, measured as a percentage of total energy use.

Data sources

The data on energy production and use come from IEA electronic files. 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.*

3.8 Energy efficiency, dependency, and emissions

	GDP per unit of energy use		Net energy imports [a]		Carbon dioxide emissions					
	1995 PPP $ per kg oil equivalent		% of energy use		Total million metric tons		Per capita metric tons		kg per 1995 PPP $ of GDP	
	1990	2001	1990	2001	1990	2000	1990	2000	1990	2000
Afghanistan	..	..	..	..	2.6	0.9	0.1	0.0	..	..
Albania	3.5	6.4	8	61	7.3	2.9	2.2	0.9	0.8	0.3
Algeria	5.1	5.0	–337	–390	80.4	89.4	3.2	2.9	0.7	0.6
Angola	2.7	2.2	–356	–415	4.6	6.4	0.5	0.5	0.3	0.4
Argentina	5.8	6.8	–5	–44	109.7	138.2	3.4	3.9	0.4	0.3
Armenia	*1.2*	3.3	94	74	*3.7*	3.5	*1.1*	1.1	*0.7*	0.5
Australia	3.7	4.2	–80	–117	266.0	344.8	15.6	18.0	0.8	0.7
Austria	6.6	6.8	68	68	57.5	60.8	7.4	7.6	0.4	0.3
Azerbaijan	*1.4*	1.7	–9	–69	*47.1*	29.0	*6.4*	3.6	*2.0*	1.6
Bangladesh	9.1	9.7	17	21	15.4	29.3	0.1	0.2	0.1	0.2
Belarus	*1.1*	1.9	90	86	*94.6*	59.2	*9.3*	5.9	*2.1*	1.3
Belgium	4.1	4.3	74	78	100.5	102.2	10.1	10.0	0.5	0.4
Benin	2.1	2.9	–6	27	0.6	1.6	0.1	0.3	0.2	0.3
Bolivia	4.5	4.3	–77	–62	5.5	11.1	0.8	1.3	0.4	0.6
Bosnia and Herzegovina	..	4.8	19	25	*4.7*	19.3	*1.1*	4.8	..	1.0
Botswana	..	..	..	..	2.2	3.9	1.7	2.3	0.3	0.3
Brazil	6.6	6.2	27	21	202.6	307.5	1.4	1.8	0.2	0.3
Bulgaria	1.9	2.5	67	47	75.3	42.3	8.6	5.2	1.3	0.9
Burkina Faso	..	..	..	..	1.0	1.0	0.1	0.1	0.2	0.1
Burundi	..	..	..	..	0.2	0.2	0.0	0.0	0.0	0.1
Cambodia	..	..	..	..	0.5	0.5	0.0	0.0	0.0	0.0
Cameroon	4.4	4.2	–140	–94	1.5	6.5	0.1	0.4	0.1	0.3
Canada	2.9	3.2	–31	–53	428.8	435.9	15.4	14.2	0.7	0.5
Central African Republic	..	..	..	..	0.2	0.3	0.1	0.1	0.1	0.1
Chad	..	..	..	..	0.1	0.1	0.0	0.0	0.0	0.0
Chile	5.0	5.6	44	64	35.3	59.5	2.7	3.9	0.5	0.5
China	2.0	4.2	–4	0	2,401.7	2,790.5	2.1	2.2	1.4	0.6
Hong Kong, China	9.7	9.9	100	100	26.2	33.1	4.6	5.0	0.3	0.2
Colombia	7.0	7.9	–94	–153	55.9	58.5	1.6	1.4	0.3	0.3
Congo, Dem. Rep.	4.2	1.9	–1	–4	4.1	2.7	0.1	0.1	0.1	0.1
Congo, Rep.	2.4	3.3	–753	–1,368	2.0	1.8	0.8	0.5	0.8	0.6
Costa Rica	8.5	8.3	49	50	2.9	5.4	1.0	1.4	0.2	0.2
Côte d'Ivoire	4.1	3.7	23	5	11.9	10.5	1.0	0.7	0.7	0.4
Croatia	*4.3*	4.7	35	53	*16.8*	19.6	*3.5*	4.4	*0.6*	0.5
Cuba	..	..	62	51	32.0	30.9	3.0	2.8	..	..
Czech Republic	2.7	3.2	19	26	*137.9*	118.8	*13.4*	11.6	*1.2*	0.9
Denmark	6.4	7.3	44	–37	50.7	44.6	9.9	8.4	0.4	0.3
Dominican Republic	5.9	5.7	75	81	9.4	25.1	1.3	3.0	0.4	0.6
Ecuador	2.8	4.4	–171	–162	16.6	25.5	1.6	2.0	1.0	0.7
Egypt, Arab Rep.	4.3	4.5	–71	–24	75.4	142.2	1.4	2.2	0.6	0.7
El Salvador	6.6	6.2	32	45	2.6	6.7	0.5	1.1	0.2	0.3
Eritrea	..	..	..	..	..	0.6	..	0.1	..	0.2
Estonia	*1.7*	2.8	34	36	*24.9*	16.0	*16.2*	11.7	*2.4*	1.3
Ethiopia	1.8	2.2	7	6	3.0	5.6	0.1	0.1	0.1	0.1
Finland	3.4	3.6	59	55	52.9	53.4	10.6	10.3	0.5	0.4
France	5.0	5.3	51	50	357.5	362.4	6.3	6.2	0.3	0.3
Gabon	4.3	4.2	–1,037	–769	6.7	3.5	7.0	2.8	1.2	0.5
Gambia, The	..	..	..	..	0.2	0.3	0.2	0.2	0.1	0.1
Georgia	*1.3*	4.2	83	48	*15.1*	6.2	*2.8*	1.2	*1.4*	0.6
Germany	4.7	5.6	48	62	*890.2*	785.5	*11.1*	9.6	*0.5*	0.4
Ghana	4.1	4.3	18	27	3.5	5.9	0.2	0.3	0.2	0.2
Greece	5.7	5.8	59	65	72.2	89.6	7.1	8.5	0.6	0.6
Guatemala	6.1	5.7	24	28	5.1	9.9	0.6	0.9	0.2	0.2
Guinea	..	..	..	..	1.0	1.3	0.2	0.2	0.1	0.1
Guinea-Bissau	..	..	..	..	0.8	0.3	0.8	0.2	1.0	0.3
Haiti	8.3	5.8	21	26	1.0	1.4	0.2	0.2	0.1	0.1

Energy efficiency, dependency, and emissions

3.8

	GDP per unit of energy use		Net energy imports[a]		Carbon dioxide emissions					
	1995 PPP $ per kg oil equivalent		% of energy use		Total million metric tons		Per capita metric tons		kg per 1995 PPP $ of GDP	
	1990	2001	1990	2001	1990	2000	1990	2000	1990	2000
Honduras	4.3	4.6	30	53	2.6	4.8	0.5	0.7	0.2	0.3
Hungary	3.7	4.7	50	57	58.5	54.2	5.6	5.4	0.6	0.5
India	3.6	4.4	8	18	675.3	1,070.9	0.8	1.1	0.5	0.5
Indonesia	3.9	3.7	–74	–54	165.2	269.6	0.9	1.3	0.5	0.5
Iran, Islamic Rep.	3.3	3.0	–161	–106	212.4	310.3	3.9	4.9	0.9	0.9
Iraq	..	..	–412	–333	49.3	76.3	2.7	3.3	..	..
Ireland	4.6	7.0	67	88	29.8	42.2	8.5	11.1	0.6	0.4
Israel	5.7	*5.6*	96	97	34.6	63.1	7.4	10.0	0.5	0.6
Italy	7.4	7.8	83	85	398.9	428.2	7.0	7.4	0.4	0.3
Jamaica	2.8	2.1	84	88	8.0	10.8	3.3	4.2	1.0	1.3
Japan	6.0	5.8	83	80	1,070.7	1,184.5	8.7	9.3	0.4	0.4
Jordan	3.2	3.7	95	95	10.2	15.6	3.2	3.2	0.9	0.8
Kazakhstan	*0.9*	1.7	–12	–108	*252.7*	121.3	*15.3*	8.1	*3.5*	2.0
Kenya	1.9	1.8	18	18	5.8	9.4	0.2	0.3	0.2	0.3
Korea, Dem. Rep.	..	..	13	6	244.6	188.9	12.3	8.5	..	..
Korea, Rep.	3.9	3.5	76	82	241.2	427.0	5.6	9.1	0.7	0.7
Kuwait	*2.5*	2.2	–477	–565	42.2	47.9	19.9	21.9	*0.9*	1.3
Kyrgyz Republic	*1.6*	3.2	64	39	*11.0*	4.6	*2.4*	0.9	*1.4*	0.7
Lao PDR	..	..	..	..	0.2	0.4	0.1	0.1	0.1	0.1
Latvia	*2.5*	4.1	87	60	*12.7*	6.0	*4.8*	2.5	*0.8*	0.4
Lebanon	3.7	3.2	94	97	9.1	15.2	2.5	3.5	1.1	0.9
Lesotho	..	..	..	..	..	..	..	..	..	..
Liberia	..	..	..	..	0.5	0.4	0.2	0.1	..	..
Libya	..	..	–534	–365	37.8	57.1	8.8	10.9	..	..
Lithuania	*2.6*	3.7	62	48	*21.4*	11.9	*5.8*	3.4	*0.8*	0.4
Macedonia, FYR	..	..	..	..	*10.6*	11.2	*5.5*	5.5	*0.9*	0.9
Madagascar	..	..	..	..	0.9	2.3	0.1	0.1	0.1	0.2
Malawi	..	..	..	..	0.6	0.8	0.1	0.1	0.1	0.1
Malaysia	4.1	3.6	–117	–50	55.3	144.4	3.0	6.2	0.6	0.8
Mali	..	..	..	..	0.4	0.6	0.0	0.1	0.1	0.1
Mauritania	..	..	..	..	2.6	3.1	1.3	1.2	1.0	0.8
Mauritius	..	..	..	..	1.2	2.9	1.1	2.4	0.2	0.3
Mexico	4.7	5.3	–57	–51	305.4	424.0	3.7	4.3	0.5	0.5
Moldova	*1.3*	1.7	99	98	*20.9*	6.6	*4.8*	1.5	*2.4*	1.3
Mongolia	..	..	..	..	10.0	7.5	4.7	3.1	2.9	2.2
Morocco	11.0	9.0	89	95	23.5	36.5	1.0	1.3	0.3	0.4
Mozambique	..	..	5	2	1.0	1.2	0.1	0.1	..	..
Myanmar	..	..	0	–26	4.1	9.1	0.1	0.2	..	..
Namibia	*10.4*	9.3	67	75	*0.0*	1.8	*0.0*	1.0	*0.0*	0.2
Nepal	3.0	3.5	5	13	0.6	3.4	0.0	0.1	0.0	0.1
Netherlands	4.5	5.2	9	22	150.0	138.9	10.0	8.7	0.5	0.3
New Zealand	3.9	4.0	13	18	23.6	32.1	6.8	8.3	0.4	0.5
Nicaragua	3.4	..	29	45	2.6	3.7	0.7	0.7	0.4	*0.4*
Niger	..	..	..	..	1.1	1.2	0.1	0.1	0.2	0.2
Nigeria	1.1	1.1	–112	–117	88.7	36.1	0.9	0.3	1.2	0.4
Norway	4.8	5.5	–460	–752	31.7	49.9	7.5	11.1	0.3	0.3
Oman	3.8	3.0	–740	–546	11.5	19.8	7.1	8.2	0.7	0.7
Pakistan	3.7	3.8	21	25	67.9	104.8	0.6	0.8	0.4	0.4
Panama	6.6	5.1	59	79	3.1	6.3	1.3	2.2	0.3	0.4
Papua New Guinea	..	..	..	..	2.4	2.4	0.6	0.5	0.4	0.2
Paraguay	5.9	6.1	–48	–62	2.3	3.7	0.5	0.7	0.1	0.2
Peru	7.7	9.4	–6	23	21.7	29.5	1.0	1.1	0.3	0.3
Philippines	7.4	6.8	44	53	44.3	77.5	0.7	1.0	0.2	0.3
Poland	2.5	3.9	1	12	347.6	301.3	9.1	7.8	1.4	0.9
Portugal	7.0	6.4	84	86	42.3	59.8	4.3	5.9	0.4	0.4
Puerto Rico	..	..	..	..	11.8	8.7	3.3	2.3	0.3	0.2

3.8 Energy efficiency, dependency, and emissions

	GDP per unit of energy use		Net energy imports [a]		Carbon dioxide emissions					
	1995 PPP $ per kg oil equivalent		% of energy use		Total million metric tons		Per capita metric tons		kg per 1995 PPP $ of GDP	
	1990	2001	1990	2001	1990	2000	1990	2000	1990	2000
Romania	2.3	3.4	35	23	155.1	86.3	6.7	3.8	1.1	0.7
Russian Federation	*1.5*	1.6	–44	–60	*1,984.0*	1,435.1	*13.3*	9.9	*1.7*	1.5
Rwanda	..	..	..	..	0.5	0.6	0.1	0.1	0.1	0.1
Saudi Arabia	2.9	2.0	–506	–331	177.9	374.3	11.3	18.1	1.0	1.7
Senegal	4.1	4.3	39	44	2.9	4.2	0.4	0.4	0.3	0.3
Serbia and Montenegro	..	..	21	33	130.5	*39.5*	12.4	*3.7*	..	..
Sierra Leone	..	..	..	..	0.3	0.6	0.1	0.1	0.1	0.3
Singapore	3.1	2.9	..	100	41.9	59.0	13.8	14.7	1.0	0.7
Slovak Republic	2.5	3.1	75	65	*44.7*	35.4	*8.4*	6.6	*1.0*	0.6
Slovenia	*4.3*	4.5	45	54	*12.3*	14.6	*6.2*	7.3	*0.6*	0.5
Somalia	..	..	..	..	0.0	..	0.0	..	..	..
South Africa	3.4	3.5	–26	–35	291.1	327.3	8.3	7.4	0.9	0.9
Spain	6.2	6.0	62	74	211.8	282.9	5.5	7.0	0.4	0.4
Sri Lanka	6.4	7.3	24	44	3.9	10.2	0.2	0.6	0.1	0.2
Sudan	2.3	3.3	17	–59	3.5	5.2	0.1	0.2	0.1	0.1
Swaziland	..	..	..	..	0.4	0.4	0.6	0.4	0.1	0.1
Sweden	3.7	4.0	36	33	48.5	46.9	5.7	5.3	0.3	0.2
Switzerland	7.1	7.0	61	56	42.7	39.1	6.4	5.4	0.2	0.2
Syrian Arab Republic	2.4	3.5	–89	–146	35.8	54.2	3.0	3.3	1.2	1.1
Tajikistan	*0.9*	1.7	83	58	*20.6*	4.0	*3.7*	0.6	*2.6*	0.9
Tanzania	1.2	1.2	8	7	2.3	4.3	0.1	0.1	0.2	0.3
Thailand	5.3	4.8	40	47	95.7	198.6	1.7	3.3	0.4	0.6
Togo	5.2	4.2	22	26	0.7	1.8	0.2	0.4	0.1	0.3
Trinidad and Tobago	1.4	1.3	–118	–111	16.9	26.4	13.9	20.5	2.1	2.4
Tunisia	6.3	7.0	–11	16	13.3	18.4	1.6	1.9	0.4	0.3
Turkey	5.1	4.9	51	64	143.8	221.6	2.6	3.3	0.5	0.6
Turkmenistan	*1.7*	1.3	–332	–229	*28.0*	34.6	*7.2*	7.5	*1.4*	2.1
Uganda	..	..	..	..	0.8	1.5	0.0	0.1	0.1	0.1
Ukraine	*1.6*	1.4	50	41	*600.0*	342.8	*11.5*	6.9	*1.7*	1.9
United Arab Emirates	..	..	–516	–343	60.9	58.9	33.0	21.0	..	..
United Kingdom	5.0	5.8	2	–11	569.3	567.8	9.9	9.6	0.5	0.4
United States	3.4	4.0	14	25	4,815.9	5,601.5	19.3	19.8	0.7	0.6
Uruguay	8.9	9.7	49	55	3.9	5.4	1.3	1.6	0.2	0.2
Uzbekistan	*0.7*	0.7	10	–10	*113.3*	118.6	*5.3*	4.8	*3.7*	3.5
Venezuela, RB	2.4	2.4	–239	–294	113.8	157.7	5.8	6.5	1.1	1.2
Vietnam	2.8	4.0	–1	–28	22.5	57.5	0.3	0.7	0.3	0.4
West Bank and Gaza	..	..	..	..	..	..	..	..	..	..
Yemen, Rep.	3.0	3.8	–273	–537	*9.4*	8.4	*0.7*	0.5	*1.2*	0.6
Zambia	1.2	1.2	10	6	2.4	1.8	0.3	0.2	0.4	0.3
Zimbabwe	2.8	2.8	9	14	16.6	14.8	1.6	1.2	0.6	0.5
World	**3.5 w**	**4.2 w**	**0 w**	**0 w**	**21,297.5 t**	**22,994.5 t**	**4.1 w**	**3.8 w**	**0.7 w**	**0.6 w**
Low income	3.1	3.6	–6	–8	1,653.2	2,066.7	0.8	0.9	0.5	0.5
Middle income	2.7	3.7	–32	–36	9,169.8	9,129.1	3.8	3.4	1.0	0.7
Lower middle income	2.5	3.7	–19	–21	7,561.2	7,116.3	3.6	3.0	1.1	0.7
Upper middle income	3.7	4.0	–97	–98	1,608.5	2,012.0	5.7	6.2	0.8	0.7
Low & middle income	2.8	3.7	–27	–30	10,823.2	11,196.2	2.5	2.2	0.9	0.6
East Asia & Pacific	..	..	–7	–3	3,051.3	3,752.3	1.9	2.1	1.0	0.6
Europe & Central Asia	1.9	2.2	–8	–19	4,818.2	3,162.6	10.3	6.7	1.4	1.2
Latin America & Carib.	5.4	5.7	–35	–42	962.7	1,357.4	2.2	2.7	0.4	0.4
Middle East & N. Africa	3.8	3.4	–275	–203	751.1	1,227.2	3.3	4.2	0.8	0.9
South Asia	3.8	4.6	11	20	765.9	1,220.3	0.7	0.9	0.5	0.4
Sub-Saharan Africa	2.5	2.5	–29	–37	471.8	478.8	0.9	0.7	0.6	0.5
High income	4.3	4.7	24	26	10,480.8	11,804.3	11.8	12.4	0.6	0.5
Europe EMU	5.3	5.8	56	63	2,463.9	2,414.6	8.4	8.0	0.4	0.4

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

About the data

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 1995 constant 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.

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.

Carbon dioxide 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 carbon dioxide emissions result primarily from fossil fuel combustion and cement manufacturing. In combustion, different fossil fuels release different amounts of carbon dioxide for the same level of energy use. Burning oil releases about 50 percent more carbon dioxide than burning natural gas, and burning coal releases about twice as much. Cement manufacturing releases about half a metric ton of carbon dioxide for each metric ton of cement produced.

The Carbon Dioxide Information Analysis Center (CDIAC), sponsored by the U.S. Department of Energy, calculates annual anthropogenic emissions of carbon dioxide. These calculations are based on data on fossil fuel consumption (from the World Energy Data Set maintained by the United Nations Statistics Division) and data on world cement manufacturing (from the Cement Manufacturing Data Set maintained by the U.S. Bureau of Mines). Emissions of carbon dioxide 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 carbon dioxide by multiplying the carbon mass by 3.664 (the ratio of the mass of carbon to that of carbon dioxide).

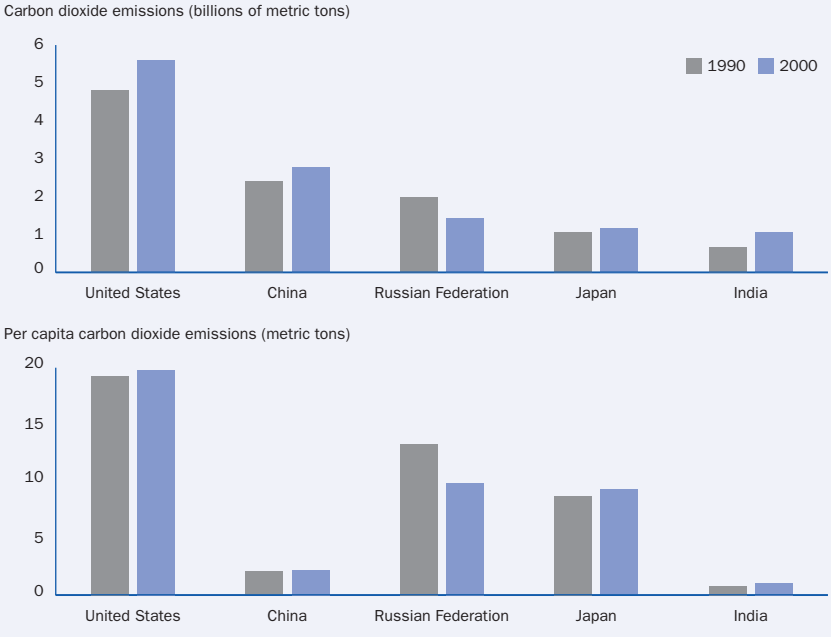
Although the estimates of global carbon dioxide emissions are probably within 10 percent of actual emissions (as calculated from global average fuel chemistry and use), country estimates may have larger error bounds. Trends estimated from a consistent time series tend to be more accurate than individual 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.

Definitions

• **GDP per unit of energy use** is the PPP GDP per kilogram of oil equivalent of energy use. PPP GDP is gross domestic product converted to 1995 constant 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. • **Net energy imports** are estimated as energy use less production, both measured in oil equivalents. A negative value indicates that the country is a net exporter. • **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.

3.8a

Per capita emissions of carbon dioxide vary, even among the five largest producers of emissions



Source: Table 3.8.

Data sources

The underlying data on energy production and use are from electronic files of the International Energy Agency. The data on carbon dioxide emissions are from the CDIAC, Environmental Sciences Division, Oak Ridge National Laboratory, in the U.S. state of Tennessee.

3.9 Sources of electricity

	Electricity production		Access to electricity	Sources of electricity[a]									
	billion kwh		% of population	% of total									
				Hydropower		Coal		Oil		Gas		Nuclear power	
	1990	2001	2000	1990	2001	1990	2001	1990	2001	1990	2001	1990	2001
Afghanistan	..	..	2.0	..	..	..	..	..	..	..	..	..	..
Albania	3.2	3.7	..	89.1	96.3	..	..	10.9	3.7	..	..	..	..
Algeria	16.1	26.6	98.0	0.8	0.3	..	..	5.4	2.9	93.7	96.8	..	..
Angola	0.8	1.6	12.0	86.2	63.2	..	..	13.8	36.8	..	..	..	..
Argentina	51.0	90.2	94.6	35.6	41.1	1.3	1.7	9.7	2.0	39.0	46.7	14.3	7.8
Armenia	*9.0*	5.7	..	*33.8*	16.8	..	..	*43.3*	..	*22.9*	48.6	..	34.6
Australia	154.3	216.9	..	9.2	7.6	77.1	78.3	2.7	1.3	10.6	12.1	..	..
Austria	49.3	62.4	..	63.9	67.0	14.2	12.7	3.8	3.2	15.7	13.6	..	..
Azerbaijan	*19.7*	19.0	..	*8.9*	6.9	..	..	*91.1*	28.4	..	64.8	..	..
Bangladesh	7.7	16.3	20.4	11.4	6.0	..	..	4.3	9.4	84.3	84.6	..	..
Belarus	*37.6*	25.0	..	*0.0*	0.1	..	..	*52.1*	7.7	*47.9*	92.2	..	..
Belgium	70.3	78.6	..	0.4	0.6	28.2	16.2	1.9	2.1	7.7	20.1	60.8	59.0
Benin	0.0	0.1	22.0	..	2.3	..	..	100.0	97.7	..	..	..	..
Bolivia	2.1	4.0	60.4	55.3	54.6	..	..	5.3	17.4	37.6	26.1	..	..
Bosnia and Herzegovina	*6.5*	10.4	..	*52.2*	48.8	*47.8*	50.7	..	0.5	..	..	..	..
Botswana	..	..	22.0	..	..	..	..	..	..	..	..	..	..
Brazil	222.8	327.9	94.9	92.8	81.7	2.1	3.1	2.5	5.4	0.0	2.6	1.0	4.4
Bulgaria	42.1	43.5	..	4.5	4.0	35.4	45.4	4.7	1.3	20.6	4.4	34.8	44.9
Burkina Faso	..	..	13.0	..	..	..	..	..	..	..	..	..	..
Burundi	..	..	..	..	..	..	..	..	..	..	..	..	..
Cambodia	..	..	15.8	..	..	..	..	..	..	..	..	..	..
Cameroon	2.7	3.5	20.0	98.5	98.1	..	..	1.5	1.9	..	..	..	..
Canada	481.9	587.9	..	61.6	56.7	17.1	20.1	3.4	2.9	2.0	6.1	15.1	13.0
Central African Republic	..	..	..	..	..	..	..	..	..	..	..	..	..
Chad	..	..	..	..	..	..	..	..	..	..	..	..	..
Chile	18.4	43.9	99.0	55.3	49.4	34.3	16.5	7.6	1.6	1.3	28.7	..	..
China	621.2	1471.7	98.6	20.4	18.9	71.2	76.2	7.9	3.2	0.5	0.4	..	1.2
Hong Kong, China	28.9	32.4	..	..	..	98.3	61.5	1.7	0.4	..	38.1	..	..
Colombia	36.2	43.5	81.0	76.0	73.2	9.8	7.3	1.1	0.2	12.4	18.0	..	..
Congo, Dem. Rep.	5.6	5.7	6.7	99.6	99.7	..	..	0.4	0.3	..	..	..	..
Congo, Rep.	0.5	0.3	20.9	99.4	99.7	..	..	0.6	0.3	..	..	..	..
Costa Rica	3.5	6.9	95.7	97.5	81.5	..	..	2.5	1.4	..	..	..	..
Côte d'Ivoire	2.0	4.9	50.0	72.4	36.7	..	..	27.6	0.3	..	63.0	..	..
Croatia	*8.9*	11.8	..	*48.8*	52.7	..	13.9	*35.8*	18.0	*15.4*	15.4	..	..
Cuba	15.0	15.3	97.0	0.6	0.5	..	..	91.5	93.9	0.2	0.0	..	..
Czech Republic	62.6	74.2	..	2.3	2.8	71.8	71.7	4.8	0.5	1.0	4.2	20.1	19.9
Denmark	26.0	37.7	..	0.1	0.1	90.3	47.3	3.7	11.1	2.7	24.6	..	..
Dominican Republic	3.7	10.3	66.8	9.4	5.4	1.2	5.3	88.6	88.9	..	..	..	..
Ecuador	6.3	11.1	80.0	78.5	64.0	..	..	21.5	36.0	..	..	..	..
Egypt, Arab Rep.	42.3	82.7	93.8	23.5	17.1	..	..	36.9	14.7	39.6	68.2	..	..
El Salvador	2.2	3.9	70.8	73.5	29.8	..	..	6.8	45.0	..	..	..	..
Eritrea	..	..	17.0	..	..	..	..	..	..	..	..	..	..
Estonia	*11.8*	8.5	..	*0.0*	0.1	*90.0*	90.2	*4.5*	0.5	*5.5*	9.1	..	..
Ethiopia	1.2	1.8	4.7	88.4	98.7	..	..	11.6	1.0	..	..	..	..
Finland	54.4	74.5	..	20.0	17.7	33.0	23.5	3.1	0.9	8.6	15.5	35.3	30.6
France	416.8	546.0	..	12.8	13.6	8.5	4.5	2.1	1.0	0.7	3.1	75.4	77.1
Gabon	1.0	1.4	31.0	72.1	63.1	..	..	11.2	20.6	16.4	15.8	..	..
Gambia, The	..	..	..	..	..	..	..	..	..	..	..	..	..
Georgia	*11.2*	6.9	..	*58.3*	79.9	..	..	*5.0*	0.4	*36.6*	19.7	..	..
Germany	547.6	579.8	..	3.2	3.5	58.8	51.9	1.9	1.1	7.4	9.9	27.8	29.5
Ghana	5.7	7.9	45.0	100.0	84.1	..	..	..	15.9	..	..	..	..
Greece	34.8	53.1	..	5.1	4.0	72.4	66.8	22.3	16.0	0.3	11.6	..	..
Guatemala	2.3	5.9	66.7	76.0	32.9	..	8.5	9.0	44.1	..	..	..	..
Guinea	..	..	..	..	..	..	..	..	..	..	..	..	..
Guinea-Bissau	..	..	..	..	..	..	..	..	..	..	..	..	..
Haiti	0.6	0.5	34.0	76.5	51.7	..	..	20.6	48.3	..	..	..	..

Sources of electricity 3.9

	Electricity production		Access to electricity	Sources of electricity [a]									
	billion kwh		% of population	% of total									
				Hydropower		Coal		Oil		Gas		Nuclear power	
	1990	2001	2000	1990	2001	1990	2001	1990	2001	1990	2001	1990	2001
Honduras	2.3	4.0	54.5	98.3	59.5	..	..	1.7	38.6	..	..	..	..
Hungary	28.4	36.4	..	0.6	0.5	30.5	24.5	4.8	11.5	15.7	24.3	48.3	38.8
India	289.4	576.5	43.0	24.8	12.8	67.5	78.3	2.7	1.2	2.9	3.6	2.1	3.4
Indonesia	37.0	101.7	53.4	17.6	10.5	28.8	28.9	46.8	23.6	3.8	34.2	..	..
Iran, Islamic Rep.	59.1	130.1	97.9	10.3	3.9	..	..	37.3	21.2	52.5	74.9	..	..
Iraq	24.0	34.9	95.0	10.8	1.8	..	..	89.2	98.2	..	..	..	..
Ireland	14.2	24.6	..	4.9	2.4	57.4	37.6	10.0	21.1	27.7	37.1	..	..
Israel	20.9	43.8	100.0	0.0	0.0	50.1	75.1	49.9	24.8	..	0.0	..	..
Italy	213.2	271.9	..	14.8	17.2	16.8	13.5	48.2	27.6	18.6	38.3	..	..
Jamaica	2.5	6.7	90.0	3.6	1.7	..	..	92.4	96.7	..	..	..	..
Japan	850.8	1,033.2	..	10.5	8.1	14.5	23.1	29.7	11.3	19.4	24.9	23.8	31.0
Jordan	3.6	7.5	95.0	0.3	0.6	..	..	87.8	89.2	11.9	10.2	..	..
Kazakhstan	*82.7*	55.4	..	*8.3*	14.6	*72.3*	69.9	*8.8*	4.9	*10.6*	10.6	..	..
Kenya	3.0	4.4	7.9	81.6	54.7	..	..	7.6	34.4	..	..	..	..
Korea, Dem. Rep.	27.7	20.2	20.0	56.3	52.5	40.1	42.5	3.6	5.0	..	..	..	..
Korea, Rep.	105.4	281.5	..	6.0	1.5	16.8	39.2	17.9	8.5	9.1	10.8	50.2	39.8
Kuwait	18.5	33.5	100.0	..	..	..	..	17.1	76.6	82.9	23.4	..	..
Kyrgyz Republic	*11.9*	13.7	..	*77.4*	90.9	*9.1*	4.5	..	..	*13.6*	4.5	..	..
Lao PDR	..	..	..	..	..	..	..	..	..	..	..	..	..
Latvia	*3.8*	4.3	..	*65.8*	66.2	..	1.0	*7.9*	2.2	*26.3*	30.5	..	..
Lebanon	1.5	8.2	95.0	33.3	4.1	..	..	66.7	95.9	..	..	..	..
Lesotho	..	..	5.0	..	..	..	..	..	..	..	..	..	..
Liberia	..	..	..	..	..	..	..	..	..	..	..	..	..
Libya	16.8	21.5	99.8	..	..	..	..	100.0	100.0	..	..	..	..
Lithuania	*16.5*	14.4	..	*1.9*	2.3	..	..	*7.4*	5.0	*2.2*	13.0	*88.5*	79.1
Macedonia, FYR	..	..	..	..	..	..	..	..	..	..	..	..	..
Madagascar	..	..	8.0	..	..	..	..	..	..	..	..	..	..
Malawi	..	..	5.0	..	..	..	..	..	..	..	..	..	..
Malaysia	23.0	71.4	96.9	17.3	9.9	4.7	3.4	55.9	8.6	22.0	78.1	..	..
Mali	..	..	..	..	..	..	..	..	..	..	..	..	..
Mauritania	..	..	..	..	..	..	..	..	..	..	..	..	..
Mauritius	..	..	100.0	..	..	..	..	..	..	..	..	..	..
Mexico	122.7	209.6	..	19.1	13.6	6.3	11.1	57.3	44.2	10.6	24.0	2.4	4.2
Moldova	*11.2*	3.6	..	*2.3*	2.0	*34.4*	3.3	*26.4*	0.9	*36.9*	93.7	..	..
Mongolia	..	..	90.0	..	..	..	..	..	..	..	..	..	..
Morocco	9.6	16.1	71.1	12.7	5.4	23.0	72.2	64.4	21.1	..	..	..	..
Mozambique	0.5	8.8	7.2	62.6	99.5	13.9	..	23.6	0.5	*0.2*	0.0	..	..
Myanmar	2.5	5.7	5.0	48.1	32.1	1.6	..	10.9	10.9	39.3	57.0	..	..
Namibia	*1.4*	1.4	34.0	*95.2*	96.7	*1.5*	0.4	*3.3*	2.9	..	..	..	..
Nepal	0.9	1.9	15.4	99.9	99.0	..	..	0.1	1.0	..	..	..	..
Netherlands	71.9	93.7	..	0.1	0.1	38.3	28.5	4.3	3.3	50.9	58.9	4.9	4.2
New Zealand	32.3	39.9	..	72.3	53.8	1.5	3.7	0.0	..	17.6	31.2	..	..
Nicaragua	1.4	2.5	48.0	28.8	8.0	..	..	39.8	82.0	..	..	..	..
Niger	..	..	..	..	..	..	..	..	..	..	..	..	..
Nigeria	12.6	18.1	40.0	34.9	38.2	0.2	..	36.5	8.2	28.5	53.6	..	..
Norway	121.6	121.3	..	99.6	99.3	0.2	0.2	0.0	0.0	..	0.2	..	..
Oman	4.5	9.7	94.0	..	..	..	..	18.4	17.7	81.6	82.3	..	..
Pakistan	37.7	72.4	52.9	44.9	26.2	0.1	0.4	20.6	36.0	33.6	34.3	0.8	3.2
Panama	2.7	5.1	76.1	83.2	48.8	..	..	14.7	50.8	..	..	..	..
Papua New Guinea	..	..	..	..	..	..	..	..	..	..	..	..	..
Paraguay	27.2	45.4	74.7	99.9	99.9	..	..	0.0	0.0	..	..	..	..
Peru	13.8	20.8	73.0	75.8	84.7	..	0.9	21.5	9.7	1.7	3.8	..	..
Philippines	25.2	46.2	87.4	24.0	15.4	7.7	40.6	46.7	21.3	..	0.1	..	..
Poland	134.4	143.7	..	1.1	1.6	97.5	95.2	1.2	1.7	0.1	0.9	..	..
Portugal	28.4	46.2	..	32.3	30.4	32.1	29.5	33.1	20.2	..	15.6	..	..
Puerto Rico	..	..	..	..	..	..	..	..	..	..	..	..	..

3.9 Sources of electricity

	Electricity production		Access to electricity	Sources of electricity[a]									
	billion kwh		% of population	% of total									
				Hydropower		Coal		Oil		Gas		Nuclear power	
	1990	2001	2000	1990	2001	1990	2001	1990	2001	1990	2001	1990	2001
Romania	64.3	53.9	..	17.7	27.7	28.8	37.2	18.4	10.0	35.1	15.0	..	10.1
Russian Federation	*1008.5*	889.3	..	*17.0*	19.6	*15.3*	19.0	*9.9*	3.4	*45.7*	42.4	*11.9*	15.4
Rwanda	..	..	..	..	..	..	..	..	..	..	..	..	..
Saudi Arabia	64.9	137.4	97.7	..	..	..	..	61.5	63.5	38.5	36.5	..	..
Senegal	0.9	1.7	30.1	..	..	..	..	98.0	100.0	2.0	*0.1*	..	..
Serbia and Montenegro	*36.5*	31.8	..	*31.1*	36.5	*65.4*	60.9	*1.9*	1.0	*1.6*	1.6	..	..
Sierra Leone	..	..	..	..	..	..	..	..	..	..	..	..	..
Singapore	15.7	33.1	100.0	..	..	..	..	100.0	52.7	..	45.1	..	..
Slovak Republic	23.4	31.9	..	8.0	15.5	32.2	19.5	3.4	2.2	4.9	8.5	51.4	53.7
Slovenia	*12.1*	14.5	..	*28.2*	26.2	*36.2*	34.0	*2.5*	0.9	*0.2*	2.0	*32.9*	36.3
Somalia	..	..	..	..	..	..	..	..	..	..	..	..	..
South Africa	165.4	211.5	66.1	0.6	1.0	94.3	94.0	..	..	..	..	5.1	5.1
Spain	151.2	234.7	..	16.8	17.5	40.1	30.6	5.7	10.5	1.0	10.0	35.9	27.1
Sri Lanka	3.2	6.6	62.0	99.8	47.0	..	..	0.2	53.0	..	..	..	..
Sudan	1.5	2.6	30.0	63.2	48.3	..	..	36.8	51.7	..	..	..	..
Swaziland	..	..	..	..	..	..	..	..	..	..	..	..	..
Sweden	146.0	161.7	..	49.7	49.0	1.2	2.1	0.8	1.7	0.3	0.2	46.7	44.6
Switzerland	54.6	70.5	..	54.6	58.6	0.1	..	0.5	0.1	0.6	1.2	43.3	38.0
Syrian Arab Republic	11.6	25.5	85.9	48.6	39.0	..	..	32.4	19.9	18.9	41.1	..	..
Tajikistan	*16.8*	14.4	..	*94.7*	97.7	..	..	..	..	*5.3*	2.3	..	..
Tanzania	1.6	2.8	10.5	95.1	91.7	..	3.2	4.9	5.1	..	..	..	..
Thailand	44.2	102.4	82.1	11.3	6.2	25.0	19.2	23.5	2.9	40.2	70.5	..	..
Togo	0.1	0.0	9.0	4.6	6.3	..	..	95.4	93.8	..	..	..	..
Trinidad and Tobago	3.6	5.6	99.0	..	..	..	..	0.1	0.1	99.0	99.4	..	..
Tunisia	5.8	11.2	94.6	0.8	0.5	..	..	35.5	9.8	63.7	89.4	..	..
Turkey	57.5	122.7	..	40.2	19.6	35.1	31.3	6.9	8.5	17.7	40.4	..	..
Turkmenistan	*13.2*	10.8	..	*0.0*	0.0	..	..	..	..	*100.0*	100.0	..	..
Uganda	..	..	3.7	..	..	..	..	..	..	..	..	..	..
Ukraine	*252.5*	172.8	..	*3.2*	7.0	*26.2*	27.5	*10.1*	4.0	*31.2*	17.4	*29.2*	44.1
United Arab Emirates	17.1	40.2	96.0	..	..	..	..	3.7	7.9	96.3	92.1	..	..
United Kingdom	317.8	383.5	..	1.6	1.1	65.0	34.8	10.9	1.9	1.6	37.2	20.7	23.5
United States	3,181.5	3,863.8	..	8.6	5.2	53.4	51.3	4.1	3.5	12.0	16.7	19.2	20.9
Uruguay	7.4	9.3	98.0	94.2	99.4	..	..	5.1	0.2	..	..	..	..
Uzbekistan	*50.9*	47.9	..	*12.3*	12.5	*4.9*	4.2	*6.9*	11.4	*75.9*	71.8	..	..
Venezuela, RB	59.3	90.0	94.0	62.3	67.2	..	..	11.5	10.4	26.2	22.4	..	..
Vietnam	8.7	30.6	75.8	61.7	59.5	23.0	10.5	15.2	15.5	0.1	14.5	..	..
West Bank and Gaza	..	..	..	..	..	..	..	..	..	..	..	..	..
Yemen, Rep.	1.7	3.1	50.0	..	..	..	..	100.0	100.0	..	..	..	..
Zambia	8.0	8.2	12.0	99.2	99.4	0.5	0.2	0.3	0.4	..	..	..	..
Zimbabwe	9.4	7.9	39.7	40.5	37.8	59.5	61.8	..	0.4	..	..	..	..
World	**11,696.7 s**	**15,442.7 s**	**.. w**	**18.1 w**	**16.6 w**	**38.0 w**	**38.8 w**	**11.3 w**	**7.4 w**	**13.9 w**	**18.3 w**	**17.2 w**	**17.2 w**
Low income	606.4	1,017.2	37.4	32.8	22.7	38.9	49.2	13.0	8.8	13.1	16.4	1.1	2.1
Middle income	3,756.1	5,133.7	94.0	21.2	22.5	34.7	38.8	15.2	10.1	20.4	20.9	7.6	6.9
Lower middle income	3,091.3	4,098.3	93.9	22.0	23.5	34.9	42.5	13.1	6.7	21.8	19.7	7.2	6.9
Upper middle income	664.8	1,035.4	..	17.2	18.6	33.6	24.0	24.9	23.4	14.2	25.8	9.5	7.1
Low & middle income	4,362.5	6,150.9	65.1	22.8	22.5	35.3	40.5	14.9	9.8	19.4	20.2	6.7	6.1
East Asia & Pacific	789.5	1,849.8	87.3	21.6	18.3	60.8	65.1	13.2	5.2	3.6	9.5	..	0.9
Europe & Central Asia	2,143.0	1,855.8	..	12.9	16.9	31.6	31.0	12.7	4.3	29.5	31.4	12.3	16.0
Latin America & Carib.	607.0	962.2	86.6	63.7	56.5	3.8	4.8	19.0	17.7	9.5	15.5	2.1	3.1
Middle East & N. Africa	261.5	514.6	90.4	10.0	6.1	0.8	2.3	51.7	41.3	37.4	50.3	..	..
South Asia	338.9	673.7	40.8	27.6	14.7	57.7	67.1	4.7	5.6	8.1	8.8	1.9	3.2
Sub-Saharan Africa	222.5	294.8	24.7	18.4	19.7	72.6	69.1	3.4	2.9	1.7	4.4	3.8	3.6
High income	7,334.2	9,291.8	..	15.4	12.7	39.7	37.6	9.2	5.9	10.6	17.1	23.4	24.5
Europe EMU	1,652.7	2,066.1	..	11.0	12.4	34.4	27.0	9.5	6.9	8.7	15.3	35.5	35.3

a. Shares may not sum to 100 percent because some sources of generated electricity are not shown.

About the data

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 wind, solar, and geothermal) are not shown.

The International Energy Agency (IEA) compiles data on energy inputs used to generate electricity. IEA data for countries that are not members of the Organisation for Economic Co-operation and Development (OECD) are based on national energy data adjusted to conform to 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.

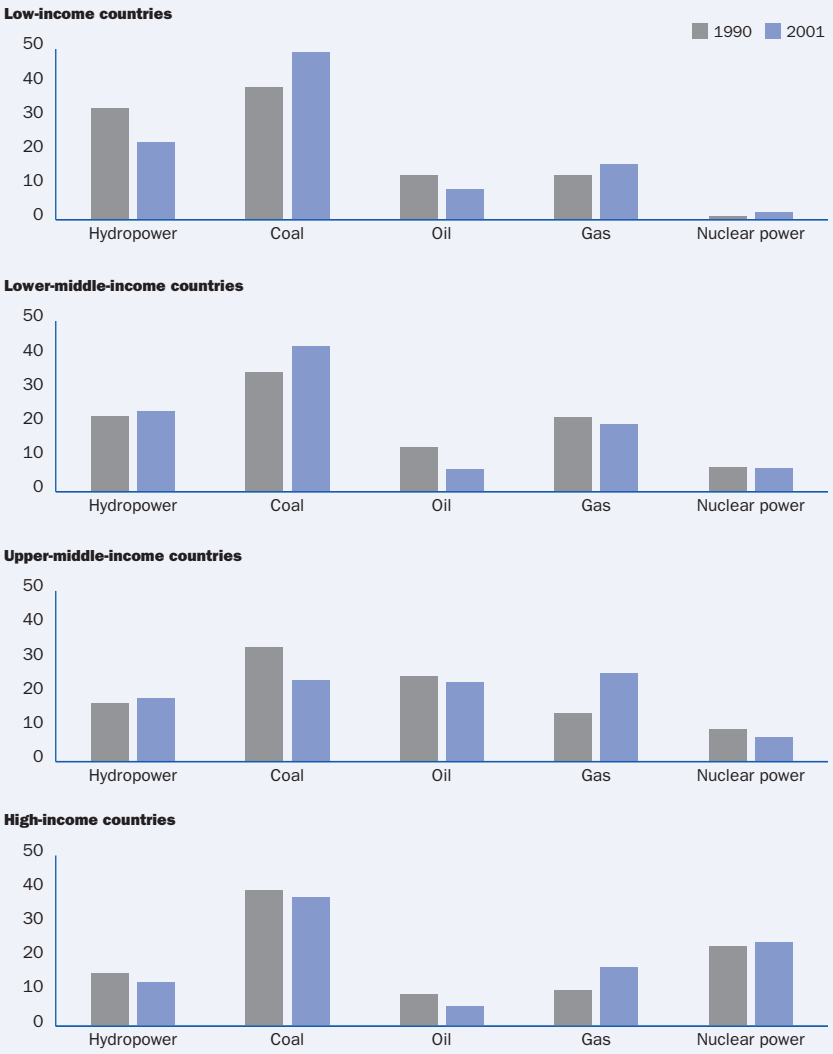
The IEA makes these estimates in consultation with national statistical offices, oil companies, electricity utilities, and national energy experts. The IEA occasionally revises its time series to reflect political changes. Since 1990, for example, it has constructed energy statistics for countries of 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.

There is no single internationally accepted definition for access to electricity. The definition used here covers access at the household level—that is, the number of people who have electricity in their home. It includes commercially sold electricity, both on-grid and off-grid. For countries where access to electricity has been assessed through surveys by government agencies, the definition also includes self-generated electricity. The data do not capture unauthorized connections.

3.9a

Sources of electricity generation have shifted differently in different income groups

Sources of electricity generation, by income group (% of total production)



Source: Table 3.9.

Definitions

• **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. • **Access to electricity** refers to the number of people with access to electricity (both on-grid and off-grid) as a percentage of the total population (see table 2.1). • **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. • **Nuclear power** refers to electricity produced by nuclear power plants.

Data sources

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.* Data on access to electricity are from the IEA's *World Energy Outlook 2002: Energy and Poverty.*

3.10 Urbanization

	Urban population				Population in urban agglomerations of more than 1 million			Population in largest city		Access to improved sanitation facilities			
	millions		% of total population		% of total population			% of urban population		% of urban population		% of rural population	
	1980	2002	1980	2002	1980	2000	2015	1980	2001	1990	2000	1990	2000
Afghanistan	2.5	6.4	16	23	6	10	14	39	*45*	..	25	..	8
Albania	0.9	1.4	34	44	..	..	..	..	*22*	..	99	..	85
Algeria	8.1	18.2	44	58	8	6	7	20	*16*	..	99	..	81
Angola	1.5	4.7	21	35	13	20	25	62	*60*	..	70	..	30
Argentina	23.3	33.6	83	88	42	41	40	43	*37*	..	87	..	47
Armenia	2.0	2.1	66	67	34	34	35	51	*55*	..	..	..	..
Australia	12.6	18.0	86	91	61	56	*55*	26	*22*	100	100	100	100
Austria	5.1	5.4	67	68	27	26	26	40	*38*	100	100	100	100
Azerbaijan	3.3	4.2	53	52	26	24	26	48	*47*	..	90	..	70
Bangladesh	12.7	35.5	15	26	6	13	*18*	26	*38*	81	71	31	41
Belarus	5.4	6.9	57	70	14	18	20	24	*24*	..	..	..	..
Belgium	9.4	10.1	95	97	12	11	*11*	13	*11*	..	..	..	..
Benin	0.9	2.9	27	44	..	..	..	..	*8*	46	46	6	6
Bolivia	2.4	5.6	45	63	14	18	20	33	*28*	73	86	26	42
Bosnia and Herzegovina	1.5	1.8	36	44	..	..	..	..	*31*	..	..	..	..
Botswana	0.2	0.9	18	50	..	..	..	..	*27*	87	88	41	43
Brazil	81.2	143.5	67	82	32	34	*34*	16	*13*	82	84	38	43
Bulgaria	5.4	5.4	61	68	12	15	16	20	*22*	..	100	..	100
Burkina Faso	0.6	2.0	8	17	..	..	..	45	*45*	..	39	..	27
Burundi	0.2	0.7	4	10	..	..	..	..	*54*	65	68	89	90
Cambodia	0.8	2.2	12	18	..	..	..	44	*53*	..	56	..	10
Cameroon	2.8	7.9	31	50	11	21	27	19	*23*	97	92	64	66
Canada	18.6	24.8	76	79	32	37	*38*	16	*20*	100	100	99	99
Central African Republic	0.8	1.6	35	42	..	..	..	..	*42*	38	38	16	16
Chad	0.8	2.0	19	25	..	..	..	..	*38*	70	81	4	13
Chile	9.1	13.5	81	86	33	36	*37*	41	*42*	98	96	92	97
China	192.8	481.8	20	38	13	14	*17*	6	*3*	57	69	18	27
Hong Kong, China	4.6	6.8	91	100	91	100	100	100	*100*	..	..	..	..
Colombia	17.8	33.2	63	76	26	32	35	21	*21*	96	96	55	56
Congo, Dem. Rep.	..	..	..	..	8	10	12	..	..	..	54	..	6
Congo, Rep.	0.8	2.4	42	67	27	41	*44*	263	*158*	..	..	..	..
Costa Rica	1.1	2.4	47	60	..	..	..	56	*43*	..	89	..	97
Côte d'Ivoire	2.8	7.3	35	44	15	21	25	44	*54*	70	71	29	35
Croatia	2.3	2.6	50	59	..	..	..	28	*42*	..	..	..	..
Cuba	6.6	8.5	68	76	20	20	*20*	29	*27*	..	99	..	95
Czech Republic	7.6	7.6	75	75	12	12	*12*	15	*16*	..	..	..	..
Denmark	4.3	4.6	84	85	27	26	*26*	32	*29*	..	..	..	..
Dominican Republic	2.9	5.7	51	67	34	61	*67*	50	*47*	70	70	60	60
Ecuador	3.7	8.2	47	64	23	32	*37*	29	*27*	88	92	49	74
Egypt, Arab Rep.	17.9	28.4	44	43	23	23	24	38	*35*	96	100	79	96
El Salvador	2.0	4.0	44	62	16	22	25	35	*35*	87	89	62	76
Eritrea	0.3	0.8	14	20	..	..	..	..	*63*	..	66	..	1
Estonia	1.0	0.9	70	69	..	..	..	..	*42*	..	93	..	..
Ethiopia	4.0	10.9	10	16	3	4	*6*	30	*27*	24	33	6	7
Finland	2.9	3.1	60	59	13	23	*25*	24	*31*	100	100	100	100
France	39.5	45.0	73	76	21	21	*20*	23	*22*	..	..	..	..
Gabon	0.3	1.1	50	83	..	..	..	..	*55*	..	55	..	43
Gambia, The	0.1	0.4	20	32	..	..	..	..	*100*	..	41	..	35
Georgia	2.6	2.9	52	57	22	24	29	42	..	..	100	..	99
Germany	64.7	72.5	83	88	39	41	43	10	*9*	..	..	..	..
Ghana	3.4	7.4	31	37	9	10	*14*	30	*27*	56	74	64	70
Greece	5.6	6.4	58	61	31	30	29	54	*49*	..	..	..	..
Guatemala	2.6	4.8	37	40	11	28	*32*	29	*72*	82	83	62	79
Guinea	0.9	2.2	19	28	12	25	32	75	*60*	94	94	41	41
Guinea-Bissau	0.1	0.5	17	33	..	..	..	..	*74*	87	95	33	44
Haiti	1.3	3.1	24	37	13	22	28	55	*62*	33	50	19	16

3.10 Urbanization

	Urban population				Population in urban agglomerations of more than 1 million			Population in largest city		Access to improved sanitation facilities			
	millions		% of total population		% of total population			% of urban population		% of urban population		% of rural population	
	1980	2002	1980	2002	1980	2000	2015	1980	2001	1990	2000	1990	2000
Honduras	1.2	3.7	35	55	..	..	..	33	*28*	88	93	41	55
Hungary	6.1	6.6	57	65	19	18	19	34	*28*	100	100	98	98
India	158.5	294.5	23	28	8	10	12	5	*6*	44	61	6	15
Indonesia	32.9	91.0	22	43	8	10	13	18	*13*	66	69	38	46
Iran, Islamic Rep.	19.4	42.9	50	65	21	23	24	26	*17*	..	86	..	79
Iraq	8.5	16.3	66	68	29	31	*34*	39	*31*	..	93	..	31
Ireland	1.9	2.3	55	60	..	..	..	48	*44*	..	..	..	..
Israel	3.4	6.0	89	92	37	35	*33*	41	*35*	..	..	..	..
Italy	37.6	38.8	67	67	24	19	*20*	14	*11*	..	..	..	..
Jamaica	1.0	1.5	47	57	..	..	..	..	*46*	99	99	99	99
Japan	89.0	100.5	76	79	34	38	39	25	*26*	..	..	..	..
Jordan	1.3	4.1	60	79	29	29	*32*	49	*30*	100	100	95	98
Kazakhstan	8.0	8.3	54	56	6	8	9	12	*13*	..	100	..	98
Kenya	2.7	11.0	16	35	5	8	*10*	32	*22*	91	96	77	82
Korea, Dem. Rep.	9.8	13.7	57	61	11	14	16	19	*24*	..	99	..	100
Korea, Rep.	21.7	39.5	57	83	40	47	*45*	38	*26*	..	76	..	4
Kuwait	1.2	2.2	91	96	60	60	55	67	*46*	..	..	..	..
Kyrgyz Republic	1.4	1.7	38	34	..	..	..	..	*43*	..	100	..	100
Lao PDR	0.4	1.1	12	20	..	..	..	..	*62*	..	67	..	19
Latvia	1.7	1.4	68	60	..	..	..	49	*53*	..	..	..	..
Lebanon	2.2	4.0	74	90	40	47	*48*	55	*53*	..	100	..	87
Lesotho	0.2	0.5	13	29	..	..	..	..	*46*	..	72	..	40
Liberia	0.7	1.5	35	46	..	..	..	..	*34*	..	..	..	..
Libya	2.1	4.8	69	88	26	34	34	38	*37*	97	97	96	96
Lithuania	2.1	2.4	61	69	..	..	..	..	*24*	..	..	..	..
Macedonia, FYR	1.0	1.2	53	60	..	..	..	..	*36*	..	..	..	..
Madagascar	1.6	5.1	19	31	6	10	13	33	*35*	70	70	25	30
Malawi	0.6	1.7	9	15	..	..	..	..	*33*	96	96	70	70
Malaysia	5.8	14.3	42	59	7	6	6	16	*10*	..	..	..	98
Mali	1.2	3.6	18	32	..	..	..	40	*34*	95	93	62	58
Mauritania	0.4	1.7	28	60	..	..	..	..	*39*	44	44	19	19
Mauritius	0.4	0.5	42	42	..	..	..	..	*35*	100	100	100	99
Mexico	44.8	75.4	66	75	28	28	*25*	29	*25*	87	88	26	34
Moldova	1.6	1.8	40	42	..	..	..	..	*37*	..	100	..	98
Mongolia	0.9	1.4	52	57	..	..	..	49	*56*	..	46	..	2
Morocco	8.0	16.8	41	57	15	18	20	26	*21*	88	86	31	44
Mozambique	1.6	6.3	13	34	6	17	21	35	*19*	..	68	..	26
Myanmar	8.1	14.0	24	29	7	9	*11*	27	*33*	..	84	..	57
Namibia	0.2	0.6	23	32	..	..	..	..	*38*	84	96	14	17
Nepal	1.0	3.0	7	13	..	..	..	..	*26*	69	73	15	22
Netherlands	12.5	14.5	88	90	14	14	14	8	*8*	100	100	100	100
New Zealand	2.6	3.4	83	86	..	..	..	30	*34*	..	..	..	..
Nicaragua	1.5	3.0	50	57	..	..	..	36	*35*	97	95	53	72
Niger	0.7	2.5	13	22	..	..	..	37	*35*	71	79	4	5
Nigeria	19.1	60.7	27	46	8	12	*15*	13	*15*	69	66	44	45
Norway	2.9	3.4	71	75	..	..	..	22	*23*	100	..	..	..
Oman	0.3	2.0	32	77	..	..	..	..	*28*	98	98	61	61
Pakistan	23.2	48.9	28	34	15	21	25	22	*22*	77	95	17	43
Panama	1.0	1.7	50	57	..	..	..	62	*73*	..	99	..	83
Papua New Guinea	0.4	1.0	13	18	..	..	..	..	*28*	92	92	80	80
Paraguay	1.3	3.2	42	57	22	23	26	52	*41*	96	94	91	93
Peru	11.2	19.7	65	73	25	29	30	39	*39*	77	79	21	49
Philippines	18.0	48.1	37	60	14	16	*17*	33	*22*	85	93	63	69
Poland	20.6	24.2	58	63	18	18	*19*	16	*14*	..	..	..	..
Portugal	2.9	6.8	29	67	19	57	68	46	*60*	..	..	..	..
Puerto Rico	2.1	2.9	67	76	34	36	37	51	*48*	..	..	..	..

3.10 Urbanization

	Urban population				Population in urban agglomerations of more than 1 million			Population in largest city		Access to improved sanitation facilities			
	millions		% of total population		% of total population			% of urban population		% of urban population		% of rural population	
	1980	2002	1980	2002	1980	2000	2015	1980	2001	1990	2000	1990	2000
Romania	10.9	12.4	49	55	9	9	*10*	18	*16*	..	86	..	10
Russian Federation	97.0	105.0	70	73	18	19	*21*	8	*8*	..	..	..	..
Rwanda	0.2	0.5	5	6	..	..	..	..	*76*	..	12	..	8
Saudi Arabia	6.2	19.1	66	87	19	25	*24*	17	*25*	..	100	..	100
Senegal	2.0	4.8	36	49	17	22	27	48	*46*	86	94	38	48
Serbia and Montenegro	4.5	4.2	46	52	11	14	*15*	25	*30*	..	100	..	99
Sierra Leone	0.8	2.0	24	38	..	..	..	47	*43*	..	88	..	53
Singapore	2.4	4.2	100	100	100	89	*83*	100	*100*	..	100	..	..
Slovak Republic	2.6	3.1	52	58	..	..	..	..	*15*	..	100	..	100
Slovenia	0.9	1.0	48	49	..	..	..	..	*26*	100	..	..	..
Somalia	1.4	2.6	22	28	..	..	..	27	*48*	..	..	..	..
South Africa	13.3	26.5	48	58	27	32	36	13	*12*	93	93	80	80
Spain	27.2	31.9	73	78	20	17	*17*	16	*13*	..	..	..	..
Sri Lanka	3.1	4.4	22	23	..	..	..	..	*16*	94	97	82	93
Sudan	3.9	12.4	20	38	6	9	11	30	*24*	87	87	48	48
Swaziland	0.1	0.3	18	27	..	..	..	..	*28*	..	..	..	..
Sweden	6.9	7.4	83	83	17	18	18	20	*22*	100	100	100	100
Switzerland	3.6	4.9	57	67	..	..	..	20	*19*	100	100	100	100
Syrian Arab Republic	4.1	8.9	47	52	28	28	*31*	26	*27*	..	98	..	81
Tajikistan	1.4	1.7	34	28	..	..	..	..	*30*	..	97	..	88
Tanzania	2.7	12.0	15	34	5	12	18	30	*19*	84	99	84	86
Thailand	8.0	12.5	17	20	10	12	15	59	*61*	95	96	75	96
Togo	0.6	1.6	23	34	..	..	..	..	*46*	71	69	24	17
Trinidad and Tobago	0.7	1.0	63	75	..	..	..	..	*6*	..	..	..	..
Tunisia	3.3	6.5	52	67	18	20	21	35	*30*	96	96	48	62
Turkey	19.5	46.4	44	67	19	27	*30*	23	*21*	97	97	70	70
Turkmenistan	1.3	2.2	47	45	..	..	..	..	*23*	..	..	..	..
Uganda	1.1	3.7	9	15	..	..	..	42	*39*	..	93	..	77
Ukraine	30.9	33.2	62	68	14	15	*17*	7	*7*	..	100	..	98
United Arab Emirates	0.7	2.8	71	88	..	..	..	34	*35*	..	..	..	..
United Kingdom	50.0	53.1	89	90	25	23	*23*	15	*15*	100	100	100	100
United States	167.6	224.0	74	78	38	38	37	9	*8*	100	100	100	100
Uruguay	2.5	3.1	85	92	42	37	35	49	*43*	..	95	..	85
Uzbekistan	6.5	9.3	41	37	11	9	8	28	*24*	..	97	..	85
Venezuela, RB	12.0	21.9	79	87	28	29	*30*	21	*15*	..	71	..	48
Vietnam	10.3	20.1	19	25	14	13	14	33	*24*	52	82	23	38
West Bank and Gaza	..	..	..	..	..	..	..	..	..	..	..	..	..
Yemen, Rep.	1.6	4.7	19	25	..	..	..	15	*31*	69	89	21	21
Zambia	2.3	4.1	40	40	9	16	22	23	*41*	86	99	48	64
Zimbabwe	1.6	4.8	22	37	9	14	19	39	*40*	70	71	50	57
World	**1,741.3 s**	**2,953.1 s**	**39 w**	**48 w**	**.. w**	**.. w**	**.. w**	**18 w**	***16* w**	**75 w**	**81 w**	**27 w**	**38 w**
Low income	348.3	763.1	22	31	..	..	..	17	*18*	58	71	20	31
Middle income	785.9	1,438.9	39	53	..	..	..	18	*15*	75	82	29	43
Lower middle income	629.7	1,190.5	35	49	16	18	21	16	*13*	72	81	28	42
Upper middle income	156.2	248.4	66	75	..	..	..	29	*26*	..	..	..	64
Low & middle income	1,134.2	2,202.0	32	42	..	..	..	18	*16*	68	78	24	36
East Asia & Pacific	288.6	701.8	21	38	..	..	..	13	*9*	61	72	24	36
Europe & Central Asia	249.2	301.0	59	64	16	18	*20*	15	*15*	..	..	..	..
Latin America & Carib.	231.8	401.1	65	76	29	32	32	27	*24*	85	86	41	52
Middle East & N. Africa	83.4	177.2	48	58	21	22	24	30	*26*	..	94	..	72
South Asia	201.1	392.9	22	28	8	12	14	9	*11*	52	66	11	21
Sub-Saharan Africa	80.2	227.8	21	33	..	..	..	27	*26*	75	76	45	46
High income	607.1	751.1	73	78	..	..	..	18	*18*	..	..	..	..
Europe EMU	209.5	237.3	73	78	26	27	*27*	17	*16*	..	..	..	..

About the data

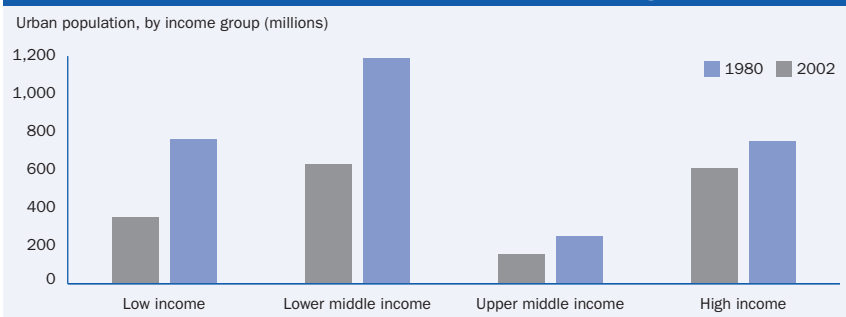
The population of a city or metropolitan area depends on the boundaries chosen. For example, in 1990 Beijing, China, contained 2.3 million people in 87 square kilometers of "inner city" and 5.4 million in 158 square kilometers of "core city." The population of "inner city and inner suburban districts" 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. In addition to 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).

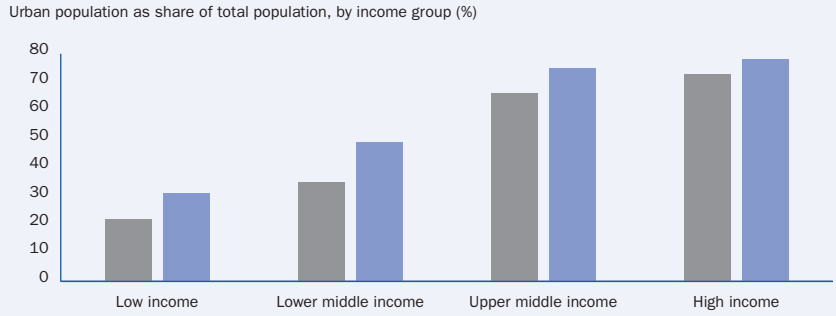
The urban population with access to improved sanitation facilities is defined as people with access to at least adequate excreta disposal facilities that can effectively prevent human, animal, and insect contact with excreta. The rural population with access is included to allow comparison of rural and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

3.10a

More people now live in urban areas in low-income countries than in high-income countries . . .



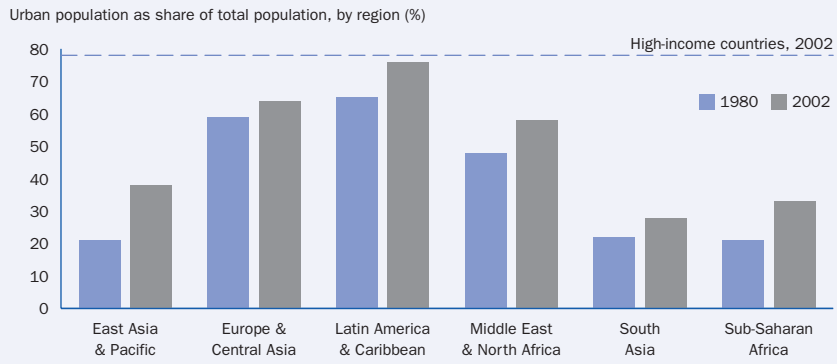
. . . and the urban population is growing fastest in low- and lower-middle-income countries



Source: Table 3.10.

3.10b

Latin America was as urban as the average high-income country in 2002



Source: Table 3.10.

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 1 million** is the percentage of a country's population living in metropolitan areas that in 1990 had a population of more than 1 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 2001 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.

3.11 Urban environment

	City	Urban population	Secure tenure	House price to annual income ratio	Work trips by public transportation	Travel time to work	Households with access to services				Wastewater treated
							Potable water	Sewerage connection	Electricity	Telephone	
		thousands	% of population		%	minutes	%	%	%	%	%
		2000	1998 [a]	1998 [a]	1998 [a]	1998 [a]	1998 [a]	1998 [a]	1998 [a]	1998 [a]	1998 [a]
Algeria	Algiers	2,562 [b]	93.2	..	..	75	..	..	..	..	80
Argentina	Buenos Aires	2,996 [b]	92.1	5.10	59	42	100	98	100	70	..
	Córdoba	1,322 [b]	85.0	6.80	44	32	99	40	99	80	49
	Rosario	1,248 [b]	..	5.7	..	22	98	67	93	76	1
Armenia	Yerevan	1,250 [b]	100.0	4.0	84	30	98	98	100	88	36
Bangladesh	Chittagong	2,301 [b]	..	8.1	27	45	44	..	95	..	..
	Dhaka	10,000 [b]	..	16.7	9	45	60	22	90	7	..
	Sylhet	242 [b]	..	6.0	10	50	29	0	93	40	..
	Tangail	152 [b]	85.7	13.9	..	30	12	0	90	12	..
Barbados	Bridgetown	..	99.7	4.4	..	..	98	5	99	78	7
Belize	Belize City	55 [b]	..	..	..	..	..	..	..	..	..
Bolivia	Santa Cruz de la Sierra	1,065 [c]	87.0	29.3	..	29	53	33	98	59	53
Bosnia and Herzegovina	Sarajevo	522 [c]	..	..	100	12	95	90	100	..	..
Brazil	Belém	1,638 [c]	..	..	..	..	..	..	..	..	..
	Icapui	..	91.7	4.5	..	30	88	..	90	33	..
	Maranguape	..	..	..	30	20	73	..	..	..	..
	Porto Alegre	3 [b]	..	..	..	..	99	87	100	..	..
	Recife	3,088 [b]	..	12.5	46	35	89	41	100	29	33
	Rio de Janeiro	10,192 [b]	..	..	..	..	88	80	10	..	..
	Santo Andre	1,658 [b]	80.3	23.4	43	40	98	95	100	79	..
Bulgaria	Bourgas	..	..	5.1	61	32	100	93	100	..	93
	Sofia	1,200 [b]	100.0	13.2	79	32	95	91	100	89	94
	Troyan	24 [b]	100.0	3.7	44	22	99	82	100	45	..
	Veliko Tarnovo	..	100.0	5.4	46	30	98	98	100	96	50
Burkina Faso	Bobo-Dioulasso	..	100.0	..	..	..	24	..	29	6	..
	Koudougou	..	..	..	..	..	30	..	26	7	..
	Ouagadougou	1,130 [c]	100.0	..	2	..	30	..	47	11	19
Burundi	Bujumbura	373 [b]	97.0	..	48	25	26	62	57	19	21
Cambodia	Phnom Penh	1,000 [b]	..	8.9	0	45	45	75	76	40	..
Cameroon	Douala	1,148 [b]	..	13.4	..	40	34	1	95	9	5
	Yaoundé	968 [b]	..	..	42	45	34	1	95	9	24
Canada	Hull	254 [b]	100.0	..	16	..	100	100	100	100	100
Central African Republic	Bangui	..	94.0	..	66	60	31	..	18	11	0
Chad	N'Djamena	998 [c]	..	..	35	..	42	0	13	6	21
Chile	Gran Concepción	..	..	..	57	35	100	91	95	69	6
	Santiago de Chile	5,737 [b]	..	..	60	38	100	99	99	73	3
	Tome	..	..	..	..	..	92	52	98	58	57
	Valparaiso	851 [b]	91.8	..	55	..	98	92	97	63	100
	Viña del mar	851 [b]	92.7	..	..	..	97	97	98	65	93
Colombia	Armenia	..	94.1	5.0	42	60	90	50	99	97	..
	Marinilla	170 [b]	94.5	8.5	18	15	98	93	100	65	..
	Medellin	2,901 [b]	..	..	38	35	100	99	100	87	..
Congo	Brazzaville	989 [b]	87.9	..	55	20	56	0	52	18	..
Côte d'Ivoire	Abidjan	3,201 [b]	..	14.5	..	45	26	15	41	5	45
Croatia	Zagreb	2,497 [b]	96.5	7.8	56	31	98	97	100	94	..
Cuba	Baracoa	..	96.2	..	..	..	83	3	93	32	..
	Camaguey	..	84.7	..	2	60	72	47	97	..	..
	Cienfuegos	..	96.3	4.0	..	80	100	73	100	9	2
	Ciudad Habana	..	..	8.5	58	83	100	85	100	14	..
	Pinar Del Rio	..	96.4	..	..	80	97	48	100	..	..
	Santa Clara	..	98.8	..	7	48	95	42	100	43	..
Czech Republic	Brno	..	..	..	50	25	100	96	100	69	100
	Prague	1,193 [b]	99.3	..	55	22	99	100	100	100	..
Dem. Rep. of Congo	Kinshasa	5,398 [b]	94.9	..	72	57	72	0	66	1	..
Dominican Republic	Santiago de los Caballeros	691 [b]	..	..	..	30	75	80	..	71	80
Ecuador	Ambato	286 [b]	..	..	..	..	90	81	91	87	..

Urban environment

	City	Urban population	Secure tenure	House price to annual 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	% of population		%	minutes	%	%	%	%	%
		2000	1998 [a]	1998 [a]	1998 [a]	1998 [a]	1998 [a]	1998 [a]	1998 [a]	1998 [a]	1998 [a]
Ecuador	Cuenca	..	91.0	4.6	..	25	97	92	97	48	82
	Guayaquil	2,317 [b]	45.8	3.4	89	45	70	42	..	44	9
	Manta	126 [b]	..	..	..	30	70	52	98	40	..
	Puyo	40 [b]	..	2.1	..	15	80	30	90	60	..
	Quito	1,531 [b]	93.8	2.4	..	33	85	70	96	55	..
	Tena	..	..	6.3	..	5	80	60	..	..	..
El Salvador	San Salvador	1,863 [b]	90.5	3.5	..	..	82	80	98	70	..
Estonia	Riik	..	99.5	..	..	..	92	90	98	55	..
	Tallin	397 [c]	98.8	6.4	..	35	98	98	100	86	10
Gabon	Libreville	523 [c]	..	..	80	30	55	0	95	45	44
Gambia	Banjul	50 [b]	91.8	11.4	55	22	23	12	24	..	..
Georgia	Tbilisi	1,310 [c]	100.0	9.4	..	..	..	98	100	58	..
Ghana	Accra	1,500 [b]	..	14.0	54	21	..	..	..	..	..
	Kumasi	780 [b]	77.7	13.7	51	21	65	..	95	51	..
Guatemala	Quetzaltenango	333 [b]	..	4.3	..	15	60	55	80	40	..
Guinea	Conakry	1,824 [c]	..	..	26	45	30	32	54	6	..
Indonesia	Jakarta	9,489 [b]	95.5	14.6	..	..	50	65	99	..	16
	Semarang	1,076 [b]	80.2	..	..	..	34	..	85	..	..
	Surabaya	2,373 [b]	97.6	3.4	18	35	41	56	89	71	..
Iraq	Baghdad	4,797 [c]	..	..	..	..	..	..	..	..	..
Italy	Aversa	..	..	..	..	..	..	..	..	..	90
Jamaica	Kingston	655 [c]	..	..	..	..	97	..	88	..	20
	Montego Bay	..	..	..	..	..	78	..	86	..	15
Jordan	Amman	1,621 [b]	97.3	6.1	21	25	98	81	99	62	54
Kenya	Kisumu	134 [b]	97.3	8.5	43	24	38	31	49	..	65
	Mombasa	..	..	..	47	20	..	..	..	..	50
	Nairobi	2,310 [c]	..	..	71	57	89	..	..	..	52
Korea, Rep	Hanam	124 [b]	..	3.7	..	..	81	68	100	100	81
	Pusan	3,843 [b]	100.0	4.0	39	42	98	69	100	100	69
	Seoul	10,389 [b]	98.6	5.7	71	60	100	99	100	..	99
Kuwait	Kuwait City	1,165 [c]	..	6.5	21	10	100	98	100	98	..
Kyrgyz Republic	Bishkek	60 [b]	94.8	..	95	35	30	23	100	20	15
Lao	Vientiane	562 [b]	92.2	23.2	2	27	87	..	100	87	20
Latvia	Riga	775 [c]	97.4	15.6	..	..	95	93	100	70	..
Lebanon	Sin El Fil	.. [b]	..	8.3	50	10	80	30	98	80	..
Liberia	Monrovia	651 [b]	57.6	28.0	80	60	..	..	..	..	..
Libya	Tripoli	1,773 [b]	..	0.8	18	20	97	90	99	6	40
Lithuania	Vilnius	578 [b]	100.0	20.0	52	37	89	89	100	77	54
Madagascar	Antananarivo	1,507 [c]	..	..	..	..	..	..	..	..	..
Malawi	Lilongwe	765 [c]	..	..	27	5	65	12	50	10	..
Malaysia	Penang	..	..	7.2	55	40	99	..	100	98	20
Mauritania	Nouakchott	881 [c]	89.9	5.4	45	50	..	..	..	..	..
Mexico	Ciudad Juárez	1,018 [b]	..	..	24	23	89	77	96	45	..
Moldova	Chisinau	..	..	..	80	23	100	95	100	83	71
Mongolia	Ulaanbaatar	627 [b]	51.6	7.8	80	30	60	60	100	90	96
Morocco	Casablanca	3,292 [b]	..	..	..	30	83	93	91	..	..
	Rabat	646 [b]	..	..	40	20	93	97	52	..	..
Myanmar	Yangon	3,692 [b]	..	8.3	69	45	78	81	85	17	..
Nicaragua	Leon	..	98.8	..	..	15	78	..	84	21	..
Niger	Niamey	731 [c]	87.4	..	..	30	33	0	51	4	..
Nigeria	Ibadan	1,731 [c]	85.8	..	46	45	26	12	41	..	..
	Lagos	13,427 [c]	93.0	..	48	60	..	..	41	..	..
Oman	Muscat	887 [b]	..	..	..	20	80	90	89	53	..
Panama	Colón	132 [b]	..	14.2	..	15	..	..	..	..	..
Paraguay	Asunción	1,262 [c]	90.2	10.7	..	25	46	8	86	17	..
Peru	Cajamarca	..	90.0	3.9	..	20	86	69	81	38	62

3.11 Urban environment

	City	Urban population	Secure tenure	House price to annual income ratio	Work trips by public transportation	Travel time to work	Households with access to services				Wastewater treated
							Potable water	Sewerage connection	Electricity	Telephone	
		thousands	% of population		%	minutes	%	%	%	%	%
		2000	1998 [a]	1998 [a]	1998 [a]	1998 [a]	1998 [a]	1998 [a]	1998 [a]	1998 [a]	1998 [a]
Peru	Huanuco	747 [b]	..	30.0	..	20	57	28	80	32	..
	Huaras	54 [b]	..	6.7	..	15	..	..	71	..	..
	Iquitos	347 [b]	97.3	5.6	25	10	73	60	82	62	..
	Lima	7,431 [b]	80.6	10.4	82	..	75	71	99	..	4
	Tacna	..	..	4.0	..	25	65	58	74	16	64
	Tumbes	..	..	..	..	20	60	35	80	25	..
Philippines	Cebu	2,189 [b]	95.0	13.3	..	35	41	92	80	25	..
Poland	Bydgoszcz	..	60.5	4.3	35	18	95	87	100	85	28
	Gdansk	893 [c]	..	4.4	56	20	99	94	100	56	100
	Katowice	3,487 [c]	27.8	1.7	29	36	99	94	100	75	67
	Poznan	..	65.5	5.8	51	25	95	96	100	86	78
Qatar	Doha	391 [c]	..	..	..	..	..	..	..	..	..
Russian Federation	Astrakhan	..	100.0	5.0	66	35	81	79	100	51	92
	Belgorod	..	100.0	4.0	..	25	90	89	100	51	96
	Kostroma	..	100.0	6.9	68	20	88	84	100	46	96
	Moscow	9,321 [c]	100.0	5.1	85	62	100	100	100	102	98
	Nizhny Novgorod	1,458 [c]	100.0	6.9	79	35	98	98	100	64	98
	Novomoscowsk	..	100.0	4.2	61	25	99	93	100	62	97
	Omsk	1,216 [c]	99.7	3.9	86	43	87	87	100	41	89
	Pushkin	..	100.0	9.6	60	15	99	99	100	89	100
	Surgut	..	100.0	4.5	81	57	98	98	100	50	93
	Veliky Novgorod	..	100.0	3.4	75	30	97	97	100	51	95
Rwanda	Kigali	358 [b]	..	11.4	32	45	36	20	57	6	20
Samoa	Apia	34 [b]	..	10.0	..	..	60	0	98	96	..
Serbia and Montenegro	Belgrad	1,182 [b]	96.5	13.5	72	40	95	86	100	86	20
Singapore	Singapore	3,164 [b]	100.0	3.1	53	30	100	100	100	100	100
Slovenia	Ljubljana	273 [b]	98.9	7.8	20	30	100	100	100	97	98
Spain	Madrid	4,577 [b]	..	..	16	32	..	..	..	..	100
	Pamplona	..	..	..	..	..	100	..	100	..	79
Sweden	Amal	13 [b]	..	2.9	..	..	100	100	100	..	100
	Stockholm	736 [b]	..	6.0	48	28	100	100	100	..	100
	Umea	104 [b]	..	5.3	..	16	100	100	100	..	100
Switzerland	Basel	170 [b]	..	12.3	..	..	100	100	100	99	100
Syria	Damascus	2,335 [b]	..	10.3	33	40	98	71	95	10	3
Thailand	Bangkok	5,647 [b]	77.2	8.8	28	60	99	100	100	60	..
	Chiang Mai	499 [b]	96.5	6.8	5	30	95	60	100	75	70
Togo	Lomé	663 [b]	64.0	..	40	30	..	70	51	18	..
Trinidad and Tobago	Port of Spain	..	78.6	..	44	..	..	..	..	..	..
Tunisia	Tunis	2,023 [b]	..	5.0	..	..	75	47	95	27	83
Turkey	Ankara	2,837 [b]	91.3	4.5	..	32	97	98	100	..	80
Uganda	Entebbe	65 [b]	74.0	10.4	65	20	48	13	42	0	30
	Jinja	92 [b]	82.0	15.4	49	12	65	43	55	5	30
Uruguay	Montevideo	1,670 [b]	88.0	5.6	60	45	98	79	100	75	34
West Bank and Gaza	Gaza	367 [b]	87.3	5.4	..	..	85	38	99	38	..
Yemen	Aden	1,200 [b]	..	..	78	20	..	..	96	..	30
	Sana'a	1,200 [b]	..	..	78	20	30	9	96	..	30
Zimbabwe	Bulawayo	900 [b]	99.4	..	75	15	100	100	98	..	80
	Chegutu	..	51.5	3.4	20	22	100	68	9	3	69
	Gweru	..	94.0	..	..	15	100	100	90	61	95
	Harare	1,634 [b]	99.9	..	32	45	100	100	88	42	..
	Mutare	149 [b]	..	..	70	20	88	88	74	4	100

a. Data are preliminary. b. Data are for 1998 and are from United Nations Centre for Human Settlements. c. Data are for 2000 and are from the United Nations Population Division's *World Urbanization Prospects: The 2001 Revision*.

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. The available data have been scattered among international agencies with different mandates, and compiling comparable data has been difficult. 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. The selection of cities in the UNCHS database 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.

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 access to potable water and urban population are more stringent than those used for tables 3.5 and 3.10 (see *Definitions*).

Definitions

• **Urban population** refers to the population of the urban agglomeration, a contiguous inhabited territory without regard to administrative boundaries. • **Secure tenure** refers to the percentage of the population protected from involuntary removal from land or residence—including subtenancy, residence in social housing, and residences owned, purchased, or privately rented—except through due legal process. • **House price to annual 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 are road vehicles other than cars taking passengers on a farepaying 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 service. Households with access to potable water are those with 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.

3.11a

The use of public transportation for work trips varied widely across cities in 1998

Country	City	Share of total work trips (%)	Country	City	Share of total work trips (%)
Lao PDR	Vientiane	2	Kyrgyz Republic	Bishkek	95
Spain	Madrid	16	Russian Federation	Moscow	85
Canada	Hull	16	Armenia	Yerevan	84
Libya	Tripoli	18	Peru	Lima	82
Slovenia	Ljubljana	20	Gabon	Libreville	80
Kuwait	Kuwait City	21	Liberia	Monrovia	80
Jordan	Amman	21	Mongolia	Ulaanbaatar	80
Mexico	Ciudad Juarez	24	Moldova	Chisinau	80
Guinea	Conakry	26	Bulgaria	Sofia	79
Malawi	Lilongwe	27	Yemen, Rep.	Aden	78

Source: Table 3.11.

Data sources

The data are from the Global Urban Indicators database of the UNCHS and the United Nations Population Division's *World Urbanization Prospects: The 2001 Revision.*

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		$ per liter	
	1990	1999–2001	1990	1999–2001	1990	1999–2001	1990	1999–2001	1990	1999–2001	Super 2002	Diesel 2002
Afghanistan	..	..	..	..	..	..	..	..	..	..	0.34	0.27
Albania	11	66	*3*	11	2	43	3	1	..	*29*	0.80	0.51
Algeria	..	..	..	..	..	..	..	..	..	..	0.22	0.10
Angola	19	..	..	..	14	..	..	..	..	..	0.19	0.13
Argentina	181	*181*	27	*37*	134	*140*	1	..	43,119	*27,458*	0.63	0.46
Armenia	5	..	2	..	1	..	..	..	..	..	0.42	0.29
Australia	530	..	11	..	450	..	18	*18*	*138,501*	..	0.50	0.48
Austria	421	*536*	30	*22*	387	*495*	71	*77*	..	..	0.84	0.73
Azerbaijan	52	52	7	17	36	42	*5*	1	..	..	0.37	0.16
Bangladesh	1	*1*	0	..	0	*0*	1	*1*	..	..	0.52	0.29
Belarus	61	*112*	13	..	59	*145*	..	*52*	*10,026*	*4,964*	0.50	0.36
Belgium	423	515	30	35	385	462	14	29	..	*156,633*	1.04	0.80
Benin	3	..	2	..	2	..	34	..	..	..	0.54	0.41
Bolivia	41	*53*	6	*8*	25	..	9	*3*	1,139	..	0.69	0.42
Bosnia and Herzegovina	114	..	24	..	101	..	..	..	..	..	0.74	0.74
Botswana	18	*69*	3	*11*	10	*30*	..	*1*	..	..	0.41	0.38
Brazil	88	..	8	..	..	..	..	*28*	..	..	0.55	0.31
Bulgaria	163	*273*	39	*60*	146	*234*	55	*64*	..	*213*	0.68	0.59
Burkina Faso	4	..	3	..	2	..	*9*	..	..	..	0.83	0.62
Burundi	..	..	..	..	..	..	..	..	..	..	0.58	0.54
Cambodia	1	*6*	0	*49*	0	..	9	*134*	*314*	*7,210*	0.63	0.44
Cameroon	10	..	3	..	6	..	..	..	..	..	0.68	0.57
Canada	605	*580*	20	*20*	468	*458*	12	*11*	..	*73,500*	0.51	0.43
Central African Republic	1	*1*	0	*0*	1	*0*	0	..	1,494	..	1.00	0.87
Chad	2	..	0	..	1	..	0	..	..	..	0.79	0.77
Chile	81	*133*	13	*25*	52	*87*	2	*2*	..	..	0.58	0.39
China	5	*12*	4	*11*	1	*7*	3	*26*	..	*840,960*	0.42	0.37
Hong Kong, China	66	*77*	253	*279*	42	*57*	4	*5*	8,192	*10,781*	1.47	0.77
Colombia	..	*51*	..	*19*	..	*43*	8	*12*	50,945	*41,587*	0.44	0.24
Congo, Dem. Rep.	..	..	..	..	..	..	..	..	..	..	0.70	0.69
Congo, Rep.	18	..	3	..	12	..	..	..	..	..	0.69	0.48
Costa Rica	87	..	7	*13*	55	..	14	*22*	..	551,139	0.64	0.44
Côte d'Ivoire	24	..	6	..	15	..	..	..	..	..	0.85	0.60
Croatia	..	*274*	..	*44*	..	*247*	..	*14*	..	15,168	0.89	0.74
Cuba	*37*	*32*	*16*	*6*	*18*	*16*	*19*	*16*	..	..	0.90	0.45
Czech Republic	246	*364*	46	*67*	228	*335*	113	*73*	..	*7,753*	0.81	0.71
Denmark	368	*420*	27	*31*	320	*359*	9	*13*	36,304	*45,165*	1.09	0.94
Dominican Republic	75	..	48	*0*	21	..	..	..	..	..	0.49	0.27
Ecuador	35	*48*	8	*14*	31	*43*	*2*	*2*	10,306	*17,528*	0.55	0.27
Egypt, Arab Rep.	29	..	33	..	21	..	6	..	..	..	0.19	0.80
El Salvador	33	*61*	14	*36*	17	*30*	0	*5*	2,002	*4,244*	0.46	0.33
Eritrea	1	..	1	..	1	..	..	..	..	..	0.36	0.25
Estonia	211	*404*	22	*11*	154	*339*	66	*5*	..	6,539	0.58	0.56
Ethiopia	1	*2*	2	*3*	1	*1*	0	*0*	..	26,450	0.52	0.32
Finland	441	*461*	29	*31*	386	*403*	12	*35*	39,750	*46,010*	1.12	0.80
France	494	*575*	32	*38*	405	*477*	*55*	*40*	422,000	*519,400*	1.05	0.80
Gabon	32	..	4	..	19	..	..	..	..	..	0.69	0.53
Gambia, The	13	..	5	..	6	..	..	..	..	..	0.46	0.40
Georgia	107	*70*	27	*15*	89	*55*	5	*1*	4,620	..	0.48	0.41
Germany	405	..	53	..	386	*516*	18	*56*	446,000	*589,500*	1.03	0.82
Ghana	..	..	..	..	..	..	..	..	..	15,320	0.28	0.23
Greece	248	*328*	22	..	171	*254*	120	*220*	..	*79,377*	0.78	0.68
Guatemala	..	*52*	..	*119*	..	*1*	..	*12*	..	*4,547*	0.48	0.32
Guinea	4	..	1	..	2	..	..	..	..	..	0.66	0.56
Guinea-Bissau	7	..	2	..	4	..	..	..	..	..	..	..
Haiti	..	..	..	..	..	..	..	..	..	..	0.54	0.30

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		$ per liter	
											Super	Diesel
	1990	1999–2001	1990	1999–2001	1990	1999–2001	1990	1999–2001	1990	1999–2001	2002	2002
Honduras	22	*60*	10	*28*	..	*51*	..	*14*	*3,288*	..	0.63	0.46
Hungary	212	*271*	21	*16*	188	*237*	16	*14*	22,898	23,670	0.94	0.85
India	4	*10*	2	..	2	*6*	15	*29*	..	..	0.66	0.41
Indonesia	16	25	10	..	7	..	34	*59*	..	..	0.27	0.19
Iran, Islamic Rep.	34	..	14	..	25	..	*36*	..	..	..	0.07	0.02
Iraq	14	..	6	..	1	..	..	..	..	..	0.02	0.01
Ireland	270	*408*	10	..	227	*349*	6	*8*	24,205	..	0.90	0.80
Israel	210	*275*	74	*108*	174	*233*	8	*12*	18,212	37,010	0.90	0.62
Italy	529	*606*	99	*74*	476	*542*	*45*	*125*	344,726	*67,916*	1.05	0.86
Jamaica	..	..	..	..	..	..	..	..	..	..	0.52	0.44
Japan	469	*572*	52	*62*	283	*413*	146	*110*	628,581	*775,723*	0.91	0.66
Jordan	60	..	26	..	..	..	*0*	..	*1,098*	490,248	0.52	0.17
Kazakhstan	76	*86*	8	*16*	50	*67*	..	*8*	18,248	..	0.35	0.29
Kenya	12	*11*	5	*4*	10	*8*	1	*1*	5,170	..	0.70	0.56
Korea, Dem. Rep.	..	..	..	..	..	..	..	..	..	..	0.55	0.41
Korea, Rep.	79	*255*	60	*120*	48	*171*	32	*59*	30,464	*67,266*	1.09	0.51
Kuwait	..	..	..	..	..	..	..	..	..	*4,450*	0.20	0.18
Kyrgyz Republic	44	..	10	..	44	*38*	..	*4*	5,220	*1,933*	0.39	0.25
Lao PDR	9	..	3	..	6	..	*18*	..	..	..	0.36	0.30
Latvia	135	*281*	6	*11*	106	*235*	76	*9*	3,932	..	0.70	0.65
Lebanon	321	..	183	..	300	..	13	..	..	..	0.65	0.25
Lesotho	11	..	4	..	3	..	..	..	..	..	0.50	0.47
Liberia	14	..	4	..	7	..	..	..	..	..	..	..
Libya	..	..	..	..	..	..	..	..	..	..	0.10	0.08
Lithuania	160	*345*	12	*17*	133	*317*	52	*5*	..	*872*	0.69	0.59
Macedonia, FYR	132	170	30	27	121	..	1	..	3,102	..	0.85	0.63
Madagascar	6	..	2	..	4	..	..	..	41,500	..	1.08	0.65
Malawi	4	..	4	*0*	2	..	..	..	..	..	0.66	0.62
Malaysia	124	..	26	..	101	..	167	*233*	..	..	0.35	0.19
Mali	3	..	2	..	2	..	..	..	..	..	0.69	0.55
Mauritania	10	..	3	..	7	..	..	..	..	..	0.63	0.39
Mauritius	59	*106*	35	*64*	44	*78*	54	*101*	..	*78*	..	..
Mexico	119	*159*	41	*44*	82	*107*	3	..	55,095	..	0.62	0.47
Moldova	53	*82*	17	*24*	48	*64*	45	..	..	557	0.45	0.31
Mongolia	21	*31*	1	*2*	6	*18*	22	*10*	340	2,093	0.38	0.37
Morocco	37	*51*	15	*26*	28	*41*	1	*1*	..	16,834	0.87	0.55
Mozambique	4	..	2	..	3	..	..	..	1,889	..	0.46	0.43
Myanmar	..	..	..	..	..	..	..	..	..	..	0.36	0.28
Namibia	71	*82*	1	*2*	39	*38*	1	*2*	1,896	*2,317*	0.45	0.43
Nepal	..	..	..	..	..	..	..	..	..	..	0.66	0.34
Netherlands	405	*428*	58	*58*	368	*384*	44	*25*	90,150	*109,955*	1.12	0.81
New Zealand	524	*696*	19	..	436	*578*	24	*20*	..	35,200	0.55	0.33
Nicaragua	19	*30*	5	*8*	10	*12*	3	*5*	108	*440*	0.54	0.41
Niger	6	..	4	..	5	..	..	..	178	..	0.77	0.55
Nigeria	*30*	..	*21*	..	*12*	..	*5*	..	..	..	0.20	0.19
Norway	458	*511*	22	*25*	380	*411*	48	*55*	..	32,589	1.23	1.18
Oman	130	..	9	..	83	..	3	..	..	..	0.31	0.26
Pakistan	6	*9*	4	*5*	4	*5*	8	*15*	..	234,515	0.52	0.35
Panama	75	..	18	..	60	..	2	*3*	..	..	0.51	0.36
Papua New Guinea	..	..	..	..	..	..	..	..	..	..	0.53	0.34
Paraguay	..	..	..	..	..	..	..	..	..	..	0.56	0.34
Peru	..	*43*	..	*13*	..	*27*	..	..	..	..	0.74	0.48
Philippines	10	*32*	4	*12*	7	*10*	6	*16*	*6,189*	*9,548*	0.35	0.27
Poland	168	*307*	18	*32*	138	*259*	36	*21*	59,608	138,100	0.83	0.68
Portugal	222	*347*	34	..	162	*321*	5	*77*	28,623	*47,943*	0.97	0.71
Puerto Rico	..	..	..	..	..	..	..	..	..	..	..	..

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		$ per liter	
											Super	Diesel
	1990	1999–2001	1990	1999–2001	1990	1999–2001	1990	1999–2001	1990	1999–2001	2002	2002
Romania	72	*160*	11	*18*	56	*139*	13	*14*	23,907	*39,184*	0.64	0.57
Russian Federation	*87*	*176*	*14*	*48*	*65*	*132*	..	*43*	..	*59,522*	0.35	0.25
Rwanda	2	..	1	..	1	..	..	..	..	..	0.84	0.84
Saudi Arabia	165	..	19	..	98	..	0	..	..	..	0.24	0.10
Senegal	11	*14*	6	*2*	8	*11*	0	*0*	..	*4,013*	0.75	0.53
Serbia and Montenegro	137	*163*	31	*39*	133	*150*	*3*	*3*	..	*1,428*	0.74	0.66
Sierra Leone	10	*0*	4	..	7	*0*	2	*0*	*996*	..	0.51	0.50
Singapore	130	*168*	142	..	89	*122*	40	*32*	..	..	0.85	0.38
Slovak Republic	194	*266*	57	*34*	163	*236*	61	*8*	..	543	0.74	0.70
Slovenia	306	*465*	42	*46*	289	*426*	8	*6*	5,620	9,449	0.76	0.67
Somalia	2	..	1	..	1	..	..	..	..	..	0.35	0.29
South Africa	139	..	26	..	97	..	8	*4*	..	..	0.43	0.40
Spain	360	*467*	43	*54*	309	*408*	79	*92*	100,981	*201,896*	0.83	0.72
Sri Lanka	21	*37*	4	*7*	7	*12*	24	*42*	3,468	*15,630*	0.54	0.31
Sudan	9	..	22	..	8	..	..	..	..	..	0.30	0.24
Swaziland	66	*71*	18	*21*	35	*35*	3	*3*	..	..	0.47	0.44
Sweden	464	*494*	29	*21*	426	*450*	11	*31*	61,040	128,200	1.06	0.96
Switzerland	491	*534*	46	*54*	449	*493*	114	*102*	48,660	54,707	0.89	0.93
Syrian Arab Republic	26	*29*	10	..	10	*9*	..	..	..	..	0.53	0.18
Tajikistan	3	..	1	..	0	..	..	..	..	*1,730*	0.36	0.24
Tanzania	5	..	2	..	1	..	..	..	..	..	0.67	0.61
Thailand	46	..	36	..	14	..	86	..	45,769	..	0.36	0.32
Togo	24	..	11	..	16	..	8	..	..	..	0.56	0.46
Trinidad and Tobago	..	..	..	..	..	..	..	..	..	..	0.40	0.21
Tunisia	48	*79*	19	..	23	*53*	..	*1*	..	*14,635*	0.29	0.19
Turkey	50	*85*	8	*14*	34	*63*	10	*15*	27,041	52,631	1.02	0.78
Turkmenistan	..	..	..	..	..	..	..	..	..	..	0.02	0.01
Uganda	2	..	..	..	1	..	0	*3*	..	..	0.83	0.70
Ukraine	63	..	20	..	63	*104*	..	*46*	59,500	..	0.47	0.34
United Arab Emirates	121	..	52	..	97	..	..	..	..	..	0.29	0.30
United Kingdom	400	*391*	64	*62*	341	*384*	14	*3*	399,000	*462,400*	1.18	1.20
United States	758	*779*	30	*34*	573	*481*	17	*15*	2,527,441	*2,653,043*	0.40	0.39
Uruguay	138	..	45	..	122	..	74	..	..	..	0.46	0.20
Uzbekistan	..	..	..	..	..	..	..	..	..	..	0.38	0.26
Venezuela, RB	..	..	..	..	..	..	..	..	..	..	0.05	0.05
Vietnam	..	..	..	..	..	..	45	..	..	..	0.34	0.27
West Bank and Gaza	..	..	..	..	..	..	..	..	..	..	0.99	0.52
Yemen, Rep.	34	..	8	..	14	..	..	..	8,681	..	0.21	0.10
Zambia	14	..	3	..	8	..	..	..	..	..	0.72	0.60
Zimbabwe	..	..	..	..	..	..	..	..	..	..	*0.85*	*0.72*
World	**118 w**	**.. w**	**..**	**..**	**91 w**	**.. w**	**..**	**..**	**..**	**..**	**0.58 m**	**0.44 m**
Low income	7	*11*	..	..	4	*8*	..	..	..	..	0.54	0.41
Middle income	40	*52*	..	..	26	*40*	..	..	..	..	0.54	0.39
Lower middle income	25	*34*	..	..	13	*26*	..	..	..	..	0.52	0.36
Upper middle income	149	*213*	..	..	114	*166*	..	..	..	..	0.60	0.43
Low & middle income	26	*37*	..	..	16	*28*	..	..	..	..	0.54	0.40
East Asia & Pacific	9	*17*	..	..	4	*10*	..	..	..	..	0.36	0.31
Europe & Central Asia	97	*199*	..	..	82	*152*	..	..	..	..	0.64	0.56
Latin America & Carib.	100	*108*	..	..	..	*72*	..	..	..	..	0.54	0.36
Middle East & N. Africa	48	..	..	..	31	..	..	..	..	..	0.29	0.18
South Asia	4	*10*	..	..	2	*6*	..	..	..	..	0.54	0.34
Sub-Saharan Africa	21	..	..	..	14	..	..	..	..	..	0.64	0.51
High income	505	*668*	..	..	396	*436*	..	..	..	..	0.87	0.66
Europe EMU	429	*553*	..	..	379	*494*	..	..	..	..	1.00	0.80

About the data

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 particulate matter 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 5.9). 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 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 lacks data 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.

Definitions

• **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*).

3.12a

The 10 countries with the most vehicles per 1,000 people in 2001—and the 10 with the fewest

Vehicles per 1,000 people

Country	Motor vehicles	Country	Motor vehicles
United States	779	Mongolia	31
New Zealand	696	Nicaragua	30
Italy	606	Syrian Arab Republic	29
Canada	580	Indonesia	25
France	575	India	10
Japan	572	Pakistan	9
Austria	536	Cambodia	6
Switzerland	534	Uganda	5
Belgium	515	Ethiopia	2
Norway	511	Bangladesh	1

Note: Data are for the most recent year available between 1999 and 2001.
Source: Table 3.12.

Data sources

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 electronic files.

3.13 Air pollution

	City	City population	Particulate matter	Sulfur dioxide	Nitrogen dioxide
		thousands	micrograms per cubic meter	micrograms per cubic meter	microgram per cubic meter
		2000	1999	1995–2001 [a]	1995–2001 [a]
Argentina	Córdoba	1,370	52	..	97
Australia	Melbourne	3,293	15	..	30
	Perth	1,245	15	5	19
	Sydney	3,855	22	28	81
Austria	Vienna	1,904	39	14	42
Belgium	Brussels	983	31	20	48
Brazil	Rio de Janeiro	5,902	40	129	..
	São Paulo	9,984	46	43	83
Bulgaria	Sofia	1,177	83	39	122
Canada	Montreal	3,519	22	10	42
	Toronto	4,535	26	17	43
	Vancouver	1,880	15	14	37
Chile	Santiago	4,522	73	29	81
China	Anshan	3,132	99	115	88
	Beijing	9,302	106	90	122
	Changchun	3,766	88	21	64
	Chengdu	4,401	103	77	74
	Chongquing	3,945	147	340	70
	Dalian	4,389	60	61	100
	Guangzhu	495	74	57	136
	Guiyang	2,103	84	424	53
	Harbin	4,545	91	23	30
	Jinan	3,037	112	132	45
	Kunming	2,037	84	19	33
	Lanzhou	2,044	109	102	104
	Liupanshui	2,330	70	102	..
	Nanchang	1,594	94	69	29
	Pinxiang	1,754	80	75	..
	Quingdao	2,316	..	190	64
	Shanghai	10,367	87	53	73
	Shenyang	5,881	120	99	73
	Taiyuan	2,811	105	211	55
	Tianjin	7,333	149	82	50
	Urumqi	1,467	61	60	70
	Wuhan	4,842	94	40	43
	Zhengzhou	2,214	116	63	95
	Zibo	3,139	88	198	43
Colombia	Bogota	5,442	33	..	..
Croatia	Zagreb	908	39	31	..
Cuba	Havana	2,270	28	1	5
Czech Republic	Prague	1,211	27	14	33
Denmark	Copenhagen	1,371	24	7	54
Ecuador	Guayaquil	2,120	26	15	..
	Quito	1,598	34	22	..
Egypt, Arab Rep.	Cairo	7,941	178	69	..
Finland	Helsinki	1,095	22	4	35
France	Paris	9,851	15	14	57
Germany	Berlin	3,555	25	18	26
	Frankfurt	668	22	11	45
	Munich	1,275	22	8	53
Ghana	Accra	1,938	31	..	..
Greece	Athens	3,229	50	34	64
Hungary	Budapest	1,958	26	39	51
Iceland	Reykjavik	164	21	5	42
India	Ahmedabad	4,154	104	30	21
	Bangalore	5,180	56	..	..

About the data

In many towns and cities exposure to air pollution is the main environmental threat to human health. Long-term exposure to high levels of soot and small particles in the air contributes to a wide range of health effects, including respiratory diseases, lung cancer, and heart disease. Particulate pollution, on its own or in combination with sulfur dioxide, leads to an enormous burden of ill health.

Emissions of sulfur dioxide and nitrogen oxides lead to the deposition of acid rain and other acidic compounds over long distances. Acid deposition changes the chemical balance of soils and can lead to the leaching of trace minerals and nutrients critical to trees and plants.

Where coal is the primary fuel for power plants, steel mills, industrial boilers, and domestic heating, the result is usually high levels of urban air pollution—especially particulates and sometimes sulfur dioxide—and, if the sulfur content of the coal is high, widespread acid deposition. Where coal is not an important primary fuel or is used in plants with effective dust control, the worst emissions of air pollutants stem from the combustion of petroleum products.

The data on sulfur dioxide and nitrogen dioxide concentrations are based on reports from urban monitoring sites. Annual means (measured in micrograms per cubic meter) are average concentrations observed at these sites. Coverage is not comprehensive because not all cities have monitoring systems.

The data on particulate matter concentrations are estimates, for selected cities, of average annual concentrations in residential areas away from air pollution "hotspots," such as industrial districts and transport corridors. The data have been extracted from a complete set of estimates developed by the World Bank's Development Research Group and Environment Department in a study of annual ambient concentrations of particulate matter in world cities with populations exceeding 100,000 (Pandey and others 2003).

Pollutant concentrations are sensitive to local conditions, and even in the same city different monitoring sites may register different concentrations. Thus these data should be considered only a general indication of air quality in each city, and cross-country comparisons should be made with caution. The current World Health Organization (WHO) air quality guidelines for annual mean concentrations are 50 micrograms per cubic meter for sulfur dioxide and 40 micrograms for nitrogen dioxide. The WHO has set no guidelines for particulate matter concentrations below which there are no appreciable health effects.

Air pollution 3.13

	City	City population	Particulate matter	Sulfur dioxide	Nitrogen dioxide
		thousands	micrograms per cubic meter	micrograms per cubic meter	microgram per cubic meter
		2000	1999	1995–2001 [a]	1995–2001 [a]
India	Calcutta	13,822	153	49	34
	Chennai	6,002	..	15	17
	Delhi	10,558	187	24	41
	Hyderabad	5,448	51	12	17
	Kanpur	2,546	136	15	14
	Lucknow	2,093	136	26	25
	Mumbai	15,797	79	33	39
	Nagpur	2,087	69	6	13
	Pune	3,128	58		
Indonesia	Jakarta	10,845	103	..	..
Iran, Islamic Rep.	Tehran	7,689	71	209	..
Ireland	Dublin	991	23	20	..
Italy	Milan	1,381	36	31	248
	Rome	2,713	35	..	..
	Torino	969	53	..	..
Japan	Osaka	2,626	39	19	63
	Tokyo	12,483	43	18	68
	Yokohama	3,366	32	100	13
Kenya	Nairobi	2,383	49	..	..
Korea, Rep	Pusan	4,075	43	60	51
	Seoul	11,548	45	44	60
	Taegu	2,417	49	81	62
Malaysia	Kuala Lumpur	1,530	24	24	..
Mexico	Mexico City	18,017	69	74	130
Netherlands	Amsterdam	1,131	37	10	58
New Zealand	Auckland	989	15	3	20
Norway	Oslo	805	23	8	43
Philippines	Manila	10,432	60	33	..
Poland	Lodz	873	45	21	43
	Warsaw	1,716	49	16	32
Portugal	Lisbon	3,318	30	8	52
Romania	Bucharest	2,070	25	10	71
Russian Federation	Moscow	8,811	27	109	..
	Omsk	1,206	28	20	34
Singapore	Singapore	3,163	41	20	30
Slovak Republic	Bratislava	456	22	21	27
South Africa	Capetown	2,942	15	21	72
	Durban	1,364	29	31	..
	Johannesburg	2,344	30	19	31
Spain	Barcelona	1,645	43	11	43
	Madrid	3,068	37	24	66
Sweden	Stockholm	916	15	3	20
Switzerland	Zurich	980	24	11	39
Thailand	Bangkok	7,296	82	11	23
Turkey	Ankara	3,702	53	55	46
	Istanbul	9,286	62	120	..
Ukraine	Kiev	2,622	45	14	51
United Kingdom	Birmingham	2,344	17	9	45
	London	7,812	23	25	77
	Manchester	2,325	19	26	49
United States	Chicago	9,024	27	14	57
	Los Angeles	16,195	38	9	74
	New York	20,951	23	26	79
Venezuela, RB	Caracas	3,488	18	33	57

a. Data are for the most recent year available.

Definitions

• **City population** is the number of residents of the city or metropolitan area as defined by national authorities and reported to the United Nations. • **Particulate matter** refers to fine suspended particulates less than 10 microns in diameter that are capable of penetrating deep into the respiratory tract and causing significant health damage. The state of a country's technology and pollution controls is an important determinant of particulate matter concentrations. • **Sulfur dioxide** 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** 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. Nitrogen dioxide is emitted by bacteria, motor vehicles, industrial activities, nitrogenous fertilizers, combustion of fuels and biomass, and aerobic decomposition of organic matter in soils and oceans.

Data sources

City population data are from the United Nations Population Division. The data on sulfur dioxide and nitrogen dioxide concentrations 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 Organisation for Economic Co-operation and Development's (OECD) *OECD Environmental Data Compendium 1999,* the U.S. Environmental Protection Agency's *National Air Quality and Emissions Trends Report 1995,* the Aerometric Information Retrieval System (AIRS) Executive International database, and the United Nations Centre for Human Settlements' (UNCHS) Urban Indicators database. The data on particulate matter concentrations are from a recent World Bank study by Kiran D. Pandey, Katharine Bolt, Uwe Deichman, Kirk Hamilton, Bart Ostro, and David Wheeler, "The Human Cost of Air Pollution: New Estimates for Developing Countries" (2003).

3.14 Government commitment

	Environmental strategies or action plans	Biodiversity assessments, strategies or action plans	Participation in treaties [a]					
			Climate change [b]	Ozone layer	CFC control	Law of the Sea [c]	Biological diversity [b]	Kyoto Protocol
Afghanistan	..	..	2002	..	..	..	2002	..
Albania	1993	..	1995	1999	1999	2003 [f]	1994 [f]	..
Algeria	2001	..	1994	1992	1992	1996	1995	..
Angola	..	..	2000	2000	2000	1994	1998	..
Argentina	1992	..	1994	1990	1990	1996	1995	2001
Armenia	..	..	1994	1999	1999	2002 [f]	1993 [d]	2003 [f]
Australia	1992	1994	1994	1987	1989	1995	1993	..
Austria	..	..	1994	1987	1989	1995	1994	2002
Azerbaijan	1998	..	1995	1996	1996	..	2000 [e]	2000 [f]
Bangladesh	1991	1990	1994	1990	1990	2001	1994	2001 [f]
Belarus	..	..	2000	1986	1988	..	1993	..
Belgium	..	..	1996	1988	1988	1998	1997	2002
Benin	1993	..	1994	1993	1993	1997	1994	2002 [f]
Bolivia	1994	1988	1995	1994	1994	1995	1995	1999
Bosnia and Herzegovina	..	..	2000	1992	1992	1994 [g]	2002 [f]	..
Botswana	1990	1991	1994	1991	1991	1994	1996	2003 [f]
Brazil	..	1988	1994	1990	1990	1994	1994	2002
Bulgaria	..	1994	1995	1990	1990	1996	1996	2002
Burkina Faso	1993	..	1994	1989	1989	..	1993	..
Burundi	1994	1989	1997	1997	1997	..	1997	2001 [f]
Cambodia	1999	..	1996	2001	2001	..	1995 [f]	2002 [f]
Cameroon	..	1989	1995	1989	1989	1994	1995	2002 [f]
Canada	1990	1994	1994	1986	1988	2003	1993	2002
Central African Republic	..	..	1995	1993	1993	..	1995	..
Chad	1990	..	1994	1989	1994	..	1994	..
Chile	..	1993	1995	1990	1990	1997	1994	2002
China	1994	1994	1994	1989	1991	1996	1993	2002 [e]
Hong Kong, China	..	..	..	..	..	..	..	..
Colombia	1998	1988	1995	1990	1993	..	1995	2001 [f]
Congo, Dem. Rep.	..	1990	1995	1994	1994	1994	1995	..
Congo, Rep.	..	1990	1997	1994	1994	..	1996	..
Costa Rica	1990	1992	1994	1991	1991	1994	1994	2002
Côte d'Ivoire	1994	1991	1995	1993	1993	1994	1995	..
Croatia	2001	2000	1996	1991	1991	1994 [g]	1997	..
Cuba	..	..	1994	1992	1992	1994	1994	..
Czech Republic	1994	..	1994	1993	1993	1996	1994 [e]	2001 [e]
Denmark	1994	..	1994	1988	1988	..	1994	2002
Dominican Republic	..	1995	1999	1993	1993	..	1996	2002 [f]
Ecuador	1993	1995	1994	1990	1990	..	1993	2000
Egypt, Arab Rep.	1992	1988	1995	1988	1988	1994	1994	..
El Salvador	1994	1988	1996	1992	1992	..	1994	1998
Eritrea	1995	..	1995	..	..	..	1996 [f]	..
Estonia	1998	..	1994	1996	1996	..	1994	2002
Ethiopia	1994	1991	1994	1994	1994	..	1994	..
Finland	1995	..	1994	1986	1988	1996	1994 [d]	2002
France	1990	..	1994	1987	1988	1996	1994	2002 [e]
Gabon	..	1990	1998	1994	1994	1998	2000	..
Gambia, The	1992	1989	1994	1990	1990	1998	1994	2001 [f]
Georgia	1998	..	1994	1996	1996	1996 [f]	1994 [f]	1999 [f]
Germany	..	..	1994	1988	1988	1994 [f]	1994	2002
Ghana	1992	1988	1995	1989	1989	1994	1994	2003 [f]
Greece	..	..	1994	1988	1988	1995	1994	2002
Guatemala	1994	1988	1996	1987	1989	1997	1995	1999
Guinea	1994	1988	1994	1992	1992	1994	1993	2000 [f]
Guinea-Bissau	1993	1991	1996	2002	2002	1994	1996	..
Haiti	1999	..	1996	2000	2000	1996	1996	..

3.14a

The Kyoto Protocol on climate change

The Kyoto Protocol was adopted at the third conference of the parties to the United Nations Framework Convention on Climate Change, held in Kyoto, Japan, in December 1997 and was open for signature from March 1998 onward.

At the heart of the protocol are its legally binding greenhouse gas emissions targets for industrial and transition economies (known as "Annex I Parties"), which accounted for at least 55 percent of carbon dioxide emissions in 1990. The emissions targets amount to an aggregate reduction of greenhouse gas emissions by all Annex I Parties of at least 5 percent from 1990 levels during the commitment period, 2008–12. All Annex I Parties have individual emissions targets, which were decided in Kyoto after intensive negotiation and are listed in the protocol's Annex B.

The protocol's rules focus on:

- Commitments, including legally binding emissions targets and general commitments.
- Implementation, including domestic steps and three novel implementing mechanisms.
- Minimization of impacts on developing countries, including use of an Adaptation Fund.
- Accounting, reporting, and review, including in-depth review of national reporting.
- Compliance, including a Compliance Committee to assess and deal with problem cases.

In addition to emissions targets for Annex I Parties, the Kyoto Protocol also contains a set of general commitments that apply to all parties, such as:

- Improving the quality of emissions data.
- Mounting national mitigation and adaptation programs.
- Promoting environmentally friendly technology transfer.
- Cooperating in scientific research and international climate observation networks.
- Supporting education, training, public awareness, and capacity building initiatives.

The Protocol is subject to ratification, acceptance, approval, or accession by Parties to the Convention, which bind the parties to the protocol's commitments, once the protocol comes into force.

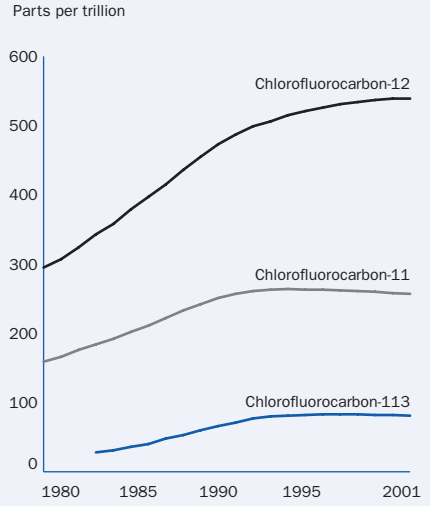
The table contains the latest information on dates of signature and ratification from the Secretary-General of the United Nations, the depository of the Kyoto Protocol. The dates are those of the receipt of the instrument of ratification, acceptance, approval, or accession. As of November 2003, 84 parties had signed the Kyoto Protocol and 120 parties had ratified or accepted it.

Government commitment

	Environmental strategies or action plans	Biodiversity assessments, strategies or action plans	Participation in treaties [a]					
			Climate change [b]	Ozone layer	CFC control	Law of the Sea [c]	Biological diversity [b]	Kyoto Protocol
Honduras	1993	..	1996	1993	1993	1994	1995	2000
Hungary	1995	..	1994	1988	1989	2002	1994	2002 [f]
India	1993	1994	1994	1991	1992	1995	1994	2002 [f]
Indonesia	1993	1993	1994	1992	1992	1994	1994	..
Iran, Islamic Rep.	..	..	1996	1990	1990	..	1996	..
Iraq	..	..	..	..	..	1994	..	..
Ireland	..	..	1994	1988	1988	1996	1996	2002
Israel	..	..	1996	1992	1992	..	1995	..
Italy	..	..	1994	1988	1988	1995	1994	2002
Jamaica	1994	..	1995	1993	1993	1994	1995	1999 [f]
Japan	..	..	1994	1988	1988	1996	1993 [d]	2002 [d]
Jordan	1991	..	1994	1989	1989	1995 [f]	1994	2003 [f]
Kazakhstan	..	..	1995	1998	1998	..	1994	..
Kenya	1994	1992	1994	1988	1988	1994	1994	..
Korea, Dem. Rep.	..	..	1995	1995	1995	..	1995 [e]	..
Korea, Rep.	..	..	1994	1992	1992	1996	1995	2002
Kuwait	..	..	1995	1992	1992	1994	2002	..
Kyrgyz Republic	1995	..	2000	2000	2000	..	1996 [e]	2003 [f]
Lao PDR	1995	..	1995	1998	1998	1998	1996 [e]	2003 [f]
Latvia	..	..	1995	1995	1995	..	1996	2002
Lebanon	..	..	1995	1993	1993	1995	1995	..
Lesotho	1989	..	1995	1994	1994	..	1995	2000 [f]
Liberia	..	..	2003	1996	1996	..	2000	2002 [f]
Libya	..	..	1999	1990	1990	..	2001	..
Lithuania	..	..	1995	1995	1995	2003 [f]	1996	2003
Macedonia, FYR	..	..	1998	1994	1994	1994 [g]	1997 [f]	..
Madagascar	1988	1991	1999	1996	1996	2001	1996	2003 [f]
Malawi	1994	..	1994	1991	1991	..	1994	2001 [f]
Malaysia	1991	1988	1994	1989	1989	1997	1994	2002
Mali	..	1989	1995	1994	1994	1994	1995	2002
Mauritania	1988	..	1994	1994	1994	1996	1996	..
Mauritius	1990	..	1994	1992	1992	1994	1993	2001 [f]
Mexico	..	1988	1994	1987	1988	1994	1993	2000
Moldova	2002	..	1995	1996	1996	..	1996	2003 [f]
Mongolia	1995	..	1994	1996	1996	1997	1993	1999 [f]
Morocco	..	1988	1996	1995	1995	..	1995	2002 [f]
Mozambique	1994	..	1995	1994	1994	1997	1995	..
Myanmar	..	1989	1995	1993	1993	1996	1995	2003 [f]
Namibia	1992	..	1995	1993	1993	1994	1997	2003 [f]
Nepal	1993	..	1994	1994	1994	1998	1994	..
Netherlands	1994	..	1994	1988	1988	1996	1994 [d]	2002 [f]
New Zealand	1994	..	1994	1987	1988	1996	1993	2002
Nicaragua	1994	..	1996	1993	1993	2000	1996	1999
Niger	..	1991	1995	1992	1992	..	1995	..
Nigeria	1990	1992	1994	1988	1988	1994	1994	..
Norway	..	1994	1994	1986	1988	1996	1993	2002
Oman	..	..	1995	1999	1999	1994	1995	..
Pakistan	1994	1991	1994	1992	1992	1997	1994	..
Panama	1990	..	1995	1989	1989	1996	1995	1999
Papua New Guinea	1992	1993	1994	1992	1992	1997	1993	2002
Paraguay	..	..	1994	1992	1992	1994	1994	1999
Peru	..	1988	1994	1989	1993	..	1993	2002
Philippines	1989	1989	1994	1991	1991	1994	1994	2003
Poland	1993	1991	1994	1990	1990	1998	1996	2002
Portugal	1995	..	1994	1988	1988	1997	1994	2002 [e]
Puerto Rico	..	..	..	..	..	..	..	..

3.14b

Global atmospheric concentrations of chlorofluorocarbons have leveled off



Note: Chlorofluorocarbon-11, chlorofluorocarbon-12, and chlorofluorocarbon-113 are potent depletors of stratospheric ozone.
Source: World Resources Institute and others 2002.

3.14 Government commitment

	Environmental strategies or action plans	Biodiversity assessments, strategies or action plans	Participation in treaties [a]					
			Climate change [b]	Ozone layer	CFC control	Law of the Sea [c]	Biological diversity [b]	Kyoto Protocol
Romania	1995	..	1994	1993	1993	1997	1994	2001
Russian Federation	1999	1994	1995	1986	1988	1997	1995	..
Rwanda	1991	..	1998	2001	2001	..	1996	..
Saudi Arabia	..	..	1995	1993	1993	1996	2001 [e]	..
Senegal	1984	1991	1995	1993	1993	1994	1995	2001 [f]
Serbia and Montenegro	..	..	2001	1992	1992	2001 [g]	2002	..
Sierra Leone	1994	..	1995	2001	2001	1995	1995 [e]	..
Singapore	1993	1995	1997	1989	1989	1994	1996	..
Slovak Republic	..	..	1994	1993	1993	1996	1994 [e]	2002
Slovenia	1994	..	1996	1992	1992	1994 [g]	1996	2002
Somalia	..	..	..	2001	2001	1994	..	..
South Africa	1993	..	1997	1990	1990	1997	2000	2002 [f]
Spain	..	..	1994	1988	1988	1997	1994	2002
Sri Lanka	1994	1991	1994	1989	1989	1994	1994	2002 [f]
Sudan	..	..	1994	1993	1993	1994	1996	..
Swaziland	..	..	1997	1992	1992	..	1995	..
Sweden	..	..	1994	1986	1988	1996	1994	2002
Switzerland	..	..	1994	1987	1988	..	1995	2003
Syrian Arab Republic	1999	..	1996	1989	1989	..	1996	..
Tajikistan	..	..	1998	1996	1998	..	1997 [e]	..
Tanzania	1994	1988	1996	1993	1993	1994	1996	2002 [f]
Thailand	..	..	1995	1989	1989	..	..	2002
Togo	1991	..	1995	1991	1991	1994	1996 [d]	..
Trinidad and Tobago	..	..	1994	1989	1989	1994 [f]	1996	1999
Tunisia	1994	1988	1994	1989	1989	1994	1993	2003 [f]
Turkey	1998	..	..	1991	1991	..	1997	..
Turkmenistan	..	..	1995	1993	1993	..	1996 [e]	1999
Uganda	1994	1988	1994	1988	1988	1994	1993	2002 [f]
Ukraine	1999	..	1997	1986	1988	1999	1995	..
United Arab Emirates	..	..	1996	1989	1989	..	2000	..
United Kingdom	1995	1994	1994	1987	1988	1997 [f]	1994	2002
United States	1995	1995	1994	1986	1988	..	..	..
Uruguay	..	..	1994	1989	1991	1994	1994	2001
Uzbekistan	..	..	1994	1993	1993	..	1995 [e]	1999
Venezuela	..	..	1995	1988	1989	..	1994	..
Vietnam	..	1993	1995	1994	1994	1994	1995	2002
West Bank and Gaza	..	..	..	..	..	..	..	..
Yemen, Rep.	1996	1992	1996	1996	1996	1994	1996	..
Zambia	1994	..	1994	1990	1990	1994	1993	..
Zimbabwe	1987	..	1994	1992	1992	1994	1995	..

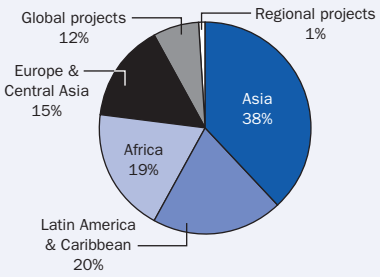
a. Ratification of the treaty. b. The years shown refer to the year the treaty entered into force in that country. c. Convention became effective November 16, 1994. d. Acceptance. e. Approval. f. Accession. g. Succession.

3.14c

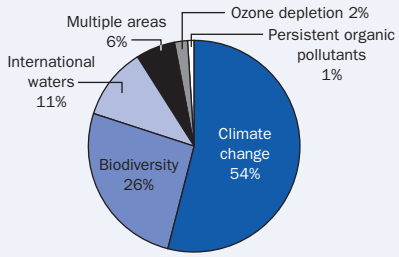
Global focus on biodiversity and climate change

Allocation of funds for Global Environment Facility programs, February 1991–January 2004
Total allocation: $19,944 million

By region



By focal area



Source: Global Environment Facility data.

About the data

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, and 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 biodiversity 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, 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). These plans are 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.

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, which produced Agenda 21—an array of actions to address environmental challenges:

- 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.

But 10 years after Rio the World Summit on Sustainable Development recognized that many of the proposed actions have yet to materialize. 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 the 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.

Definitions

• **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. • **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 Chlorofluorocarbon 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. • **Kyoto Protocol** refers to the protocol on climate change adopted at the third conference of the parties to the United Nations Framework Convention on Climate Change, held in Kyoto, Japan, in December 1997 (for more details see box 3.14a).

Data sources

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, and Center for International Earth Science Information Network.

3.15 Toward a broader measure of savings

	Gross national savings [a]	Consumption of fixed capital	Net national savings	Education expenditure	Energy depletion	Mineral depletion	Net forest depletion	Carbon dioxide damage	Particulate emissions damage	Adjusted net savings
	% of GNI 2002	% of GNI 2002	% of GNI 2002	% of GNI 2002	% of GNI 2002	% of GNI 2002	% of GNI 2002	% of GNI 2002	% of GNI 2002	% of GNI 2002
Afghanistan	..	..	..	..	..	..	..	..	..	..
Albania	13.8	9.1	4.7	2.8	1.0	0.0	0.0	0.3	0.1	6.1
Algeria	..	11.1	..	4.5	33.4	0.1	0.1	1.3	0.7	..
Angola	*23.3*	10.4	12.9	4.4	36.3	0.0	0.0	0.5	..	–19.6 [b]
Argentina	22.3	11.1	11.2	3.2	5.4	0.2	0.0	0.8	1.6	6.5
Armenia	13.9	8.5	5.3	1.8	0.0	0.1	0.0	1.1	2.0	4.0
Australia	*19.7*	16.2	3.5	5.2	1.2	1.4	0.0	0.6	0.1	5.4
Austria	21.4	14.4	7.0	5.0	0.1	0.0	0.0	0.2	0.2	11.5
Azerbaijan	21.5	15.0	6.5	3.0	38.7	0.0	0.0	5.2	1.0	–35.3
Bangladesh	28.5	5.8	22.7	1.3	0.8	0.0	0.8	0.4	0.3	21.7
Belarus	18.6	9.3	9.3	5.4	2.2	0.0	0.0	3.4	0.0	9.2
Belgium	*23.4*	14.5	8.9	3.0	0.0	0.0	0.0	0.3	0.2	11.4
Benin	9.2	8.1	1.1	2.7	0.1	0.0	1.3	0.4	0.3	1.8
Bolivia	12.2	9.1	3.1	4.8	5.9	0.8	0.0	1.1	0.7	–0.5
Bosnia and Herzegovina	7.5	8.5	–1.0	..	0.1	0.0	0.0	2.4	0.4	..
Botswana	..	11.8	..	5.6	0.0	0.2	0.0	0.6	..	..
Brazil	19.7	10.8	8.9	4.7	2.9	1.1	0.0	0.5	0.2	9.0
Bulgaria	15.4	10.3	5.1	3.0	0.2	0.4	0.0	2.2	2.1	3.3
Burkina Faso	8.0	6.7	1.3	2.4	0.0	0.0	1.2	0.3	0.5	1.8
Burundi	11.0	6.4	4.6	3.9	0.0	0.1	10.4	0.2	0.1	–2.3
Cambodia	*18.5*	7.3	11.2	*1.8*	0.0	0.0	0.9	0.1	0.1	11.9
Cameroon	..	8.9	..	2.3	6.2	0.0	0.0	0.6	0.7	..
Canada	*23.2*	13.0	10.2	6.9	4.0	0.1	0.0	0.5	0.2	12.3
Central African Republic	..	7.8	..	1.6	0.0	0.0	0.0	0.2	0.4	..
Chad	..	7.2	..	1.4	0.0	0.0	0.0	0.1	..	..
Chile	24.5	10.0	14.4	3.4	0.2	4.7	0.0	0.7	1.0	11.2
China	43.7	9.0	34.7	2.0	2.7	0.2	0.0	2.2	1.0	30.7
Hong Kong, China	32.1	12.9	19.2	2.8	0.0	0.0	0.0	0.2	0.0	21.8
Colombia	13.7	10.5	3.2	3.1	6.5	0.2	0.0	0.5	0.1	–1.0
Congo, Dem. Rep.	..	6.8	..	0.9	1.8	0.0	0.0	0.3	0.0	..
Congo, Rep.	34.6	12.5	22.2	5.9	47.4	0.2	0.0	0.8	..	..
Costa Rica	15.1	5.9	9.2	5.2	0.0	0.0	0.3	0.2	0.3	13.5
Côte d'Ivoire	20.5	9.2	11.3	4.5	0.0	0.0	0.6	0.5	0.6	14.1
Croatia	21.2	11.5	9.7	..	0.6	0.0	0.0	0.6	0.3	..
Cuba	..	..	..	6.1	..	..	..	..	..	..
Czech Republic	23.0	12.2	10.7	4.4	0.1	0.0	0.0	1.2	0.1	13.8
Denmark	23.4	15.4	8.0	7.7	0.3	0.0	0.0	0.2	0.1	15.0
Dominican Republic	20.4	5.3	15.1	1.7	0.0	0.3	0.0	0.9	0.2	15.4
Ecuador	..	10.6	..	3.2	13.8	0.0	0.0	1.2	0.1	..
Egypt, Arab Rep.	15.1	9.5	5.6	4.4	4.6	0.1	0.2	1.0	1.4	2.7
El Salvador	14.2	10.4	3.8	2.2	0.0	0.0	0.6	0.3	0.2	4.9
Eritrea	21.7	5.2	16.6	1.4	0.0	0.0	0.0	0.5	0.5	16.9
Estonia	20.2	14.2	6.0	6.3	0.5	0.0	0.0	2.2	0.2	9.4
Ethiopia	15.4	6.1	9.3	4.0	0.0	0.1	12.8	0.6	0.3	–0.5
Finland	27.0	16.1	11.0	7.0	0.0	0.0	0.0	0.3	0.1	17.5
France	*21.1*	12.4	8.7	5.6	0.0	0.0	0.0	0.2	0.0	14.0
Gabon	*40.7*	12.9	27.8	*2.2*	27.8	0.0	0.0	0.6	0.1	1.5
Gambia, The	..	8.4	..	3.4	0.0	0.0	0.6	0.5	0.7	..
Georgia	15.0	15.7	–0.7	4.3	0.5	0.0	0.0	1.0	2.5	–0.5
Germany	20.4	14.8	5.5	4.4	0.1	0.0	0.0	0.3	0.1	9.5
Ghana	20.4	7.1	13.3	2.8	0.0	1.2	2.7	0.8	0.2	11.3
Greece	19.7	8.7	11.0	3.1	0.1	0.0	0.0	0.5	0.7	12.8
Guatemala	14.8	10.1	4.7	1.6	0.7	0.0	0.9	0.3	0.2	4.2
Guinea	17.1	8.1	9.0	2.0	0.0	1.7	1.9	0.3	0.6	6.5
Guinea-Bissau	..	7.7	..	..	0.0	0.0	0.0	0.7	0.9	..
Haiti	..	1.9	..	1.5	0.0	0.0	0.9	0.3	0.2	..

Toward a broader measure of savings

	Gross national savings [a]	Consumption of fixed capital	Net national savings	Education expenditure	Energy depletion	Mineral depletion	Net forest depletion	Carbon dioxide damage	Particulate emissions damage	Adjusted net savings
	% of GNI 2002	% of GNI 2002	% of GNI 2002	% of GNI 2002	% of GNI 2002	% of GNI 2002	% of GNI 2002	% of GNI 2002	% of GNI 2002	% of GNI 2002
Honduras	23.3	5.6	17.7	3.5	0.0	0.2	0.0	0.5	0.2	20.4
Hungary	*23.5*	11.8	11.7	4.3	0.3	0.0	0.0	0.7	0.4	14.6
India	22.3	9.7	12.6	3.2	2.3	0.3	1.0	1.7	0.7	9.8
Indonesia	18.2	5.4	12.7	0.6	8.6	1.2	0.0	0.9	0.5	2.1
Iran, Islamic Rep.	*38.9*	9.7	29.2	3.5	29.7	0.2	0.0	2.1	0.7	0.1
Iraq	..	..	..	..	..	..	..	..	..	..
Ireland	*28.0*	12.5	15.5	5.7	0.0	0.1	0.0	0.4	0.1	20.6
Israel	13.4	*13.2*	0.2	6.9	0.0	0.1	0.0	*0.4*	0.0	6.7
Italy	19.8	13.6	6.1	4.7	0.1	0.0	0.0	0.2	0.2	10.3
Jamaica	20.7	11.6	9.1	5.8	0.0	1.2	0.0	0.9	0.3	12.4
Japan	*27.2*	15.8	11.4	3.6	0.0	0.0	0.0	0.2	0.4	14.4
Jordan	26.2	10.6	15.6	5.6	0.0	1.1	0.0	1.2	0.7	18.2
Kazakhstan	25.5	10.0	15.5	4.4	33.4	0.0	0.0	4.4	0.4	–18.3
Kenya	*13.7*	7.9	5.7	6.1	0.0	0.0	0.1	0.4	0.2	11.0
Korea, Dem. Rep.	..	..	..	..	..	..	..	..	..	..
Korea, Rep.	27.3	12.0	15.3	3.7	0.0	0.0	0.0	0.7	0.8	17.5
Kuwait	19.4	*6.7*	12.7	5.0	42.2	0.0	0.0	*0.8*	2.0	–27.3
Kyrgyz Republic	17.4	8.2	9.2	5.1	1.0	0.0	0.0	2.6	0.2	10.5
Lao PDR	..	8.0	..	1.8	0.0	0.0	0.0	0.2	0.2	..
Latvia	19.6	10.8	8.9	6.1	0.0	0.0	0.0	0.7	0.3	13.9
Lebanon	2.1	10.3	–8.2	2.5	0.0	0.0	0.0	0.6	0.6	–6.8
Lesotho	22.0	6.5	15.4	6.4	0.0	0.0	2.5	*0.0*	0.4	18.9
Liberia	..	8.2	..	..	0.0	0.2	3.3	1.1	0.0	..
Libya	..	..	..	..	..	..	..	..	..	..
Lithuania	17.4	10.1	7.2	5.2	0.3	0.0	0.0	0.9	0.7	10.5
Macedonia, FYR	12.9	9.8	3.1	4.9	0.0	0.0	0.0	2.0	0.3	5.8
Madagascar	8.5	7.9	0.6	1.9	0.0	0.0	0.0	0.3	0.2	2.0
Malawi	0.8	7.0	–6.3	4.4	0.0	0.0	1.4	0.3	0.2	–3.7
Malaysia	34.5	11.7	22.8	4.1	8.9	0.0	0.0	1.0	0.1	16.8
Mali	*3.2*	8.4	–5.2	2.1	0.0	0.0	0.0	0.2	0.5	–3.8
Mauritania	..	8.1	..	3.7	0.0	20.5	0.9	2.4	..	..
Mauritius	27.7	10.8	16.9	3.3	0.0	0.0	0.0	0.4	..	..
Mexico	18.3	10.5	7.8	4.6	4.9	0.1	0.0	0.5	0.5	6.5
Moldova	14.4	7.3	7.2	10.3	0.0	0.0	0.0	3.3	0.5	13.6
Mongolia	26.7	12.1	14.6	5.7	0.0	2.3	0.0	4.8	0.5	12.7
Morocco	26.1	10.0	16.1	4.9	0.0	0.2	0.0	0.7	0.2	19.9
Mozambique	*27.7*	8.3	19.4	3.8	0.0	0.0	0.0	0.3	0.4	22.4
Myanmar	*12.4*	..	..	0.9	..	..	..	..	..	..
Namibia	39.6	11.5	28.1	8.5	0.0	0.4	0.0	0.4	0.2	35.6
Nepal	*22.1*	2.4	19.8	3.2	0.0	0.0	4.2	0.4	0.1	18.2
Netherlands	22.2	15.0	7.2	4.9	0.1	0.0	0.0	0.3	0.4	11.3
New Zealand	*19.4*	10.8	8.6	6.9	0.9	0.1	0.0	0.4	0.0	14.2
Nicaragua	11.2	..	..	3.7	0.0	0.1	0.9	0.6	0.0	..
Niger	..	7.1	..	2.3	0.0	0.0	3.6	0.4	0.4	..
Nigeria	13.1	8.3	4.8	*0.5*	38.7	0.0	0.0	0.5	0.8	–34.7
Norway	32.0	15.9	16.1	6.9	4.2	0.0	0.0	0.3	0.1	18.4
Oman	..	11.5	..	4.1	40.3	0.0	0.0	0.6	..	..
Pakistan	25.6	7.7	17.9	2.3	3.6	0.0	1.0	1.2	1.0	13.4
Panama	24.2	7.6	16.6	4.8	0.0	0.0	0.0	0.6	0.3	20.4
Papua New Guinea	..	8.6	..	..	10.0	4.2	0.0	0.5	0.0	..
Paraguay	14.2	9.0	5.2	3.9	0.0	0.0	0.0	0.5	0.4	8.3
Peru	17.2	10.4	6.7	2.6	0.9	1.4	0.0	0.3	0.6	6.0
Philippines	24.5	7.9	16.5	2.9	0.0	0.1	0.2	0.7	0.4	18.0
Poland	16.6	11.2	5.4	7.5	0.3	0.1	0.0	1.3	0.7	10.5
Portugal	*19.3*	15.3	4.0	5.3	0.0	0.0	0.0	0.3	0.4	8.6
Puerto Rico	..	*7.4*	..	..	*0.0*	*0.0*	*0.0*	*0.2*	..	..

3.15 Toward a broader measure of savings

	Gross national savings [a]	Consumption of fixed capital	Net national savings	Education expenditure	Energy depletion	Mineral depletion	Net forest depletion	Carbon dioxide damage	Particulate emissions damage	Adjusted net savings
	% of GNI 2002	% of GNI 2002	% of GNI 2002	% of GNI 2002	% of GNI 2002	% of GNI 2002	% of GNI 2002	% of GNI 2002	% of GNI 2002	% of GNI 2002
Romania	19.9	9.8	10.0	3.6	2.3	0.0	0.0	1.4	0.2	9.7
Russian Federation	30.6	10.4	20.1	*3.6*	25.5	0.3	0.0	3.1	0.6	–5.7
Rwanda	12.2	7.3	4.9	3.5	0.0	0.0	3.9	0.3	0.0	4.2
Saudi Arabia	28.9	*10.0*	18.9	7.2	42.2	0.0	0.0	*0.8*	1.0	–17.9
Senegal	11.5	8.4	3.2	3.7	0.0	0.2	0.3	0.6	..	..
Serbia and Montenegro	..	9.6	..	..	0.9	0.1	0.0	1.7	0.2	..
Sierra Leone	..	7.1	..	0.9	0.0	0.0	5.2	0.4	0.4	..
Singapore	42.7	14.4	28.3	2.3	0.0	0.0	0.0	0.6	0.4	29.6
Slovak Republic	*23.2*	11.2	12.0	4.6	0.0	0.0	0.0	1.2	0.1	15.2
Slovenia	25.2	11.7	13.5	5.3	0.0	0.0	0.0	0.5	0.2	18.2
Somalia	..	..	..	..	..	..	..	..	..	..
South Africa	16.5	13.3	3.2	7.6	1.6	1.2	0.3	2.3	0.2	5.2
Spain	24.0	12.8	11.1	4.6	0.0	0.0	0.0	0.3	0.4	15.0
Sri Lanka	19.9	5.1	14.8	2.9	0.0	0.0	0.6	0.3	0.3	16.3
Sudan	13.1	8.3	4.8	0.9	0.0	0.1	0.0	0.2	0.6	4.8
Swaziland	7.2	8.9	–1.7	5.1	0.0	0.0	0.0	0.2	0.1	3.1
Sweden	21.4	13.4	8.0	8.3	0.1	0.1	0.0	0.1	0.0	16.0
Switzerland	26.8	14.9	12.0	4.9	0.0	0.0	0.0	0.1	0.2	16.6
Syrian Arab Republic	*24.3*	10.4	13.9	2.6	27.5	0.1	0.0	1.7	0.8	–13.6
Tajikistan	5.0	7.4	–2.5	2.0	0.4	0.0	0.0	3.8	0.2	–4.8
Tanzania	14.5	7.5	7.0	2.4	0.0	0.4	0.0	0.3	0.2	8.5
Thailand	30.4	14.9	15.5	3.6	0.8	0.0	0.3	1.1	0.4	16.5
Togo	*8.0*	7.8	0.2	4.2	0.0	0.6	3.9	1.0	0.3	–1.4
Trinidad and Tobago	*28.9*	11.9	17.0	3.3	21.9	0.0	0.0	1.9	0.0	–3.4
Tunisia	22.7	10.1	12.6	6.6	3.6	0.5	0.1	0.7	0.3	13.9
Turkey	16.7	7.0	9.8	2.2	0.3	0.0	0.0	0.7	1.2	9.8
Turkmenistan	*36.3*	9.7	26.6	..	53.6	0.0	0.0	4.8	0.3	..
Uganda	15.8	7.6	8.2	1.9	0.0	0.0	5.6	0.2	0.0	4.3
Ukraine	27.1	19.0	8.1	6.4	7.6	0.0	0.0	6.3	1.0	–0.5
United Arab Emirates	..	..	..	..	..	..	..	..	..	..
United Kingdom	14.4	11.3	3.1	5.3	0.6	0.0	0.0	0.2	0.1	7.5
United States	14.4	11.8	2.6	5.4	0.9	0.0	0.0	0.4	0.3	6.4
Uruguay	13.5	11.1	2.4	3.0	0.0	0.0	0.3	0.3	1.9	3.0
Uzbekistan	*17.2*	9.9	7.3	9.4	51.7	0.0	0.0	10.9	0.6	–46.6
Venezuela, RB	26.6	7.4	19.2	4.3	27.0	0.3	0.0	1.0	0.0	–4.8
Vietnam	33.6	8.1	25.4	2.8	6.7	0.0	0.7	1.0	0.4	19.3
West Bank and Gaza	..	7.3	..	..	0.0	0.0	0.0	*0.0*	..	..
Yemen, Rep.	24.1	9.5	14.6	..	36.0	0.0	0.0	1.1	0.5	..
Zambia	..	8.2	..	2.0	0.0	1.1	0.0	0.4	..	..
Zimbabwe	..	*9.0*	..	6.9	*0.3*	*0.3*	*0.0*	*1.1*	0.5	..
World	**19.5 w**	**12.5 w**	**7.0 w**	**4.7 w**	**1.9 w**	**0.1 w**	**0.0 w**	**0.5 w**	**0.3 w**	**8.8 w**
Low income	21.5	8.4	13.1	2.6	5.9	0.4	0.8	1.3	0.6	6.7
Middle income	27.7	10.1	17.6	3.8	7.7	0.3	0.0	1.4	0.7	11.3
Lower middle income	30.8	9.9	20.9	3.2	6.6	0.3	0.1	1.7	0.7	14.6
Upper middle income	21.4	10.6	10.8	5.0	9.7	0.2	0.0	0.7	0.6	4.5
Low & middle income	26.6	9.8	16.8	3.6	7.4	0.3	0.2	1.4	0.6	10.5
East Asia & Pacific	38.8	9.2	29.6	2.2	3.4	0.3	0.1	1.8	0.8	25.5
Europe & Central Asia	22.7	10.5	12.2	4.8	9.7	0.1	..	2.1	0.6	..
Latin America & Carib.	19.3	10.3	9.0	4.2	5.2	0.6	0.0	0.5	0.5	6.3
Middle East & N. Africa	23.4	10.0	13.4	5.2	26.3	0.1	0.0	1.3	0.9	–10.0
South Asia	23.1	9.0	14.0	2.9	2.2	0.3	1.0	1.5	0.7	11.3
Sub-Saharan Africa	15.9	10.2	5.8	5.1	8.1	0.5	0.7	1.1	0.4	0.0
High income	17.4	13.1	4.3	5.0	0.7	0.0	..	0.3	0.3	..
Europe EMU	21.1	13.8	7.4	4.8	0.0	0.0	..	0.3	0.2	..

a. The cutoff date for these data is February 2004; later revisions are not captured in this table. b. Adjusted net savings do not include particulate emission damage.

Toward a broader measure of savings

About the data

Adjusted net savings measure the change in value of a specified set of assets, excluding capital gains. If a country's net savings are positive and the accounting includes a sufficiently broad range of assets, economic theory suggests that the present value of social welfare is increasing. Conversely, persistently negative adjusted net savings indicate that an economy is on an unsustainable path.

Adjusted net savings are derived from standard national accounting measures of gross national savings by making four adjustments. First, estimates of capital consumption of produced assets are deducted to obtain net national savings. Second, current expenditures on education are added to net national savings (in standard national accounting these expenditures are treated as consumption). Third, 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. And fourth, deductions are made for damage from carbon dioxide and particulate emissions.

The exercise treats education expenditures as an addition to savings effort. But because of the wide variability in the effectiveness of government education expenditures, these figures cannot be construed as the value of investments in human capital. The accounting for human capital is also incomplete because depreciation of human capital is not estimated.

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

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—in this case the returns from resource extraction or harvest are higher than the normal rate of return on capital. Natural resources give rise to rents because they are not produced; 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 net depletion figure for forest resources implies that the harvest rate exceeds the rate of natural growth; this is not the same as deforestation, which represents a change in land use (see *Definitions* for table 3.4). In principle, there should be an addition to savings in countries where growth exceeds harvest, but empirical estimates suggest that most of this net growth is in forested areas that cannot be exploited economically at present. Because the depletion estimates reflect only timber values, they ignore all the external and nontimber benefits associated with standing forests.

Pollution damage from emissions of carbon dioxide is calculated as the marginal social cost per unit multiplied by the increase in the stock of carbon dioxide. The unit damage figure represents the present value of global damage to economic assets and to human welfare over the time the unit of pollution remains in the atmosphere.

Pollution damage from particulate emissions is estimated by valuing the human health effects from exposure to particulate matter less than 10 microns in diameter. The estimates are calculated as willingness to pay to avoid mortality attributable to particulate emissions (in particular, mortality relating to cardiopulmonary disease in adults, lung cancer in adults, and acute respiratory infections in children).

Definitions

• **Gross national savings** are calculated as the difference between gross national income and public and private consumption, plus net current transfers. • **Consumption of fixed capital** represents the replacement value of capital used up in the process of production. • **Net national savings** are equal to gross national savings less the value of consumption of fixed capital. • **Education expenditure** refers to public 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 coal, crude oil, and natural gas. • **Mineral depletion** is equal to the product of unit resource rents and the physical quantities of minerals extracted. It refers to tin, gold, lead, zinc, iron, copper, nickel, silver, bauxite, and phosphate. • **Net forest depletion** is calculated as the product of unit resource rents and the excess of roundwood harvest over natural growth. • **Carbon dioxide emissions damage** is estimated to be $20 per ton of carbon (the unit damage in 1995 U.S. dollars) times the number of tons of carbon emitted. • **Particulate emissions damage** is calculated as the willingness to pay to avoid mortality attributable to particulate emissions. • **Adjusted net savings** are equal to net national savings plus education expenditure and minus energy depletion, mineral depletion, net forest depletion, and carbon dioxide and particulate emissions damage.

Data sources

Gross national 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 2002. The education expenditure data are from the United Nations Statistics Division's *Statistical Yearbook 1997,* extrapolated to 2002. 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). The estimates of damage from particulate emissions are from Pandey and others (2003). The conceptual underpinnings of the savings measure appear in Hamilton and Clemens (1999).