3 ENVIRONMENT

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Agriculture is environment

For the 70 percent of the world's poor in rural areas, agriculture is the major source of income and employment. It takes up more than one-third of the world's area and more than two-thirds of the world's water withdrawals. Competition for these resources is increasing with growth of population, cities, and demand for food. And climate change is altering the patterns of rainfall and temperature that agriculture depends on. The depletion and degradation of these resources thus pose serious challenges to the capacity of agriculture to produce enough food and other agricultural products to sustain the livelihoods of rural populations and accommodate the needs of urban populations.

In the agriculture-based economies of Sub-Saharan Africa agriculture contributed a third to economic growth in 1990–2005. In the transforming economies of Asia, mainly China, India, and Indonesia, it contributed 8 percent to economic growth, while making up a fifth of the economy and employing half the labor force. And in the urbanizing economies of Latin America and some countries of Eastern Europe and Central Asia, it contributed 10 percent to the economy and to growth. Agriculture is a way of life throughout the world, with 2.5 billion of 3 billion rural people tied to agricultural activities, particularly to producing food.

Producing food requires enormous amounts of water and cropland. In some parts of the world, the demand for water exceeds the supply. But in many places it appears that water scarcity is caused not by shortages of water but by its mismanagement. Not enough is known because data on the availability and productivity of water are limited. However, water is clearly central to the social, political, and economic affairs of a country and to cooperation or conflict across boundaries.

Agricultural intensification—producing more crops on the same or smaller amounts of land—along with irrigation and the conversion of forest lands to cropland have helped meet the increasing demand for food. Food production has thankfully outpaced population growth in most regions. But this has too often been at the expense of soil degradation, water pollution, and added pressure on water resources. Turning forests into agricultural lands reduces biodiversity and contributes to global warming. Rising sea levels, warming temperatures, and changes in weather patterns affect millions of people. The impact is especially severe for those in developing countries, threatening their potential to move out of poverty.

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Agriculture, poverty reduction, and food security

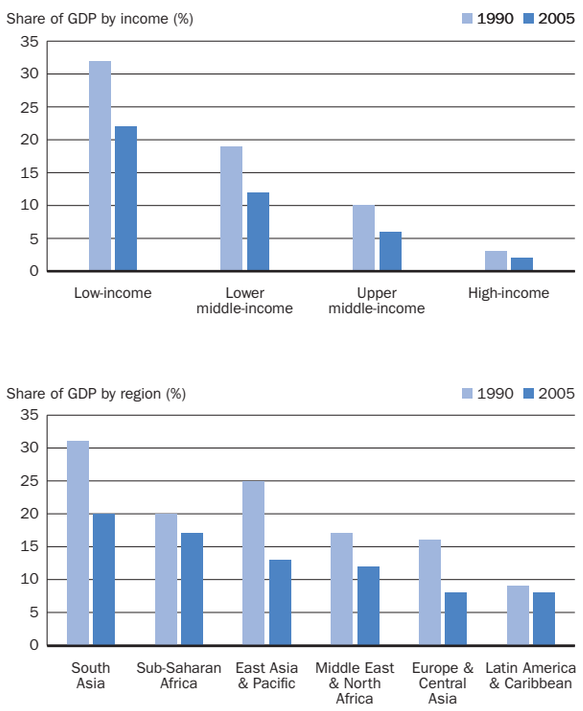
With economic growth the share of agriculture in the global economy declines. Even so, agriculture remains important in many developing economies and the source of income for many poor people. In some African countries more than half the GDP is in agriculture—in Liberia 64 percent, in Guinea-Bissau 60 percent, and in Central African Republic 54 percent. On average agriculture contributes more than 20 percent to value added in low-income economies (figure 3a).

Globally, about 40 percent of the active labor force is in agriculture, but in Sub-Saharan Africa and Asia and the Pacific about 60 percent is in agriculture. Compare that with 18 percent in Latin America and 4 percent in high-income economies. Variations across countries are even greater, with agricultural employment's share ranging from less than 2 percent in the United Kingdom and the United States to 44 percent in China and 80 percent in Nepal. Agriculture is associated with natural wealth—particularly in developing economies. A recent World Bank study estimates that roughly two-thirds of the natural wealth in low-income countries is embodied in cropland and pastureland (World Bank 2006e).

Agriculture's changing role is underscored by rapid rural-urban migration. The United Nations estimates that in 2007, for the first time, the majority of the global population will be urban (United Nations Population Division 2005, *World Population Prospects 2004*). And this will continue. Urban population is expected to grow 1.8 percent a year through 2030, almost twice as fast as the global population. Productivity must continue to rise, so that the shrinking rural population can provide more agricultural products for a rising urban population with higher incomes.

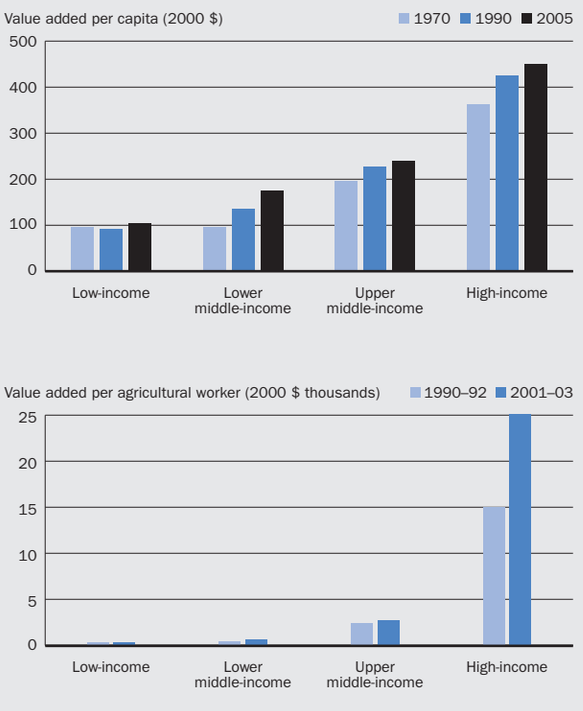
In recent years the increases in demand for food have been met by higher productivity through agricultural intensification, technological advance, mechanization, and irrigation (figure 3b). However, continuing depletion and degradation of natural resources that constitute the agricultural sector's main inputs—water and land—could slow the growth of productivity and undermine food security.

Agriculture's share in GDP—declining, but still more than a fifth in low-income economies **3a**



Source: Table 4.2.

Agricultural productivity has increased, yielding more output for all **3b**



Source: World Bank data files.

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Water . . . water . . .

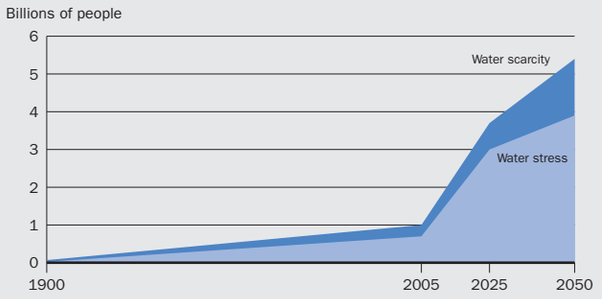
Water is life. Water is health. Water is livelihood. But some 1.1 billion people in developing countries have inadequate access to water, and about 700 million people in 43 countries live below the water-stress threshold of 1,700 cubic meters per person per year (figure 3c). One billion people live in areas of *economic* water scarcity—where human, institutional, and financial capital limit access to water even though water in nature is available locally to meet human demands, a situation especially prevalent in much of Sub-Saharan Africa and South Asia (CAWMA 2007).

Water is needed for most economic activities, but agriculture is the most water-intensive sector (figure 3d), using 70 percent of global water withdrawals (indicator table 3.5). Each year some 7,100 cubic kilometers of water are consumed by crops to meet global food demand, the equivalent of 90 times the annual runoff of the Nile River, or more than 3,000 liters per person per day. Most of it (78 percent) comes directly from rainfall, the remainder from irrigation (CAWMA 2007). Competition between water for food production and for other sectors will intensify, but food production will remain the largest consumer of water worldwide. Water productivity is much lower in agriculture than it is in industry (figure 3e).

Globally, there is more than enough water for domestic purposes, for agriculture, and for industry. But access to water is very uneven across and within countries. Poor people have limited access, not so much because of physical water scarcity, but because of their lack of purchasing power and because of inappropriate policies that limit their access to infrastructure.

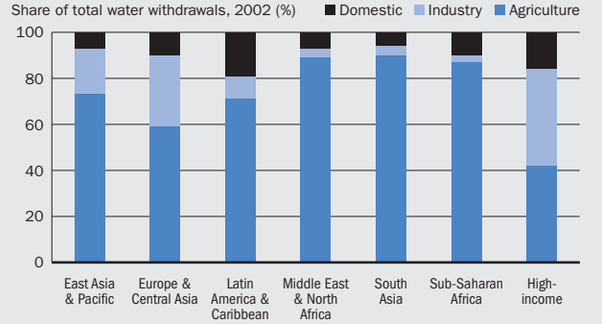
Techniques to control soil moisture and intensify agricultural production have been substantially improved in the last 50 years in many parts of the world. Irrigation is increasing globally, in all income groups and all regions (figure 3f). While the world's cultivated land increased by about 13 percent from 1961 to 2003, the irrigated area almost doubled, from 10 percent to 18 percent of cropland. About 70 percent of the world's irrigated land and 30 percent of cultivated land are in Asia. By contrast, there is very little irrigation in Sub-Saharan Africa, where agriculture is almost exclusively rainfed.

More people will experience water scarcity and water stress 3c



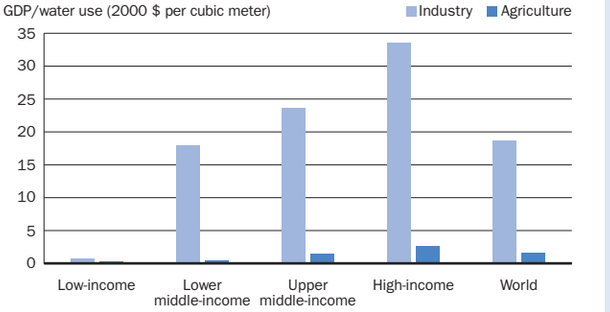
Source: UNDP 2006.

Agriculture is the biggest consumer of water . . . 3d



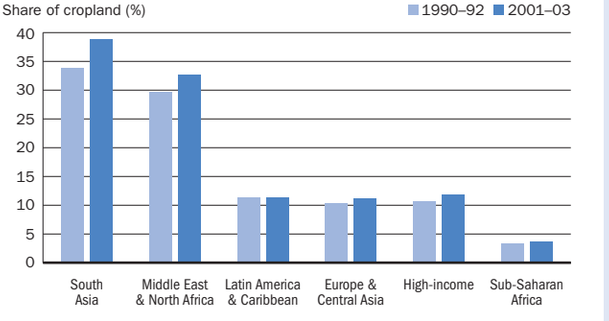
Source: Table 3.5.

. . . and the least productive user 3e



Source: Table 3.5 and World Bank data files.

Irrigation has increased, demanding more water 3f



Source: Table 3.2.

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Land use and land loss

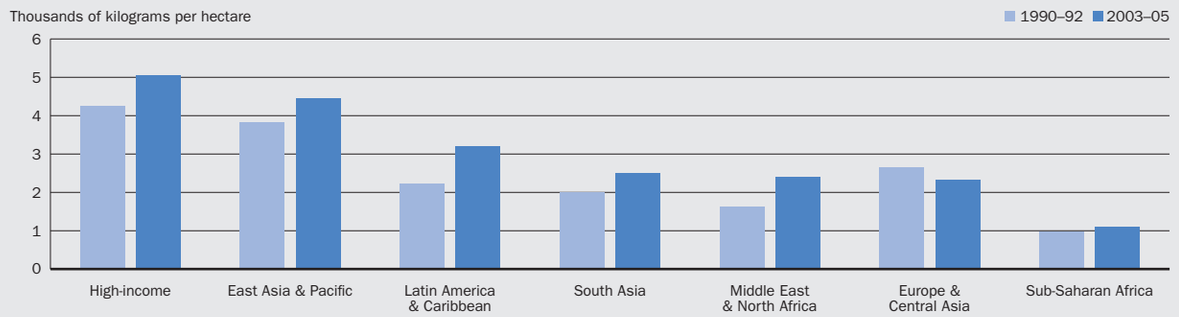
Global demand for food is projected to double in the next 50 years, as urbanization proceeds and income rises (CAWMA 2007). But arable land per capita is shrinking. In the last 12 years it has fallen from 2,100 square meters per person to 1,700 in low-income countries, and from 2,300 to 2,100 in high-income economies.

Agricultural intensification has met global food demand. In Asia land under cereal production increased only 4 percent between 1970 and 1995, while cereal production doubled due to the green revolution (Rosengrant and Hazel 2000). More recently, the high-income economies, already the most intensified producers, realized an almost 20 percent increase—from 4,260 kilograms per hectare in 1990–92 to 5,040 in 2003–05 (figure 3g), substantially higher than their rate of population increase. In contrast, cereal yields in water-stressed Sub-Saharan Africa increased by 10 percent—far less than the region's population growth. The differences in productivity are even starker among countries, ranging from 296 kilograms per hectare in Eritrea to 8,710 in Belgium.

Perhaps more worrisome, productivity has declined substantially on approximately 16 percent of agricultural land in developing countries, especially in Africa and Central America. One study estimates that global cropland production is 12.7 percent lower and pastoral production 3.8 percent lower than would have been the case without soil degradation. This implies a total agricultural production loss of 4.8 percent. Another estimate puts the global loss at 8.9 percent (Scherr 1999, pp. 16–20).

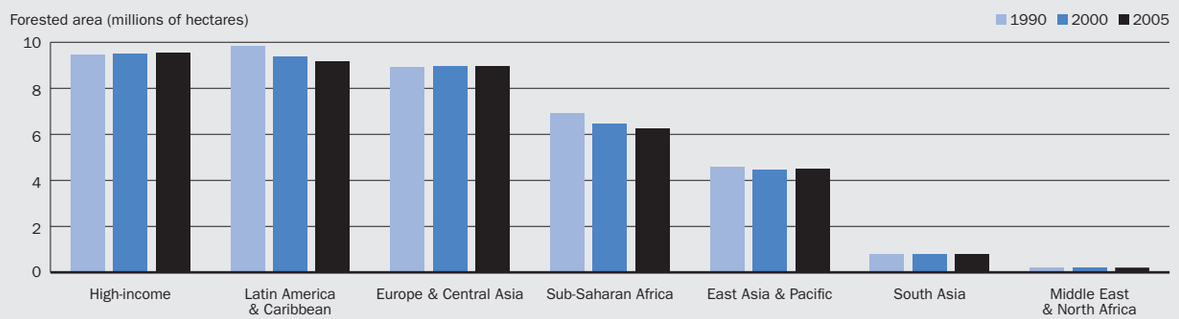
In many countries soil degradation and the loss of agricultural land combined with population growth have created pressure that led to substantial deforestation. Global forested area in 2005 was about 4 billion hectares, covering 30 percent of total land area (figure 3h). But deforestation continues at about 13 million hectares a year. Reforestation reduced the net loss of forest areas to 7.3 million hectares a year in 2000–05—an improvement from losses of 8.9 million hectares a year in 1990–2000. Africa and Latin America continued to have the largest loss of forest after 1990.

Cereal yields have increased in most regions—East Asia has almost reached the high-income economies **3g**



Source: Table 3.3.

Forested areas are shrinking in Latin America and Sub-Saharan Africa—recovering in East Asia **3h**



Source: Table 3.4.

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Agriculture and climate change

Agriculture and deforestation are estimated to be responsible for one-third of greenhouse gas emissions, which are the main contributors to climate change (figure 3i). In turn, climate change affects agriculture more than any other sector, increasing risks of crop failures and livestock losses and threatening food security. The decline in crop yields, especially in Africa, could leave hundreds of millions without the ability to produce or purchase sufficient food. Warming may also induce sudden shifts in regional weather patterns that would have severe consequences for water availability and flooding in tropical regions. And the impact of sea level rise could be catastrophic for many developing countries (Dasgupta and others 2007).

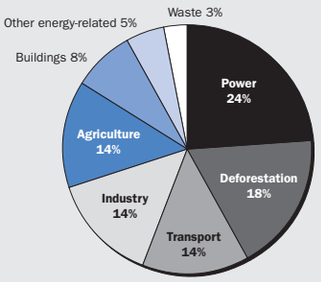
Changes in climate patterns are already observed in some parts of the world. Average rainfall has fallen in the Sahel (figure 3j), with droughts in the 1970s and 1980s that resulted in more than 100,000 deaths (UNEP 2002, p. 219). Africa has had one major drought in each of the last three decades (box 3k). Ethiopia's 1984 drought affected 8.7 million people—one million died and millions more faced malnourishment and famine (UNEP 2002). The 1991–92 drought in South Africa reduced cereal harvests and exposed more than 17 million to the risk of starvation (UNEP 2002).

Delay in addressing climate change could prove tremendously costly, while efforts to mitigate may be less expensive than commonly feared. A recent cost assessment argues that tackling climate change is a pro-growth strategy—and that ignoring it will ultimately undermine economic growth (Stern 2006). If action does not start now, the world may face far higher costs later. Efforts to stabilize emissions must aim not only at the energy sector, but also at reducing deforestation, encouraging reforestation, and fostering more sustainable agricultural practices.

While all countries will be affected, the poorest countries and people will suffer earliest and most because they depend heavily on agriculture, the most climate-sensitive of all economic sectors. The developing regions are also at a geographic disadvantage. They are already warmer, on average, than developed regions. They suffer from high rainfall variability. And their low incomes and other vulnerabilities make their adaptation to climate change particularly difficult.

Agriculture accounts for a seventh of all greenhouse gas emissions **3i**

Greenhouse gas emissions by source, 2000



Source: Stern Review.

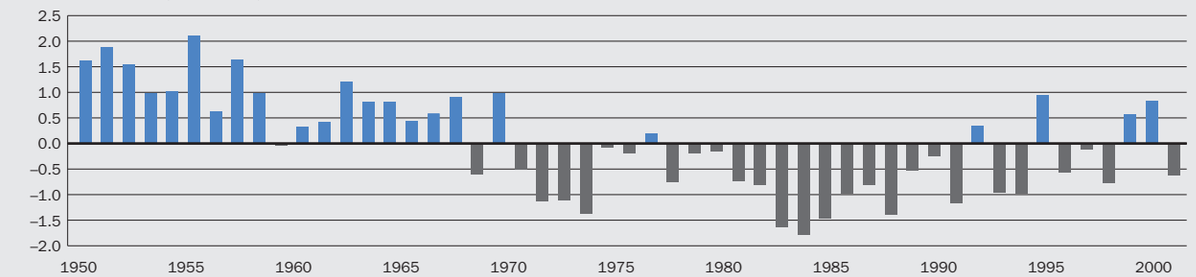
Horn of Africa suffers floods after parching drought **Box 3k**

In November 2006 thousands of Somalis trekked from flooded refugee camps to drier ground in northeast Kenya as UN agencies rushed emergency supplies to some 1.8 million people hit by the worst floods in the Horn of Africa in 50 years. The floods, which also affected Kenya and Ethiopia, began in late October. They worsened food insecurity caused by severe drought earlier this year. In some areas the soil was so parched that it was not able to absorb the rain, and the few crops that survived the drought were destroyed by floods.

The flood displaced more than 100,000 of the estimated 160,000 mainly Somali refugees in Dadaab, who had fled the increasing violence in their country. At least 80 people died in floods in southern Somalia. The rain also dislodged landmines seeded during Somalia's long-standing conflict, posing additional hazards.

Less rain is falling in the Sahel, with dire consequences **3j**

Mean normalized rainfall, 1950–2000, June–October



Note: The averages are standardized for the period 1950–2000 so that the mean of the series is zero and the standard deviation is one.
Source: World Bank 2003c.

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3.1 Rural population and land use

	Rural population			Land area	Land use							
	% of total		average annual % growth	thousand sq. km	Forest area		% of land area Permanent cropland		Arable land		Arable land hectares per 100 people	
	1990	2005	1990–2005	2005	1990	2005	1990	2005	1990	2005	1990–92	2003–05
Afghanistan	..	..	..	652.1	2.0	1.3	0.2	0.2	12.1	12.1	..	..
Albania	63.6	54.6	–1.4	27.4	28.8	29.0	4.6	4.5	21.1	21.1	18.8	18.6
Algeria	47.9	36.7	–0.1	2,381.7	0.8	1.0	0.2	0.3	3.0	3.2	24.6	23.7
Angola	62.9	46.7	0.7	1,246.7	48.9	47.4	0.4	0.2	2.3	2.6	21.3	21.9
Argentina	13.0	9.9	–0.7	2,736.7	12.9	12.1	0.4	0.4	9.6	10.2	74.7	73.4
Armenia	32.5	35.9	–0.4	28.2	12.3	10.0	4.3	2.1	18.2	17.6	16.2	16.4
Australia	14.6	11.8	–0.3	7,682.3	21.9	21.3	0.0	0.0	6.2	6.4	249.0	241.1
Austria	34.2	34.0	0.3	82.5	45.8	46.8	1.0	0.8	17.3	16.8	17.3	17.0
Azerbaijan	46.3	48.5	1.4	82.7	11.2	11.3	6.0	2.7	21.1	22.3	22.6	22.2
Bangladesh	80.2	74.9	1.6	130.2	6.8	6.7	2.3	3.5	70.2	61.1	6.1	5.7
Belarus	33.6	27.8	–1.6	207.5	35.6	38.0	1.4	0.6	30.1	26.3	58.4	56.2
Belgium	3.6	2.8	–1.4	30.2	22.4	22.1	0.5	0.8	23.3	27.9	8.2	8.1
Benin	65.5	59.9	2.6	110.6	30.0	21.3	0.9	2.4	14.6	24.0	33.1	33.5
Bolivia	44.4	35.8	0.7	1,084.4	57.9	54.2	0.1	0.2	1.9	2.8	34.9	34.5
Bosnia and Herzegovina	60.8	54.3	–0.8	51.2	43.2	42.7	2.0	1.9	23.6	19.5	25.8	25.9
Botswana	58.1	42.6	–0.5	566.7	24.2	21.1	0.0	0.0	0.7	0.7	21.4	21.3
Brazil	25.2	15.8	–1.7	8,459.4	61.5	56.5	0.8	0.9	6.0	7.0	33.2	32.5
Bulgaria	33.6	30.0	–1.5	108.6	30.1	33.4	2.7	1.9	34.9	29.2	43.4	42.0
Burkina Faso	86.2	81.7	2.6	273.6	26.1	24.8	0.2	0.2	12.9	17.7	37.8	39.0
Burundi	93.7	90.0	1.4	25.7	11.3	5.9	14.0	14.2	36.2	38.6	14.7	14.1
Cambodia	87.4	80.3	1.8	176.5	73.3	59.2	0.6	0.9	20.9	21.0	28.5	26.8
Cameroon	59.3	45.4	0.5	465.4	52.7	45.6	2.6	2.6	12.8	12.8	39.3	37.8
Canada	23.4	19.9	–0.2	9,093.5	34.1	34.1	0.7	0.7	5.0	5.0	147.4	144.4
Central African Republic	63.2	62.0	1.9	623.0	37.2	36.5	0.1	0.2	3.1	3.1	50.4	49.0
Chad	79.2	74.7	2.8	1,259.2	10.4	9.5	0.0	0.0	2.6	2.9	42.0	39.4
Chile	16.7	12.4	–0.6	748.8	20.4	21.5	0.3	0.4	3.7	2.6	12.7	12.4
China	72.6	59.6	–0.4	9,598.1[a]	16.8	21.2	0.8	1.3	11.1	11.1	8.1	8.0
Hong Kong, China	0.5	0.0	..	1.0	..	..	..	..	..	..	..	..
Colombia	31.3	27.3	1.0	1,109.5	55.4	54.7	1.5	1.5	3.0	1.8	5.8	4.8
Congo, Dem. Rep.	72.2	67.9	2.3	2,267.1	62.0	58.9	0.5	0.5	2.9	3.0	13.1	12.4
Congo, Rep.	45.7	39.8	2.3	341.5	66.5	65.8	0.1	0.2	1.4	1.4	13.9	13.1
Costa Rica	49.3	38.3	0.7	51.1	50.2	46.8	4.9	5.9	5.1	4.4	5.6	5.4
Côte d'Ivoire	60.3	55.0	1.8	318.0	32.1	32.7	11.0	11.3	7.6	10.4	18.6	18.8
Croatia	46.0	43.5	–0.7	55.9	37.8	38.2	1.4	2.1	30.8	19.8	32.7	27.6
Cuba	26.6	24.5	–0.2	109.8	18.7	24.7	7.4	6.6	27.6	27.9	28.6	27.3
Czech Republic	24.8	26.5	0.3	77.3	34.0	34.3	3.1	3.1	41.1	39.4	30.1	29.9
Denmark	15.2	14.4	0.0	42.4	10.5	11.8	0.2	0.2	60.4	52.7	42.7	41.8
Dominican Republic	44.8	33.2	–0.5	48.4	28.4	28.4	9.3	10.3	21.7	22.7	13.1	12.7
Ecuador	44.9	37.2	0.4	276.8	49.9	39.2	4.8	4.4	5.8	4.9	12.0	10.0
Egypt, Arab Rep.	56.5	57.2	2.0	995.5	0.0	0.1	0.4	0.5	2.3	3.0	4.2	4.1
El Salvador	50.8	40.2	0.4	20.7	18.1	14.4	12.5	12.1	26.5	31.9	10.2	9.9
Eritrea	84.2	80.6	2.3	101.0	..	15.4	..	0.0	..	5.6	15.1	13.9
Estonia	28.9	30.9	–0.6	42.4	51.0	53.9	0.5	0.3	27.0	13.9	52.1	40.9
Ethiopia	87.4	84.0	2.0	1,000.0	13.7	13.0	0.6	0.7	9.8	11.1	15.5	16.1
Finland	38.6	38.9	0.4	304.6	72.9	73.9	0.0	0.0	7.4	7.3	42.2	42.5
France	25.9	23.3	–0.3	550.1	26.4	28.3	2.2	2.1	32.7	33.6	31.1	30.5
Gabon	30.9	16.4	–1.7	257.7	85.1	84.5	0.6	0.7	1.1	1.3	25.1	24.2
Gambia, The	61.7	46.1	1.3	10.0	44.2	47.1	0.5	0.5	18.2	31.5	22.5	21.9
Georgia	44.8	47.8	–0.9	69.5	39.7	39.7	7.8	3.8	11.8	11.5	17.1	17.8
Germany	26.6	24.8	–0.2	348.8	30.8	31.8	1.3	0.6	34.3	34.1	14.3	14.4
Ghana	63.5	52.2	1.1	227.5	32.7	24.2	6.6	9.7	11.9	18.4	20.0	19.7
Greece	41.2	41.0	0.6	128.9	25.6	29.1	8.3	8.8	22.5	20.4	24.9	24.1
Guatemala	58.9	52.8	1.6	108.4	43.8	36.3	4.5	5.6	12.0	13.3	12.3	12.0
Guinea	72.0	67.0	2.2	245.7	30.1	27.4	2.0	2.6	3.0	4.5	11.7	12.2
Guinea-Bissau	71.9	70.4	2.9	28.1	78.8	73.7	4.2	8.9	10.7	10.7	21.3	20.1
Haiti	70.5	61.2	0.5	27.6	4.2	3.8	11.6	11.6	28.3	28.3	9.7	9.4

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Rural population and land use

	Rural population			Land area	Land use							
	% of total		average annual % growth	thousand sq. km	Forest area		% of land area Permanent cropland		Arable land		Arable land hectares per 100 people	
	1990	2005	1990–2005	2005	1990	2005	1990	2005	1990	2005	1990–92	2003–05
Honduras	59.7	53.5	1.9	111.9	66.0	41.5	3.2	*3.2*	13.1	9.5	16.2	15.5
Hungary	34.2	33.7	–0.2	89.6	20.0	22.1	2.6	2.3	56.2	51.3	45.2	45.5
India	74.5	71.3	1.4	2,973.2	21.5	22.8	2.2	3.4	54.8	53.7	15.5	14.8
Indonesia	69.4	51.9	–0.6	1,811.6	64.3	48.8	6.5	7.5	11.2	12.7	10.3	10.6
Iran, Islamic Rep.	43.7	33.1	–0.4	1,636.2	6.8	6.8	0.8	0.9	9.3	9.8	23.3	24.4
Iraq	30.3	..	..	437.4	1.8	1.9	0.7	*0.6*	12.1	*13.1*	21.9	..
Ireland	43.1	39.5	0.5	68.9	6.4	9.7	0.0	0.0	15.1	17.6	29.7	29.5
Israel	9.6	8.4	1.6	21.6	7.1	7.9	4.1	3.5	15.9	14.6	5.3	4.8
Italy	33.3	32.4	0.0	294.1	28.5	33.9	10.1	8.6	30.6	26.3	14.7	13.6
Jamaica	50.6	46.9	0.2	10.8	31.9	31.3	9.2	*10.2*	11.0	*16.1*	6.7	6.6
Japan	36.9	34.2	–0.2	364.5	68.4	68.2	1.3	0.9	13.1	12.0	3.5	3.4
Jordan	27.8	17.7	0.4	88.2	0.9	0.9	0.8	1.0	2.0	2.1	3.9	3.5
Kazakhstan	43.7	42.7	–0.9	2,699.7	1.3	1.2	0.1	0.1	13.3	8.3	148.7	149.3
Kenya	81.8	79.3	2.3	569.1	6.5	6.2	0.9	*1.0*	7.4	*8.2*	14.6	14.2
Korea, Dem. Rep.	41.6	38.4	0.4	120.4	68.1	51.4	1.5	1.7	19.0	23.3	12.0	12.3
Korea, Rep.	26.2	19.2	–1.1	98.7	64.5	63.5	1.6	2.0	19.8	16.6	3.6	3.4
Kuwait	2.0	1.7	1.7	17.8	0.2	0.3	0.1	0.2	0.2	0.8	0.6	0.6
Kyrgyz Republic	62.2	64.2	1.3	191.8	4.4	4.5	0.6	0.4	7.1	6.7	27.2	25.9
Lao PDR	84.6	79.4	2.0	230.8	75.0	69.9	0.3	0.4	3.5	4.3	16.7	17.2
Latvia	30.7	32.2	–0.7	62.3	44.7	47.2	0.6	0.2	28.0	17.5	41.0	44.1
Lebanon	16.9	13.4	0.2	10.2	11.8	13.3	11.9	*14.0*	17.9	*16.6*	5.2	4.9
Lesotho	82.8	81.3	0.8	30.4	0.2	0.3	0.1	*0.1*	10.4	*10.9*	18.4	18.3
Liberia	54.7	41.9	2.1	96.3	42.1	32.7	2.2	*2.3*	4.2	*4.0*	12.1	11.9
Libya	21.4	15.2	–0.3	1,759.5	0.1	0.1	0.2	*0.2*	1.0	*1.0*	33.5	32.3
Lithuania	32.4	33.4	–0.4	62.7	31.0	33.5	1.1	0.6	47.3	30.4	58.8	49.0
Macedonia, FYR	42.2	31.1	–1.6	25.4	35.6	35.6	1.5	1.8	33.9	22.3	27.9	27.9
Madagascar	76.4	73.2	2.7	581.5	23.5	22.1	1.0	*1.0*	4.7	*5.1*	17.6	16.7
Malawi	88.4	82.8	1.7	94.1	41.4	36.2	1.2	*1.5*	19.3	*26.0*	18.7	19.9
Malaysia	50.2	32.7	–0.5	328.6	68.1	63.6	16.0	*17.6*	5.2	*5.5*	7.7	7.4
Mali	76.7	69.5	2.2	1,220.2	11.5	10.3	0.0	0.0	1.7	3.9	38.9	36.6
Mauritania	60.3	59.6	2.7	1,025.2	0.4	0.3	0.0	*0.0*	0.4	*0.5*	17.9	16.9
Mauritius	56.1	57.6	1.3	2.0	19.2	18.2	3.0	3.0	49.3	49.3	8.3	8.1
Mexico	27.5	24.0	0.5	1,908.7	36.2	33.7	1.0	*1.3*	12.6	*13.0*	25.1	24.6
Moldova	53.2	53.3	–0.3	32.9	9.7	10.0	22.9	9.1	54.3	56.2	43.3	43.9
Mongolia	43.0	43.3	1.3	1,566.5	7.3	6.5	0.0	*0.0*	0.9	*0.8*	49.1	48.3
Morocco	51.6	41.3	0.0	446.3	9.6	9.8	1.6	*2.0*	19.5	*19.0*	30.4	29.4
Mozambique	78.9	65.5	1.4	784.1	25.5	24.6	0.3	*0.3*	4.4	*5.5*	22.0	22.8
Myanmar	75.1	69.4	0.9	657.6	59.6	49.0	0.8	*1.4*	14.5	*15.3*	20.5	20.4
Namibia	72.3	64.9	1.8	823.3	10.6	9.3	0.0	*0.0*	0.8	*1.0*	42.3	41.0
Nepal	91.1	84.2	1.8	143.0	33.7	25.4	0.5	0.9	16.0	16.5	9.4	8.9
Netherlands	31.3	19.8	–2.4	33.9	10.2	10.8	0.9	1.0	25.9	26.8	5.7	5.6
New Zealand	15.3	13.8	0.5	268.0	28.8	31.0	5.1	*7.0*	9.4	*5.6*	38.5	37.4
Nicaragua	46.9	41.0	0.9	121.4	53.9	42.7	1.6	*1.9*	10.7	*15.9*	38.5	37.8
Niger	84.6	83.2	3.3	1,266.7	1.5	1.0	0.0	*0.0*	8.7	*11.4*	118.8	111.0
Nigeria	65.0	51.8	1.0	910.8	18.9	12.2	2.8	*3.2*	32.4	*33.5*	24.1	24.2
Norway	28.0	22.6	–0.9	304.3	30.0	30.8	..	..	2.8	2.8	19.6	18.9
Oman	34.6	28.5	1.1	309.5	0.0	0.0	0.1	*0.1*	0.1	*0.1*	1.5	1.5
Pakistan	69.4	65.1	2.0	770.9	3.3	2.5	0.6	1.0	26.6	27.6	15.2	14.1
Panama	46.1	29.2	–1.1	74.4	58.8	57.7	2.1	*2.0*	6.7	*7.4*	18.1	17.6
Papua New Guinea	86.9	86.6	2.4	452.9	69.6	65.0	1.3	*1.4*	0.4	*0.5*	3.9	4.0
Paraguay	51.3	41.5	0.8	397.3	53.3	46.5	0.2	*0.2*	5.3	*7.7*	54.3	53.6
Peru	31.1	27.4	0.9	1,280.0	54.8	53.7	0.3	*0.5*	2.7	*2.9*	14.0	13.6
Philippines	51.2	37.3	–0.1	298.2	35.5	24.0	14.8	*16.8*	18.4	*19.1*	7.4	7.1
Poland	38.7	37.9	–0.2	306.3	29.2	30.0	1.1	1.2	47.3	39.6	35.3	32.6
Portugal	52.1	42.4	–0.9	91.5	33.9	41.3	8.5	8.5	25.6	16.8	16.4	14.9
Puerto Rico	27.8	2.4	–14.6	8.9	45.5	46.0	5.6	4.7	7.3	8.0	1.7	1.8

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3.1 Rural population and land use

	Rural population			Land area	Land use							
	% of total		average annual % growth	thousand sq. km	Forest area		% of land area Permanent cropland		Arable land		Arable land hectares per 100 people	
	1990	2005	1990–2005	2005	1990	2005	1990	2005	1990	2005	1990–92	2003–05
Romania	45.7	46.3	–0.4	230.0	27.8	27.7	2.6	2.3	41.2	40.4	42.4	43.2
Russian Federation	26.6	27.0	–0.2	16,381.4	49.4	49.4	0.2	0.1	8.3	7.4	85.0	84.9
Rwanda	94.6	80.7	1.8	24.7	12.9	19.5	12.4	*10.9*	35.7	*48.6*	12.0	13.7
Saudi Arabia	23.4	19.0	1.0	2,000.0[b]	1.4	1.4	0.0	*0.1*	1.7	*1.8*	17.0	16.3
Senegal	61.0	58.4	2.3	192.5	48.6	45.0	0.1	*0.2*	12.1	*12.8*	22.9	22.1
Serbia and Montenegro	49.1	47.8	–2.4	102.0	25.1	26.4	2.4	3.1	51.9	34.4	41.9	42.4
Sierra Leone	69.9	59.3	0.9	71.6	42.5	38.5	0.8	*1.0*	6.8	*8.0*	10.8	11.1
Singapore	0.0	0.0	..	0.7	3.0	2.9	1.5	0.3	1.5	0.9	0.0	0.0
Slovak Republic	43.5	43.8	0.2	48.1	40.0	40.1	1.0	0.5	32.5	28.9	27.1	26.0
Slovenia	49.6	49.0	–0.1	20.1	59.0	62.8	1.2	1.3	14.1	8.7	8.6	8.7
Somalia	70.3	64.8	1.0	627.3	13.2	11.4	0.0	*0.0*	1.6	*1.7*	14.5	13.6
South Africa	48.0	40.7	0.9	1,214.5	7.6	7.6	0.7	*0.8*	11.1	*12.1*	33.0	32.2
Spain	24.6	23.3	0.3	499.2	27.0	35.9	9.7	9.9	30.7	27.4	32.2	32.0
Sri Lanka	82.8	84.9	1.1	64.6	36.4	29.9	15.9	*15.5*	13.5	*14.2*	4.7	4.8
Sudan	73.4	59.2	0.8	2,376.0	32.1	28.4	0.1	*0.2*	5.5	*7.2*	48.4	48.8
Swaziland	77.1	75.9	2.6	17.2	27.4	31.5	0.7	*0.8*	10.5	*10.3*	16.7	16.1
Sweden	16.9	15.8	–0.1	410.3	66.7	67.1	0.0	0.0	6.9	6.6	30.3	29.8
Switzerland	31.6	24.8	–1.0	40.0	28.9	30.5	0.5	0.6	9.8	10.3	5.7	5.5
Syrian Arab Republic	51.1	49.4	2.4	183.8	2.0	2.5	4.0	4.7	26.6	26.5	26.6	25.6
Tajikistan	68.5	75.3	2.0	140.0	2.9	2.9	1.4	*0.9*	6.3	*6.6*	14.9	14.6
Tanzania	81.1	75.8	2.1	883.6	46.9	39.9	1.0	*1.2*	4.0	*4.5*	11.3	10.8
Thailand	70.6	67.7	0.8	510.9	31.2	28.4	6.1	*7.0*	34.2	*27.7*	25.6	22.4
Togo	69.9	59.9	2.0	54.4	12.6	7.1	1.7	*2.2*	38.6	*46.1*	45.5	43.0
Trinidad and Tobago	91.5	87.8	0.2	5.1	45.8	44.1	9.0	*9.2*	14.4	*14.6*	5.8	5.8
Tunisia	40.4	34.7	0.3	155.4	4.1	6.8	12.5	*13.8*	18.7	*18.0*	29.0	28.4
Turkey	40.8	32.7	0.2	769.6	12.6	13.2	3.9	3.6	32.0	31.0	34.8	33.2
Turkmenistan	54.9	53.8	1.6	469.9	8.8	8.8	0.2	*0.1*	3.0	*4.7*	40.5	46.8
Uganda	88.9	87.4	3.1	197.1	25.0	18.4	9.4	*10.9*	25.4	*26.4*	20.3	19.4
Ukraine	33.2	32.2	–0.9	579.4	16.0	16.5	3.1	1.6	59.2	56.0	66.9	68.5
United Arab Emirates	20.9	23.3	7.4	83.6	2.9	3.7	0.2	*2.3*	0.4	*0.8*	2.0	1.6
United Kingdom	11.3	10.3	–0.4	241.9	10.8	11.8	0.3	0.2	27.4	23.7	9.7	9.6
United States	24.7	19.2	–0.5	9,161.9	32.6	33.1	0.2	0.3	20.3	19.0	61.6	59.7
Uruguay	11.0	8.0	–1.3	175.0	5.2	8.6	0.3	*0.2*	7.2	*7.8*	40.7	40.1
Uzbekistan	59.9	63.3	2.0	425.4	7.2	7.7	0.6	*0.8*	10.8	*11.0*	18.0	18.4
Venezuela, RB	16.0	6.6	–3.9	882.1	59.0	54.1	0.9	*0.9*	3.2	*2.9*	10.5	10.1
Vietnam	79.7	73.6	1.0	310.1	28.8	41.7	3.2	7.6	16.4	21.3	8.2	8.0
West Bank and Gaza	32.1	28.4	3.4	6.0	1.5	1.5	19.1	19.1	18.4	17.8	3.4	3.1
Yemen, Rep.	79.1	72.7	3.1	528.0	1.0	1.0	0.2	*0.3*	2.9	*2.9*	8.2	7.8
Zambia	60.6	65.0	2.8	743.4	66.1	57.1	0.0	*0.0*	7.1	*7.1*	48.3	46.6
Zimbabwe	71.0	64.1	0.7	386.9	57.5	45.3	0.3	*0.3*	7.5	*8.3*	25.4	25.0
World	**57.0 w**	**51.2 w**	**0.6 w**	**129,606.2 s**	**31.5 w**	**30.5 w**	**1.0 w**	***1.1* w**	**10.7 w**	***10.6* w**	**22.3 w**	**21.9 w**
Low income	74.6	70.0	1.6	28,184.8	26.3	23.9	1.0	*1.3*	12.9	*13.6*	17.3	16.9
Middle income	55.6	46.1	–0.2	68,517.7	34.8	33.8	1.1	*1.2*	9.5	*9.2*	21.2	20.8
Lower middle income	61.7	50.5	–0.2	39,305.8	32.6	31.2	1.4	*1.6*	9.5	*9.3*	15.3	15.1
Upper middle income	31.7	28.0	0.0	29,211.9	37.7	37.2	0.6	*0.6*	9.5	*8.9*	45.1	43.9
Low & middle income	63.2	56.5	0.7	96,702.5	32.3	30.9	1.0	*1.2*	10.5	*10.5*	19.5	19.1
East Asia & Pacific	71.2	58.5	–0.2	15,869.9	28.8	28.4	2.2	*2.8*	10.8	*11.0*	9.5	9.4
Europe & Central Asia	36.9	36.3	–0.1	23,367.1	38.2	38.3	0.6	0.4	13.0	11.5	56.8	58.1
Latin America & Carib.	29.1	22.8	–0.1	20,126.9	48.9	45.5	0.9	*1.0*	6.5	*7.1*	27.3	26.6
Middle East & N. Africa	48.1	42.9	1.3	8,960.9	2.2	2.4	0.8	*0.9*	5.6	*5.9*	18.0	18.0
South Asia	75.1	71.5	1.5	4,781.3	16.5	16.8	1.8	2.8	42.6	47.1	14.6	13.8
Sub-Saharan Africa	72.1	64.8	1.8	23,596.5	29.2	26.5	0.8	*0.9*	6.4	*7.5*	25.1	24.8
High income	26.3	22.4	–0.3	32,903.7	29.1	29.4	0.7	*0.7*	11.5	*11.0*	37.5	36.9
Europe EMU	29.1	26.7	–0.2	2,455.3	33.5	37.3	4.7	4.4	27.0	25.6	20.5	20.2

a. Includes Taiwan, China; Macao, China; and Hong Kong, China. b. Provisional estimate.

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Rural population and land use 3.1

About the data

Three billion people, including 70 percent of the world's poor people, live in rural areas. Therefore, adequate indicators to monitor progress in rural areas are essential However, indicators of rural development are sparse, as few indicators are disaggregated between rural and urban areas (for some that are, see tables 2.7, 3.5, and 3.10). This table shows indicators of rural population and land use. Rural population is approximated as the midyear nonurban population. While a practical means of identifying the rural population, it is not precise (see box 3a for more discussion of the issue).

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 and urban 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. Because the data reflect changes in 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 may be particularly unreliable because of differences in definitions and irregular surveys (see *About the data* for table 3.4). FAO's *Global Forest Resources Assessment 2005* aims to address this limitation. FAO has been coordinating global forest resources assessments every 5–10 years since 1946. *Global Forest Resources Assessment 2005* was carried out between 2003 and 2005 and covered 229 countries and territories at three points in time: 1990, 2000, and 2005. It is the most comprehensive assessment of forests and forestry to date both in scope and in number of countries and people involved. It examines current status and recent trends for about 40 variables covering the extent, condition, uses, and values of forests and other wooded land with the aim of assessing all benefits from forest resources.

What is rural? Urban? Box 3.1a

The rural population identified in table 3.1 is approximated as the difference between total population and the urban population, which is calculated on the basis of the urban share reported by the United Nations Population Division. However, there is no universal standard for distinguishing urban from rural areas, and any urban-rural dichotomy is an oversimplification (see *About the data* for table 3.10). The two distinct images—isolated farm, thriving metropolis—represent poles on a continuum. Life changes along a variety of dimensions, moving from the most remote forest outpost through fields and pastures, past tiny hamlets, through small towns with weekly farm markets, into intensively cultivated areas near large towns and small cities, eventually reaching the center of a cosmopolitan megacity. The changes may sometimes be abrupt, but more often they are gradual. Along the way access to infrastructure, social services, and nonfarm employment all increase, and with them population density and income. For policy purposes, therefore, one needs to go beyond the rural-urban dichotomy presented in tables 3.1 and 3.10, because rurality has many dimensions.

A recent World Bank Policy Research Paper proposes an operational definition of rurality based on two dimensions: population density and distance to large cities (population greater than 100,000; Chomitz, Buys, and Thomas 2005). The report argues that these criteria constitute important gradients along which economic behavior and appropriate development interventions vary substantially. Where population densities are low, markets of all kinds are thin, and the unit cost of delivering most social services and many types of infrastructure is high. Where large urban areas are distant, farm-gate (or factory-gate) prices of outputs will be low and prices of inputs will be high, and it will be difficult to recruit skilled people to public service or private enterprises. Thus, remoteness and low population density together define a set of rural areas that face special challenges in development.

Based on these criteria, and using the Gridded Population of the World (CIESIN 2005), the authors produced estimates of the rural population for Latin America and the Caribbean that differ substantially from those presented in table 3.1. The range of these estimates are from 13 percent of the total population, based on a population density of less than 20 people per square kilometer, to 64 percent, based on a population density of more than 500 people per square kilometer. Taking remoteness into account, the estimated rural population would be between 13 and 52 percent of the population. The estimate for Latin America and the Caribbean in table 3.1 is 23 percent.

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). • **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 definitions of inland water bodies includes major rivers and lakes. (See table 1.1 for the total surface area of countries.) • **Land use** can be broken into several categories, three of which are presented in this table (not shown are land used as permanent pasture and land under urban developments). • **Forest area** is land under natural or planted stands of trees, whether productive or not. • **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. • **Arable land** includes land defined by the FAO as 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.

Data sources

Data on urban population shares used to estimate rural population come from the United Nations Population Division's *World Urbanization Prospects: The 2005 Revision.* The total population figures are World Bank estimates. Data on land area and land use are from the FAO's electronic files. The FAO gathers these data from national agencies through annual questionnaires and by analyzing the results of national agricultural censuses. Data on forest area are from the FAO's *Global Forest Resources Assessment 2005.*

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3.2 Agricultural inputs

	Agricultural land[a]		Irrigated land		Land under cereal production		Fertilizer consumption		Agricultural employment		Agricultural machinery	
	% of land area		% of cropland		thousand hectares		hundred grams per hectare of arable land		% of total employment		Tractors per 100 sq. km of arable land	
	1990–92	2003–05	1990–92	2001–03	1990–92	2003–05	1990–92	2000–02	1990–92	2001–03	1990–92	2001–03
Afghanistan	58.3	58.3	33.9	33.8	2,283	2,788	59	19	..	..	1	1
Albania	41.1	40.9	55.6	49.5	243	148	903	420	..	62.7	177	141
Algeria	16.3	16.8	6.4	6.9	3,105	2,751	144	130	..	21.1	128	129
Angola	46.1	46.2	2.3	2.3	893	1,306	29	5	..	..	35	33
Argentina	46.6	47.0	5.6	5.4	8,510	9,391	73	295	0.4	1.1	103	108
Armenia	43.1	49.3	49.9	51.2	163	198	493	157	..	45.7	277	289
Australia	60.5	57.5	4.2	5.2	12,814	19,905	275	479	5.5	4.4	67	65
Austria	42.5	40.0	0.3	0.3	903	810	1,995	1,540	7.5	5.6	2,367	2,380
Azerbaijan	51.5	57.5	68.0	70.5	628	788	432	61	32.5	40.1	184	164
Bangladesh	73.5	69.3	33.8	54.3	10,985	11,511	1,136	1,738	66.4	51.7	6	7
Belarus	43.6	42.7	2.1	2.3	2,581	2,148	2,251	1,325	21.7	..	195	111
Belgium	43.6	46.0	..	4.6	326	314	4,937	3,427	2.8	1.7	1,498	1,254
Benin	20.6	31.3	0.6	0.4	660	963	78	154	..	..	1	1
Bolivia	32.9	34.2	5.5	4.1	633	792	42	37	1.7	..	25	20
Bosnia and Herzegovina	15.0	42.1	0.2	0.3	333	326	..	356	..	..	235	289
Botswana	45.9	45.8	0.2	0.3	140	67	22	122	..	16.8	143	159
Brazil	28.9	31.2	4.6	4.4	19,633	19,806	656	1,201	25.6	20.6	142	137
Bulgaria	55.7	48.5	29.6	16.5	2,174	1,721	1,194	500	19.7	18.0	128	95
Burkina Faso	34.9	39.8	0.6	0.5	2,725	3,249	60	30	..	..	3	4
Burundi	82.9	91.3	1.2	1.6	219	210	34	33	..	..	2	2
Cambodia	30.2	30.3	6.6	7.0	1,801	2,332	19	..	..	70.2	3	7
Cameroon	19.7	19.7	0.3	0.4	816	1,077	34	75	60.6	..	1	1
Canada	7.5	7.4	1.4	1.5	20,864	17,272	476	549	4.2	2.8	162	160
Central African Republic	8.0	8.3	0.0	0.1	104	187	5	3	..	..	0	0
Chad	38.4	38.6	0.5	0.8	1,242	2,096	25	49	..	..	1	0
Chile	21.0	20.4	57.1	82.4	742	687	1,215	2,386	18.8	13.6	144	272
China	57.0	59.5	43.6	47.5	93,430	79,896	2,777	3,519	53.5	44.7	77	89
Hong Kong, China	..	..	..	..	..	..	..	..	0.8	0.2	..	..
Colombia	40.5	38.2	14.3	23.3	1,598	1,265	1,822	2,670	1.4	21.2	98	91
Congo, Dem. Rep.	10.1	10.1	0.1	0.1	1,868	1,974	8	7	..	..	4	4
Congo, Rep.	30.8	30.9	0.3	0.4	9	13	35	67	..	..	15	14
Costa Rica	55.7	56.1	15.2	20.6	83	58	4,522	6,455	25.2	15.5	259	311
Côte d'Ivoire	59.8	62.6	1.1	1.1	1,434	953	151	256	..	..	15	12
Croatia	15.0	50.8	0.2	0.4	647	646	1,514	1,303	..	15.8	35	25
Cuba	61.5	60.6	22.6	22.5	235	309	1,288	476	25.1	21.7	250	249
Czech Republic	55.4	55.2	..	0.7	..	1,563	..	1,186	10.1	4.7	..	305
Denmark	65.4	62.0	16.9	19.6	1,581	1,495	2,249	1,393	5.4	3.2	625	540
Dominican Republic	74.7	76.4	14.9	17.2	134	150	860	848	19.5	15.4	22	17
Ecuador	28.6	26.9	27.9	33.0	861	892	508	1,679	7.0	8.5	67	106
Egypt, Arab Rep.	2.7	3.5	100.0	100.0	2,410	2,851	3,977	4,464	36.2	28.6	251	309
El Salvador	71.1	82.2	4.9	4.9	453	330	1,336	1,054	17.9	19.9	60	52
Eritrea	..	74.6	..	3.7	..	370	..	119	..	..	..	8
Estonia	31.2	19.1	0.5	0.6	454	268	993	432	19.5	6.7	395	889
Ethiopia	51.0	31.8	1.4	2.6	4,586	9,039	..	145	..	..	..	3
Finland	7.9	7.4	2.8	2.9	1,050	1,200	1,647	1,353	8.8	5.3	1,040	882
France	55.3	53.9	11.0	13.3	9,212	9,160	2,918	2,221	..	4.3	784	685
Gabon	20.0	20.0	1.1	1.4	14	20	25	9	..	..	50	46
Gambia, The	63.2	77.9	0.9	0.6	90	186	44	26	..	..	2	1
Georgia	44.8	43.3	39.9	44.1	249	339	889	412	..	53.8	279	254
Germany	49.8	48.8	4.0	4.0	6,673	6,875	2,616	2,245	4.0	2.5	1,253	801
Ghana	55.7	64.8	0.7	0.5	1,078	1,376	38	60	62.2	..	15	9
Greece	71.3	65.2	31.1	37.4	1,455	1,272	2,289	1,580	22.7	15.6	774	939
Guatemala	39.5	42.9	6.8	6.4	768	666	1,072	1,427	..	38.7	33	30
Guinea	48.9	50.7	7.0	5.6	627	778	16	32	..	..	5	5
Guinea-Bissau	53.2	58.0	4.1	4.6	112	138	15	80	..	..	1	1
Haiti	57.9	57.7	8.0	8.4	406	458	35	181	..	..	2	2

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Agricultural inputs 3.2

	Agricultural land[a]		Irrigated land		Land under cereal production		Fertilizer consumption		Agricultural employment		Agricultural machinery	
	% of land area		% of cropland		thousand hectares		hundred grams per hectare of arable land		% of total employment		Tractors per 100 sq. km of arable land	
	1990–92	2003–05	1990–92	2001–03	1990–92	2003–05	1990–92	2000–02	1990–92	2001–03	1990–92	2001–03
Honduras	29.8	26.2	3.8	5.6	502	391	203	1,193	42.1	35.1	31	49
Hungary	70.7	65.4	4.1	4.8	2,803	2,940	796	993	11.3	6.0	158	247
India	60.9	60.6	28.3	32.7	100,760	97,872	758	1,044	68.1	..	65	141
Indonesia	23.5	26.3	14.5	12.7	13,861	15,140	1,330	1,259	54.9	44.8	18	41
Iran, Islamic Rep.	37.7	37.9	39.7	42.7	9,612	8,983	750	890	25.6	..	136	161
Iraq	21.9	22.9	63.0	58.6	3,506	3,221	347	968	..	..	72	80
Ireland	70.2	62.4	..	..	298	294	6,591	5,172	14.1	6.8	1,667	1,324
Israel	26.7	24.4	44.4	45.4	108	92	2,836	2,575	3.7	2.0	763	714
Italy	55.4	50.7	22.9	24.9	4,347	4,142	2,195	1,819	8.4	5.0	1,619	2,031
Jamaica	44.0	47.4	11.0	5.9	3	1	1,737	1,258	27.3	20.4	242	177
Japan	15.5	12.9	54.3	54.7	2,439	2,008	3,779	3,066	6.8	4.7	4,297	4,588
Jordan	12.0	11.5	25.0	27.3	112	53	969	1,322	..	3.9	352	308
Kazakhstan	79.1	76.9	9.8	15.7	22,174	13,697	133	23	..	35.4	59	22
Kenya	45.7	..	1.3	1.8	1,766	2,017	255	320	19.0	..	24	28
Korea, Dem. Rep.	21.0	24.9	58.2	50.9	1,569	1,272	3,522	1,018	..	..	297	241
Korea, Rep.	21.9	19.2	47.1	47.1	1,368	1,093	4,932	4,317	16.7	9.4	275	1,239
Kuwait	7.9	8.6	60.0	77.0	0	1	2,000	711	..	..	215	69
Kyrgyz Republic	50.7	56.2	72.6	76.0	579	596	238	209	35.5	52.8	179	167
Lao PDR	7.2	8.5	16.2	17.2	630	758	31	94	..	..	11	12
Latvia	39.3	26.5	1.1	2.1	699	451	977	572	..	14.8	343	580
Lebanon	31.1	32.2	28.1	33.2	41	61	1,639	2,838	..	..	188	488
Lesotho	76.7	76.9	0.6	0.9	178	177	167	309	..	..	57	61
Liberia	27.1	27.0	0.5	0.5	135	120	8	..	..	..	8	9
Libya	8.8	8.8	21.8	21.9	355	341	458	349	..	..	187	219
Lithuania	52.1	42.5	0.5	0.4	1,135	899	531	903	18.8	17.7	242	641
Macedonia, FYR	17.9	48.8	12.1	9.0	257	195	..	502	..	23.0	730	954
Madagascar	47.0	47.4	30.7	30.6	1,321	1,457	34	31	..	78.0	11	12
Malawi	40.2	47.2	1.2	2.3	1,443	1,544	351	400	..	..	8	6
Malaysia	22.7	24.0	4.8	4.8	699	701	5,264	6,548	23.9	14.8	161	241
Mali	26.3	32.4	3.7	5.0	2,393	3,292	91	88	..	..	11	6
Mauritania	38.7	38.8	11.8	6.5	133	176	132	59	..	..	8	8
Mauritius	55.7	55.7	16.0	20.1	1	0	2,732	3,035	14.3	10.5	36	37
Mexico	54.5	56.2	22.4	23.2	10,075	10,126	696	727	24.2	17.2	129	131
Moldova	75.1	76.7	14.2	13.9	676	927	762	86	..	47.9	293	221
Mongolia	79.9	83.3	5.8	7.0	620	180	111	31	..	45.0	73	42
Morocco	68.2	68.1	13.2	15.5	5,374	5,565	353	440	..	44.8	46	58
Mozambique	60.9	62.0	2.8	2.7	1,509	2,071	12	53	..	..	16	14
Myanmar	15.8	17.2	10.1	17.9	5,283	7,215	79	146	69.4	..	12	10
Namibia	47.0	47.2	0.7	1.0	215	244	..	4	48.2	..	47	39
Nepal	29.0	29.5	43.0	47.2	2,957	3,346	340	333	82.3	..	23	24
Netherlands	58.9	56.8	61.0	60.0	185	217	6,298	4,286	4.3	2.8	2,056	1,645
New Zealand	65.0	64.3	7.6	8.5	153	121	1,892	5,704	10.7	8.7	322	507
Nicaragua	52.1	57.5	4.0	2.8	299	502	270	177	38.7	26.8	20	15
Niger	27.0	30.4	0.5	0.5	7,011	8,111	1	3	..	..	0	0
Nigeria	79.4	79.7	0.7	0.8	16,417	17,799	142	66	..	..	8	10
Norway	3.3	3.4	..	..	361	326	2,362	2,086	5.9	3.8	1,723	1,486
Oman	3.5	3.5	71.6	88.4	2	2	2,441	2,491	..	..	42	50
Pakistan	33.7	35.2	78.5	81.1	11,777	12,587	962	1,378	48.9	45.3	133	149
Panama	28.7	30.0	4.8	6.2	182	195	666	545	25.8	17.7	103	148
Papua New Guinea	2.0	2.3	..	..	2	3	622	556	..	..	59	53
Paraguay	59.6	62.5	2.9	2.1	455	782	92	319	1.7	32.2	72	55
Peru	17.1	16.6	29.9	27.9	683	1,116	246	759	1.0	3.5	36	36
Philippines	37.4	40.9	15.7	14.5	6,957	6,613	935	1,313	45.3	37.3	20	20
Poland	61.6	52.8	0.7	0.7	8,523	8,290	895	1,151	25.2	18.9	821	1,034
Portugal	42.8	41.7	20.5	27.2	780	435	1,123	1,258	15.6	12.5	569	1,044
Puerto Rico	47.5	25.1	36.8	37.1	0	0	..	..	3.5	2.0	..	..

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3.2 Agricultural inputs

	Agricultural land[a]		Irrigated land		Land under cereal production		Fertilizer consumption		Agricultural employment		Agricultural machinery	
	% of land area		% of cropland		thousand hectares		hundred grams per hectare of arable land		% of total employment		Tractors per 100 sq. km of arable land	
	1990–92	2003–05	1990–92	2001–03	1990–92	2003–05	1990–92	2000–02	1990–92	2001–03	1990–92	2001–03
Romania	64.4	63.8	31.0	31.2	5,842	5,675	788	355	30.6	38.1	146	179
Russian Federation	13.0	13.2	4.2	3.7	59,600	39,471	410	121	14.5	11.4	92	52
Rwanda	75.6	78.4	0.3	0.7	258	332	20	48	..	..	1	1
Saudi Arabia	..	..	44.2	42.7	1,062	669	1,446	1,067	..	5.4	20	28
Senegal	41.9	42.4	3.3	4.6	1,154	1,202	65	140	..	..	2	3
Serbia and Montenegro	21.1	54.8	1.9	0.8	2,618	1,987	265	732	..	..	1,067	1,023
Sierra Leone	38.3	39.7	5.2	5.0	452	253	23	5	..	..	3	2
Singapore	2.2	1.2	..	..	..	..	54,333	25,920	0.3	0.3	637	794
Slovak Republic	50.9	42.3	..	12.6	1	802	..	..	..	6.0	..	..
Slovenia	9.8	25.0	0.8	1.5	130	99	3,168	4,239	..	9.3	..	..
Somalia	70.2	70.3	19.2	18.7	531	682	26	5	..	..	21	16
South Africa	80.2	82.0	8.3	9.5	5,736	4,429	549	558	..	10.7	101	46
Spain	60.8	58.3	16.9	20.7	7,588	6,573	1,186	1,653	10.7	6.1	494	712
Sri Lanka	36.2	36.5	28.0	34.4	834	882	2,016	2,862	44.3	34.7	71	113
Sudan	52.0	56.6	13.9	11.0	6,267	10,005	51	40	..	..	8	7
Swaziland	75.8	80.9	24.1	26.0	69	61	688	371	..	..	251	222
Sweden	8.2	7.8	4.1	4.3	1,184	1,098	1,112	1,010	3.3	2.2	604	615
Switzerland	46.9	38.1	6.0	5.8	207	164	4,032	2,272	4.2	4.2	2,870	2,649
Syrian Arab Republic	73.7	75.6	14.3	24.0	3,812	3,195	621	718	..	30.3	137	224
Tajikistan	30.9	30.4	72.9	68.2	266	393	1,461	175	..	..	392	233
Tanzania	53.7	54.4	3.2	3.5	3,003	3,340	136	31	84.2	82.1	19	19
Thailand	41.9	36.2	21.0	26.6	10,594	11,134	598	1,039	61.5	45.7	39	144
Togo	58.7	66.7	0.3	0.3	610	767	56	74	..	..	0	0
Trinidad and Tobago	25.7	25.9	3.3	3.3	6	2	1,111	631	11.8	7.4	354	360
Tunisia	58.4	63.0	7.3	8.0	1,525	1,450	330	372	..	..	88	126
Turkey	51.8	53.3	14.8	19.5	13,760	13,817	757	768	46.5	35.5	287	410
Turkmenistan	66.1	70.2	..	89.1	332	983	1,273	543	..	..	439	256
Uganda	61.0	..	0.1	0.1	1,098	1,550	1	14	91.5	69.1	9	9
Ukraine	69.8	71.4	7.6	6.8	12,555	13,082	792	154	..	19.5	145	124
United Arab Emirates	3.7	6.7	..	29.2	1	0	4,810	5,149	..	..	50	55
United Kingdom	75.0	70.2	2.5	3.0	3,549	3,040	3,323	3,141	2.2	1.4	762	878
United States	46.6	45.3	11.3	12.5	64,547	57,163	1,015	1,096	2.9	2.2	245	270
Uruguay	84.7	85.4	10.2	14.3	509	528	610	849	4.5	4.3	259	241
Uzbekistan	62.8	64.1	87.3	87.4	1,227	1,692	1,602	1,614	..	..	380	373
Venezuela, RB	24.7	24.5	13.9	16.9	799	1,042	1,388	1,132	12.6	10.0	176	189
Vietnam	21.0	30.8	44.6	33.9	6,726	8,392	1,299	3,172	73.8	61.9	60	247
West Bank and Gaza	..	..	..	..	..	..	..	..	..	14.1	..	..
Yemen, Rep.	33.4	33.6	24.3	31.4	738	635	127	95	..	..	40	43
Zambia	47.4	47.5	0.7	2.8	813	717	131	84	..	..	11	11
Zimbabwe	52.3	53.1	3.6	5.2	1,431	1,617	508	443	..	..	61	75
World	**37.7 w**	**38.3 w**	**17.7 w**	**18.4 w**	**704,675 s**	**677,585 s**	**925 w**	**1,020 w**	**41.8 w**	**.. w**	**186 w**	**200 w**
Low income	44.3	45.2	21.8	24.4	211,290	230,781	541	686	..	..	52	84
Middle income	34.6	35.5	20.1	18.5	350,107	310,863	970	1,110	44.2	35.8	127	137
Lower middle income	41.2	42.6	24.4	24.4	228,729	208,372	1,278	1,573	48.9	40.1	99	112
Upper middle income	25.7	25.9	11.8	9.5	121,378	102,492	553	471	20.8	15.5	164	173
Low & middle income	37.4	38.2	20.7	20.7	561,397	541,644	817	951	50.6	..	100	117
East Asia & Pacific	48.4	50.7	..	..	142,270	133,753	..	..	54.2	44.9	63	89
Europe & Central Asia	28.4	27.6	10.3	11.2	140,517	114,042	581	347	22.4	20.9	172	185
Latin America & Carib.	34.7	35.8	11.3	11.4	47,720	49,696	587	896	18.1	16.7	123	123
Middle East & N. Africa	22.6	23.2	29.6	32.7	30,593	29,108	643	833	..	..	115	142
South Asia	54.7	54.5	33.9	38.9	129,690	129,043	767	1,067	66.1	..	67	129
Sub-Saharan Africa	43.4	44.1	3.4	3.6	70,608	86,002	136	125	..	..	19	13
High income	38.5	38.6	10.7	11.8	143,278	135,941	1,213	1,212	5.7	3.8	417	431
Europe EMU	49.7	47.5	14.9	17.0	32,976	31,419	2,332	2,059	7.3	4.9	992	1,002

a. Agricultural land includes permanent pastures, arable land, and land under permanent crops.

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Agricultural inputs 3.2

About the data

Agriculture is still a major sector in many economies, and 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.

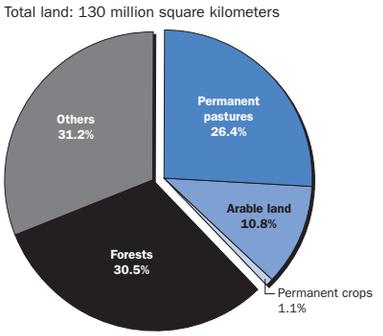
This table provides indicators of major inputs to agricultural production: land, fertilizer, labor, and agricultural machinery. There is no single correct mix of inputs: appropriate levels and application rates vary by country and over time, depending on the type of crops, the climate and soils, and 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. For example, despite standard definitions, data on agricultural land in different climates may not be comparable. For example, permanent pastures are quite different in nature and intensity in African countries and dry Middle Eastern countries. 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.

Nearly 40 percent of land globally is used for agriculture **3.2a**



Note: Agricultural land includes permanent pastures, arable land, and land under permanent crops.
Source: Tables 3.1 and 3.2.

Definitions

• **Agricultural land** refers to the share of land area that is arable, under permanent crops, or under permanent pastures. 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. Land under permanent crops 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. Permanent pasture is land used for five or more years for forage, including natural and cultivated crops. • **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 employment** refers to employment in agriculture, forestry, hunting, and fishing (see table 2.3 for more detail). • **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.

Data sources

Data on agricultural inputs are from electronic files that the FAO makes available to the World Bank.

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3.3 Agricultural output and productivity

	Crop production index		Food production index		Livestock production index		Cereal yield		Agricultural productivity	
	1999–2001 = 100		1999–2001 = 100		1999–2001 = 100		kilograms per hectare		Agriculture value added per worker 2000 $	
	1990–92	2002–04	1990–92	2002–04	1990–92	2002–04	1990–92	2003–05	1990–92	2001–03
Afghanistan	..	..	..	..	..	..	..	..	..	..
Albania	86.2	100.6	74.2	105.9	66.6	108.9	2,372	3,491	773	1,314
Algeria	85.4	122.9	81.7	113.2	80.7	103.3	915	1,468	1,911	2,067
Angola	60.5	119.4	65.0	113.0	75.6	100.0	378	547	183	160
Argentina	67.2	106.4	73.6	101.4	89.2	92.0	2,652	3,771	6,764	9,272
Armenia	106.5	119.2	112.9	121.8	118.9	123.2	1,826	2,122	1,428	2,645
Australia	59.7	81.6	69.2	91.7	83.3	96.9	1,739	1,960	22,405	31,218
Austria	93.4	99.1	89.8	99.0	92.5	99.6	5,400	5,738	12,048	20,587
Azerbaijan	137.4	122.7	104.8	118.6	98.2	113.6	2,113	2,633	1,085	1,033
Bangladesh	75.4	104.7	73.8	104.6	73.8	103.2	2,567	3,533	246	308
Belarus	107.3	124.7	136.1	107.2	146.5	99.7	2,739	2,850	1,977	2,513
Belgium	77.6	106.0	91.3	101.3	94.3	99.7	6,122	8,710	21,356	36,043
Benin	57.7	125.4	62.7	126.3	89.1	109.2	880	1,147	368	578
Bolivia	63.6	116.4	70.0	111.6	77.2	107.9	1,385	1,857	670	746
Bosnia and Herzegovina	107.2	101.1	120.3	96.0	122.7	86.6	3,548	3,393	..	5,696
Botswana	96.2	111.5	114.8	104.8	118.8	103.4	312	514	571	410
Brazil	77.2	119.6	70.4	118.0	65.5	116.8	1,916	3,149	1,700	3,002
Bulgaria	149.2	110.9	137.5	101.7	147.1	96.2	3,639	3,157	2,493	6,313
Burkina Faso	67.0	126.6	68.7	116.2	70.7	108.1	783	959	143	163
Burundi	112.4	107.0	112.1	106.3	135.1	100.2	1,370	1,336	110	80
Cambodia	65.2	105.8	65.1	106.3	65.7	103.5	1,356	2,062	..	296
Cameroon	71.2	103.0	73.9	104.2	84.1	103.1	1,166	1,720	713	1,102
Canada	87.9	93.8	84.1	94.8	78.3	103.6	2,559	2,962	28,224	37,590
Central African Republic	74.4	97.7	69.9	106.9	68.1	113.5	884	1,046	290	407
Chad	69.0	110.9	72.5	110.2	84.5	105.4	636	711	179	225
Chile	78.2	110.5	74.0	108.6	68.0	107.0	3,949	5,621	3,618	4,795
China	69.6	110.6	60.1	113.2	49.4	116.1	4,307	5,057	254	368
Hong Kong, China	..	..	..	..	..	..	..	..	..	..
Colombia	98.4	107.4	83.9	106.8	80.6	107.1	2,492	3,567	3,406	2,951
Congo, Dem. Rep.	124.7	97.2	121.4	97.5	100.8	99.2	791	767	186	154
Congo, Rep.	80.2	105.1	79.0	107.0	76.0	114.5	688	806	314	329
Costa Rica	71.4	99.6	72.2	101.0	79.9	101.4	3,188	4,001	3,143	4,283
Côte d'Ivoire	73.0	96.2	72.9	100.0	74.9	110.9	869	1,266	605	798
Croatia	79.9	97.2	99.0	98.9	126.6	108.2	3,975	4,179	4,751	8,957
Cuba	112.1	112.6	111.5	108.1	130.0	92.7	2,092	3,076	..	..
Czech Republic	..	94.8	..	96.6	..	95.8	..	4,816	..	4,564
Denmark	103.5	97.7	97.6	100.6	89.0	102.8	5,448	6,080	15,157	35,696
Dominican Republic	119.1	110.0	104.0	106.1	79.5	103.7	4,078	4,177	2,254	4,108
Ecuador	80.1	95.9	72.4	106.5	65.1	115.3	1,724	2,485	1,686	1,486
Egypt, Arab Rep.	69.2	104.2	67.5	107.7	65.4	115.3	5,738	7,528	1,531	1,975
El Salvador	102.2	90.6	86.4	102.9	74.5	108.5	1,871	2,462	1,633	1,616
Eritrea	..	67.7	..	83.2	..	97.1	..	296	..	64
Estonia	121.4	89.9	181.3	100.4	193.3	101.7	1,304	2,274	3,002	3,168
Ethiopia	..	106.7	..	110.6	..	117.7	..	1,261	..	150
Finland	97.5	102.4	104.0	103.3	106.5	104.3	3,246	3,284	15,425	29,735
France	94.0	98.8	97.4	99.5	97.3	100.4	6,370	6,876	22,234	39,220
Gabon	87.2	101.9	89.1	101.6	86.5	100.5	1,712	1,641	1,566	1,696
Gambia, The	55.8	65.2	60.2	68.7	98.8	102.6	1,120	1,155	224	226
Georgia	120.6	91.9	102.7	100.9	78.9	110.3	1,998	2,152	2,388	1,404
Germany	83.7	95.1	98.0	97.5	107.5	101.0	5,578	6,497	14,025	23,475
Ghana	59.1	117.0	61.1	116.9	89.8	108.7	1,084	1,437	302	331
Greece	86.9	90.4	93.7	92.2	101.5	98.2	3,589	3,699	7,563	9,114
Guatemala	77.6	102.6	75.4	105.5	76.6	100.6	1,882	1,747	2,149	2,274
Guinea	73.7	107.5	72.9	110.7	60.5	111.8	1,064	1,476	172	225
Guinea-Bissau	71.1	104.9	73.1	105.1	81.2	106.6	1,529	1,149	205	225
Haiti	108.5	98.8	99.8	101.9	69.8	111.6	997	824	..	..

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Agricultural output and productivity 3.3

	Crop production index		Food production index		Livestock production index		Cereal yield		Agricultural productivity	
	1999–2001 = 100		1999–2001 = 100		1999–2001 = 100		kilograms per hectare		Agriculture value added per worker 2000 $	
	1990–92	2002–04	1990–92	2002–04	1990–92	2002–04	1990–92	2003–05	1990–92	2001–03
Honduras	92.9	118.9	86.5	111.9	69.3	105.8	1,371	1,095	976	1,110
Hungary	114.0	99.7	117.0	100.9	125.5	101.9	4,551	4,718	3,268	4,120
India	79.6	100.0	75.9	102.5	69.4	110.5	1,947	2,391	332	381
Indonesia	82.8	112.7	83.8	113.1	85.8	127.3	3,826	4,278	483	556
Iran, Islamic Rep.	73.8	118.1	72.2	113.3	68.8	103.3	1,523	2,411	1,953	2,330
Iraq	..	..	..	..	..	..	..	..	..	2,256
Ireland	92.7	100.3	95.3	96.4	94.3	96.1	6,653	7,390	..	..
Israel	97.8	103.3	82.8	106.5	72.4	113.1	3,132	3,725	..	..
Italy	97.3	92.6	97.0	94.3	95.1	99.4	4,340	5,057	11,536	21,113
Jamaica	84.9	96.7	85.7	97.9	87.2	102.8	1,298	1,162	2,013	1,944
Japan	112.9	95.0	108.4	97.4	106.8	100.2	5,713	5,807	20,196	33,546
Jordan	100.1	136.6	85.4	124.1	71.2	94.1	1,167	1,354	1,892	1,099
Kazakhstan	163.8	108.4	163.0	106.4	178.5	111.6	1,338	994	1,745	1,389
Kenya	86.9	103.2	85.7	106.4	83.9	110.4	1,645	1,409	335	327
Korea, Dem. Rep.	126.2	108.4	119.6	109.1	145.1	114.2	5,073	3,408	..	..
Korea, Rep.	88.2	91.3	79.8	92.8	68.1	100.4	5,885	6,233	5,677	9,948
Kuwait	33.6	110.6	26.4	122.0	27.9	115.7	3,112	1,975	..	13,048
Kyrgyz Republic	68.5	102.9	74.0	101.0	106.9	98.4	2,772	2,984	676	929
Lao PDR	62.2	115.3	59.1	115.9	60.6	107.5	2,344	3,180	360	459
Latvia	128.7	119.4	222.3	111.0	273.8	101.1	1,641	2,225	1,790	2,442
Lebanon	109.7	94.1	100.4	100.4	65.6	120.4	2,001	2,377	..	24,436
Lesotho	67.5	100.8	87.8	100.4	115.0	100.0	703	906	476	503
Liberia	62.3	97.7	80.5	96.2	90.4	107.8	951	889	..	..
Libya	79.2	96.9	77.1	101.6	75.9	101.0	706	626	..	..
Lithuania	80.2	113.1	159.9	111.0	187.0	107.8	1,938	3,183	..	4,117
Macedonia, FYR	107.4	93.3	107.8	96.2	105.1	103.3	2,652	3,053	2,256	2,964
Madagascar	93.6	103.5	90.4	101.8	93.3	97.1	1,935	2,321	185	177
Malawi	57.5	84.3	49.6	87.1	85.4	101.8	871	1,150	72	130
Malaysia	74.4	114.0	70.5	113.7	81.3	115.1	2,827	3,293	3,803	4,570
Mali	73.8	107.4	78.6	105.8	81.3	112.9	840	872	204	227
Mauritania	63.2	97.2	84.2	107.6	87.4	109.3	802	1,075	574	385
Mauritius	110.7	101.6	101.1	104.9	71.1	116.8	4,117	3,436	3,942	5,065
Mexico	82.8	103.8	77.7	105.5	71.4	107.8	2,520	2,872	2,247	2,708
Moldova	136.6	112.2	153.3	112.6	198.7	103.2	2,928	2,572	1,286	725
Mongolia	246.9	107.3	98.3	96.4	93.9	95.9	967	808	703	684
Morocco	101.1	133.4	94.3	122.6	81.3	102.0	1,095	1,282	1,438	1,515
Mozambique	64.7	106.1	70.5	103.0	94.8	100.9	330	921	108	137
Myanmar	61.5	114.7	62.3	115.2	65.0	115.1	2,739	3,420	..	..
Namibia	71.9	111.4	99.5	109.8	104.1	109.3	381	441	811	1,057
Nepal	73.5	111.2	75.2	109.4	80.1	107.3	1,831	2,284	196	208
Netherlands	93.7	97.9	105.5	94.8	105.3	92.6	7,145	8,036	24,056	37,337
New Zealand	78.9	101.9	77.8	112.1	80.7	112.1	5,257	7,360	20,180	26,310
Nicaragua	76.6	115.3	64.0	119.4	57.5	119.9	1,529	1,778	..	1,901
Niger	71.4	119.5	75.4	116.3	82.0	104.7	323	394	170	172
Nigeria	68.9	103.4	69.1	103.7	76.9	106.6	1,135	1,057	592	843
Norway	120.7	103.4	104.1	98.6	98.2	97.3	3,744	4,121	20,055	32,649
Oman	62.8	87.3	60.2	89.9	65.7	94.0	2,145	2,332	1,005	1,128
Pakistan	80.6	102.5	70.6	106.0	67.6	109.1	1,818	2,438	589	690
Panama	110.9	104.2	94.8	101.8	76.3	101.1	1,862	1,958	2,363	3,557
Papua New Guinea	78.5	101.6	79.9	105.9	80.8	110.1	2,504	3,539	..	614
Paraguay	85.8	120.7	77.4	110.3	87.3	98.2	1,905	2,245	1,596	1,939
Peru	52.6	108.1	57.1	110.7	68.3	114.1	2,463	3,399	930	1,428
Philippines	84.2	109.6	77.9	112.2	62.1	120.7	2,070	2,946	899	1,010
Poland	109.1	91.6	110.0	103.6	114.8	105.0	2,958	3,191	1,502	1,967
Portugal	103.1	98.6	98.7	99.1	85.7	98.2	1,939	2,683	4,640	5,925
Puerto Rico	167.7	114.6	127.6	97.8	118.4	94.1	1,100	1,731	..	..

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3.3 Agricultural output and productivity

	Crop production index		Food production index		Livestock production index		Cereal yield		Agricultural productivity	
	1999–2001 = 100		1999–2001 = 100		1999–2001 = 100		kilograms per hectare		Agriculture value added per worker 2000 $	
	1990–92	2002–04	1990–92	2002–04	1990–92	2002–04	1990–92	2003–05	1990–92	2001–03
Romania	92.2	112.2	97.7	110.7	114.5	107.6	2,777	3,255	2,196	3,477
Russian Federation	125.8	116.0	132.6	110.2	152.1	103.2	1,743	1,839	1,824	2,226
Rwanda	111.4	117.6	107.3	117.2	77.7	107.3	1,088	989	192	222
Saudi Arabia	120.7	114.8	105.2	116.0	67.8	104.9	4,212	4,430	7,867	13,964
Senegal	73.0	68.3	71.9	74.9	74.8	98.2	803	1,013	250	250
Serbia and Montenegro	97.6	110.0	109.2	106.0	103.8	94.9	2,926	4,056	..	1,562
Sierra Leone	128.1	113.5	118.9	112.3	86.1	105.2	1,223	1,223	..	..
Singapore	157.1	100.0	352.1	69.3	396.3	74.2	..	..	25,421	34,911
Slovak Republic	..	..	..	..	..	..	..	..	..	3,475
Slovenia	93.1	110.2	77.2	105.8	73.6	103.6	3,609	5,247	11,310	32,311
Somalia	..	..	..	..	..	..	..	..	..	..
South Africa	79.6	102.4	84.2	105.7	94.6	108.2	1,602	2,907	1,796	2,391
Spain	87.9	106.1	87.1	105.3	79.5	107.2	2,310	3,040	9,515	18,691
Sri Lanka	86.2	98.8	88.9	100.0	94.6	109.9	2,950	3,428	705	737
Sudan	68.9	110.8	66.7	107.6	67.6	106.3	596	481	346	707
Swaziland	106.6	100.1	108.9	105.3	130.3	111.9	1,299	1,114	1,239	1,149
Sweden	102.2	102.1	97.9	100.0	95.7	97.7	4,272	4,835	21,463	30,116
Switzerland	112.4	95.3	104.9	100.1	104.8	101.9	6,102	6,150	22,228	22,348
Syrian Arab Republic	73.6	117.1	75.1	122.2	75.0	115.6	947	1,786	2,247	3,248
Tajikistan	123.6	132.9	138.1	132.6	192.6	139.2	1,037	2,252	391	379
Tanzania	92.7	103.6	88.7	105.0	82.9	109.4	1,276	1,469	245	283
Thailand	82.0	106.1	84.1	106.0	86.8	105.5	2,186	2,725	501	586
Togo	73.4	110.3	74.1	104.2	87.9	106.7	791	1,040	354	404
Trinidad and Tobago	116.3	91.9	88.7	122.1	73.5	142.6	3,159	2,722	1,666	2,435
Tunisia	104.6	104.2	91.2	103.0	60.3	99.9	1,401	1,539	2,431	2,431
Turkey	88.0	104.0	89.5	103.2	92.2	101.6	2,192	2,399	1,788	1,764
Turkmenistan	111.4	116.5	57.1	125.2	64.0	121.7	2,210	3,011	1,222	..
Uganda	78.0	106.6	79.5	107.7	82.3	112.9	1,487	1,667	187	230
Ukraine	130.6	114.0	146.0	108.1	170.0	108.1	2,834	2,436	1,194	1,433
United Arab Emirates	23.4	56.0	26.5	62.2	57.5	116.9	2,042	3,119	9,390	34,155
United Kingdom	104.9	100.3	107.2	98.9	105.6	98.5	6,321	7,097	22,506	25,876
United States	88.4	101.5	84.8	102.7	83.4	102.6	4,875	6,444	20,797	36,216
Uruguay	70.4	112.7	76.7	104.3	84.2	98.3	2,445	4,279	5,714	6,743
Uzbekistan	107.8	109.0	91.3	107.9	99.7	104.7	1,777	3,461	1,274	1,524
Venezuela, RB	79.5	96.0	73.9	98.9	73.5	100.4	2,561	3,329	4,548	5,899
Vietnam	60.1	116.6	63.1	118.3	57.9	124.9	3,097	4,651	215	290
West Bank and Gaza	..	..	..	..	..	..	..	..	..	..
Yemen, Rep.	75.0	100.1	71.5	107.4	66.3	115.5	906	772	273	348
Zambia	80.7	102.4	84.3	104.1	80.1	99.2	1,251	1,584	161	205
Zimbabwe	69.2	69.3	77.3	85.7	90.1	100.1	1,123	676	244	266
World	**82.5 w**	**105.7 w**	**82.0 w**	**106.2 w**	**83.4 w**	**107.0 w**	**2,868 w**	**3,247 w**	**756 w**	**875 w**
Low income	78.5	103.5	76.1	105.2	73.5	109.6	1,753	2,086	315	364
Middle income	80.9	110.2	79.8	110.5	81.2	111.0	2,987	3,312	535	717
Lower middle income	77.5	111.7	72.8	112.5	67.9	114.1	3,206	3,629	424	576
Upper middle income	93.1	104.9	101.8	104.2	115.8	102.7	2,453	2,673	2,378	2,731
Low & middle income	80.1	108.1	78.7	108.9	79.3	110.6	2,452	2,791	448	562
East Asia & Pacific	71.8	110.8	64.5	112.4	52.4	116.6	3,816	4,460	303	412
Europe & Central Asia	113.2	107.1	127.1	106.1	149.3	104.1	2,657	2,324	1,817	1,946
Latin America & Carib.	78.2	111.5	74.4	110.4	72.9	108.9	2,234	3,204	2,223	2,924
Middle East & N. Africa	78.8	113.7	75.7	112.5	70.4	107.7	1,632	2,405	1,575	1,919
South Asia	79.9	101.0	75.5	103.5	69.1	109.8	1,992	2,497	340	393
Sub-Saharan Africa	75.9	103.9	77.6	105.1	84.5	107.1	986	1,102	314	337
High income	89.9	98.2	89.7	99.9	90.1	101.2	4,263	5,041	15,048	25,144
Europe EMU	91.5	97.8	94.6	98.8	97.9	99.7	4,656	5,426	12,644	21,414

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Agricultural output and productivity 3.3

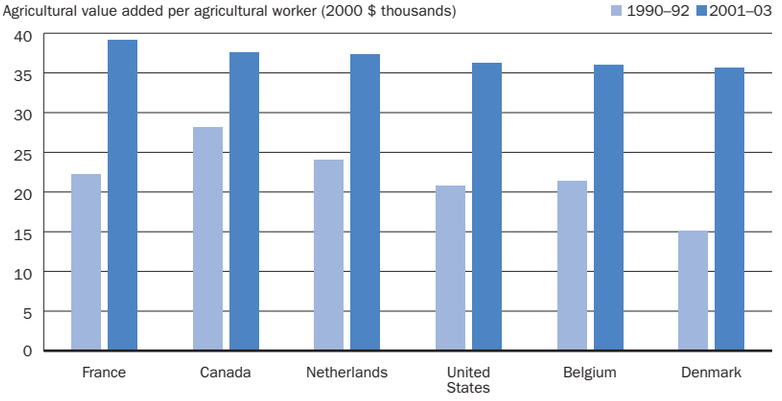
About the data

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

To ease cross-country comparisons, the FAO uses international commodity prices to value production. These prices, expressed in international dollars (equivalent in purchasing power to the U.S. dollar), are derived using a Geary-Khamis formula applied to agricultural outputs (see Inter-Secretariat Working Group on National Accounts 1993, sections 16.93–96). This method assigns a single price to each commodity so that, for example, one metric ton of wheat has the same price regardless of where it was produced. The use of international prices eliminates fluctuations in the value of output due to transitory movements of nominal exchange rates unrelated to the purchasing power of the domestic currency.

Data on cereal yield may be affected by a variety of reporting and timing differences. 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.

The five countries with the highest agricultural productivity 3.3a



Source: Table 3.3.

The 10 countries with the highest cereal yield in 2003–05—and the 10 with the lowest 3.3b

Country	Kilograms per hectare	Country	Kilograms per hectare
Belgium	8,710	Eritrea	296
Netherlands	8,036	Niger	394
Egypt, Arab Rep.	7,528	Namibia	441
Ireland	7,390	Sudan	481
New Zealand	7,360	Botswana	514
United Kingdom	7,097	Angola	547
France	6,876	Libya	626
Germany	6,497	Zimbabwe	676
United States	6,444	Chad	711
Korea, Rep.	6,233	Congo, Dem. Rep.	767

Source: Table 3.3.

Definitions

• **Crop production index** shows agricultural production for each period relative to the base period 1999–2001. 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 1999–2001. 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. 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.• **Agricultural productivity** refers to the ratio of agricultural value added, measured in 2000 U.S. dollars, to the number of workers in agriculture. 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.

Data sources

The agricultural production indexes are prepared by the FAO. 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 published versions. For sources of data on agricultural value added, see *Data sources* for table 4.2.

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3.4 Deforestation and biodiversity

	Forest area	Average annual deforestation[a]	Mammals		Birds		Higher plants[b]		GEF benefits index for biodiversity	Nationally protected areas		Marine protected areas	
	thousand sq. km	%	Total known species	Threatened species	Total known species	Threatened species	Total known species	Threatened species		thousand sq. km	% of total land area	thousand sq. km	% of surface area
	2005	1990–2005	2004	2004	2004	2004	2002	2002	2005	2004[c]	2004[c]	2004[c]	2004[c]
Afghanistan	9	2.3	144	12	434	17	4,000	1	3.6	2.2	0.3	..	..
Albania	8	0.0	73	1	303	9	3,031	0	0.2	0.7	2.7	0.3	1.0
Algeria	23	–1.8	100	12	372	11	3,164	2	3.0	118.6	5.0	0.9	0.0
Angola	591	0.2	296	11	930	20	5,185	26	9.6	125.5	10.1	29.1	2.3
Argentina	330	0.4	375	32	1,038	55	9,372	42	18.5	174.5	6.4	7.8	0.3
Armenia	3	1.2	78	9	302	12	3,553	1	0.3	3.0	10.6	..	..
Australia	1,637	0.2	376	63	851	60	15,638	56	95.8	745.3	9.7	680.8	8.8
Austria	39	–0.2	101	5	412	8	3,100	3	0.3	23.5	28.5	..	..
Azerbaijan	9	0.0	82	11	364	11	4,300	0	0.9	4.0	4.8	1.2	1.4
Bangladesh	9	0.1	131	22	604	23	5,000	12	1.6	0.7	0.5	0.3	0.2
Belarus	79	–0.5	71	6	226	4	2,100	0	0.0	13.2	6.3	..	..
Belgium[d]	7	0.1	92	9	427	10	1,550	0	0.0	1.0	3.5	0.0	0.0
Benin	24	1.9	159	6	485	2	2,500	14	0.2	26.4	23.9	..	..
Bolivia	587	0.4	361	26	1,414	30	17,367	70	13.8	211.0	19.5	..	..
Bosnia and Herzegovina	22	0.1	78	8	312	8	..	1	0.4	0.3	0.5	..	..
Botswana	119	0.9	169	6	570	9	2,151	0	1.5	174.9	30.9	..	..
Brazil	4,777	0.5	578	74	1,712	120	56,215	381	100.0	1,532.6	18.1	47.4	0.6
Bulgaria	36	–0.6	106	12	379	11	3,572	0	0.9	11.2	10.3	0.0	0.0
Burkina Faso	68	0.3	129	6	452	2	1,100	2	0.3	42.1	15.4	..	..
Burundi	2	3.2	116	7	597	9	2,500	2	0.5	1.5	5.7	..	..
Cambodia	104	1.3	127	23	521	24	..	31	3.9	41.5	23.5	1.9	1.1
Cameroon	212	0.9	322	42	936	18	8,260	334	13.3	37.4	8.0	3.9	0.8
Canada	3,101	0.0	211	16	472	19	3,270	1	22.2	628.7	6.9	362.7	3.6
Central African Republic	228	0.1	187	11	663	3	3,602	15	1.7	103.3	16.6	..	..
Chad	119	0.6	104	12	531	5	1,600	2	2.1	119.8	9.5	..	..
Chile	161	–0.4	159	22	445	32	5,284	40	16.2	26.9	3.6	114.5	15.1
China	1,973	–1.7	580	80	1,221	82	32,200	443	64.8	1,100.7	11.8	16.0	0.2
Hong Kong, China	..	..	57	1	306	20	..	6	..	0.3	24.7	0.3	..
Colombia	607	0.1	467	39	1,821	86	51,220	222	57.3	825.3	74.4	8.1	0.7
Congo, Dem. Rep.	1,336	0.3	430	29	1,148	30	11,007	65	17.0	194.4	8.6	..	..
Congo, Rep.	225	0.1	166	14	597	4	6,000	35	3.4	61.3	18.0	..	..
Costa Rica	24	0.4	232	13	838	18	12,119	110	11.1	12.1	23.6	4.8	9.4
Côte d'Ivoire	104	–0.1	229	23	702	11	3,660	105	3.9	54.5	17.1	0.3	0.1
Croatia	21	–0.1	96	7	365	9	4,288	0	0.5	3.6	6.5	2.5	4.4
Cuba	27	–2.1	65	11	358	18	6,522	163	13.5	1.5	1.4	31.7	28.6
Czech Republic	26	0.0	88	6	386	9	1,900	4	0.1	14.4	18.7	..	..
Denmark	5	–0.8	81	4	427	10	1,450	3	0.2	10.9	25.7	5.1	11.8
Dominican Republic	14	0.0	36	5	224	16	5,657	30	6.8	11.9	24.6	8.6	17.6
Ecuador	109	1.4	341	34	1,515	69	19,362	1	30.0	67.2	24.3	141.0	49.7
Egypt, Arab Rep.	1	–3.5	118	6	481	17	2,076	2	3.2	56.0	5.6	76.7	7.7
El Salvador	3	1.4	137	2	434	3	2,911	25	0.8	0.4	1.9	0.1	0.4
Eritrea	16	0.3	70	9	537	7	..	3	0.9	5.0	5.0	..	..
Estonia	23	–0.4	67	4	267	3	1,630	0	0.0	8.9	21.1	..	..
Ethiopia	130	0.9	288	35	839	20	6,603	22	8.5	186.2	18.6	..	..
Finland	225	–0.1	80	3	421	10	1,102	1	0.2	29.5	9.7	1.1	0.3
France	156	–0.5	148	16	517	15	4,630	2	3.9	16.2	3.0	0.5	0.1
Gabon	218	0.0	166	11	632	5	6,651	107	3.4	8.8	3.4	1.0	0.4
Gambia, The	5	–0.4	133	3	535	2	974	4	0.1	0.3	3.5	0.2	1.9
Georgia	28	0.0	98	11	268	8	4,350	0	0.7	3.0	4.3	0.0	0.1
Germany	111	–0.2	126	9	487	14	2,682	12	0.7	111.5	32.0	9.1	2.6
Ghana	55	1.7	249	15	729	8	3,725	117	2.0	36.9	16.2	..	..
Greece	38	–0.9	118	11	412	14	4,992	2	3.0	4.3	3.3	2.5	1.9
Guatemala	39	1.1	193	7	684	10	8,681	85	8.9	25.4	23.4	0.1	0.1
Guinea	67	0.6	215	18	640	10	3,000	22	2.6	15.6	6.4	..	..
Guinea-Bissau	21	0.4	101	5	459	1	1,000	4	0.7	0.0	0.0	..	..
Haiti	1	0.6	41	4	271	15	5,242	28	5.8	0.1	0.3	..	..

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3.4 Deforestation and biodiversity

	Forest area	Average annual deforestation[a]	Mammals		Birds		Higher plants[b]		GEF benefits index for biodiversity	Nationally protected areas		Marine protected areas	
	thousand sq. km	%	Total known species	Threatened species	Total known species	Threatened species	Total known species	Threatened species		thousand sq. km	% of total land area	thousand sq. km	% of surface area
	2005	1990–2005	2004	2004	2004	2004	2002	2002	2005	2004[c]	2004[c]	2004[c]	2004[c]
Honduras	46	2.5	201	10	699	6	5,680	111	7.9	23.4	21.0	1.9	1.7
Hungary	20	–0.6	88	7	367	9	2,214	1	0.2	8.3	9.3	..	..
India	677	–0.4	422	85	1,180	79	18,664	246	43.9	156.3	5.3	16.1	0.5
Indonesia	885	1.6	667	146	1,604	121	29,375	383	90.0	259.9	14.3	130.1	6.8
Iran, Islamic Rep.	111	0.0	158	21	498	18	8,000	1	7.9	105.5	6.5	6.2	0.4
Iraq	8	–0.1	102	9	396	18	..	0	1.7	0.0	0.0	..	..
Ireland	7	–3.4	63	4	408	8	950	1	0.7	0.8	1.1	0.0	0.0
Israel	2	–0.7	115	13	534	18	2,317	0	0.9	4.6	21.3	0.1	0.6
Italy	100	–1.3	132	12	478	15	5,599	3	4.4	32.4	11.0	1.5	0.5
Jamaica	3	0.1	35	5	298	12	3,308	208	4.9	1.8	16.2	8.2	74.5
Japan	249	0.0	171	37	592	53	5,565	12	41.4	52.2	14.3	10.6	2.8
Jordan	1	0.0	93	7	397	14	2,100	0	0.3	9.7	11.0	0.0	0.0
Kazakhstan	33	0.2	145	15	497	23	6,000	1	5.4	77.4	2.9	0.5	0.0
Kenya	35	0.3	407	33	1,103	28	6,506	103	9.9	71.9	12.6	3.1	0.5
Korea, Dem. Rep.	62	1.6	105	12	369	22	2,898	3	0.7	3.2	2.6	..	..
Korea, Rep.	63	0.1	89	12	423	34	2,898	0	1.8	3.5	3.6	3.5	3.5
Kuwait	0	–6.7	23	1	358	12	234	0	0.1	0.0	0.0	0.3	1.5
Kyrgyz Republic	9	–0.3	58	6	207	4	4,500	1	1.2	7.2	3.7	..	..
Lao PDR	161	0.5	215	30	704	21	8,286	19	5.4	37.4	16.2	..	..
Latvia	29	–0.4	68	4	325	8	1,153	0	0.0	9.7	15.6	0.2	0.2
Lebanon	1	–0.8	70	5	377	10	3,000	0	0.2	0.1	0.7	0.0	0.0
Lesotho	0	–4.0	59	3	311	7	1,591	1	0.3	0.1	0.2	..	..
Liberia	32	1.5	183	20	576	11	2,200	46	2.9	15.2	15.8	0.6	0.5
Libya	2	0.0	87	5	326	7	1,825	1	1.7	1.2	0.1	0.5	0.0
Lithuania	21	–0.5	71	5	227	4	1,796	0	0.0	5.9	9.5	0.5	0.8
Macedonia, FYR	9	0.0	89	9	291	9	3,500	0	0.2	2.0	7.9	..	..
Madagascar	128	0.4	165	49	262	34	9,505	276	31.4	18.3	3.1	0.2	0.0
Malawi	34	0.8	207	7	658	13	3,765	14	3.9	19.4	20.6	..	..
Malaysia	209	0.4	337	50	746	40	15,500	683	14.8	100.8	30.7	5.0	1.5
Mali	126	0.7	134	12	624	5	1,741	6	1.6	46.7	3.8	..	..
Mauritania	3	2.4	94	7	521	5	1,100	0	1.4	2.5	0.2	15.0	1.5
Mauritius	0	0.3	14	3	137	13	750	87	4.2	0.1	3.3	0.1	4.4
Mexico	642	0.5	544	72	1,026	57	26,071	261	75.8	99.0	5.2	82.1	4.2
Moldova	3	–0.2	50	4	203	8	1,752	0	0.0	0.5	1.4	..	..
Mongolia	103	0.7	140	13	387	22	2,823	0	4.4	217.9	13.9	..	..
Morocco	44	–0.1	129	12	430	13	3,675	2	4.0	4.7	1.1	0.5	0.1
Mozambique	193	0.2	228	12	685	23	5,692	46	8.2	45.3	5.8	22.5	2.8
Myanmar	322	1.2	288	39	1,047	41	7,000	38	10.6	35.3	5.4	0.2	0.0
Namibia	77	0.8	192	10	619	18	3,174	24	5.9	46.0	5.6	74.0	9.0
Nepal	36	1.6	203	29	274	31	6,973	7	2.2	26.6	18.6	..	..
Netherlands	4	–0.4	95	9	444	11	1,221	0	0.1	9.5	28.0	0.8	1.9
New Zealand	83	–0.5	73	8	351	74	2,382	21	22.3	64.7	24.1	22.7	8.4
Nicaragua	52	1.4	181	6	632	8	7,590	39	3.6	28.1	23.1	1.3	1.0
Niger	13	2.3	123	10	493	2	1,460	2	0.9	96.9	7.7	..	..
Nigeria	111	2.4	290	25	899	9	4,715	170	6.6	55.0	6.0	..	..
Norway	94	–0.2	83	9	442	6	1,715	2	1.6	19.7	6.5	1.3	0.4
Oman	0	0.0	74	12	483	14	1,204	6	4.4	0.2	0.1	29.6	9.6
Pakistan	19	1.6	195	17	625	30	4,950	2	5.1	73.1	9.5	2.2	0.3
Panama	43	0.1	241	17	904	20	9,915	195	11.7	13.1	17.6	10.0	13.3
Papua New Guinea	294	0.4	260	58	720	33	11,544	142	27.7	7.3	1.6	3.5	0.8
Paraguay	185	0.8	168	11	696	27	7,851	10	3.3	16.6	4.2	..	..
Peru	687	0.1	441	46	1,781	94	17,144	274	36.3	216.1	16.9	3.4	0.3
Philippines	72	2.2	222	50	590	70	8,931	212	33.7	24.3	8.2	16.6	5.5
Poland	92	–0.2	110	12	424	12	2,450	4	0.6	70.3	23.1	0.7	0.2
Portugal	38	–1.5	105	15	501	15	5,050	15	3.8	4.7	5.1	2.0	2.2
Puerto Rico	4	–0.1	38	2	310	12	2,493	52	3.8	0.3	3.5	1.7	19.1

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3.4 Deforestation and biodiversity

	Forest area	Average annual deforestation[a]	Mammals		Birds		Higher plants[b]		GEF benefits index for biodiversity	Nationally protected areas		Marine protected areas	
	thousand sq. km	%	Total known species	Threatened species	Total known species	Threatened species	Total known species	Threatened species		thousand sq. km	% of total land area	thousand sq. km	% of surface area
	2005	1990–2005	2004	2004	2004	2004	2002	2002	2005	2004[c]	2004[c]	2004[c]	2004[c]
Romania	64	0.0	101	15	365	13	3,400	1	..	5.8	2.5	6.1	2.6
Russian Federation	8,088	0.0	296	43	645	47	11,400	7	37.1	1,287.0	7.9	301.8	1.8
Rwanda	5	–3.4	206	13	665	9	2,288	3	1.1	1.9	7.9	..	..
Saudi Arabia	27	0.0	94	9	433	17	2,028	3	3.4	819.1	41.0	5.2	0.2
Senegal	87	0.5	191	11	612	5	2,086	7	1.3	21.6	11.2	0.9	0.4
Serbia and Montenegro	27	–0.4	96	10	381	10	4,082	1	..	3.8	3.7	0.1	0.1
Sierra Leone	28	0.6	197	12	626	10	2,090	47	1.5	3.2	4.5	..	..
Singapore	0	0.0	73	3	400	10	2,282	54	0.1	0.0	4.2	0.0	0.1
Slovak Republic	19	0.0	87	7	332	11	3,124	2	0.1	11.0	22.8	..	..
Slovenia	13	–0.4	87	7	350	7	3,200	0	0.2	2.9	14.5	0.0	0.0
Somalia	71	0.9	182	15	642	13	3,028	17	6.7	1.9	0.3	3.3	0.5
South Africa	92	0.0	320	29	829	36	23,420	75	23.5	74.0	6.1	3.4	0.3
Spain	179	–2.2	132	20	515	20	5,050	14	6.6	46.2	9.3	1.8	0.4
Sri Lanka	19	1.2	123	21	381	16	3,314	280	6.6	17.7	27.3	2.3	3.5
Sudan	675	0.8	302	16	952	10	3,137	17	5.5	123.0	5.2	0.3	0.0
Swaziland	5	–1.0	124	6	490	6	2,715	11	0.1	0.6	3.5	..	..
Sweden	275	0.0	85	5	457	9	1,750	3	0.3	44.8	10.9	4.3	1.0
Switzerland	12	–0.4	93	4	382	8	3,030	2	0.2	11.9	29.6	..	..
Syrian Arab Republic	5	–1.6	82	3	350	11	3,000	0	0.9	2.7	1.5	..	..
Tajikistan	4	0.0	76	7	351	9	5,000	2	0.7	26.0	18.6	..	..
Tanzania	353	1.0	375	34	1,056	37	10,008	239	15.1	374.3	42.4	2.3	0.2
Thailand	145	0.6	300	36	971	42	11,625	84	8.0	80.3	15.7	5.8	1.1
Togo	4	2.9	175	7	565	2	3,085	10	0.4	6.5	11.9	..	..
Trinidad and Tobago	2	0.3	116	1	435	2	2,259	1	2.4	0.2	4.7	0.1	1.3
Tunisia	11	–4.3	78	10	360	9	2,196	0	0.5	2.3	1.5	0.2	0.1
Turkey	102	–0.3	145	15	436	14	8,650	3	6.0	20.3	2.6	4.5	0.6
Turkmenistan	41	0.0	103	12	318	13	..	0	2.0	19.8	4.2	..	..
Uganda	36	1.8	360	29	1,015	15	4,900	38	3.3	64.3	32.6	..	..
Ukraine	96	–0.2	120	14	325	13	5,100	1	0.4	19.4	3.3	3.1	0.5
United Arab Emirates	3	–1.8	30	5	268	11	..	0	0.2	0.2	0.2	..	..
United Kingdom	28	–0.6	103	10	557	10	1,623	13	2.1	60.5	25.0	22.5	9.2
United States	3,031	–0.1	468	40	888	71	19,473	240	90.3	1,490.1	16.3	909.5	9.4
Uruguay	15	–4.4	118	6	414	24	2,278	1	1.4	0.7	0.4	0.1	0.0
Uzbekistan	33	–0.5	91	7	343	16	4,800	1	1.2	20.5	4.8	..	..
Venezuela, RB	477	0.6	353	26	1,392	25	21,073	67	26.8	644.4	73.1	21.3	2.3
Vietnam	129	–2.5	279	41	837	41	10,500	145	11.7	13.6	4.4	0.7	0.2
West Bank and Gaza	0	..	..	*1*	..	*1*	..	..	..	..	..	..	..
Yemen, Rep.	5	0.0	74	6	385	14	1,650	159	3.4	0.0	0.0	..	..
Zambia	425	0.9	255	11	770	12	4,747	8	5.0	312.3	42.0	..	..
Zimbabwe	175	1.4	222	8	661	10	4,440	17	2.1	57.5	14.9	..	..
World	**39,426 s**	**0.1 w**								**15,048.4 s**	**11.6 w**	**4,348.9 s**	**3.8 w**
Low income	6,746	0.5								2,806.6	10.0	73.8	..
Middle income	23,132	0.1								7,988.4	11.7	1,233.1	1.9
Lower middle income	12,255	0.2								5,196.6	13.2	632.6	1.7
Upper middle income	10,878	0.1								2,791.8	9.6	600.6	2.1
Low & middle income	29,878	0.2								10,795.0	11.2	1,307.0	1.6
East Asia & Pacific	4,507	–0.2								1,924.7	12.1	192.1	1.3
Europe & Central Asia	8,946	0.0								1,657.2	7.1	321.6	1.4
Latin America & Carib.	9,150	0.4								3,966.3	19.7	495.7	2.7
Middle East & N. Africa	211	–0.5								301.1	3.4	114.7	1.5
South Asia	801	–0.2								288.6	6.0	20.9	0.5
Sub-Saharan Africa	6,263	0.6								2,657.1	11.3	162.0	..
High income	9,548	–0.1								4,253.5	12.9	3,042.0	8.8
Europe EMU	915	–0.8								283.1	11.5	19.5	0.8

a. Negative numbers indicate an increase in forest area. b. Flowering plants only. c. Data may refer to earlier years. They are the most recent reported by the World Conservation Monitoring Centre in 2004. d. Includes Luxembourg.

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Deforestation and biodiversity 3.4

About the data

Biological diversity is defined in terms of the variability in genes, species, and ecosystems. Faced with mounting threats to biodiversity, the international community has increasingly focused on conserving this diversity. Deforestation is a major cause of loss of biodiversity, and habitat conservation is vital for stemming this loss. Conservation efforts traditionally have focused on protecting areas of high biodiversity.

The estimates of forest area are from the Food and Agriculture Organization's (FAO) *Global Forest Resources Assessment 2005,* which provides detailed information on forest cover in 2005 and adjusted estimates of forest cover in 1990 and 2000. The current survey is the latest global forest assessment and uses a uniform global definition of forest. 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.

Measures of species richness are among the most straightforward ways to indicate the importance of an area for biodiversity. The number of threatened species is also an important measure of the immediate need for conservation efforts in a geographic area. Global analyses of the status of threatened species have been carried out for few groups of organisms. Only for mammals, birds, and amphibians has the status of virtually all known species been assessed. Threatened species are defined according to the World Conservation Union's (IUCN) 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).

While the number of birds and mammals is fairly well known, it is difficult to make an accurate count of plants. The number of plant species is highly debated. The IUCN's *2003 IUCN Red List of Threatened Plants* provides the most comprehensive list of threatened species on a global scale, the result of more than 20 years' work by botanists from around the world. Only 5 percent of plant species have been evaluated, and 70 percent of these are threatened with extinction. Plant species data should be interpreted with caution since they are not necessarily comparable across countries because of differences in taxonomic concepts and coverage. However, they do identify countries that are major sources of global biodiversity and that show national commitments to habitat protection.

Setting priorities for conserving biodiversity requires a broader set of information than species richness. With the support of the World Bank's Development Research Group and in close collaboration with scientific nongovernmental organizations, the Global Environment Facility (GEF) developed the GEF benefits index for biodiversity, a comprehensive indicator of national biodiversity status, to guide its biodiversity priorities. This indicator incorporates information on individual species range maps available from the IUCN for virtually all mammals (4,612), amphibians (5,327), and endangered birds (1,098); country-level data from the World Resources Institute (WRI) for reptiles and vascular plants; country-level data from FishBase for 27,669 fish species; and the ecological characteristics of 867 terrestrial ecoregions of the world from WWF International. For each country the biodiversity indicator incorporates the best available and comparable information in four relevant dimensions: represented species, threatened species, represented ecoregions, and threatened ecoregions. To combine these dimensions into one measure, the indicator uses dimensional weights that reflect the consensus of conservation scientists in the GEF, IUCN, WWF International, and other nongovernmental organizations. The index shown in the table has been normalized so that values run from 0 (no biodiversity potential) to 100 (maximum biodiversity potential).

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 six IUCN management categories:

- Scientific reserves and strict nature reserves with limited public access.
- National parks of national or international significance and not materially affected by human activity.
- Natural monuments and natural landscapes with unique aspects.
- Managed nature reserves and wildlife sanctuaries.
- Protected landscapes (which may include cultural landscapes).
- Areas managed mainly for the sustainable use of natural systems to ensure long-term protection and maintenance of biological diversity.

Designating land as a protected area does not necessarily mean that protection is in force. And 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.

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** are listed for countries included within their breeding or wintering ranges. • **Higher plants** refer to native vascular plant species. • **Threatened species** are the number of species classified by the IUCN as endangered, vulnerable, rare, indeterminate, out of danger, or insufficiently known. • **GEF benefits index for biodiversity** is a composite index of relative biodiversity potential for each country based on the species represented in each country, their threat status, and the diversity of habitat types in each country. The index shown in the table has been normalized so that values run from 0 (no biodiversity potential) to 100 (maximum biodiversity potential). • **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. Marine areas, unclassified areas, and littoral (intertidal) areas are not included. The data also 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). • **Marine protected areas** are areas of intertidal or subtidal terrain—and overlying water and associated flora and fauna and historical and cultural features—that have been reserved by law or other effective means to protect part or all of the enclosed environment.

Data sources

Data on forest area and deforestation are from the FAO's *Global Forest Resources Assessment 2005.* Data on species are from the electronic files of the United Nations Environmental Program and WCMC and *2003 IUCN Red List of Threatened Plants.* For China the number of mammals is from Princeton University Press *Guide to the Mammals of China* (forthcoming). The GEF benefits index for biodiversity is from Kiran Dev Pandey, Piet Buys, Ken Chomitz, and David Wheeler's, "Biodiversity Conservation Indicators: New Tools for Priority Setting at the Global Environment Facility" (2006). Data on protected areas are from the United Nations Environment Programme and WCMC.

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3.5 Freshwater

	Renewable internal freshwater resources[a]		Annual freshwater withdrawals					Water productivity	Access to an improved water source	
	Flows billion cu. m 2005	Per capita cu. m 2005	billion cu. m 2002[b]	% of internal resources 2002[b]	% for agriculture 2002[b]	% for industry 2002[b]	% for domestic 2002[b]	GDP/water use 2000 $ per cu. m 2002	% of urban population 2004	% of rural population 2004
Afghanistan	55	..	23.3	42.3	98	0	2	..	..	..
Albania	27	8,595	1.7	6.4	62	11	27	2.4	99	94
Algeria	11	341	6.1	54.2	65	13	22	9.7	88	80
Angola	148	9,284	0.4	0.2	60	17	23	30.8	75	40
Argentina	276	7,123	29.2	10.6	74	9	17	8.3	98	80
Armenia	9	3,017	3.0	32.4	66	4	30	0.8	99	80
Australia	492	24,202	23.9	4.9	75	10	15	17.9	100	100
Austria	55	6,680	2.1	3.8	1	64	35	93.5	100	100
Azerbaijan	8	966	17.3	213.0	68	28	5	0.4	95	59
Bangladesh	105	740	79.4	75.6	96	1	3	0.7	82	72
Belarus	37	3,805	2.8	7.5	30	47	23	5.0	100	100
Belgium	12	1,145	..	..	..	..	..	..	100	100
Benin	10	1,221	0.1	1.3	45	23	32	19.0	78	57
Bolivia	304	33,054	1.4	0.5	81	7	13	6.1	95	68
Bosnia and Herzegovina	36	9,086	..	..	..	..	..	..	99	96
Botswana	2	1,360	0.2	8.1	41	18	41	35.4	100	90
Brazil	5,418	29,066	59.3	1.1	62	18	20	10.5	96	57
Bulgaria	21	2,713	10.5	50.0	19	78	3	1.3	100	97
Burkina Faso	13	945	0.8	6.4	86	1	13	3.6	94	54
Burundi	10	1,338	0.3	2.9	77	6	17	2.6	92	77
Cambodia	121	8,571	4.1	3.4	98	0	1	1.0	64	35
Cameroon	273	16,726	1.0	0.4	74	8	18	11.1	86	44
Canada	2,850	88,238	46.0	1.6	12	69	20	16.3	100	99
Central African Republic	141	34,920	0.0	0.0	4	16	80	38.4	93	61
Chad	15	1,539	0.2	1.5	83	0	17	7.2	41	43
Chile	884	54,249	12.6	1.4	64	25	11	6.3	100	58
China	2,812	2,156	630.3	22.4	68	26	7	2.2	93	67
Hong Kong, China	..	..	..	..	..	..	..	..	..	..
Colombia	2,112	46,316	10.7	0.5	46	4	50	8.1	99	71
Congo, Dem. Rep.	900	15,639	0.4	0.0	31	17	53	12.1	82	29
Congo, Rep.	222	55,515	0.0	0.0	9	22	70	76.0	84	27
Costa Rica	112	25,975	2.7	2.4	53	17	29	6.2	100	92
Côte d'Ivoire	77	4,231	0.9	1.2	65	12	24	11.0	97	74
Croatia	38	8,485	..	..	..	..	..	..	100	100
Cuba	38	3,381	8.2	21.5	69	12	19	..	95	78
Czech Republic	13	1,290	2.6	19.5	2	57	41	23.0	100	100
Denmark	6	1,108	1.3	21.2	43	25	32	127.5	100	100
Dominican Republic	21	2,361	3.4	16.1	66	2	32	6.3	97	91
Ecuador	432	32,657	17.0	3.9	82	5	12	1.0	97	89
Egypt, Arab Rep.	2	24	68.3	3,794.4	86	6	8	1.6	99	97
El Salvador	18	2,587	1.3	7.2	59	16	25	10.7	94	70
Eritrea	3	636	0.3	10.7	97	0	3	2.3	74	57
Estonia	13	9,435	0.2	1.2	5	38	57	39.5	100	99
Ethiopia	122	1,712	5.6	4.6	94	0	6	1.5	81	11
Finland	107	20,396	2.5	2.3	3	84	14	50.3	100	100
France	179	2,932	40.0	22.4	10	74	16	34.2	100	100
Gabon	164	118,511	0.1	0.1	42	8	50	42.1	95	47
Gambia, The	3	1,977	0.0	1.0	65	12	23	14.1	95	77
Georgia	58	12,985	3.6	6.2	59	21	20	0.9	96	67
Germany	107	1,297	47.1	44.0	20	68	12	40.9	100	100
Ghana	30	1,370	1.0	3.2	66	10	24	5.5	88	64
Greece	58	5,223	7.8	13.4	80	3	16	16.1	..	..
Guatemala	109	8,667	2.0	1.8	80	13	6	10.0	99	92
Guinea	226	24,037	1.5	0.7	90	2	8	2.2	78	35
Guinea-Bissau	16	10,086	0.2	1.1	82	5	13	1.1	79	49
Haiti	13	1,524	1.0	7.6	94	1	5	3.8	52	56

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3.5 Freshwater

	Renewable internal freshwater resources[a]		Annual freshwater withdrawals					Water productivity	Access to an improved water source	
	Flows billion cu. m 2005	Per capita cu. m 2005	billion cu. m 2002[b]	% of internal resources 2002[b]	% for agriculture 2002[b]	% for industry 2002[b]	% for domestic 2002[b]	GDP/water use 2000 $ per cu. m 2002	% of urban population 2004	% of rural population 2004
Honduras	96	13,311	0.9	0.9	80	12	8	7.3	95	81
Hungary	6	595	7.6	127.3	32	59	9	6.7	100	98
India	1,261	1,152	645.8	51.2	86	5	8	0.8	95	83
Indonesia	2,838	12,867	82.8	2.9	91	1	8	2.2	87	69
Iran, Islamic Rep.	129	1,883	72.9	56.7	91	2	7	1.5	99	84
Iraq	35	..	42.7	121.3	92	5	3	0.5	..	..
Ireland	49	11,781	1.1	2.3	0	77	23	95.9	100	..
Israel	1	116	2.1	256.3	62	7	31	55.5	100	100
Italy	183	3,114	44.4	24.3	45	37	18	25.3	100	..
Jamaica	9	3,541	0.4	4.4	49	17	34	20.2	98	88
Japan	430	3,365	88.4	20.6	62	18	20	52.9	100	100
Jordan	1	128	1.0	144.3	75	4	21	9.3	99	91
Kazakhstan	75	4,978	35.0	46.4	82	17	2	0.7	97	73
Kenya	21	604	1.6	7.6	64	6	30	8.4	83	46
Korea, Dem. Rep.	67	2,979	9.0	13.5	55	25	20	..	100	100
Korea, Rep.	65	1,344	18.6	28.6	48	16	36	30.6	97	71
Kuwait	0	0	0.4	..	52	2	45	90.8	..	..
Kyrgyz Republic	47	9,041	10.1	21.7	94	3	3	0.1	98	66
Lao PDR	190	32,140	3.0	1.6	90	6	4	0.6	79	43
Latvia	17	7,259	0.3	1.8	13	33	53	30.0	100	96
Lebanon	5	1,342	1.4	28.8	67	1	33	13.1	100	100
Lesotho	5	2,897	0.1	1.0	20	40	40	18.4	92	76
Liberia	200	60,915	0.1	0.1	55	18	27	5.4	72	52
Libya	1	103	4.3	711.3	83	3	14	8.7	..	..
Lithuania	16	4,569	0.3	1.7	7	15	78	48.2	..	..
Macedonia, FYR	5	2,655	..	..	..	..	..	..	..	..
Madagascar	337	18,113	15.0	4.4	96	2	3	0.2	77	35
Malawi	16	1,250	1.0	6.3	80	5	15	1.7	98	68
Malaysia	580	22,882	9.0	1.6	62	21	17	10.5	100	96
Mali	60	4,438	6.5	10.9	90	1	9	0.4	78	36
Mauritania	0	130	1.7	425.0	88	3	9	0.7	59	44
Mauritius	3	2,252	0.6	21.8	..	..	..	7.9	100	100
Mexico	409	3,967	78.2	19.1	77	5	17	7.5	100	87
Moldova	1	238	2.3	231.0	33	58	10	0.6	97	88
Mongolia	35	13,626	0.4	1.3	52	27	20	2.3	87	30
Morocco	29	961	12.6	43.4	87	3	10	2.9	99	56
Mozambique	100	5,068	0.6	0.6	87	2	11	7.3	72	26
Myanmar	881	17,431	33.2	3.8	98	1	1	..	80	77
Namibia	6	3,052	0.3	4.8	71	5	24	12.4	98	81
Nepal	198	7,305	10.2	5.1	96	1	3	0.6	96	89
Netherlands	11	674	7.9	72.2	34	60	6	49.4	100	100
New Zealand	327	79,778	2.1	0.6	42	9	48	27.2	100	..
Nicaragua	190	36,840	1.3	0.7	83	2	15	3.1	90	63
Niger	4	251	2.2	62.3	95	0	4	0.9	80	36
Nigeria	221	1,680	8.0	3.6	69	10	21	6.0	67	31
Norway	382	82,625	2.2	0.6	11	67	23	79.2	100	100
Oman	1	390	1.4	136.0	90	2	7	16.0	..	..
Pakistan	52	336	169.4	323.3	96	2	2	0.5	96	89
Panama	147	45,613	0.8	0.6	28	5	67	14.6	99	79
Papua New Guinea	801	136,059	..	..	..	..	..	..	88	32
Paraguay	94	15,936	0.5	0.5	71	8	20	14.7	99	68
Peru	1,616	57,780	20.1	1.2	82	10	8	2.8	89	65
Philippines	479	5,767	28.5	6.0	74	9	17	2.8	87	82
Poland	54	1,404	16.2	30.2	8	79	13	10.8	100	..
Portugal	38	3,602	11.3	29.6	78	12	10	10.3	..	..
Puerto Rico	7	1,815	..	..	..	..	..	..	..	..

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3.5 Freshwater

	Renewable internal freshwater resources[a]		Annual freshwater withdrawals					Water productivity	Access to an improved water source	
	Flows billion cu. m 2005	Per capita cu. m 2005	billion cu. m 2002[b]	% of internal resources 2002[b]	% for agriculture 2002[b]	% for industry 2002[b]	% for domestic 2002[b]	GDP/water use 2000 $ per cu. m 2002	% of urban population 2004	% of rural population 2004
Romania	42	1,955	23.2	54.8	57	34	9	1.8	91	16
Russian Federation	4,313	30,135	76.7	1.8	18	63	19	3.7	100	88
Rwanda	10	1,051	0.2	1.6	68	8	24	14.1	92	69
Saudi Arabia	2	104	17.3	721.7	89	1	10	11.0	97	..
Senegal	26	2,213	2.2	8.6	93	3	4	2.1	92	60
Serbia and Montenegro	44	5,456	..	..	..	..	..	..	99	86
Sierra Leone	160	28,957	0.4	0.2	92	3	5	2.5	75	46
Singapore	1	138	..	..	..	..	..	..	100	..
Slovak Republic	13	2,339	..	..	..	..	..	..	100	99
Slovenia	19	9,348	..	..	..	..	..	..	..	..
Somalia	6	729	3.3	54.8	100	0	0	..	32	27
South Africa	45	955	12.5	27.9	63	6	31	11.3	99	73
Spain	111	2,562	35.6	32.0	68	19	13	17.3	100	100
Sri Lanka	50	2,548	12.6	25.2	95	2	2	1.3	98	74
Sudan	30	828	37.3	124.4	97	1	3	0.4	78	64
Swaziland	3	2,299	1.0	40.1	97	1	2	1.4	87	54
Sweden	171	18,949	3.0	1.7	9	54	37	84.3	100	100
Switzerland	40	5,432	2.6	6.4	2	74	24	97.0	100	100
Syrian Arab Republic	7	368	20.0	285.0	95	2	3	1.0	98	87
Tajikistan	66	10,189	12.0	18.0	92	5	4	0.1	92	48
Tanzania	84	2,192	5.2	6.2	89	0	10	2.0	85	49
Thailand	210	3,269	87.1	41.5	95	2	2	1.5	98	100
Togo	12	1,871	0.2	1.5	45	2	53	8.2	80	36
Trinidad and Tobago	4	2,911	0.3	8.2	6	26	68	29.6	92	88
Tunisia	4	419	2.6	62.9	82	4	14	7.9	99	82
Turkey	227	3,150	37.5	16.5	74	11	15	5.3	98	93
Turkmenistan	1	290	24.7	1,760.7	98	1	2	..	93	54
Uganda	39	1,353	0.3	0.8	40	17	43	22.0	87	56
Ukraine	53	1,128	37.5	70.7	52	35	12	1.0	99	91
United Arab Emirates	0	44	2.3	1,150.0	68	9	23	34.0	100	100
United Kingdom	145	2,408	9.5	6.6	3	75	22	157.7	100	100
United States	2,800	9,446	479.3	17.1	41	46	13	20.9	100	100
Uruguay	59	17,036	3.2	5.3	96	1	3	5.6	100	100
Uzbekistan	16	623	58.3	357.9	93	2	5	0.3	95	75
Venezuela, RB	723	27,185	8.4	1.2	47	7	46	13.2	85	70
Vietnam	367	4,409	71.4	19.5	68	24	8	0.5	99	80
West Bank and Gaza	0	0	..	..	..	..	..	..	94	88
Yemen, Rep.	4	195	6.6	161.7	95	1	4	1.5	71	65
Zambia	80	6,873	1.7	2.2	76	7	17	2.0	90	40
Zimbabwe	12	945	4.2	34.2	79	7	14	1.6	98	72
World	**43,507 s**	**6,794 w**	**3,807.4 s**	**9.1 w**	**70 w**	**20 w**	**10 w**	**8.6 w**	**95 w**	**72 w**
Low income	7,404	3,149	1,240.7	18.9	89	5	6	0.8	88	70
Middle income	26,662	8,677	1,667.0	6.3	71	19	10	3.3	95	92
Lower middle income	18,455	7,460	1,337.3	7.3	75	17	8	2.5	94	71
Upper middle income	8,207	13,701	329.6	4.0	54	29	18	6.8	98	82
Low & middle income	34,066	6,280	2,907.6	8.8	78	13	8	2.3	93	71
East Asia & Pacific	9,454	5,019	958.8	11.1	74	20	7	2.1	92	70
Europe & Central Asia	5,255	11,139	383.2	7.5	59	31	10	2.7	99	80
Latin America & Carib.	13,429	24,402	265.3	2.0	71	10	19	7.6	96	73
Middle East & N. Africa	228	746	239.8	105.0	89	4	7	2.0	96	81
South Asia	1,816	1,236	941.1	51.8	90	4	6	0.7	94	81
Sub-Saharan Africa	3,884	5,229	119.3	3.1	87	3	10	3.1	80	43
High income	9,441	9,640	899.7	10.2	42	42	15	28.2	100	99
Europe EMU	929	2,959	199.7	22.3	38	48	15	30.5	100	100

a. River flows from other countries are not included because of data unreliability. b. Data are for the most recent year available for 1987–2002 (see *Primary data documentation*).

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About the data

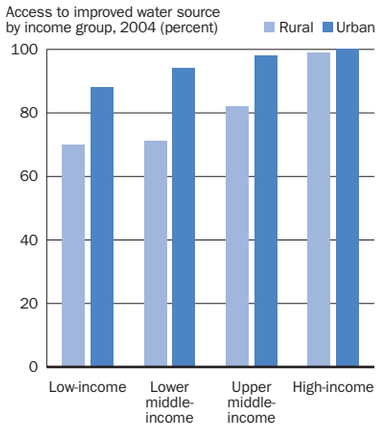
The data on freshwater resources are based on estimates of runoff into rivers and recharge of groundwater. These estimates are based on different sources and refer to different years, so cross-country comparisons should be made with caution. Because the data are collected intermittently, they may hide 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.

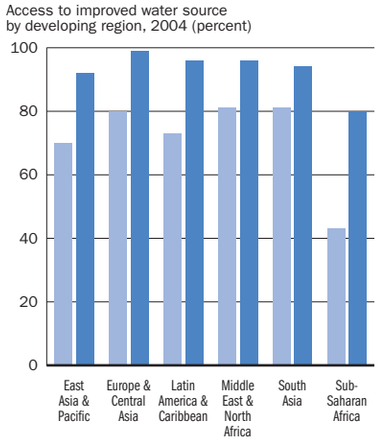
Caution is also needed in comparing data on annual freshwater withdrawals, which are subject to variations in collection and estimation methods. In addition, inflows and outflows are estimated at different times and at different levels of quality and precision, requiring caution in interpreting the data, particularly for water-short countries, notably in the Middle East.

The data on access to an improved water source measure the percentage of the population with ready access to water for domestic purposes. The data are based on surveys and estimates provided by governments to the Joint Monitoring Program of the World Health Organization (WHO) and the United Nations Children's Fund (UNICEF). The coverage rates are based on information from service users on what their households actually use rather than on information from service providers, which may include nonfunctioning systems. Access to drinking water from an improved source does not ensure that the water is safe or adequate, as these characteristics are not tested at the time of surveys. 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 different meaning in different countries despite official WHO 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 supply system, this does not take into account variations in the quality and cost (broadly defined) of the service once connected.

Water productivity is an indication only of the efficiency by which each country uses its water resources. Given the different economic structure of each country, these indicators should be used with proper caution, taking into account the countries' sectoral activities and natural resource endowments.

The rural-urban divide in access to an improved water source **3.5a**





Source: Table 3.5.

Definitions

• **Renewable internal freshwater resources flows** refer to internal renewable resources (internal river flows and groundwater from rainfall) in the country. • **Renewable internal 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. • **Water productivity** is calculated as GDP in constant prices divided by annual total water withdrawal. • **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 piped water into a dwelling, plot, or yard; public tap or standpipe; tubewell or borehole; protected dug well or spring; and rainwater collection. Unimproved sources include unprotected dug wells or springs, cart with small tank or drum, bottled water, and tanker trucks. 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

Data on freshwater resources and withdrawals are compiled by the World Resources Institute from various sources and published in *World Resources 2005* (produced in collaboration with the United Nations Environment Programme, United Nations Development Programme, and World Bank). These data are supplemented by the Food and Agriculture Organization's AQUASTAT data. Data on access to water are from WHO and UNICEF's *Meeting the MDG Drinking Water and Sanitation Target* (www.unicef.org/wes/mdgreport).

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3.6 Water pollution

	Emissions of organic water pollutants				Industry shares of emissions of organic water pollutants							
	thousand kilograms per day		kilograms per day per worker		% of total							
	1990	2003[a]	1990	2003[a]	Primary metals 2003[a]	Paper and pulp 2003[a]	Chemicals 2003[a]	Food and beverages 2003[a]	Stone, ceramics, and glass 2003[a]	Textiles 2003[a]	Wood 2003[a]	Other 2003[a]
Afghanistan	5.9	0.2	0.16	0.21	..	37.7	17.5	31.1	0.4	13.2	..	..
Albania	34.8	..	0.14	..	..	..	..	..	..	..	..	..
Algeria	107.0	..	0.25	..	..	..	..	..	..	..	..	..
Angola	4.5	..	0.19	..	..	..	..	..	..	..	..	..
Argentina	186.7	164.3	0.20	0.23	5.6	14.6	8.6	58.9	0.1	7.6	1.1	3.5
Armenia	37.9	7.1	0.11	0.28	..	..	..	77.6	..	22.4	..	..
Australia	186.1	111.7	0.18	0.18	..	..	5.6	77.1	0.2	5.1	5.3	..
Austria	94.1	36.9	0.15	0.08	14.6	14.8	15.4	34.9	0.6	0.9	12.3	3.5
Azerbaijan	53.3	15.5	0.15	0.16	20.2	5.5	15.9	39.2	0.3	11.0	0.9	6.9
Bangladesh	171.1	303.3	0.17	0.14	1.6	6.2	2.6	23.8	0.1	64.2	0.4	1.0
Belarus	..	..	..	..	..	..	..	..	..	..	..	..
Belgium	118.0	102.3	0.16	0.17	13.6	18.4	11.2	40.3	0.2	5.9	2.2	8.2
Benin	..	..	..	..	..	..	..	..	..	..	..	..
Bolivia	8.4	11.5	0.24	0.25	1.2	15.1	6.8	64.9	0.2	8.7	2.3	0.7
Bosnia and Herzegovina	50.7	..	0.14	..	..	..	..	..	..	..	..	..
Botswana	4.5	5.5	0.19	0.19	1.9	10.8	1.6	56.3	0.3	25.0	1.7	2.5
Brazil	780.4	..	0.19	..	..	..	..	..	..	..	..	..
Bulgaria	149.4	101.9	0.11	0.17	7.9	9.5	6.6	46.1	0.2	22.2	2.3	5.2
Burkina Faso	..	2.6	..	0.22	3.5	1.1	5.4	73.8	0.1	4.1	10.1	1.9
Burundi	1.6	..	0.24	..	..	..	..	..	..	..	..	..
Cambodia	11.8	..	0.14	..	..	..	..	..	..	..	..	..
Cameroon	14.0	10.0	0.28	0.19	0.4	5.2	36.1	48.8	0.0	3.8	5.0	0.8
Canada	321.5	312.5	0.17	0.16	9.6	22.1	8.6	39.5	0.1	5.8	5.4	8.9
Central African Republic	1.0	..	0.18	..	..	..	..	..	..	..	..	..
Chad	..	..	..	..	..	..	..	..	..	..	..	..
Chile	66.8	72.9	0.22	0.24	6.9	11.3	8.9	62.7	0.1	5.0	2.6	2.5
China	7,038.1	6,088.7	0.14	0.14	20.4	10.9	14.8	28.1	0.5	15.5	0.9	8.8
Hong Kong, China	86.1	34.3	0.12	0.20	1.2	43.5	3.9	30.5	0.1	16.2	0.2	4.6
Colombia	93.3	93.9	0.19	0.21	3.1	16.2	9.7	53.2	0.2	14.2	1.0	2.4
Congo, Dem. Rep.	..	..	..	..	..	..	..	..	..	..	..	..
Congo, Rep.	2.5	..	0.32	..	..	..	..	..	..	..	..	..
Costa Rica	27.2	31.2	0.20	0.22	1.6	10.0	8.2	65.7	0.1	10.2	1.3	2.9
Côte d'Ivoire	7.9	..	0.22	..	..	..	..	..	..	..	..	..
Croatia	80.0	42.9	0.15	0.17	6.1	15.9	7.5	48.4	0.2	12.0	3.6	6.3
Cuba	173.0	..	0.25	..	..	..	..	..	..	..	..	..
Czech Republic	205.1	158.5	0.13	0.14	15.6	7.0	7.9	43.6	0.3	10.4	3.9	11.4
Denmark	91.9	83.6	0.18	0.17	4.4	29.1	7.9	44.2	0.2	2.2	3.5	8.6
Dominican Republic	47.9	..	0.36	..	..	..	..	..	..	..	..	..
Ecuador	25.6	40.2	0.23	0.28	2.2	11.2	5.9	72.3	0.1	5.8	1.3	1.3
Egypt, Arab Rep.	211.5	186.1	0.20	0.20	10.8	8.2	9.0	50.7	0.3	17.7	0.6	2.8
El Salvador	5.5	22.8	0.22	0.18	2.1	10.2	8.1	43.5	0.1	34.1	0.5	1.4
Eritrea	..	..	..	..	..	..	..	..	..	..	..	..
Estonia	..	..	..	..	..	..	..	..	..	..	..	..
Ethiopia	18.6	22.1	0.23	0.23	2.3	11.0	5.5	61.0	0.3	17.3	2.0	0.7
Finland	79.5	67.4	0.18	0.16	8.7	40.1	7.6	26.6	0.2	2.4	3.9	10.6
France	653.5	564.6	0.15	0.15	7.2	13.8	12.9	49.5	0.2	2.9	2.3	11.1
Gabon	2.0	..	0.25	..	..	..	..	..	..	..	..	..
Gambia, The	0.8	..	0.34	..	..	..	..	..	..	..	..	..
Georgia	..	..	..	..	..	..	..	..	..	..	..	..
Germany	835.0	966.7	0.12	0.14	9.3	20.4	11.8	38.7	0.2	2.3	2.1	15.1
Ghana	16.5	..	0.20	..	..	..	..	..	..	..	..	..
Greece	63.5	43.7	0.18	0.19	8.1	9.7	9.0	55.0	0.3	12.4	1.6	4.0
Guatemala	21.6	19.3	0.23	0.28	4.9	7.2	6.1	72.8	0.1	6.9	0.8	1.0
Guinea	..	..	..	..	..	..	..	..	..	..	..	..
Guinea-Bissau	..	..	..	..	..	..	..	..	..	..	..	..
Haiti	5.4	..	0.20	..	..	..	..	..	..	..	..	..

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3.6 Water pollution

	Emissions of organic water pollutants				Industry shares of emissions of organic water pollutants							
	thousand kilograms per day		kilograms per day per worker		% of total							
	1990	2003[a]	1990	2003[a]	Primary metals 2003[a]	Paper and pulp 2003[a]	Chemicals 2003[a]	Food and beverages 2003[a]	Stone, ceramics, and glass 2003[a]	Textiles 2003[a]	Wood 2003[a]	Other 2003[a]
Honduras	17.8	..	0.23	..	..	..	..	..	..	..	..	..
Hungary	178.0	*60.7*	0.16	*0.10*	*11.8*	..	*12.8*	*49.1*	*0.4*	..	*5.5*	*9.8*
India	1,410.6	*1,519.8*	0.20	*0.20*	*12.2*	*7.6*	*9.2*	*53.7*	*0.3*	*12.7*	*0.3*	*3.9*
Indonesia	495.6	733.0	0.19	0.18	2.5	8.2	9.2	53.7	0.1	19.4	4.5	2.4
Iran, Islamic Rep.	102.7	164.8	0.16	0.15	15.6	8.0	10.7	46.7	0.7	9.5	0.9	8.1
Iraq	*26.7*	..	*0.19*	..	..	..	..	..	..	..	..	..
Ireland	34.6	*11.6*	0.18	*0.21*	*1.9*	..	*10.4*	*22.9*	*0.7*	*3.1*	*7.5*	*9.3*
Israel	46.4	*54.0*	0.16	*0.16*	*3.6*	*22.3*	*10.5*	*45.5*	*0.1*	*6.0*	*1.9*	*10.1*
Italy	358.1	488.9	0.13	0.12	9.4	16.6	10.7	30.8	0.3	15.0	3.9	13.3
Jamaica	18.7	..	0.29	..	..	..	..	..	..	..	..	..
Japan	1,556.6	*1,184.7*	0.14	*0.15*	*7.1*	*19.0*	*9.4*	*45.7*	*0.2*	*4.8*	*1.6*	*12.3*
Jordan	8.3	23.5	0.19	0.18	5.1	12.7	10.8	53.4	0.4	10.8	3.3	3.4
Kazakhstan	..	..	..	..	..	..	..	..	..	..	..	..
Kenya	42.6	56.1	0.23	0.24	..	11.5	5.4	66.8	0.1	12.8	1.7	..
Korea, Dem. Rep.	..	..	..	..	..	..	..	..	..	..	..	..
Korea, Rep.	369.2	*315.2*	0.12	*0.12*	*11.4*	*18.9*	*13.0*	*25.8*	*0.2*	*13.6*	*1.5*	*15.7*
Kuwait	9.1	*11.9*	0.16	*0.17*	*2.1*	*16.6*	*11.1*	*50.2*	*0.4*	*11.6*	*2.8*	*5.2*
Kyrgyz Republic	30.9	19.1	0.12	0.21	7.3	7.8	3.5	65.4	0.4	11.0	0.9	3.7
Lao PDR	..	..	..	..	..	..	..	..	..	..	..	..
Latvia	39.9	29.2	0.12	0.19	4.1	15.4	3.6	53.8	0.1	9.6	9.7	3.7
Lebanon	..	*14.9*	..	*0.19*	*0.9*	*15.6*	*4.0*	*60.7*	*0.5*	*10.2*	*4.6*	*3.4*
Lesotho	3.0	*3.1*	0.16	*0.16*	*1.2*	*4.0*	*0.7*	*39.7*	*0.1*	*51.3*	*0.6*	*2.3*
Liberia	*0.6*	..	*0.30*	..	..	..	..	..	..	..	..	..
Libya	..	..	..	..	..	..	..	..	..	..	..	..
Lithuania	*53.8*	45.3	*0.13*	0.17	0.8	10.6	4.9	54.0	0.2	18.1	7.1	4.3
Macedonia, FYR	32.4	..	0.18	..	..	..	..	..	..	..	..	..
Madagascar	*11.0*	..	*0.27*	..	..	..	..	..	..	..	..	..
Malawi	10.0	*11.8*	0.29	*0.29*	*0.0*	*16.0*	*3.7*	*70.0*	*0.0*	*7.8*	*1.7*	*0.7*
Malaysia	104.7	*183.8*	0.13	*0.12*	*7.8*	*14.9*	*15.5*	*33.7*	*0.2*	*8.3*	*6.8*	*12.8*
Mali	..	..	..	..	..	..	..	..	..	..	..	..
Mauritania	..	..	..	..	..	..	..	..	..	..	..	..
Mauritius	17.8	*17.7*	0.16	*0.15*	*0.9*	*6.6*	*2.6*	*32.8*	*0.1*	*55.4*	*0.6*	*1.1*
Mexico	174.3	*296.1*	0.18	*0.20*	*7.8*	*12.5*	*10.4*	*55.6*	*0.2*	*7.5*	*0.9*	*5.1*
Moldova	55.9	21.6	0.15	0.45	..	2.2	..	97.7	..	..	..	..
Mongolia	10.2	..	0.18	..	..	..	..	..	..	..	..	..
Morocco	41.7	72.1	0.14	0.16	2.1	8.0	6.8	43.0	0.3	35.3	1.1	3.4
Mozambique	20.4	*10.2*	0.27	*0.31*	*1.1*	*7.1*	*2.7*	*81.2*	*0.1*	*5.8*	*1.4*	*0.7*
Myanmar	7.7	*6.2*	0.17	*0.18*	*56.5*	*4.6*	*13.2*	*14.9*	*0.4*	*2.9*	*1.7*	*5.8*
Namibia	*7.4*	..	*0.35*	..	..	..	..	..	..	..	..	..
Nepal	20.9	*26.9*	0.13	*0.16*	*3.5*	*9.7*	*5.9*	*55.1*	*1.4*	*21.7*	*1.7*	*1.0*
Netherlands	136.7	..	0.18	..	..	..	..	..	..	..	..	..
New Zealand	50.2	*46.1*	0.22	*0.22*	*3.2*	*21.7*	*5.2*	*57.3*	*0.1*	*4.6*	*3.6*	*4.2*
Nicaragua	*10.5*	..	*0.27*	..	..	..	..	..	..	..	..	..
Niger	..	0.4	..	0.32	..	17.0	4.4	76.9	0.3	..	0.8	..
Nigeria	*70.8*	..	*0.22*	..	..	..	..	..	..	..	..	..
Norway	55.0	*51.7*	0.20	*0.20*	*9.0*	*31.3*	*4.7*	*42.8*	*0.1*	*1.4*	*3.1*	*7.5*
Oman	0.4	5.8	0.11	0.17	7.3	13.3	10.1	54.3	0.9	8.3	2.4	3.4
Pakistan	104.1	..	0.18	..	..	..	..	..	..	..	..	..
Panama	9.7	*11.7*	0.26	*0.32*	*1.5*	*13.2*	*4.6*	*76.6*	*0.2*	*3.2*	*0.4*	*0.4*
Papua New Guinea	*5.7*	..	*0.25*	..	..	..	..	..	..	..	..	..
Paraguay	*3.3*	..	*0.28*	..	..	..	..	..	..	..	..	..
Peru	56.1	..	0.20	..	..	..	..	..	..	..	..	..
Philippines	228.3	..	0.21	..	..	..	..	..	..	..	..	..
Poland	428.9	*329.4*	0.14	*0.17*	*7.5*	*11.7*	*7.6*	*52.2*	*0.2*	*9.1*	*4.3*	*7.3*
Portugal	147.9	127.5	0.15	0.15	3.1	16.4	4.9	37.8	0.4	26.1	5.3	6.0
Puerto Rico	19.0	9.2	0.15	0.18	*1.9*	*14.9*	36.4	..	*0.2*	9.8	2.4	*9.7*

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3.6 Water pollution

	Emissions of organic water pollutants				Industry shares of emissions of organic water pollutants							
	thousand kilograms per day		kilograms per day per worker		% of total							
	Primary metals	Paper and pulp	Chemicals	Food and beverages	Stone, ceramics, and glass	Textiles	Wood	Other
	1990	2003[a]	1990	2003[a]	2003[a]	2003[a]	2003[a]	2003[a]	2003[a]	2003[a]	2003[a]	2003[a]
Romania	413.9	*38.4*	0.12	*0.07*	..	*17.6*	..	*5.1*	..	*28.7*	*12.5*	..
Russian Federation	*1,911.3*	1,388.1	*0.13*	0.18	20.3	8.1	3.2	51.9	0.4	5.9	2.6	7.5
Rwanda	*1.6*	..	*0.25*	..	..	..	..	..	..	..	..	..
Saudi Arabia	*18.5*	..	*0.15*	..	..	..	..	..	..	..	..	..
Senegal	10.3	6.6	0.32	*0.30*	*5.8*	*8.4*	*10.7*	*70.1*	*0.1*	*4.2*	*0.4*	*0.3*
Serbia and Montenegro	*137.8*	*98.7*	*0.15*	*0.16*	9.9	*11.8*	*8.2*	*47.4*	*0.3*	*12.7*	*2.2*	*7.6*
Sierra Leone	*4.2*	..	*0.32*	..	..	..	..	..	..	..	..	..
Singapore	32.4	34.3	0.09	0.10	1.4	24.6	16.0	25.4	0.1	3.9	1.6	26.9
Slovak Republic	*77.2*	43.3	*0.13*	0.14	2.9	16.9	8.4	43.7	0.3	12.2	4.0	11.6
Slovenia	55.6	*38.4*	0.16	*0.16*	*33.7*	*14.7*	*8.3*	*23.7*	*0.2*	*10.8*	*2.0*	*6.7*
Somalia	*6.2*	..	*0.38*	..	..	..	..	..	..	..	..	..
South Africa	261.6	*221.3*	0.17	*0.18*	*15.1*	*18.0*	*10.5*	*36.0*	*0.1*	*10.9*	*3.9*	*5.5*
Spain	320.3	352.9	0.17	0.15	7.5	20.6	9.5	39.6	0.4	8.6	4.3	9.6
Sri Lanka	53.0	*78.4*	0.19	*0.18*	*0.5*	*7.2*	*6.6*	*51.5*	*0.2*	*31.6*	*1.1*	*1.2*
Sudan	..	*38.6*	..	*0.29*	*0.7*	*2.5*	*3.1*	*88.6*	*0.4*	*3.2*	*0.6*	*1.1*
Swaziland	6.6	..	0.33	..	..	..	..	..	..	..	..	..
Sweden	109.6	*103.9*	0.15	*0.14*	*11.3*	*35.0*	*7.8*	*26.6*	*0.1*	*1.3*	*3.0*	*14.9*
Switzerland	146.0	..	0.16	..	..	..	..	..	..	..	..	..
Syrian Arab Republic	21.7	*15.1*	0.22	*0.20*	*4.1*	*1.5*	*3.9*	*69.8*	*0.9*	*19.4*	*0.2*	*0.2*
Tajikistan	..	..	..	..	..	..	..	..	..	..	..	..
Tanzania	31.1	*35.2*	0.24	*0.25*	*1.5*	*9.4*	*2.7*	*69.3*	*0.1*	*14.0*	*1.5*	*1.4*
Thailand	291.6	..	0.17	..	..	..	..	..	..	..	..	..
Togo	..	..	..	..	..	..	..	..	..	..	..	..
Trinidad and Tobago	10.0	*7.9*	0.26	*0.23*	*6.5*	*18.8*	*11.9*	*55.3*	*0.2*	*3.8*	*2.0*	*1.5*
Tunisia	*44.6*	55.8	*0.18*	0.14	2.5	6.1	5.5	35.8	0.4	43.3	1.9	4.6
Turkey	177.3	*172.2*	0.18	*0.16*	*11.4*	*4.8*	*8.0*	*43.7*	*0.3*	*26.4*	*0.4*	*5.0*
Turkmenistan	..	..	..	..	..	..	..	..	..	..	..	..
Uganda	*16.7*	..	*0.30*	..	..	..	..	..	..	..	..	..
Ukraine	692.4	*445.8*	0.14	*0.18*	*28.1*	*4.2*	*7.0*	*46.8*	*0.4*	*5.4*	*1.1*	*7.0*
United Arab Emirates	*5.6*	..	*0.14*	..	..	..	..	..	..	..	..	..
United Kingdom	739.6	331.0	0.15	0.12	9.0	48.0	17.5	0.6	0.3	5.2	4.0	15.4
United States	2,565.2	*1,805.9*	0.15	*0.13*	*9.6*	*10.6*	*14.0*	*42.1*	*0.2*	*5.4*	*4.2*	*13.9*
Uruguay	38.7	*15.8*	0.23	*0.28*	*1.2*	*3.7*	*6.6*	*79.2*	*0.1*	*7.4*	*0.6*	*1.2*
Uzbekistan	..	..	..	..	..	..	..	..	..	..	..	..
Venezuela, RB	96.5	*94.2*	0.21	*0.21*	*13.7*	*10.4*	*10.2*	*53.1*	*0.3*	*7.5*	*1.5*	*3.3*
Vietnam	..	..	..	..	..	..	..	..	..	..	..	..
West Bank and Gaza	..	..	..	..	..	..	..	..	..	..	..	..
Yemen, Rep.	6.9	15.4	0.27	0.23	..	7.7	6.8	74.6	0.4	7.6	0.9	..
Zambia	15.9	..	0.23	..	..	..	..	..	..	..	..	..
Zimbabwe	37.1	..	0.20	..	..	..	..	..	..	..	..	..

Note: Industry shares may not sum to 100 percent because data may be for different years.
a. Data are for most recent year available for 1993–2003.

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Water pollution 3.6

About the data

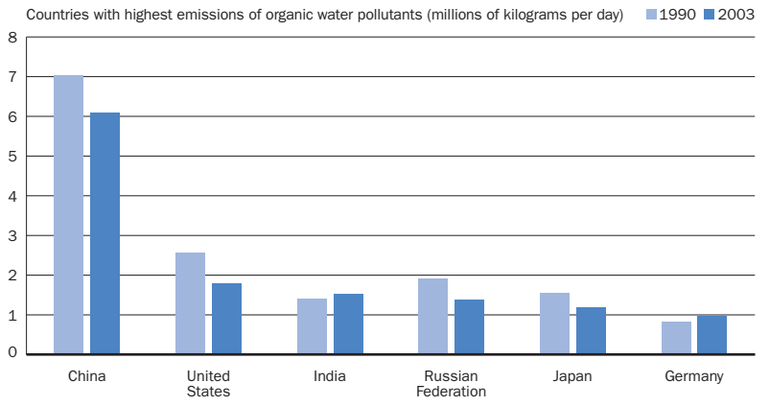
Emissions of organic pollutants from industrial activities are a major cause of degradation of water quality. Water quality and pollution levels are generally measured in terms of concentration or load—the rate of occurrence of a substance in an aqueous solution. Polluting substances include organic 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 2003 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 by 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 2003.

Emissions of organic water pollutants declined in most countries from 1990 to 2003, even among the top emitters **3.6a**



Source: Table 3.6.

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).

Data sources

Data on water pollution come from a 1998 study by Hemamala Hettige, Muthukumara Mani, and David Wheeler, "Industrial Pollution in Economic Development: Kuznets Revisited" (available at www.worldbank.org/nipr). The data were updated through 2003 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.

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3.7 Energy production and use

	Total energy production		Energy use								Net energy imports[a]	
	million metric tons of oil equivalent		Total million metric tons of oil equivalent		average annual % growth	Per capita kilograms of oil equivalent		average annual % growth	Combustible renewables and waste % of total		% of energy use	
	1990	2004	1990	2004	1990–2004	1990	2004	1990–2004	1990	2004	1990	2004
Afghanistan	..	..	..	..	..	..	..	..	..	..	..	..
Albania	2.4	1.0	2.7	2.4	1.9	809	760	2.5	13.6	6.3	8	59
Algeria	104.4	165.7	23.9	32.9	2.2	943	1,017	0.5	0.1	0.2	–338	–404
Angola	28.7	57.4	6.3	9.5	2.9	597	613	0.2	68.8	64.7	–356	–505
Argentina	48.5	85.4	46.1	63.7	2.0	1,415	1,661	0.8	3.7	3.3	–5	–34
Armenia	*0.3*	0.7	*4.3*	2.1	–1.5	*1,246*	704	–0.5	*0.0*	0.0	*94*	65
Australia	157.5	261.8	87.5	115.8	2.2	5,130	5,762	1.1	4.5	4.3	–80	–126
Austria	8.1	9.9	25.0	33.2	1.9	3,246	4,060	1.6	9.9	11.3	68	70
Azerbaijan	*18.2*	20.1	*16.7*	12.9	–2.4	*2,259*	1,559	–3.3	*0.0*	0.0	–9	–55
Bangladesh	10.8	18.4	12.8	22.8	4.5	123	164	2.3	53.5	35.7	16	19
Belarus	*3.5*	3.6	*38.9*	26.8	–1.9	*3,810*	2,725	–1.5	*0.6*	4.2	*91*	86
Belgium	13.1	13.5	49.1	57.7	1.3	4,927	5,536	1.0	1.4	2.2	73	77
Benin	1.8	1.6	1.7	2.5	2.7	324	303	–0.5	93.2	65.6	–6	34
Bolivia	4.9	11.8	2.8	5.0	4.1	416	553	1.9	27.2	14.7	–77	–137
Bosnia and Herzegovina	*3.6*	3.2	*4.5*	4.7	5.8	*1,130*	1,203	5.0	*3.6*	3.9	*19*	31
Botswana	0.9	1.0	1.3	1.9	2.9	890	1,055	1.3	33.1	24.4	28	46
Brazil	98.1	176.3	134.0	204.8	3.2	897	1,114	1.7	31.1	26.5	27	14
Bulgaria	9.6	10.3	28.8	18.9	–2.0	3,306	2,434	–1.2	0.6	3.9	67	46
Burkina Faso	..	..	..	..	..	..	..	..	..	..	..	..
Burundi	..	..	..	..	..	..	..	..	..	..	..	..
Cambodia	..	..	..	..	..	..	..	..	..	..	..	..
Cameroon	12.1	12.5	5.0	6.9	2.5	432	433	0.2	75.9	77.8	–140	–80
Canada	273.7	397.5	209.4	269.0	1.7	7,534	8,411	0.7	3.9	4.4	–31	–48
Central African Republic	..	..	..	..	..	..	..	..	..	..	..	..
Chad	..	..	..	..	..	..	..	..	..	..	..	..
Chile	7.6	8.4	14.1	27.9	5.4	1,067	1,732	3.9	19.0	15.4	46	70
China	889.3	1,536.8	866.5	1,609.3	3.6	763	1,242	2.6	23.1	13.7	–3	5
Hong Kong, China	0.0	0.0	10.7	17.1	3.1	1,869	2,488	1.6	0.5	0.3	100	100
Colombia	48.5	76.2	25.0	27.7	0.5	716	616	–1.2	23.2	14.9	–94	–175
Congo, Dem. Rep.	12.0	17.0	11.9	16.6	2.4	315	297	–0.3	84.0	92.5	–1	–3
Congo, Rep.	9.0	12.6	1.1	1.1	–0.6	425	274	–3.8	69.4	61.7	–753	–1,084
Costa Rica	1.0	1.7	2.0	3.7	4.7	658	870	2.3	36.6	8.2	49	53
Côte d'Ivoire	3.4	7.2	4.4	6.9	3.6	348	388	1.0	72.1	64.9	23	–4
Croatia	*4.3*	3.9	*6.7*	8.8	2.2	*1,502*	1,985	2.5	*3.8*	4.3	*35*	56
Cuba	6.5	5.9	16.8	10.7	–1.6	1,594	950	–2.0	34.8	19.4	61	45
Czech Republic	40.1	34.2	49.0	45.5	–0.3	4,728	4,460	–0.2	*1.2*	3.3	18	25
Denmark	10.0	31.0	17.9	20.1	0.4	3,481	3,716	0.0	6.4	11.7	44	–55
Dominican Republic	1.0	1.6	4.1	7.7	5.1	584	873	3.6	24.2	19.3	75	79
Ecuador	16.5	29.3	6.1	10.1	3.9	597	773	2.2	13.5	5.7	–169	–191
Egypt, Arab Rep.	54.9	64.7	31.9	56.9	4.4	573	783	2.5	3.3	2.5	–72	–14
El Salvador	1.7	2.4	2.5	4.5	4.1	496	664	2.0	48.2	32.5	32	46
Eritrea	..	..	..	..	..	..	..	..	..	..	..	..
Estonia	*4.1*	3.6	*6.3*	5.2	–1.2	*4,091*	3,835	–0.2	*2.9*	11.7	*34*	31
Ethiopia	14.2	19.4	15.2	21.2	2.6	296	303	0.3	92.8	90.4	7	9
Finland	12.1	15.9	29.2	38.1	2.0	5,851	7,286	1.7	15.6	20.3	59	58
France	111.9	137.4	227.3	275.2	1.3	4,006	4,547	0.8	4.8	4.3	51	50
Gabon	14.6	12.1	1.2	1.7	2.2	1,298	1,243	–0.4	59.8	58.8	–1,077	–615
Gambia, The	..	..	..	..	..	..	..	..	..	..	..	..
Georgia	*1.5*	1.3	*8.8*	2.8	–7.9	*1,642*	626	–6.6	*7.7*	22.8	*83*	54
Germany	186.2	136.0	356.2	348.0	0.0	4,485	4,218	–0.2	1.3	3.0	48	61
Ghana	4.4	6.2	5.3	8.4	3.6	345	386	1.2	73.1	69.1	18	25
Greece	9.2	10.3	22.2	30.5	2.5	2,183	2,755	1.9	4.0	3.2	59	66
Guatemala	3.4	5.3	4.5	7.6	4.3	504	616	1.9	67.9	52.9	24	30
Guinea	..	..	..	..	..	..	..	..	..	..	..	..
Guinea-Bissau	..	..	..	..	..	..	..	..	..	..	..	..
Haiti	1.3	1.7	1.6	2.2	3.2	231	262	1.8	76.5	74.0	21	25

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3.7 Energy production and use

	Total energy production		Energy use								Net energy imports[a]	
	million metric tons of oil equivalent		Total million metric tons of oil equivalent		average annual % growth	Per capita kilograms of oil equivalent		average annual % growth	Combustible renewables and waste % of total		% of energy use	
	1990	2004	1990	2004	1990–2004	1990	2004	1990–2004	1990	2004	1990	2004
Honduras	1.7	1.7	2.4	3.9	3.0	496	548	0.3	62.0	40.0	30	55
Hungary	14.3	10.2	28.6	26.4	–0.2	2,753	2,608	0.0	1.3	3.3	50	61
India	333.4	466.9	361.6	572.9	3.3	426	531	1.5	48.6	37.4	8	19
Indonesia	164.7	258.0	97.6	174.0	4.0	548	800	2.6	40.4	27.1	–69	–48
Iran, Islamic Rep.	179.7	278.0	68.8	145.8	5.3	1,264	2,167	3.7	1.0	0.5	–161	–91
Iraq	104.9	103.4	19.1	29.7	3.5	1,029	..	..	0.1	0.1	–451	–248
Ireland	3.5	1.9	10.4	15.2	3.5	2,969	3,738	2.5	1.0	1.4	67	87
Israel	0.4	1.7	12.1	20.7	4.0	2,599	3,049	1.3	0.0	0.0	96	92
Italy	25.3	30.1	148.0	184.5	1.6	2,610	3,171	1.5	0.6	3.3	83	84
Jamaica	0.5	0.5	2.9	4.1	2.6	1,231	1,541	1.8	16.2	11.7	84	88
Japan	76.8	96.8	446.0	533.2	1.2	3,610	4,173	1.0	1.1	1.2	83	82
Jordan	0.2	0.3	3.5	6.5	3.7	1,104	1,219	0.3	0.1	0.0	95	96
Kazakhstan	*89.0*	118.6	*79.7*	54.8	–2.8	*4,846*	3,652	–2.0	*0.1*	0.1	*–12*	–116
Kenya	10.3	13.7	12.5	16.9	2.1	533	506	–0.4	78.4	74.1	18	19
Korea, Dem. Rep.	28.7	19.2	32.9	20.4	–3.4	1,670	910	–4.2	2.9	5.0	13	6
Korea, Rep.	21.9	38.0	92.7	213.0	6.0	2,161	4,431	5.1	*0.3*	0.8	76	82
Kuwait	50.4	132.8	8.5	25.1	8.4	3,985	10,212	6.4	0.1	..	–495	–429
Kyrgyz Republic	*1.8*	1.5	*5.1*	2.8	–3.5	*1,114*	546	–4.6	*0.1*	0.1	*64*	47
Lao PDR	..	..	..	..	..	..	..	..	..	..	..	..
Latvia	*0.8*	2.1	*5.9*	4.6	–1.8	*2,245*	1,988	–0.8	*8.2*	29.9	*87*	53
Lebanon	0.1	0.2	2.3	5.4	5.9	842	1,525	4.1	4.5	2.4	94	96
Lesotho	..	..	..	..	..	..	..	..	..	..	..	..
Liberia	..	..	..	..	..	..	..	..	..	..	..	..
Libya	73.2	85.4	11.5	18.2	2.9	2,663	3,169	0.9	1.1	0.8	–534	–369
Lithuania	*4.4*	5.2	*11.1*	9.2	–1.0	*3,002*	2,666	–0.4	*2.6*	7.6	*60*	43
Macedonia, FYR	*1.7*	1.5	*2.9*	2.7	–1.0	*1,515*	1,328	–1.4	*6.4*	6.3	*41*	43
Madagascar	..	..	..	..	..	..	..	..	..	..	..	..
Malawi	..	..	..	..	..	..	..	..	..	..	..	..
Malaysia	48.8	88.5	22.6	56.7	6.3	1,269	2,279	3.8	9.4	4.9	–115	–56
Mali	..	..	..	..	..	..	..	..	..	..	..	..
Mauritania	..	..	..	..	..	..	..	..	..	..	..	..
Mauritius	..	..	..	..	..	..	..	..	..	..	..	..
Mexico	194.8	253.9	124.3	165.5	1.9	1,494	1,622	0.4	5.9	5.0	–57	–53
Moldova	*0.1*	0.1	6.9	3.4	–6.0	*1,575*	802	–5.7	*0.5*	2.3	99	98
Mongolia	..	..	..	..	..	..	..	..	..	..	..	..
Morocco	0.8	0.7	6.7	11.5	3.8	281	384	2.3	4.7	3.9	89	94
Mozambique	6.8	8.2	7.2	8.6	1.1	536	441	–1.6	94.4	84.1	5	4
Myanmar	10.7	19.0	10.7	14.1	2.0	262	283	0.5	84.4	73.4	0	–34
Namibia	*0.2*	0.3	*0.7*	1.3	5.1	*449*	665	2.5	*16.0*	13.8	67	76
Nepal	5.5	8.1	5.8	9.1	3.3	304	341	0.9	93.4	86.8	5	11
Netherlands	60.5	67.9	66.7	82.1	1.3	4,464	5,045	0.6	1.4	2.6	9	17
New Zealand	12.0	13.0	13.8	17.6	1.9	3,990	4,344	0.7	4.0	5.0	13	26
Nicaragua	1.5	1.9	2.1	3.3	2.9	535	643	1.0	53.2	51.1	29	41
Niger	..	..	..	..	..	..	..	..	..	..	..	..
Nigeria	150.5	229.4	70.9	99.0	2.3	783	769	–0.3	79.8	80.2	–112	–132
Norway	120.3	238.6	21.5	27.7	1.6	5,067	6,024	1.0	4.8	4.9	–460	–763
Oman	38.3	58.1	4.6	11.8	6.8	2,475	4,667	4.4	..	..	–740	–391
Pakistan	34.4	59.0	43.4	74.4	3.7	402	489	1.2	43.2	35.6	21	21
Panama	0.6	0.8	1.5	2.5	4.2	618	801	2.2	28.3	16.8	59	70
Papua New Guinea	..	..	..	..	..	..	..	..	..	..	..	..
Paraguay	4.6	6.6	3.1	4.0	1.9	731	694	–0.3	72.3	53.8	–48	–65
Peru	10.6	9.5	10.0	13.2	2.1	458	479	0.3	26.9	17.7	–6	28
Philippines	13.7	23.4	26.2	44.3	4.3	428	542	2.1	29.2	23.9	48	47
Poland	99.4	78.8	99.9	91.7	–0.9	2,620	2,403	–0.8	2.2	5.0	1	14
Portugal	3.4	3.9	17.7	26.5	3.3	1,793	2,528	2.9	14.0	10.9	81	85
Puerto Rico	..	..	..	..	..	..	..	..	..	..	..	..

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3.7 Energy production and use

	Total energy production		Energy use								Net energy imports[a]	
	million metric tons of oil equivalent		Total million metric tons of oil equivalent		average annual % growth	Per capita kilograms of oil equivalent		average annual % growth	Combustible renewables and waste % of total		% of energy use	
	1990	2004	1990	2004	1990–2004	1990	2004	1990–2004	1990	2004	1990	2004
Romania	40.8	28.1	62.4	38.6	–2.9	2,689	1,778	–2.4	1.0	8.4	35	27
Russian Federation	*1,118.7*	1,158.5	*774.8*	641.5	–1.2	*5,211*	4,460	–0.9	*1.6*	1.1	*–44*	–81
Rwanda	..	..	..	..	..	..	..	..	..	..	..	..
Saudi Arabia	376.9	556.2	67.4	140.4	4.3	4,114	6,233	1.9	0.0	0.0	–459	–296
Senegal	1.4	1.1	2.2	2.8	1.6	281	242	–0.9	60.6	38.9	39	60
Serbia and Montenegro	13.2	*11.5*	21.5	*16.2*	–1.1	2,044	*2,004*	1.1	1.8	*4.9*	38	*29*
Sierra Leone	..	..	..	..	..	..	..	..	..	..	..	..
Singapore	..	*0.1*	13.4	25.6	3.4	4,384	6,034	0.8	..	..	..	99
Slovak Republic	5.3	6.5	21.3	18.3	–0.3	4,035	3,407	–0.4	0.8	2.2	75	65
Slovenia	*2.8*	3.4	*5.0*	7.2	2.7	*2,508*	3,591	2.7	5.3	6.7	*45*	52
Somalia	..	..	..	..	..	..	..	..	..	..	..	..
South Africa	114.5	156.0	91.2	131.1	2.4	2,592	2,829	0.3	11.4	10.0	–26	–19
Spain	34.6	32.5	91.1	142.2	3.4	2,345	3,331	2.7	4.5	3.4	62	77
Sri Lanka	4.2	5.2	5.5	9.4	3.8	324	485	2.9	71.0	52.0	24	45
Sudan	8.8	29.3	10.6	17.6	3.7	408	497	1.4	81.7	79.2	18	–66
Swaziland	..	..	..	..	..	..	..	..	..	..	..	..
Sweden	29.8	35.1	47.6	53.9	0.7	5,557	5,998	0.4	11.6	16.7	37	35
Switzerland	9.7	11.8	25.0	27.1	0.7	3,724	3,672	0.1	3.7	6.3	61	56
Syrian Arab Republic	22.3	29.5	11.7	18.4	3.2	909	993	0.5	0.0	0.0	–91	–60
Tajikistan	*1.6*	1.5	*9.1*	3.3	–5.5	*1,647*	519	–6.7	..	..	*83*	55
Tanzania	9.1	17.5	9.8	18.7	4.6	374	498	1.9	91.0	91.6	8	7
Thailand	26.5	50.1	43.9	97.1	5.2	803	1,524	4.1	33.4	16.4	40	48
Togo	1.2	1.9	1.4	2.7	4.6	365	449	1.4	82.6	70.6	17	29
Trinidad and Tobago	12.6	29.4	6.0	11.3	5.4	4,968	8,675	4.9	0.8	0.2	–109	–160
Tunisia	6.1	6.8	5.5	8.7	3.4	679	876	2.0	18.7	12.4	–11	22
Turkey	25.8	24.1	53.0	81.9	3.4	943	1,151	1.6	13.6	6.8	51	71
Turkmenistan	*48.8*	58.2	*11.3*	15.6	3.1	*2,912*	3,265	1.4	..	..	*–332*	–274
Uganda	..	..	..	..	..	..	..	..	..	..	..	..
Ukraine	*101.3*	76.3	*210.0*	140.3	–3.0	*4,027*	2,958	–2.1	*0.1*	0.2	*52*	46
United Arab Emirates	109.4	164.0	22.5	43.8	4.6	12,716	10,142	–1.8	*0.1*	0.0	–385	–274
United Kingdom	208.0	225.2	212.2	233.7	0.6	3,686	3,906	0.3	0.3	1.3	2	4
United States	1,650.5	1,641.0	1,927.6	2,325.9	1.4	7,722	7,921	0.2	3.2	3.0	14	29
Uruguay	1.1	0.9	2.3	2.9	1.1	725	832	0.3	24.3	15.4	49	70
Uzbekistan	*40.5*	56.9	*45.0*	54.0	1.9	*2,098*	2,088	0.3	..	..	*10*	–5
Venezuela, RB	148.9	196.1	43.9	56.2	1.6	2,224	2,149	–0.5	1.2	1.0	–239	–249
Vietnam	24.7	65.3	24.3	50.2	5.1	367	611	3.5	77.7	47.2	–2	–30
West Bank and Gaza	..	..	..	..	..	..	..	..	..	..	..	..
Yemen, Rep.	9.4	20.6	2.6	6.4	6.2	212	313	2.4	3.0	1.2	–266	–224
Zambia	4.9	6.4	5.5	6.9	1.6	653	605	–0.7	73.4	79.1	10	8
Zimbabwe	8.6	8.6	9.4	9.3	–0.1	888	719	–1.5	50.4	63.8	9	8
World	**8,798.3 t**	**11,171.2 t**	**8,609.9 t**	**11,026.3 t**	**1.7 w**	**1,685 w**	**1,793 w**	**0.3 w**	**10.8 w**	**10.3 w**	**–2 w**	**–2 w**
Low income	791.6	1,173.8	773.3	1,136.6	2.8	464	513	0.7	55.6	47.8	–2	–3
Middle income	4,386.6	5,604.9	3,502.9	4,431.1	1.4	1,349	1,451	0.2	11.8	10.5	–25	–27
Lower middle income	2,160.0	3,257.8	1,923.6	2,889.6	2.5	953	1,175	1.1	18.4	13.9	–12	–13
Upper middle income	2,226.9	2,347.3	1,579.4	1,541.6	–0.2	2,980	2,583	–1.1	3.7	4.0	–41	–52
Low & middle income	5,175.0	6,767.1	4,267.1	5,548.9	1.6	1,008	1,068	0.2	19.0	17.5	–21	–22
East Asia & Pacific	1,218.4	2,079.8	1,135.3	2,085.8	3.7	722	1,124	2.5	26.1	16.1	–7	0
Europe & Central Asia	1,885.7	1,721.9	1,733.4	1,335.7	–1.9	3,726	2,847	–2.0	1.9	2.4	–9	–30
Latin America & Carib.	618.0	910.5	459.8	644.6	2.5	1,050	1,187	0.9	18.2	14.8	–34	–41
Middle East & N. Africa	601.9	823.7	194.4	356.7	4.3	861	1,189	2.3	1.8	1.2	–210	–131
South Asia	391.5	562.2	432.8	694.3	3.4	394	486	1.5	49.1	38.0	10	19
Sub-Saharan Africa	481.8	715.4	317.4	452.2	2.4	693	703	0.0	56.6	55.7	–52	–58
High income	3,657.9	4,450.0	4,369.4	5,512.8	1.7	4,842	5,511	0.9	2.9	3.1	16	19
Europe EMU	470.7	462.9	1,053.1	1,245.1	1.3	3,568	3,990	0.9	3.1	4.2	55	63

a. Negative value indicates that a country is a net exporter.

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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 energy 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.

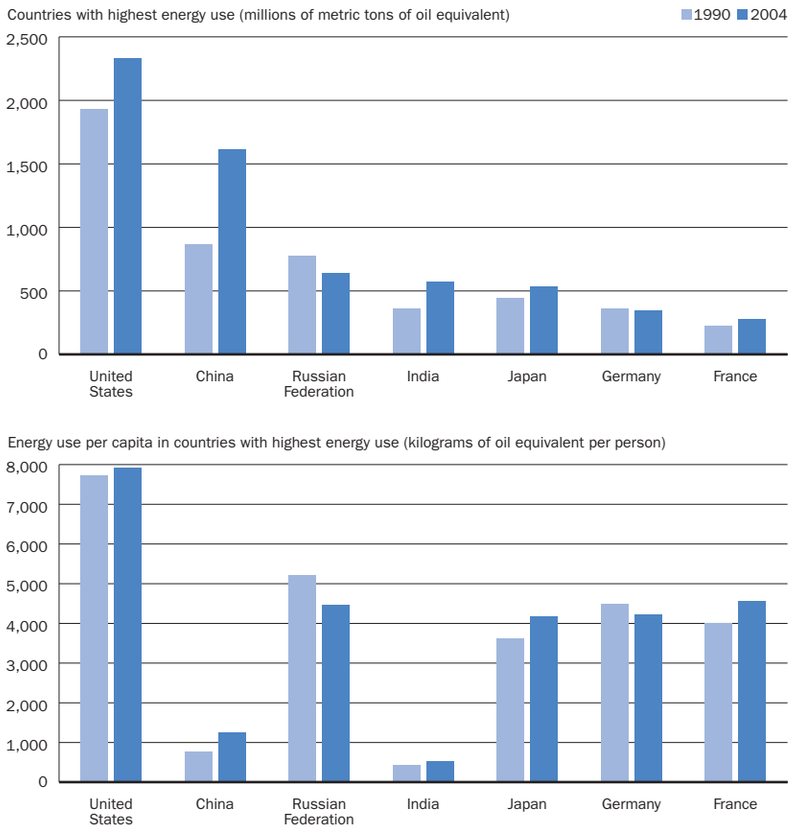
Total energy use refers to the use of primary energy before transformation to other end-use fuels (such as electricity and refined petroleum products). It includes energy from combustible renewables and waste—solid biomass and animal products, gas and liquid from biomass, and industrial and municipal 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 include country notes that explain some of these differences (see *Data sources*). 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.

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. 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.

Definitions

• **Total energy production** refers to forms of primary energy—petroleum (crude oil, natural gas liquids, and oil from non-conventional 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 use of primary energy before transformation to other end-use fuels, 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. • **Net energy imports** are estimated as energy use less production, both measured in oil equivalents. The deviations from zero of the world net imports are from statistical errors and changes in stock.

Energy use per capita varies widely among the top energy users 3.7a



Source: Table 3.7.

Data sources

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.*

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3.8 Energy efficiency and emissions

	GDP per unit of energy use		Carbon dioxide emissions							Methane emissions		Nitrous oxide emissions	
	2000 PPP $ per kilogram of oil equivalent		Total million metric tons		average annual % change	Per capita metric tons		kilograms per 2000 PPP $ of GDP		million metric tons of carbon dioxide equivalent	average annual % change	million metric tons of carbon dioxide equivalent	average annual % change
	1990	2004	1990	2003	1990–2003	1990	2003	1990	2003	2000	1990–2000	2000	1990–2000
Afghanistan	..	..	2.6	0.7	–9.0	0.2	..	..	..	13.2	5.3	7.5	3.4
Albania	3.8	5.9	7.3	3.0	–3.7	2.2	1.0	0.9	0.2	0.5	–3.8	0.1	–0.5
Algeria	5.7	6.0	77.0	163.6	7.8	3.0	5.1	0.7	0.8	28.5	4.0	9.2	1.4
Angola	3.7	3.3	4.6	8.6	4.3	0.4	0.6	0.3	0.3	15.8	1.6	6.1	2.0
Argentina	6.4	7.4	109.7	127.5	1.2	3.4	3.4	0.5	0.3	86.7	0.7	63.4	1.2
Armenia	*1.6*	5.6	4.2	3.4	–0.9	1.2	1.1	0.5	0.3	2.8	–2.0	0.3	–4.1
Australia	4.0	4.8	272.2	354.1	2.7	15.9	17.8	1.0	0.6	113.2	0.1	27.0	3.4
Austria	7.1	7.3	57.7	70.3	1.2	7.5	8.7	0.4	0.3	9.7	–1.6	2.8	1.0
Azerbaijan	..	2.5	53.7	29.2	–5.1	7.5	3.5	1.9	1.0	11.9	–2.4	0.8	–4.2
Bangladesh	9.8	10.5	15.4	34.6	6.9	0.1	0.3	0.2	0.1	47.6	0.9	44.8	3.7
Belarus	*1.2*	2.4	107.8	62.5	–4.4	10.6	6.3	2.4	1.0	21.6	–1.1	8.3	–3.4
Belgium	4.7	5.2	100.6	102.8	–0.4	10.1	9.9	0.5	0.3	11.7	–0.4	13.3	0.1
Benin	2.6	3.3	0.7	2.0	7.4	0.1	0.3	0.2	0.2	3.3	2.2	2.7	2.7
Bolivia	5.1	4.5	5.5	7.9	4.4	0.8	0.9	0.5	0.3	21.3	1.2	5.8	–0.1
Bosnia and Herzegovina	..	5.3	6.9	19.1	15.3	1.6	4.9	..	..	1.4	–3.0	0.6	–5.1
Botswana	6.2	8.6	2.2	4.1	4.2	1.5	2.3	0.3	0.2	7.0	1.3	4.8	1.0
Brazil	7.2	6.8	202.6	298.3	3.7	1.4	1.6	0.3	0.2	297.2	0.9	207.7	1.1
Bulgaria	2.1	3.0	75.3	44.0	–3.6	8.6	5.6	1.6	0.7	10.0	–6.3	18.5	–2.2
Burkina Faso	..	..	1.0	1.0	1.2	0.1	0.1	0.2	0.1	8.8	2.1	11.7	2.3
Burundi	..	..	0.2	0.2	1.9	0.0	0.0	0.0	0.0	1.8	2.0	1.2	0.9
Cambodia	..	..	0.5	0.5	1.4	0.0	0.0	..	0.0	68.0	1.0	0.1	3.6
Cameroon	4.7	4.5	1.6	3.5	4.7	0.1	0.2	0.1	0.1	11.8	1.2	9.8	1.9
Canada	3.0	3.4	415.7	565.5	2.2	15.0	17.9	0.8	0.6	123.4	5.8	57.5	0.9
Central African Republic	..	..	0.2	0.3	2.3	0.1	0.1	0.1	0.1	6.6	1.6	5.1	1.8
Chad	..	..	0.1	0.1	2.8	0.0	0.0	0.0	0.0	9.6	1.6	8.7	2.2
Chile	5.5	6.1	35.3	58.5	5.2	2.7	3.7	0.6	0.4	14.5	1.5	7.5	3.6
China	2.1	4.4	2,398.2	4,143.5	2.5	2.1	3.2	1.6	0.6	802.9	1.8	644.7	2.4
Hong Kong, China	10.8	11.5	26.2	37.8	2.5	4.6	5.6	0.3	0.2	..	..	..	..
Colombia	8.4	10.9	56.8	55.5	–0.6	1.6	1.3	0.4	0.2	55.5	1.2	41.2	4.8
Congo, Dem. Rep.	5.0	2.2	4.0	1.8	–6.5	0.1	0.0	0.1	0.1	32.9	0.6	17.2	0.0
Congo, Rep.	2.3	3.3	1.2	1.4	–1.0	0.5	0.4	0.5	0.3	3.2	1.9	1.0	2.6
Costa Rica	9.7	10.0	2.9	6.3	5.1	0.9	1.5	0.2	0.2	3.6	–0.3	3.6	–1.0
Côte d'Ivoire	5.2	3.7	5.4	5.7	1.3	0.4	0.3	0.3	0.2	6.5	2.0	2.9	1.8
Croatia	*5.0*	5.6	24.6	23.8	1.6	5.1	5.4	0.6	0.5	3.8	–0.5	3.4	–1.2
Cuba	..	..	32.0	25.2	–1.8	3.0	2.3	..	..	9.1	–0.8	9.3	–3.3
Czech Republic	*3.1*	4.0	161.7	116.3	–2.2	15.6	11.4	1.3	0.6	10.8	–3.5	8.2	–4.8
Denmark	6.9	7.9	49.7	54.5	–1.2	9.7	10.1	0.5	0.3	6.0	–0.3	9.3	–1.5
Dominican Republic	7.1	7.6	9.6	21.3	6.8	1.3	2.5	0.4	0.3	5.9	1.1	4.3	0.4
Ecuador	5.8	4.8	16.6	23.2	2.4	1.6	1.8	0.6	0.5	16.2	1.8	2.9	–0.3
Egypt, Arab Rep.	5.1	4.9	75.4	139.6	5.6	1.4	2.0	0.6	0.5	34.3	4.1	16.0	3.9
El Salvador	7.3	7.0	2.6	6.5	6.4	0.5	1.0	0.2	0.2	3.2	1.9	2.2	0.7
Eritrea	..	..	..	0.7	..	..	0.2	..	0.2	0.0	..	..	..
Estonia	*1.6*	3.5	28.3	18.2	–3.9	18.1	13.5	2.5	1.1	2.4	–4.4	0.4	–5.8
Ethiopia	2.6	2.8	3.0	7.3	8.0	0.1	0.1	0.1	0.1	47.5	2.0	12.2	6.6
Finland	3.8	3.8	51.2	67.8	1.4	10.3	13.0	0.6	0.4	4.3	–3.4	7.3	–1.5
France	5.5	5.9	362.3	373.9	0.1	6.4	6.2	0.4	0.2	59.3	–1.1	72.3	–1.7
Gabon	4.8	4.9	6.0	1.2	–9.1	6.3	0.9	1.2	0.1	3.8	2.3	1.8	0.0
Gambia, The	..	..	0.2	0.3	3.4	0.2	0.2	0.2	0.1	0.7	1.7	0.5	0.3
Georgia	*1.2*	4.1	17.3	3.7	–11.3	3.2	0.8	0.8	0.3	4.4	–1.9	1.1	–4.4
Germany	4.7	6.2	980.3	805.0	–1.1	12.3	9.8	0.7	0.4	62.7	–4.4	60.5	–3.2
Ghana	4.6	5.4	3.8	7.7	5.7	0.2	0.4	0.2	0.2	7.1	3.4	7.4	6.4
Greece	6.7	7.4	72.2	96.2	2.6	7.1	8.7	0.6	0.4	10.9	2.4	11.2	0.2
Guatemala	6.7	6.4	5.1	10.7	6.7	0.6	0.9	0.2	0.2	6.2	0.5	5.2	0.8
Guinea	..	..	1.0	1.3	2.3	0.2	0.1	0.1	0.1	5.7	1.9	2.4	2.9
Guinea-Bissau	..	..	0.2	0.3	2.0	0.2	0.2	0.3	0.2	0.9	0.0	0.8	2.4
Haiti	10.4	6.2	1.0	1.7	7.2	0.1	0.2	0.1	0.1	3.4	1.7	2.6	0.7

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Energy efficiency and emissions

3.8

	GDP per unit of energy use		Carbon dioxide emissions							Methane emissions		Nitrous oxide emissions	
	2000 PPP $ per kilogram of oil equivalent		Total million metric tons		average annual % change	Per capita metric tons		kilograms per 2000 PPP $ of GDP		million metric tons of carbon dioxide equivalent	average annual % change	million metric tons of carbon dioxide equivalent	average annual % change
	1990	2004	1990	2003	1990–2003	1990	2003	1990	2003	2000	1990–2000	2000	1990–2000
Honduras	5.0	4.8	2.6	6.5	7.5	0.5	0.9	0.2	0.3	4.9	–0.2	3.5	0.0
Hungary	4.2	5.9	60.1	58.2	–0.4	5.8	5.7	0.6	0.4	11.3	–2.5	12.9	13.6
India	4.0	5.5	677.7	1,273.2	4.9	0.8	1.2	0.6	0.4	445.3	1.6	399.0	2.6
Indonesia	4.1	4.1	149.3	295.0	4.6	0.8	1.4	0.5	0.4	169.2	1.4	38.7	1.0
Iran, Islamic Rep.	3.6	3.1	218.2	381.4	3.7	4.0	5.7	1.0	0.8	96.9	6.7	43.8	1.5
Iraq	..	..	48.5	72.9	3.8	2.6	..	..	..	14.4	0.7	6.5	0.1
Ireland	5.2	9.5	30.6	41.4	2.9	8.7	10.4	0.7	0.3	12.9	–0.1	9.8	0.6
Israel	7.0	7.3	33.1	68.3	5.8	7.1	10.2	0.5	0.4	11.4	3.3	1.7	2.0
Italy	8.4	8.2	389.5	445.5	1.0	6.9	7.7	0.4	0.3	37.0	–0.7	43.5	0.6
Jamaica	3.0	2.5	8.0	10.7	2.4	3.3	4.1	1.3	1.0	1.3	0.8	1.3	0.3
Japan	6.5	6.4	1,070.4	1,231.3	1.0	8.7	9.6	0.4	0.3	21.8	–1.7	37.0	–0.6
Jordan	3.5	3.6	10.2	17.1	3.8	3.2	3.3	1.0	0.7	7.9	1.0	0.2	9.2
Kazakhstan	*1.0*	1.9	288.1	159.2	–6.0	17.6	10.7	3.8	1.7	27.3	–4.5	7.8	–6.5
Kenya	2.2	2.1	5.8	8.8	5.0	0.2	0.3	0.3	0.2	21.5	1.1	22.6	0.3
Korea, Dem. Rep.	..	..	244.6	77.5	–11.9	12.4	3.5	..	..	33.5	0.3	6.5	–4.0
Korea, Rep.	4.5	4.2	241.1	455.9	4.6	5.6	9.5	0.7	0.5	25.0	–0.2	16.1	4.8
Kuwait	*1.2*	1.9	45.2	78.5	11.0	21.3	32.7	*1.5*	1.4	9.9	6.5	0.2	14.1
Kyrgyz Republic	*1.7*	3.3	12.6	5.3	–7.5	2.8	1.1	1.4	0.6	2.2	–2.4	0.1	1.2
Lao PDR	..	..	0.2	1.3	16.7	0.1	0.2	0.1	0.1	6.2	0.9	0.1	2.7
Latvia	*2.5*	5.6	14.5	6.7	–6.9	5.4	2.9	0.7	0.3	2.6	–4.0	1.2	–6.6
Lebanon	2.7	3.5	9.1	19.0	5.1	3.3	5.4	1.5	1.1	1.3	8.6	1.1	5.5
Lesotho	..	..	..	..	..	..	..	..	..	1.2	2.0	1.5	0.5
Liberia	..	..	0.5	0.5	3.1	0.2	0.1	..	..	1.2	–0.8	0.8	0.9
Libya	..	..	37.8	50.2	2.3	8.7	8.9	..	..	9.6	0.9	2.5	–1.1
Lithuania	*2.8*	4.5	24.3	12.7	–5.2	6.6	3.7	0.7	0.3	5.9	–4.2	3.5	16.8
Macedonia, FYR	*4.1*	4.6	15.5	10.5	–0.7	8.1	5.2	1.4	0.8	1.3	0.0	1.1	1.5
Madagascar	..	..	0.9	2.3	8.5	0.1	0.1	0.1	0.2	18.9	1.5	11.6	1.2
Malawi	..	..	0.6	0.9	2.8	0.1	0.1	0.2	0.1	3.6	1.6	2.3	1.3
Malaysia	4.4	4.1	55.3	156.4	6.8	3.1	6.4	0.7	0.7	30.4	4.3	13.3	1.5
Mali	..	..	0.4	0.6	2.3	0.0	0.0	0.1	0.0	12.0	0.9	13.8	2.4
Mauritania	..	..	2.6	2.5	–1.2	1.3	0.9	0.9	0.4	4.4	1.3	6.4	1.3
Mauritius	..	..	1.5	3.1	6.4	1.4	2.6	0.3	0.2	0.3	5.0	0.9	1.7
Mexico	5.1	5.5	375.1	415.9	0.7	4.5	4.1	0.7	0.4	111.7	0.0	10.0	1.1
Moldova	*1.4*	2.0	23.8	7.2	–10.1	5.5	1.7	1.9	1.0	2.6	–4.1	1.6	–6.0
Mongolia	..	..	10.0	8.0	–2.6	4.7	3.2	3.3	1.8	8.2	1.7	12.1	3.7
Morocco	11.9	10.3	23.5	37.9	3.7	1.0	1.3	0.4	0.3	10.0	1.0	15.7	0.6
Mozambique	1.3	2.6	1.0	1.6	3.2	0.1	0.1	0.1	0.1	11.1	1.8	3.2	1.0
Myanmar	..	..	4.3	9.5	6.5	0.1	0.2	..	..	61.1	2.4	12.5	3.2
Namibia	*12.3*	10.2	0.0	2.3	..	0.0	1.2	0.0	0.2	4.5	0.5	4.2	–0.2
Nepal	3.4	4.0	0.6	2.9	11.4	0.0	0.1	0.0	0.1	16.4	1.5	11.3	1.5
Netherlands	5.2	5.8	139.7	140.9	0.2	9.3	8.7	0.5	0.3	21.6	–2.3	17.2	0.3
New Zealand	4.1	5.1	23.6	34.8	3.3	6.8	8.7	0.5	0.4	36.2	–0.5	12.4	0.5
Nicaragua	5.3	5.5	2.6	3.9	5.0	0.7	0.8	0.3	0.2	5.3	1.3	4.0	0.8
Niger	..	..	1.0	1.2	1.1	0.1	0.1	0.2	0.1	6.5	2.5	5.0	2.8
Nigeria	1.1	1.4	45.3	52.2	–0.1	0.5	0.4	0.7	0.4	72.5	4.2	41.6	1.9
Norway	5.1	5.9	35.3	45.0	2.0	8.3	9.9	0.4	0.3	7.1	0.6	5.1	0.0
Oman	4.3	3.0	10.3	32.2	8.7	5.6	12.8	0.6	0.9	3.7	8.5	1.0	1.9
Pakistan	3.9	4.2	68.0	114.1	4.3	0.6	0.8	0.5	0.4	94.7	2.5	84.6	3.4
Panama	7.4	8.4	3.1	6.0	5.5	1.3	1.9	0.4	0.3	3.3	1.0	2.7	0.7
Papua New Guinea	..	..	2.4	2.5	–0.2	0.6	0.4	0.4	0.2	3.9	3.9	2.3	1.8
Paraguay	6.5	6.6	2.3	4.1	4.7	0.5	0.7	0.1	0.2	12.3	0.5	10.2	0.2
Peru	8.4	10.9	21.0	26.1	2.3	1.0	1.0	0.3	0.2	19.6	1.5	21.9	8.0
Philippines	9.1	7.9	43.9	76.9	5.0	0.7	1.0	0.2	0.2	34.2	0.7	20.8	3.3
Poland	2.9	5.1	347.5	304.5	–1.3	9.1	8.0	1.5	0.7	47.2	–2.2	23.9	–2.2
Portugal	7.9	7.1	42.3	57.5	3.0	4.3	5.5	0.4	0.3	14.3	0.3	8.1	0.3
Puerto Rico	..	..	11.8	2.1	–4.1	3.3	0.5	..	..	..	..	..	..

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3.8 Energy efficiency and emissions

	GDP per unit of energy use		Carbon dioxide emissions							Methane emissions		Nitrous oxide emissions	
	2000 PPP $ per kilogram of oil equivalent		Total million metric tons		average annual % change	Per capita metric tons		kilograms per 2000 PPP $ of GDP		million metric tons of carbon dioxide equivalent	average annual % change	million metric tons of carbon dioxide equivalent	average annual % change
	1990	2004	1990	2003	1990–2003	1990	2003	1990	2003	2000	1990–2000	2000	1990–2000
Romania	2.5	4.5	155.0	91.1	–4.0	6.7	4.2	1.2	0.6	36.1	–1.7	7.2	–6.6
Russian Federation	*1.6*	2.0	2,261.7	1,493.0	–3.3	15.3	10.3	1.8	1.2	298.7	–4.6	51.5	–3.7
Rwanda	..	..	0.5	0.6	1.7	0.1	0.1	0.1	0.1	2.2	–1.5	1.2	–1.4
Saudi Arabia	2.8	2.2	197.4	302.3	0.5	12.1	13.7	1.1	0.9	54.4	5.7	8.7	1.5
Senegal	5.0	6.5	3.1	4.8	2.6	0.4	0.4	0.3	0.3	8.4	2.5	6.6	3.8
Serbia and Montenegro	..	..	65.4	49.9	–0.4	6.2	6.2	..	..	9.5	–2.6	6.1	–3.5
Sierra Leone	..	..	0.3	0.7	4.3	0.1	0.1	0.1	0.2	2.6	0.8	0.9	3.0
Singapore	3.4	4.4	45.1	47.8	1.2	14.8	11.4	1.2	0.5	1.2	7.1	0.9	46.1
Slovak Republic	2.7	3.9	51.4	37.5	–1.8	9.7	7.0	1.1	0.5	4.2	–3.1	3.2	–4.9
Slovenia	*4.9*	5.4	18.0	15.4	1.1	9.0	7.7	0.8	0.4	2.5	–0.7	2.0	2.3
Somalia	..	..	0.0	..	..	0.0	..	..	..	..	..	..	..
South Africa	3.9	3.7	285.4	364.2	1.7	8.1	7.9	1.1	0.8	37.4	0.7	25.8	0.1
Spain	7.3	6.9	211.8	309.2	3.2	5.5	7.4	0.4	0.3	39.6	2.3	30.1	1.5
Sri Lanka	7.3	8.3	3.8	10.3	8.8	0.2	0.5	0.1	0.1	13.3	2.9	2.9	2.0
Sudan	2.7	3.7	5.4	9.0	5.0	0.2	0.3	0.2	0.1	46.6	1.7	47.1	2.0
Swaziland	..	..	0.4	1.0	12.0	0.6	0.9	0.2	0.2	1.1	1.0	1.2	1.2
Sweden	4.0	4.5	49.4	52.7	0.0	5.8	5.9	0.3	0.2	7.1	–1.0	7.1	–0.4
Switzerland	8.2	8.3	42.7	40.4	–0.2	6.4	5.5	0.3	0.2	5.0	–1.1	3.7	0.3
Syrian Arab Republic	2.9	3.4	35.8	48.9	1.9	2.8	2.7	1.4	0.8	9.7	6.7	9.4	2.0
Tajikistan	*0.9*	2.1	23.4	4.7	–12.5	4.4	0.7	2.2	0.7	1.4	0.8	0.1	1.5
Tanzania	1.4	1.3	2.3	3.8	2.8	0.1	0.1	0.2	0.2	31.7	1.8	27.1	1.6
Thailand	5.7	4.9	95.7	245.9	6.4	1.8	3.9	0.5	0.5	75.9	0.4	13.1	0.7
Togo	4.3	3.1	0.8	2.2	7.8	0.2	0.4	0.2	0.3	2.1	1.7	2.3	1.5
Trinidad and Tobago	1.4	1.3	16.9	28.6	3.5	13.9	22.1	2.4	1.8	3.1	2.4	0.3	–1.6
Tunisia	6.7	8.2	13.3	20.9	3.2	1.6	2.1	0.4	0.3	4.8	3.0	5.2	1.4
Turkey	5.8	6.2	146.2	220.0	3.6	2.6	3.1	0.6	0.4	97.4	2.1	40.6	–1.2
Turkmenistan	*1.6*	..	32.0	43.3	2.6	8.7	9.2	1.9	..	27.1	1.7	0.6	–1.4
Uganda	..	..	0.8	1.7	7.2	0.0	0.1	0.1	0.0	12.4	2.5	12.9	2.7
Ukraine	*1.8*	2.0	684.0	314.4	–6.6	13.2	6.6	1.8	1.2	153.5	–2.2	19.9	–4.3
United Arab Emirates	1.9	2.2	54.7	135.0	7.4	30.8	33.4	1.5	1.5	35.2	7.1	0.1	3.2
United Kingdom	5.9	7.3	569.1	558.5	–0.4	9.9	9.4	0.6	0.3	51.1	–3.3	43.8	–3.5
United States	3.7	4.6	4,816.2	5,788.2	1.7	19.3	19.9	0.8	0.5	613.4	–0.5	430.0	0.8
Uruguay	9.9	10.4	3.9	4.4	0.7	1.3	1.3	0.2	0.2	18.3	2.0	0.7	3.0
Uzbekistan	*0.7*	0.8	129.2	123.6	0.1	6.3	4.8	4.2	2.8	46.2	1.5	13.5	1.9
Venezuela, RB	2.6	2.6	117.3	144.0	2.0	5.9	5.6	1.3	1.1	95.1	2.4	6.9	–0.5
Vietnam	3.3	4.2	21.4	76.1	11.5	0.3	0.9	0.3	0.4	68.1	1.5	12.9	5.2
West Bank and Gaza	..	..	..	..	..	..	..	..	..	..	..	..	..
Yemen, Rep.	3.0	2.8	9.6	17.1	4.2	0.8	0.9	1.4	1.0	8.7	8.9	5.6	0.9
Zambia	1.5	1.5	2.4	2.2	–2.0	0.3	0.2	0.4	0.2	11.2	1.4	5.5	1.3
Zimbabwe	3.0	2.6	16.6	11.5	–2.7	1.6	0.9	0.7	0.4	11.0	0.2	8.6	–0.5
World	**3.9 w**	**4.8 w**	**22,501.8 t**	**26,750.9 t**	**1.2 w**	**4.3 w**	**4.3 w**	**0.7 w**	**0.5 w**	**5,893.6 t**	**–0.6 w**	**3,454.4 t**	**0.3 w**
Low income	3.5	4.4	1,336.9	1,893.3	2.4	0.8	0.8	0.5	0.4	1,344.6	1.8	910.8	2.7
Middle income	3.0	4.2	9,319.6	10,753.5	0.5	3.5	3.6	1.1	0.6	3,033.6	0.8	1,545.4	1.0
Lower middle income	3.1	4.5	4,965.3	6,943.3	1.7	2.4	2.9	1.0	0.5	2,080.8	1.5	1,242.3	1.7
Upper middle income	2.8	3.7	4,353.8	3,811.5	–1.1	8.1	6.4	1.2	0.7	952.9	–0.1	303.4	0.0
Low & middle income	3.0	4.3	10,656.6	12,646.8	0.8	2.4	2.4	1.0	0.5	4,377.7	1.0	2,455.6	1.2
East Asia & Pacific	2.6	4.4	3,030.6	5,100.6	2.5	1.9	2.7	1.2	0.6	1,365.5	1.7	780.0	2.2
Europe & Central Asia	2.1	2.8	4,821.9	3,265.3	–3.1	10.2	6.9	1.6	0.9	844.1	–2.0	236.3	–1.9
Latin America & Carib.	6.0	6.2	1,037.3	1,299.9	2.0	2.4	2.4	0.5	0.3	800.9	0.8	418.8	1.4
Middle East & N. Africa	4.6	4.2	575.4	1,012.5	4.5	2.5	3.4	0.8	0.7	233.0	4.2	118.3	1.9
South Asia	4.2	5.5	768.4	1,436.7	4.9	0.7	1.0	0.5	0.4	631.7	1.7	550.3	2.8
Sub-Saharan Africa	2.8	2.8	418.3	531.9	1.6	0.8	0.8	0.6	0.4	504.6	1.5	353.8	1.2
High income	4.7	5.2	10,651.9	12,738.4	1.5	11.8	12.8	0.6	0.4	1,450.2	–0.9	961.9	0.1
Europe EMU	5.8	6.5	2,466.1	2,535.8	0.4	8.3	8.2	0.5	0.3	287.0	–1.8	278.2	–1.1

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Energy efficiency and emissions 3.8

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 2000 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.

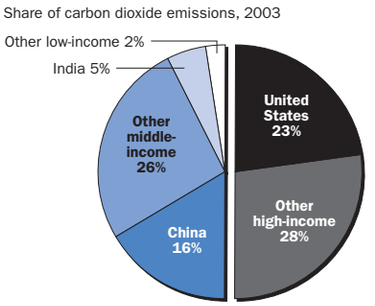
Because commercial energy is widely traded, it is necessary to distinguish between its production and its use. Net energy imports show the extent to which an economy's use exceeds its domestic production. High-income countries are net energy importers; middle-income countries have been their main suppliers.

Carbon dioxide emissions, largely byproducts 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.

Methane emissions, largely the result of agricultural activities and industrial production of methane, are expressed in carbon dioxide equivalents using global warming potential, which allows different gases to be compared on the basis of their effective contributions. A kilogram of methane is 23 times as effective at trapping heat in the earth's atmosphere as a kilogram of carbon dioxide within a time horizon of 100 years. The global warming potential of a kilogram of nitrous oxide is nearly 300 times that of a kilogram of carbon dioxide within the same time horizon.

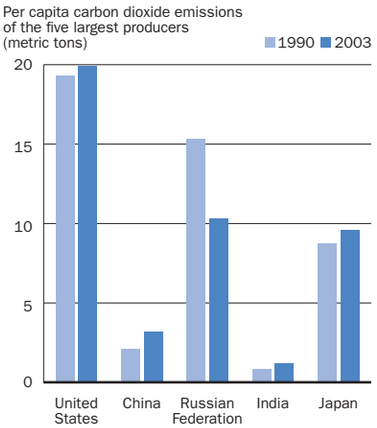
The Carbon Dioxide Information Analysis Center (CDIAC), sponsored by the U.S. Department of Energy, calculates annual anthropogenic emissions of carbon dioxide. These calculations are based on data on fossil fuel consumption (from the World Energy Data Set maintained by the United Nations Statistics 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. The world totals shown in the table include the carbon dioxide emissions not allocated to specific countries. 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.

High-income countries contribute more than half of global carbon dioxide emissions **3.8a**



Source: Table 3.8.

The five largest contributors to carbon dioxide emissions differ considerably in per capita emissions **3.8b**



Source: Table 3.8.

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 2000 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. • **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. • **Methane emissions** are those stemming from human activities such as agriculture and from industrial methane production. • **Nitrous oxide emissions** are those stemming from agriculture, biomass burning, industrial activities, and livestock management.

Data sources

The underlying data on energy use are from electronic files of the International Energy Agency. Data on carbon dioxide emissions are from the CDIAC, Environmental Sciences Division, Oak Ridge National Laboratory, in the U.S. state of Tennessee. Data on methane and nitrous oxide emissions are compiled by the World Resources Institute.

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3.9 Sources of electricity

	Electricity production		Sources of electricity[a]									
			% of total									
	billion kilowatt hours		Coal		Gas		Oil		Hydropower		Nuclear power	
	1990	2004	1990	2004	1990	2004	1990	2004	1990	2004	1990	2004
Afghanistan	..	..	..	..	..	..	..	..	..	..	..	..
Albania	3.2	5.6	..	..	..	..	10.9	1.7	89.1	98.3	..	..
Algeria	16.1	31.3	..	..	93.7	97.0	5.4	2.2	0.8	0.8	..	..
Angola	0.8	2.2	..	..	..	..	13.8	33.5	86.2	66.5	..	..
Argentina	51.0	100.3	1.3	1.7	39.0	54.8	9.7	4.0	35.6	30.4	14.3	7.8
Armenia	*9.0*	6.0	..	..	*22.9*	30.4	*43.3*	..	*33.8*	33.1	..	36.5
Australia	154.3	239.3	77.1	79.3	10.6	12.3	2.7	0.7	9.2	6.8	..	..
Austria	49.3	61.6	14.2	14.8	15.7	17.8	3.8	3.0	63.9	59.1	..	..
Azerbaijan	*19.7*	21.6	..	..	*0.5*	58.9	*91.1*	28.4	*8.9*	12.7	..	..
Bangladesh	7.7	21.5	..	..	84.3	87.5	4.3	6.7	11.4	5.7	..	..
Belarus	*37.6*	31.2	..	0.0	*47.9*	87.3	*52.1*	12.6	*0.0*	0.1	..	..
Belgium	70.3	84.4	28.2	13.6	7.7	25.5	1.9	2.0	0.4	0.4	60.8	56.1
Benin	0.0	0.1	..	..	..	..	100.0	98.8	..	1.2	..	..
Bolivia	2.1	4.4	..	..	37.6	29.2	5.3	19.7	55.3	49.0	..	..
Bosnia and Herzegovina	*6.5*	12.6	*47.8*	52.1	..	..	..	1.1	*52.2*	46.8	..	..
Botswana	0.9	1.3	88.1	95.7	..	..	11.9	4.3	..	..	..	..
Brazil	222.8	387.5	2.0	2.7	0.0	5.0	2.2	3.2	92.8	82.8	1.0	3.0
Bulgaria	42.1	41.4	50.3	46.1	7.6	3.6	2.9	2.0	4.5	7.6	34.8	40.6
Burkina Faso	..	..	..	..	..	..	..	..	..	..	..	..
Burundi	..	..	..	..	..	..	..	..	..	..	..	..
Cambodia	..	0.8	..	..	..	..	..	49.3	..	1.8	..	..
Cameroon	2.7	4.1	..	..	..	..	1.5	4.6	98.5	95.4	..	..
Canada	481.9	598.4	17.1	17.2	2.0	5.4	3.4	3.6	61.6	57.0	15.1	15.1
Central African Republic	..	..	..	..	..	..	..	..	..	..	..	..
Chad	..	..	..	..	..	..	..	..	..	..	..	..
Chile	18.4	52.0	34.3	16.1	1.3	34.0	7.6	1.5	55.3	45.4	..	..
China	621.2	2,199.6	71.2	77.9	0.5	0.4	7.9	3.3	20.4	16.1	*0.2*	2.3
Hong Kong, China	28.9	37.1	98.3	68.5	..	30.9	1.7	0.6	..	..	..	..
Colombia	36.2	50.2	9.8	6.0	12.4	12.9	1.0	0.2	76.0	79.8	..	..
Congo, Dem. Rep.	5.7	6.9	..	..	..	..	0.4	0.3	99.6	99.7	..	..
Congo, Rep.	0.5	0.4	..	..	..	..	0.6	..	99.4	100.0	..	..
Costa Rica	3.5	8.2	..	..	..	..	2.5	1.8	97.5	79.0	..	..
Côte d'Ivoire	2.0	5.4	..	..	..	67.5	33.3	0.1	66.7	32.4	..	..
Croatia	*8.9*	13.2	..	16.2	*15.4*	18.6	*35.8*	12.4	*48.8*	52.7	..	..
Cuba	15.0	15.7	..	..	0.2	*0.0*	91.5	95.3	0.6	0.6	..	..
Czech Republic	62.3	83.8	76.4	60.3	0.6	2.6	0.9	0.4	1.9	2.4	20.2	31.4
Denmark	26.0	40.5	90.7	46.1	2.7	24.7	3.4	4.0	0.1	0.1	..	..
Dominican Republic	3.7	13.8	1.2	15.2	..	0.1	88.6	72.6	9.4	11.5	..	..
Ecuador	6.3	12.6	..	..	..	8.5	21.5	32.6	78.5	58.9	..	..
Egypt, Arab Rep.	42.3	101.3	..	..	39.6	70.8	36.9	16.2	23.5	12.5	..	..
El Salvador	2.2	4.4	..	..	..	..	6.9	45.6	73.5	31.2	..	..
Eritrea	..	..	..	..	..	..	..	..	..	..	..	..
Estonia	*11.8*	10.3	*90.0*	92.4	*5.5*	4.7	*4.5*	0.3	*0.0*	0.2	..	..
Ethiopia	1.2	2.5	..	..	..	..	11.6	0.7	88.4	99.3	..	..
Finland	54.4	85.8	33.0	27.5	8.6	14.9	3.1	0.7	20.0	17.6	35.3	26.5
France	417.2	567.1	8.5	5.0	0.7	3.2	2.1	1.0	12.9	10.5	75.3	79.0
Gabon	1.0	1.5	..	..	16.4	16.7	11.2	24.8	72.1	58.1	..	..
Gambia, The	..	..	..	..	..	..	..	..	..	..	..	..
Georgia	*11.2*	6.9	..	..	*36.6*	12.0	*5.0*	0.6	*58.3*	87.4	..	..
Germany	547.7	610.0	58.8	50.5	7.4	10.1	1.9	1.7	3.2	3.5	27.8	27.4
Ghana	5.7	6.0	..	..	..	..	..	12.6	100.0	87.4	..	..
Greece	34.8	58.8	72.4	60.2	0.3	15.3	22.3	14.3	5.1	7.9	..	..
Guatemala	2.3	7.0	..	17.1	..	..	9.0	35.7	76.0	34.7	..	..
Guinea	..	..	..	..	..	..	..	..	..	..	..	..
Guinea-Bissau	..	..	..	..	..	..	..	..	..	..	..	..
Haiti	0.6	0.5	..	..	..	..	20.6	52.5	76.5	47.5	..	..

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Sources of electricity 3.9

	Electricity production		Sources of electricity[a]									
			% of total									
	billion kilowatt hours		Coal		Gas		Oil		Hydropower		Nuclear power	
	1990	2004	1990	2004	1990	2004	1990	2004	1990	2004	1990	2004
Honduras	2.3	4.9	..	..	..	..	1.7	51.5	98.3	48.1	..	..
Hungary	28.4	33.7	30.5	24.7	15.7	34.8	4.8	2.3	0.6	0.6	48.3	35.3
India	289.4	667.8	65.3	69.1	3.4	9.5	4.3	5.4	24.8	12.7	2.1	2.5
Indonesia	33.3	120.2	31.5	40.1	2.3	16.1	42.7	30.2	20.2	8.1	..	..
Iran, Islamic Rep.	59.1	164.5	..	..	52.5	76.2	37.3	17.3	10.3	6.5	..	..
Iraq	24.0	32.3	..	..	..	..	89.2	98.5	10.8	1.5	..	..
Ireland	14.2	25.2	57.4	30.6	27.7	51.1	10.0	12.7	4.9	2.5	..	..
Israel	20.9	49.1	50.1	75.3	..	8.8	49.9	15.8	0.0	0.1	..	..
Italy	213.1	293.0	16.8	17.4	18.6	44.3	48.2	15.7	14.8	13.5	*0.1*	..
Jamaica	2.5	7.2	..	..	..	..	92.4	96.5	3.6	1.9	..	..
Japan	838.2	1,071.0	13.9	27.5	19.8	22.8	18.4	9.2	10.7	8.8	24.1	26.4
Jordan	3.6	9.0	..	..	11.9	50.2	87.8	49.2	0.3	0.6	..	..
Kazakhstan	*82.7*	66.9	*72.3*	69.9	*10.6*	10.6	*8.8*	7.4	*8.3*	12.0	..	..
Kenya	3.0	5.6	..	..	..	..	7.6	24.1	81.6	51.5	..	..
Korea, Dem. Rep.	27.7	22.0	40.1	38.6	..	..	3.6	4.5	56.3	56.9	..	..
Korea, Rep.	105.4	366.6	16.8	38.8	9.1	16.2	17.9	7.6	6.0	1.2	50.2	35.7
Kuwait	18.5	41.3	..	..	45.7	20.5	54.3	79.5	..	..	..	..
Kyrgyz Republic	*11.9*	15.1	*9.1*	3.5	*13.6*	3.5	..	..	*77.4*	93.1	..	..
Lao PDR	..	..	..	..	..	..	..	..	..	..	..	..
Latvia	*4.0*	4.7	*3.8*	*0.6*	*25.4*	30.6	*7.6*	1.3	*63.3*	66.4	..	..
Lebanon	1.5	10.2	..	..	..	..	66.7	89.0	33.3	11.0	..	..
Lesotho	..	..	..	..	..	..	..	..	..	..	..	..
Liberia	..	..	..	..	..	..	..	..	..	..	..	..
Libya	10.2	20.2	..	..	..	19.3	100.0	80.7	..	..	..	..
Lithuania	*18.7*	18.8	..	..	*6.7*	14.4	*12.4*	1.9	*2.5*	2.2	*78.2*	80.5
Macedonia, FYR	*6.1*	6.7	*85.0*	77.6	..	..	*1.0*	0.2	*14.0*	22.2	..	..
Madagascar	..	..	..	..	..	..	..	..	..	..	..	..
Malawi	..	..	..	..	..	..	..	..	..	..	..	..
Malaysia	23.0	82.9	12.3	27.9	20.4	61.8	50.0	3.3	17.3	7.0	..	..
Mali	..	..	..	..	..	..	..	..	..	..	..	..
Mauritania	..	..	..	..	..	..	..	..	..	..	..	..
Mauritius	..	..	..	..	..	..	..	..	..	..	..	..
Mexico	124.1	224.1	6.3	10.7	11.6	38.8	56.7	31.1	18.9	11.2	2.4	4.1
Moldova	*11.2*	3.6	*34.4*	..	*36.9*	97.9	*26.4*	0.4	*2.3*	1.6	..	..
Mongolia	..	..	..	..	..	..	..	..	..	..	..	..
Morocco	9.6	19.3	23.0	67.4	..	..	64.4	23.2	12.7	8.4	..	..
Mozambique	0.5	11.7	13.9	..	*0.2*	0.1	23.6	0.2	62.6	99.7	..	..
Myanmar	2.5	6.4	1.6	..	39.3	57.0	10.9	6.8	48.1	36.2	..	..
Namibia	*1.4*	1.7	*1.5*	0.4	..	..	*3.3*	2.7	*95.2*	96.9	..	..
Nepal	0.9	2.3	..	..	..	..	0.1	0.2	99.9	99.8	..	..
Netherlands	71.9	100.8	38.3	26.0	50.9	60.5	4.3	2.8	0.1	0.1	4.9	3.8
New Zealand	32.1	41.8	1.5	9.9	17.7	16.7	0.0	0.1	72.6	64.6	..	..
Nicaragua	1.4	2.8	..	..	..	..	39.8	75.2	28.8	11.4	..	..
Niger	..	..	..	..	..	..	..	..	..	..	..	..
Nigeria	13.5	20.2	0.1	..	53.7	62.7	13.7	3.1	32.6	34.2	..	..
Norway	121.6	110.1	0.1	0.1	*0.0*	0.3	0.0	0.0	99.6	98.8	..	..
Oman	4.5	11.5	..	..	81.6	82.0	18.4	18.0	..	..	..	..
Pakistan	37.7	85.7	0.1	0.2	33.6	50.7	20.6	15.9	44.9	30.0	0.8	3.3
Panama	2.7	5.8	..	..	..	..	14.7	34.0	83.2	65.6	..	..
Papua New Guinea	..	..	..	..	..	..	..	..	..	..	..	..
Paraguay	27.2	51.9	..	..	..	..	0.0	..	99.9	100.0	..	..
Peru	13.8	24.3	..	3.8	1.7	8.2	21.5	15.1	75.8	72.3	..	..
Philippines	25.2	56.0	7.7	28.9	..	22.1	46.7	15.2	24.0	15.4	..	..
Poland	134.4	152.6	97.5	94.1	0.1	2.1	1.2	1.6	1.1	1.4	..	..
Portugal	28.4	44.8	32.1	33.1	..	26.1	33.1	12.7	32.3	22.0	..	..
Puerto Rico	..	..	..	..	..	..	..	..	..	..	..	..

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3.9 Sources of electricity

	Electricity production		Sources of electricity[a]									
			% of total									
	billion kilowatt hours		Coal		Gas		Oil		Hydropower		Nuclear power	
	1990	2004	1990	2004	1990	2004	1990	2004	1990	2004	1990	2004
Romania	64.3	56.5	28.8	38.5	35.1	18.5	18.4	3.9	17.7	29.2	..	9.8
Russian Federation	*1,008.5*	929.9	*15.3*	17.3	*45.7*	45.3	9.9	2.7	*17.0*	18.9	*11.9*	15.6
Rwanda	..	..	..	..	..	..	..	..	..	..	..	..
Saudi Arabia	69.2	159.9	..	..	43.5	49.2	56.5	50.8	..	..	..	..
Senegal	0.9	2.4	..	..	2.0	1.8	98.0	75.0	..	12.5	..	..
Serbia and Montenegro	*36.5*	*35.4*	*65.6*	*69.9*	*1.6*	*1.5*	*1.7*	*0.8*	*31.1*	*27.9*	..	..
Sierra Leone	..	..	..	..	..	..	..	..	..	..	..	..
Singapore	15.7	36.8	..	..	*11.8*	68.8	100.0	31.2	..	..	..	..
Slovak Republic	25.5	30.5	31.9	20.0	7.1	7.9	6.4	2.4	7.4	13.5	47.2	55.9
Slovenia	*12.1*	15.3	*36.2*	34.0	*0.2*	2.3	*2.5*	0.3	*28.2*	26.8	*32.9*	35.7
Somalia	..	..	..	..	..	..	..	..	..	..	..	..
South Africa	165.4	242.2	94.3	93.2	..	0.0	*0.0*	..	0.6	0.9	5.1	5.5
Spain	151.2	277.1	40.1	29.0	1.0	20.0	5.7	8.6	16.8	11.4	35.9	23.0
Sri Lanka	3.2	8.0	..	..	..	..	0.2	63.2	99.8	36.8	..	..
Sudan	1.5	3.9	..	..	..	..	36.8	72.8	63.2	27.2	..	..
Swaziland	..	..	..	..	..	..	..	..	..	..	..	..
Sweden	146.0	151.7	1.1	1.7	0.3	0.5	0.9	1.3	49.7	39.6	46.7	51.1
Switzerland	54.9	63.6	0.1	..	0.6	1.5	0.7	0.3	54.3	53.1	43.1	42.4
Syrian Arab Republic	11.6	32.1	..	..	20.5	41.2	56.0	45.6	23.5	13.2	..	..
Tajikistan	*16.8*	17.3	..	..	*5.3*	2.3	..	..	*94.7*	97.7	..	..
Tanzania	1.6	2.5	..	3.5	..	..	4.9	1.5	95.1	95.1	..	..
Thailand	44.2	125.7	25.0	15.9	40.2	71.0	23.5	6.2	11.3	4.8	..	..
Togo	0.2	0.3	..	..	..	..	39.9	38.9	60.1	61.1	..	..
Trinidad and Tobago	3.6	6.4	..	..	99.0	99.5	0.1	0.1	..	..	..	..
Tunisia	5.8	13.1	..	..	63.7	90.2	35.5	8.3	0.8	1.2	..	..
Turkey	57.5	150.7	35.1	22.9	17.7	41.3	6.9	5.1	40.2	30.6	..	..
Turkmenistan	*13.2*	11.5	..	..	*100.0*	100.0	..	..	*0.0*	0.0	..	..
Uganda	..	..	..	..	..	..	..	..	..	..	..	..
Ukraine	*252.5*	182.0	*41.8*	24.7	*16.8*	20.7	*9.0*	0.3	*3.2*	6.5	*29.2*	47.8
United Arab Emirates	17.1	52.4	..	..	96.3	97.5	3.7	2.5	..	..	..	..
United Kingdom	317.8	393.2	65.0	34.1	1.6	40.6	10.9	1.3	1.6	1.3	20.7	20.3
United States	3,202.8	4,147.7	53.1	50.4	11.9	17.6	4.1	3.4	8.5	6.5	19.1	19.6
Uruguay	7.4	5.9	..	..	..	0.0	5.1	18.3	94.2	81.0	..	..
Uzbekistan	*50.9*	51.0	*4.9*	3.9	*75.9*	74.0	6.9	9.2	*12.3*	12.8	..	..
Venezuela, RB	59.3	98.5	..	..	26.2	16.9	11.5	12.1	62.3	71.0	..	..
Vietnam	8.7	46.0	23.1	15.3	0.1	42.7	15.0	3.7	61.8	38.4	..	..
West Bank and Gaza	..	..	..	..	..	..	..	..	..	..	..	..
Yemen, Rep.	1.7	4.3	..	..	..	..	100.0	100.0	..	..	..	..
Zambia	8.0	8.5	0.5	0.2	..	..	0.3	0.4	99.2	99.4	..	..
Zimbabwe	9.4	9.7	53.3	43.0	..	..	..	0.2	46.7	56.8	..	..
World	**11,787.7 s**	**17,372.6 s**	**38.1 w**	**39.8 w**	**13.8 w**	**19.7 w**	**10.3 w**	**6.4 w**	**18.1 w**	**16.0 w**	**17.1 w**	**15.8 w**
Low income	518.1	1,026.4	40.9	47.1	15.0	19.9	6.6	7.0	34.8	23.4	1.2	1.9
Middle income	3,842.9	6,258.9	35.8	42.7	19.5	20.6	14.7	7.6	21.6	21.5	7.4	6.7
Lower middle income	1,828.6	3,903.4	41.5	50.0	10.4	13.3	16.0	8.0	27.5	23.4	5.0	4.3
Upper middle income	2,014.3	2,355.4	30.6	30.6	27.6	32.6	13.5	6.9	16.2	18.3	9.6	10.7
Low & middle income	4,361.0	7,285.3	36.4	43.3	18.9	20.5	13.7	7.5	23.1	21.8	6.7	6.0
East Asia & Pacific	785.8	2,659.5	61.3	69.1	3.5	7.6	12.7	4.9	21.7	15.6	*0.2*	1.9
Europe & Central Asia	2,213.4	1,964.1	33.0	28.6	28.4	33.8	12.1	3.2	13.3	17.4	12.0	16.6
Latin America & Carib.	608.5	1,088.3	3.8	4.7	9.7	19.6	18.8	14.0	63.5	56.3	2.0	2.6
Middle East & N. Africa	190.0	449.0	1.2	2.9	38.4	60.2	48.2	29.8	12.2	7.0	..	..
South Asia	338.9	785.3	55.8	58.7	8.6	16.0	6.1	7.1	27.6	14.9	1.9	2.5
Sub-Saharan Africa	224.4	339.0	72.1	68.2	3.3	4.9	2.2	2.7	18.4	19.5	3.8	3.9
High income	7,426.7	10,087.3	39.1	37.3	10.8	19.1	8.4	5.6	15.2	11.9	23.2	22.8
Europe EMU	1,667.3	2,227.2	34.5	27.0	8.6	18.3	9.4	4.9	11.1	10.0	35.4	34.0

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

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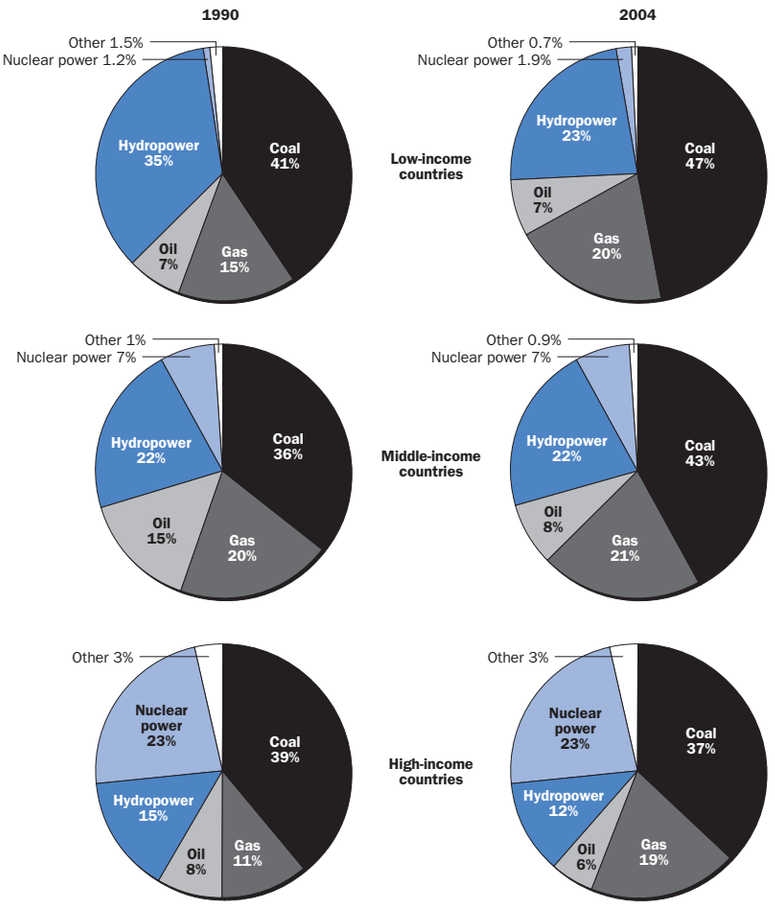
Sources of electricity 3.9

About the data

Use of energy is 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. It 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.

Coal is still the major source of electricity in all income groups, with low-income countries increasingly relying on this source **3.9a**



Note: Components may not sum to 100 percent because of rounding.
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. • **Sources of electricity** refer to the inputs used to generate electricity: coal, gas, oil, hydropower, and nuclear power. • **Coal** refers to all coal and brown coal, both primary (including hard coal and lignite-brown coal) and derived fuels (including patent fuel, coke oven coke, gas coke, coke oven gas, and blast furnace gas). Peat is also included in this category. • **Gas** refers to natural gas but not to natural gas liquids. • **Oil** refers to crude oil and petroleum products. • **Hydropower** refers to electricity produced by hydroelectric power plants.• **Nuclear power** refers to electricity produced by nuclear power plants.

Data sources

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.*

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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		average annual % growth	% of total population		% of urban population		% of urban population		% of rural population	
	1990	2005	1990	2005	1990–2005	1990	2005	1990	2005	1990	2004	1990	2004
Afghanistan	..	..	..	..	..	..	..	..	..	..	..	..	..
Albania	1.2	1.4	36	45	1.0	..	..	..	..	99	99	..	84
Algeria	13.2	20.8	52	63	3.0	8	10	14	15	99	99	77	82
Angola	3.9	8.5	37	53	5.2	15	17	40	33	61	56	18	16
Argentina	28.3	34.9	87	90	1.4	39	39	37	36	86	92	45	83
Armenia	2.4	1.9	68	64	–1.4	33	37	49	57	96	96	..	61
Australia	14.6	17.9	85	88	1.4	60	61	25	24	100	100	100	100
Austria	5.1	5.4	66	66	0.4	27	27	41	42	100	100	100	100
Azerbaijan	3.8	4.3	54	52	0.7	24	22	45	43	..	73	..	36
Bangladesh	20.6	35.6	20	25	3.7	9	13	32	35	55	51	12	35
Belarus	6.8	7.1	66	72	0.3	16	18	24	25	..	93	..	61
Belgium	9.6	10.2	96	97	0.4	10	10	10	10	100	100	100	100
Benin	1.8	3.4	35	40	4.3	..	..	..	..	32	59	2	11
Bolivia	3.7	5.9	56	64	3.1	25	31	29	26	49	60	14	22
Bosnia and Herzegovina	1.7	1.8	39	46	1.0	..	..	..	..	99	99	..	92
Botswana	0.6	1.0	42	57	3.5	..	..	..	..	61	57	21	25
Brazil	111.7	157.0	75	84	2.3	34	37	13	12	82	83	37	37
Bulgaria	5.8	5.4	66	70	–0.5	14	14	21	20	100	100	96	96
Burkina Faso	1.2	2.4	14	18	4.9	..	..	50	38	32	42	3	6
Burundi	0.4	0.8	6	10	4.9	..	..	..	..	42	47	44	35
Cambodia	1.2	2.8	13	20	5.6	6	10	48	49	..	53	..	8
Cameroon	4.7	8.9	41	55	4.3	14	20	20	20	59	58	40	43
Canada	21.3	25.9	77	80	1.3	40	44	18	21	100	100	99	99
Central African Republic	1.1	1.5	37	38	2.2	..	..	..	..	34	47	17	12
Chad	1.3	2.5	21	25	4.6	..	..	38	36	28	24	2	4
Chile	11.0	14.3	83	88	1.8	35	35	42	40	91	95	52	62
China	311.0	527.0	27	40	3.6	13	18	3	3	64	69	7	28
Hong Kong, China	5.7	6.9	100	100	1.4	100	100	100	100	..	..	..	..
Colombia	24.0	33.2	69	73	2.1	30	36	20	23	95	96	52	54
Congo, Dem. Rep.	10.5	18.5	28	32	3.7	15	17	35	33	53	42	1	25
Congo, Rep.	1.3	2.4	54	60	4.0	28	29	52	49	..	28	..	25
Costa Rica	1.6	2.7	51	62	3.7	24	28	47	46	..	89	97	97
Côte d'Ivoire	5.0	8.2	40	45	3.3	17	20	42	44	37	46	10	29
Croatia	2.6	2.5	54	57	0.0	..	..	..	..	100	100	100	100
Cuba	7.7	8.5	73	76	0.7	20	19	27	26	99	99	95	95
Czech Republic	7.8	7.5	75	74	–0.3	12	11	16	16	99	99	97	97
Denmark	4.4	4.6	85	86	0.4	26	20	31	23	100	100	100	100
Dominican Republic	3.9	5.9	55	67	2.9	21	23	39	34	60	81	43	73
Ecuador	5.7	8.3	55	63	2.5	26	29	28	29	77	94	45	82
Egypt, Arab Rep.	24.2	31.7	44	43	1.8	22	20	37	35	70	86	42	58
El Salvador	2.5	4.1	49	60	3.4	19	22	39	37	70	77	33	39
Eritrea	0.5	0.9	16	19	4.0	..	..	..	..	44	32	0	3
Estonia	1.1	0.9	71	69	–1.2	..	..	..	..	97	97	96	96
Ethiopia	6.4	11.4	13	16	3.9	3	4	28	25	13	44	2	7
Finland	3.1	3.2	61	61	0.3	17	21	28	34	100	100	100	100
France	42.0	46.7	74	77	0.7	23	22	22	21	..	..	..	..
Gabon	0.7	1.2	69	84	3.8	..	..	..	..	..	37	..	30
Gambia, The	0.4	0.8	38	54	5.7	..	..	..	..	..	72	..	46
Georgia	3.0	2.3	55	52	–1.7	22	23	41	45	99	96	94	91
Germany	58.3	62.0	73	75	0.4	8	8	6	5	100	100	100	100
Ghana	5.6	10.6	37	48	4.2	12	16	21	19	23	27	10	11
Greece	6.0	6.6	59	59	0.6	30	29	51	49	..	..	..	..
Guatemala	3.7	5.9	41	47	3.3	..	..	22	17	73	90	47	82
Guinea	1.7	3.1	28	33	3.8	14	15	51	46	27	31	10	11
Guinea-Bissau	0.3	0.5	28	30	3.3	..	..	..	..	..	57	..	23
Haiti	2.0	3.3	30	39	3.3	17	25	56	64	25	57	23	14

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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		average annual % growth	% of total population		% of urban population		% of urban population		% of rural population	
	1990	2005	1990	2005	1990–2005	1990	2005	1990	2005	1990	2004	1990	2004
Honduras	2.0	3.4	40	47	3.6	..	..	29	28	77	87	31	54
Hungary	6.8	6.7	66	66	–0.2	19	17	29	25	100	100	..	85
India	216.6	314.1	26	29	2.5	10	12	6	6	45	59	3	22
Indonesia	54.5	106.1	31	48	4.6	9	12	14	12	65	73	37	40
Iran, Islamic Rep.	30.6	45.7	56	67	2.7	23	23	21	16	86	..	78	..
Iraq	12.9	..	70	..	..	26	..	32	..	95	..	48	..
Ireland	2.0	2.5	57	61	1.5	26	25	46	41	..	..	..	..
Israel	4.2	6.3	90	92	2.6	43	44	48	47	100	100	..	..
Italy	37.8	39.6	67	68	0.2	19	17	9	8	..	..	..	..
Jamaica	1.2	1.4	49	53	1.2	..	..	..	..	86	91	64	69
Japan	78.0	84.1	63	66	0.5	46	48	42	42	100	100	100	100
Jordan	2.3	4.5	72	82	4.1	27	24	37	29	97	94	82	87
Kazakhstan	9.2	8.7	56	57	–0.7	7	8	12	13	87	87	52	52
Kenya	4.3	7.1	18	21	3.4	6	8	32	39	48	46	37	41
Korea, Dem. Rep.	11.5	13.9	58	62	1.3	16	20	22	24	..	58	..	60
Korea, Rep.	31.6	39.0	74	81	1.4	51	51	33	25	..	..	..	..
Kuwait	2.1	2.5	98	98	2.9	65	71	67	73	..	..	..	..
Kyrgyz Republic	1.7	1.8	38	36	0.6	..	..	38	43	75	75	51	51
Lao PDR	0.6	1.2	15	21	4.4	..	..	..	..	..	67	..	20
Latvia	1.9	1.6	69	68	–1.2	..	..	..	..	..	82	..	71
Lebanon	2.3	3.1	83	87	2.0	47	50	57	57	100	100	..	87
Lesotho	0.3	0.3	17	19	1.4	..	..	..	..	61	61	32	32
Liberia	1.0	1.9	45	58	5.7	..	..	55	49	59	49	24	7
Libya	3.4	5.0	79	85	2.5	49	55	44	42	97	97	96	96
Lithuania	2.5	2.3	68	67	–0.7	..	..	..	..	..	..	..	..
Macedonia, FYR	1.1	1.4	58	69	1.6	..	..	..	..	..	..	..	..
Madagascar	2.8	5.0	24	27	3.8	8	9	33	32	27	48	10	26
Malawi	1.1	2.2	12	17	4.8	..	..	..	..	64	62	45	61
Malaysia	8.9	17.1	50	67	4.5	6	6	13	8	95	95	..	93
Mali	2.1	4.1	23	31	4.7	8	10	36	33	50	59	32	39
Mauritania	0.8	1.2	40	40	2.9	..	..	..	..	42	49	22	8
Mauritius	0.5	0.5	44	42	0.9	..	..	..	..	95	95	..	94
Mexico	60.3	78.3	73	76	1.8	32	35	25	25	75	91	13	41
Moldova	2.0	2.0	47	47	–0.3	..	..	..	..	..	86	..	52
Mongolia	1.2	1.4	57	57	1.2	..	..	48	60	..	75	..	37
Morocco	11.6	17.7	48	59	2.7	16	16	23	18	87	88	27	52
Mozambique	2.8	6.8	21	35	6.0	6	7	27	19	49	53	12	19
Myanmar	10.1	15.5	25	31	2.9	7	8	29	27	48	88	16	72
Namibia	0.4	0.7	28	35	4.2	..	..	..	..	70	50	8	13
Nepal	1.7	4.3	9	16	6.4	..	..	23	19	48	62	7	30
Netherlands	10.3	13.1	69	80	1.6	14	14	10	9	100	100	100	100
New Zealand	2.9	3.5	85	86	1.2	25	28	30	33	..	..	88	..
Nicaragua	2.1	3.0	53	59	2.6	19	23	35	38	64	56	24	34
Niger	1.3	2.3	15	17	4.0	..	..	33	36	35	43	2	4
Nigeria	31.7	63.4	35	48	4.7	11	14	15	17	51	53	33	36
Norway	3.1	3.6	72	77	1.1	..	..	22	22	100	100	100	100
Oman	1.2	1.8	65	72	2.7	..	..	..	..	97	97	61	..
Pakistan	33.0	54.4	31	35	3.4	16	18	22	21	82	92	17	41
Panama	1.3	2.3	54	71	3.9	35	38	65	53	89	89	51	51
Papua New Guinea	0.5	0.8	13	13	2.6	..	..	..	..	67	67	41	41
Paraguay	2.1	3.5	49	59	3.5	22	31	45	54	72	94	45	61
Peru	15.0	20.3	69	73	2.0	27	26	39	35	69	74	15	32
Philippines	29.8	52.1	49	63	3.8	14	14	27	21	66	80	48	59
Poland	23.4	23.7	61	62	0.1	4	4	7	7	..	..	..	..
Portugal	4.7	6.1	48	58	1.7	37	39	54	45	..	..	..	..
Puerto Rico	2.6	3.8	72	98	2.6	44	67	60	68	..	..	..	..

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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		average annual % growth	% of total population		% of urban population		% of urban population		% of rural population	
	1990	2005	1990	2005	1990–2005	1990	2005	1990	2005	1990	2004	1990	2004
Romania	12.6	11.6	54	54	–0.5	8	9	14	17	..	89	..	..
Russian Federation	108.8	104.5	73	73	–0.3	18	19	8	10	93	93	70	70
Rwanda	0.4	1.7	5	19	12.4	..	..	57	45	49	56	36	38
Saudi Arabia	12.5	18.7	77	81	2.7	30	36	19	22	100	100	..	..
Senegal	3.1	4.8	39	42	3.0	17	19	44	45	53	79	19	34
Serbia and Montenegro	5.4	4.2	51	52	–2.1	11	14	22	26	97	97	77	77
Sierra Leone	1.2	2.2	30	41	4.0	..	..	43	36	..	53	..	30
Singapore	3.0	4.3	100	100	2.4	99	100	99	100	100	100	..	..
Slovak Republic	3.0	3.0	57	56	0.1	..	..	..	..	100	100	98	98
Slovenia	1.0	1.0	50	51	0.1	..	..	..	..	..	..	..	..
Somalia	2.0	2.9	30	35	2.7	14	16	48	46	..	48	..	14
South Africa	18.3	27.8	52	59	2.9	25	30	10	12	85	79	53	46
Spain	29.3	33.3	75	77	0.8	22	24	15	17	100	100	100	100
Sri Lanka	2.9	3.0	17	15	0.0	..	..	..	..	89	98	64	89
Sudan	6.9	14.8	27	41	5.2	9	12	34	31	53	50	26	24
Swaziland	0.2	0.3	23	24	3.1	..	..	..	..	..	59	..	44
Sweden	7.1	7.6	83	84	0.4	17	19	21	22	100	100	100	100
Switzerland	4.6	5.6	68	75	1.2	14	15	20	20	100	100	100	100
Syrian Arab Republic	6.3	9.6	49	51	2.9	25	25	25	26	97	99	50	81
Tajikistan	1.7	1.6	32	25	–0.3	..	..	..	..	..	70	..	45
Tanzania	5.0	9.3	19	24	4.2	5	7	27	29	52	53	45	43
Thailand	16.1	20.7	29	32	1.7	11	10	37	32	95	98	74	99
Togo	1.2	2.5	30	40	5.1	16	22	52	54	71	71	24	15
Trinidad and Tobago	0.1	0.2	9	12	2.9	..	..	..	..	100	100	100	100
Tunisia	4.9	6.5	60	65	2.0	..	..	..	..	95	96	47	65
Turkey	33.2	48.5	59	67	2.6	22	26	20	20	96	96	70	72
Turkmenistan	1.7	2.2	45	46	1.9	..	..	..	..	..	77	..	50
Uganda	2.0	3.6	11	13	4.1	4	5	38	36	54	54	41	41
Ukraine	34.7	31.9	67	68	–0.7	12	13	7	8	98	98	92	93
United Arab Emirates	1.4	3.5	79	77	6.3	27	29	34	38	98	98	95	95
United Kingdom	51.1	54.0	89	90	0.4	26	26	15	16	..	..	..	..
United States	188.0	239.5	75	81	1.6	41	43	9	8	100	100	100	100
Uruguay	2.8	3.2	89	92	1.0	41	36	46	40	100	100	99	99
Uzbekistan	8.2	9.6	40	37	1.0	10	8	25	23	69	78	39	61
Venezuela, RB	16.6	24.8	84	93	2.7	34	37	17	12	..	71	..	48
Vietnam	13.4	21.9	20	26	3.3	13	13	30	23	58	92	30	50
West Bank and Gaza	1.3	2.6	68	72	4.6	..	..	..	..	..	78	..	61
Yemen, Rep.	2.5	5.7	21	27	5.4	5	9	26	31	82	86	19	28
Zambia	3.3	4.1	39	35	1.3	9	11	23	31	63	59	31	52
Zimbabwe	3.1	4.7	29	36	2.8	10	12	34	32	69	63	42	47
World	**2,253.0 s**	**3,128.3 s**	**43 w**	**49 w**	**2.2 w**	**18 w**	**20 w**	**17 w**	**16 w**	**77 w**	**80 w**	**23 w**	**38 w**
Low income	442.0	704.7	25	30	3.2	10	12	17	18	50	61	12	28
Middle income	1,160.1	1,657.4	44	54	2.4	17	20	15	14	79	81	25	42
Lower middle income	798.0	1,225.8	38	50	2.9	16	19	14	12	75	77	22	39
Upper middle income	362.0	431.6	68	72	1.2	..	..	18	19	89	91	58	66
Low & middle income	1,602.1	2,362.1	37	44	2.6	14	17	16	15	71	75	19	35
East Asia & Pacific	459.7	781.5	29	41	3.6	..	..	9	8	65	72	15	36
Europe & Central Asia	294.0	300.5	63	64	0.1	15	16	13	15	94	93	72	71
Latin America & Carib.	310.1	425.4	71	77	2.1	32	34	24	22	81	86	36	49
Middle East & N. Africa	117.1	174.7	52	57	2.7	20	20	27	25	87	92	52	58
South Asia	277.7	418.4	25	28	2.8	10	12	10	11	50	63	6	27
Sub-Saharan Africa	143.5	261.7	28	35	4.1	..	..	26	26	52	53	24	28
High income	650.9	766.2	74	78	1.1	..	..	20	19	100	100	100	100
Europe EMU	209.5	230.1	71	73	0.6	18	18	15	15	..	..	..	..

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Urbanization 3.10

About the data

There is no consistent and universally accepted standard for making the distinction between urban and rural. The wide variety of situations across countries makes it difficult to adopt uniform criteria for distinguishing urban and rural areas. Most countries have adopted an urban classification related to the size or characteristics of settlements. Other countries have defined urban areas based on the presence of certain infrastructure and services. And some countries have designated urban areas based on administrative arrangements. 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.) For further discussion of urban-rural issues see box 3.1a in *About the data* for table 3.1.

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, UN 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.

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 2005 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

Data on urban population and the population in urban agglomerations and in the largest city are from the United Nations Population Division's *World Urbanization Prospects: The 2005 Revision.* The total population figures are World Bank estimates. Data on access to sanitation in urban and rural areas are from the World Health Organization.

Population of the world's largest metropolitan areas in 1000, 1900, 2000, and 2015 (millions) **3.10a**

1000	
City	**Population**
Cordova	0.45
Kaifeng	0.40
Constantinopole	0.30
Angkor	0.20
Kyoto	0.18
Cairo	0.14
Baghdad	0.13
Nishapur	0.13
Hasa	0.11
Anhivada	0.10

1900	
City	**Population**
London	6.5
New York	4.2
Paris	3.3
Berlin	2.7
Chicago	1.7
Vienna	1.7
Tokyo	1.5
St. Petersburg	1.4
Manchester	1.4
Philadelphia	1.4

2000	
City	**Population**
Tokyo	34.5
Mexico City	18.1
New York–Newark	17.9
São Paulo	17.1
Mumbai	16.1
Shanghai	13.2
Kolkata	13.1
Delhi	12.4
Buenos Aires	11.9
Los Angeles–Long Beach–Santa Ana	11.8

2015	
City	**Population**
Tokyo	35.5
Mumbai	21.9
Mexico City	21.6
São Paulo	20.5
New York–Newark	19.9
Delhi	18.6
Shanghai	17.2
Kolkata	17.0
Dhaka	16.8
Jakarta	16.8

Source: O'Meara 1999; United Nations Population Division, 2005, *World Urbanization Prospects: The 2005 Revision.*

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3.11 Urban housing conditions

	Census year	Household size		Overcrowding		Durable dwelling units		Home ownership		Multiunit dwellings		Vacancy rate	
		number of people		People living in overcrowded dwellings[a] % of total		Buildings with durable structure % of total		Privately owned dwellings % of total		% of total		Unoccupied dwellings % of total	
		National	Urban	National	Urban	National	Urban	National	Urban	National	Urban	National	Urban
Afghanistan		..	..	..	..	..	..	..	..	..	..	..	..
Albania	2001	4.2	3.9	..	..	..	..	65[b]	30[b]	..	..	12	13
Algeria	1998	4.9	..	..	..	..	..	67	..	..	..	19	..
Angola		..	..	..	..	..	..	..	..	..	..	..	..
Argentina	2001	3.6	..	19	..	97	..	..	..	4	..	16[b]	..
Armenia	2001	4.1	4.0	4	6	93	93	95	90	1	1	..	..
Australia	2001	3.8	..	1	..	..	..	..	..	..	..	..	..
Austria	1991	2.6	..	2	..	..	..	..	..	50	..	13	..
Azerbaijan	1999	4.7	4.4	..	..	..	..	74	62	4	5	..	..
Bangladesh	2001	4.8	4.8	..	..	21[b]	42[b]	88[b]	61[b]	..	..	..	..
Belarus	1999	..	..	..	..	..	..	..	..	..	..	..	..
Belgium	2001	2.6	..	0[b]	..	..	..	67	..	32[b]	..	..	..
Benin	1992	5.9	..	..	..	26	..	59	..	..	..	..	..
Bolivia	2001	4.2	4.3	40	..	43	58	70	59	3[b]	5[b]	6	4
Bosnia and Herzegovina		..	..	..	..	..	..	..	..	..	..	..	..
Botswana	2001	4.2	3.9	27	47	88	90[b]	61	47	1	..	..	..
Brazil	2000	3.8	3.7	..	..	..	..	74	75	..	..	..	..
Bulgaria	2001	2.7	2.7	..	..	79	89	98	98	..	..	23	17
Burkina Faso	1996	6.2	5.8	30	53	..	..	..	..	..	..	..	..
Burundi	1990	4.7	..	..	..	..	..	..	..	..	..	..	..
Cambodia	1998	5.2	..	..	..	..	..	..	..	..	..	..	..
Cameroon	1987	5.2	5.1	67	77	77	..	73	48	27	42	..	..
Canada	2001	2.6	..	..	..	..	..	64	..	32	..	8	..
Central African Republic	2003	5.2	5.8	32	36[b]	78	92	85	74	..	..	..	..
Chad	1993	5.1	5.1	..	..	..	..	..	..	..	..	..	..
Chile	2002	3.4	3.5	..	..	91	92	66	65	13	15	11	10
China	2000	3.4	3.2	..	..	82	..	88	74	..	..	1	..
Hong Kong, China		..	..	..	..	..	..	..	..	..	..	..	..
Colombia	1993	4.8	..	27[b]	..	83[b]	..	68[b]	..	13	..	10[b]	..
Congo Dem Rep	1984	5.4	..	55	..	..	..	..	..	..	..	..	..
Congo Rep	1984	10.5	..	..	..	..	..	76	..	..	..	..	..
Costa Rica	2000	4.0	..	22	..	88	..	72	..	2	3	9	6
Côte d'Ivoire	1998	5.4	..	..	..	..	..	..	..	..	..	..	..
Croatia	2001	3.0	..	..	..	..	..	..	..	..	..	12	..
Cuba	1981	4.2	4.2	..	..	..	..	..	..	15	21	0	0
Czech Republic	2001	2.4	..	..	..	..	..	52	..	49	..	12	..
Denmark	2001	2.2	..	..	..	..	..	..	..	..	..	..	..
Dominican Republic	2002	3.9	..	..	..	97	..	..	..	8	..	11	..
Ecuador	2001	3.5	3.7	30	..	81	88	68[b]	58[b]	9	14	12	7
Egypt	1996	4.7	..	..	..	..	..	..	..	75	..	..	..
El Salvador	1992	..	..	63	..	67	83	70	68	3	6	11	11
Eritrea		..	..	..	..	..	..	..	..	..	..	..	..
Estonia	2000	2.4	2.3	3	..	..	..	..	..	72	..	13	..
Ethiopia	1994	4.8	4.7	..	..	..	23	..	54	..	..	..	..
Finland	2000	2.2	..	..	..	..	..	64	..	44	..	..	..
France	1999	2.5	..	..	..	..	..	55	..	..	..	7	..
Gabon	2003	5.2	..	..	..	..	..	..	..	..	..	..	..
Gambia	1993	8.9	..	..	..	18	..	68	..	..	..	..	..
Georgia	2002	3.5	3.5	..	..	..	..	..	..	..	..	..	..
Germany	2001	2.3	..	..	..	..	..	43	..	..	..	7	..
Ghana	2000	5.1	5.1	..	..	45	..	57	..	53	..	5	..
Greece	2001	3.0	..	1	..	..	..	..	..	..	..	..	..
Guatemala	2002	4.4	4.7	..	..	67	80	81	74	2	4	13	11
Guinea		..	..	..	..	..	..	..	..	..	..	..	..
Guinea-Bissau		..	..	..	..	..	..	..	..	..	..	..	..
Haiti	1982	4.2	..	26	..	..	..	92	68	..	..	9	19

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Urban housing conditions

3.11

ENVIRONMENT

	Census year	Household size		Overcrowding		Durable dwelling units		Home ownership		Multiunit dwellings		Vacancy rate	
		number of people		People living in overcrowded dwellings[a] % of total		Buildings with durable structure % of total		Privately owned dwellings % of total		% of total		Unoccupied dwellings % of total	
		National	Urban	National	Urban	National	Urban	National	Urban	National	Urban	National	Urban
Honduras	2001	4.4	..	..	..	69	85	..	..	..	..	14	..
Hungary	1990	2.7	..	..	..	..	..	..	..	..	..	4	..
India	2001	5.3	5.3	77	71	83	81	87	67	..	..	6	9
Indonesia	2000	4.0	..	..	..	..	..	..	..	..	..	..	..
Iran, Islamic Rep.	1996	4.8	4.6	33[b]	26[b]	72	76	73	67	..	..	..	..
Iraq	1997	7.7	7.2	..	..	88	96	70	66	4	5	13	15
Ireland	2002	3.0	..	..	..	..	..	..	..	8[b]	..	..	..
Israel	1995	3.5	..	..	..	..	..	..	..	..	..	..	..
Italy	2001	2.8	..	..	..	..	..	..	..	..	..	21	..
Jamaica	2001	3.5	..	..	..	98[b]	..	58[b]	..	2[b]	..	..	..
Japan	2000	2.7	..	..	..	..	..	61	..	37	..	..	..
Jordan	1994	6.2	6.0	1	..	97	97	69	64	57	67	..	..
Kazakhstan		..	..	..	..	..	..	..	..	..	..	..	..
Kenya	1999	4.6	3.4	..	..	35	72	72	25	..	..	39	17
Korea, Dem Rep	2000	3.8	..	23	..	..	..	50	..	15	..	..	..
Korea, Rep.	1993	4.4	..	..	..	..	..	..	..	..	..	..	..
Kuwait	1995	6.4	..	..	..	..	..	..	..	9[b]	..	11	..
Kyrgyz Republic	1999	4.4	3.6	..	..	..	..	..	..	..	..	..	..
Laos	1995	6.1	6.1	..	..	49	77	96	86	..	..	..	..
Latvia	2000	3.0	2.6	4	..	88	..	58	..	74	..	0	..
Lebanon		..	..	..	..	..	..	..	..	..	..	..	..
Lesotho	2001	5.0	..	10[b]	..	..	..	84	..	0	..	..	..
Liberia	1974	4.8	..	31	..	20	..	1	..	..	..	..	..
Libya		6.4	..	..	..	..	..	..	..	..	..	7	..
Lithuania	2001	2.6	..	7	..	..	..	..	..	..	..	..	..
Macedonia, FYR	2002	3.6	3.6[b]	8[b]	..	95[b]	95[b]	48[b]	..	..	..	7[b]	3[b]
Madagascar	1993	4.9	4.8	64	57	..	..	81	59	..	..	..	..
Malawi	1998	4.4	4.4	30	..	48	84	86	47	..	..	..	..
Malaysia	2000	4.5	4.4	..	..	..	..	..	..	10[b]	16[b]	..	..
Mali	1998	5.6	..	..	..	..	..	..	..	..	..	..	..
Mauritania	1988	..	..	..	..	..	..	..	..	..	..	..	..
Mauritius	2000	3.9	3.8	6	7	91	94	87	81	..	..	7	6
Mexico	2000	4.4	..	27[b]	..	87	..	78	..	6	..	..	..
Moldova	2003	..	..	..	..	..	..	..	..	..	..	..	..
Mongolia	2000	4.4	4.5	..	..	..	..	..	..	48	56	..	..
Morocco	1982	5.9	5.3	..	..	..	..	..	..	..	..	..	..
Mozambique	1997	4.4	4.9	37	28	7	20	92	83	1	1	0	..
Myanmar		..	..	..	..	..	..	..	..	..	..	..	..
Namibia	2001	5.3	..	..	..	..	..	..	..	..	..	..	..
Nepal	2001	5.4	4.9	..	..	..	..	88	..	..	..	0	..
Netherlands		..	..	..	..	..	..	..	..	..	..	..	..
New Zealand	2001	2.8	..	1[b]	..	..	..	65	..	17	..	10	..
Nicaragua	1995	5.3	..	..	..	79	87	84	86	0	0	8	..
Niger	2001	6.4	6.0	..	..	..	..	77	40	..	..	..	..
Nigeria	1991	5.0	4.7	..	..	..	..	..	..	..	..	..	..
Norway	1980	2.7	..	1	..	..	..	67	..	38	..	..	..
Oman	2003	7.1	..	..	..	..	..	..	..	..	..	..	..
Pakistan	1998	6.8	6.8	..	..	58	86	81	..	..	..	..	..
Panama	2000	4.1	..	28[b]	..	88	98[b]	80	66[b]	10[b]	10[b]	14	..
Papua New Guinea	1990	4.5[b]	6.5	..	..	..	..	..	44	..	8	..	..
Paraguay	2002	4.6	4.5	38[b]	..	95[b]	98[b]	79	75	1[b]	2[b]	6[b]	6[b]
Peru	1993	..	..	..	..	49	64	..	..	..	..	7	3
Philippines	1990	5.3	5.3	..	..	62	..	83	76	6	11	4	4
Poland	1988	3.2	..	..	..	..	..	..	..	..	..	1	..
Portugal	2001	2.8	..	..	..	..	..	76	..	86	..	..	..
Puerto Rico	1990	3.3	..	..	..	..	..	72	..	..	..	11	..

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3.11 Urban housing conditions

	Census year	Household size		Overcrowding		Durable dwelling units		Home ownership		Multiunit dwellings		Vacancy rate	
		number of people		People living in overcrowded dwellings[a] % of total		Buildings with durable structure % of total		Privately owned dwellings % of total		% of total		Unoccupied dwellings % of total	
		National	Urban	National	Urban	National	Urban	National	Urban	National	Urban	National	Urban
Romania	1992	3.1	3.1	..	..	58	..	87	77	39	71	6	4
Russia	2002	2.8	2.7	7	5	..	..	..	..	73	86	..	..
Rwanda	1991	4.7	..	..	..	79	78	92	73	19	25	..	..
Saudi Arabia	1992	6.1	..	..	..	92	..	42	..	..	..	..	..
Senegal		..	..	..	..	..	..	..	..	..	..	..	..
Serbia	2001	2.9	2.2	..	..	..	..	..	..	..	..	..	..
Sierra Leone	1985	6.8	..	..	..	34	..	68	..	..	..	..	..
Singapore	2000	4.4	..	..	..	..	..	..	..	..	..	..	..
Slovak Republic		..	..	..	..	..	..	..	..	..	..	..	..
Slovenia	1991	3.1	..	..	..	..	..	69	..	37	..	9	..
Somalia	1975	..	..	..	..	..	..	..	..	..	..	..	..
South Africa	2001	4.0	..	..	..	..	..	..	..	7	..	..	..
Spain	1991	3.3	..	0	..	..	..	78	..	..	..	..	..
Sri Lanka	2001	3.8	..	..	..	93[b]	92[b]	70[b]	58[b]	1	14[b]	13	1[b]
Sudan	1993	5.8	6.0	..	..	..	..	86[b]	58[b]	0[b]	1[b]	..	..
Swaziland	1997	5.4	3.7	..	..	..	..	..	..	..	..	..	..
Sweden	1990	2.0	..	..	..	..	..	..	..	54	..	1	..
Switzerland	1990	2.4	2.1	..	..	..	..	31	24	28	32	11	7
Syrian Arab Republic	1981	6.3	6.0	..	..	..	..	..	..	..	..	..	..
Tajikistan	2000	..	..	..	..	..	..	..	..	..	..	..	..
Tanzania	2002	4.9	4.5[b]	33[b]	7[b]	..	..	82[b]	43[b]	..	..	..	..
Thailand	2000	3.8	..	..	..	93	93	81	62	3	..	3	..
Togo		..	..	..	..	..	..	..	..	..	..	..	..
Trinidad and Tobago	2000	3.7	..	9[b]	..	98[b]	..	74[b]	..	17[b]	..	..	..
Tunisia	1994	8.0	..	..	..	99	..	71	89[b]	6	10[b]	15	12[b]
Turkey	1990	5.0	..	..	..	..	..	70	..	..	..	..	..
Turkmenistan		..	..	..	..	..	..	..	..	..	..	..	..
Uganda	1991	4.9	4.0[b]	..	..	21[b]	..	80[b]	24[b]	0[b]	2[b]	..	..
Ukraine	2003	..	..	..	..	..	..	..	..	..	..	..	..
United Arab Emirates		..	..	..	..	..	..	..	..	..	..	..	..
United Kingdom	2001	..	2.4	..	..	..	..	..	69	..	19	..	..
United States	2000	2.7	..	..	..	..	..	66	..	..	..	9	7
Uruguay	1996	3.3	3.4[b]	22[b]	..	..	..	57[b]	57[b]	..	..	13[b]	13[b]
Uzbekistan		..	..	..	..	..	..	..	..	..	..	..	..
Venezuela. RB	2001	4.4	..	..	..	..	..	78	..	14	..	16	..
Vietnam	1999	4.6	4.5	..	..	77	89	95	86	..	..	..	..
West Bank and Gaza	1997	7.1	..	..	..	..	..	78	..	45	..	..	..
Yemen	1994	6.7	6.8	54[b]	6[b]	..	..	88[b]	68[b]	3[b]	11[b]	..	..
Zambia	2000	5.3	5.9	..	..	..	..	94	30	..	..	..	..
Zimbabwe	1992	4.8	4.2	..	..	..	..	94	30	6	..	..	..

a. More than two people per room. b. Data are from a previous census.

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Urban housing conditions 3.11

About the data

Urbanization can yield important social benefits, improving access to public services and the job market. At the same time it also leads to significant demands for services. Inadequate living quarters and demand for housing and shelter are major concerns for policymakers. The unmet demand for affordable housing, along with urban poverty, has led to the emergence of slums in many poor countries. Improving the shelter situation requires a better understanding of the mechanisms governing housing markets and the processes governing housing availability. That requires good data and adequate policy-oriented analysis so that housing policy can be formulated in a global comparative perspective and drawn from the lessons learned in other countries. Housing policies and outcomes affect such broad socioeconomic conditions as the infant mortality rate, performance in school, household saving, productivity levels, capital formation, and government budget deficits. A good understanding of housing conditions thus requires an extensive set of indicators within a reasonable framework.

There is a strong demand for quantitative indicators that can measure housing conditions on a regular basis to monitor progress. However, data deficiencies and lack of rigorous quantitative analysis hamper informed decision-making on desirable policies to improve housing conditions. The data in the table are from housing and population censuses, collected using similar definitions. The table will incorporate household survey data in future editions. The table focuses attention on urban areas, where housing conditions are typically most severe. Not all the compiled indicators are presented in the table because of space limitations. Additional indicators for more countries will be available in the World Bank's central database.

Selected housing indicators for smaller economies **3.11a**

	Census year	Household size	Overcrowding	Durable dwelling units	Home ownership	Multiunit dwellings	Vacancy rate
		number of people	People living in overcrowded dwellings[a] % of total	Buildings with durable structure % of total	Privately owned dwellings % of total	% of total	Unoccupied dwellings % of total
Antigua and Barbuda	2001	3.0	..	99[b]	65[b]	3[b]	22
Bahamas	1990	3.8	12	99	55	13	14
Bahrain	2001	5.9	..	94[b]	51	28	6
Barbados	1990	3.5	3	100	76	9	9
Belize	2000	4.6	..	93	63	4	..
Cape Verde	1990	5.1	28	78	72	2	..
Cayman Islands	1999	3.1	..	100	53	38	19
Equatorial Guinea	1993	7.5	14	56[b]	75	14	..
Fiji	1996	5.4	..	60	65	7	..
Guam	2000	4.0	2[b]	93	48	29	19
Isle of Man	2001	2.4	0	..	68	16	..
Maldives	2000	6.6	..	93	..	1	15
Marshall Islands	1999	7.8	..	95	72	12	8
Netherlands Antilles	2001	2.9	24[b]	99	60	16	12
New Caledonia	1989	4.1	..	77	53	9	13
Northern Mariana Islands	1995	4.9	9[b]	99	33	27	17
Palau	2000	5.7	8	76	79	11	3
Seychelles	1997	4.2	15[b]	97	78	..	0
Solomon Islands	1999	6.3	51	23	85	1	..
St. Vincent & Grenadines	1991	3.9	..	98	71	7	..
Turks and Caicos	1990	3.3	4	96	66	11	..
Virgin Islands (UK)	1991	3.0	2	99	40	46	..
Western Samoa	1991	7.3	..	42	90	47	30

a. More than two people per room. b. Data are from a previous census.
Source: National population and housing censuses.

Definitions

• **Census year** is the year in which the underlying data were collected. • **Household size** refers to the average number of people within a household. It is calculated by dividing total population by the number of households in the country and in urban areas. • **Overcrowding** refers to the number of households living in dwellings with two or more people per room as a percentage of the total number of households in the country and in urban areas. • **Durable dwelling units** refer to the number of housing units in structures made of durable building materials (concrete, stone, cement, brick, asbestos, zinc, and stucco) expected to maintain their stability for 20 years or longer under local conditions with normal maintenance and repair, taking into account location and environmental hazards such as floods, mudslides, and earthquakes as a percentage of total dwellings. • **Home ownership** refers to the number of privately owned dwellings as a percentage of total dwellings or the number of households that own housing units as a percentage of total households. This category includes privately owned and owner-occupied units, depending on the definition used in the census data. State- and community-owned units, rented, squatted, and rent-free units are not included. • **Multiunit dwellings** refer to the number of multiunit dwellings, such as apartments, flats, condominiums, barracks, boarding houses, orphanages, retirement houses, hostels, hotels, and collective dwellings, as a percentage of total occupied dwellings. • **Vacancy rate** refers to the percentage of completed dwelling units that are currently unoccupied. It includes all vacant units, whether on the market or not (such as second homes).

Data sources

Data on urban housing conditions are from national population and housing censuses.

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3.12 Traffic and congestion

	Motor vehicles				Passenger cars		Road density	Fuel prices		Particulate matter concentrations	
	per 1,000 people		per kilometer of road		per 1,000 people		km. of road per 100 sq. km. of land	$ per liter Super gasoline	Diesel fuel	Urban-population-weighted PM10 micrograms per cubic meter	
	1990	2004[a]	1990	2004[a]	1990	2004[a]	2004[a]	2006	2006	1990	2004
Afghanistan	*3*	..	*3*	..	*2*	*9*	5	0.68	0.65	75	46
Albania	11	*70*	*3*	*12*	2	*47*	*66*	1.44	1.29	92	56
Algeria	*55*	..	*15*	..	*26*	..	5	0.32	0.19	115	88
Angola	19	..	*3*	..	14	..	*4*	0.50	0.36	142	91
Argentina	181	*181*	27	*37*	134	*140*	15	0.62	0.48	105	78
Armenia	5	..	2	..	1	..	*27*	0.96	0.77	..	69
Australia	530	..	11	..	450	..	*11*	0.93	0.94	22	16
Austria	421	599	30	*33*	387	503	*162*	1.32	1.26	38	35
Azerbaijan	52	66	7	9	36	53	72	0.46	0.41	*105*	59
Bangladesh	1	*1*	0	*1*	0	*0*	*184*	0.79	0.45	223	140
Belarus	61	*168*	13	*18*	59	174	45	0.79	0.55	7	7
Belgium	423	529	30	37	385	468	498	1.63	1.34	32	25
Benin	3	..	2	..	2	..	17	0.81	0.81	75	43
Bolivia	41	49	6	7	25	15	6	0.54	0.47	120	86
Bosnia and Herzegovina	114	..	24	..	101	..	*43*	1.34	1.24	42	19
Botswana	18	105	3	8	10	42	4	0.78	0.74	119	69
Brazil	88	170	8	18	*84*	136	21	1.26	0.84	40	28
Bulgaria	163	360	39	63	146	314	40	1.05	1.08	111	55
Burkina Faso	4	..	3	..	2	..	6	1.15	1.12	149	94
Burundi	..	..	*3*	..	*3*	..	48	1.20	1.22	56	39
Cambodia	..	*30*	0	*31*	..	*25*	22	1.01	0.78	116	64
Cameroon	10	..	3	..	6	..	11	1.14	1.07	119	64
Canada	605	*577*	20	*34*	468	*561*	15	0.84	0.78	25	19
Central African Republic	1	..	0	..	1	..	*4*	1.37	1.27	61	48
Chad	2	..	0	..	1	..	*3*	1.31	1.20	214	127
Chile	81	*136*	13	*26*	52	*89*	*11*	1.09	0.86	88	54
China	5	*15*	4	*11*	1	*10*	20	0.69	0.61	113[b]	72[b]
Hong Kong, China	66	72	253	254	42	53	186	1.69	1.06	..	..
Colombia	*39*	*51*	*13*	*19*	*21*	*43*	*10*	0.98	0.57	38	23
Congo, Dem. Rep.	..	..	9	..	*17*	..	7	0.94	1.00	73	52
Congo, Rep.	18	..	3	..	12	..	5	0.96	0.67	130	85
Costa Rica	87	198	7	24	55	146	69	0.98	0.67	45	39
Côte d'Ivoire	24	..	6	..	15	..	25	1.20	1.06	94	38
Croatia	..	370	*34*	58	*185*	302	51	1.34	1.22	60	31
Cuba	*37*	..	*16*	..	*18*	..	*55*	1.10	0.91	44	19
Czech Republic	246	*391*	46	*31*	228	*358*	*165*	1.30	1.29	73	23
Denmark	368	*424*	27	*32*	320	*360*	*169*	1.58	1.45	30	20
Dominican Republic	75	..	48	..	21	..	*26*	1.03	0.75	44	30
Ecuador	35	55	8	17	31	32	16	0.47	0.39	38	25
Egypt, Arab Rep.	29	..	33	..	21	..	9	0.30	0.12	221	135
El Salvador	33	..	14	..	17	..	*48*	0.82	0.80	46	35
Eritrea	1	..	1	..	1	..	*4*	1.90	0.81	122	85
Estonia	211	459	22	11	154	349	134	1.23	1.22	19	16
Ethiopia	1	*2*	2	*4*	1	*1*	4	0.93	0.62	134	76
Finland	441	515	29	34	386	446	26	1.55	1.26	24	19
France	494	597	32	38	405	495	173	1.48	1.33	18	14
Gabon	32	..	4	..	19	..	4	0.64	0.39	9	6
Gambia, The	13	7	5	3	6	5	37	1.08	1.01	141	95
Georgia	107	*63*	27	*16*	89	*50*	29	0.86	0.89	..	45
Germany	405	580	53	207	386	546	..	1.55	1.38	27	19
Ghana	*8*	..	*4*	..	*5*	..	*21*	0.86	0.84	39	35
Greece	248	476	22	46	171	368	89	1.16	1.19	69	41
Guatemala	*21*	*57*	*16*	*45*	*11*	*52*	*13*	0.78	0.64	63	67
Guinea	4	..	1	..	2	..	*18*	0.79	0.82	105	71
Guinea-Bissau	7	..	2	..	4	..	*12*	..	..	117	78
Haiti	*8*	..	*14*	..	*5*	..	*15*	*0.88*	*0.60*	70	42

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Traffic and congestion 3.12

	Motor vehicles				Passenger cars		Road density	Fuel prices		Particulate matter concentrations	
	per 1,000 people		per kilometer of road		per 1,000 people		km. of road per 100 sq. km. of land	$ per liter Super gasoline	Diesel fuel	Urban-population-weighted PM10 micrograms per cubic meter	
	1990	2004[a]	1990	2004[a]	1990	2004[a]	2004[a]	2006	2006	1990	2004
Honduras	22	*61*	10	*28*	*5*	*52*	*12*	0.89	0.73	45	47
Hungary	212	*313*	21	*19*	188	*274*	*178*	1.30	1.31	36	18
India	4	*9*	2	*3*	2	*6*	*114*	1.01	0.75	110	72
Indonesia	16	..	10	..	7	..	*20*	0.57	0.44	139	102
Iran, Islamic Rep.	34	..	14	..	25	..	*11*	0.09	0.03	86	58
Iraq	14	..	6	..	1	..	*10*	..	..	146	138
Ireland	270	*447*	10	*11*	227	*382*	*140*	1.34	1.35	26	19
Israel	210	288	74	112	174	234	81	1.47	1.27	71	38
Italy	529	*610*	99	*73*	476	590	*165*	1.56	1.49	42	27
Jamaica	*52*	..	*7*	..	*43*	135	194	0.82	0.75	58	42
Japan	469	586	52	*63*	283	441	*323*	1.09	0.90	43	31
Jordan	60	106	26	77	*44*	71	8	0.86	0.45	110	50
Kazakhstan	76	100	8	17	50	80	3	0.70	0.45	12	19
Kenya	12	18	5	10	10	9	11	1.12	0.98	66	39
Korea, Dem. Rep.	..	..	..	..	..	..	*26*	0.71	0.79	184	79
Korea, Rep.	79	302	60	145	48	218	102	1.65	1.33	82	38
Kuwait	*474*	422	*165*	181	*368*	349	32	0.22	0.21	82	108
Kyrgyz Republic	44	*38*	10	*10*	44	39	*10*	0.64	0.54	*65*	24
Lao PDR	9	..	3	..	6	..	*14*	0.86	0.73	73	47
Latvia	135	348	6	12	106	297	112	1.20	1.15	40	16
Lebanon	321	..	183	..	300	..	*71*	0.74	0.62	45	42
Lesotho	11	..	4	..	3	..	*20*	0.89	0.88	85	54
Liberia	14	..	4	..	7	..	*11*	0.79	0.85	59	44
Libya	*165*	..	*10*	..	*96*	..	*5*	0.13	0.13	107	98
Lithuania	160	421	12	18	133	383	127	1.08	1.09	30	10
Macedonia, FYR	132	..	30	..	121	..	*34*	1.23	1.09	38	20
Madagascar	6	..	2	..	4	..	*9*	1.15	1.00	77	45
Malawi	4	..	4	..	2	..	*16*	1.17	1.12	74	46
Malaysia	124	*254*	26	*75*	101	*222*	30	0.53	0.40	37	29
Mali	3	..	2	..	2	..	2	1.22	1.04	264	165
Mauritania	10	..	3	..	7	..	*1*	0.97	0.84	146	103
Mauritius	59	130	35	79	44	96	99	*0.74*	*0.56*	26	16
Mexico	119	211	41	93	82	142	*18*	0.74	0.52	69	39
Moldova	53	87	17	29	48	65	39	*0.45*	*0.31*	*110*	39
Mongolia	21	*41*	1	*2*	6	*26*	*3*	0.88	0.87	65	68
Morocco	37	*45*	15	*23*	28	*45*	13	1.22	0.87	32	20
Mozambique	4	..	2	..	3	..	*4*	1.15	1.06	110	39
Myanmar	*2*	..	*3*	..	*1*	..	*4*	0.66	0.75	116	69
Namibia	71	*82*	1	*4*	39	*42*	*5*	0.87	0.87	74	43
Nepal	..	..	..	..	..	..	12	0.94	0.73	67	39
Netherlands	405	*427*	58	*58*	368	429	*372*	1.70	1.32	45	34
New Zealand	524	701	19	*31*	436	592	*35*	0.98	0.70	16	15
Nicaragua	19	46	5	13	10	18	15	0.67	0.58	49	31
Niger	6	..	4	..	5	..	1	1.14	1.11	216	144
Nigeria	*30*	..	*21*	..	*12*	17	21	0.51	0.66	179	67
Norway	458	*527*	22	*26*	380	*424*	*30*	1.80	1.66	24	12
Oman	130	..	9	..	83	..	*11*	0.31	0.39	148	120
Pakistan	6	14	4	8	4	10	34	1.01	0.64	224	128
Panama	75	*107*	18	*27*	60	*76*	*16*	0.70	0.60	58	37
Papua New Guinea	*27*	..	*6*	..	*7*	..	*4*	*0.94*	*0.64*	34	19
Paraguay	*27*	*88*	*4*	*15*	*16*	*52*	*7*	0.97	0.77	105	101
Peru	*128*	47	*43*	16	*62*	30	6	1.22	0.86	98	65
Philippines	10	*34*	4	*13*	7	*9*	*67*	0.76	0.67	55	32
Poland	168	*354*	18	*33*	138	*294*	*138*	1.30	1.30	59	38
Portugal	222	*463*	34	*278*	162	*429*	86	1.56	1.10	52	26
Puerto Rico	*295*	..	*79*	..	*242*	..	289	0.65	0.78	27	20

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3.12 Traffic and congestion

	Motor vehicles				Passenger cars		Road density	Fuel prices		Particulate matter concentrations	
	per 1,000 people		per kilometer of road		per 1,000 people		km. of road per 100 sq. km. of land	$ per liter Super gasoline	Diesel fuel	Urban-population-weighted PM10 micrograms per cubic meter	
	1990	2004[a]	1990	2004[a]	1990	2004[a]	2004[a]	2006	2006	1990	2004
Romania	72	185	11	20	56	149	86	1.26	1.24	36	16
Russian Federation	*87*	*174*	*14*	*48*	*65*	*140*	*3*	0.77	0.66	13	20
Rwanda	2	..	1	..	1	..	57	1.11	1.08	49	37
Saudi Arabia	165	..	19	..	98	..	*8*	0.16	0.07	163	133
Senegal	11	*14*	6	*9*	8	*11*	*7*	1.31	1.09	95	76
Serbia and Montenegro	137	199	31	102	133	181	*44*	1.48	1.31	28	13
Sierra Leone	10	*4*	4	*2*	7	*2*	*16*	0.98	0.98	91	56
Singapore	130	134	142	179	89	99	463	0.92	0.63	106	44
Slovak Republic	194	256	57	32	163	222	89	1.35	1.43	40	16
Slovenia	306	505	42	26	289	456	191	1.23	1.21	*40*	30
Somalia	2	..	1	..	1	..	*4*	0.74	0.67	78	41
South Africa	139	*144*	26	*24*	97	*92*	*30*	0.85	0.84	34	26
Spain	360	*558*	43	*34*	309	*455*	*133*	1.15	1.10	41	33
Sri Lanka	21	*34*	4	..	7	*13*	*151*	0.88	0.55	95	104
Sudan	9	..	22	..	8	..	*1*	0.72	0.49	288	182
Swaziland	66	*83*	18	*24*	35	*40*	*21*	0.80	0.85	60	34
Sweden	464	*504*	29	*11*	426	457	104	1.46	1.44	15	12
Switzerland	491	559	46	58	449	516	178	1.27	1.36	37	24
Syrian Arab Republic	26	36	10	7	10	12	52	0.60	0.13	158	86
Tajikistan	3	..	1	..	0	..	*20*	0.80	0.74	*148*	55
Tanzania	5	..	2	..	1	..	*9*	1.04	0.99	57	28
Thailand	46	..	36	..	14	..	*11*	0.70	0.65	88	73
Togo	24	..	11	..	16	..	*14*	1.03	1.01	49	43
Trinidad and Tobago	*117*	..	*19*	..	*98*	..	*162*	0.43	0.24	142	114
Tunisia	48	95	19	49	23	83	12	0.83	0.57	71	33
Turkey	50	108	8	18	34	75	55	1.88	1.62	75	48
Turkmenistan	..	..	..	..	..	..	*5*	..	..	*185*	62
Uganda	2	*5*	..	*4*	1	*2*	*36*	1.17	1.01	27	17
Ukraine	63	138	20	39	63	115	29	0.81	0.87	47	27
United Arab Emirates	121	..	52	..	97	..	*1*	0.37	0.53	264	126
United Kingdom	400	510	64	79	341	451	160	1.63	1.73	25	15
United States	758	808	30	37	573	465	70	0.63	0.69	30	23
Uruguay	138	..	45	..	122	..	34	1.23	0.94	237	134
Uzbekistan	..	..	..	..	..	..	*19*	0.85	0.54	79	76
Venezuela, RB	*93*	..	*25*	..	*73*	..	*11*	0.03	0.02	22	7
Vietnam	..	..	..	..	..	..	72	0.67	0.53	124	65
West Bank and Gaza	..	35	..	24	..	27	83	1.29	0.98	..	..
Yemen, Rep.	34	..	8	..	14	..	*12*	0.30	0.28	*142*	91
Zambia	14	..	3	..	8	..	*12*	1.31	1.22	95	58
Zimbabwe	*32*	*50*	*4*	*7*	*29*	*44*	*25*	*0.61*	*0.65*	35	28
World	**118 w**	***141* w**	**..**	**..**	**91 w**	***100* w**	***22* w**	**0.97 m**	**0.84 m**	**77 w**	**54 w**
Low income	5	*8*	..	..	3	*5*	*19*	0.98	0.84	129	77
Middle income	37	*69*	..	..	24	*51*	*15*	0.86	0.74	79	56
Lower middle income	22	*38*	..	..	10	*27*	16	0.85	0.70	93	64
Upper middle income	*119*	*186*	..	..	*90*	*142*	*12*	0.92	0.79	50	36
Low & middle income	25	*47*	..	..	16	*35*	*15*	0.89	0.79	93	63
East Asia & Pacific	9	*20*	..	..	4	*14*	*18*	*0.53*	*0.40*	112	72
Europe & Central Asia	*97*	*170*	..	..	*79*	*142*	*12*	1.14	1.09	38	30
Latin America & Carib.	100	*153*	..	..	*72*	*108*	17	0.82	0.67	59	38
Middle East & N. Africa	36	..	..	..	24	..	*7*	0.46	0.34	124	84
South Asia	4	*10*	..	..	2	6	..	0.91	0.65	131	84
Sub-Saharan Africa	21	..	..	..	14	..	*6*	1.03	0.98	114	64
High income	499	636	..	..	390	457	*41*	1.33	1.24	38	28
Europe EMU	428	*569*	..	..	379	522	*139*	1.52	1.29	33	24

a. Data are for 2004 or most recent year available. b. Includes Taiwan, China; Macao, China; and Hong Kong, China.

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3.12 Traffic and congestion

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, and 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 those on fuel prices and particulate matter—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. The IRF recently took steps to improve the quality of the data published in its 2006 *World Road Statistics*. However, this effort covers data only for 1999–2004. Therefore, the data shown in this table for 1990 and 2004 may not be comparable. Moreover, the data do not capture the quality or age of vehicles. Road density is a very rough indicator of accessibility and does not capture the condition, type, 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 and other sources, including the Allgemeiner Deutscher Automobile Club (for Europe) and a project of the Latin American Energy Organization for Latin America. Local prices are converted to U.S. dollars using the exchange rate on the survey date listed in the international monetary table of the *Financial Times*. For countries with multiple exchange rates the market, parallel, or black market rate is used rather than the official exchange rate.

Significant uncertainties exist around estimates of particulate matter concentrations, and caution should be used in interpreting them. But they do allow for cross-country comparisons of the relative risk of particulate matter pollution that urban residents face. Major sources of urban outdoor particulate matter pollution are emissions from traffic and industrial sources, but nonanthropogenic sources such as dust storms may also be a significant contributor for some cities. Data on particulate matter for selected cities are in table 3.13. Estimates of economic damages from death and illness due to particulate matter pollution are shown in table 3.15.

The 15 economies with the most expensive gasoline—and the 15 with the cheapest, 2006 **3.12a**

Economy	$ per liter	Economy	$ per liter
Eritrea	1.90	Venezuela, RB	0.03
Turkey	1.88	Iran, Islamic Rep.	0.09
Norway	1.80	Libya	0.13
Netherlands	1.70	Saudi Arabia	0.16
Hong Kong, China	1.69	Kuwait	0.22
Korea, Rep.	1.65	Egypt, Arab Rep.	0.30
Belgium	1.63	Yemen, Rep.	0.30
United Kingdom	1.63	Oman	0.31
Denmark	1.58	Algeria	0.32
Italy	1.56	United Arab Emirates	0.37
Portugal	1.56	Trinidad and Tobago	0.43
Finland	1.55	Azerbaijan	0.46
Germany	1.55	Ecuador	0.47
France	1.48	Angola	0.50
Serbia and Montenegro	1.48	Nigeria	0.51

Source: Table 3.12.

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). • **Road density** refers to the ratio of the length of the country's total road network to the country's land area. The road network includes all roads in the country—motorways, highways, main or national roads, secondary or regional roads, and other urban and rural roads. • **Fuel prices** refer to the pump prices of the most widely sold grade of gasoline and of diesel fuel. Prices are converted from the local currency to U.S. dollars (see *About the data*). • **Particulate matter concentrations** refer to fine suspended particulates less than 10 microns in diameter (PM10) that are capable of penetrating deep into the respiratory tract and causing significant health damage. Data for countries and aggregates for regions and income groups are urban-population-weighted PM10 levels in residential areas of cities with more than 100,000 residents. The estimates represent the average annual exposure level of the average urban resident to outdoor particulate matter. The state of a country's technology and pollution controls is an important determinant of particulate matter concentrations.

Data sources

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. Data on particulate matter concentrations are from Kiran Dev Pandey, David Wheeler, Bart Ostro, Uwe Deichmann, Kirk Hamilton, and Katie Bolt's "Ambient Particulate Matter Concentrations in Residential and Pollution Hotspot Areas of World Cities: New Estimates Based on the Global Model of Ambient Particulates (GMAPS)" (2006).

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3.13 Air pollution

	City	City population	Particulate matter	Sulfur dioxide	Nitrogen dioxide
		thousands	micrograms per cubic meter	micrograms per cubic meter	micrograms per cubic meter
		2005	2004	1995–2001[a]	1995–2001[a]
Argentina	Córdoba	1,423	58	..	97
	Melbourne	3,626	12	..	30
	Perth	1,474	12	5	19
	Sydney	4,331	20	28	81
Austria	Vienna	2,260	41	14	42
Belgium	Brussels	1,012	28	20	48
Brazil	Rio de Janeiro	11,469	35	129	..
	São Paulo	18,333	40	43	83
Bulgaria	Sofia	1,093	61	39	122
Canada	Montréal	3,640	19	10	42
	Toronto	5,312	22	17	43
	Vancouver	2,188	13	14	37
Chile	Santiago	5,683	61	29	81
China	Anshan	1,611	82	115	88
	Beijing	10,717	89	90	122
	Changchun	3,046	74	21	64
	Chengdu	4,065	86	77	74
	Chongqing	6,363	123	340	70
	Dalian	3,073	50	61	100
	Guangzhou	8,425	63	57	136
	Guiyang	3,447	70	424	53
	Harbin	3,695	77	23	30
	Jinan	2,743	94	132	45
	Kunming	2,837	70	19	33
	Lanzhou	2,411	91	102	104
	Liupanshui	1,149	59	102	..
	Nanchang	2,188	78	69	29
	Pingxiang	905	67	75	..
	Quingdao	2,817	68	190	64
	Shanghai	14,503	73	53	73
	Shenyang	4,720	101	99	73
	Taiyuan	2,794	88	211	55
	Tianjin	7,040	125	82	50
	Wulumqi	2,025	57	60	70
	Wuhan	7,093	79	40	43
	Zhengzhou	2,590	97	63	95
	Zibo	2,982	74	198	43
Colombia	Bogotá	7,747	31	..	..
Croatia	Zagreb	908[b]	33	31	..
Cuba	Havana	2,189	21	1	5
Czech Republic	Prague	1,171	23	14	33
Denmark	Copenhagen	1,088	21	7	54
Ecuador	Guayaquil	2,387	23	15	..
	Quito	1,514	30	22	..
Egypt, Arab Rep.	Cairo	11,128	169	69	..
Finland	Helsinki	1,091	21	4	35
France	Paris	9,820	11	14	57
Germany	Berlin	3,389	22	18	26
	Frankfurt	668[b]	19	11	45
	Munich	1,263	20	8	53
Ghana	Accra	1,981	33	..	..
Greece	Athens	3,230	43	34	64
Hungary	Budapest	1,693	19	39	51
Iceland	Reykjavik	164[b]	18	5	42
India	Ahmadabad	5,120	83	30	21
	Bangalore	6,462	45	..	..

About the data

Indoor and outdoor air pollution place a major burden on world health. More than half of the world's population rely on dung, wood, crop waste, or coal to meet their basic energy needs. Cooking and heating with such solid fuels on open fires or stoves without chimneys leads to indoor air pollution. Every year indoor air pollution is responsible for the deaths of 1.6 million people—one death every 20 seconds. In many urban areas 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 concentrations of particulate matter 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 are extracted from a complete set of estimates 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 2006).

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

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3.13 Air pollution

	City	City population	Particulate matter	Sulfur dioxide	Nitrogen dioxide
		thousands	micrograms per cubic meter	micrograms per cubic meter	micrograms per cubic meter
		2005	**2004**	**1995–2001[a]**	**1995–2001[a]**
India	Kolkata	14,277	128	49	34
	Madras	6,916	37	15	17
	Delhi	15,048	150	24	41
	Hyderabad	6,115	41	12	17
	Kanpur	3,018	109	15	14
	Lucknow	2,566	109	26	25
	Mumbai	18,196	63	33	39
	Nagpur	2,350	56	6	13
	Pune	4,409	47	..	..
Indonesia	Jakarta	13,215	104	..	..
Iran, Islamic Rep.	Tehran	7,314	58	209	..
Ireland	Dublin	1,037	19	20	..
Italy	Milan	2,953	30	31	248
	Rome	3,348	29	..	..
	Turin	1,660	44	..	..
Japan	Osaka-Kobe	11,268	35	19	63
	Tokyo	35,197	40	18	68
	Yokohama	3,366[b]	31	100	13
Kenya	Nairobi	2,773	43	..	..
Korea, Rep	Pusan	3,554	*44*	60	51
	Seoul	9,645	41	44	60
	Taegu	2,511	*50*	81	62
Malaysia	Kuala Lumpur	1,405	29	24	..
Mexico	Mexico City	19,411	51	74	130
Netherlands	Amsterdam	1,147	34	10	58
New Zealand	Auckland	1,148	14	3	20
Norway	Oslo	802	14	8	43
Philippines	Manila	10,686	39	33	..
Poland	Katowice	2,914[b]	39	83	79
	Lódz	776	39	21	43
	Warsaw	1,680	43	16	32
Portugal	Lisbon	2,761	23	8	52
Romania	Bucharest	1,934	18	10	71
Russian Federation	Moscow	10,654	21	109	..
	Omsk	1,132	22	20	34
Singapore	Singapore	4,326	44	20	30
Slovak Republic	Bratislava	456[b]	15	21	27
South Africa	Cape Town	3,083	16	21	72
	Durban	2,631	32	31	..
	Johannesburg	3,254	33	19	31
Spain	Barcelona	4,795	35	11	43
	Madrid	5,608	30	24	66
Sweden	Stockholm	1,708	11	3	20
Switzerland	Zurich	1,144	23	11	39
Thailand	Bangkok	6,593	79	11	23
Turkey	Ankara	3,573	46	55	46
	Istanbul	9,712	55	120	..
Ukraine	Kiev	2,672	35	14	51
United Kingdom	Birmingham	2,280	25	9	45
	London	8,505	21	25	77
	Manchester	2,228	15	26	49
United States	Chicago	8,814	25	14	57
	Los Angeles	12,298	34	9	74
	New York–Newark	18,718	21	26	79
Venezuela, RB	Caracas	2,913	10	33	57

a. Data are for the most recent year available. b. Data are for 2000.

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 are annual mean concentrations of 20 micrograms per cubic meter for particulate matter less than 10 microns in diameter (PM10) and 40 micrograms for nitrogen dioxide and daily mean concentrations of 20 micrograms per cubic meter for sulfur dioxide.

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 (PM10) that are capable of penetrating deep into the respiratory tract and causing significant health damage. Data are extracted from a larger study of urban-population-weighted PM10 levels in residential areas of cities with more than 100,000 residents. The estimates represent the average annual exposure level of the average urban resident to outdoor particulate matter. 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

Data on city population are from the United Nations Population Division. Data on particulate matter concentrations are from a recent World Bank study by Kiran D. Pandey, David Wheeler, Bart Ostro, Uwe Deichman, Kirk Hamilton, and Kathrine Bolt, "Ambient Particulate Matter Concentration in Residential and Pollution Hotspot Areas of World Cities: New Estimates Based on the Global Model of Ambient Particulates (GMAPS)" (2006). Data on sulfur dioxide and nitrogen dioxide concentrations are from the WHO's Healthy Cities Air Management Information System and the World Resources Institute.

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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	CITES	CCD	Stockholm Convention
Afghanistan	..	..	2002	2004[f]	2004[f]	..	2002	1985[f]	1995[f]	..	
Albania	1993	..	1995	1999[f]	1999[f]	2003[f]	1994[f]	2005[f]	2003[f]	2000[f]	2004
Algeria	2001	..	1994	1992[f]	1992[f]	1996	1995	2005[f]	1983[f]	1996	2006
Angola	..	..	2000	2000[f]	2000[f]	1994	1998	..	..	1997	2006
Argentina	1992	..	1994	1990	1990	1995	1994	2001	1981	1997	2005
Armenia	..	..	1994	1999[f]	1999[f]	2002[f]	1993[d]	2003[f]	..	1997	2003
Australia	1992	1994	1994	1987[f]	1989	1994	1993	..	1976	2000	2004
Austria	..	..	1994	1987	1989	1995	1994	2002	1982[f]	1997[f]	2002
Azerbaijan	1998	..	1995	1996[f]	1996[f]	..	2000[e]	2000[f]	1998[f]	1998[f]	2004[f]
Bangladesh	1991	1990	1994	1990[f]	1990[f]	2001	1994	2001[f]	1981	1996	..
Belarus	..	..	2000	1986[d]	1988[d]	2006[f]	1993	..	1995[f]	2001[f]	2004[f]
Belgium	..	..	1996	1988	1988	1998	1996	2002	1983	1997[f]	2006
Benin	1993	..	1994	1993[f]	1993[f]	1997	1994	2002[f]	1984[f]	1996	2004
Bolivia	1994	1988	1995	1994[f]	1994[f]	1995	1994	1999	1979	1996	2003
Bosnia and Herzegovina	..	..	2000	1992[g]	1992[g]	1994[g]	2002[f]	..	2002	2002[f]	..
Botswana	1990	1991	1994	1991[f]	1991[f]	1994	1995	2003[f]	1977[f]	1996	2002[f]
Brazil	..	1988	1994	1990[f]	1990[f]	1994	1994	2002	1975	1997	2004
Bulgaria	..	1994	1995	1990[f]	1990[f]	1996	1996	2002	1991[f]	2001[f]	2004
Burkina Faso	1993	..	1994	1989	1989	2005	1993	2005[f]	1989[f]	1996	2004
Burundi	1994	1989	1997	1997[f]	1997[f]	..	1997	2001[f]	1988[f]	1997	2005
Cambodia	1999	..	1996	2001[f]	2001[f]	..	1995[f]	2002[f]	1997	1997	2006
Cameroon	..	1989	1995	1989[f]	1989[f]	1994	1994	2002[f]	1981[f]	1997	..
Canada	1990	1994	1994	1986	1988	2003	1992	2002	1975	1995	2001
Central African Republic	..	..	1995	1993[f]	1993[f]	..	1995	..	1980[f]	1996	..
Chad	1990	..	1994	1989[f]	1994	..	1994	..	1989[f]	1996	2004
Chile	..	1993	1995	1990	1990	1997	1994	2002	1975	1997	2005
China	1994	1994	1994	1989[f]	1991[f]	1996	1993	2002[e]	1981[f]	1997	2004
Hong Kong, China	..	..	..	..	..	..	..	..	..	..	..
Colombia	1998	1988	1995	1990[f]	1993[f]	1994	2001[f]	1981	1999	..	
Congo, Dem. Rep.	..	1990	1995	1994[f]	1994[f]	1995	1996	2005[f]	1976[f]	1997	2005[f]
Congo, Rep.	..	1990	1997	1994[f]	1994[f]	..	1994	..	1983[f]	1999	..
Costa Rica	1990	1992	1994	1991[f]	1991[f]	1994	1994	2002	1975	1998	..
Côte d'Ivoire	1994	1991	1995	1993[f]	1993[f]	1994	1994	..	1994[f]	1997	2004
Croatia	2001	2000	1996	1991[d]	1991[d]	1994[g]	1996	..	2000[f]	2000[d]	..
Cuba	..	..	1994	1992[f]	1992[f]	1994	1994	2002	1990[f]	1997	..
Czech Republic	1994	..	1994	1993[d]	1993[d]	1996	1993[e]	2001[e]	993[g]	2000[f]	2002
Denmark	1994	..	1994	1988	1988	2004	1993	2002	1977	1995[f]	2003
Dominican Republic	..	1995	1999	1993[f]	1993[f]	..	1996	2002[f]	1986[f]	1997[f]	..
Ecuador	1993	1995	1994	1990[f]	1990[f]	..	1993	2000	1975	1995	2004
Egypt, Arab Rep.	1992	1988	1995	1988	1988	1994	1994	2005[f]	1978	1995	2003
El Salvador	1994	1988	1996	1992	1992	..	1994	1998	1987[f]	1997[f]	..
Eritrea	1995	..	1995	2005[f]	2005[f]	..	1996[f]	2005[f]	1994[f]	1996	2005[f]
Estonia	1998	..	1994	1996[f]	1996[f]	2005[f]	1994	2002	1992[f]	..	..
Ethiopia	1994	1991	1994	1994[f]	1994[f]	..	1994	2005[f]	1989[f]	1997	2003
Finland	1995	..	1994	1986	1988	1996	1994[d]	2002	1976[f]	1995[d]	2002[d]
France	1990	..	1994	1987[e]	1988[e]	1996	1994	2002[e]	1978	1997	2004[e]
Gabon	..	1990	1998	1994[f]	1994[f]	1998	1997	..	1989[f]	1996[f]	..
Gambia, The	1992	1989	1994	1990[f]	1990[f]	1994	1994	2001[f]	1977[f]	1996	2006
Georgia	1998	..	1994	1996[f]	1996[f]	1996[f]	1994[f]	1999[f]	1996[f]	1999	2006
Germany	..	..	1994	1988	1988	1994[f]	1993	2002	1976	1996	2002
Ghana	1992	1988	1995	1989[f]	1989	1994	1994	2003[f]	1975	1996	2003
Greece	..	..	1994	1988	1988	1995	1994	2002	1992[f]	1997	2006
Guatemala	1994	1988	1996	1987[f]	1989[f]	1997	1995	1999	1979	1998[f]	..
Guinea	1994	1988	1994	1992[f]	1992[f]	1994	1993	2000[f]	1981[f]	1997	..
Guinea-Bissau	1993	1991	1996	2002[f]	2002[f]	1994	1995	..	1990[f]	1995	..
Haiti	1999	..	1996	2000[f]	2000[f]	1996	1996	2005[f]	..	1996	..

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Government commitment 3.14

	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	CITES	CCD	Stockholm Convention
Honduras	1993	..	1996	1993[f]	1993[f]	1994	1995	2000	1985[f]	1997	2005
Hungary	1995	..	1994	1988[f]	1989[f]	2002	1994	2002[f]	1985[f]	1999[f]	..
India	1993	1994	1994	1991[f]	1992[f]	1995	1994	2002[f]	1976	1996	2006
Indonesia	1993	1993	1994	1992[f]	1992	1994	1994	2004	1978[f]	1998	..
Iran, Islamic Rep.	..	..	1996	1990[f]	1990[f]	..	1996	2005[f]	1976	1997	2006
Iraq	..	..	..	..	..	1994	..	..	..	..	..
Ireland	..	..	1994	1988[f]	1988	1996	1996	2002	2002	1997	..
Israel	..	..	1996	1992[f]	1992	..	1995	2004	1979	1996	..
Italy	..	..	1994	1988	1988	1995	1994	2002	1979	1997	..
Jamaica	1994	..	1995	1993[f]	1993[f]	1994	1995	1999[f]	1997[f]	1997[f]	..
Japan	..	..	1994	1988[f]	1988	1996	1993[d]	2002[d]	1980	1998[d]	2002[f]
Jordan	1991	..	1994	1989[f]	1989[f]	1995[f]	1993	2003[f]	1978[f]	1996	2004
Kazakhstan	..	..	1995	1998[f]	1998[f]	..	1994	..	2000[f]	1997	..
Kenya	1994	1992	1994	1988[f]	1988	1994	1994	2005[f]	1978	1997	2004
Korea, Dem. Rep.	..	..	1995	1995[f]	1995[f]	..	1994[e]	2005[f]	..	2003[f]	2002[f]
Korea, Rep.	..	..	1994	1992	1992	1996	1994	2002	1993[f]	1999	2007
Kuwait	..	..	1995	1992[f]	1992[f]	1994	2002	2005[f]	2002	1997	2006
Kyrgyz Republic	1995	..	2000	2000[f]	2000[f]	..	1996[e]	2003[f]	..	1997[f]	2006
Lao PDR	1995	..	1995	1998[f]	1998[f]	1998	1996[e]	2003[f]	2004[f]	1996[d]	2006
Latvia	..	..	1995	1995[f]	1995[f]	2004[f]	1995	2002	1997[f]	2002[f]	2004
Lebanon	..	..	1995	1993[f]	1993[f]	1995	1994	..	..	1996	2003
Lesotho	1989	..	1995	1994[f]	1994[f]	..	1995	2000[f]	2003	1995	2002
Liberia	2003	1996[f]	1996[f]	..	2000	2002[f]	2005[f]	1998[f]	2002[f]		
Libya	..	..	1999	1990[f]	1990[f]	..	2001	..	2003[f]	1996	2005[f]
Lithuania	..	..	1995	1995[f]	1995[f]	2003[f]	1996	2003	2001[f]	2003[f]	2006
Macedonia, FYR	..	..	1998	1994[g]	1994[g]	1994[g]	1997[f]	2004[f]	2000[f]	2002[f]	2004
Madagascar	1988	1991	1999	1996[f]	1996[f]	2001	1996	2003[f]	1975	1997	..
Malawi	1994	..	1994	1991[f]	1991[f]	..	1994	2001[f]	1982[f]	1996	..
Malaysia	1991	1988	1994	1989[f]	1989[f]	1996	1994	2002	1977[f]	1997	..
Mali	..	1989	1995	1994[f]	1994[f]	1994	1995	2002	1994[f]	1995	2003
Mauritania	1988	..	1994	1994[f]	1994[f]	1996	1996	2005[f]	1998[f]	1996	2005
Mauritius	1990	..	1994	1992[f]	1992[f]	1994	1992	2001[f]	1975	1996	2004
Mexico	..	1988	1994	1987	1988	1994	1993	2000	1991[f]	1995	2003
Moldova	2002	..	1995	1996[f]	1996[f]	..	1995	2003[f]	2001[f]	1999[f]	2004
Mongolia	1995	..	1994	1996[f]	1996[f]	1996	1993	1999[f]	1996[f]	1996	2004
Morocco	..	1988	1996	1995	1995	..	1995	2002[f]	1975	1996	2004
Mozambique	1994	..	1995	1994[f]	1994[f]	1997	1995	2005[f]	1981[f]	1997	2005
Myanmar	..	1989	1995	1993[f]	1993[f]	1996	1995	2003[f]	1997[f]	1997[f]	2004[f]
Namibia	1992	..	1995	1993[f]	1993[f]	1994	1997	2003[f]	1990[f]	1997	2005[f]
Nepal	1993	..	1994	1994[f]	1994[f]	1998	1993	2005[f]	1975[f]	1996	..
Netherlands	1994	..	1994	1988[f]	1988[d]	1996	1994[d]	2002[f]	1984	1995[d]	2002[d]
New Zealand	1994	..	1994	1987	1988	1996	1993	2002	1989[f]	2000[f]	2004
Nicaragua	1994	..	1996	1993[f]	1993[f]	2000	1995	1999	1977[f]	1998	..
Niger	..	1991	1995	1992[f]	1992[f]	..	1995	2004	1975	1996	2006
Nigeria	1990	1992	1994	1988[f]	1988[f]	1994	1994	2004[f]	1974	1997	2004
Norway	..	1994	1994	1986	1988	1996	1993	2002	1976	1996	2002
Oman	..	..	1995	1999[f]	1999[f]	1994	1995	2005[f]	..	1996[f]	2005
Pakistan	1994	1991	1994	1992[f]	1992[f]	1997	1994	2005[f]	1976[f]	1997	..
Panama	1990	..	1995	1989[f]	1989	1996	1995	1999	1978	1996	2003
Papua New Guinea	1992	1993	1994	1992[f]	1992[f]	1997	1993	2002	1975[f]	2000[f]	2003
Paraguay	..	..	1994	1992[f]	1992[f]	1994	1994	1999	1976	1997	2004
Peru	..	1988	1994	1989	1993[f]	..	1993	2002	1975	1995	2005
Philippines	1989	1989	1994	1991[f]	1991	1994	1993	2003	1981	2000	2004
Poland	1993	1991	1994	1990[f]	1990[f]	1998	1996	2002	1989	2001[f]	..
Portugal	1995	..	1994	1988[f]	1988	1997	1993	2002[e]	1980	1996	2004[d]
Puerto Rico	..	..	..	..	..	..	..	..	..	..	..

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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	CITES	CCD	Stockholm Convention
Romania	1995	..	1994	1993[f]	1993[f]	1996	1994	2001	1994[f]	1998[f]	2004
Russian Federation	1999	1994	1995	1986[d]	1988[d]	1997	1995	2004	1992	2003[f]	..
Rwanda	1991	..	1998	2001[f]	2001[f]	..	1996	2004[f]	1980[f]	1998	2002[f]
Saudi Arabia	..	..	1995	1993[f]	1993[f]	1996	2001[e]	2005[f]	1996[f]	1997[f]	..
Senegal	1984	1991	1995	1993[f]	1993	1994	1994	2001[f]	1977[f]	1995	2003
Serbia and Montenegro	2001	2001[g]	2001[g]	2001[g]	2002	..	2002	..	2002		
Sierra Leone	1994	..	1995	2001[f]	2001[f]	1994	1994[e]	2006[f]	1994[f]	1997	2003[f]
Singapore	1993	1995	1997	1989[f]	1989[f]	1994	1995	2006[f]	1986[f]	1999[f]	2005
Slovak Republic	..	..	1994	1993[g]	1993[g]	1996	1994[e]	2002	1993	2001[f]	2002
Slovenia	1994	..	1996	1992[g]	1992[g]	1995[g]	1996	2002	2000[f]	2001[f]	2004
Somalia	..	2001[f]	2001[f]	1994	..	..	1985[f]	2002[f]	..		
South Africa	1993	..	1997	1990[f]	1990[f]	1997	1995	2002[f]	1975	1997	2002
Spain	..	..	1994	1988[f]	1988	1997	1995	2002	1986[f]	1996	2004
Sri Lanka	1994	1991	1994	1989[f]	1989[f]	1994	1994	2002[f]	1979[f]	1998[f]	..
Sudan	..	..	1994	1993[f]	1993[f]	1994	1995	2004[f]	1982	1995	2006
Swaziland	1997	1992[f]	1992[f]	..	1994	..	1997[f]	1996	2006		
Sweden	..	..	1994	1986	1988	1996	1993	2002	1974	1995	2002
Switzerland	..	..	1994	1987	1988	..	1994	2006[f]	1974	1996	2003
Syrian Arab Republic	1999	..	1996	1989[f]	1989[f]	..	1996	2006[f]	2003[f]	1997	2005
Tajikistan	..	..	1998	1996[f]	1998[f]	..	1997[e]	..	..	1997[f]	..
Tanzania	1994	1988	1996	1993[f]	1993[f]	1994	1996	2002[f]	1979	1997	2004
Thailand	..	..	1995	1989[f]	1989	..	2004	2002	1983	2001[f]	2005
Togo	1991	..	1995	1991[f]	1991	1994	1995[d]	2004[f]	1978	1995[d]	2004
Trinidad and Tobago	..	..	1994	1989[f]	1989[f]	1994	1996	1999	1984[f]	2000[f]	2002[f]
Tunisia	1994	1988	1994	1989[f]	1989[f]	1994	1993	2003[f]	1974	1995	2004
Turkey	1998	..	2004	1991[f]	1991[f]	..	1997	..	1996[f]	1998	..
Turkmenistan	..	..	1995	1993[f]	1993[f]	..	1996[e]	1999	..	1996	..
Uganda	1994	1988	1994	1988[f]	1988	1994	1993	2002[f]	1991[f]	1997	2004[f]
Ukraine	1999	..	1997	1986[d]	1988[d]	1999	1995	2004	1999[f]	2002[f]	..
United Arab Emirates	..	..	1996	1989[f]	1989[f]	..	2000	2005[f]	1990[f]	1998[f]	2002
United Kingdom	1995	1994	1994	1987	1988	1997[f]	1994	2002	1976	1996	2005
United States	1995	1995	1994	1986	1988	..	..	..	1974	2000	..
Uruguay	..	..	1994	1989[f]	1991[f]	1994	1993	2001	1975	1999[f]	2004
Uzbekistan	..	..	1994	1993[f]	1993[f]	..	1995[e]	1999	1997[f]	1995	..
Venezuela	..	..	1995	1988[f]	1989	..	1994	..	1977	1998[f]	2005
Vietnam	..	1993	1995	1994[f]	1994[f]	2006[f]	1994	2002	1994[f]	1998[f]	2002
West Bank and Gaza	..	..	..	..	..	..	..	..	..	..	
Yemen, Rep.	1996	1992	1996	1996[f]	1996[f]	1994	1996	2004[f]	1997[f]	1997[f]	2004
Zambia	1994	..	1994	1990[f]	1990[f]	1994	1993	2006[f]	1980[f]	1996	2006
Zimbabwe	1987	..	1994	1992[f]	1992[f]	1994	1994	..	1981[f]	1997	..

a. Ratification of the treaty. b. 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.

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3.14 Government commitment

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. 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 chlorofluorocarbon) and technologies, monitoring the ozone layer, and taking measures to control the activities that produce adverse effects.
- The Montreal Protocol for Chlorofluorocarbon 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 through scientific and technological cooperation among countries, access to financial and genetic resources, and transfer of ecologically sound technologies.

But 10 years after Rio the World Summit on Sustainable Development in Johannesburg 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, 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 or 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, or action plans** include biodiversity profiles (see *About the data*). • **Participation in treaties** covers nine 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). • **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. • **CITES** refers to the Convention on International Trade in Endangered Species of Wild Fauna and Flora, an agreement among governments to ensure that the survival of wild animals and plants is not threatened by uncontrolled exploitation. • **CCD** refers to the United Nations Convention to Combat Desertification, an international convention dedicated to addressing the problems of land degradation in the world's drylands. Adopted in Paris on June 17, 1994, it entered into force on December 26, 1996. • **Stockholm Convention** is an international legally binding instrument designed to protect human health and the environment from persistent organic pollutants. It was adopted on May 22, 2001, and entered into force May 17, 2004.

Data sources

Data on environmental strategies and participation in international environmental treaties 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 Center for International Earth Science Information Network, and the United Nations Treaty Series.

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3.15 Toward a broader measure of savings

	Gross savings	Consumption of fixed capital	Net savings	Education expenditure	Energy depletion	Mineral depletion	Net forest depletion	Carbon dioxide damage	Particulate emission damage	Adjusted net savings
	% of GNI	% of GNI	% of GNI	% of GNI	% of GNI	% of GNI	% of GNI	% of GNI	% of GNI	% of GNI
	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005
Afghanistan	23.8	7.6	16.2	..	0.0	..	1.0	0.1	0.7	..
Albania	15.6	10.7	4.9	2.8	1.9	0.0	0.0	0.2	0.2	5.4
Algeria	53.8	11.6	42.2	4.5	46.9	0.1	0.1	1.3	0.3	–2.1
Angola	23.4	12.0	11.3	3.0	51.3	0.0	0.0	0.3	1.8	–39.1
Argentina	24.8	12.1	12.8	4.1	10.4	0.4	0.0	0.6	1.6	3.9
Armenia	25.7	10.1	15.6	3.0	0.0	0.8	0.0	0.7	1.8	15.3
Australia	20.7[a]	15.0	5.8	4.8	3.1	3.1	0.0	0.4	0.1	3.9
Austria	24.6	14.3	10.3	5.6	0.2	0.0	0.0	0.2	0.3	15.2
Azerbaijan	34.5	11.6	22.9	3.5	60.4	0.0	0.0	2.8	1.1	–37.9
Bangladesh	28.8	8.2	20.7	1.7	3.8	0.0	0.7	0.4	0.5	17.0
Belarus	30.9	11.0	19.9	5.5	2.4	0.0	0.0	1.8	..	21.2[b]
Belgium	23.4	15.4	8.0	3.0	0.0	0.0	0.0	0.2	0.2	10.6
Benin	10.7	8.7	2.0	2.4	0.0	0.0	0.9	0.3	0.4	2.7
Bolivia	20.4	10.0	10.4	6.3	33.7	1.0	0.0	0.7	1.3	–20.0
Bosnia and Herzegovina	–1.9	10.3	–12.2	..	1.2	0.0	..	1.5	0.1	..
Botswana	49.2	12.9	36.3	5.6	0.4	2.1	0.0	0.3	..	39.1[b]
Brazil	23.0	11.9	11.1	4.1	4.1	2.4	0.0	0.3	0.3	8.0
Bulgaria	17.0	11.1	5.9	3.5	1.2	1.0	0.0	1.3	1.4	4.7
Burkina Faso	..	8.3	..	2.4	0.0	0.0	1.2	0.2	1.4	..
Burundi	8.7	6.7	2.0	3.9	0.0	0.1	11.3	0.2	0.1	–5.8
Cambodia	15.0	8.8	6.2	1.8	0.0	0.0	0.3	0.1	0.4	7.3
Cameroon	18.1	9.9	8.2	3.2	13.8	0.0	0.0	0.2	0.8	–3.4
Canada	21.7[a]	14.6	7.1	5.2	6.8	0.4	0.0	0.3	0.2	4.6
Central African Republic	14.0	8.1	5.9	1.6	0.0	0.0	0.0	0.1	0.4	6.9
Chad	25.4	10.8	14.6	1.4	73.3	0.0	0.0	0.0	1.1	–58.4
Chile	19.1	13.4	5.6	3.9	0.4	13.6	0.0	0.4	0.6	–5.5
China	50.4	10.2	40.2	2.0	6.8	0.8	0.0	1.4	1.4	31.8
Hong Kong, China	31.9	13.9	18.0	3.7	0.0	0.0	0.0	0.2	..	21.6[b]
Colombia	19.0	11.4	7.6	4.9	10.2	0.7	0.0	0.4	0.1	1.1
Congo, Dem. Rep.	14.1	7.0	7.1	0.9	4.3	1.6	0.0	0.2	0.6	1.2
Congo, Rep.	37.6	12.8	24.8	3.8	74.9	0.0	0.0	0.2	0.8	–47.3
Costa Rica	19.2	6.1	13.0	4.0	0.0	0.0	0.2	0.2	0.3	16.3
Côte d'Ivoire	13.3	9.9	3.5	4.6	5.4	0.0	0.0	0.3	0.3	2.1
Croatia	24.0	12.9	11.1	4.1	1.6	0.0	0.2	0.5	0.4	12.5
Cuba	..	..	..	8.1	..	..	..	..	..	..
Czech Republic	25.6	13.6	12.0	4.2	0.7	0.0	0.0	0.8	0.1	14.6
Denmark	23.7	15.1	8.6	8.1	2.3	0.0	0.0	0.1	0.1	14.2
Dominican Republic	20.5	11.9	8.6	1.2	0.0	1.5	0.0	0.6	0.3	7.5
Ecuador	24.9	11.5	13.3	1.4	28.1	0.1	0.0	0.5	0.1	–14.2
Egypt, Arab Rep.	21.4	9.8	11.6	4.4	17.5	0.2	0.2	1.2	0.9	–4.0
El Salvador	11.2	11.1	0.0	2.8	0.0	0.0	0.5	0.3	0.2	1.8
Eritrea	10.3	7.6	2.8	2.7	0.0	0.0	1.2	0.5	0.7	3.2
Estonia	22.4[a]	13.5	8.9	5.1	1.7	0.0	0.2	1.2	0.0	11.0
Ethiopia	17.3	7.1	10.2	3.0	0.0	0.0	0.0	0.5	0.3	12.3
Finland	22.6	16.1	6.5	6.0	0.0	0.0	0.0	0.2	0.1	12.2
France	18.0	12.5	5.5	5.2	0.0	0.0	0.0	0.1	0.0	10.5
Gabon	35.5	13.2	22.2	3.3	37.8	0.0	0.0	0.2	..	–12.5[b]
Gambia, The	15.6	8.2	7.4	2.0	0.0	0.0	0.6	0.5	0.8	7.5
Georgia	20.0	9.9	10.1	2.9	0.6	0.0	0.0	0.5	1.1	10.7
Germany	21.1	14.8	6.3	4.3	0.2	0.0	0.0	0.2	0.1	10.1
Ghana	22.2	8.7	13.6	2.8	0.1	0.5	1.8	0.5	0.1	13.3
Greece	14.9	8.7	6.2	3.1	0.3	0.1	0.0	0.3	0.9	7.7
Guatemala	14.8	10.9	3.8	1.6	1.5	0.0	0.7	0.2	0.5	2.5
Guinea	6.6	8.3	–1.7	2.0	0.0	3.5	2.0	0.3	0.3	–5.8
Guinea-Bissau	7.8	7.6	0.2	2.3	0.0	0.0	0.0	0.6	1.0	0.8
Haiti	..	8.6	..	1.5	0.0	0.0	0.8	0.2	0.5	..

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Toward a broader measure of savings

	Gross savings	Consumption of fixed capital	Net savings	Education expenditure	Energy depletion	Mineral depletion	Net forest depletion	Carbon dioxide damage	Particulate emission damage	Adjusted net savings
	% of GNI 2005	% of GNI 2005	% of GNI 2005	% of GNI 2005	% of GNI 2005	% of GNI 2005	% of GNI 2005	% of GNI 2005	% of GNI 2005	% of GNI 2005
Honduras	30.8	10.1	20.6	3.5	0.0	0.3	0.0	0.6	0.4	22.9
Hungary	16.5	13.6	2.9	5.8	0.8	0.0	0.0	0.4	0.1	7.4
India	32.2	9.2	23.0	4.0	4.8	1.0	0.6	1.3	0.7	18.6
Indonesia	24.7	10.2	14.4	0.9	13.7	2.0	0.0	0.8	1.1	–2.3
Iran, Islamic Rep.	41.6	11.1	30.5	4.4	48.1	0.5	0.0	1.4	0.8	–16.0
Iraq	..	..	..	..	..	..	..	..	..	..
Ireland	27.6[a]	10.9	16.7	4.8	0.0	0.1	0.0	0.2	0.1	21.1
Israel	..	17.6	..	7.3	0.2	0.0	0.0	0.4	0.5	..
Italy	19.9	13.4	6.5	4.6	0.2	0.0	0.0	0.2	0.2	10.5
Jamaica	19.6[a]	7.6	12.0	5.0	0.0	1.7	0.0	0.8	0.3	14.3
Japan	26.2[a]	14.0	12.2	3.1	0.0	0.0	0.0	0.2	0.5	14.6
Jordan	6.5	10.4	–3.9	5.6	0.5	0.1	0.0	1.0	0.7	–0.5
Kazakhstan	28.5	12.5	16.0	4.4	53.6	1.7	0.0	2.5	0.3	–37.6
Kenya	12.2	8.8	3.4	6.6	0.0	0.0	1.1	0.4	0.1	8.3
Korea, Dem. Rep.	..	..	..	..	..	..	..	..	..	..
Korea, Rep.	32.2	13.4	18.9	3.7	0.0	0.0	0.0	0.4	0.6	21.5
Kuwait	..	12.8	..	6.9	52.1	0.0	0.0	0.7	1.3	..
Kyrgyz Republic	5.7	8.8	–3.1	4.4	1.5	0.0	0.0	1.5	0.3	–1.9
Lao PDR	1.7	9.5	–7.8	1.4	0.0	0.0	0.0	0.4	0.7	–7.5
Latvia	22.7	17.8	4.9	5.6	0.0	0.0	0.8	0.4	0.1	9.2
Lebanon	–0.9	12.3	–13.2	2.4	0.0	0.0	0.0	0.6	1.1	–12.5
Lesotho	21.7	7.6	14.1	6.7	0.0	0.0	1.4	0.0	0.3	19.1
Liberia	23.0	9.0	14.0	..	0.0	0.0	6.1	0.6	0.5	..
Libya	..	12.4	..	..	76.9	0.0	0.0	1.0	..	..
Lithuania	18.5	12.4	6.1	5.7	0.5	0.0	0.1	0.4	0.2	10.7
Macedonia, FYR	20.3	11.1	9.2	4.9	0.0	0.0	0.2	1.4	0.1	12.4
Madagascar	11.6	7.9	3.7	2.5	0.0	0.0	0.0	0.3	0.2	5.6
Malawi	–7.6	7.2	–14.8	5.1	0.0	0.0	0.9	0.3	0.3	–11.3
Malaysia	37.6	12.4	25.2	5.8	20.9	0.0	0.0	0.9	0.2	9.0
Mali	12.0	8.7	3.3	2.7	0.0	0.0	0.0	0.1	1.1	4.8
Mauritania	–5.2	8.6	–13.8	3.2	0.0	28.1	0.6	1.0	2.5	–42.7
Mauritius	19.8	11.8	8.0	3.9	0.0	0.0	0.0	0.4	..	11.6[b]
Mexico	21.5	12.5	9.0	5.3	9.6	0.2	0.0	0.4	0.4	3.6
Moldova	20.8	8.1	12.7	4.2	0.0	0.0	0.0	1.8	0.7	14.4
Mongolia	38.2	8.9	29.3	5.4	0.0	13.0	0.0	3.6	1.2	16.9
Morocco	29.1	10.3	18.8	6.0	0.0	0.3	0.0	0.5	0.1	23.9
Mozambique	4.7	8.6	–3.9	1.8	0.1	0.0	0.5	0.2	0.3	–3.2
Myanmar	..	..	..	0.8	..	..	..	..	..	..
Namibia	39.2	10.9	28.3	7.3	0.0	1.2	0.0	0.3	0.1	34.1
Nepal	31.0	7.8	23.2	2.6	0.0	0.0	2.5	0.3	0.1	23.0
Netherlands	26.5	15.0	11.5	4.9	1.6	0.0	0.0	0.2	0.6	14.1
New Zealand	23.0[a]	13.7	9.3	7.2	1.0	0.1	0.0	0.2	0.1	15.1
Nicaragua	12.9	9.6	3.3	2.9	0.0	0.1	0.0	0.6	0.1	5.4
Niger	10.3	7.7	2.7	2.3	0.0	0.0	2.6	0.3	0.8	1.3
Nigeria	34.1	10.5	23.6	0.9	54.4	0.0	0.1	0.5	0.8	–31.4
Norway	37.1	13.4	23.7	7.0	16.0	0.0	0.0	0.1	0.1	14.6
Oman	..	..	..	4.2	..	..	..	..	..	..
Pakistan	18.4	8.9	9.5	1.6	7.5	0.0	0.4	0.8	1.5	0.9
Panama	10.5	12.6	–2.1	4.4	0.0	0.0	0.0	0.3	0.2	1.8
Papua New Guinea	..	..	..	..	..	..	..	..	..	..
Paraguay	16.4	9.8	6.6	4.2	0.0	0.0	0.0	0.4	0.7	9.7
Peru	19.9	11.7	8.2	2.9	2.2	3.4	0.0	0.3	0.7	4.5
Philippines	28.2	8.1	20.1	2.8	0.5	0.4	0.2	0.6	0.4	20.8
Poland	18.2	12.8	5.4	5.6	1.7	0.4	0.0	0.8	0.4	7.7
Portugal	13.1	17.1	–4.1	5.7	0.0	0.0	0.0	0.2	0.4	1.0
Puerto Rico	..	..	..	..	..	..	..	..	..	..

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3.15 Toward a broader measure of savings

	Gross savings	Consumption of fixed capital	Net savings	Education expenditure	Energy depletion	Mineral depletion	Net forest depletion	Carbon dioxide damage	Particulate emission damage	Adjusted net savings
	% of GNI 2005	% of GNI 2005	% of GNI 2005	% of GNI 2005	% of GNI 2005	% of GNI 2005	% of GNI 2005	% of GNI 2005	% of GNI 2005	% of GNI 2005
Romania	14.2	11.7	2.4	3.2	4.2	0.1	0.0	0.7	0.1	0.6
Russian Federation	32.7	7.0	25.7	3.5	36.8	0.8	0.0	1.6	0.4	–10.4
Rwanda	19.5	7.7	11.8	3.5	0.0	0.0	2.6	0.2	0.1	12.3
Saudi Arabia	..	13.0	..	7.2	61.4	0.0	0.0	0.7	1.2	..
Senegal	15.8	9.3	6.5	3.7	0.0	0.0	0.0	0.4	0.9	8.8
Serbia and Montenegro	9.8	11.3	–1.5	..	2.4	0.0	..	1.4	0.0	..
Sierra Leone	7.0	7.7	–0.6	1.0	0.0	0.0	1.9	0.5	1.1	–3.1
Singapore	..	14.6	..	2.7	0.0	0.0	0.0	0.4	0.9	..
Slovak Republic	21.2	22.5	–1.3	4.1	0.1	0.0	0.5	0.7	0.0	1.5
Slovenia	25.2	13.5	11.7	5.4	0.1	0.0	0.2	0.3	0.2	16.3
Somalia	..	..	..	..	..	..	..	..	..	..
South Africa	14.4	12.0	2.4	5.3	4.8	1.2	0.2	1.1	0.1	0.3
Spain	22.6	14.6	8.1	4.1	0.0	0.0	0.0	0.2	0.4	11.6
Sri Lanka	20.5	9.9	10.6	2.6	0.0	0.0	0.3	0.3	0.4	12.1
Sudan	18.5	9.9	8.6	0.9	18.9	0.0	0.0	0.2	0.4	–10.1
Swaziland	16.6	10.6	6.0	6.3	0.0	0.0	0.0	0.3	0.1	11.9
Sweden	23.1	12.1	11.0	8.0	0.0	0.2	0.1	0.1	0.0	18.6
Switzerland	..	13.7	..	5.0	0.0	0.0	0.0	0.1	0.2	..
Syrian Arab Republic	14.6	10.3	4.3	2.6	43.8	0.1	0.0	1.4	0.9	–39.4
Tajikistan	7.3	8.5	–1.2	2.6	0.8	0.0	0.0	1.8	0.4	–1.6
Tanzania	9.3	8.0	1.3	2.4	0.0	0.4	0.0	0.2	0.2	2.8
Thailand	30.1	11.2	18.9	4.7	3.8	0.0	0.3	1.0	0.4	18.2
Togo	9.9	8.3	1.6	2.6	0.0	0.1	2.8	0.6	0.3	0.4
Trinidad and Tobago	..	12.4	..	4.0	57.9	0.0	0.0	1.7	0.2	..
Tunisia	21.9	11.6	10.3	5.9	6.3	0.2	0.1	0.6	0.3	8.7
Turkey	18.5	11.8	6.7	3.5	0.4	0.1	0.0	0.5	1.3	7.9
Turkmenistan	36.4	11.0	25.4	..	..	0.0	..	3.7	1.1	..
Uganda	10.1	8.1	2.0	4.0	0.0	0.0	4.6	0.2	0.0	1.1
Ukraine	22.7	10.4	12.2	4.4	9.0	0.0	0.0	3.2	0.7	3.7
United Arab Emirates	..	..	..	..	..	..	..	..	..	..
United Kingdom	13.9	10.3	3.6	5.3	1.6	0.0	0.0	0.2	0.0	7.1
United States	13.0[a]	12.2	0.8	4.8	1.9	0.0	0.0	0.3	0.3	3.0
Uruguay	13.1	12.1	1.0	2.6	0.0	0.0	0.3	0.2	1.8	1.3
Uzbekistan	35.1	8.7	26.4	9.4	75.4	0.0	0.0	7.1	1.1	–47.9
Venezuela, RB	40.5	12.0	28.5	4.4	37.9	1.0	0.0	0.8	0.0	–6.9
Vietnam	34.4	9.2	25.3	2.8	17.5	0.0	0.5	1.1	0.6	8.5
West Bank and Gaza	11.6	8.8	2.8	..	0.0	0.0	..	..	..	..
Yemen, Rep.	35.4	10.2	25.2	..	52.3	0.0	0.0	0.9	0.8	..
Zambia	10.9	9.5	1.4	2.9	0.1	7.9	0.0	0.2	1.0	–4.9
Zimbabwe	2.9	8.1	–5.2	6.9	5.2	2.7	0.0	2.2	0.1	–8.6
World	**20.8 w**	**12.6 w**	**8.2 w**	**4.4 w**	**4.1 w**	**0.3 w**	**0.0 w**	**0.4 w**	**0.4 w**	**7.4 w**
Low income	28.1	9.1	19.0	3.3	9.8	0.7	0.6	1.1	0.7	9.5
Middle income	30.0	11.0	19.0	3.6	12.1	0.9	0.0	1.0	0.7	7.8
Lower middle income	35.0	10.7	24.3	2.9	10.4	1.0	0.0	1.1	0.9	13.7
Upper middle income	23.4	11.4	12.0	4.5	14.4	0.8	0.0	0.8	0.5	–0.1
Low & middle income	29.7	10.7	19.0	3.5	11.8	0.9	0.1	1.0	0.7	8.0
East Asia & Pacific	44.4	10.3	34.1	2.2	7.8	0.8	0.0	1.2	1.2	25.3
Europe & Central Asia	23.2	10.6	12.6	4.1	16.6	0.4	0.0	1.2	0.5	–2.0
Latin America & Carib.	22.9	12.0	10.9	4.4	8.9	1.7	0.0	0.4	0.5	3.7
Middle East & N. Africa	30.9	11.0	19.9	4.5	35.2	0.2	0.1	1.2	0.6	–13.0
South Asia	30.1	9.1	21.0	3.6	4.9	0.8	0.6	1.1	0.8	16.4
Sub-Saharan Africa	17.4	10.7	6.7	3.8	15.5	0.8	0.3	0.7	0.5	–7.3
High income	18.7	13.1	5.7	4.6	2.0	0.1	0.0	0.3	0.3	7.7
Europe EMU	20.7	13.9	6.8	4.6	0.2	0.0	0.0	0.2	0.2	10.8

a. World Bank estimate based on preliminary data. b. Adjusted net savings do not include particulate emission damage.

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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.

The table provides a test to check the extent to which today's rents from a number of natural resources and changes in human capital are balanced by net savings, that is, this generation's bequest to future generations.

Adjusted net savings are derived from standard national accounting measures of gross savings by making four adjustments. First, estimates of capital consumption of produced assets are deducted to obtain net savings. Second, current public expenditures on education are added to net 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 damages from carbon dioxide and particulate emissions.

The exercise treats public education expenditures as an addition to savings effort. However, 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 reader should bear in mind that current expenditure of $1 on education does not necessarily yield $1 of human capital. The calculation should also consider private education expenditure, but data are not available for a large number of countries.

While extensive, the accounting of natural resource depletion and pollution costs still has some gaps. 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. World prices are used in order to reflect the social opportunity cost of depleting minerals and energy.

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 pollution in urban areas. The estimates are calculated as willingness to pay to avoid mortality and morbidity from cardiopulmonary disease and lung cancer in adults and acute respiratory infections in children that is attributable to particulate emissions.

For a detailed note on methodology, see www.worldbank.org/data.

Definitions

• **Gross savings** are 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 savings** are gross savings minus 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 the product of unit resource rents and the physical quantities of energy extracted. It covers coal, crude oil, and natural gas. • **Mineral depletion** is 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 the product of unit resource rents and the excess of roundwood harvest over natural growth. • **Carbon dioxide damage** is estimated to be $20 per ton of carbon (the unit damage in 1995 U.S. dollars) times the number of tons of carbon emitted. • **Particulate emission damage** is the willingness to pay to avoid mortality and morbidity attributable to particulate emissions.• **Adjusted net savings** are net savings plus education expenditure and minus energy depletion, mineral depletion, net forest depletion, and carbon dioxide and particulate emissions damage.

Data sources

Gross 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 2005. Data on education expenditure are from the United Nations Statistics Division's *Statistical Yearbook 1997* and from the United Nations Educational, Scientific, and Cultural Organization Institute for Statistics online database. Missing data are estimated. The wide range of data sources and estimation methods used to arrive at resource depletion estimates are described in Kunte and others' "Estimating National Wealth" (1998). The unit damage figure for carbon dioxide emissions is from Frankhauser's "Fractales, tissues urbains et reseaux de transport" (1994). The estimates of damage from particulate emissions are from Pandey and others' "The Human Costs of Air Pollution: New Estimates for Developing Countries" (2006). The conceptual underpinnings of the savings measure appear in Hamilton and Clemens' "Genuine Savings Rates in Developing Countries" (1999).

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