3 ENVIRONMENT

Another 2 billion people will be added to the global population over the next 25 years, most of them in poorer countries, generating huge new demands for goods and services and affordable shelter and housing and requiring faster economic growth and higher energy use. It is widely recognized that faster economic growth is the key to meeting the Millennium Development Goals by 2015. But if growth is not achieved in an environmentally sustainable way, its effect on poverty and human well-being will be disastrous.

Economic development has led to dramatic improvements in the quality of life in developing countries, producing gains unparalleled in human history. But the gains have been unevenly distributed, and a large part of the world's population remains desperately poor. Natural resources—land, water, and air—are being degraded at alarming rates in many countries. And environmental factors such as indoor and outdoor air pollution, waterborne diseases, and exposure to toxic chemicals threaten the health of millions of people. These concerns can be addressed by achieving the Millennium Development Goals.

A healthy environment is an integral part of meeting the Millennium Development Goals, which call for integrating principles of sustainable development into country policies and programs and reversing environmental losses. The environmental Goal sets a target of halving by 2015 the proportion of people without sustainable access to safe drinking water and basic sanitation. It also calls for achieving a significant improvement in the lives of at least 100 million slum dwellers by 2020, bringing to fore the inadequacy of shelters and housing conditions in many poor countries (see table 3.a for selected indicators of housing conditions). All this requires measuring and monitoring the state of the environment and its changes—with better data on access to safe water and sanitation and a minimum set of indicators to monitor the conditions of shelters and housing. It also requires measuring and monitoring the links between economic growth and environmental change.

Many such indicators are presented here. But despite greater awareness of the importance of environmental issues and efforts to improve environmental data, information on many aspects of the environment remains sparse. Data are often uneven in quality, cover different periods, and are sometimes out of date. The lack of adequate data hampers efforts to measure the state of the environment and to design sound policies. Many environmental indicators are not meaningful at the national level. Climate change has impacts that go beyond national boundaries. Environmental factors such as air and water pollution may have relevance only to the locality where they are measured. So global, regional, or city indicators (tables 3.11 and 3.13) are often more meaningful than national aggregates.

Indicators of economic growth and environmental change

Human activity and economic growth affect the natural environment. In a chapter dedicated to environmental protection, the 2000 Millennium Declaration explicitly referenced climate change,

desertification, biodiversity, and forest and water management and established a set of indicators to monitor the state of natural resources and to measure environmental change. Most of these indicators are covered in the tables in this section.

Forest coverage and protected areas. Forests are shrinking, and with them the diversity of the plants and animals they support. With growth and development, forests are being converted to agricultural land and urban areas. At the beginning of the 20th century the Earth had some 5 billion hectares of forested area. Now it has less than 4 billion hectares. The loss has been concentrated in developing countries, driven by the growing demand for timber and agricultural land, exacerbated by weak monitoring institutions. Low-income countries lost some 60 million hectares—about 7 percent of their forest—in the 1990s. By contrast, high-income countries reforested about 8 million hectares of forest in the same period (table 3.4).

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

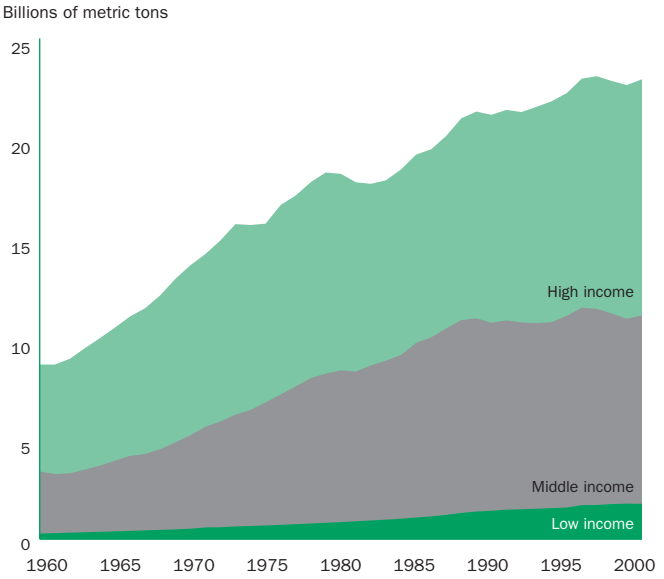
Energy use and carbon dioxide emissions. Energy, especially electricity, is important in raising people's standard of living. High-income countries use more than five times as much energy per capita as developing countries, and with only 15 percent of the world's population they use more than half of its energy (table 3.7). Energy use and electricity generation also have environmental consequences. Generating energy from fossil fuels produces emissions of carbon dioxide, the main greenhouse gas contributing to global warming. Anthropogenic (human-caused) carbon dioxide emissions result primarily from fossil fuel combustion and cement manufacturing, with high-income countries contributing half (figure 3a and table 3.8). Among countries in all income groups, per capita emissions vary widely (from 22 tons in Kuwait and 20 tons in the United States to 0.016 tons in Chad). How energy is generated largely determines the environmental damage. Burning coal releases twice as much carbon dioxide as burning an equivalent amount of natural gas (see About the data for table 3.8, and table 3.9 for the sources of generating electricity).

Access to safe water and sanitation. While water supply and access to safe drinking water receive considerable attention at the international level, sanitation problems are seldom mentioned. Yet water supply issues are closely linked to sanitation. Evidence suggests that sanitation is at least as important as water supply in preventing diseases, and many of the health benefits from access to water cannot be realized without improved access to sanitation. Lack of access to adequate water and sanitation has enormous health and economic costs for households, with consequences for national economies and the environment. It contributes to illness and death, especially in children. Every year 2.2 million children under age five die from diarrhea—closely linked to inadequate access to safe water and sanitation. In addition, almost half the people in developing countries suffer from diseases caused directly or indirectly by inadequate sanitation and consumption of contaminated water. In addition to diarrhea, these include intestinal infections, trachoma blindness, cholera, and schistosomiasis. Improving access is crucial for reducing illness and death among children under age five. World Bank estimates suggest that achieving the water target would save the lives of 400,000 children a year, while halving the proportion of people without access to sanitation would save the lives of 550,000 children a year.

Improvement in the lives of slum dwellers. The Cities without Slums Initiative was endorsed at the Millennium Summit, which included in the Millennium Declaration the goal of improving the lives of 100 million slum dwellers (target 11; see section 1). This initiative focuses on upgrading unhealthy and often threatening urban slums and squatter settlements by improving basic municipal services over the next 20 years. Improving slum dwellers' lives includes better housing; more secure tenure; greater access to water, sanitation, and waste management services and cleaner fuels; reduced urban air

3a

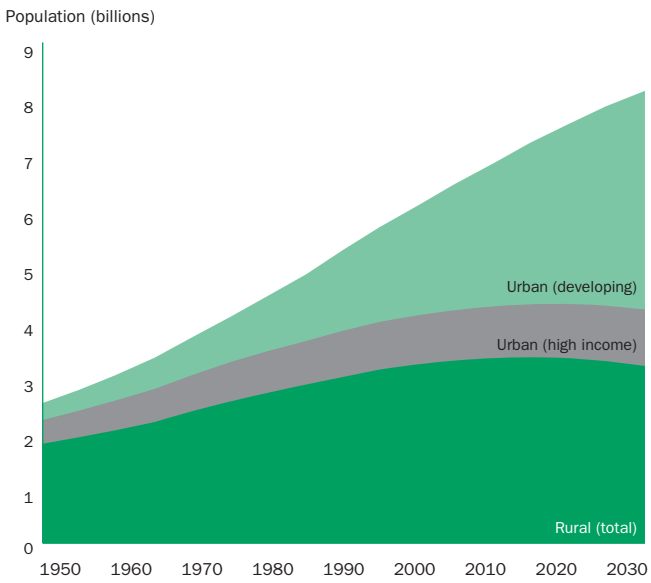
High-income countries account for half the world's carbon dioxide emissions



Source: Carbon Dioxide Information Analysis Center data.

3b

Most future urban growth will be absorbed by developing economies



Source: United Nations Population Division 2004.

pollution; and easier access to safe transport services. In developing countries an estimated 38 percent of urban residents live in slums. As the urban population increases, the number of people living in slums will likely rise, increasing the challenges of providing services. The plight of slum dwellers has brought forward the more general issue of housing conditions, particularly in cities and urban areas.

Rapid urbanization and higher demand for shelter

The world is becoming increasingly urban. Urban areas are home to 48 percent of the world's population—two of five people in low- and middle-income countries and almost four of five in high-income countries. Most of Latin America is as urbanized as Europe, with 77 percent of the population living in urban areas. Asia is urbanizing rapidly. Even such traditionally rural countries as China, India, and Indonesia now have hundreds of millions of people living in urban areas, with both the number of people and the share of the population in cities growing rapidly (table 3.10).

In 1950 only 18 percent of people in developing countries lived in cities. In 2005 the proportion exceeded 40 percent, and by 2030 it is forecast to be 56 percent. Most future urban growth will be absorbed by urban centers in developing countries, which have a high average annual urban population growth rate of 2.2 percent, in contrast with the less than 1 percent rate in high-income economies.

Expanding cities serve many needs—with many consequences. Urbanization can yield important social benefits, improving access to public services such as education, health care, and cultural facilities (table 3.11). It can also lead to adverse environmental effects that require policy responses. Greater urbanization usually means greater pollution, which can overwhelm the natural capacities of air and water to absorb pollutants. The costs of controlling pollution can be enormous. And pollution exposes people to severe health hazards. Several major urban air pollutants—lead, sulfur dioxide, suspended particulate matter—are known to harm human health (table 3.13). A big source of urban air pollution is motor vehicles, whose numbers are strongly linked to rising income. The number of passenger cars increased from 16 cars per 1,000 people in 1990 to 27 in 2002 in developing countries and from 400 cars per 1,000 people to 440 in high-income countries, with New Zealand having the highest number, at 613, up from 438 in 1990 (table 3.12).

While there is no evidence of a population threshold beyond which cities generate more negative than positive effects for their inhabitants, the rapid pace of population growth and enormous size of the population in many cities have overwhelmed the capacity of municipal authorities to respond. Millions of people in cities in developing countries cannot meet their basic needs for shelter, water, food, health, and education.

Demand for housing and emergence of the slums. Ever since there have been cities, there has been demand for housing and shelter and there have been poor living quarters. But only since the sixteenth century have there been slums—places that are "squalid, overcrowded, and wretched."

The unmet demand for affordable housing, along with urban poverty, has led to the emergence of slums in many poor countries. Slums have been the only large-scale solution to housing for low-income people. In cities, where competition for land and profits is intense, slums are the only type of housing that is affordable and accessible to most poor people.

In 2001, 924 million people, or 31.6 percent of the world's urban population, lived in slums (UN-HABITAT 2003). The majority were in developing economies, accounting for 43 percent of the urban population, with Sub-Saharan Africa having the largest proportion of the urban population living in slums (72 percent). The expected growth rate of the urban labor force far outpaces the rate of creation of formal sector urban jobs, so in all likelihood the majority of new urban residents will eke out a living in the informal economy and many will end up living in slums.

3c

Data initiative

Global monitoring of housing conditions and data requirements

Improving shelter requires a better understanding of the mechanisms governing housing availability. That requires better data and better policy-oriented analysis so that housing policy can be formulated in a more global comparative perspective and the accomplishments and lessons learned in one country can be drawn on by others. This comparative perspective can help countries chart their paths, formulate realistic development objectives, and measure their achievements over time and compare them with other countries in similar circumstances.

Housing is viewed increasingly as a commodity with an exchange value, rather than as a good to be produced and allocated outside the marketplace. It is also viewed as a commodity driven by market forces—especially supply and demand—that have a powerful influence across all parts of the market despite the existence of apparently distinctive submarkets. Housing demand and supply are both affected by the regulatory, institutional, and policy environment. Housing policies and outcomes in turn affect such broader socioeconomic conditions as the infant mortality rate, inflation, household saving, manufacturing wage and productivity levels, capital formation, and the government budget deficit. A good understanding of housing condition thus requires an extensive set of indicators within a reasonable framework.

Data deficiencies and a lack of serious quantitative analysis hamper decisionmakers in making informed choices on desirable policies to improve housing. As a result, costly policy failures have impeded development of the housing sector and frustrated broader development objectives. There is a strong demand for quantitative indicators that can measure housing conditions on a regular basis, so that decisionmakers can determine whether conditions are improving or worsening or whether broad housing policy goals are being attained—which are not possible now. Nor is it possible to determine how a particular country compares with other countries, whether its performance is above or below expected norms given its circumstances, or which policies lead to better outcomes and so are worthy of emulation.

The Millennium Development Goals have identified improving housing conditions as an integral part of the global development agenda. The United Nations Human Settlements Programme (UN-HABITAT) is charged with monitoring target 11 for improving the lives of slum dwellers and has proposed four measures of housing deprivation as proxies for the number of households living in slum conditions:

- Individuals lacking access to an improved water supply.
- Individuals lacking access to improved sanitation.
- Individuals living in overcrowded conditions.
- Individuals living in nondurable structures.

Data on these indicators are collected in national censuses using similar definitions and in household surveys such as Demographic and Health Surveys, Multiple Indicator Cluster Surveys, and Living Standards Measurement Study surveys. They are reported for the first time in World Development Indicators in the new table 3.a. In conjunction with data in tables 1.3, 3.5, and 3.10 on water and sanitation, they allow for the monitoring of most aspects of target 11 on a global scale. Table 3.a was constructed using available census data and will later incorporate household survey data as well.

Because published census tables do not provide data on the distribution of housing deprivations, it is not possible to tell how many households suffer from how many of the four housing deprivations—only the total number of households that suffer from any one housing deprivation. A recent investigation by UN-HABITAT's Monitoring System Branch of the distribution of housing deprivations in 20 Sub–Saharan African countries suggests that—even in the worst of circumstances—very few households suffer from all four basic shelter deprivations. The average number was 1.7. On average, 47 percent of slum dwellings in these countries had only one shelter deprivation, 33 percent had two, 17 percent had three, and only 2 percent had four.

Table 3.a focuses attention on urban areas, where housing conditions are typically most severe. Not all compiled indicators are presented in the table because of space limitations. More indicators for many more countries will be available in the online version of World Development Indicators, including data on housing deficits. Beyond the qualitative dimensions of available shelter, it also measures the quantitative housing deficit—the share of households in excess of available dwelling units—considering that a well-functioning housing sector should have a separate dwelling unit for each household. Quantitative housing deficits in most countries—even very poor ones—are relatively small, suggesting that the housing problem is still largely a qualitative rather than a quantitative one. Shelter is still being produced in adequate quantities in most countries. Though much of it is substandard, in some places it has improved over time. The data in table 3a will allow, for the first time, the monitoring of both quantitative and qualitative dimensions of the housing sector over time on a global scale, adding an important dimension to the mission of World Development Indicators to monitor all the key dimensions of development.

3.a

Urban housing conditions

	Census year	Household size		Overcrowding		Dwelling structure		Home ownership		Multiunit dwellings		Vacancy rate	
		People		People living in overcrowded dwellings[a] %		Buildings with durable structure % of total		Privately owned dwellings % of total		Households in multiunit housing % of total		Unoccupied dwellings % of total	
		National	Urban	National	Urban	National	Urban	National	Urban	National	Urban	National	Urban
Armenia	2001	4.1	4.0	35	38	93	92	91	90				
Bahrain	1991	5.9	5.8	16				51		28		3	
Bangladesh	2001	4.8	4.8			21[b]	42[b]	88[b]	61[b]				
Belize	2000	4.6	4.4			45	54	63	53	4	5		
Bolivia	2001	4.2	4.3	35		38	54	58	49	3[b]	5[b]	6	4
Botswana	2001	4.2	3.9	54	47	88		61	47	1			
Brazil	2000	3.8	3.7					74	75				
Bulgaria	2001	2.7	2.7			79	89	98	98			23	17
Cameroon	1987	5.2	5.1	67	77	77	76						
Cape Verde	2000	4.6	3.8[b]	55[b]	60[b]	78[b]	88[b]	72[b]	60[b]	2[b]	5[b]		
Central African Republic	1988	5.2	5.8	31	28	77		85	74				
Chad	1993	5.1	5.1			3	1	85	47				
Chile	2002	3.4	3.5			53	59	47	45	13	15	11	10
Costa Rica	2000	4.0		3		68		65		2	2	9	6
Czech Republic	2001	2.4						52		56		12	
Ecuador	2001			25		59	73	58[b]	53[b]	9	14	12	7
El Salvador	1992			56		57	71	62	60	3	5	11	11
Equatorial Guinea	1993	7.5	7.0	29				75	55	14	26		
Ethiopia	1994	4.8	4.7	10			23		47				..
Fiji	1996	5.8	5.6			56	72	78	62				
Ghana	2000	5.1	5.1			45		57		56		5	
India	2001	5.4	5.3	77	71	56	81	87	67			6	9
Iran, Islamic Rep.	1996	4.8	4.6			72	76	73	67				
Iraq	1997	7.7	7.2			88	96	70	66	4	6	13	15
Jamaica	2001	4.4				56[b]		60[b]		1[b]		72	
Jordan	1994	6.2	6.1			97	77	68	63	57	66	20	19
Kenya	1990	4.6	3.4			35	72	72	25			39	17
Lithuania	2001	2.6	2.5	17						71		8	
Macedonia, FYR	2002	3.6	3.6[b]			95[b]	95[b]	48[b]				7[b]	3[b]
Madagascar	1993	4.9	4.8	64	57			81	59				
Malawi	1987	4.3	4.3			48	85	86	48				
Mauritius	2000	3.9	3.8			91	94	87	81			7	6
Mexico	2000	4.4		27[b]		78		76					
Mozambique	1997	4.4	4.9	37	7	6	14	92	83	1	4	0	
Nicaragua	1995					46		77		0		8	
Pakistan	1998	6.8	6.8			58	86	81					
Panama	2000	4.1		25[b]		66	88[b]	68	60[b]	10[b]	17[b]	14	
Paraguay	2002	4.6	4.5	38[b]	38[b]	38[b]	38[b]	78	73	1[b]	2[b]	6[b]	6[b]
Peru	1993					32	46					7	3
Philippines	1990	5.3	5.3			62		83	76	6	12	4	4
Romania	1992	3.1	3.1			58		87	77	42	74	6	4
Rwanda	1991	4.8				75	64	92	55	19	25		
Slovenia	1991	3.1						66		35		9	
Solomon Islands	1999	6.3	6.9	50		23		85	43	1	3		
Sri Lanka	2001	3.8				91[b]	92[b]	65[b]	54[b]	1	13[b]	13	1[b]
Sudan	1993	5.8	6.0					79	58	0[b]	1[b]		
Tanzania	2002	4.9	4.5[b]	33[b]	7[b]			82[b]	43[b]				
Thailand	2000	3.8				93	93	83	65	3			
Trinidad and Tobago	2000	3.7		9[b]		58[b]		64[b]		15[b]			
Tunisia	1994	5.1	5.2					79[b]	89[b]	6[b]	10[b]	10[b]	12[b]
Uganda	2002	4.8	4.0[b]			21[b]		80[b]	24[b]	0[b]	2[b]		
Uruguay	1996	3.3	3.4[b]	22[b]				50[b]	50[b]			13[b]	13[b]
Venezuela. RB	2001	4.4						66		14		16	
Vietnam	1999	4.6	4.5			77	89	73	77				
Yemen	1994	6.7	6.8	52[b]	6[b]			88[b]	68[b]	3[b]	11[b]		
Zimbabwe	1992	4.8	4.2					57	30	4	10		

Note: This table is still a work in progress; coverage and quality are being enhanced.
a. More than two people per room. b. Data are from previous census.

3.1 Rural environment and land use

	Rural population			Rural population density	Land area	Land use					
	% of total		average annual % growth	people per sq. km of arable land	thousands of sq. km	Arable land		% of land area Permanent cropland		Other land	
	1990	2003	1990–2003	2002	2002	1990	2002	1990	2002	1990	2002
Afghanistan	82	77	3.3	273	652	12.1	12.1	0.2	0.2	87.6	87.6
Albania	64	56	–1.3	307	27	21.1	21.1	4.6	4.4	74.3	74.5
Algeria	49	41	0.6	171	2,382	3.0	3.2	0.2	0.3	96.8	96.5
Angola	72	64	1.9	282	1,247	2.3	2.4	0.4	0.2	97.3	97.4
Argentina	13	11	–0.3	12	2,737	10.6	12.3	0.4	0.5	89.0	87.2
Armenia	33	33	–1.2	202	28	17.7	17.6	2.7	2.3	79.7	80.1
Australia	15	8	–3.5	3	7,682	6.2	6.3	0.0	0.0	93.7	93.7
Austria	33	32	0.2	188	83	17.2	16.8	1.0	0.9	81.8	82.3
Azerbaijan	46	48	1.4	220	83	18.1	21.6	3.5	2.7	78.5	75.7
Bangladesh	80	73	1.0	1,249	130	70.2	61.6	2.3	3.1	27.5	35.2
Belarus	34	30	–1.1	54	207	29.3	27.0	0.9	0.6	69.8	72.4
Belgium[a]	4	3	–2.4	36	33	23.3	24.9	0.5	0.7	76.2	74.4
Benin	66	55	1.5	144	111	14.6	23.1	0.9	2.4	84.5	74.6
Bolivia	44	36	0.5	109	1,084	1.9	2.7	0.1	0.2	97.9	97.1
Bosnia and Herzegovina	61	56	–1.2	231	51	16.6	19.5	2.9	1.9	80.5	78.7
Botswana	58	50	1.2	232	567	0.7	0.7	0.0	0.0	99.3	99.3
Brazil	25	17	–1.6	53	8,459	6.0	7.0	0.8	0.9	93.2	92.1
Bulgaria	34	32	–1.1	76	111	34.9	30.3	2.7	2.1	62.4	67.6
Burkina Faso	86	82	2.0	225	274	12.9	15.9	0.2	0.2	86.9	83.9
Burundi	94	90	1.8	648	26	36.2	38.4	14.0	14.2	49.8	47.4
Cambodia	87	81	2.0	292	177	20.9	21.0	0.6	0.6	78.5	78.4
Cameroon	60	49	0.9	131	465	12.8	12.8	2.6	2.6	84.6	84.6
Canada	23	21	0.0	14	9,221	5.0	5.0	0.0	0.0	95.0	95.0
Central African Republic	63	57	1.5	114	623	3.1	3.1	0.1	0.2	96.8	96.8
Chad	79	75	2.6	175	1,259	2.6	2.9	0.0	0.0	97.4	97.1
Chile	17	13	–0.3	108	749	3.7	2.6	0.3	0.4	95.9	96.9
China[b]	73	61	–0.3	559	9,327	13.3	15.3	0.8	1.2	85.9	83.5
Hong Kong, China	0	0	..	..	1	..	..	..	..	..	..
Colombia	31	24	–0.3	459	1,039	3.2	2.2	1.6	1.5	95.2	96.3
Congo, Dem. Rep.	..	..	..	..	2,267	2.9	3.0	0.5	0.5	96.5	96.6
Congo, Rep.	44	33	0.8	642	342	0.5	0.6	0.1	0.1	99.4	99.3
Costa Rica	46	39	0.9	700	51	5.1	4.4	4.9	5.9	90.0	89.7
Côte d'Ivoire	60	55	2.1	296	318	7.6	9.7	11.0	11.9	81.4	78.3
Croatia	46	41	–1.4	126	56	21.7	26.1	2.0	2.3	76.3	71.6
Cuba	26	24	–0.2	103	110	29.6	24.3	7.4	10.2	63.0	65.5
Czech Republic	25	25	–0.1	84	77	..	39.7	..	3.1	..	57.2
Denmark	15	15	0.2	35	42	60.4	53.6	0.2	0.2	39.3	46.2
Dominican Republic	42	33	–0.2	263	48	21.7	22.7	9.3	10.3	69.0	67.0
Ecuador	45	36	0.1	286	277	5.8	5.9	4.8	4.9	89.4	89.2
Egypt, Arab Rep.	56	57	2.0	1,309	995	2.3	2.9	0.4	0.5	97.3	96.6
El Salvador	51	36	–0.7	365	21	26.5	31.9	12.5	12.1	60.9	56.1
Eritrea	84	80	2.2	691	101	..	5.0	..	0.0	..	95.0
Estonia	29	30	–0.7	68	42	26.7	14.5	0.4	0.4	72.9	85.1
Ethiopia	87	83	1.9	567	1,000	..	9.9	..	0.7	..	89.3
Finland	39	41	0.8	97	305	7.4	7.2	0.0	0.0	92.5	92.7
France	26	24	–0.2	78	550	32.7	33.5	2.2	2.1	65.1	64.4
Gabon	32	16	–2.5	69	258	1.1	1.3	0.6	0.7	98.2	98.1
Gambia, The	75	67	2.4	378	10	18.2	25.0	0.5	0.5	81.3	74.5
Georgia	45	43	–0.8	280	69	11.4	11.5	4.8	3.8	83.8	84.7
Germany	15	12	–1.3	85	349	34.3	33.8	1.3	0.6	64.4	65.6
Ghana	66	63	1.9	307	228	11.9	18.4	6.6	9.4	81.5	72.2
Greece	41	39	0.2	160	129	22.5	21.1	8.3	8.8	69.2	70.2
Guatemala	62	59	2.3	526	108	12.0	12.5	4.5	5.0	83.5	82.4
Guinea	77	71	1.9	616	246	3.0	3.7	2.0	2.6	95.0	93.7
Guinea-Bissau	76	66	1.8	322	28	10.7	10.7	4.2	8.8	85.2	80.5
Haiti	71	62	1.1	669	28	28.3	28.3	11.6	11.6	60.1	60.1

3.1 Rural environment and land use

	Rural population			Rural population density	Land area	Land use					
	% of total		average annual % growth	people per sq. km of arable land	thousands of sq. km	Arable land		% of land area Permanent cropland		Other land	
	1990	2003	1990–2003	2002	2002	1990	2002	1990	2002	1990	2002
Honduras	58	44	0.7	289	112	13.1	9.5	3.2	3.2	83.7	87.2
Hungary	38	35	–0.9	77	92	54.7	50.1	2.5	2.1	42.7	47.8
India	74	72	1.4	466	2,973	54.9	54.4	2.1	2.8	43.0	42.8
Indonesia	69	56	–0.2	588	1,812	11.2	11.3	6.5	7.3	82.4	81.4
Iran, Islamic Rep.	44	34	–0.4	151	1,636	9.3	9.2	0.8	1.3	89.9	89.6
Iraq	30	32	2.9	137	437	12.1	13.1	0.7	0.8	87.2	86.1
Ireland	43	40	0.5	142	69	15.1	16.3	0.0	0.0	84.8	83.7
Israel	10	8	1.2	157	22	15.8	15.6	4.1	4.0	80.1	80.5
Italy	33	33	0.0	228	294	30.6	28.2	10.1	9.4	59.3	62.4
Jamaica	49	42	–0.3	647	11	11.0	16.1	9.2	10.2	79.8	73.8
Japan	23	21	–0.4	603	365	13.1	12.1	1.3	0.9	85.6	86.9
Jordan	28	21	1.8	369	89	3.3	3.3	1.0	1.2	95.7	95.5
Kazakhstan	43	44	–0.5	30	2,700	13.0	8.0	0.1	0.1	87.0	92.0
Kenya	76	64	1.0	441	569	7.4	8.1	0.9	1.0	91.7	90.9
Korea, Dem. Rep.	42	39	0.4	352	120	19.0	20.8	1.5	1.7	79.5	77.6
Korea, Rep.	26	16	–2.7	481	99	19.8	17.1	1.6	2.0	78.6	81.0
Kuwait	5	4	–1.4	689	18	0.2	0.7	0.1	0.1	99.7	99.2
Kyrgyz Republic	62	66	1.4	244	192	6.5	7.0	0.4	0.3	93.1	92.6
Lao PDR	85	79	1.9	480	231	3.5	4.0	0.3	0.4	96.3	95.7
Latvia	30	40	1.1	50	62	27.2	29.5	0.4	0.5	72.4	70.0
Lebanon	16	9	–2.4	253	10	17.9	16.6	11.9	14.0	70.2	69.4
Lesotho	80	70	0.0	379	30	10.4	10.9	0.1	0.1	89.4	89.0
Liberia	58	53	1.9	467	96	4.2	3.9	2.2	2.3	93.6	93.8
Libya	18	12	–1.5	35	1,760	1.0	1.0	0.2	0.2	98.8	98.8
Lithuania	32	31	–0.8	37	63	47.8	46.7	0.9	0.9	51.3	52.3
Macedonia, FYR	42	40	0.2	146	25	23.8	22.3	2.2	1.8	74.0	75.9
Madagascar	76	69	2.0	386	582	4.7	5.1	1.0	1.0	94.3	93.9
Malawi	88	84	1.6	395	94	19.3	24.4	1.2	1.5	79.5	74.1
Malaysia	50	41	0.7	557	329	5.2	5.5	16.0	17.6	78.9	76.9
Mali	76	68	1.6	167	1,220	1.7	3.8	0.0	0.0	98.3	96.1
Mauritania	56	38	–0.3	226	1,025	0.4	0.5	0.0	0.0	99.6	99.5
Mauritius	60	58	0.9	702	2	49.3	49.3	3.0	3.0	47.8	47.8
Mexico	28	25	0.8	102	1,909	12.6	13.0	1.0	1.3	86.4	85.7
Moldova	53	58	0.5	134	33	52.8	56.1	14.2	9.1	33.0	34.8
Mongolia	43	43	1.3	88	1,567	0.9	0.8	0.0	0.0	99.1	99.2
Morocco	52	43	0.3	153	446	19.5	18.8	1.6	2.0	78.8	79.2
Mozambique	79	64	0.6	288	784	4.4	5.4	0.3	0.3	95.3	94.3
Myanmar	75	71	1.0	353	658	14.5	15.0	0.8	1.1	84.7	83.9
Namibia	73	68	2.1	166	823	0.8	1.0	0.0	0.0	99.2	99.0
Nepal	91	87	2.0	659	143	16.0	22.4	0.5	0.7	83.6	77.0
Netherlands	11	10	–0.2	182	34	25.9	27.0	0.9	1.0	73.2	72.0
New Zealand	15	14	0.4	37	268	9.4	5.6	5.1	7.0	85.6	87.4
Nicaragua	47	43	2.0	120	121	10.7	15.9	1.6	1.9	87.7	82.2
Niger	84	78	2.7	200	1,267	2.8	3.5	0.0	0.0	97.2	96.4
Nigeria	65	53	1.2	239	911	32.4	33.2	2.8	3.1	64.8	63.8
Norway	28	24	–0.5	129	306	2.8	2.8	..	..	..	..
Oman	38	22	–0.4	1,534	310	0.1	0.1	0.1	0.1	99.7	99.7
Pakistan	69	66	2.0	447	771	26.6	27.8	0.6	0.9	72.8	71.3
Panama	46	43	1.1	231	74	6.7	7.4	2.1	2.0	91.2	90.7
Papua New Guinea	85	82	2.2	2,007	453	0.4	0.5	1.3	1.4	98.3	98.1
Paraguay	51	42	0.8	78	397	5.3	7.6	0.2	0.2	94.5	92.2
Peru	31	26	0.4	192	1,280	2.7	2.9	0.3	0.5	96.9	96.6
Philippines	51	39	0.1	559	298	18.4	19.1	14.8	16.8	66.9	64.1
Poland	39	37	–0.4	102	306	47.3	45.5	1.1	1.0	51.6	53.6
Portugal	53	32	–3.5	173	92	25.6	21.7	8.5	7.8	65.8	70.4
Puerto Rico	29	24	–0.7	2,662	9	7.3	3.9	5.6	5.5	87.0	90.5

3.1 Rural environment and land use

	Rural population			Rural population density	Land area	Land use					
	% of total		average annual % growth	people per sq. km of arable land	thousands of sq. km	Arable land		% of land area Permanent cropland		Other land	
	1990	2003	1990–2003	2002	2002	1990	2002	1990	2002	1990	2002
Romania	46	44	–0.8	103	230	41.0	40.9	2.6	2.2	56.4	56.9
Russian Federation	27	27	–0.1	32	16,889	7.8	7.3	0.1	0.1	92.1	92.6
Rwanda	95	93	1.4	684	25	35.7	45.2	12.4	10.9	52.0	43.9
Saudi Arabia	22	12	–1.6	79	2,150	1.6	1.7	0.0	0.1	98.4	98.2
Senegal	60	50	1.2	208	193	12.1	12.8	0.1	0.2	87.8	87.0
Serbia and Montenegro	49	48	–2.2	116	102	27.5	..	2.8	..	69.7	..
Sierra Leone	70	61	1.2	607	72	6.8	7.5	0.8	0.9	92.5	91.6
Singapore	0	0	..	0	1	1.5	1.5	1.5	1.5	97.0	97.0
Slovak Republic	44	42	–0.1	..	49	..	..	..	..	..	..
Slovenia	50	51	0.2	603	20	9.9	8.3	1.8	1.5	88.3	90.2
Somalia	76	71	1.8	638	627	1.6	1.7	0.0	0.0	98.3	98.3
South Africa	51	41	0.3	128	1,214	11.1	12.1	0.7	0.8	88.2	87.1
Spain	25	22	–0.5	65	499	30.7	27.5	9.7	10.0	59.6	62.5
Sri Lanka	79	76	1.0	1,588	65	13.5	14.2	15.9	15.5	70.6	70.4
Sudan	73	61	0.9	125	2,376	5.5	6.8	0.1	0.2	94.4	93.0
Swaziland	76	73	2.4	446	17	10.5	10.3	0.7	0.7	88.8	89.0
Sweden	17	17	0.2	56	412	6.9	6.5	0.0	0.0	93.1	93.5
Switzerland	40	32	–1.0	579	40	9.9	10.3	0.5	0.6	89.6	89.1
Syrian Arab Republic	51	47	2.2	177	184	26.6	25.0	4.0	4.5	69.4	70.5
Tajikistan	68	72	1.8	488	141	6.1	6.6	0.9	0.9	93.0	92.5
Tanzania	78	65	1.2	578	884	4.0	4.5	1.0	1.2	95.0	94.2
Thailand	81	80	0.7	310	511	34.2	31.1	6.1	6.9	59.7	62.1
Togo	71	65	1.9	124	54	38.6	46.1	1.7	2.2	59.7	51.6
Trinidad and Tobago	31	25	–1.1	437	5	14.4	14.6	9.0	9.2	76.6	76.2
Tunisia	42	33	–0.5	117	155	18.7	17.8	12.5	13.8	68.8	68.4
Turkey	39	33	0.5	90	770	32.0	33.7	3.9	3.4	64.0	62.9
Turkmenistan	55	55	2.1	142	470	2.9	3.9	0.1	0.1	97.0	95.9
Uganda	89	85	2.5	410	197	25.4	25.9	9.4	10.7	65.2	63.5
Ukraine	33	32	–0.8	48	579	57.6	56.2	1.9	1.6	40.5	42.3
United Arab Emirates	20	12	2.5	621	84	0.4	0.9	0.2	2.3	99.3	96.8
United Kingdom	11	10	–0.2	107	241	27.5	23.9	0.3	0.2	72.2	75.9
United States	25	22	0.3	37	9,159	20.3	19.2	0.2	0.2	79.5	80.6
Uruguay	11	7	–2.4	20	175	7.2	7.4	0.3	0.2	92.5	92.3
Uzbekistan	60	63	2.1	357	414	10.8	10.8	0.9	0.8	88.3	88.3
Venezuela, RB	16	12	0.0	130	882	3.2	2.8	0.9	0.9	95.9	96.3
Vietnam	80	75	1.1	901	325	16.4	20.6	3.2	6.7	80.4	72.7
West Bank and Gaza	..	..	..	..	6	..	..	..	..	..	..
Yemen, Rep.	77	74	3.4	903	528	2.9	2.9	0.2	0.2	96.9	96.8
Zambia	61	60	2.1	117	743	7.1	7.1	0.0	0.0	92.9	92.9
Zimbabwe	72	63	0.9	255	387	7.5	8.3	0.3	0.3	92.2	91.3
World	56 w	51 w	0.7 w	477 w	130,331 s	10.7 w	10.8 w	0.9 w	1.0 w	88.4 w	88.2 w
Low income	74	70	1.5	509	30,456	12.2	12.6	1.0	1.2	86.9	86.2
Middle income	56	47	–0.1	480	68,844	9.5	9.6	1.0	1.1	89.5	89.2
Lower middle income	59	50	–0.1	497	56,103	9.9	10.0	1.0	1.2	89.1	88.8
Upper middle income	29	25	0.1	193	12,741	7.5	8.0	0.9	1.0	91.5	90.9
Low & middle income	63	57	0.7	495	99,300	10.3	10.6	1.0	1.1	88.7	88.3
East Asia & Pacific	72	61	–0.1	565	15,886	12.1	13.3	2.2	2.7	85.7	83.9
Europe & Central Asia	37	36	0.0	122	23,868	12.2	11.3	0.4	0.4	87.4	88.3
Latin America & Carib.	29	23	–0.1	210	20,057	6.7	7.4	0.9	1.0	92.4	91.6
Middle East & N. Africa	46	41	1.2	603	11,111	4.8	4.9	0.6	0.7	94.6	94.3
South Asia	75	72	1.5	559	4,781	42.7	42.5	1.7	2.2	55.6	55.2
Sub-Saharan Africa	72	64	1.6	352	23,596	5.9	6.8	0.8	0.9	93.2	92.3
High income	23	20	–0.2	202	31,030	12.1	11.6	0.5	0.5	87.4	87.9
Europe EMU	25	22	–0.5	138	2,436	27.1	26.0	4.7	4.5	68.2	69.4

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

Rural environment and land use 3.1

About the data

Indicators of rural development are sparse, as few indicators are disaggregated between rural and urban areas (for some that are, see tables 2.5, 3.5, and 3.10). This table shows indicators of rural population and land use. Rural population is approximated as the midyear nonurban population.

The data in the table show that land use patterns are changing. They also indicate major differences in resource endowments and uses among countries.

True comparability of the data is limited, however, by variations in definitions, statistical methods, and the quality of data collection. Countries use different definitions of rural population and land use, for example. The Food and Agriculture Organization (FAO), the primary compiler of these data, occasionally adjusts its definitions of land use categories and sometimes revises earlier data. Because the data reflect changes in data reporting procedures as well as actual changes in land use, apparent trends should be interpreted with caution.

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

Definitions

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

3.1a

All income groups and all regions are becoming less rural

Source: Table 3.1.

Data sources

The data on urban population shares used to estimate rural population come from the United Nations Population Division's World Urbanization Prospects: The 2003 Revision. The total population figures are World Bank estimates. The data on land area and land use are from the FAO's electronic files, which may contain more recent information than those published in its Production Yearbook. The FAO gathers these data from national agencies through annual questionnaires and by analyzing the results of national agricultural censuses.

3.2 Agricultural inputs

	Arable land		Irrigated land		Land under cereal production		Fertilizer consumption		Agricultural machinery			
	hectares per capita		% of cropland		thousands of hectares		hundreds of grams per hectare of arable land		Tractors per 1,000 agricultural workers		Tractors per 100 sq. km of arable land	
	1989–91	2000–02	1989–91	2000–02	1989–91	2001–03	1989–91	2000–02	1989–91	2000–02	1989–91	2000–02
Afghanistan	0.45	0.29	31.2	29.6	..	..	63	19	0	0	1	1
Albania	0.18	0.18	58.9	48.6	295	162	1,378	420	13	11	195	139
Algeria	0.29	0.25	5.1	6.8	2,807	2,383	157	129	48	36	125	123
Angola	0.31	0.24	2.2	2.3	883	1,124	46	2	3	2	35	34
Argentina	0.89	0.93	5.2	4.5	8,557	10,474	56	244	184	205	94	89
Armenia	..	0.16	..	50.2	..	196	..	157	..	92	..	370
Australia	2.76	2.57	4.0	4.9	12,823	17,676	272	464	686	708	67	63
Austria	0.19	0.17	0.3	0.3	940	797	2,001	1,533	1,250	1,796	2,378	2,363
Azerbaijan	..	0.22	..	72.6	..	777	..	63	..	31	..	170
Bangladesh	0.08	0.06	31.0	52.0	11,083	11,582	1,048	1,730	0	0	6	7
Belarus	..	0.58	..	2.2	..	2,279	..	1,325	..	100	..	116
Belgium[a]	..	..	2.3	4.7	367	..	4,969	3,487	425	543	1,530	1,245
Benin	0.34	0.39	0.3	0.4	658	971	54	154	0	0	1	1
Bolivia	0.31	0.34	5.4	4.2	620	750	37	38	4	4	25	21
Bosnia and Herzegovina	..	0.25	..	0.3	..	337	..	356	..	321	..	289
Botswana	0.33	0.22	0.5	0.3	201	174	22	124	21	17	135	162
Brazil	0.34	0.34	4.6	4.4	20,101	18,614	653	1,201	47	62	142	138
Bulgaria	0.44	0.43	30.1	16.4	2,152	1,950	1,698	500	88	120	135	96
Burkina Faso	0.40	0.36	0.5	0.6	2,743	3,375	59	31	0	0	2	5
Burundi	0.17	0.14	5.5	5.5	218	211	32	33	0	0	2	2
Cambodia	0.39	0.29	6.3	7.1	1,860	2,068	9	0	0	1	3	7
Cameroon	0.51	0.39	0.3	0.5	755	810	38	75	0	0	1	1
Canada	1.65	1.47	1.6	1.7	21,446	17,071	468	550	1,496	1,921	164	160
Central African Republic	0.65	0.51	..	..	110	185	5	3	0	0	0	0
Chad	0.56	0.44	0.5	0.6	1,170	1,939	20	49	0	0	1	0
Chile	0.22	0.13	51.8	82.6	778	656	1,082	2,386	39	55	129	273
China	0.11	0.11	36.0	35.9	93,047	80,626	2,223	2,576	2	2	67	65
Hong Kong, China	..	..	..	..	..	..	..	..	..	..	..	..
Colombia	0.09	0.06	13.1	21.5	1,655	1,144	1,770	2,605	9	6	98	83
Congo, Dem. Rep.	0.18	0.13	0.1	0.1	1,840	2,023	11	7	0	0	4	4
Congo, Rep.	0.06	0.05	0.5	0.4	15	10	76	180	1	1	46	38
Costa Rica	0.09	0.06	15.0	20.6	89	57	4,256	6,455	21	22	248	311
Côte d'Ivoire	0.21	0.19	1.1	1.1	1,401	1,350	152	263	1	1	15	12
Croatia	..	0.33	..	0.3	..	709	..	1,303	..	18	..	20
Cuba	0.31	0.28	22.0	21.1	233	323	1,658	502	90	101	239	256
Czech Republic	..	0.30	..	0.7	..	1,584	..	1,186	..	209	..	310
Denmark	0.50	0.43	16.9	19.5	1,564	1,521	2,436	1,394	1,014	1,159	639	539
Dominican Republic	0.15	0.13	15.1	17.2	135	163	859	848	3	3	22	17
Ecuador	0.16	0.13	27.9	29.0	828	872	465	1,531	9	12	65	91
Egypt, Arab Rep.	0.04	0.04	100.0	100.0	2,280	2,696	4,181	4,473	7	11	250	309
El Salvador	0.11	0.10	4.9	5.0	428	351	1,392	1,054	5	4	62	53
Eritrea	..	0.12	..	4.2	..	325	..	134	..	0	..	9
Estonia	..	0.59	..	0.5	..	266	..	397	..	656	..	709
Ethiopia	..	0.16	..	1.7	..	7,160	..	145	..	0	..	3
Finland	0.46	0.42	2.8	2.9	1,144	1,182	1,904	1,353	1,116	1,425	1,059	886
France	0.32	0.31	10.3	13.3	9,244	9,069	3,217	2,221	1,057	1,475	799	685
Gabon	0.31	0.25	2.9	3.0	14	20	33	9	7	7	50	46
Gambia, The	0.20	0.18	0.5	0.8	92	141	64	33	0	0	2	2
Georgia	..	0.15	..	44.1	..	351	..	412	..	37	..	235
Germany	0.15	0.14	3.9	4.0	6,864	6,951	3,070	2,245	972	994	1,314	814
Ghana	0.18	0.20	0.2	0.2	1,066	1,477	36	60	1	1	15	9
Greece	0.28	0.25	30.3	37.3	1,473	1,288	2,307	1,580	225	323	752	917
Guatemala	0.15	0.12	6.6	6.8	726	664	999	1,477	3	2	32	32
Guinea	0.13	0.12	7.2	6.2	603	763	18	36	0	0	5	6
Guinea-Bissau	0.29	0.21	4.1	3.1	106	143	22	80	0	0	1	1
Haiti	0.12	0.10	6.8	6.8	408	445	32	181	0	0	3	2

3.2 Agricultural inputs

	Arable land		Irrigated land		Land under cereal production		Fertilizer consumption		Agricultural machinery			
	hectares per capita		% of cropland		thousands of hectares		hundreds of grams per hectare of arable land		Tractors per 1,000 agricultural workers		Tractors per 100 sq. km of arable land	
	1989–91	2000–02	1989–91	2000–02	1989–91	2001–03	1989–91	2000–02	1989–91	2000–02	1989–91	2000–02
Honduras	0.30	0.16	4.1	5.6	475	387	191	1,193	6	7	31	49
Hungary	0.49	0.46	3.8	4.7	2,827	2,941	1,459	992	89	230	126	246
India	0.19	0.16	27.0	33.7	102,279	97,285	736	1,032	4	6	61	94
Indonesia	0.11	0.10	14.3	14.3	13,442	14,755	1,227	1,321	1	2	15	46
Iran, Islamic Rep.	0.29	0.23	41.1	45.1	9,503	8,396	760	921	39	38	136	163
Iraq	0.29	0.24	57.2	58.8	..	..	350	968	53	94	72	105
Ireland	0.30	0.29	..	..	306	294	6,609	5,308	895	989	1,624	1,431
Israel	0.07	0.05	47.0	45.8	111	90	2,876	2,610	370	355	795	725
Italy	0.16	0.15	21.9	24.3	4,481	4,196	2,135	1,819	682	1,287	1,593	1,974
Jamaica	0.05	0.07	11.3	8.8	2	1	2,079	1,258	11	12	252	177
Japan	0.04	0.03	54.3	54.7	2,469	1,998	3,865	3,066	441	779	4,306	4,562
Jordan	0.09	0.05	16.5	18.8	101	60	663	977	50	30	213	225
Kazakhstan	..	1.44	..	10.8	..	13,551	..	24	..	38	..	23
Kenya	0.18	0.15	1.2	1.7	1,845	1,941	258	320	1	1	24	27
Korea, Dem. Rep.	0.11	0.11	57.5	54.1	1,604	1,302	3,577	1,071	18	19	299	258
Korea, Rep.	0.05	0.04	63.7	60.4	1,427	1,156	4,888	4,294	12	88	215	1,176
Kuwait	0.00	0.01	60.0	85.6	0	2	417	747	8	7	222	77
Kyrgyz Republic	..	0.27	..	75.6	..	619	..	208	..	46	..	188
Lao PDR	0.19	0.17	15.7	18.0	643	826	18	95	1	1	11	12
Latvia	..	0.78	..	1.1	..	442	..	300	..	379	..	305
Lebanon	0.05	0.04	28.2	32.6	41	56	1,510	2,838	51	185	175	471
Lesotho	0.20	0.19	0.3	0.3	199	235	161	309	7	7	59	61
Liberia	0.16	0.12	0.4	0.5	179	123	25	0	1	0	8	9
Libya	0.42	0.34	20.2	21.9	418	343	445	349	228	381	179	219
Lithuania	..	0.84	..	0.2	..	897	..	579	..	490	..	349
Macedonia, FYR	..	0.28	..	9.1	..	198	..	502	..	473	..	960
Madagascar	0.23	0.18	30.1	30.9	1,308	1,417	32	31	1	1	11	12
Malawi	0.21	0.21	1.0	1.3	1,415	1,642	317	400	0	0	8	7
Malaysia	0.09	0.08	4.8	4.8	696	696	5,386	6,548	13	24	153	240
Mali	0.24	0.42	5.7	2.9	2,340	2,951	78	89	1	1	10	6
Mauritania	0.20	0.18	12.2	9.8	156	157	95	40	1	1	8	8
Mauritius	0.09	0.08	16.0	20.1	1	0	2,867	3,035	5	6	36	37
Mexico	0.29	0.25	21.6	23.1	10,014	10,504	716	727	35	38	124	131
Moldova	..	0.43	..	14.0	..	963	..	86	..	86	..	225
Mongolia	0.65	0.49	5.7	7.0	649	211	116	31	33	16	79	41
Morocco	0.36	0.29	13.5	14.1	5,545	5,217	369	440	10	11	45	56
Mozambique	0.24	0.22	2.8	2.5	1,561	2,008	10	53	1	1	17	14
Myanmar	0.24	0.21	10.0	18.6	5,154	7,069	84	146	1	1	13	10
Namibia	0.47	0.42	0.6	0.9	214	252	0	4	11	10	46	39
Nepal	0.13	0.13	41.0	35.4	3,013	3,318	322	251	1	0	19	15
Netherlands	0.06	0.06	61.0	59.9	192	226	6,506	4,286	583	621	2,074	1,642
New Zealand	0.73	0.39	7.3	8.5	161	143	1,525	5,704	456	450	301	507
Nicaragua	0.34	0.37	5.7	4.3	305	489	281	177	7	7	20	15
Niger	0.47	0.41	1.8	1.5	6,232	7,957	5	11	0	0	0	0
Nigeria	0.31	0.22	0.7	0.7	15,596	21,095	135	66	2	2	8	10
Norway	0.21	0.19	..	..	357	327	2,388	2,100	1,142	1,282	1,741	1,503
Oman	0.02	0.02	72.6	76.9	2	2	2,185	2,491	1	0	41	39
Pakistan	0.19	0.15	80.4	81.1	11,794	12,204	921	1,381	13	13	127	150
Panama	0.21	0.19	4.8	5.1	179	132	656	545	21	32	103	146
Papua New Guinea	0.05	0.04	..	..	2	3	671	556	1	1	60	55
Paraguay	0.51	0.55	3.0	2.2	447	689	92	319	25	23	71	56
Peru	0.16	0.14	30.5	27.8	802	1,141	320	759	5	4	37	36
Philippines	0.09	0.07	15.7	14.5	7,113	6,524	955	1,313	1	1	19	20
Poland	0.38	0.36	0.7	0.7	8,541	8,426	1,383	1,115	228	313	815	950
Portugal	0.24	0.19	20.2	24.0	832	486	1,152	1,062	153	269	563	849
Puerto Rico	0.02	0.01	34.5	47.6	1	0	..	..	..	..	..	..

3.2 Agricultural inputs

	Arable land		Irrigated land		Land under cereal production		Fertilizer consumption		Agricultural machinery			
	hectares per capita		% of cropland		thousands of hectares		hundreds of grams per hectare of arable land		Tractors per 1,000 agricultural workers		Tractors per 100 sq. km of arable land	
	1989–91	2000–02	1989–91	2000–02	1989–91	2001–03	1989–91	2000–02	1989–91	2000–02	1989–91	2000–02
Romania	0.41	0.42	31.1	31.1	5,927	5,760	1,077	355	54	106	147	175
Russian Federation	..	0.86	..	3.7	..	40,911	..	121	..	87	..	56
Rwanda	0.12	0.13	0.3	0.4	250	306	20	48	0	0	1	1
Saudi Arabia	0.22	0.17	45.5	42.7	1,009	677	1,461	1,067	6	14	19	28
Senegal	0.32	0.25	3.6	2.9	1,211	1,230	58	140	0	0	2	3
Serbia and Montenegro	..	0.35	2.1	..	..	3,412	1,075	..	..	..	1,424	..
Sierra Leone	0.12	0.10	5.2	5.3	462	231	24	5	0	0	6	2
Singapore	0.00	0.00	..	..	..	..	54,333	25,920	11	22	620	650
Slovak Republic	..	..	..	..	..	..	..	..	..	..	..	..
Slovenia	..	0.09	..	1.5	..	101	..	4,239	..	6,160	..	6,430
Somalia	0.14	0.12	17.3	18.7	..	..	18	5	1	1	21	16
South Africa	0.38	0.33	9.0	9.5	6,175	4,465	573	558	75	43	108	49
Spain	0.40	0.33	16.8	20.3	7,756	6,586	1,282	1,605	390	725	481	684
Sri Lanka	0.05	0.05	27.1	33.1	810	864	2,127	2,862	2	2	75	107
Sudan	0.52	0.51	14.7	11.7	5,376	8,684	48	40	1	2	7	7
Swaziland	0.24	0.17	33.2	36.8	80	71	697	371	38	33	233	221
Sweden	0.33	0.30	4.0	4.3	1,235	1,152	1,148	1,010	836	1,131	604	613
Switzerland	0.06	0.06	6.1	5.7	210	168	4,297	2,272	567	718	2,874	2,723
Syrian Arab Republic	0.40	0.28	12.9	23.5	3,968	3,046	581	718	53	66	129	219
Tajikistan	..	0.15	..	68.0	..	379	..	175	..	27	..	241
Tanzania	0.14	0.12	3.3	3.3	2,990	2,870	378	31	1	1	19	19
Thailand	0.32	0.26	20.6	25.7	10,991	11,421	537	1,039	3	11	33	139
Togo	0.60	0.54	0.3	0.7	625	773	57	74	0	0	0	0
Trinidad and Tobago	0.06	0.06	3.3	3.3	6	2	833	631	50	55	355	360
Tunisia	0.36	0.29	6.7	7.7	1,372	807	328	372	31	37	86	125
Turkey	0.44	0.37	13.9	17.9	13,679	13,829	735	727	53	65	278	377
Turkmenistan	..	0.39	..	94.0	..	865	..	543	..	72	..	270
Uganda	0.29	0.21	0.1	0.1	1,078	1,411	1	14	1	1	9	9
Ukraine	..	0.66	..	7.0	..	12,907	..	154	..	108	..	116
United Arab Emirates	0.02	0.02	128.1	29.6	1	0	4,247	5,221	2	5	55	57
United Kingdom	0.12	0.10	2.4	2.9	3,677	3,106	3,553	3,147	829	970	762	868
United States	0.74	0.62	11.1	12.6	63,775	55,604	1,007	1,093	1,321	1,619	258	273
Uruguay	0.41	0.39	9.6	13.5	508	536	586	895	172	174	262	254
Uzbekistan	..	0.18	..	88.7	..	1,560	..	1,614	..	57	..	379
Venezuela, RB	0.14	0.10	13.4	17.2	819	869	1,579	1,157	55	62	169	193
Vietnam	0.08	0.08	44.8	34.8	6,549	8,301	1,183	3,157	1	6	51	250
West Bank and Gaza	..	..	..	..	..	..	..	..	..	..	..	..
Yemen, Rep.	0.12	0.08	22.4	30.4	781	595	134	95	3	2	40	43
Zambia	0.67	0.52	0.6	0.9	929	628	128	84	2	2	11	11
Zimbabwe	0.28	0.25	3.3	3.5	1,606	1,641	562	443	5	7	60	75
World	0.27 w	0.23 w	17.8 w	19.7 w	695,097 s	665,131 s	999 w	986 w	22 w	20 w	191 w	190 w
Low income	0.21	0.17	24.4	26.8	206,088	228,681	552	672	4	4	50	66
Middle income	0.25	0.23	18.1	19.7	345,990	304,868	1,104	1,051	13	12	132	130
Lower middle income	0.24	0.21	18.9	20.8	308,466	264,386	1,143	1,096	10	9	116	106
Upper middle income	0.36	0.32	13.0	13.4	37,524	40,482	880	808	93	119	231	258
Low & middle income	0.23	0.20	20.3	22.3	552,079	533,549	909	912	9	8	103	106
East Asia & Pacific	0.12	0.12	..	..	141,841	133,881	1,768	2,148	2	2	56	73
Europe & Central Asia	0.64	0.58	10.3	10.9	141,325	116,270	994	343	108	111	194	184
Latin America & Carib.	0.31	0.29	12.4	12.5	48,262	49,456	590	861	36	40	119	119
Middle East & N. Africa	0.23	0.18	33.5	38.4	27,826	24,278	702	855	22	25	107	136
South Asia	0.18	0.15	34.1	41.2	129,072	125,321	743	1,053	4	5	62	92
Sub-Saharan Africa	0.29	0.24	4.5	4.3	63,753	84,343	150	132	2	1	21	15
High income	0.43	0.38	10.9	12.2	143,018	131,582	1,248	1,205	642	918	433	436
Europe EMU	0.22	0.21	16.9	19.8	33,599	31,403	2,524	2,032	654	920	997	973

a. Includes Luxembourg.

3.2 Agricultural inputs

About the data

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

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

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

Fertilizer consumption measures the quantity of plant nutrients. Consumption is calculated as production plus imports minus exports. Because some chemical compounds used for fertilizers have other industrial applications, the consumption data may overstate the quantity available for crops.

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

Definitions

• Arable land includes land defined by the FAO as land under temporary crops (double-cropped areas are counted once), temporary meadows for mowing or for pasture, land under market or kitchen gardens, and land temporarily fallow. Land abandoned as a result of shifting cultivation is excluded. • Irrigated land refers to areas purposely provided with water, including land irrigated by controlled flooding. • Cropland refers to arable land and permanent cropland (see table 3.1). • Land under cereal production refers to harvested areas, although some countries report only sown or cultivated area. • Fertilizer consumption is the quantity of plant nutrients used per unit of arable land. Fertilizer products cover nitrogenous, potash, and phosphate fertilizers (including ground rock phosphate). Traditional nutrients—animal and plant manures—are not included. The time reference for fertilizer consumption is the crop year (July through June). • Agricultural machinery refers to wheel and crawler tractors (excluding garden tractors) in use in agriculture at the end of the calendar year specified or during the first quarter of the following year. • Agricultural workers refer to all economically active people engaged principally in agriculture, forestry, hunting, or fishing.

3.2a

Arable land per person is shrinking in all regions and in all income groups

Source: Table 3.2.

Data sources

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

3.3 Agricultural output and productivity

	Crop production index		Food production index		Livestock production index		Cereal yield		Agricultural productivity	
	1999–2001 = 100		1999–2001 = 100		1999–2001 = 100		kilograms per hectare		Agriculture value added per worker 2000 $	
	1992–94	2002–04	1992–94	2002–04	1992–94	2002–04	1992–94	2002–04	1989–91	2001–03
Afghanistan	..	..	..	..	..	..	..	..	..	..
Albania	..	..	..	..	..	..	2,465	3,143	770	1,354
Algeria	85.2	119.1	84.5	110.1	85.5	101.0	812	1,323	1,801	1,964
Angola	67.9	119.5	71.3	113.1	79.4	100.0	321	502	207	155
Argentina	68.7	106.0	75.9	101.8	92.5	97.1	2,907	3,212	6,507	9,272
Armenia	106.9	108.6	104.6	108.8	97.9	107.7	1,642	1,976	..	2,646
Australia	59.9	77.8	72.4	91.3	85.4	99.6	1,714	1,709	20,601	26,957
Austria	89.9	95.5	92.0	94.0	97.6	95.2	5,219	5,612	11,153	24,456
Azerbaijan	115.6	123.0	90.7	118.9	86.7	111.5	1,788	2,587	..	1,026
Bangladesh	74.8	103.9	74.1	103.6	80.3	102.3	2,583	3,410	239	309
Belarus	116.3	113.1	129.4	106.9	137.3	98.8	2,602	2,630	..	2,520
Belgium	87.4	103.9	98.4	99.9	98.7	99.3	6,563	8,504	19,687	38,431
Benin	66.0	111.0	67.8	108.3	92.3	105.7	930	1,060	360	582
Bolivia	68.2	114.7	72.6	111.5	77.5	108.0	1,466	1,880	662	739
Bosnia and Herzegovina	..	..	..	..	..	..	3,559	3,220	..	..
Botswana	100.7	112.9	113.6	105.9	115.4	104.8	248	212	570	408
Brazil	82.2	115.8	76.8	115.0	73.1	114.6	2,261	3,129	1,658	3,004
Bulgaria	113.1	102.9	114.5	102.2	116.3	96.6	2,756	3,026	2,434	6,310
Burkina Faso	76.5	127.4	79.4	115.3	76.4	106.3	865	988	140	163
Burundi	108.0	108.3	108.1	107.3	137.2	100.1	1,348	1,333	119	104
Cambodia	64.1	101.8	66.1	103.2	75.8	102.1	1,366	2,042	..	292
Cameroon	75.7	108.4	78.6	107.9	86.8	102.3	1,000	1,710	725	1,143
Canada	89.1	86.8	84.0	92.4	80.2	103.2	2,568	2,683	27,739	36,702
Central African Republic	76.6	100.0	76.0	105.5	77.4	113.1	935	1,047	291	408
Chad	68.7	108.3	73.8	109.1	84.1	104.3	659	713	164	220
Chile	85.9	106.7	82.8	105.4	78.6	104.8	4,304	5,239	4,775	6,177
China	75.0	108.0	68.4	110.5	61.2	112.3	4,481	4,984	242	365
Hong Kong, China	..	..	..	..	..	..	..	..	..	..
Colombia	98.2	105.2	87.2	103.0	84.1	102.0	2,521	3,475	3,315	2,900
Congo, Dem. Rep.	126.2	97.0	123.3	97.2	103.2	97.0	783	780	230	196
Congo, Rep.	83.3	104.0	82.2	105.3	79.6	110.2	752	780	319	329
Costa Rica	66.7	120.0	78.1	94.3	80.8	98.9	3,468	3,965	3,039	4,306
Côte d'Ivoire	73.5	92.2	75.4	96.4	78.1	117.6	921	1,138	610	804
Croatia	83.6	98.0	92.1	95.7	100.8	93.8	4,124	4,432	..	8,956
Cuba	82.5	112.6	84.7	108.1	99.1	91.2	1,625	3,167	..	..
Czech Republic	97.2	85.7	112.0	95.1	115.4	103.3	4,057	4,308	..	5,078
Denmark	94.2	96.0	96.7	100.8	93.9	103.2	5,174	6,003	18,564	36,320
Dominican Republic	114.9	110.9	104.6	108.2	85.5	106.8	3,826	4,722	2,273	4,076
Ecuador	91.2	97.2	80.7	107.3	70.5	115.3	1,933	2,204	1,969	1,441
Egypt, Arab Rep.	74.1	100.6	71.9	101.8	68.9	105.5	5,918	7,191	1,497	1,952
El Salvador	102.7	89.7	90.0	99.8	81.3	104.7	1,879	2,445	1,571	1,613
Eritrea	91.2	64.0	82.8	79.8	75.9	93.9	523	267	..	64
Estonia	113.4	94.6	160.7	102.1	166.6	105.3	1,687	2,184	..	3,372
Ethiopia	69.9	106.7	71.8	107.3	78.8	106.9	1,143	1,318	..	123
Finland	91.8	104.2	99.6	104.0	101.9	103.7	3,357	3,231	16,056	30,391
France	92.1	95.8	95.9	97.8	97.4	100.8	6,515	7,034	20,265	38,647
Gabon	86.0	101.5	88.3	100.9	88.4	99.9	1,805	1,641	1,571	1,696
Gambia, The	55.5	64.7	59.7	68.1	102.1	101.7	1,197	1,107	234	226
Georgia	119.7	94.7	100.9	104.3	77.8	109.1	1,927	2,049	..	1,374
Germany	83.7	90.1	91.8	94.8	96.8	100.6	5,625	6,324	10,963	22,127
Ghana	69.1	114.3	70.2	114.2	90.9	107.0	1,237	1,406	315	338
Greece	96.1	95.0	99.3	97.0	103.0	98.6	3,674	3,539	7,579	9,226
Guatemala	79.8	101.5	78.7	104.6	80.2	99.8	1,849	1,735	2,121	2,261
Guinea	80.5	104.4	79.9	107.7	68.5	111.1	1,133	1,406	171	225
Guinea-Bissau	73.1	101.6	76.0	101.6	86.4	102.3	1,423	1,138	224	247
Haiti	101.9	99.6	95.7	101.8	76.7	109.2	948	868	802	469

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 $	
	1992–94	2002–04	1992–94	2002–04	1992–94	2002–04	1992–94	2002–04	1989–91	2001–03
Honduras	97.0	111.5	90.5	109.0	76.6	106.0	1,323	1,400	961	1,146
Hungary	89.1	88.5	93.5	96.0	101.7	103.9	3,567	4,250	3,456	4,114
India	84.0	97.0	80.8	100.1	75.2	107.2	2,075	2,313	341	402
Indonesia	87.8	106.3	89.4	107.2	100.4	113.6	3,866	4,229	479	538
Iran, Islamic Rep.	83.1	114.5	82.1	111.0	77.4	102.1	1,690	2,387	1,799	2,354
Iraq	..	..	..	..	..	..	..	..	..	..
Ireland	89.8	98.0	95.1	95.5	94.8	95.5	6,237	7,030	..	..
Israel	92.5	98.8	81.2	106.6	80.5	111.3	2,723	3,109	..	..
Italy	98.9	90.1	98.2	92.8	95.0	99.5	4,745	4,886	11,411	21,436
Jamaica	100.2	99.7	94.0	100.7	81.9	103.3	1,491	1,167	1,658	1,937
Japan	108.7	95.8	106.9	97.6	107.0	100.0	5,585	5,949	19,163	25,339
Jordan	109.0	144.3	98.5	135.1	92.8	98.9	1,462	1,073	1,456	960
Kazakhstan	123.0	114.7	136.7	107.5	174.9	105.7	1,056	1,057	..	1,385
Kenya	77.9	96.3	80.4	99.0	83.9	103.8	1,645	1,466	184	148
Korea, Dem. Rep.	..	..	..	..	..	..	5,487	3,310	..	..
Korea, Rep.	89.2	93.7	84.3	94.6	80.3	101.3	5,852	5,991	5,312	9,888
Kuwait	39.6	108.6	35.1	116.0	39.1	116.0	5,722	2,136	..	..
Kyrgyz Republic	60.8	106.7	71.8	103.6	102.6	102.6	2,349	2,767	..	931
Lao PDR	63.5	117.0	63.5	118.3	72.1	111.5	2,487	3,174	351	459
Latvia	126.9	119.0	188.2	108.7	220.3	97.9	1,752	2,290	..	2,385
Lebanon	115.2	95.7	106.3	100.8	68.3	116.3	2,107	2,486	..	43,100
Lesotho	74.1	103.3	95.2	101.4	125.8	100.0	801	963	503	506
Liberia	..	..	..	..	..	..	1,037	917	..	..
Libya	81.4	93.5	79.4	101.7	76.0	101.8	705	626	..	..
Lithuania	87.2	109.5	131.6	105.3	152.9	102.6	1,934	2,788	..	4,071
Macedonia, FYR	90.5	88.2	95.0	88.1	108.5	95.2	2,453	2,747	..	2,935
Madagascar	95.4	101.1	92.4	101.3	92.3	101.4	1,928	2,059	187	176
Malawi	57.7	79.5	49.3	81.3	85.3	101.8	956	1,135	76	121
Malaysia	79.8	109.7	78.4	110.4	97.2	110.8	2,996	3,275	3,694	4,571
Mali	75.6	102.2	81.7	102.4	85.1	110.8	773	822	203	228
Mauritania	85.6	93.6	82.3	105.6	81.2	107.5	793	959	244	278
Mauritius	107.3	100.7	100.4	103.8	82.2	117.8	4,135	4,854	3,718	5,034
Mexico	83.7	102.6	81.8	104.2	78.3	106.1	2,622	2,825	2,194	2,784
Moldova	147.1	107.2	149.7	107.0	168.3	100.0	2,981	2,659	..	726
Mongolia	171.5	112.7	83.1	100.6	81.3	99.6	812	676	1,003	694
Morocco	95.2	123.9	89.6	117.1	80.7	104.3	911	1,192	1,580	1,515
Mozambique	60.5	104.6	65.9	102.5	91.5	100.7	420	862	117	137
Myanmar	71.7	117.5	72.1	117.0	68.2	116.5	2,873	3,517	..	..
Namibia	70.3	107.5	108.2	94.7	115.3	91.0	277	410	792	1,003
Nepal	75.2	107.3	77.2	106.0	82.4	105.3	1,786	2,258	196	208
Netherlands	98.5	95.8	105.4	95.7	105.9	95.3	7,541	7,974	23,496	38,085
New Zealand	84.5	98.8	84.0	110.3	85.8	110.3	5,538	6,487	19,930	26,526
Nicaragua	73.9	106.5	73.9	114.5	73.4	119.9	1,733	1,792	1,167	1,934
Niger	74.2	112.7	78.6	110.6	86.2	103.0	313	415	174	172
Nigeria	79.4	103.6	79.5	103.8	82.8	105.5	1,150	1,058	576	836
Norway	115.3	101.8	105.7	98.6	102.3	97.1	3,496	3,901	19,055	30,854
Oman	69.2	88.9	66.9	90.3	75.2	92.0	2,168	2,318	..	..
Pakistan	79.9	100.4	76.8	105.9	75.2	109.2	1,893	2,332	563	690
Panama	111.7	101.9	97.5	104.2	80.2	104.8	1,901	2,447	2,320	3,470
Papua New Guinea	83.9	101.3	84.6	105.8	85.3	110.1	2,759	3,761	406	452
Paraguay	81.3	114.5	78.4	109.3	88.2	99.9	1,908	2,026	2,201	2,380
Peru	57.3	103.9	61.3	103.6	70.1	102.6	2,697	3,069	1,196	1,734
Philippines	87.2	107.6	81.5	111.6	67.4	121.5	2,209	2,825	910	1,013
Poland	101.3	91.5	99.2	102.7	99.3	104.4	2,573	3,131	..	1,358
Portugal	88.0	98.2	90.4	99.9	88.9	100.4	2,070	2,775	3,807	5,444
Puerto Rico	133.3	99.9	111.2	100.2	104.6	100.2	1,404	1,731	..	..

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 $	
	1992–94	2002–04	1992–94	2002–04	1992–94	2002–04	1992–94	2002–04	1989–91	2001–03
Romania	94.7	110.1	101.4	110.8	113.1	110.6	2,441	2,958	2,079	3,430
Russian Federation	114.8	114.1	122.5	113.1	142.7	107.8	1,612	1,891	..	2,204
Rwanda	86.6	117.8	85.4	117.0	76.8	105.5	1,150	1,001	179	225
Saudi Arabia	126.0	105.7	100.8	110.7	70.7	103.0	4,400	3,761	7,280	13,982
Senegal	72.3	73.6	74.1	78.8	83.9	98.2	792	944	270	260
Serbia and Montenegro	99.6	110.0	105.6	105.6	101.8	94.9	3,099	3,505	..	..
Sierra Leone	123.0	108.9	114.7	109.2	88.6	110.0	1,194	1,210	532	285
Singapore	116.1	100.0	215.2	66.2	212.4	71.3	..	..	25,523	32,915
Slovak Republic	..	..	..	..	..	..	..	..	..	..
Slovenia	101.0	98.2	86.6	105.6	83.2	109.1	4,150	4,927	..	30,306
Somalia	..	..	..	..	..	..	..	..	..	..
South Africa	81.4	100.6	85.4	105.7	93.8	109.8	1,901	2,676	1,890	2,238
Spain	81.6	104.3	83.4	103.8	80.5	107.6	2,342	3,395	8,740	14,852
Sri Lanka	89.4	98.4	91.2	99.6	87.9	107.2	2,961	3,305	696	737
Sudan	80.3	115.9	77.5	110.0	75.6	106.1	554	593	352	700
Swaziland	95.9	94.1	107.5	101.9	140.5	115.3	1,407	1,114	1,342	1,158
Sweden	94.0	103.0	96.3	100.4	97.2	97.5	4,003	4,882	20,416	30,469
Switzerland	112.2	93.5	104.3	99.9	103.3	101.9	6,137	6,005	..	..
Syrian Arab Republic	84.0	116.5	81.0	120.7	69.6	110.5	1,396	1,911	2,065	2,799
Tajikistan	118.6	128.7	129.9	126.5	183.7	132.3	1,012	1,977	..	412
Tanzania	88.1	102.6	87.2	104.0	87.7	109.0	1,162	1,476	246	283
Thailand	85.7	105.4	88.7	104.7	98.9	103.7	2,298	2,708	493	588
Togo	81.3	110.6	81.5	104.5	83.6	106.9	821	1,004	356	404
Trinidad and Tobago	116.8	91.9	91.0	121.5	75.0	141.7	3,496	2,688	1,623	2,397
Tunisia	91.7	93.4	84.9	94.7	66.7	98.6	1,208	1,422	2,144	2,438
Turkey	88.1	103.6	90.2	103.2	94.5	101.8	2,097	2,298	1,749	1,764
Turkmenistan	122.3	111.3	75.6	103.8	78.6	97.3	2,385	2,790	..	1,253
Uganda	81.4	107.4	82.5	108.7	86.1	116.8	1,522	1,651	187	230
Ukraine	127.4	112.8	134.9	108.4	155.5	107.2	2,952	2,542	..	1,442
United Arab Emirates	31.8	58.8	34.0	56.4	65.1	113.9	1,676	3,423	..	..
United Kingdom	102.5	100.5	106.4	99.0	106.1	98.5	6,435	7,082	21,655	25,609
United States	92.2	101.2	88.7	102.4	87.1	102.5	5,075	6,138	26,105	47,566
Uruguay	78.8	109.1	82.2	102.3	88.3	97.7	2,728	3,777	5,346	6,632
Uzbekistan	105.2	106.1	92.5	106.9	102.3	104.7	1,678	3,455	..	1,520
Venezuela, RB	79.5	93.1	77.3	99.6	79.5	103.2	2,817	3,242	5,016	6,126
Vietnam	67.2	114.9	70.3	116.0	64.7	120.2	3,344	4,484	212	290
West Bank and Gaza	..	..	..	..	..	..	..	..	..	..
Yemen, Rep.	83.0	99.5	79.1	105.9	73.7	112.9	1,104	871	361	504
Zambia	88.7	101.3	92.2	103.3	87.3	99.2	1,495	1,514	188	205
Zimbabwe	71.9	76.1	75.1	85.3	86.4	102.3	1,112	605	260	277
World	84.3 w	105.1 w	83.6 w	105.8 w	83.9 w	106.7 w	2,793 w	3,163 w	772 w	776 w
Low income	81.9	102.6	80.2	104.5	77.3	109.3	1,800	2,021	329	375
Middle income	82.2	109.6	80.3	110.0	79.3	110.4	2,782	3,249	550	719
Lower middle income	81.9	110.6	79.3	111.3	77.0	112.3	2,776	3,253	472	617
Upper middle income	84.4	102.2	86.1	102.2	89.8	101.5	2,828	3,222	3,440	3,970
Low & middle income	82.1	107.4	80.3	108.4	78.8	110.2	2,401	2,722	461	565
East Asia & Pacific	77.0	110.6	72.1	112.0	63.8	115.5	3,965	4,400	..	397
Europe & Central Asia	104.9	106.1	112.8	105.7	125.5	104.3	1,936	2,275	1,791	1,869
Latin America & Carib.	80.7	110.9	79.2	109.8	78.8	108.3	2,456	3,012	2,166	2,872
Middle East & N. Africa	86.2	111.0	82.1	110.1	74.4	106.3	1,898	2,398	1,825	2,238
South Asia	83.5	99.7	80.2	102.8	75.1	109.7	2,099	2,423	344	406
Sub-Saharan Africa	80.1	103.5	81.5	104.5	85.6	106.5	1,000	1,071	314	327
High income	90.9	97.9	91.0	99.7	91.7	101.2	4,383	4,939	..	..
Europe EMU	90.7	97.6	93.2	98.6	96.0	99.5	4,808	5,462	11,395	20,544

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. The FAO allocates production data to the calendar year in which the bulk of the harvest took place. But most of a crop harvested near the end of a year will be used in the following year. Cereal crops harvested for hay or harvested green for food, feed, or silage, and those used for grazing, are generally excluded. But millet and sorghum, which are grown as feed for livestock and poultry in Europe and North America, are used as food in Africa, Asia, and countries of the former Soviet Union. So some cereal crops are excluded from the data for some countries and included elsewhere, depending on their use.

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

Definitions

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

3.3a

The 10 countries with the highest cereal yield in 2002–04—and the 10 with the lowest

Country	Kilograms per hectare	Country	Kilograms per hectare
Belgium	8,504	Botswana	212
Netherlands	7,974	Eritrea	267
Egypt, Arab Rep.	7,191	Namibia	410
United Kingdom	7,082	Niger	415
France	7,034	Angola	502
Ireland	7,030	Sudan	593
New Zealand	6,487	Zimbabwe	605
Germany	6,324	Libya	626
United States	6,138	Mongolia	676
Switzerland	6,005	Chad	713

Source: Table 3.3.

Data sources

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

3.4 Deforestation and biodiversity

	Forest area		Average annual deforestation[a]		Mammals		Birds		Higher plants[b]		Nationally protected areas	
	thousand sq. km 2000	% of total land area 2000	sq. km 1990–2000	% 1990–2000	Species 2002	Threatened species 2002	Species 2002	Threatened species 2002	Species 2002	Threatened species 2002	thousand sq. km 2003[c]	% of total land area 2003[c]
Afghanistan	14	2.1	..	..	119	13	181	11	4,000	1	2.0	0.3
Albania	10	36.2	78	0.8	68	3	193	3	3,031	0	1.0	3.8
Algeria	21	0.9	–266	–1.3	92	13	183	6	3,164	2	119.1	5.0
Angola	698	56.0	1,242	0.2	276	19	265	15	5,185	19	82.3	6.6
Argentina	346	12.7	2,851	0.8	320	34	362	39	9,372	42	180.6	6.6
Armenia	4	12.4	–42	–1.3	84	11	236	4	3,553	1	2.1	7.6
Australia	1,545	20.1	2,820	0.2	252	63	497	37	15,638	38	1,029.4	13.4
Austria	39	47.0	–77	–0.2	83	7	230	3	3,100	3	27.3	33.0
Azerbaijan	11	13.2	–130	–1.3	99	13	229	8	4,300	0	5.3	6.1
Bangladesh	13	10.2	–165	–1.3	125	23	166	23	5,000	12	1.0	0.8
Belarus	94	45.3	–2,562	–3.2	74	7	194	3	2,100	0	13.1	6.3
Belgium[d]	7	22.2	13	0.2	58	11	191	2	1,550	0	0.9	2.6
Benin	27	24.0	699	2.3	188	8	112	2	2,500	11	12.6	11.4
Bolivia	531	48.9	1,611	0.3	316	24	504	28	17,367	70	145.3	13.4
Bosnia and Herzegovina	23	44.4	0	0.0	72	10	205	3	..	1	0.3	0.5
Botswana	124	21.9	1,184	0.9	164	6	184	7	2,151	0	104.8	18.5
Brazil	5,439	64.3	23,093	0.4	394	81	686	114	56,215	..	566.6	6.7
Bulgaria	37	33.4	–204	–0.6	81	14	248	10	3,572	0	5.0	4.5
Burkina Faso	71	25.9	152	0.2	147	7	138	2	1,100	2	31.5	11.5
Burundi	1	3.7	147	9.0	107	6	145	7	2,500	2	1.5	5.7
Cambodia	93	52.9	561	0.6	123	24	183	19	..	29	32.7	18.5
Cameroon	239	51.3	2,218	0.9	409	40	165	15	8,260	155	20.9	4.5
Canada	2,446	26.5	0	0.0	193	14	310	8	3,270	1	1,023.5	11.1
Central African Republic	229	36.8	300	0.1	209	14	168	3	3,602	10	54.2	8.7
Chad	127	10.1	817	0.6	134	17	141	5	1,600	2	114.6	9.1
Chile	155	20.7	203	0.1	91	21	157	22	5,284	40	141.5	18.9
China	1,635	17.5	–18,063	–1.2	394	79	618	74	32,200	168	727.5	7.8
Hong Kong, China	..	..	..	..	..	1	..	11	..	..	0.5	..
Colombia	496	47.8	1,905	0.4	359	41	708	78	51,220	213	105.9	10.2
Congo, Dem. Rep.	1,352	59.6	5,324	0.4	200	15	130	3	6,000	33	113.4	5.0
Congo, Rep.	221	64.6	175	0.1	450	40	345	28	11,007	55	22.2	6.5
Costa Rica	20	38.5	158	0.8	205	14	279	13	12,119	109	11.7	23.0
Côte d'Ivoire	71	22.4	2,649	3.1	230	19	252	12	3,660	101	19.1	6.0
Croatia	18	31.9	–20	–0.1	76	9	224	4	4,288	0	4.2	7.5
Cuba	23	21.4	–277	–1.3	31	11	86	18	6,522	160	75.9	69.1
Czech Republic	26	34.1	–5	0.0	81	8	205	2	1,900	4	12.4	16.1
Denmark	5	10.7	–10	–0.2	43	5	196	1	1,450	3	14.4	34.0
Dominican Republic	14	28.4	0	0.0	20	5	79	15	5,657	29	25.1	51.9
Ecuador	106	38.1	1,372	1.2	302	33	640	62	19,362	197	50.7	18.3
Egypt, Arab Rep.	1	0.1	–20	–3.3	98	13	123	7	2,076	2	96.6	9.7
El Salvador	1	5.8	72	4.6	135	2	141	0	2,911	23	0.1	0.4
Eritrea	16	15.7	54	0.3	112	12	138	7	..	3	4.3	4.3
Estonia	21	48.6	–125	–0.6	65	4	204	3	1,630	0	5.0	11.8
Ethiopia	46	4.6	403	0.8	277	35	262	16	6,603	22	169.0	16.9
Finland	219	72.0	–80	0.0	60	5	243	3	1,102	1	28.3	9.3
France	153	27.9	–616	–0.4	93	18	283	5	4,630	2	73.2	13.3
Gabon	218	84.7	101	0.0	190	15	156	5	6,651	71	1.8	0.7
Gambia, The	5	48.1	–45	–1.0	117	3	154	2	974	3	0.2	2.3
Georgia	30	43.0	0	0.0	107	13	208	3	4,350	..	1.6	2.3
Germany	107	30.8	0	0.0	76	11	247	5	2,682	12	113.8	32.6
Ghana	63	27.8	1,200	1.7	222	14	206	8	3,725	115	12.7	5.6
Greece	36	27.9	–300	–0.9	95	13	255	7	4,992	2	4.6	3.6
Guatemala	29	26.3	537	1.7	250	6	221	6	8,681	77	21.7	20.0
Guinea	69	28.2	347	0.5	190	12	109	10	3,000	21	1.7	0.7
Guinea-Bissau	22	77.8	216	0.9	108	3	235	0	1,000	4	..	..
Haiti	1	3.2	70	5.7	20	4	62	14	5,242	27	0.1	0.4

3.4 Deforestation and biodiversity

	Forest area		Average annual deforestation[a]		Mammals		Birds		Higher plants[b]		Nationally protected areas	
	thousand sq. km 2000	% of total land area 2000	sq. km 1990–2000	% 1990–2000	Species 2002	Threatened species 2002	Species 2002	Threatened species 2002	Species 2002	Threatened species 2002	thousand sq. km 2003[c]	% of total land area 2003[c]
Honduras	54	48.1	589	1.0	173	10	232	5	5,680	108	7.2	6.4
Hungary	18	20.0	–72	–0.4	83	9	208	8	2,214	1	6.5	7.0
India	641	21.6	–381	–0.1	390	88	458	72	18,664	244	154.6	5.2
Indonesia	1,050	58.0	13,124	1.2	515	147	929	114	29,375	384	373.2	20.6
Iran, Islamic Rep.	73	4.5	0	0.0	140	22	293	13	8,000	1	78.5	4.8
Iraq	8	1.8	0	0.0	81	11	140	11	..	0	0.0	0.0
Ireland	7	9.6	–170	–3.0	25	5	143	1	950	1	1.2	1.7
Israel	1	6.1	–50	–4.9	116	14	162	12	2,317	0	3.3	15.8
Italy	100	34.0	–295	–0.3	90	14	250	5	5,599	3	23.2	7.9
Jamaica	3	30.0	54	1.5	24	5	75	12	3,308	206	..	..
Japan	241	66.1	–34	0.0	188	37	210	34	5,565	11	24.8	6.8
Jordan	1	1.0	0	0.0	71	10	117	8	2,100	0	3.0	3.4
Kazakhstan	121	4.5	–2,390	–2.2	178	16	379	15	6,000	1	72.9	2.7
Kenya	171	30.0	931	0.5	359	51	344	24	6,506	98	45.5	8.0
Korea, Dem. Rep.	82	68.2	0	0.0	..	13	150	19	2,898	3	3.1	2.6
Korea, Rep.	62	63.3	51	0.1	49	13	138	25	2,898	0	6.8	6.9
Kuwait	0	0.3	–2	–5.2	21	1	35	7	234	0	0.3	1.5
Kyrgyz Republic	10	5.2	–228	–2.6	83	7	168	4	4,500	1	28.9	15.0
Lao PDR	126	54.4	527	0.4	172	31	212	20	8,286	18	6.9	3.0
Latvia	29	47.1	–127	–0.4	83	4	216	3	1,153	0	8.3	13.4
Lebanon	0	3.5	1	0.3	57	5	116	7	3,000	0	0.1	0.5
Lesotho	0	0.5	0	0.0	33	3	123	7	1,591	0	0.1	0.2
Liberia	35	36.1	760	2.0	193	17	146	11	2,200	46	1.6	1.7
Libya	4	0.2	–47	–1.4	76	8	76	1	1,825	1	1.8	0.1
Lithuania	20	31.8	–48	–0.2	68	5	201	4	1,796	0	6.7	10.3
Macedonia, FYR	9	35.6	0	0.0	78	11	199	3	3,500	0	1.8	7.1
Madagascar	117	20.2	1,174	0.9	141	50	172	27	9,505	162	25.0	4.3
Malawi	26	27.2	707	2.4	195	8	219	11	3,765	14	10.5	11.2
Malaysia	193	58.7	2,369	1.2	300	50	254	37	15,500	681	18.7	5.7
Mali	132	10.8	993	0.7	137	13	191	4	1,741	6	45.1	3.7
Mauritania	3	0.3	98	2.7	61	10	172	2	1,100	0	17.4	1.7
Mauritius	0	7.9	1	0.6	..	3	..	9	..	..	0.2	7.8
Mexico	552	28.9	6,306	1.1	491	70	440	39	26,071	..	194.7	10.2
Moldova	3	9.9	–7	–0.2	68	6	175	5	1,752	0	0.5	1.4
Mongolia	106	6.8	600	0.5	133	14	274	16	2,823	0	180.1	11.5
Morocco	30	6.8	12	0.0	105	16	206	9	3,675	2	3.1	0.7
Mozambique	306	39.0	637	0.2	179	14	144	16	5,692	36	65.9	8.4
Myanmar	344	52.3	5,169	1.4	300	39	310	35	7,000	37	2.0	0.3
Namibia	80	9.8	734	0.9	250	15	201	11	3,174	5	112.0	13.6
Nepal	39	27.3	783	1.8	181	31	274	25	6,973	6	12.7	8.9
Netherlands	4	11.1	–10	–0.3	55	10	192	4	1,221	0	4.8	14.2
New Zealand	79	29.7	–390	–0.5	..	8	..	63	..	..	79.3	29.6
Nicaragua	33	27.0	1,172	3.0	200	6	215	5	7,590	39	21.6	17.8
Niger	13	1.0	617	3.7	131	11	125	3	1,460	2	97.5	7.7
Nigeria	135	14.8	3,984	2.6	274	27	286	9	4,715	119	30.1	3.3
Norway	89	29.0	–310	–0.4	54	10	241	2	1,715	2	20.9	6.8
Oman	0	0.0	0	0.0	56	9	109	10	1,204	6	43.3	14.0
Pakistan	24	3.1	394	1.5	188	19	237	17	4,950	2	37.8	4.9
Panama	29	38.6	519	1.6	218	20	302	16	9,915	193	16.2	21.7
Papua New Guinea	306	67.6	1,129	0.4	214	58	414	32	11,544	142	10.4	2.3
Paraguay	234	58.8	1,230	0.5	305	10	233	26	7,851	10	13.9	3.5
Peru	652	50.9	2,688	0.4	460	49	695	76	17,144	269	78.1	6.1
Philippines	58	19.4	887	1.4	153	50	404	67	8,931	193	17.0	5.7
Poland	90	29.7	–175	–0.2	84	15	233	4	2,450	4	37.7	12.4
Portugal	37	40.1	–570	–1.7	63	17	235	7	5,050	15	6.0	6.6
Puerto Rico	2	25.8	5	0.2	..	2	..	8	..	..	0.3	3.5

3.4 Deforestation and biodiversity

	Forest area		Average annual deforestation[a]		Mammals		Birds		Higher plants[b]		Nationally protected areas	
	thousand sq. km 2000	% of total land area 2000	sq. km 1990–2000	% 1990–2000	Species 2002	Threatened species 2002	Species 2002	Threatened species 2002	Species 2002	Threatened species 2002	thousand sq. km 2003[c]	% of total land area 2003[c]
Romania	64	28.0	–147	–0.2	84	17	257	8	3,400	1	10.8	4.7
Russian Federation	8,514	50.4	–1,353	0.0	269	45	528	38	11,400	7	1,317.3	7.8
Rwanda	3	12.4	150	3.9	151	9	200	9	2,288	3	1.5	6.2
Saudi Arabia	15	0.7	0	0.0	77	8	125	15	2,028	3	823.3	38.3
Senegal	62	32.2	450	0.7	192	12	175	4	2,086	7	22.3	11.6
Serbia and Montenegro	29	28.3	14	0.0	96	12	238	5	4,082	1	..	..
Sierra Leone	11	14.7	361	2.9	147	12	172	10	2,090	43	1.5	2.1
Singapore	0	3.0	0	0.0	85	3	142	7	2,282	54	0.0	4.9
Slovak Republic	22	..	–203	–1.0	85	9	199	4	3,124	2	11.0	..
Slovenia	11	55.0	–22	–0.2	75	9	201	1	3,200	0	1.2	6.0
Somalia	75	12.0	769	1.0	171	19	179	10	3,028	17	5.0	0.8
South Africa	89	7.3	80	0.1	247	42	304	28	23,420	45	67.2	5.5
Spain	144	28.8	–860	–0.6	82	24	281	7	5,050	14	42.5	8.5
Sri Lanka	19	30.0	348	1.6	88	22	126	14	3,314	280	8.7	13.5
Sudan	616	25.9	9,589	1.4	267	23	280	6	3,137	17	123.6	5.2
Swaziland	5	30.3	–58	–1.2	..	4	..	5	..	..	0.6	3.5
Sweden	271	65.9	–6	0.0	60	7	259	2	1,750	3	37.5	9.1
Switzerland	12	30.3	–43	–0.4	75	5	199	2	3,030	2	11.9	30.0
Syrian Arab Republic	5	2.5	0	0.0	63	4	145	8	3,000	0	..	..
Tajikistan	4	2.8	–20	–0.5	84	9	210	7	5,000	2	5.9	4.2
Tanzania	388	43.9	913	0.2	316	42	229	33	10,008	236	263.3	29.8
Thailand	148	28.9	1,124	0.7	265	37	285	37	11,625	78	71.0	13.9
Togo	5	9.4	209	3.4	196	9	117	0	3,085	9	4.3	7.9
Trinidad and Tobago	3	50.5	22	0.8	100	1	131	1	2,259	1	0.3	6.0
Tunisia	5	3.3	–11	–0.2	78	11	165	5	2,196	0	0.5	0.3
Turkey	102	13.3	–220	–0.2	116	17	278	11	8,650	3	12.3	1.6
Turkmenistan	38	8.0	0	0.0	103	13	204	6	..	0	19.7	4.2
Uganda	42	21.3	913	2.0	345	20	243	13	4,900	33	48.5	24.6
Ukraine	96	16.5	–310	–0.3	108	16	245	8	5,100	1	22.6	3.9
United Arab Emirates	3	3.8	–78	–2.8	25	3	34	8	..	0	0.0	0.0
United Kingdom	28	11.6	–170	–0.6	50	12	229	2	1,623	13	50.3	20.9
United States	2,260	24.7	–3,880	–0.2	428	37	508	55	19,473	..	2,372.2	25.9
Uruguay	13	7.4	–501	–5.0	81	6	115	11	2,278	1	0.5	0.3
Uzbekistan	20	4.8	–46	–0.2	97	9	203	9	4,800	1	8.3	2.0
Venezuela, RB	495	56.1	2,175	0.4	323	26	547	24	21,073	67	562.7	63.8
Vietnam	98	30.2	–516	–0.5	213	40	262	37	10,500	126	12.0	3.7
West Bank and Gaza	..	..	..	..	..	1	..	1	..	..	..	..
Yemen, Rep.	4	0.9	92	1.8	66	5	93	12	1,650	52	..	..
Zambia	312	42.0	8,509	2.4	233	12	252	11	4,747	8	237.1	31.9
Zimbabwe	190	49.2	3,199	1.5	270	12	229	10	4,440	14	46.8	12.1
World	38,611 s	29.7 w	93,952 s	0.2 w							13,750.0 s	10.7 w
Low income	7,939	26.1	60,183	0.7							2,285.5	7.7
Middle income	22,743	33.0	38,904	0.2							6,454.0	9.4
Lower middle income	20,316	36.2	23,971	0.1							4,271.0	7.7
Upper middle income	2,427	19.0	14,933	0.6							2,183.0	17.3
Low & middle income	30,682	30.9	99,087	0.3							8,739.5	8.9
East Asia & Pacific	4,284	27.0	7,025	0.2							1,454.8	9.2
Europe & Central Asia	9,463	39.6	–8,342	–0.1							1,610.2	6.8
Latin America & Carib.	9,552	47.6	46,701	0.5							2,237.8	11.2
Middle East & N. Africa	168	1.5	–239	–0.1							1,169.3	11.3
South Asia	780	16.3	979	0.1							228.6	4.8
Sub-Saharan Africa	6,435	27.3	52,963	0.8							2,038.8	8.7
High income	7,929	25.9	–5,135	–0.1							5,010.5	19.5
Europe EMU	853	35.0	–2,965	–0.4							324.9	13.5

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 Center in 2003. d. Includes Luxembourg.

3.4 Deforestation and biodiversity

About the data

The estimates of forest area are from the Food and Agriculture Organization's (FAO) State of the World's Forests 2004, which provides information on forest cover in 2000 and an estimate of forest cover in 1990. The current survey is the latest global forest assessment and the first to use a uniform global definition of forest. According to this assessment, the global rate of net deforestation has slowed to 9.5 million hectares a year, a rate 20 percent lower than that previously reported. No breakdown of forest cover between natural forest and plantation is shown in the table because of space limitations. (This breakdown is provided by the FAO only for developing countries.) For this reason the deforestation data in the table may underestimate the rate at which natural forest is disappearing in some countries.

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

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

Nationally protected areas are areas of at least 1,000 hectares that fall into one of six management categories defined by the WCMC:

- Scientific reserves and strict nature reserves with limited public access.
- National parks of national or international significance (not materially affected by human activity).
- Natural monuments and natural landscapes with unique aspects.
- Managed nature reserves and wildlife sanctuaries.
- Protected landscapes and seascapes (which may include cultural landscapes).
- 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. For small countries that may only have protected areas smaller than 1,000 hectares, this size limit in the definition will result in an underestimate of the extent and number of protected areas.

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

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

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

Definitions

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

Data sources

The forestry data are from the FAO's State of the World's Forests 2004. The data on species are from the WCMC's electronic files and the IUCN's 2002 IUCN Red List of Threatened Animals and 1997 IUCN Red List of Threatened Plants. The data on protected areas are from the United Nations Environment Programme and WCMC.

3.5 Freshwater

	Renewable internal freshwater resources[a]		Annual freshwater withdrawals[b]					Access to improved water source			
	Flows billion cu. m 2003	per capita cu. m 2003	billion cu. m 1987–2003	% of internal resources 1987–2003	% for agriculture 1987–2003	% for industry 1987–2003	% for domestic 1987–2003	% of urban population 1990	% of urban population 2002	% of rural population 1990	% of rural population 2002
Afghanistan	55	1,912	26.1	47.5	99	0	1	..	19	..	11
Albania	27	8,520	1.4	5.2	71	0	29	99	99	95	95
Algeria	14	440	5.0	35.7	52	14	34	99	92	92	80
Angola	184	13,607	0.5	0.3	76	10	14	11	70	40	40
Argentina	276	7,506	28.6	10.4	75	9	16	97	97	73	..
Armenia	9	2,945	2.9	32.2	66	4	30	99	99	..	80
Australia	492	24,747	14.6	3.0	33	2	65	100	100	100	100
Austria	55	6,799	2.4	4.4	9	58	33	100	100	100	100
Azerbaijan	8	972	16.5	206.3	70	25	5	80	95	49	59
Bangladesh	105	761	14.6	13.9	86	2	12	83	82	68	72
Belarus	37	3,745	2.7	7.3	35	43	22	100	100	100	100
Belgium	12	1,157	..	..	..	..	..	100	100	..	..
Benin	10	1,488	0.1	1.0	67	10	23	71	79	54	60
Bolivia	304	34,490	1.2	0.4	87	3	10	91	95	48	68
Bosnia and Herzegovina	36	8,696	1.0	2.8	60	10	30	100	100	96	96
Botswana	3	1,742	0.1	3.3	48	20	32	100	100	88	90
Brazil	5,418	30,680	54.9	1.0	61	18	21	93	96	55	58
Bulgaria	21	2,684	13.9	66.2	22	75	3	100	100	100	100
Burkina Faso	13	1,074	0.4	3.1	81	0	19	63	82	35	44
Burundi	4	555	0.1	2.5	64	0	36	96	90	67	78
Cambodia	121	9,027	0.5	0.4	94	1	5	..	58	..	29
Cameroon	273	16,970	0.4	0.1	35	19	46	77	84	32	41
Canada	2,850	90,104	45.1	1.6	12	70	18	100	100	99	99
Central African Republic	141	36,332	0.1	0.1	74	5	21	70	93	35	61
Chad	15	1,748	0.2	1.3	82	2	16	45	40	13	32
Chile	884	56,042	20.3	2.3	84	11	5	98	100	49	59
China	2,812	2,183	525.5	18.7	78	18	5	100	92	59	68
Hong Kong, China	..	..	..	..	..	..	..	..	..	..	..
Colombia	2,112	47,371	8.9	0.4	37	4	59	98	99	78	71
Congo, Dem. Rep.	900	16,932	0.4	0.0	23	16	61	92	83	24	29
Congo, Rep.	222	59,086	0.0	0.0	11	27	62	..	72	..	17
Costa Rica	112	27,967	5.8	5.2	80	7	13	100	100	..	92
Côte d'Ivoire	77	4,574	0.7	0.9	67	11	22	74	98	66	74
Croatia	38	8,550	0.8	2.1	0	50	50	..	..	..	..
Cuba	38	3,355	5.2	13.7	51	0	49	95	95	..	78
Czech Republic	13	1,274	2.7	20.8	2	57	41	..	..	..	..
Denmark	6	1,114	1.2	20.0	43	27	30	100	100	100	100
Dominican Republic	21	2,403	8.3	39.5	89	0	11	97	98	72	85
Ecuador	432	33,210	17.0	3.9	82	6	12	81	92	54	77
Egypt, Arab Rep.	2	30	66.0	3,300.0	82	11	7	97	100	92	97
El Salvador	18	2,755	0.7	3.9	46	20	34	88	91	47	68
Eritrea	3	683	..	..	..	..	..	60	72	36	54
Estonia	13	9,608	0.2	1.5	5	39	56	..	..	..	..
Ethiopia	110	1,603	2.2	2.0	86	3	11	80	81	16	11
Finland	107	20,530	2.2	2.1	3	85	12	100	100	100	100
France	179	2,995	32.3	18.0	10	72	18	100	100	..	..
Gabon	164	121,984	0.1	0.1	6	22	72	95	95	..	47
Gambia, The	3	2,111	0.0	0.0	91	2	7	95	95	..	77
Georgia	58	11,315	3.5	6.0	59	20	21	..	90	..	61
Germany	107	1,296	46.3	43.3	20	69	11	100	100	100	100
Ghana	30	1,451	0.3	1.0	52	13	35	85	93	36	68
Greece	58	5,257	8.7	15.0	87	3	10	..	..	..	..
Guatemala	109	8,857	1.2	1.1	74	17	9	88	99	69	92
Guinea	226	28,575	0.7	0.3	87	3	10	70	78	32	38
Guinea-Bissau	16	10,744	0.0	0.0	36	4	60	..	79	..	49
Haiti	13	1,540	1.0	7.7	94	1	5	77	91	43	59

3.5 Freshwater

	Renewable internal freshwater resources[a]		Annual freshwater withdrawals[b]					Access to improved water source			
	Flows billion cu. m 2003	per capita cu. m 2003	billion cu. m 1987–2003	% of internal resources 1987–2003	% for agriculture 1987–2003	% for industry 1987–2003	% for domestic 1987–2003	% of urban population 1990	% of urban population 2002	% of rural population 1990	% of rural population 2002
Honduras	96	13,776	1.5	1.6	91	5	4	89	99	78	82
Hungary	6	592	6.8	113.3	36	55	9	100	100	98	98
India	1,261	1,185	500.0	39.7	92	3	5	88	96	61	82
Indonesia	2,838	13,220	74.3	2.6	93	1	6	92	89	62	69
Iran, Islamic Rep.	129	1,943	70.0	54.3	92	2	6	98	98	83	83
Iraq	35	1,417	42.8	122.3	92	5	3	97	97	50	50
Ireland	49	12,268	0.8	1.6	10	74	16	100	100	..	..
Israel	1	150	1.6	160.0	54	7	39	100	100	100	100
Italy	183	3,175	42.0	23.0	48	34	19	100	100	..	..
Jamaica	9	3,406	0.9	10.0	77	7	15	97	98	86	87
Japan	430	3,371	91.4	21.3	64	17	19	100	100	100	100
Jordan	1	188	1.0	100.0	75	3	22	100	91	91	91
Kazakhstan	75	5,041	33.7	44.9	81	17	2	96	96	72	72
Kenya	20	627	2.0	10.0	76	4	20	91	89	30	46
Korea, Dem. Rep.	67	2,963	14.2	21.2	73	16	11	100	100	100	100
Korea, Rep.	65	1,357	23.7	36.5	63	11	26	97	97	..	71
Kuwait	0	0	0.5	..	60	2	37	..	..	..	..
Kyrgyz Republic	46	9,105	10.1	22.0	94	3	3	98	98	..	66
Lao PDR	190	33,570	1.0	0.5	82	10	8	..	66	..	38
Latvia	17	7,324	0.3	1.8	13	32	55	..	..	..	..
Lebanon	5	1,112	1.3	26.0	68	6	27	100	100	100	100
Lesotho	5	2,789	0.1	2.0	56	22	22	..	88	..	74
Liberia	200	59,285	0.1	0.1	60	13	27	85	72	34	52
Libya	1	180	4.5	450.0	84	3	13	72	72	68	68
Lithuania	16	4,632	0.3	1.9	3	16	81	..	..	..	..
Macedonia, FYR	5	2,440	1.9	38.0	74	15	12	..	..	..	..
Madagascar	337	19,948	16.3	4.8	99	..	1	82	75	27	34
Malawi	16	1,460	0.9	5.6	86	3	10	90	96	34	62
Malaysia	580	23,411	12.7	2.2	77	13	11	96	96	..	94
Mali	60	5,150	1.4	2.3	97	1	2	50	76	29	35
Mauritania	0	0	1.6	..	92	2	6	19	63	57	45
Mauritius	..	..	..	..	..	..	..	100	100	100	100
Mexico	409	3,998	77.8	19.0	78	5	17	90	97	54	72
Moldova	1	236	3.0	300.0	26	65	9	97	97	..	88
Mongolia	35	14,115	0.4	1.1	53	27	20	87	87	30	30
Morocco	29	963	11.5	39.7	89	2	10	94	99	58	56
Mozambique	99	5,268	0.6	0.6	89	2	9	..	76	..	24
Myanmar	881	17,848	4.0	0.5	90	3	7	73	95	40	74
Namibia	6	2,978	0.2	3.3	68	3	29	99	98	43	72
Nepal	198	8,029	29.0	14.6	99	0	1	94	93	67	82
Netherlands	11	678	7.8	70.9	34	61	5	100	100	99	99
New Zealand	327	81,562	2.0	0.6	44	10	46	100	100	82	..
Nicaragua	190	34,672	1.3	0.7	84	2	14	92	93	42	65
Niger	4	340	0.5	12.5	82	2	16	62	80	35	36
Nigeria	221	1,620	3.6	1.6	54	15	31	78	72	33	49
Norway	382	83,735	2.0	0.5	8	72	20	100	100	100	100
Oman	1	385	1.2	120.0	94	2	5	81	81	72	72
Pakistan	52	350	155.6	299.2	97	2	2	95	95	78	87
Panama	147	49,262	1.6	1.1	70	2	28	99	99	..	79
Papua New Guinea	801	145,587	0.1	0.0	49	22	29	88	88	32	32
Paraguay	94	16,658	0.4	0.4	78	7	15	80	100	46	62
Peru	1,616	59,526	19.0	1.2	86	7	7	88	87	42	66
Philippines	479	5,877	55.4	11.6	88	4	8	93	90	82	77
Poland	54	1,414	12.3	22.8	11	76	13	100	100	..	..
Portugal	38	3,638	7.3	19.2	48	37	15	..	..	..	..
Puerto Rico	..	..	..	..	..	..	..	..	..	..	..

3.5 Freshwater

	Renewable internal freshwater resources[a]		Annual freshwater withdrawals[b]					Access to improved water source			
	Flows billion cu. m 2003	per capita cu. m 2003	billion cu. m 1987–2003	% of internal resources 1987–2003	% for agriculture 1987–2003	% for industry 1987–2003	% for domestic 1987–2003	% of urban population 1990	% of urban population 2002	% of rural population 1990	% of rural population 2002
Romania	42	1,932	26.0	61.9	59	33	8	..	91	..	16
Russian Federation	4,313	30,071	77.1	1.8	20	62	19	97	99	86	88
Rwanda	5	596	0.8	16.0	94	2	5	88	92	57	69
Saudi Arabia	2	89	17.0	850.0	90	1	9	97	97	63	..
Senegal	26	2,539	1.4	5.4	92	3	5	90	90	50	54
Serbia and Montenegro	44	5,429	13.0	29.5	8	86	6	99	99	86	86
Sierra Leone	160	29,982	0.4	0.3	89	4	7	..	75	..	46
Singapore	..	..	..	..	4	51	45	100	100	..	..
Slovak Republic	13	2,412	1.8	13.8	..	..	..	100	100	100	100
Slovenia	19	9,524	1.3	6.8	1	80	20	..	..	..	..
Somalia	6	623	0.8	13.3	97	0	3	..	32	..	27
South Africa	45	982	13.3	29.6	72	11	17	99	98	67	73
Spain	111	2,701	35.2	31.7	68	19	13	..	..	..	..
Sri Lanka	50	2,600	9.8	19.6	96	2	2	91	99	62	72
Sudan	30	894	17.8	59.3	94	1	4	85	78	57	64
Swaziland	..	..	..	..	..	..	..	..	87	..	42
Sweden	171	19,093	2.9	1.7	9	55	36	100	100	100	100
Switzerland	40	5,442	1.2	3.0	4	73	23	100	100	100	100
Syrian Arab Republic	7	403	12.0	171.4	90	2	8	94	94	64	64
Tajikistan	66	10,468	11.9	18.0	92	4	3	..	93	..	47
Tanzania	82	2,285	1.2	1.5	89	2	9	79	92	27	62
Thailand	210	3,386	33.1	15.8	91	4	5	87	95	78	80
Togo	12	2,468	0.1	0.8	25	13	62	81	80	37	36
Trinidad and Tobago	4	3,047	0.3	7.5	6	26	68	93	92	89	88
Tunisia	4	404	2.8	70.0	86	1	13	93	94	57	60
Turkey	227	3,210	35.5	15.6	73	12	16	92	96	65	87
Turkmenistan	1	206	23.8	2,380.0	98	1	1	..	93	..	54
Uganda	39	1,543	0.2	0.5	60	8	32	79	87	40	52
Ukraine	53	1,096	26.0	49.1	30	52	18	100	100	..	94
United Arab Emirates	0	49	2.1	1,050.0	67	9	24	..	..	..	..
United Kingdom	145	2,444	11.8	8.1	3	77	20	100	100	..	..
United States	2,800	9,628	467.3	16.7	42	45	13	100	100	100	100
Uruguay	59	17,455	0.7	1.2	91	3	6	98	98	..	93
Uzbekistan	16	625	58.1	363.1	94	2	4	97	97	84	84
Venezuela, RB	722	28,122	4.1	0.6	46	10	44	..	85	..	70
Vietnam	367	4,513	54.3	14.8	87	10	4	93	93	67	67
West Bank and Gaza	..	..	..	..	..	..	..	..	..	..	..
Yemen, Rep.	4	209	2.9	72.5	92	1	7	74	74	68	68
Zambia	80	7,690	1.7	2.1	77	7	16	86	90	27	36
Zimbabwe	14	1,069	1.2	8.6	79	7	14	99	100	69	74
World	42,883 s	6,895 w	3,325 s	8 w	71 w	20 w	10 w	95 w	94 w	62	72 w
Low income	8,278	3,583	947	11	92	3	5	86	89	56	70
Middle income	25,797	8,657	1,524	6	74	17	9	96	94	64	71
Lower middle income	22,242	8,397	1,323	6	74	18	8	97	94	63	71
Upper middle income	3,555	10,741	201	6	71	14	15	95	96	..	..
Low & middle income	34,075	6,441	2,471	7	81	12	7	93	93	60	70
East Asia & Pacific	9,455	5,103	776	8	81	14	5	97	92	61	69
Europe & Central Asia	5,255	11,128	387	7	57	33	10	97	98	..	80
Latin America & Carib.	13,428	25,245	263	2	74	9	18	93	96	58	69
Middle East & N. Africa	234	761	238	102	88	5	7	96	96	78	78
South Asia	1,816	1,275	735	40	94	3	4	89	93	63	80
Sub-Saharan Africa	3,887	5,546	73	2	85	6	10	81	82	37	46
High income	8,808	9,479	854	10	42	42	16	100	100	..	98
Europe EMU	910	2,970	185	21	38	47	15	100	100	..	..

a. River flows from other countries are not included because of data unreliability. b. Data are for most recent year available for 1987–2003 (see Primary data documentation).

About the data

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

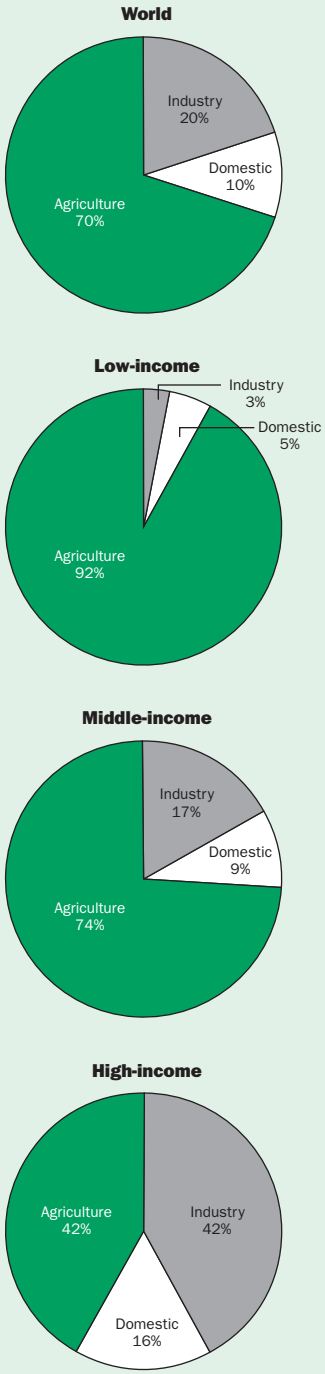
Caution is also needed in comparing data on annual freshwater withdrawals, which are subject to variations in collection and estimation methods. In addition, inflows and outflows are estimated at different times and at different levels of quality and precision, requiring caution in interpreting the data,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

The data on access to an improved water source measure the share of the population with reasonable and ready access to an adequate amount of safe water for domestic purposes. An improved source can be any form of collection or piping used to make water regularly available. While information on access to an improved water source is widely used, it is extremely subjective, and such terms as safe, improved, adequate, and reasonable may have very different meanings in different countries despite official World Health Organization (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 public supply system, this does not take into account variations in the quality and cost (broadly defined) of the service once connected. Changes over time within countries may reflect changes in definitions or measurements. Thus cross-country comparisons must be made cautiously. The definition in this table and in table 2.15 differs from that used for the city-level data shown in table 3.11, which is more stringent.

3.5a

Agriculture uses more than 71 percent of freshwater globally

Share of annual freshwater withdrawals, most recent year available



Source: Table 3.5.

Definitions

• Renewable internal freshwater resources refer to internal renewable resources (internal river flows and groundwater from rainfall) in the country. • 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. • Access to an improved water source refers to the percentage of the population with reasonable access to an adequate amount of water from an improved source, such as a household connection, public standpipe, borehole, protected well or spring, or rainwater collection. Unimproved sources include vendors, tanker trucks, and unprotected wells and springs. Reasonable access is defined as the availability of at least 20 liters a person a day from a source within 1 kilometer of the dwelling.

Data sources

The data on freshwater resources and withdrawals are compiled by the World Resources Institute from various sources and published in World Resources 2002–03 (produced in collaboration with the United Nations Environment Programme, United Nations Development Programme, and World Bank). These are supplemented by the Food and Agriculture Organization's AQUASTAT data. The data on access to an improved water source come from the WHO.

3.6 Water pollution

	Emissions of organic water pollutants				Industry shares of emissions of organic water pollutants							
	kilograms per day		kilograms per day per worker		% of total							
	1990	2001[a]	1990	2001[a]	Primary metals 2001[a]	Paper and pulp 2001[a]	Chemicals 2001[a]	Food and beverages 2001[a]	Stone, ceramics, and glass 2001[a]	Textiles 2001[a]	Wood 2001[a]	Other 2001[a]
Afghanistan	..	..	..	..	..	..	..	..	..	..	..	..
Albania	34,785	6,512	0.14	0.29	14.3	0.9	5.5	73.5	0.3	5.0	0.0	0.4
Algeria	106,977	45,645	0.25	0.24	23.4	2.0	5.9	59.5	0.7	8.0	1.0	..
Angola	4,544	1,472	0.19	0.20	7.6	3.0	9.1	65.9	0.3	6.0	4.0	4.0
Argentina	186,686	149,455	0.20	0.23	4.9	7.2	4.2	71.1	0.0	7.0	1.0	4.6
Armenia	37,900	7,104	0.11	0.28	..	..	0.0	77.6	..	22.0	..	..
Australia	186,110	111,658	0.18	0.18	12.4	22.8	5.6	77.1	0.2	5.0	5.0	6.4
Austria	94,121	80,789	0.15	0.13	14.9	18.2	11.1	32.8	0.4	5.0	5.0	12.5
Azerbaijan	53,251	18,672	0.15	0.16	12.5	4.7	16.6	43.7	0.3	15.0	1.0	6.2
Bangladesh	171,087	273,082	0.17	0.14	1.8	6.8	2.5	23.2	0.1	64.0	1.0	0.7
Belarus	..	..	..	..	..	..	..	..	..	..	..	..
Belgium	117,978	102,460	0.16	0.17	13.7	18.0	12.0	40.4	0.2	6.0	2.0	7.6
Benin	..	..	..	..	..	..	..	..	..	..	..	..
Bolivia	8,404	12,759	0.24	0.25	0.9	20.5	6.6	61.4	0.3	7.0	2.0	1.4
Bosnia and Herzegovina	50,741	8,903	0.14	0.18	20.5	13.1	6.6	33.3	0.2	18.0	6.0	2.2
Botswana	4,509	3,543	0.19	0.25	1.7	6.7	5.4	77.9	0.2	10.0	3.0	2.5
Brazil	780,395	629,406	0.19	0.20	17.7	12.9	9.2	44.4	0.1	10.0	1.0	4.7
Bulgaria	149,381	90,976	0.11	0.17	7.9	7.2	8.2	46.8	0.2	22.0	2.0	5.7
Burkina Faso	..	2,598	..	0.22	3.5	1.1	5.4	73.8	0.1	4.0	10.0	2.2
Burundi	1,570	..	0.24	..	..	..	..	..	..	..	..	..
Cambodia	11,823	..	0.14	..	..	..	..	..	..	..	..	..
Cameroon	13,989	10,714	0.28	0.20	3.1	6.3	28.3	52.7	0.0	4.0	6.0	..
Canada	321,471	313,431	0.17	0.16	9.7	22.8	8.3	38.5	0.1	6.0	5.0	9.5
Central African Republic	998	670	0.18	0.17	0.0	..	4.0	62.0	0.0	14.0	20.0	..
Chad	..	..	..	..	..	..	..	..	..	..	..	..
Chile	66,783	72,850	0.22	0.24	6.9	11.3	8.9	62.7	0.1	5.0	3.0	2.1
China	7,038,131	6,088,663	0.14	0.14	20.4	10.9	14.8	28.1	0.5	15.0	1.0	9.2
Hong Kong, China	86,124	34,767	0.12	0.19	1.2	43.3	3.5	30.2	0.1	16.0	0.0	5.8
Colombia	93,253	93,879	0.19	0.21	3.1	16.2	9.7	53.2	0.2	14.0	1.0	2.6
Congo, Dem. Rep.	..	..	..	..	..	..	..	..	..	..	..	..
Congo, Rep.	..	..	..	..	..	..	..	..	..	..	..	..
Costa Rica	27,249	32,914	0.20	0.21	1.8	10.0	7.4	62.2	0.1	14.0	2.0	2.5
Côte d'Ivoire	..	12,401	..	0.24	..	5.5	7.1	71.9	0.0	9.0	6.0	..
Croatia	80,034	43,087	0.15	0.17	6.2	15.4	8.0	47.1	0.2	13.0	4.0	6.0
Cuba	..	..	..	..	..	..	..	..	..	..	..	..
Czech Republic	309,469	..	0.13	..	..	..	..	..	..	..	..	..
Denmark	91,871	83,591	0.18	0.17	4.4	29.1	7.9	44.2	0.2	2.0	3.0	9.3
Dominican Republic	..	..	..	..	..	..	..	..	..	..	..	..
Ecuador	25,567	32,266	0.23	0.27	2.3	10.8	6.2	71.8	0.1	6.0	1.0	1.7
Egypt, Arab Rep.	211,531	203,633	0.20	0.20	11.8	7.9	8.0	49.8	0.3	19.0	0.0	3.3
El Salvador	7,663	22,760	0.22	0.18	2.1	10.2	8.1	43.5	0.1	34.0	0.0	1.9
Eritrea	..	..	..	..	..	..	..	..	..	..	..	..
Estonia	..	..	..	..	..	..	..	..	..	..	..	..
Ethiopia	18,593	20,849	0.23	0.23	1.8	10.4	4.6	61.2	0.3	20.0	1.0	0.7
Finland	79,514	66,877	0.18	0.16	8.7	40.1	6.8	27.0	0.2	3.0	4.0	10.3
France	653,455	281,747	0.15	0.10	14.7	31.0	23.0	37.4	0.3	9.0	3.0	10.7
Gabon	2,018	1,886	0.25	0.26	0.0	6.0	4.9	79.7	0.1	1.0	7.0	1.3
Gambia, The	..	832	..	0.34	..	..	..	..	..	..	..	..
Georgia	..	..	..	..	..	..	..	..	..	..	..	..
Germany	835,019	1,020,145	0.12	0.14	9.0	20.9	11.3	38.7	0.2	3.0	2.0	15.0
Ghana	..	14,449	..	0.17	9.8	16.9	10.5	39.5	0.2	9.0	12.0	2.2
Greece	63,479	43,707	0.18	0.19	8.1	9.7	9.0	55.0	0.3	12.0	2.0	3.9
Guatemala	16,070	19,253	0.27	0.28	4.9	7.2	6.1	72.8	0.1	7.0	1.0	0.8
Guinea	..	..	..	..	..	..	..	..	..	..	..	..
Guinea-Bissau	..	..	..	..	..	..	..	..	..	..	..	..
Haiti	..	..	..	..	..	..	..	..	..	..	..	..

3.6 Water pollution

	Emissions of organic water pollutants				Industry shares of emissions of organic water pollutants							
	kilograms per day		kilograms per day per worker		% of total							
	1990	2001[a]	1990	2001[a]	Primary metals 2001[a]	Paper and pulp 2001[a]	Chemicals 2001[a]	Food and beverages 2001[a]	Stone, ceramics, and glass 2001[a]	Textiles 2001[a]	Wood 2001[a]	Other 2001[a]
Honduras	17,824	34,036	0.23	0.20	1.1	7.8	3.9	55.5	0.1	27.0	4.0	0.6
Hungary	178,002	113,527	0.16	0.15	6.4	11.8	7.6	49.1	0.2	13.0	2.0	10.0
India	1,410,617	1,556,371	0.20	0.20	12.6	7.5	9.3	53.0	0.2	13.0	0.0	4.4
Indonesia	495,594	753,657	0.19	0.18	2.8	8.5	9.6	50.1	0.1	21.0	5.0	4.3
Iran, Islamic Rep.	102,689	140,775	0.16	0.16	17.4	7.0	10.7	43.6	0.6	13.0	1.0	6.7
Iraq	20,352	19,617	0.16	0.16	8.8	14.1	15.1	39.4	0.7	17.0	0.0	4.8
Ireland	34,610	49,144	0.18	0.15	1.3	14.2	11.4	56.4	0.2	3.0	2.0	11.4
Israel	46,359	39,824	0.16	0.14	3.2	8.2	7.7	54.5	0.1	10.0	2.0	14.2
Italy	358,084	495,973	0.13	0.12	9.3	16.8	10.8	30.1	0.3	16.0	4.0	12.6
Jamaica	18,736	17,507	0.29	0.29	6.9	7.2	3.8	70.8	0.1	10.0	1.0	0.1
Japan	1,556,648	1,279,287	0.14	0.15	7.0	21.9	9.0	43.2	0.2	5.0	2.0	11.7
Jordan	8,325	18,682	0.19	0.19	4.9	12.8	12.9	52.4	0.5	11.0	3.0	2.6
Kazakhstan	..	..	..	..	..	..	..	..	..	..	..	..
Kenya	42,588	53,029	0.23	0.25	4.1	11.9	5.7	70.0	0.1	8.0	2.0	2.3
Korea, Dem. Rep.	..	..	..	..	..	..	..	..	..	..	..	..
Korea, Rep.	369,193	309,517	0.12	0.12	11.4	18.2	12.9	26.0	0.2	14.0	1.0	16.3
Kuwait	9,052	11,412	0.16	0.17	2.5	16.4	10.6	49.4	0.4	12.0	3.0	5.7
Kyrgyz Republic	30,885	20,721	0.12	0.21	8.4	4.1	1.6	67.7	0.3	13.0	1.0	3.9
Lao PDR	..	..	..	..	..	..	..	..	..	..	..	..
Latvia	39,887	25,106	0.12	0.19	2.8	8.7	2.7	64.5	0.1	11.0	10.0	5.6
Lebanon	..	14,899	..	0.19	0.9	15.6	4.0	60.7	0.5	10.0	5.0	3.2
Lesotho	2,958	3,123	0.16	0.16	1.2	4.0	0.7	39.7	0.1	51.0	1.0	2.2
Liberia	..	..	..	..	..	..	..	..	..	..	..	..
Libya	..	..	..	..	..	..	..	..	..	..	..	..
Lithuania	53,818	37,539	0.13	0.18	1.2	11.3	5.1	54.8	0.2	18.0	6.0	3.5
Macedonia, FYR	32,419	23,490	0.18	0.18	11.7	9.6	6.2	45.0	0.1	21.0	2.0	4.5
Madagascar	..	..	..	..	..	..	..	..	..	..	..	..
Malawi	10,024	11,805	0.29	0.29	0.0	16.0	3.7	70.0	0.0	8.0	2.0	0.2
Malaysia	104,728	186,198	0.13	0.12	7.8	14.3	15.5	32.9	0.2	8.0	7.0	14.3
Mali	..	..	..	..	..	..	..	..	..	..	..	..
Mauritania	..	..	..	..	..	..	..	..	..	..	..	..
Mauritius	17,813	17,700	0.16	0.15	0.9	6.6	2.6	32.8	0.1	55.0	1.0	1.1
Mexico	174,266	296,093	0.18	0.20	7.8	12.5	10.4	55.6	0.2	7.0	1.0	5.5
Moldova	55,887	34,234	0.15	0.29	0.2	4.0	1.4	81.7	0.2	11.0	1.0	0.6
Mongolia	10,160	7,939	0.18	0.18	1.8	4.3	0.9	64.2	0.3	25.0	5.0	0.9
Morocco	41,710	88,779	0.14	0.18	0.7	7.0	6.4	54.4	0.4	27.0	1.0	3.2
Mozambique	20,414	10,230	0.27	0.31	1.1	7.1	2.7	81.2	0.1	6.0	1.0	0.8
Myanmar	7,663	5,681	0.17	0.14	47.6	5.0	14.9	16.1	1.1	3.0	11.0	1.3
Namibia	..	7,350	..	0.35	0.0	5.0	1.6	90.4	0.1	1.0	1.0	0.9
Nepal	20,894	26,550	0.13	0.14	1.5	8.1	3.9	43.3	1.2	39.0	2.0	1.0
Netherlands	136,686	124,182	0.18	0.18	7.3	26.7	11.3	43.0	0.2	2.0	1.0	8.7
New Zealand	50,243	46,099	0.22	0.22	3.2	21.7	5.2	57.3	0.1	5.0	4.0	3.5
Nicaragua	..	..	..	..	..	..	..	..	..	..	..	..
Niger	..	..	..	..	..	..	..	..	..	..	..	..
Nigeria	52,350	82,477	0.23	0.17	1.4	15.4	11.3	40.2	0.1	23.0	5.0	3.7
Norway	54,996	51,693	0.20	0.19	9.0	31.3	4.7	42.8	0.1	1.0	3.0	8.1
Oman	360	5,936	0.11	0.17	6.7	14.0	8.6	52.8	0.8	10.0	3.0	4.1
Pakistan	104,095	100,821	0.18	0.18	11.6	7.0	8.4	39.9	0.2	30.0	0.0	3.0
Panama	9,700	11,692	0.26	0.32	1.5	13.2	4.6	76.6	0.2	3.0	0.0	1.0
Papua New Guinea	..	..	..	..	..	..	..	..	..	..	..	..
Paraguay	3,250	..	0.28	..	..	..	..	..	..	..	..	..
Peru	56,144	52,644	0.20	0.21	8.1	13.5	8.9	52.8	0.2	12.0	2.0	2.5
Philippines	228,301	201,952	0.21	0.18	5.2	9.8	7.3	54.5	0.2	16.0	2.0	5.0
Poland	428,894	404,285	0.14	0.16	8.4	11.8	7.8	52.4	0.3	10.0	2.0	7.3
Portugal	147,873	131,200	0.15	0.14	3.6	15.3	4.8	36.9	0.4	27.0	6.0	5.9
Puerto Rico	19,026	15,367	0.15	0.14	1.9	14.9	21.9	34.4	0.2	15.0	1.0	10.7

3.6 Water pollution

	Emissions of organic water pollutants				Industry shares of emissions of organic water pollutants							
	kilograms per day		kilograms per day per worker		% of total							
	1990	2001[a]	1990	2001[a]	Primary metals 2001[a]	Paper and pulp 2001[a]	Chemicals 2001[a]	Food and beverages 2001[a]	Stone, ceramics, and glass 2001[a]	Textiles 2001[a]	Wood 2001[a]	Other 2001[a]
Romania	413,864	38,395	0.12	0.07	17.1	17.6	9.0	5.1	0.3	29.0	13.0	9.6
Russian Federation	..	1,484,991	..	0.19	20.3	7.3	7.3	49.1	0.1	6.0	3.0	6.9
Rwanda	..	..	..	..	..	..	..	..	..	..	..	..
Saudi Arabia	24,436	24,436	0.14	0.14	4.4	15.9	21.1	45.1	1.0	4.0	2.0	6.5
Senegal	10,309	6,643	0.32	0.36	0.0	6.6	4.2	87.0	0.1	2.0	0.0	1.0
Serbia and Montenegro	137,795	98,696	0.15	0.16	9.9	11.8	8.2	47.4	0.0	13.0	2.0	7.7
Sierra Leone	..	4,170	..	0.32	..	9.6	3.0	82.3	0.1	2.0	2.0	..
Singapore	32,364	32,250	0.09	0.09	1.4	25.5	16.7	22.7	0.1	4.0	1.0	28.5
Slovak Republic	77,174	45,011	0.13	0.14	4.2	15.0	8.4	44.2	0.4	15.0	2.0	10.9
Slovenia	55,640	40,378	0.16	0.17	33.8	15.0	8.2	23.2	0.2	11.0	2.0	6.5
Somalia	..	..	..	..	..	..	..	..	..	..	..	..
South Africa	261,618	181,284	0.17	0.19	9.8	19.5	7.9	46.4	0.0	5.0	5.0	6.4
Spain	320,262	374,589	0.17	0.15	6.7	19.8	8.9	42.5	0.3	9.0	4.0	8.8
Sri Lanka	53,024	88,943	0.19	0.18	0.5	7.0	6.4	52.3	0.2	31.0	1.0	1.5
Sudan	..	..	..	..	..	..	..	..	..	..	..	..
Swaziland	6,586	2,009	0.33	0.23	..	79.8	0.3	..	0.2	17.0	2.0	..
Sweden	109,582	103,913	0.15	0.14	11.3	35.0	7.8	26.6	0.1	1.0	3.0	15.2
Switzerland	146,038	123,752	0.16	0.17	24.9	23.6	10.4	25.0	0.2	3.0	4.0	9.0
Syrian Arab Republic	21,702	15,115	0.22	0.20	4.1	1.5	3.9	69.8	0.9	19.0	0.0	0.7
Tajikistan	..	..	..	..	..	..	..	..	..	..	..	..
Tanzania	31,125	35,155	0.24	0.25	1.5	9.4	2.7	69.3	0.1	14.0	2.0	0.9
Thailand	291,552	355,819	0.17	0.16	6.1	5.3	5.3	42.2	0.2	35.0	1.0	4.8
Togo	..	..	..	..	..	..	..	..	..	..	..	..
Trinidad and Tobago	9,951	11,787	0.26	0.28	4.4	10.9	6.7	72.6	0.1	3.0	1.0	1.3
Tunisia	..	49,337	..	0.14	3.0	5.3	7.0	33.7	0.4	44.0	2.0	4.6
Turkey	177,264	159,225	0.18	0.18	13.5	8.6	8.7	49.5	0.3	12.0	2.0	5.4
Turkmenistan	..	..	..	..	..	..	..	..	..	..	..	..
Uganda	..	..	..	..	..	..	..	..	..	..	..	..
Ukraine	692,373	445,758	0.14	0.18	28.1	4.2	7.0	46.8	0.4	5.0	1.0	7.5
United Arab Emirates	..	..	..	..	..	..	..	..	..	..	..	..
United Kingdom	739,562	604,821	0.15	0.15	6.6	29.0	11.1	34.4	0.2	6.0	3.0	9.8
United States	2,565,226	1,968,196	0.15	0.12	10.5	11.0	13.8	38.4	0.2	7.0	4.0	15.1
Uruguay	38,661	16,362	0.23	0.28	1.2	7.2	6.7	75.9	0.1	8.0	1.0	1.8
Uzbekistan	..	..	..	..	..	..	..	..	..	..	..	..
Venezuela, RB	96,495	94,175	0.21	0.21	13.7	10.4	10.2	53.1	0.3	8.0	2.0	2.4
Vietnam	..	..	..	..	..	..	..	..	..	..	..	..
West Bank and Gaza	..	..	..	..	..	..	..	..	..	..	..	..
Yemen, Rep.	6,873	7,823	0.27	0.25	0.0	9.1	12.9	71.1	0.0	5.0	1.0	0.9
Zambia	15,880	11,433	0.23	0.22	3.4	10.8	7.3	63.6	0.0	9.0	3.0	2.8
Zimbabwe	37,149	26,810	0.20	0.19	5.2	10.2	7.9	54.2	0.0	16.0	3.0	3.5

Note: Industry shares may not sum to 100 percent because data may be from different years.
a. Data refer to any year from 1993 to 2001.

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 2001 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 2001.

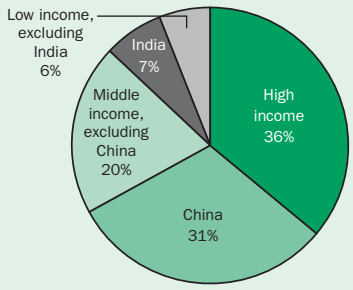
Definitions

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

3.6a

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

Emissions of organic water pollutants, 1998



Source: World Bank staff estimates.

Data sources

The data come from a 1998 study by Hemamala Hettige, Muthukumara Mani, and David Wheeler, "Industrial Pollution in Economic Development: Kuznets Revisited" (available at www.worldbank.org/nipr). These data were updated through 2001 by the World Bank's Development Research Group using the same methodology as the initial study. Sectoral employment numbers are from UNIDO's industry database.

3.7 Energy production and use

	Total energy production		Energy use					Energy use per capita		
	thousands of metric tons of oil equivalent		Total thousands of metric tons of oil equivalent		Combustible renewables and waste % of total		average annual % growth	kg of oil equivalent		average annual % growth
	1990	2002	1990	2002	1990	2002	1990–2002	1990	2002	1990–2002
Afghanistan	..	..	..	..	..	..	..	..	..	..
Albania	2,449	771	2,662	1,944	13.6	6.9	–0.2	812	617	0.3
Algeria	104,507	150,292	23,874	30,845	0.1	0.2	1.8	954	985	–0.1
Angola	28,652	51,548	6,280	8,815	68.8	67.8	2.8	672	672	0.0
Argentina	48,456	81,692	46,110	56,297	3.7	5.3	2.3	1,428	1,543	1.3
Armenia	263	738	4,298	1,938	0.0	0.1	–2.6	1,231	632	–1.3
Australia	157,712	255,192	87,536	112,712	4.5	6.2	2.4	5,130	5,732	1.2
Austria	8,080	9,926	25,260	30,443	9.7	11.1	1.6	3,270	3,774	1.3
Azerbaijan	18,150	19,753	16,675	11,728	0.0	0.0	–3.5	2,259	1,435	–4.5
Bangladesh	10,747	16,747	12,815	21,004	53.6	37.5	4.4	116	155	2.6
Belarus	4,103	3,589	39,703	24,771	1.5	4.4	–3.3	3,886	2,496	–3.0
Belgium	12,490	13,164	48,685	56,887	1.4	1.6	1.6	4,884	5,505	1.3
Benin	1,774	1,546	1,678	2,231	93.2	69.3	2.6	356	340	–0.1
Bolivia	4,923	8,152	2,774	4,310	27.2	16.8	4.9	416	499	2.7
Bosnia and Herzegovina	3,642	3,318	4,474	4,324	3.6	4.2	5.8	..	1,052	..
Botswana	..	..	..	..	..	..	..	..	..	..
Brazil	97,616	161,737	133,531	190,664	30.9	24.3	3.4	902	1,093	2.0
Bulgaria	9,613	10,512	28,820	19,019	0.6	3.4	–2.5	3,306	2,417	–1.7
Burkina Faso	..	..	..	..	..	..	..	..	..	..
Burundi	..	..	..	..	..	..	..	..	..	..
Cambodia	..	..	..	..	..	..	..	..	..	..
Cameroon	12,090	12,004	5,031	6,569	75.9	79.2	2.4	431	417	–0.1
Canada	273,680	385,412	209,089	250,035	3.9	4.5	1.7	7,524	7,973	0.7
Central African Republic	..	..	..	..	..	..	..	..	..	..
Chad	..	..	..	..	..	..	..	..	..	..
Chile	7,640	8,783	13,629	24,708	19.6	17.4	5.7	1,040	1,585	4.2
China	902,689	1,220,812	879,923	1,228,574	22.8	17.7	2.8	775	960	1.7
Hong Kong, China	43	48	10,662	16,377	0.5	0.3	3.6	1,869	2,413	1.9
Colombia	48,479	72,275	25,048	27,397	23.2	18.0	0.9	716	625	–1.0
Congo, Dem. Rep.	12,019	16,134	11,903	15,402	84.0	93.6	2.2	319	299	–0.4
Congo, Rep.	9,005	13,199	1,056	923	69.4	67.3	–1.9	423	252	–5.0
Costa Rica	1,032	1,762	2,025	3,564	36.6	7.5	4.8	664	904	2.6
Côte d'Ivoire	3,382	6,528	4,408	6,555	72.1	66.0	3.7	374	397	0.9
Croatia	4,346	3,706	6,714	8,222	3.8	3.6	2.1	1,502	1,852	2.5
Cuba	6,271	6,480	16,524	14,197	33.7	17.1	0.0	1,555	1,262	–0.5
Czech Republic	38,474	30,668	47,379	41,725	1.2	2.0	–0.8	4,572	4,090	–0.7
Denmark	9,735	28,754	17,581	19,749	6.5	10.5	0.6	3,420	3,675	0.2
Dominican Republic	1,031	1,513	4,139	8,167	24.2	17.6	6.2	586	948	4.4
Ecuador	16,474	22,209	6,128	9,048	13.5	8.0	3.4	597	706	1.6
Egypt, Arab Rep.	54,869	59,766	31,895	52,393	3.3	2.6	4.3	608	789	2.3
El Salvador	1,722	2,367	2,535	4,299	48.2	33.1	4.3	496	670	2.3
Eritrea	..	..	..	..	..	..	..	..	..	..
Estonia	4,118	3,160	6,271	4,514	2.9	11.6	–2.2	4,091	3,324	–1.0
Ethiopia	14,158	18,445	15,151	19,934	92.8	91.7	2.5	296	297	0.2
Finland	12,081	16,089	29,171	35,622	15.6	19.9	1.8	5,851	6,852	1.4
France	111,439	134,379	227,276	265,881	4.9	4.2	1.2	4,006	4,470	0.8
Gabon	14,630	12,690	1,242	1,590	59.8	61.9	2.1	1,303	1,209	–0.6
Gambia, The	..	..	..	..	..	..	..	..	..	..
Georgia	1,470	1,325	8,757	2,559	7.7	25.2	–10.4	1,611	494	–10.0
Germany	186,159	134,771	356,221	346,352	1.3	2.6	0.0	4,485	4,198	–0.3
Ghana	4,392	5,974	5,337	8,344	73.1	66.4	4.0	349	411	1.5
Greece	9,200	10,232	22,181	29,025	4.0	3.6	2.5	2,183	2,637	1.8
Guatemala	3,390	5,408	4,478	7,384	67.9	52.8	4.7	512	616	2.0
Guinea	..	..	..	..	..	..	..	..	..	..
Guinea-Bissau	..	..	..	..	..	..	..	..	..	..
Haiti	1,253	1,515	1,585	2,081	76.5	71.6	3.2	245	251	1.0

3.7 Energy production and use

	Total energy production		Energy use					Energy use per capita		
	thousands of metric tons of oil equivalent		Total thousands of metric tons of oil equivalent		Combustible renewables and waste % of total		average annual % growth	kg of oil equivalent		average annual % growth
	1990	2002	1990	2002	1990	2002	1990–2002	1990	2002	1990–2002
Honduras	1,694	1,618	2,416	3,426	62.0	41.1	2.7	496	504	–0.1
Hungary	14,325	10,834	28,553	25,449	1.3	1.6	–0.6	2,755	2,505	–0.4
India	334,056	438,797	365,377	538,305	48.1	38.7	3.4	430	513	1.6
Indonesia	161,308	240,908	94,836	156,086	39.3	27.4	4.1	532	737	2.7
Iran, Islamic Rep.	179,738	240,522	68,775	133,960	1.0	0.6	5.4	1,264	2,044	3.8
Iraq	106,715	105,414	20,841	28,996	0.1	0.1	4.1	1,153	1,199	1.6
Ireland	3,467	1,499	10,575	15,303	1.0	1.2	3.6	3,016	3,894	2.7
Israel	433	722	12,112	20,954	0.0	0.0	5.0	2,599	3,191	2.2
Italy	25,548	26,590	152,553	172,720	0.6	1.5	1.2	2,690	2,994	1.0
Jamaica	485	463	2,943	3,914	16.2	11.6	2.8	1,231	1,493	2.0
Japan	76,129	98,133	445,916	516,927	1.3	1.4	1.4	3,610	4,058	1.1
Jordan	162	261	3,499	5,359	0.1	0.1	3.6	1,104	1,036	–0.2
Kazakhstan	89,007	95,780	79,661	46,455	0.1	0.2	–5.5	4,823	3,123	–4.4
Kenya	10,272	12,877	12,479	15,324	78.4	80.1	2.1	534	489	–0.4
Korea, Dem. Rep.	28,725	18,358	32,874	19,537	2.9	5.2	–4.5	1,647	869	–5.4
Korea, Rep.	21,908	36,206	92,650	203,498	0.3	1.4	6.7	2,161	4,272	5.7
Kuwait	50,401	105,991	7,579	22,189	0.1	..	9.1	3,567	9,503	7.8
Kyrgyz Republic	1,818	1,204	5,066	2,536	0.1	0.2	–5.4	1,114	507	–6.4
Lao PDR	..	..	..	..	..	..	..	..	..	..
Latvia	794	1,870	5,979	4,266	8.1	30.1	–2.8	2,272	1,825	–1.6
Lebanon	143	192	2,309	5,369	4.5	2.4	7.1	635	1,209	5.3
Lesotho	..	..	..	..	..	..	..	..	..	..
Liberia	..	..	..	..	..	..	..	..	..	..
Libya	73,173	69,519	11,541	18,704	1.1	0.8	4.0	2,680	3,433	2.0
Lithuania	4,298	4,915	11,085	8,589	2.6	7.7	–2.1	2,996	2,476	–1.4
Macedonia, FYR	..	..	..	..	..	..	..	..	..	..
Madagascar	..	..	..	..	..	..	..	..	..	..
Malawi	..	..	..	..	..	..	..	..	..	..
Malaysia	48,727	80,243	22,455	51,753	9.5	4.8	6.7	1,234	2,129	4.1
Mali	..	..	..	..	..	..	..	..	..	..
Mauritania	..	..	..	..	..	..	..	..	..	..
Mauritius	..	..	..	..	..	..	..	..	..	..
Mexico	194,482	229,888	124,057	157,308	5.9	5.2	1.9	1,491	1,560	0.3
Moldova	58	66	6,884	2,993	0.5	2.0	–7.8	1,582	703	–7.6
Mongolia	..	..	..	..	..	..	..	..	..	..
Morocco	773	589	6,725	10,753	4.7	4.2	3.9	280	363	2.1
Mozambique	6,846	8,041	7,203	8,045	94.4	86.1	0.5	509	436	–1.8
Myanmar	10,651	15,825	10,683	12,578	84.4	76.7	1.6	264	258	0.0
Namibia	218	301	652	1,188	16.0	15.2	5.2	445	599	2.3
Nepal	5,501	7,618	5,806	8,515	93.4	87.2	3.4	320	353	0.9
Netherlands	60,316	59,924	66,491	77,923	1.1	1.7	1.1	4,447	4,827	0.5
New Zealand	12,153	14,876	13,914	18,013	4.9	6.9	2.4	4,035	4,573	1.3
Nicaragua	1,495	1,659	2,118	2,908	53.3	49.9	2.7	554	544	–0.2
Niger	..	..	..	..	..	..	..	..	..	..
Nigeria	150,453	192,660	70,905	95,675	79.8	79.1	2.3	737	718	–0.5
Norway	120,304	232,221	21,492	26,515	4.8	5.5	1.8	5,067	5,843	1.2
Oman	38,312	62,516	4,562	10,825	..	..	5.8	2,804	4,265	2.4
Pakistan	34,360	49,677	43,424	65,806	43.2	37.4	3.6	402	454	1.1
Panama	612	738	1,490	3,022	28.3	14.7	6.1	621	1,028	4.3
Papua New Guinea	..	..	..	..	..	..	..	..	..	..
Paraguay	4,578	6,293	3,083	3,905	72.3	55.0	2.5	743	709	0.1
Peru	10,596	9,234	9,952	12,024	26.9	18.8	2.3	461	450	0.5
Philippines	13,701	21,941	26,159	42,008	29.2	23.9	4.8	429	525	2.5
Poland	99,228	79,633	99,847	89,185	2.2	5.0	–0.9	2,619	2,333	–0.9
Portugal	3,393	3,643	17,746	26,392	14.0	10.7	3.6	1,793	2,546	3.3
Puerto Rico	..	..	..	..	..	..	..	..	..	..

3.7 Energy production and use

	Total energy production		Energy use					Energy use per capita		
	thousands of metric tons of oil equivalent		Total thousands of metric tons of oil equivalent		Combustible renewables and waste % of total		average annual % growth	kg of oil equivalent		average annual % growth
	1990	2002	1990	2002	1990	2002	1990–2002	1990	2002	1990–2002
Romania	40,834	28,406	62,403	36,976	1.0	6.7	–3.6	2,689	1,696	–3.2
Russian Federation	1,118,707	1,034,519	774,823	617,843	1.6	1.1	–2.0	5,211	4,288	–1.7
Rwanda	..	..	..	..	..	..	..	..	..	..
Saudi Arabia	372,985	462,807	65,538	126,387	0.0	0.0	5.0	4,147	5,775	2.2
Senegal	1,362	1,807	2,238	3,192	60.6	56.6	3.4	305	319	0.6
Serbia and Montenegro	11,835	10,876	15,002	16,169	5.0	5.0	1.7	1,435	1,981	2.8
Sierra Leone	..	..	..	..	..	..	..	..	..	..
Singapore	..	64	13,357	25,307	..	..	4.5	4,384	6,078	1.7
Slovak Republic	5,273	6,650	21,426	18,546	0.8	1.7	–0.7	4,056	3,448	–0.9
Slovenia	2,765	3,379	5,008	6,951	5.3	6.7	3.0	2,508	3,486	3.0
Somalia	..	..	..	..	..	..	..	..	..	..
South Africa	114,534	146,506	91,229	113,458	11.4	11.2	1.9	2,592	2,502	–0.3
Spain	34,648	31,737	91,209	131,558	4.5	3.3	3.2	2,349	3,215	2.7
Sri Lanka	4,191	4,557	5,516	8,179	71.0	52.9	3.7	339	430	2.4
Sudan	8,775	25,013	10,627	15,850	81.8	79.8	3.7	426	483	1.3
Swaziland	..	..	..	..	..	..	..	..	..	..
Sweden	29,754	32,403	46,658	51,031	11.8	16.3	0.7	5,451	5,718	0.4
Switzerland	9,831	11,942	25,106	27,139	4.1	6.1	0.8	3,740	3,723	0.2
Syrian Arab Republic	22,570	36,706	11,928	18,054	0.0	0.0	3.3	984	1,063	0.4
Tajikistan	1,553	1,330	9,087	3,247	..	..	–7.3	1,631	518	–8.5
Tanzania	9,063	13,286	9,808	14,339	91.0	90.7	3.3	385	408	0.6
Thailand	26,496	45,303	43,860	83,339	33.4	16.4	5.2	789	1,353	4.4
Togo	778	1,081	1,001	1,540	77.7	70.2	4.4	290	324	1.5
Trinidad and Tobago	12,612	21,321	5,795	9,286	0.8	0.3	4.1	4,770	7,121	3.6
Tunisia	6,127	6,943	5,536	8,276	18.7	15.3	3.8	679	846	2.2
Turkey	25,857	24,432	53,005	75,418	13.6	8.0	3.6	944	1,083	1.7
Turkmenistan	48,822	53,645	11,314	16,606	..	..	3.3	2,914	3,465	1.2
Uganda	..	..	..	..	..	..	..	..	..	..
Ukraine	110,170	71,520	218,376	130,743	0.1	0.2	–4.8	4,187	2,684	–4.1
United Arab Emirates	109,446	142,148	17,839	36,072	0.2	0.0	5.9	10,061	9,609	–0.5
United Kingdom	207,007	257,541	212,176	226,508	0.3	1.0	0.6	3,686	3,824	0.4
United States	1,650,474	1,666,050	1,927,638	2,290,410	3.2	3.0	1.6	7,722	7,943	0.4
Uruguay	1,149	1,239	2,251	2,510	24.3	16.7	1.6	725	747	1.0
Uzbekistan	40,461	55,788	44,994	51,740	..	..	1.8	2,098	2,047	0.1
Venezuela, RB	148,854	210,150	43,918	54,006	1.2	1.0	2.1	2,224	2,141	0.0
Vietnam	24,711	53,439	24,324	42,645	77.7	54.5	4.9	367	530	3.2
West Bank and Gaza	..	..	..	..	..	..	..	..	..	..
Yemen, Rep.	9,384	22,235	2,708	4,107	2.8	1.9	2.8	228	221	–0.5
Zambia	4,923	6,226	5,470	6,549	73.4	81.3	1.4	703	639	–0.9
Zimbabwe	8,500	8,468	9,334	9,761	50.7	59.0	0.3	911	751	–1.7
World	8,801,246 t	10,274,551 t	8,616,766 t	10,196,821 t	10.8 w	10.6 w	1.5 w	1,686 w	1,699 w	0.1 w
Low income	846,065	1,145,938	799,880	1,080,050	54.9	49.4	2.6	463	493	0.6
Middle income	4,724,337	5,359,274	3,557,855	3,969,589	11.3	10.8	0.9	1,372	1,338	–0.2
Lower middle income	3,574,000	3,956,799	2,968,825	3,232,254	12.6	12.3	0.7	1,286	1,227	–0.4
Upper middle income	1,147,843	1,400,237	585,444	733,823	4.0	4.1	1.9	2,072	2,232	0.7
Low & middle income	5,567,198	6,493,223	4,348,016	5,030,378	18.6	18.4	1.2	1,020	990	–0.3
East Asia & Pacific	1,228,554	1,712,927	1,145,883	1,652,046	25.6	19.6	3.1	721	904	1.9
Europe & Central Asia	1,890,149	1,565,055	1,736,182	1,272,422	1.9	2.3	–2.7	3,725	2,697	–2.9
Latin America & Carib.	617,206	859,786	458,283	606,747	18.1	14.6	2.7	1,055	1,156	1.1
Middle East & N. Africa	978,411	1,229,008	262,130	458,221	1.4	1.0	4.5	1,107	1,504	2.4
South Asia	392,135	521,760	436,590	647,223	48.7	39.3	3.4	393	468	1.5
Sub-Saharan Africa	489,230	652,199	321,208	418,008	56.7	57.5	2.2	693	667	–0.3
High income	3,276,666	3,831,019	4,299,133	5,201,115	3.0	3.1	1.7	4,859	5,395	1.0
Europe EMU	466,852	442,010	1,050,939	1,192,147	3.1	3.7	1.2	3,583	3,895	0.8

Energy production and use 3.7

About the data

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

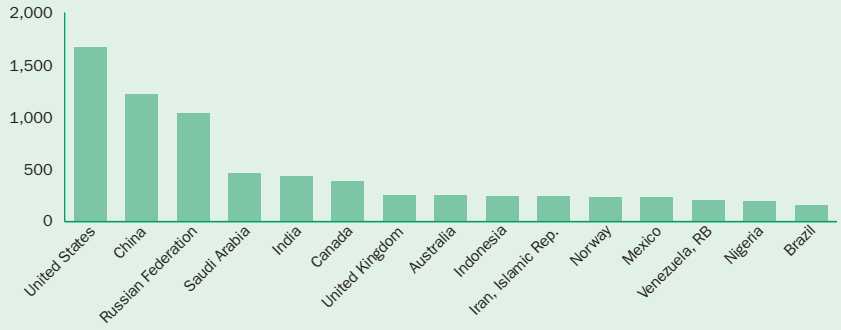
Energy data are compiled by the International Energy Agency (IEA). IEA data for countries that are not members of the Organisation for Economic Co-operation and Development (OECD) are based on national energy data adjusted to conform to annual questionnaires completed by OECD member governments.

Total energy use refers to the use of domestic primary energy before transformation to other end-use fuels (such as electricity and refined petroleum products). It includes energy from combustible renewables and waste—solid biomass and animal products, gas and liquid from biomass, and industrial and municipal waste. Biomass is defined as any plant matter used directly as fuel or converted into fuel, heat, or electricity. (The data series published in World Development Indicators 1998 and earlier editions did not include energy from combustible renewables and waste.) Data for combustible renewables and waste are often based on small surveys or other incomplete information. Thus the data give only a broad impression of developments and are not strictly comparable between countries. The IEA reports (see Data sources) include country notes that explain some of these differences. All forms of energy—primary energy and primary electricity—are converted into oil equivalents. To convert nuclear electricity into oil equivalents, a notional thermal efficiency of 33 percent is assumed; for hydroelectric power 100 percent efficiency is assumed.

3.7a

Ten of the top 15 energy producers are low-income countries . . .

Total energy production, 2002 (millions of metric tons of oil equivalent)

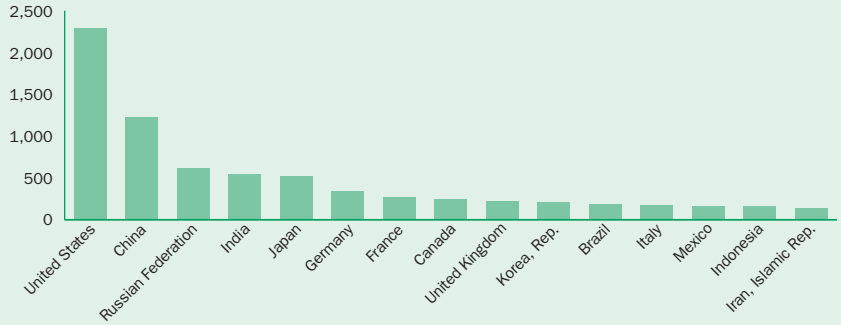


Source: Table 3.7.

3.7b

. . . but only 7 of the top 15 energy users are

Total energy use, 2002 (millions of metric tons of oil equivalent)

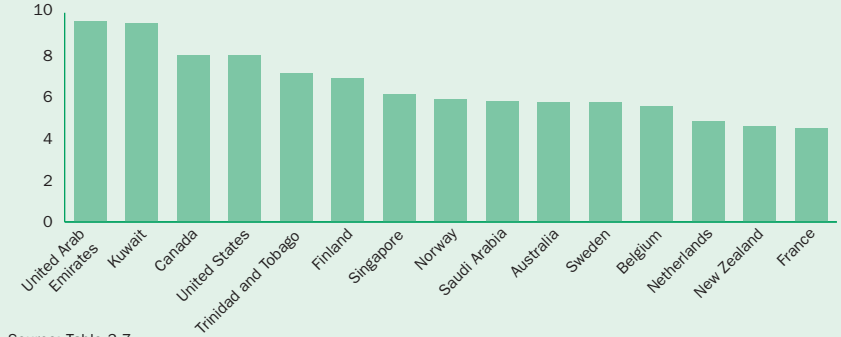


Source: Table 3.7.

3.7c

High-income countries have the highest energy use per capita

Energy use per capita, 2002 (thousands of kg of oil equivalent)



Source: Table 3.7.

Definitions

• Total energy production refers to forms of primary energy—petroleum (crude oil, natural gas liquids, and oil from nonconventional sources), natural gas, solid fuels (coal, lignite, and other derived fuels), and combustible renewables and waste—and primary electricity, all converted into oil equivalents (see About the data). • Energy use refers to apparent consumption, which is equal to indigenous production plus imports and stock changes, minus exports and fuels supplied to ships and aircraft engaged in international transport (see About the data). • Combustible renewables and waste comprise solid biomass, liquid biomass, biogas, industrial waste, and municipal waste, measured as a percentage of total energy use.

Data sources

The data on energy production and use come from IEA electronic files. The IEA's data are published in its annual publications, Energy Statistics and Balances of Non-OECD Countries, Energy Statistics of OECD Countries, and Energy Balances of OECD Countries.

3.8 Energy efficiency, dependency, and emissions

	GDP per unit of energy use		Net energy imports[a]		Carbon dioxide emissions					
	2000 PPP $ per kg oil equivalent		% of energy use		Total million metric tons		Per capita metric tons		kg per 2000 PPP $ of GDP	
	1990	2002	1990	2002	1990	2000	1990	2000	1990	2000
Afghanistan	..	..	..	..	2.6	0.9	0.1	0.0	..	..
Albania	3.9	6.7	8	60	7.3	2.9	2.2	0.9	0.7	0.2
Algeria	5.7	5.6	–338	–387	80.4	89.4	3.2	2.9	0.6	0.5
Angola	3.6	3.2	–356	–485	4.6	6.4	0.5	0.5	0.2	0.3
Argentina	6.2	6.9	–5	–45	109.7	138.2	3.4	3.9	0.4	0.3
Armenia	1.6	4.8	94	62	3.7	3.5	1.1	1.1	0.5	0.5
Australia	4.1	4.8	–80	–126	266.0	344.8	15.6	18.0	0.7	0.7
Austria	6.9	7.5	68	67	57.5	60.8	7.4	7.6	0.3	0.3
Azerbaijan	..	2.2	–9	–68	47.1	29.0	6.4	3.6	..	1.4
Bangladesh	10.1	10.5	16	20	15.4	29.3	0.1	0.2	0.1	0.1
Belarus	1.2	2.1	90	86	94.6	59.2	9.3	5.9	2.0	1.2
Belgium	4.6	4.8	74	77	100.5	102.2	10.1	10.0	0.5	0.4
Benin	2.3	3.0	–6	31	0.6	1.6	0.1	0.3	0.1	0.3
Bolivia	5.1	4.8	–77	–89	5.5	11.1	0.8	1.3	0.4	0.6
Bosnia and Herzegovina	..	5.3	19	23	4.7	19.3	..	4.8	..	0.9
Botswana	..	..	..	..	2.2	3.9	1.7	2.3	0.3	0.3
Brazil	7.2	6.8	27	15	202.6	307.5	1.4	1.8	0.2	0.2
Bulgaria	2.2	2.9	67	45	75.3	42.3	8.6	5.3	1.2	0.8
Burkina Faso	..	..	..	..	1.0	1.0	0.1	0.1	0.1	0.1
Burundi	..	..	..	..	0.2	0.2	0.0	0.0	0.0	0.1
Cambodia	..	..	..	..	0.5	0.5	0.0	0.0	..	0.0
Cameroon	4.8	4.7	–140	–83	1.5	6.5	0.1	0.4	0.1	0.2
Canada	3.1	3.6	–31	–54	428.8	435.9	15.4	14.2	0.7	0.5
Central African Republic	..	..	..	..	0.2	0.3	0.1	0.1	0.1	0.1
Chad	..	..	..	..	0.1	0.1	0.0	0.0	0.0	0.0
Chile	5.6	6.0	44	64	35.3	59.5	2.7	3.9	0.5	0.4
China	2.1	4.6	–3	1	2,401.7	2,790.5	2.1	2.2	1.3	0.6
Hong Kong, China	10.6	10.6	100	100	26.2	33.1	4.6	5.0	0.2	0.2
Colombia	8.3	9.8	–94	–164	55.9	58.5	1.6	1.4	0.3	0.2
Congo, Dem. Rep.	5.1	2.2	–1	–5	4.1	2.7	0.1	0.1	0.1	0.1
Congo, Rep.	2.3	3.7	–753	–1,330	2.0	1.8	0.8	0.5	0.8	0.5
Costa Rica	9.7	9.4	49	51	2.9	5.4	1.0	1.4	0.1	0.2
Côte d'Ivoire	4.9	3.7	23	0	11.9	10.5	1.0	0.7	0.6	0.4
Croatia	4.8	5.3	35	55	16.8	19.6	3.8	4.5	0.5	0.5
Cuba	..	..	62	54	32.0	30.9	3.0	2.8	..	..
Czech Republic	2.8	3.7	19	26	137.9	118.8	13.4	11.6	1.1	0.8
Denmark	7.1	8.1	45	–46	50.7	44.6	9.9	8.4	0.4	0.3
Dominican Republic	6.9	6.8	75	81	9.4	25.1	1.3	3.0	0.3	0.5
Ecuador	5.9	4.8	–169	–145	16.6	25.5	1.6	2.0	0.5	0.6
Egypt, Arab Rep.	4.8	4.6	–72	–14	75.4	142.2	1.4	2.2	0.5	0.6
El Salvador	7.3	7.1	32	45	2.6	6.7	0.5	1.1	0.1	0.2
Eritrea	..	..	..	..	..	0.6	..	0.1	..	0.2
Estonia	1.7	3.6	34	30	24.9	16.0	16.2	11.7	2.3	1.1
Ethiopia	2.1	2.4	7	7	3.0	5.6	0.1	0.1	0.1	0.1
Finland	3.8	3.7	59	55	52.9	53.4	10.6	10.3	0.5	0.4
France	5.5	5.8	51	49	357.5	362.4	6.3	6.2	0.3	0.2
Gabon	4.7	5.1	–1,078	–698	6.7	3.5	7.0	2.8	1.1	0.5
Gambia, The	..	..	..	..	0.2	0.3	0.2	0.2	0.1	0.1
Georgia	1.4	4.4	83	48	15.1	6.2	2.8	1.2	1.3	0.6
Germany	4.9	6.2	48	61	890.2	785.5	11.1	9.6	0.5	0.4
Ghana	4.7	5.0	18	28	3.5	5.9	0.2	0.3	0.1	0.2
Greece	6.4	6.8	59	65	72.2	89.6	7.1	8.2	0.5	0.5
Guatemala	6.8	6.4	24	27	5.1	9.9	0.6	0.9	0.2	0.2
Guinea	..	..	..	..	1.0	1.3	0.2	0.2	0.1	0.1
Guinea-Bissau	..	..	..	..	0.8	0.3	0.8	0.2	0.8	0.2
Haiti	10.1	6.6	21	27	1.0	1.4	0.2	0.2	0.1	0.1

Energy efficiency, dependency, and emissions

	GDP per unit of energy use		Net energy imports[a]		Carbon dioxide emissions					
	2000 PPP $ per kg oil equivalent		% of energy use		Total million metric tons		Per capita metric tons		kg per 2000 PPP $ of GDP	
	1990	2002	1990	2002	1990	2000	1990	2000	1990	2000
Honduras	5.1	5.0	30	53	2.6	4.8	0.5	0.7	0.2	0.3
Hungary	4.1	5.3	50	57	58.5	54.2	5.6	5.4	0.5	0.4
India	4.0	5.0	9	18	675.3	1,070.9	0.8	1.1	0.5	0.4
Indonesia	4.3	4.1	–70	–54	165.2	269.6	0.9	1.3	0.4	0.4
Iran, Islamic Rep.	3.6	3.1	–161	–80	212.4	310.3	3.9	4.9	0.8	0.9
Iraq	..	..	–412	–264	49.3	76.3	2.7	3.3	..	..
Ireland	5.1	9.1	67	90	29.8	42.2	8.5	11.1	0.6	0.4
Israel	6.1	6.0	96	97	34.6	63.1	7.4	10.0	0.5	0.5
Italy	8.1	8.5	83	85	398.9	428.2	7.0	7.4	0.3	0.3
Jamaica	3.1	2.5	84	88	8.0	10.8	3.3	4.2	0.9	1.1
Japan	6.4	6.4	83	81	1,070.7	1,184.5	8.7	9.3	0.4	0.4
Jordan	3.5	3.9	95	95	10.2	15.6	3.2	3.2	0.8	0.8
Kazakhstan	1.0	1.8	–12	–106	252.7	121.3	15.3	8.1	3.1	1.8
Kenya	2.1	2.0	18	16	5.8	9.4	0.2	0.3	0.2	0.3
Korea, Dem. Rep.	..	..	13	6	244.6	188.9	12.3	8.5	..	..
Korea, Rep.	4.3	3.9	76	82	241.2	427.0	5.6	9.1	0.6	0.6
Kuwait	..	1.7	–565	–378	42.2	47.9	19.9	21.9	..	1.4
Kyrgyz Republic	1.7	3.1	64	53	11.0	4.6	2.4	0.9	1.3	0.6
Lao PDR	..	..	..	..	0.2	0.4	0.1	0.1	0.1	0.1
Latvia	2.4	4.9	87	56	12.7	6.0	4.8	2.5	0.9	0.3
Lebanon	3.4	3.8	94	96	9.1	15.2	2.5	3.5	1.1	0.8
Lesotho	..	..	..	..	..	..	..	..	..	..
Liberia	..	..	..	..	0.5	0.4	0.2	0.1	..	..
Libya	..	..	–534	–272	37.8	57.1	8.8	10.9	..	..
Lithuania	2.8	4.0	61	43	21.4	11.9	5.8	3.4	0.7	0.4
Macedonia, FYR	..	..	..	..	10.6	11.2	5.5	5.5	0.8	0.8
Madagascar	..	..	..	..	0.9	2.3	0.1	0.1	0.1	0.2
Malawi	..	..	..	..	0.6	0.8	0.1	0.1	0.1	0.1
Malaysia	4.5	4.1	–117	–55	55.3	144.4	3.0	6.2	0.6	0.7
Mali	..	..	..	..	0.4	0.6	0.0	0.1	0.1	0.1
Mauritania	..	..	..	..	2.6	3.1	1.3	1.2	0.9	0.7
Mauritius	..	..	..	..	1.2	2.9	1.1	2.4	0.2	0.3
Mexico	5.1	5.6	–57	–46	305.4	424.0	3.7	4.3	0.5	0.5
Moldova	1.4	2.0	99	98	20.9	6.6	4.8	1.5	2.1	1.2
Mongolia	..	..	..	..	10.0	7.5	4.7	3.1	1.8	1.9
Morocco	12.0	10.1	89	95	23.5	36.5	1.0	1.3	0.3	0.4
Mozambique	1.2	2.3	5	0	1.0	1.2	0.1	0.1	0.1	0.1
Myanmar	..	..	0	–26	4.1	9.1	0.1	0.2	..	..
Namibia	12.3	10.2	67	75	0.0	1.8	0.0	1.0	0.0	0.2
Nepal	3.2	3.8	5	11	0.6	3.4	0.0	0.1	0.0	0.1
Netherlands	4.9	5.8	9	23	150.0	138.9	10.0	8.7	0.5	0.3
New Zealand	4.1	4.6	13	17	23.6	32.1	6.8	8.3	0.4	0.4
Nicaragua	5.3	5.7	29	43	2.6	3.7	0.7	0.7	0.2	0.2
Niger	..	..	..	..	1.1	1.2	0.1	0.1	0.2	0.1
Nigeria	1.2	1.3	–112	–101	88.7	36.1	0.9	0.3	1.0	0.3
Norway	5.2	6.1	–460	–776	31.7	49.9	7.5	11.1	0.3	0.3
Oman	4.1	3.0	–740	–478	11.5	19.8	7.1	8.2	0.6	0.7
Pakistan	3.9	4.3	21	25	67.9	104.8	0.6	0.8	0.4	0.4
Panama	7.3	5.9	59	76	3.1	6.3	1.3	2.2	0.3	0.4
Papua New Guinea	..	..	..	..	2.4	2.4	0.6	0.5	0.3	0.2
Paraguay	6.3	6.3	–48	–61	2.3	3.7	0.5	0.7	0.1	0.2
Peru	8.4	10.7	–6	23	21.7	29.5	1.0	1.1	0.3	0.2
Philippines	9.1	7.6	48	48	44.3	77.5	0.7	1.0	0.2	0.3
Poland	2.8	4.4	1	11	347.6	301.3	9.1	7.8	1.2	0.8
Portugal	7.5	6.9	81	86	42.3	59.8	4.3	5.8	0.3	0.3
Puerto Rico	..	..	..	..	11.8	8.7	3.3	2.3	0.2	0.1

3.8 Energy efficiency, dependency, and emissions

	GDP per unit of energy use		Net energy imports[a]		Carbon dioxide emissions					
	2000 PPP $ per kg oil equivalent		% of energy use		Total million metric tons		Per capita metric tons		kg per 2000 PPP $ of GDP	
	1990	2002	1990	2002	1990	2000	1990	2000	1990	2000
Romania	2.4	3.8	35	23	155.1	86.3	6.7	3.8	1.0	0.7
Russian Federation	1.6	1.9	–44	–67	1,984.0	1,435.1	13.3	9.9	1.6	1.4
Rwanda	..	..	..	..	0.5	0.6	0.1	0.1	0.1	0.1
Saudi Arabia	2.8	2.1	–469	–266	177.9	374.3	11.3	18.1	1.0	1.4
Senegal	4.6	4.8	39	43	2.9	4.2	0.4	0.4	0.3	0.3
Serbia and Montenegro	..	..	21	33	..	39.5	..	3.7	..	..
Sierra Leone	..	..	..	..	0.3	0.6	0.1	0.1	0.1	0.2
Singapore	3.3	3.8	..	100	41.9	59.0	13.8	14.7	0.9	0.6
Slovak Republic	2.7	3.6	75	64	44.7	35.4	8.4	6.6	1.0	0.6
Slovenia	4.8	5.1	45	51	12.3	14.6	6.2	7.3	0.5	0.4
Somalia	..	..	..	..	0.0	..	0.0	..	..	..
South Africa	3.9	3.9	–26	–29	291.1	327.3	8.3	7.4	0.8	0.8
Spain	6.8	6.5	62	76	211.8	282.9	5.5	7.0	0.3	0.3
Sri Lanka	7.0	8.0	24	44	3.9	10.2	0.2	0.6	0.1	0.2
Sudan	2.7	3.6	17	–58	3.5	5.2	0.1	0.2	0.1	0.1
Swaziland	..	..	..	..	0.4	0.4	0.6	0.4	0.1	0.1
Sweden	3.9	4.4	36	37	48.5	46.9	5.7	5.3	0.3	0.2
Switzerland	7.7	7.8	61	56	42.7	39.1	6.4	5.4	0.2	0.2
Syrian Arab Republic	2.7	3.2	–89	–103	35.8	54.2	3.0	3.3	1.1	1.0
Tajikistan	0.9	1.8	83	59	20.6	4.0	3.7	0.6	2.5	0.8
Tanzania	1.4	1.4	8	7	2.3	4.3	0.1	0.1	0.2	0.2
Thailand	5.7	5.0	40	46	95.7	198.6	1.7	3.3	0.4	0.5
Togo	5.8	4.9	22	30	0.7	1.8	0.2	0.4	0.1	0.2
Trinidad and Tobago	1.5	1.3	–118	–130	16.9	26.4	13.9	20.5	2.0	2.3
Tunisia	6.7	7.7	–11	16	13.3	18.4	1.6	1.9	0.4	0.3
Turkey	5.6	5.7	51	68	143.8	221.6	2.6	3.3	0.5	0.5
Turkmenistan	1.7	1.4	–332	–223	28.0	34.6	7.2	7.5	1.5	2.0
Uganda	..	..	..	..	0.8	1.5	0.0	0.1	0.1	0.1
Ukraine	1.7	1.8	50	45	600.0	342.8	11.5	6.9	1.6	1.7
United Arab Emirates	2.6	..	–514	–294	60.9	58.9	34.3	18.1	1.3	1.6
United Kingdom	5.5	6.6	2	–14	569.3	567.8	9.9	9.6	0.5	0.4
United States	3.7	4.4	14	27	4,815.9	5,601.5	19.3	19.8	0.7	0.6
Uruguay	9.9	10.0	49	51	3.9	5.4	1.3	1.6	0.2	0.2
Uzbekistan	0.7	0.8	10	–8	113.3	118.6	5.3	4.8	3.4	3.2
Venezuela, RB	2.6	2.4	–239	–289	113.8	157.7	5.8	6.5	1.0	1.2
Vietnam	3.3	4.2	–2	–25	22.5	57.5	0.3	0.7	0.3	0.4
West Bank and Gaza	..	..	..	..	..	..	..	..	..	..
Yemen, Rep.	2.8	3.8	–247	–441	9.4	8.4	0.7	0.5	1.2	0.6
Zambia	1.4	1.3	10	5	2.4	1.8	0.3	0.2	0.3	0.2
Zimbabwe	3.0	3.0	9	13	16.6	14.8	1.6	1.2	0.6	0.5
World	3.9 w	4.6 w	–2 w	–1 w	21,172.6 t	22,942.1 t	3.9 w	3.8 w	0.6 w	0.5 w
Low income	3.5	4.1	–6	–6	1,419.3	1,764.4	0.8	0.8	0.4	0.4
Middle income	2.9	4.1	–33	–35	9,388.0	9,408.8	3.6	3.2	0.9	0.6
Lower middle income	2.8	4.1	–20	–22	7,811.9	7,397.3	3.4	2.9	1.0	0.6
Upper middle income	4.0	4.3	–96	–91	1,565.8	2,014.3	5.2	6.3	0.7	0.6
Low & middle income	3.0	4.1	–28	–29	10,805.5	11,173.2	2.4	2.2	0.8	0.6
East Asia & Pacific	2.6	4.6	–7	–4	3,051.6	3,752.7	1.9	2.1	1.0	0.5
Europe & Central Asia	2.1	2.5	–9	–23	4,845.2	3,144.8	10.2	6.7	1.3	1.1
Latin America & Carib.	5.9	6.1	–35	–42	964.0	1,359.2	2.2	2.7	0.4	0.4
Middle East & N. Africa	4.1	3.5	–273	–168	751.8	1,228.3	3.3	4.2	0.7	0.8
South Asia	4.2	5.1	10	19	765.9	1,220.3	0.7	0.9	0.4	0.4
Sub-Saharan Africa	2.8	2.8	–53	–56	473.4	480.5	0.9	0.7	0.5	0.4
High income	4.6	5.2	24	26	10,377.8	11,789.3	11.8	12.4	0.5	0.5
Europe EMU	5.7	6.4	56	63	2,349.7	2,414.6	6.9	7.9	0.3	0.3

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

Energy efficiency, dependency, and emissions

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 a by-product of energy production and use (see table 3.7), account for the largest share of greenhouse gases, which are associated with global warming. Anthropogenic carbon dioxide emissions result primarily from fossil fuel combustion and cement manufacturing. In combustion, different fossil fuels release different amounts of carbon dioxide for the same level of energy use. Burning oil releases about 50 percent more carbon dioxide than burning natural gas, and burning coal releases about twice as much. Cement manufacturing releases about half a metric ton of carbon dioxide for each metric ton of cement produced.

The Carbon Dioxide Information Analysis Center (CDIAC), sponsored by the U.S. Department of Energy, calculates annual anthropogenic emissions of carbon dioxide. These calculations are based on data on fossil fuel consumption (from the World Energy Data Set maintained by the United Nations Statistics Division) and data on world cement manufacturing (from the Cement Manufacturing Data Set maintained by the U.S. Bureau of Mines). Emissions of carbon dioxide are often calculated and reported in terms of their content of elemental carbon. For this table these values were converted to the actual mass of carbon dioxide by multiplying the carbon mass by 3.664 (the ratio of the mass of carbon to that of carbon dioxide).

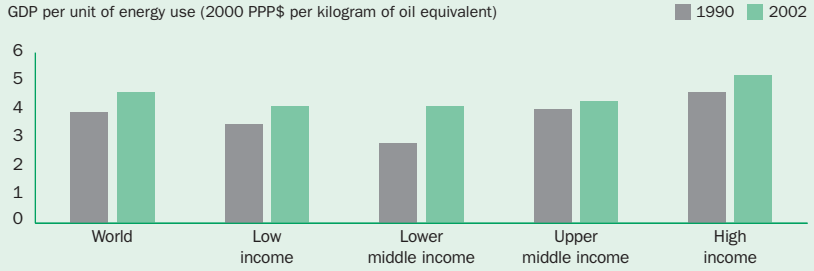
Although the estimates of global carbon dioxide emissions are probably within 10 percent of actual emissions (as calculated from global average fuel chemistry and use), country estimates may have larger error bounds. Trends estimated from a consistent time series tend to be more accurate than individual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

Definitions

• GDP per unit of energy use is the PPP GDP per kilogram of oil equivalent of energy use. PPP GDP is gross domestic product converted to 1995 constant international dollars using purchasing power parity rates. An international dollar has the same purchasing power over GDP as a U.S. dollar has in the United States. • Net energy imports are estimated as energy use less production, both measured in oil equivalents. A negative value indicates that the country is a net exporter. • Carbon dioxide emissions are those stemming from the burning of fossil fuels and the manufacture of cement. They include carbon dioxide produced during consumption of solid, liquid, and gas fuels and gas flaring.

3.8a

All income groups are using energy more efficiently now



Source: Table 3.8.

Data sources

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

3.9 Sources of electricity

	Electricity production		Access to electricity	Sources of electricity[a]									
				% of total									
	billion kwh		% of population	Hydropower		Coal		Oil		Gas		Nuclear power	
	1990	2002	2000	1990	2002	1990	2002	1990	2002	1990	2002	1990	2002
Afghanistan	..	..	6.0	..	..	..	..	..	..	..	..	..	..
Albania	3.2	3.7	..	89.1	95.3	..	..	10.9	4.7	..	..	..	..
Algeria	16.1	27.6	98.0	0.8	0.2	..	..	5.4	2.2	93.7	97.6	..	..
Angola	0.8	1.8	12.0	86.2	64.3	..	..	13.8	35.7	..	..	..	..
Argentina	51.0	84.5	94.6	35.6	42.5	1.3	1.4	9.7	1.8	39.0	45.9	14.3	6.9
Armenia	10.4	5.5	..	15.0	30.0	..	..	85.0	..	..	28.6	..	41.3
Australia	154.3	222.0	..	9.2	7.1	77.1	78.3	2.7	1.7	10.6	11.6	..	..
Austria	49.3	60.4	..	63.9	66.1	14.2	12.3	3.8	2.6	15.7	15.5	..	..
Azerbaijan	23.2	19.5	..	3.0	10.3	..	..	..	22.5	97.0	67.1	..	..
Bangladesh	7.7	18.4	32.5	11.4	6.0	..	..	4.3	8.5	84.3	85.5	..	..
Belarus	39.5	26.5	..	0.1	0.1	..	..	99.9	5.7	..	94.2	..	..
Belgium	70.3	80.9	..	0.4	0.4	28.2	15.6	1.9	1.2	7.7	22.1	60.8	58.5
Benin	0.0	0.1	22.0	..	3.2	..	..	100.0	96.8	..	..	..	..
Bolivia	2.1	4.2	60.4	55.3	53.1	..	..	5.3	17.5	37.6	27.3	..	..
Bosnia and Herzegovina	6.5	10.8	..	52.2	48.8	47.8	49.9	..	1.3	..	..	..	..
Botswana	..	..	22.0	..	..	..	..	..	..	..	..	..	..
Brazil	222.8	344.6	94.9	92.8	82.7	2.1	2.4	2.5	3.8	0.0	3.8	1.0	4.0
Bulgaria	42.1	42.2	..	4.5	5.2	35.4	41.2	4.7	2.0	20.6	3.6	34.8	48.0
Burkina Faso	..	..	13.0	..	..	..	..	..	..	..	..	..	..
Burundi	..	..	..	..	..	..	..	..	..	..	..	..	..
Cambodia	..	..	15.8	..	..	..	..	..	..	..	..	..	..
Cameroon	2.7	3.3	20.0	98.5	96.4	..	..	1.5	3.6	..	..	..	..
Canada	481.9	601.4	..	61.6	58.2	17.1	19.5	3.4	2.4	2.0	5.8	15.1	12.6
Central African Republic	..	..	..	..	..	..	..	..	..	..	..	..	..
Chad	..	..	..	..	..	..	..	..	..	..	..	..	..
Chile	18.4	45.5	99.0	55.3	51.0	34.3	19.0	7.7	1.1	1.3	25.3	..	..
China	621.2	1,640.5	98.6	20.4	17.6	71.2	77.5	7.9	3.0	0.5	0.3	..	1.5
Hong Kong, China	28.9	34.3	..	..	..	98.3	63.8	1.7	0.4	..	35.8	..	..
Colombia	36.2	45.2	81.0	76.0	75.1	9.8	6.7	1.0	0.2	12.4	16.8	..	..
Congo, Dem. Rep.	5.6	5.9	6.7	99.6	99.7	..	..	0.4	0.3	..	..	..	..
Congo, Rep.	0.5	0.4	20.9	99.4	99.7	..	..	0.6	0.3	..	..	..	..
Costa Rica	3.5	7.5	95.7	97.5	79.2	..	..	2.5	1.6	..	..	..	..
Côte d'Ivoire	2.0	5.3	50.0	66.7	32.7	..	..	33.3	0.2	..	67.1	..	..
Croatia	8.9	12.2	..	48.8	43.9	..	17.3	35.8	18.2	15.4	20.7	..	..
Cuba	15.0	15.7	97.0	0.6	0.7	..	..	91.5	94.3	0.2	0.0	..	..
Czech Republic	62.6	76.0	..	2.3	3.3	71.8	66.8	4.8	0.5	1.0	3.9	20.1	24.7
Denmark	26.0	39.2	..	0.1	0.1	90.3	46.5	3.7	10.2	2.7	24.4	..	..
Dominican Republic	3.7	11.5	66.8	9.4	7.6	1.2	5.5	88.6	86.6	..	..	..	..
Ecuador	6.3	11.9	80.0	78.5	63.3	..	..	21.5	33.6	..	3.1	..	..
Egypt, Arab Rep.	42.3	86.1	93.8	23.5	16.3	..	..	36.9	7.5	39.6	76.0	..	..
El Salvador	2.2	4.1	70.8	73.5	27.8	..	..	6.9	47.5	..	..	..	..
Eritrea	..	..	17.0	..	..	..	..	..	..	..	..	..	..
Estonia	17.2	8.5	..	0.0	0.1	86.8	90.9	8.4	0.3	4.8	8.4	..	..
Ethiopia	1.2	2.0	4.7	88.4	98.9	..	..	11.6	1.0	..	..	..	..
Finland	54.4	74.9	..	20.0	14.4	33.0	26.3	3.1	0.8	8.6	15.1	35.3	29.8
France	416.7	554.8	..	12.8	10.9	8.5	4.5	2.1	0.8	0.7	4.2	75.4	78.7
Gabon	1.0	1.4	31.0	72.1	65.5	..	..	11.2	16.6	16.4	17.4	..	..
Gambia, The	..	..	..	..	..	..	..	..	..	..	..	..	..
Georgia	14.2	7.3	..	52.8	93.2	..	..	26.1	0.4	21.1	6.3	..	..
Germany	547.7	566.9	..	3.2	4.1	58.8	51.4	1.9	0.8	7.4	9.5	27.8	29.1
Ghana	5.7	7.3	45.0	100.0	69.0	..	..	..	31.0	..	..	..	..
Greece	34.8	53.9	..	5.1	5.2	72.4	64.1	22.3	16.0	0.3	13.1	..	..
Guatemala	2.3	6.2	66.7	76.0	27.5	..	15.7	9.0	43.1	..	..	..	..
Guinea	..	..	..	..	..	..	..	..	..	..	..	..	..
Guinea-Bissau	..	..	..	..	..	..	..	..	..	..	..	..	..
Haiti	0.6	0.6	34.0	76.5	47.6	..	..	20.6	52.4	..	..	..	..

3.9 Sources of electricity

	Electricity production		Access to electricity	Sources of electricity[a]									
	billion kwh		% of population	% of total									
				Hydropower		Coal		Oil		Gas		Nuclear power	
	1990	2002	2000	1990	2002	1990	2002	1990	2002	1990	2002	1990	2002
Honduras	2.3	4.2	54.5	98.3	57.8	..	..	1.7	40.1	..	..	..	..
Hungary	28.4	36.2	..	0.6	0.5	30.5	25.1	4.8	5.9	15.7	29.7	48.3	38.6
India	289.4	596.5	43.0	24.8	10.7	65.3	70.1	4.3	4.7	3.4	10.5	2.1	3.3
Indonesia	33.3	108.2	53.4	20.2	9.2	31.5	39.7	42.7	23.3	2.3	22.1	..	..
Iran, Islamic Rep.	59.1	140.8	97.9	10.3	5.7	..	..	37.3	17.8	52.5	76.4	..	..
Iraq	24.0	31.2	95.0	10.8	2.0	..	..	89.2	98.0	..	..	..	..
Ireland	14.2	24.8	..	4.9	3.7	57.4	35.8	10.0	15.0	27.7	43.6	..	..
Israel	20.9	45.4	100.0	0.0	0.0	50.1	77.4	49.9	22.5	..	0.1	..	..
Italy	213.1	277.5	..	14.8	14.2	16.8	14.6	48.2	31.6	18.6	35.8	..	..
Jamaica	2.5	6.9	90.0	3.6	1.4	..	..	92.4	97.2	..	..	..	..
Japan	850.7	1,087.7	..	10.5	7.6	14.6	26.8	29.9	13.4	19.1	22.5	23.8	27.1
Jordan	3.6	8.1	95.0	0.3	0.7	..	..	87.8	90.9	11.9	8.4	..	..
Kazakhstan	87.4	58.3	..	8.4	15.2	..	69.9	91.6	4.2	..	10.6	0.6	..
Kenya	3.0	4.5	7.9	81.6	68.9	..	..	7.6	22.6	..	..	..	..
Korea, Dem. Rep.	27.7	19.8	20.0	56.3	53.7	40.1	41.2	3.6	5.1	..	..	..	..
Korea, Rep.	105.4	326.9	..	6.0	1.0	16.8	39.9	17.9	9.6	9.1	12.8	50.2	36.4
Kuwait	18.5	36.9	100.0	..	..	..	..	17.1	78.9	82.9	21.1	..	..
Kyrgyz Republic	13.4	11.9	..	67.3	90.5	..	4.8	32.7	..	..	4.8	..	..
Lao PDR	..	..	..	..	..	..	..	..	..	..	..	..	..
Latvia	6.6	4.0	..	67.7	62.0	..	1.0	32.3	3.4	..	33.1	..	..
Lebanon	1.5	9.7	95.0	33.3	7.0	..	..	66.7	93.0	..	..	..	..
Lesotho	..	..	5.0	..	..	..	..	..	..	..	..	..	..
Liberia	..	..	..	..	..	..	..	..	..	..	..	..	..
Libya	10.2	15.3	99.8	..	..	..	..	100.0	77.8	..	22.2	..	..
Lithuania	28.4	17.3	..	1.5	2.0	..	..	38.6	4.3	..	11.1	60.0	81.8
Macedonia, FYR	..	..	..	..	..	..	..	..	..	..	..	..	..
Madagascar	..	..	8.0	..	..	..	..	..	..	..	..	..	..
Malawi	..	..	5.0	..	..	..	..	..	..	..	..	..	..
Malaysia	23.0	74.2	96.9	17.3	7.1	4.8	6.0	55.9	9.3	22.0	77.5	..	..
Mali	..	..	..	..	..	..	..	..	..	..	..	..	..
Mauritania	..	..	..	..	..	..	..	..	..	..	..	..	..
Mauritius	..	..	100.0	..	..	..	..	..	..	..	..	..	..
Mexico	122.7	215.2	..	19.1	11.6	6.3	12.1	57.3	36.9	10.6	32.1	2.4	4.5
Moldova	15.5	3.2	..	1.7	3.7	32.3	3.8	26.6	0.7	39.5	91.8	..	..
Mongolia	..	..	90.0	..	..	..	..	..	..	..	..	..	..
Morocco	9.6	17.2	71.1	12.7	4.9	23.0	70.1	64.4	23.9	..	..	..	..
Mozambique	0.5	12.7	7.2	62.6	99.7	13.9	..	23.6	0.3	0.2	0.0	..	..
Myanmar	2.5	6.6	5.0	48.1	33.7	1.6	..	10.9	9.3	39.3	57.0	..	..
Namibia	1.4	1.5	34.0	95.2	96.8	1.5	0.4	3.3	2.8	..	..	..	..
Nepal	0.9	2.1	15.4	99.9	99.8	..	..	0.1	0.2	..	..	..	..
Netherlands	71.9	96.0	..	0.1	0.1	38.3	28.0	4.3	2.9	50.9	59.4	4.9	4.1
New Zealand	32.3	40.3	..	72.3	60.7	1.5	4.0	0.0	..	17.6	25.1	..	..
Nicaragua	1.4	2.7	48.0	28.8	11.4	..	..	39.8	78.8	..	..	..	..
Niger	..	..	..	..	..	..	..	..	..	..	..	..	..
Nigeria	13.5	15.3	40.0	32.6	46.2	0.1	..	13.7	9.8	53.7	44.0	..	..
Norway	121.6	130.1	..	99.6	99.3	0.2	0.2	0.0	0.0	..	0.2	..	..
Oman	4.5	10.3	94.0	..	..	..	..	18.4	18.0	81.6	82.0	..	..
Pakistan	37.7	75.7	52.9	44.9	29.5	0.1	0.3	20.6	32.2	33.6	35.7	0.8	2.3
Panama	2.7	5.3	76.1	83.2	64.3	..	..	14.7	35.4	..	..	..	..
Papua New Guinea	..	..	..	..	..	..	..	..	..	..	..	..	..
Paraguay	27.2	48.2	74.7	99.9	100.0	..	..	0.0	..	..	..	..	..
Peru	13.8	22.0	73.0	75.8	82.1	..	2.3	21.5	10.3	1.7	4.5	..	..
Philippines	25.2	48.5	87.4	24.0	14.5	7.7	33.3	46.7	13.0	..	18.1	..	..
Poland	134.4	142.5	..	1.1	1.6	97.5	94.5	1.2	1.7	0.1	1.5	..	..
Portugal	28.4	45.7	..	32.3	17.1	32.1	33.3	33.1	25.0	..	19.8	..	..
Puerto Rico	..	..	..	..	..	..	..	..	..	..	..	..	..

3.9 Sources of electricity

	Electricity production		Access to electricity	Sources of electricity[a]									
				% of total									
	billion kwh		% of population	Hydropower		Coal		Oil		Gas		Nuclear power	
	1990	2002	2000	1990	2002	1990	2002	1990	2002	1990	2002	1990	2002
Romania	64.3	54.9	..	17.7	29.2	28.8	37.6	18.4	6.5	35.1	16.7	..	10.0
Russian Federation	1,082.2	889.3	..	15.4	18.2	5.2	19.2	68.0	3.1	..	43.3	10.8	15.9
Rwanda	..	..	..	..	..	..	..	..	..	..	..	..	..
Saudi Arabia	64.9	145.6	97.7	..	..	..	..	61.5	65.9	38.5	34.1	..	..
Senegal	0.9	1.5	30.1	..	..	..	..	98.0	100.0	2.0	0.1	..	..
Serbia and Montenegro	36.5	33.2	..	31.1	31.5	65.4	66.1	1.9	0.7	1.6	1.6	..	..
Sierra Leone	..	..	..	..	..	..	..	..	..	..	..	..	..
Singapore	15.7	35.4	100.0	..	..	..	..	100.0	39.6	..	58.3	..	..
Slovak Republic	23.4	32.2	..	8.0	16.4	32.2	17.3	3.4	2.2	4.9	7.8	51.4	55.7
Slovenia	12.1	14.7	..	28.2	23.2	36.2	36.1	2.5	0.4	0.2	2.0	32.9	37.6
Somalia	..	..	..	..	..	..	..	..	..	..	..	..	..
South Africa	165.4	218.4	66.1	0.6	1.3	94.3	93.1	..	..	..	..	5.1	5.5
Spain	151.2	242.7	..	16.8	9.5	40.1	34.0	5.7	11.8	1.0	13.3	35.9	26.0
Sri Lanka	3.2	7.0	62.0	99.8	38.7	..	..	0.2	61.2	..	..	..	..
Sudan	1.5	2.9	30.0	63.2	44.4	..	..	36.8	55.6	..	..	..	..
Swaziland	..	..	..	..	..	..	..	..	..	..	..	..	..
Sweden	146.0	146.0	..	49.7	45.6	1.2	2.6	0.8	2.0	0.3	0.4	46.7	46.3
Switzerland	54.6	64.9	..	54.6	54.2	0.1	..	0.5	0.1	0.6	1.4	43.3	41.9
Syrian Arab Republic	11.6	26.9	85.9	48.6	39.7	..	..	32.4	25.2	18.9	35.2	..	..
Tajikistan	18.1	15.2	..	90.9	97.7	..	..	9.1	..	6.7	2.3	..	..
Tanzania	1.6	3.0	10.5	95.1	91.4	..	3.5	4.9	5.1	..	..	..	..
Thailand	44.2	109.0	82.1	11.3	6.9	25.0	16.5	23.5	2.6	40.2	72.2	..	..
Togo	0.1	0.1	9.0	4.6	5.7	..	..	95.4	94.3	..	..	..	..
Trinidad and Tobago	3.6	6.1	99.0	..	..	..	..	0.1	0.0	99.0	99.5	..	..
Tunisia	5.8	11.8	94.6	0.8	0.6	..	..	35.5	10.2	63.7	89.0	..	..
Turkey	57.5	129.4	..	40.2	26.0	35.1	24.8	6.9	8.3	17.7	40.6	..	..
Turkmenistan	14.6	11.2	..	4.8	0.0	..	..	..	..	95.2	100.0	..	..
Uganda	..	..	3.7	..	..	..	..	..	..	..	..	..	..
Ukraine	298.8	173.7	..	3.6	5.6	27.6	17.2	14.9	0.7	28.4	31.6	25.5	44.9
United Arab Emirates	17.1	42.2	96.0	..	..	..	..	3.7	7.9	96.3	92.1	..	..
United Kingdom	317.8	384.5	..	1.6	1.2	65.0	32.8	10.9	1.8	1.6	39.6	20.7	22.9
United States	3,202.8	3,992.7	..	8.5	5.8	53.1	51.3	4.1	2.5	11.9	17.8	19.1	20.1
Uruguay	7.4	9.6	98.0	94.2	99.3	..	..	5.1	0.4	..	..	..	..
Uzbekistan	56.3	49.6	..	11.8	12.8	..	4.0	88.2	11.4	..	71.8	..	..
Venezuela, RB	59.3	87.4	94.0	62.3	66.2	..	..	11.5	11.6	26.2	22.2	..	..
Vietnam	8.7	35.8	75.8	61.8	50.8	23.1	13.6	15.0	12.3	0.1	23.3	..	..
West Bank and Gaza	..	..	..	..	..	..	..	..	..	..	..	..	..
Yemen, Rep.	1.7	3.8	50.0	..	..	..	..	100.0	100.0	..	..	..	..
Zambia	8.0	9.1	12.0	99.2	99.5	0.5	0.2	0.3	0.4	..	..	..	..
Zimbabwe	9.4	8.6	39.7	40.5	44.5	59.5	55.1	..	0.3	..	..	..	..
World	11,708.5 s	16,014.1 s	.. w	18.1 w	16.2 w	37.9 w	39.1 w	11.2 w	7.1 w	13.9 w	19.1 w	17.2 w	16.6 w
Low income	535.9	925.9	35.8	34.3	23.0	41.0	47.4	7.3	8.7	14.5	18.1	1.2	2.3
Middle income	3,817.1	5,519.5	90.4	21.2	21.8	34.4	39.2	15.8	9.2	20.3	21.9	7.5	6.9
Lower middle income	3,156.7	4,473.0	90.2	22.1	22.7	34.5	42.8	14.0	6.3	21.5	20.6	7.0	6.7
Upper middle income	660.5	1,046.5	..	17.3	17.8	34.0	23.9	24.3	21.8	14.4	27.6	9.6	7.7
Low & middle income	4,353.0	6,445.4	65.0	22.8	22.0	35.2	40.4	14.7	9.1	19.6	21.4	6.7	6.2
East Asia & Pacific	785.8	2,042.5	87.3	21.7	17.1	61.1	66.8	12.8	4.7	3.5	9.1	..	1.2
Europe & Central Asia	2,143.0	1,874.4	..	12.9	16.7	31.6	29.4	12.7	3.6	29.5	33.4	12.3	16.7
Latin America & Carib.	607.0	989.2	86.6	63.7	56.9	3.8	5.0	19.0	15.6	9.5	17.0	2.1	3.0
Middle East & N. Africa	254.9	534.5	90.4	10.3	6.6	0.9	2.3	50.5	38.3	38.4	52.8	..	..
South Asia	338.9	699.8	40.8	27.6	13.2	55.8	59.8	6.1	8.3	8.6	15.1	1.9	3.0
Sub-Saharan Africa	223.4	305.0	24.7	18.2	21.1	72.3	68.2	2.2	3.1	3.3	3.5	3.8	3.9
High income	7,355.4	9,568.7	..	15.3	12.2	39.6	38.2	9.2	5.8	10.6	17.6	23.3	23.6
Europe EMU	1,652.6	2,081.4	..	11.0	10.0	34.4	27.1	9.5	7.4	8.7	16.1	35.5	35.5

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

Sources of electricity 3.9

About the data

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

The International Energy Agency (IEA) compiles data on energy inputs used to generate electricity. IEA data for countries that are not members of the Organisation for Economic Co-operation and Development (OECD) are based on national energy data adjusted to conform to annual questionnaires completed by OECD member governments. In addition, estimates are sometimes made to complete major aggregates from which key data are missing, and adjustments are made to compensate for differences in definitions.

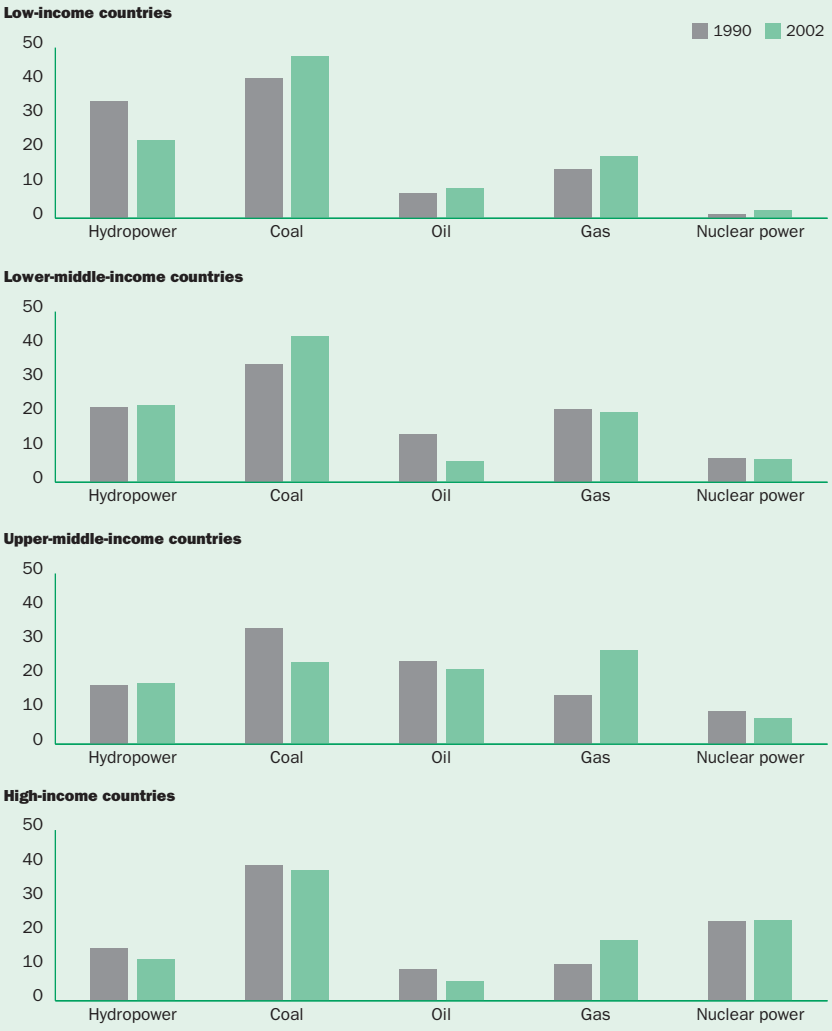
The IEA makes these estimates in consultation with national statistical offices, oil companies, electricity utilities, and national energy experts. The IEA occasionally revises its time series to reflect political changes. Since 1990, for example, it has constructed energy statistics for countries of the former Soviet Union. In addition, energy statistics for other countries have undergone continuous changes in coverage or methodology as more detailed energy accounts have become available in recent years. Breaks in series are therefore unavoidable.

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

3.9a

Sources of electricity generation have shifted differently in different income groups

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



Source: Table 3.9.

Definitions

• Electricity production is measured at the terminals of all alternator sets in a station. In addition to hydropower, coal, oil, gas, and nuclear power generation, it covers generation by geothermal, solar, wind, and tide and wave energy as well as that from combustible renewables and waste. Production includes the output of electricity plants designed to produce electricity only, as well as that of combined heat and power plants. • Access to electricity refers to the number of people with access to electricity (both on-grid and off-grid) as a percentage of the total population (see table 2.1). • Sources of electricity refer to the inputs used to generate electricity: hydropower, coal, oil, gas, and nuclear power. • Hydropower refers to electricity produced by hydroelectric power plants. • Oil refers to crude oil and petroleum products. • Gas refers to natural gas but not to natural gas liquids. • Nuclear power refers to electricity produced by nuclear power plants.

Data sources

The data on electricity production are from the IEA's electronic files and its annual publications Energy Statistics and Balances of Non-OECD Countries, Energy Statistics of OECD Countries, and Energy Balances of OECD Countries. Data on access to electricity are from the IEA's World Energy Outlook 2002: Energy and Poverty.

3.10 Urbanization

	Urban population					Population in urban agglomerations of more than 1 million		Population in largest city		Access to improved sanitation facilities			
	millions		% of total population		average annual % growth	% of total population		% of urban population		% of urban population		% of rural population	
	1990	2003	1990	2003	1990–2003	1990	2005	1990	2005	1990	2002	1990	2002
Afghanistan	3.2	6.7	18	23	5.6	9	11	48	45	..	16	5	5
Albania	1.2	1.4	36	44	1.3	..	..	..	..	99	99	..	81
Algeria	12.9	18.7	51	59	2.9	8	10	15	17	99	99	76	82
Angola	2.6	4.9	28	36	4.9	17	20	62	52	62	56	19	16
Argentina	27.9	32.6	87	89	1.2	42	41	40	38	87	..	47	..
Armenia	2.4	2.1	67	67	–1.1	33	35	49	52	96	96	..	61
Australia	14.5	18.3	85	92	1.8	60	61	25	23	100	100	100	100
Austria	5.2	5.5	67	68	0.4	27	27	40	40	100	100	100	100
Azerbaijan	3.9	4.3	54	52	0.8	24	22	45	42	..	73	..	36
Bangladesh	21.8	37.0	20	27	4.1	9	13	30	31	71	75	11	39
Belarus	6.8	6.9	66	70	0.2	16	17	24	25	..	..	..	..
Belgium	9.6	10.1	97	98	0.4	..	..	10	10	..	..	..	..
Benin	1.6	3.0	34	45	4.7	..	..	..	..	31	58	1	12
Bolivia	3.7	5.6	56	64	3.2	25	31	29	26	49	58	13	23
Bosnia and Herzegovina	1.7	1.8	39	44	0.4	..	..	..	..	99	99	..	88
Botswana	0.5	0.9	42	50	3.6	..	..	..	..	61	57	21	25
Brazil	110.6	146.2	75	83	2.1	33	37	13	12	82	83	37	35
Bulgaria	5.8	5.3	66	68	–0.7	14	13	21	20	100	100	100	100
Burkina Faso	1.2	2.1	14	18	4.4	..	..	49	37	47	45	8	5
Burundi	0.3	0.7	6	10	5.7	..	..	..	..	42	47	44	35
Cambodia	1.2	2.5	13	19	5.6	6	8	..	..	..	53	..	8
Cameroon	4.7	8.2	40	51	4.3	16	22	21	22	43	63	7	33
Canada	21.3	25.1	77	79	1.3	34	37	18	20	100	100	99	99
Central African Republic	1.1	1.7	37	43	3.1	..	..	..	..	32	47	18	12
Chad	1.2	2.1	21	25	4.3	..	..	..	..	27	30	1	0
Chile	10.9	13.7	83	87	1.7	35	35	42	40	91	96	52	64
China	311.1	498.0	27	39	3.6	14	15	4	2	64	69	7	29
Hong Kong, China	5.7	6.8	100	100	1.4	100	100	100	100	..	..	..	..
Colombia	24.0	34.1	69	76	2.7	28	33	21	21	95	96	52	54
Congo, Dem. Rep.	..	..	..	..	..	9	10	..	..	56	43	3	23
Congo, Rep.	1.4	2.5	56	67	4.6	..	..	51	43	..	14	2	2
Costa Rica	1.6	2.4	54	61	3.0	..	..	45	45	..	89	97	97
Côte d'Ivoire	4.7	7.6	40	45	3.7	18	20	45	44	52	61	16	23
Croatia	2.6	2.6	54	59	0.1	..	..	..	..	..	..	..	..
Cuba	7.8	8.6	74	76	0.7	20	19	27	25	99	99	95	95
Czech Republic	7.7	7.6	75	75	–0.1	12	11	16	15	..	..	..	..
Denmark	4.4	4.6	85	85	0.4	26	20	31	24	..	..	..	..
Dominican Republic	4.1	5.9	58	67	2.7	22	21	37	31	60	67	33	43
Ecuador	5.7	8.4	55	64	3.0	26	29	28	27	73	80	36	59
Egypt, Arab Rep.	22.9	28.9	44	43	1.8	23	21	40	37	70	84	42	56
El Salvador	2.5	4.1	49	64	3.8	19	22	39	33	70	78	33	40
Eritrea	0.5	0.9	16	20	4.4	..	..	..	..	46	34	0	3
Estonia	1.1	0.9	71	70	–1.3	..	..	..	..	..	93	..	..
Ethiopia	6.5	11.4	13	17	4.3	3	4	28	23	14	19	2	4
Finland	3.1	3.1	61	59	0.0	17	21	28	36	100	100	100	100
France	42.0	45.3	74	76	0.6	23	23	22	22	..	..	..	..
Gabon	0.6	1.1	68	84	4.2	..	..	..	..	..	37	..	30
Gambia, The	0.2	0.5	25	33	5.3	..	..	..	..	..	72	..	46
Georgia	3.0	2.9	55	57	–0.3	22	21	41	36	96	96	..	69
Germany	67.8	72.7	85	88	0.5	40	41	9	9	..	..	..	..
Ghana	5.1	7.7	34	37	3.1	8	9	23	24	54	74	37	46
Greece	6.0	6.7	59	61	0.9	30	29	51	47	..	..	..	..
Guatemala	3.3	5.0	38	41	3.1	..	..	24	18	71	72	35	52
Guinea	1.3	2.3	23	29	4.1	15	18	65	60	27	25	13	6
Guinea-Bissau	0.2	0.5	24	34	5.7	..	..	..	..	..	57	..	23
Haiti	1.9	3.2	29	38	3.9	18	24	59	62	27	52	11	23

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	2003	1990	2003	1990–2003	1990	2005	1990	2005	1990	2002	1990	2002
Honduras	2.0	3.9	42	56	4.9	..	..	35	25	77	89	31	52
Hungary	6.4	6.6	62	65	0.2	19	17	31	25	100	100	..	85
India	216.9	301.3	26	28	2.5	9	11	6	6	43	58	1	18
Indonesia	54.5	94.7	31	44	4.2	9	11	14	13	66	71	38	38
Iran, Islamic Rep.	30.6	43.9	56	66	2.8	22	22	21	16	86	86	78	78
Iraq	12.6	16.7	70	68	2.2	30	32	33	34	95	95	48	48
Ireland	2.0	2.4	57	60	1.4	..	..	46	42	..	..	..	..
Israel	4.2	6.2	90	92	2.9	48	58	43	47	100	100	..	..
Italy	37.8	38.9	67	67	0.2	23	20	12	10	..	..	..	..
Jamaica	1.2	1.5	51	58	1.6	..	..	..	..	85	90	64	68
Japan	95.6	101.1	77	79	0.4	42	44	34	35	100	100	100	100
Jordan	2.3	4.2	72	79	4.7	27	23	37	29	97	94	..	85
Kazakhstan	9.3	8.3	57	56	–0.9	7	7	12	13	87	87	52	52
Kenya	5.6	11.6	24	36	5.6	6	9	25	22	49	56	40	43
Korea, Dem. Rep.	11.7	13.8	58	61	1.3	15	20	21	23	..	58	..	60
Korea, Rep.	31.7	40.0	74	84	1.8	49	46	33	23	..	..	..	..
Kuwait	2.0	2.3	95	96	1.0	48	49	51	51	..	..	..	..
Kyrgyz Republic	1.7	1.7	38	34	0.3	..	..	38	47	..	75	..	51
Lao PDR	0.6	1.2	15	21	4.7	..	..	..	..	..	61	..	14
Latvia	1.9	1.4	70	60	–2.2	..	..	47	52	..	..	..	..
Lebanon	3.1	4.1	84	91	2.2	32	41	38	45	100	100	..	87
Lesotho	0.3	0.5	20	30	4.2	..	..	..	..	61	61	32	32
Liberia	1.0	1.6	42	47	3.3	..	..	..	..	59	49	24	7
Libya	3.5	4.9	82	88	2.6	35	36	43	41	97	97	96	96
Lithuania	2.5	2.4	68	69	–0.4	..	..	..	..	..	..	..	..
Macedonia, FYR	1.1	1.2	58	60	0.8	..	..	..	..	..	..	..	..
Madagascar	2.7	5.3	24	31	5.1	8	10	35	31	25	49	8	27
Malawi	1.0	1.7	12	16	4.4	..	..	..	..	52	66	34	42
Malaysia	9.1	14.7	50	59	3.7	6	5	12	9	94	..	98	98
Mali	2.0	3.8	24	32	4.8	9	11	37	34	50	59	32	38
Mauritania	0.9	1.8	44	62	5.2	..	..	..	..	31	64	26	9
Mauritius	0.4	0.5	41	42	1.4	..	..	..	..	100	100	99	99
Mexico	60.3	76.7	72	75	1.9	32	34	25	24	84	90	20	39
Moldova	2.0	1.8	47	42	–1.1	..	..	..	..	..	86	..	52
Mongolia	1.2	1.4	57	57	1.2	..	..	48	58	..	75	..	37
Morocco	11.6	17.3	48	57	3.0	21	24	23	21	87	83	28	31
Mozambique	3.0	6.7	21	36	6.2	5	7	26	18	..	51	14	14
Myanmar	10.0	14.4	25	29	2.8	7	8	29	27	39	96	15	63
Namibia	0.4	0.7	27	32	4.3	..	..	..	..	68	66	8	14
Nepal	1.6	3.2	9	13	5.2	..	..	..	..	62	68	7	20
Netherlands	13.3	14.6	89	90	0.7	14	14	8	8	100	100	100	100
New Zealand	2.9	3.5	85	86	1.3	25	28	30	32	..	..	88	..
Nicaragua	2.0	3.1	53	57	3.4	19	20	36	35	64	78	27	51
Niger	1.2	2.6	16	22	5.8	..	..	36	35	35	43	2	4
Nigeria	33.7	63.6	35	47	4.9	10	12	14	16	50	48	33	30
Norway	3.1	3.4	72	76	0.9	..	..	22	23	..	..	..	..
Oman	1.0	2.0	62	78	5.3	..	..	..	..	97	97	61	61
Pakistan	33.0	50.6	31	34	3.3	16	18	22	22	81	92	19	35
Panama	1.3	1.7	54	57	2.2	..	..	66	53	..	89	..	51
Papua New Guinea	0.6	1.0	15	18	4.0	..	..	..	..	67	67	41	41
Paraguay	2.0	3.3	49	58	3.7	22	29	46	50	71	94	46	58
Peru	14.9	20.1	69	74	2.3	27	29	39	39	68	72	15	33
Philippines	29.8	49.7	49	61	3.9	14	14	27	20	63	81	46	61
Poland	23.1	24.1	61	63	0.3	14	13	15	12	..	..	..	..
Portugal	4.6	7.1	47	68	3.3	30	31	40	27	..	..	..	..
Puerto Rico	2.5	3.0	71	76	1.3	44	59	61	77	..	..	..	..

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	2003	1990	2003	1990–2003	1990	2005	1990	2005	1990	2002	1990	2002
Romania	12.4	12.1	54	56	−0.2	9	8	16	14	..	86	..	10
Russian Federation	108.7	104.6	73	73	−0.3	18	20	8	10	93	93	70	70
Rwanda	0.4	0.6	5	7	3.1	..	..	..	..	49	56	36	38
Saudi Arabia	12.4	19.7	78	88	3.6	31	45	19	26	100	100	..	..
Senegal	2.9	5.1	40	50	4.2	20	22	50	43	52	70	23	34
Serbia and Montenegro	5.4	4.2	51	52	−1.8	11	10	21	20	97	97	77	77
Sierra Leone	1.2	2.1	30	39	4.2	..	..	48	45	..	53	..	30
Singapore	3.0	4.3	100	100	2.6	99	99	99	99	100	100	..	..
Slovak Republic	3.0	3.1	56	58	0.4	..	..	..	..	100	100	100	100
Slovenia	1.0	1.0	50	49	−0.2	..	..	..	..	..	..	..	..
Somalia	1.7	2.8	24	29	3.6	11	12	44	41	..	47	..	14
South Africa	17.2	27.1	49	59	3.5	23	29	11	12	85	86	42	44
Spain	29.3	32.2	75	78	0.7	23	23	16	16	..	..	..	..
Sri Lanka	3.5	4.6	21	24	2.1	..	..	..	..	89	98	64	89
Sudan	6.6	13.0	27	39	5.2	9	13	36	31	53	50	26	24
Swaziland	0.2	0.3	24	27	3.9	..	..	..	..	..	78	..	44
Sweden	7.1	7.5	83	83	0.4	17	19	21	23	100	100	100	100
Switzerland	4.0	5.0	60	68	1.6	..	..	21	20	100	100	100	100
Syrian Arab Republic	5.9	9.1	49	53	3.3	27	27	26	26	97	97	56	56
Tajikistan	1.7	1.7	32	28	0.3	..	..	..	..	..	71	..	47
Tanzania	5.5	12.7	22	35	6.4	5	7	24	19	51	54	45	41
Thailand	10.4	12.7	19	20	1.5	11	11	57	51	95	97	74	100
Togo	1.0	1.7	29	35	4.2	..	..	..	..	71	71	24	15
Trinidad and Tobago	0.8	1.0	69	75	1.3	..	..	..	..	100	100	100	100
Tunisia	4.7	6.7	58	67	2.6	19	20	33	30	95	90	47	62
Turkey	34.4	47.4	61	67	2.5	22	26	19	20	96	94	67	62
Turkmenistan	1.7	2.2	45	45	2.2	..	..	..	..	..	77	..	50
Uganda	1.9	3.9	11	15	5.3	4	5	39	31	54	53	41	39
Ukraine	34.7	33.0	67	68	−0.4	14	15	7	8	100	100	97	97
United Arab Emirates	1.4	3.6	80	88	7.1	..	..	33	36	100	100	100	100
United Kingdom	51.3	53.2	89	90	0.3	24	23	15	14	..	..	..	..
United States	187.8	226.6	75	78	1.4	40	42	9	8	100	100	100	100
Uruguay	2.8	3.1	89	93	1.0	41	40	46	43	95	95	..	85
Uzbekistan	8.2	9.4	40	37	1.0	10	8	25	22	73	73	48	48
Venezuela, RB	16.6	22.5	84	88	2.3	31	34	17	14	..	71	..	48
Vietnam	13.4	20.7	20	25	3.3	13	13	30	23	46	84	16	26
West Bank and Gaza	..	..	..	..	..	..	..	..	..	..	..	..	..
Yemen, Rep.	2.7	4.9	23	26	4.6	6	8	25	30	59	76	11	14
Zambia	3.1	4.2	39	40	2.4	13	13	32	33	64	68	26	32
Zimbabwe	2.9	4.9	28	37	4.0	10	12	36	30	69	69	40	51
World	2,263.3 s	3,015.7 s	44 w	49 w	2.2 w	.. w	.. w	17 w	16 w	77 w	79 w	21 w	35 w
Low income	447.5	686.5	26	30	3.3	10	12	17	16	49	61	10	24
Middle income	1,148.1	1,570.8	44	53	2.4	..	..	16	15	79	81	25	41
Lower middle income	946.4	1,319.8	41	50	2.6	17	18	14	13	78	80	24	41
Upper middle income	201.8	251.1	71	75	1.7	..	..	27	26	89	..	..	..
Low & middle income	1,595.7	2,257.4	37	43	2.7	..	..	16	15	71	75	18	32
East Asia & Pacific	454.1	725.5	28	39	3.6	..	..	11	8	64	71	16	35
Europe & Central Asia	294.4	301.1	63	64	0.2	16	18	14	..	94	93	72	64
Latin America & Carib.	309.1	407.8	71	77	2.1	31	33	24	23	83	84	35	44
Middle East & N. Africa	126.6	181.8	54	59	2.8	22	24	27	27	88	90	52	56
South Asia	280.1	403.5	25	28	2.8	10	12	10	10	50	64	5	23
Sub-Saharan Africa	131.5	237.6	28	36	4.6	..	..	26	24	53	55	25	26
High income	667.6	758.3	77	80	1.0	..	..	19	19	..	..	..	..
Europe EMU	220.9	239.0	75	78	0.6	28	28	16	18	..	..	..	..

3.10 Urbanization

About the data

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

Estimates of the world's urban population would change significantly if China, India, and a few other populous nations were to change their definition of urban centers. According to China's State Statistical Bureau, by the end of 1996 urban residents accounted for about 43 percent of China's population, while in 1994 only 20 percent of the population was considered urban. In addition to the continuous migration of people from rural to urban areas, one of the main reasons for this shift was the rapid growth in the hundreds of towns reclassified as cities in recent years. Because the estimates in the table are based on national definitions of what constitutes a city or metropolitan area, cross-country comparisons should be made with caution. To estimate urban populations, the United Nations' ratios of urban to total population were applied to the World Bank's estimates of total population (see table 2.1).

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

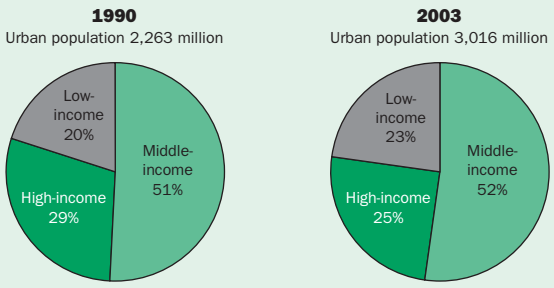
Definitions

• 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 2000 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.

3.10a

Developing economies are becoming more urban

Share of urban population

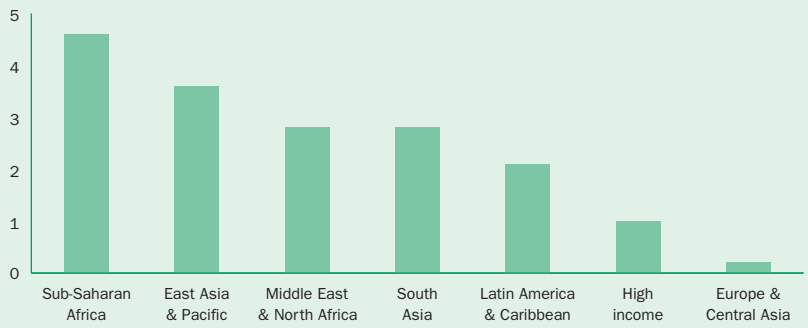


Source: Table 3.10.

3.10b

. . . and urbanization is growing fastest in Sub-Saharan Africa and Asia

Average annual growth rate, 1990–2003 (%)



Source: Table 3.10.

Data sources

The data on urban population and the population in urban agglomerations and in the largest city come from the United Nations Population Division's World Urbanization Prospects: The 2003 Revision. The total population figures are World Bank estimates. The data on access to sanitation in urban and rural areas are from the World Health Organization.

3.11 Urban environment

	City	Urban population	Secure tenure	House price to annual income ratio	Work trips by public trans-portation	Travel time to work	Households with access to services				Wastewater treated
							Potable water	Sewerage connection	Electricity	Telephone	
		thousands	% of population		%	minutes	%	%	%	%	%
		2005	1998	1998	1998	1998	1998	1998	1998	1998	1998
Algeria	Algiers	3,260	93.2	..	..	75	..	..	..	..	80
Argentina	Buenos Aires	13,349	92.1	5.10	59	42	100	98	100	70	..
	Córdoba	1,592	85.0	6.80	44	32	99	40	99	80	49
	Rosario	1,312	..	5.7	..	22	98	67	93	76	1
Armenia	Yerevan	1,066	100.0	4.0	84	30	98	98	100	88	36
Bangladesh	Chittagong	4,171	..	8.1	27	45	44	..	95	..	..
	Dhaka	12,560	..	16.7	9	45	60	22	90	7	..
	Sylhet	242[a]	..	6.0	10	50	29	0	93	40	..
	Tangail	152[a]	85.7	13.9	..	30	12	0	90	12	..
Barbados	Bridgetown	..	99.7	4.4	..	..	98	5	99	78	7
Belize	Belize City	55[a]	..	..	..	..	..	..	..	..	..
Bolivia	Santa Cruz de la Sierra	1,352	87.0	29.3	..	29	53	33	98	59	53
Bosnia and Herzegovina	Sarajevo	522[a]	..	..	100	12	95	90	100	..	..
Brazil	Belém	2,097	..	..	..	..	..	..	..	..	..
	Icapui	..	91.7	4.5	..	30	88	..	90	33	..
	Maranguape	..	..	..	30	20	73	..	..	..	..
	Porto Alegre	3,795	..	..	..	..	99	87	100	..	..
	Recife	3,527	..	12.5	46	35	89	41	100	29	33
	Rio de Janeiro	11,469	..	..	..	..	88	80	10	..	..
	Santo Andre	1,658[a]	80.3	23.4	43	40	98	95	100	79	..
Bulgaria	Bourgas	..	..	5.1	61	32	100	93	100	..	93
	Sofia	1,045	100.0	13.2	79	32	95	91	100	89	94
	Troyan	24[a]	100.0	3.7	44	22	99	82	100	45	..
	Veliko Tarnovo	..	100.0	5.4	46	30	98	98	100	96	50
Burkina Faso	Bobo-Dioulasso	..	100.0	..	..	..	24	..	29	6	..
	Koudougou	..	..	..	..	..	30	..	26	7	..
	Ouagadougou	870	100.0	..	2	..	30	..	47	11	19
Burundi	Bujumbura	373[a]	97.0	..	48	25	26	62	57	19	21
Cambodia	Phnom Penh	1,174	..	8.9	0	45	45	75	76	40	..
Cameroon	Douala	1,980	..	13.4	..	40	34	1	95	9	5
	Yaoundé	1,727	..	..	42	45	34	1	95	9	24
Canada	Hull	254[a]	100.0	..	16	..	100	100	100	100	100
Central African Republic	Bangui	..	94.0	..	66	60	31	..	18	11	0
Chad	N'Djamena	998[a]	..	..	35	..	42	0	13	6	21
Chile	Gran Concepción	..	..	..	57	35	100	91	95	69	6
	Santiago de Chile	5,623	..	..	60	38	100	99	99	73	3
	Tome	..	..	..	..	..	92	52	98	58	57
	Valparaiso	851[a]	91.8	..	55	..	98	92	97	63	100
	Viña del mar	851[a]	92.7	..	..	..	97	97	98	65	93
Colombia	Armenia	..	94.1	5.0	42	60	90	50	99	97	..
	Marinilla	170[a]	94.5	8.5	18	15	98	93	100	65	..
	Medellin	2,901[a]	..	..	38	35	100	99	100	87	..
Congo	Brazzaville	1,153	87.9	..	55	20	56	0	52	18	..
Côte d'Ivoire	Abidjan	3,516	..	14.5	..	45	26	15	41	5	45
Croatia	Zagreb	2,497[a]	96.5	7.8	56	31	98	97	100	94	..
Cuba	Baracoa	..	96.2	..	..	..	83	3	93	32	..
	Camaguey	..	84.7	..	2	60	72	47	97	..	..
	Cienfuegos	..	96.3	4.0	..	80	100	73	100	9	2
	Ciudad Habana	..	..	8.5	58	83	100	85	100	14	..
	Pinar Del Rio	..	96.4	..	..	80	97	48	100	..	..
	Santa Clara	..	98.8	..	7	48	95	42	100	43	..
Czech Republic	Brno	..	..	..	50	25	100	96	100	69	100
	Prague	1,164	99.3	..	55	22	99	100	100	100	..
Dem. Rep. of Congo	Kinshasa	5,717	94.9	..	72	57	72	0	66	1	..
Dominican Republic	Santiago de los Caballeros	691[a]	..	..	..	30	75	80	..	71	80
Ecuador	Ambato	286[a]	..	..	..	..	90	81	91	87	..

3.11 Urban environment

	City	Urban population	Secure tenure	House price to annual income ratio	Work trips by public trans-portation	Travel time to work	Households with access to services				Wastewater treated
							Potable water	Sewerage connection	Electricity	Telephone	
		thousands	% of population		%	minutes	%	%	%	%	%
		2005	1998	1998	1998	1998	1998	1998	1998	1998	1998
Ecuador	Cuenca	..	91.0	4.6	..	25	97	92	97	48	82
	Guayaquil	2,387	45.8	3.4	89	45	70	42	..	44	9
	Manta	126[a]	..	..	..	30	70	52	98	40	..
	Puyo	40[a]	..	2.1	..	15	80	30	90	60	..
	Quito	1,514	93.8	2.4	..	33	85	70	96	55	..
	Tena	..	..	6.3	..	5	80	60	..	..	..
El Salvador	San Salvador	1,472	90.5	3.5	..	..	82	80	98	70	..
Estonia	Riik	..	99.5	..	..	..	92	90	98	55	..
	Tallin	397[a]	98.8	6.4	..	35	98	98	100	86	10
Gabon	Libreville	523[a]	..	..	80	30	55	0	95	45	44
Gambia	Banjul	50[a]	91.8	11.4	55	22	23	12	24	..	..
Georgia	Tbilisi	1,042	100.0	9.4	..	..	..	98	100	58	..
Ghana	Accra	1,970	..	14.0	54	21	..	..	..	..	..
	Kumasi	862	77.7	13.7	51	21	65	..	95	51	..
Guatemala	Quetzaltenango	333[a]	..	4.3	..	15	60	55	80	40	..
Guinea	Conakry	1,465	..	..	26	45	30	32	54	6	..
Indonesia	Jakarta	13,194	95.5	14.6	..	..	50	65	99	..	16
	Semarang	816	80.2	..	..	..	34	..	85	..	..
	Surabaya	2,735	97.6	3.4	18	35	41	56	89	71	..
Iraq	Baghdad	5,911	..	..	..	..	..	..	..	..	..
Italy	Aversa	..	..	..	..	..	..	..	..	..	90
Jamaica	Kingston	655[a]	..	..	..	..	97	..	88	..	20
	Montego Bay	..	..	..	..	..	78	..	86	..	15
Jordan	Amman	1,292	97.3	6.1	21	25	98	81	99	62	54
Kenya	Kisumu	134[a]	97.3	8.5	43	24	38	31	49	..	65
	Mombasa	..	..	..	47	20	..	..	..	..	50
	Nairobi	2,819	..	..	71	57	89	..	..	..	52
Korea, Rep	Hanam	124[a]	..	3.7	..	..	81	68	100	100	81
	Pusan	3,527	100.0	4.0	39	42	98	69	100	100	69
	Seoul	9,592	98.6	5.7	71	60	100	99	100	..	99
Kuwait	Kuwait City	1,225	..	6.5	21	10	100	98	100	98	..
Kyrgyz Republic	Bishkek	829	94.8	..	95	35	30	23	100	20	15
Lao	Vientiane	562[a]	92.2	23.2	2	27	87	..	100	87	20
Latvia	Riga	719	97.4	15.6	..	..	95	93	100	70	..
Lebanon	Sin El Fil	..	..	8.3	50	10	80	30	98	80	..
Liberia	Monrovia	651[a]	57.6	28.0	80	60	..	..	..	..	..
Libya	Tripoli	2,093	..	0.8	18	20	97	90	99	6	40
Lithuania	Vilnius	578[a]	100.0	20.0	52	37	89	89	100	77	54
Madagascar	Antananarivo	1,808	..	..	..	..	..	..	..	..	..
Malawi	Lilongwe	765[a]	..	..	27	5	65	12	50	10	..
Malaysia	Penang	..	..	7.2	55	40	99	..	100	98	20
Mauritania	Nouakchott	881[a]	89.9	5.4	45	50	..	..	..	..	..
Mexico	Ciudad Juárez	1,469	..	..	24	23	89	77	96	45	..
Moldova	Chisinau	..	..	..	80	23	100	95	100	83	71
Mongolia	Ulaanbaatar	842	51.6	7.8	80	30	60	60	100	90	96
Morocco	Casablanca	3,743	..	..	..	30	83	93	91	..	..
	Rabat	1,859	..	..	40	20	93	97	52	..	..
Myanmar	Yangon	4,082	..	8.3	69	45	78	81	85	17	..
Nicaragua	Leon	..	98.8	..	..	15	78	..	84	21	..
Niger	Niamey	997	87.4	..	..	30	33	0	51	4	..
Nigeria	Ibadan	2,375	85.8	..	46	45	26	12	41	..	..
	Lagos	11,136	93.0	..	48	60	..	..	41	..	..
Oman	Muscat	887[a]	..	..	..	20	80	90	89	53	..
Panama	Colón	132[a]	..	14.2	..	15	..	..	..	..	..
Paraguay	Asunción	1,750	90.2	10.7	..	25	46	8	86	17	..
Peru	Cajamarca	..	90.0	3.9	..	20	86	69	81	38	62

3.11 Urban environment

	City	Urban population	Secure tenure	House price to annual income ratio	Work trips by public trans-portation	Travel time to work	Households with access to services				Wastewater treated
							Potable water	Sewerage connection	Electricity	Telephone	
		thousands	% of population		%	minutes	%	%	%	%	%
		2005	1998	1998	1998	1998	1998	1998	1998	1998	1998
Peru	Huanuco	747[a]	..	30.0	..	20	57	28	80	32	..
	Huaras	54[a]	..	6.7	..	15	..	..	71	..	..
	Iquitos	347[a]	97.3	5.6	25	10	73	60	82	62	..
	Lima	8,180	80.6	10.4	82	..	75	71	99	..	4
	Tacna	..	..	4.0	..	25	65	58	74	16	64
	Tumbes	..	..	..	..	20	60	35	80	25	..
Philippines	Cebu	2,189[a]	95.0	13.3	..	35	41	92	80	25	..
Poland	Bydgoszcz	..	60.5	4.3	35	18	95	87	100	85	28
	Gdansk	851	..	4.4	56	20	99	94	100	56	100
	Katowice	2,914	27.8	1.7	29	36	99	94	100	75	67
	Poznan	..	65.5	5.8	51	25	95	96	100	86	78
Qatar	Doha	391	..	..	..	..	..	..	..	..	..
Russian Federation	Astrakhan	..	100.0	5.0	66	35	81	79	100	51	92
	Belgorod	..	100.0	4.0	..	25	90	89	100	51	96
	Kostroma	..	100.0	6.9	68	20	88	84	100	46	96
	Moscow	10,672	100.0	5.1	85	62	100	100	100	102	98
	Nizhny Novgorod	1,458[a]	100.0	6.9	79	35	98	98	100	64	98
	Novomoscowsk	..	100.0	4.2	61	25	99	93	100	62	97
	Omsk	1,132	99.7	3.9	86	43	87	87	100	41	89
	Pushkin	..	100.0	9.6	60	15	99	99	100	89	100
	Surgut	..	100.0	4.5	81	57	98	98	100	50	93
	Veliky Novgorod	..	100.0	3.4	75	30	97	97	100	51	95
Rwanda	Kigali	358[a]	..	11.4	32	45	36	20	57	6	20
Samoa	Apia	34[a]	..	10.0	..	..	60	0	98	96	..
Serbia and Montenegro	Belgrad	4,372	96.5	13.5	72	40	95	86	100	86	20
Singapore	Singapore	273[a]	100.0	3.1	53	30	100	100	100	100	100
Slovenia	Ljubljana	5,145	98.9	7.8	20	30	100	100	100	97	98
Spain	Madrid	..	..	..	16	32	..	..	..	..	100
	Pamplona	13[a]	..	..	..	..	100	..	100	..	79
Sweden	Amal	1,729	..	2.9	..	..	100	100	100	..	100
	Stockholm	104[a]	..	6.0	48	28	100	100	100	..	100
	Umea	170[a]	..	5.3	..	16	100	100	100	..	100
Switzerland	Basel	2,317	..	12.3	..	..	100	100	100	99	100
Syria	Damascus	6,604	..	10.3	33	40	98	71	95	10	3
Thailand	Bangkok	499[a]	77.2	8.8	28	60	99	100	100	60	..
	Chiang Mai	663[a]	96.5	6.8	5	30	95	60	100	75	70
Togo	Lomé	..	64.0	..	40	30	..	70	51	18	..
Trinidad and Tobago	Port of Spain	2,063	78.6	..	44	..	..	..	..	..	..
Tunisia	Tunis	3,594	..	5.0	..	..	75	47	95	27	83
Turkey	Ankara	65[a]	91.3	4.5	..	32	97	98	100	..	80
Uganda	Entebbe	92[a]	74.0	10.4	65	20	48	13	42	0	30
	Jinja	1,353	82.0	15.4	49	12	65	43	55	5	30
Uruguay	Montevideo	367[a]	88.0	5.6	60	45	98	79	100	75	34
West Bank and Gaza	Gaza	1,200[a]	87.3	5.4	..	..	85	38	99	38	..
Yemen	Aden	1,621	..	..	78	20	..	..	96	..	30
	Sana'a	1,116	..	..	78	20	30	9	96	..	30
Zimbabwe	Bulawayo	900[a]	99.4	..	75	15	100	100	98	..	80
	Chegutu	..	51.5	3.4	20	22	100	68	9	3	69
	Gweru	..	94.0	..	..	15	100	100	90	61	95
	Harare	1,528	99.9	..	32	45	100	100	88	42	..
	Mutare	149[a]	..	..	70	20	88	88	74	4	100

a. Data are for 2000 and are from the United Nations Population Division's World Urbanization Prospects: The 2003 Revision.

Urban environment 3.11

About the data

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

The United Nations Global Plan of Action calls for monitoring the changing role of the world's cities and human settlements. The international agency with the mandate to assemble information on urban areas is the United Nations Centre for Human Settlements (UNCHS, or Habitat). Its Urban Indicators Programme is intended to provide data for monitoring and evaluating the performance of urban areas and for developing government policies and strategies. These data are collected through questionnaires completed by city officials in more than a hundred countries.

The table shows selected indicators for more than 160 cities from the UNCHS data set. A few more indicators are included on the World Development Indicators CD-ROM. The selection of cities in the UNCHS database does not reflect population weights or the economic importance of cities and is therefore biased toward smaller cities. Moreover, it is based on demand for participation in the Urban Indicators Programme. As a result, the database excludes a large number of major cities. The table reflects this bias as well as the criterion of data availability for the indicators shown.

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

Definitions

• Urban population refers to the population of the urban agglomeration, a contiguous inhabited territory without regard to administrative boundaries. • Secure tenure refers to the percentage of the population protected from involuntary removal from land or residence—including subtenancy, residence in social housing, and residences owned, purchased, or privately rented—except through due legal process. • House price to annual income ratio is the average house price divided by the average household income. • Work trips by public transportation are the percentage of trips to work made by bus or minibus, tram, or train. Buses or minibuses are road vehicles other than cars taking passengers on a farepaying basis. Other means of transport commonly used in developing countries, such as taxi, ferry, rickshaw, or animal, are not included. • Travel time to work is the average time in minutes, for all modes, for a one-way trip to work. Train and bus times include average walking and waiting times, and car times include parking and walking to the workplace. • Households with access to services are the percentage of households in formal settlements with access to potable water and connections to sewerage, electricity, and telephone service. Households with access to potable water are those with access to safe or potable drinking water within 200 meters of the dwelling. • Potable water is water that is free from contamination and safe to drink without further treatment. • Wastewater treated is the percentage of all wastewater undergoing some form of treatment.

3.11a

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

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

Source: Table 3.11.

Data sources

The data are from the Global Urban Indicators database of the UNCHS and the United Nations Population Division's World Urbanization Prospects: The 2003 Revision.

3.12 Traffic and congestion

	Motor vehicles				Passenger cars		Two-wheelers		Road traffic		Fuel prices	
	per 1,000 people		per kilometer of road		per 1,000 people		per 1,000 people		million vehicle kilometers		$ per liter	
	1990	2002[a]	1990	2002	1990	2002	1990	2002	1990	2002	Super 2004	Diesel 2004
Afghanistan	..	..	..	..	..	..	..	..	..	..	0.53	0.58
Albania	11	66	3	11	2	43	3	1	..	29	1.23	1.02
Algeria	..	..	..	..	..	..	..	..	..	..	0.32	0.15
Angola	19	..	..	..	14	..	..	..	..	..	0.39	0.29
Argentina	181	181	27	37	134	140	1	..	43,119	27,458	0.63	0.49
Armenia	5	..	2	..	1	..	..	..	..	258	0.68	0.56
Australia	530	..	11	..	450	..	18	18	138,501	..	0.85	0.83
Austria	421	534	30	22	387	494	71	74	..	..	1.32	1.19
Azerbaijan	52	52	7	17	36	43	5	1	..	..	0.41	0.18
Bangladesh	1	1	0	..	0	0	1	1	..	..	0.59	0.34
Belarus	61	..	13	..	59	156	..	53	10,026	4,046	0.62	0.44
Belgium	423	518	30	36	385	464	14	30	..	156,633	1.50	1.07
Benin	3	..	2	..	2	..	34	..	..	..	0.77	0.72
Bolivia	41	..	6	..	25	..	9	0	1,139	..	0.54	0.40
Bosnia and Herzegovina	114	..	24	..	101	..	..	..	..	..	0.97	0.97
Botswana	18	69	3	11	10	30	..	1	..	..	0.66	0.61
Brazil	88	..	8	..	..	..	..	28	..	..	0.84	0.49
Bulgaria	163	326	39	69	146	287	55	0	..	213	0.92	0.89
Burkina Faso	4	..	3	..	2	..	9	..	..	..	1.18	0.94
Burundi	..	..	..	..	..	..	..	..	..	..	1.04	1.08
Cambodia	1	380	0	49	0	312	9	134	314	7,210	0.79	0.61
Cameroon	10	..	3	..	6	..	..	..	..	..	0.95	0.83
Canada	605	582	20	20	468	559	12	0	..	73,500	0.68	0.68
Central African Republic	1	..	0	..	1	..	0	..	1,494	..	1.29	1.14
Chad	2	..	0	..	1	..	0	..	..	..	1.17	1.01
Chile	81	133	13	25	52	87	2	2	..	..	0.85	0.64
China	5	12	4	11	1	7	3	26	..	840,960	0.48	0.43
Hong Kong, China	66	77	253	279	42	57	4	5	8,192	10,781	1.54	1.00
Colombia	..	51	..	19	..	43	8	12	50,945	41,587	0.72	0.36
Congo, Dem. Rep.	..	..	..	..	..	..	..	..	..	..	0.92	0.81
Congo, Rep.	18	..	3	..	12	..	..	..	..	..	0.87	0.59
Costa Rica	87	..	7	..	55	..	14	22	..	572,038	0.78	0.56
Côte d'Ivoire	24	..	6	..	15	..	..	..	..	..	1.14	0.95
Croatia	..	311	..	49	..	280	..	19	..	16,609	1.24	1.13
Cuba	37	..	16	..	18	..	19	..	..	..	0.95	0.55
Czech Republic	246	325	46	26	228	356	113	74	..	7,753	1.08	1.07
Denmark	368	425	27	32	320	360	9	15	36,304	46,302	1.51	1.35
Dominican Republic	75	..	48	..	21	..	..	..	..	..	0.85	0.61
Ecuador	35	49	8	14	31	44	2	2	10,306	17,528	0.54	0.27
Egypt, Arab Rep.	29	..	33	..	21	..	6	..	..	..	0.28	0.10
El Salvador	33	..	14	..	17	..	0	..	2,002	4,244	0.65	0.58
Eritrea	1	..	1	..	1	..	..	..	..	..	0.80	0.40
Estonia	211	359	22	9	154	296	66	5	..	6,843	0.94	0.94
Ethiopia	1	2	2	4	1	1	0	0	..	1,642	0.60	0.42
Finland	441	481	29	32	386	419	12	43	39,750	48,750	1.54	1.21
France	494	592	32	39	405	491	55	..	422,000	544,400	1.42	1.25
Gabon	32	..	4	..	19	..	..	..	..	..	0.90	0.69
Gambia, The	13	..	5	..	6	..	..	..	..	..	0.75	0.73
Georgia	107	72	27	16	89	56	5	1	4,620	..	0.73	0.67
Germany	405	..	53	..	386	516	18	56	446,000	589,500	1.46	1.29
Ghana	..	..	..	..	..	..	..	..	..	15,320	0.49	0.43
Greece	248	..	22	..	171	254	120	220	..	79,377	1.14	1.23
Guatemala	..	52	..	119	..	1	..	12	..	4,547	0.68	0.63
Guinea	4	..	1	..	2	..	..	..	..	..	0.75	0.69
Guinea-Bissau	7	..	2	..	4	..	..	..	..	..	0.00	0.00
Haiti	..	..	..	..	..	..	..	..	..	..	0.88	0.60

3.12 Traffic and congestion

	Motor vehicles				Passenger cars		Two-wheelers		Road traffic		Fuel prices	
	per 1,000 people		per kilometer of road		per 1,000 people		per 1,000 people		million vehicle kilometers		$ per liter	
	1990	2002[a]	1990	2002	1990	2002	1990	2002	1990	2002	Super 2004	Diesel 2004
Honduras	22	60	10	28	..	51	..	14	3,288	..	0.81	0.66
Hungary	212	302	21	19	188	259	16	0	22,898	23,260	1.30	1.22
India	4	9	2	..	2	6	15	0	..	..	0.87	0.62
Indonesia	16	..	10	..	7	..	34	59	..	..	0.27	0.18
Iran, Islamic Rep.	34	..	14	..	25	..	36	..	..	..	0.09	0.02
Iraq	14	..	6	..	1	..	..	..	..	..	0.03	0.01
Ireland	270	408	10	..	227	349	6	8	24,205	33,915	1.29	1.29
Israel	210	283	74	111	174	230	8	12	18,212	37,293	1.05	0.80
Italy	529	606	99	74	476	542	45	125	344,726	67,916	1.53	1.31
Jamaica	..	..	..	..	..	..	..	..	..	..	0.63	0.57
Japan	469	581	52	63	283	428	146	106	628,581	790,820	1.26	0.95
Jordan	60	..	26	..	..	..	0	..	1,098	526,677	0.61	0.19
Kazakhstan	76	89	8	16	50	72	..	5	18,248	3,824	0.52	0.38
Kenya	12	11	5	4	10	8	1	1	5,170	..	0.92	0.76
Korea, Dem. Rep.	..	..	..	..	..	..	..	..	..	..	0.78	0.61
Korea, Rep.	79	292	60	120	48	205	32	59	30,464	67,266	1.35	0.95
Kuwait	..	..	..	..	..	..	..	..	..	4,450	0.24	0.24
Kyrgyz Republic	44	..	10	..	44	38	..	4	5,220	1,917	0.48	0.43
Lao PDR	9	..	3	..	6	..	18	..	..	..	0.71	0.63
Latvia	135	314	6	12	106	266	76	10	3,932	..	0.94	0.90
Lebanon	321	..	183	..	300	..	13	..	..	..	0.71	0.43
Lesotho	11	..	4	..	3	..	..	..	..	..	0.73	0.68
Liberia	14	..	4	..	7	..	..	..	..	..	0.75	0.77
Libya	..	..	..	..	..	..	..	..	..	..	0.09	0.08
Lithuania	160	373	12	17	133	346	52	6	..	1,345	1.03	1.02
Macedonia, FYR	132	..	30	..	121	..	1	..	3,102	..	1.17	0.92
Madagascar	6	..	2	..	4	..	..	..	41,500	..	1.05	0.79
Malawi	4	..	4	..	2	..	..	..	..	..	0.95	0.88
Malaysia	124	..	26	79	101	..	167	238	..	..	0.37	0.22
Mali	3	..	2	..	2	..	..	..	..	..	1.16	0.90
Mauritania	10	..	3	..	7	..	..	..	..	..	0.80	0.59
Mauritius	59	117	35	69	44	86	54	104	..	78	0.74	0.56
Mexico	119	159	41	44	82	107	3	..	55,095	..	0.59	0.45
Moldova	53	92	17	26	48	74	45	22	..	691	0.45	0.31
Mongolia	21	41	1	2	6	26	22	10	340	2,093	0.61	0.67
Morocco	37	54	15	27	28	44	1	1	..	17,370	1.10	0.70
Mozambique	4	..	2	..	3	..	..	..	1,889	..	0.88	0.79
Myanmar	..	..	..	..	..	..	..	..	..	..	0.12	0.10
Namibia	71	82	1	2	39	38	1	1,877	1,896	2,317	0.68	0.65
Nepal	..	..	..	..	..	..	..	..	..	..	0.72	0.49
Netherlands	405	428	58	58	368	384	44	25	90,150	109,955	1.62	1.23
New Zealand	524	731	19	..	436	613	24	21	..	35,200	0.77	0.41
Nicaragua	19	37	5	10	10	16	3	5	108	441	0.69	0.64
Niger	6	..	4	..	5	..	..	..	178	..	1.02	0.91
Nigeria	30	..	21	..	12	..	5	..	..	..	0.39	0.45
Norway	458	520	22	26	380	417	48	61	..	33,482	1.61	1.44
Oman	130	..	9	..	83	..	3	..	..	..	0.31	0.26
Pakistan	6	8	4	..	4	7	8	11	..	234,515	0.62	0.41
Panama	75	..	18	..	60	..	2	..	..	..	0.54	0.48
Papua New Guinea	..	..	..	..	..	..	..	..	..	..	0.94	0.64
Paraguay	..	..	..	..	..	..	..	..	..	..	0.62	0.51
Peru	..	46	..	15	..	30	..	9	..	64	1.12	0.76
Philippines	10	34	4	13	7	9	6	18	6,189	9,548	0.52	0.34
Poland	168	307	18	32	138	259	36	21	59,608	138,100	1.20	1.09
Portugal	222	459	34	..	162	426	5	55	28,623	47,943	1.38	1.08
Puerto Rico	..	..	..	..	..	..	..	..	..	278,699	0.51	0.52

3.12 Traffic and congestion

	Motor vehicles				Passenger cars		Two-wheelers		Road traffic		Fuel prices	
	per 1,000 people		per kilometer of road		per 1,000 people		per 1,000 people		million vehicle kilometers		$ per liter	
	1990	2002[a]	1990	2002	1990	2002	1990	2002	1990	2002	Super 2004	Diesel 2004
Romania	72	168	11	19	56	144	13	12	23,907	42,684	0.96	0.91
Russian Federation	87	176	14	48	65	132	..	43	..	59,522	0.55	0.45
Rwanda	2	..	1	..	1	..	..	..	..	..	0.98	0.99
Saudi Arabia	165	..	19	..	98	..	0	..	..	..	0.24	0.10
Senegal	11	14	6	2	8	11	0	0	..	4,013	1.10	0.90
Serbia and Montenegro	137	..	31	..	133	..	3	..	..	1,428	0.74	0.66
Sierra Leone	10	..	4	..	7	..	2	0	996	..	0.76	0.89
Singapore	130	..	142	..	89	..	40	..	..	..	0.89	0.55
Slovak Republic	194	279	57	35	163	247	61	9	..	534	1.17	1.19
Slovenia	306	481	42	47	289	438	8	25	5,620	9,744	1.12	1.11
Somalia	2	..	1	..	1	..	..	..	..	..	0.35	0.29
South Africa	139	..	26	..	97	94	8	4	..	..	0.81	0.80
Spain	360	539	43	33	309	441	79	80	100,981	224,370	1.21	1.10
Sri Lanka	21	34	4	..	7	..	24	49	3,468	15,630	0.72	0.41
Sudan	9	..	22	..	8	..	..	..	..	..	0.47	0.29
Swaziland	66	86	18	21	35	41	3	0	..	..	0.76	0.73
Sweden	464	500	29	21	426	452	11	34	61,040	72,000	1.51	1.37
Switzerland	491	549	46	56	449	507	114	102	48,660	59,007	1.29	1.37
Syrian Arab Republic	26	29	10	..	10	9	..	6	..	..	0.46	0.13
Tajikistan	3	..	1	..	0	..	..	..	..	1,730	0.67	0.59
Tanzania	5	..	2	..	1	..	..	..	..	..	0.93	0.87
Thailand	46	..	36	..	14	..	86	..	45,769	..	0.54	0.37
Togo	24	..	11	..	16	..	8	..	..	..	0.85	0.83
Trinidad and Tobago	..	..	..	..	..	..	..	..	..	..	0.35	0.24
Tunisia	48	79	19	..	23	53	..	1	..	19,231	0.68	0.39
Turkey	50	90	8	18	34	66	10	15	27,041	51,664	1.44	1.12
Turkmenistan	..	..	..	..	..	..	..	..	..	..	0.02	0.01
Uganda	2	..	..	..	1	..	0	3	..	..	1.02	0.88
Ukraine	63	135	20	..	63	108	..	0	59,500	12,190	0.55	0.44
United Arab Emirates	121	..	52	..	97	..	..	..	..	..	0.28	0.28
United Kingdom	400	391	64	62	341	384	14	3	399,000	462,400	1.56	1.60
United States	758	779	30	34	573	..	17	0	2,527,441	4,462,811	0.54	0.57
Uruguay	138	..	45	..	122	..	74	..	..	..	1.13	0.71
Uzbekistan	..	..	..	..	..	..	..	..	..	..	0.35	0.30
Venezuela, RB	..	..	..	..	..	..	..	..	..	..	0.04	0.02
Vietnam	..	..	..	..	..	..	45	..	..	..	0.48	0.32
West Bank and Gaza	..	..	..	..	..	..	..	..	..	..	1.17	0.70
Yemen, Rep.	34	..	8	..	14	..	..	..	8,681	..	0.19	0.09
Zambia	14	..	3	..	8	..	..	..	..	..	1.10	0.98
Zimbabwe	..	..	..	..	..	..	..	..	..	..	0.61	0.65
World	118 w	135 w			91 w	105 w					0.78 m	0.64 m
Low income	5	..			3	..					0.78	0.65
Middle income	38	56			25	42					0.68	0.55
Lower middle income	25	39			13	28					0.68	0.49
Upper middle income	149	196			114	153					0.76	0.58
Low & middle income	26	36			16	27					0.74	0.61
East Asia & Pacific	9	17			4	10					0.53	0.40
Europe & Central Asia	97	172			79	138					0.94	0.90
Latin America & Carib.	100	..			..	..					0.69	0.56
Middle East & N. Africa	48	..			31	..					0.31	0.14
South Asia	4	10			2	6					0.67	0.45
Sub-Saharan Africa	21	..			14	..					0.85	0.77
High income	505	601			396	436					1.29	1.10
Europe EMU	429	..			379	483					1.42	1.23

a. Data are for 2002 or most recent year available.

Traffic and congestion 3.12

About the data

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

In recent years ownership of passenger cars has increased, and the expansion of economic activity has led to the transport by road of more goods and services over greater distances (see table 5.9). These developments have increased demand for roads and vehicles, adding to urban congestion, air pollution, health hazards, traffic accidents, and injuries.

Congestion, the most visible cost of expanding vehicle ownership, is reflected in the indicators in the table. Other relevant indicators—such as average vehicle speed in major cities or the cost of traffic congestion, which takes a heavy toll on economic productivity—are not included because data are incomplete or difficult to compare. The data in the table—except for those on fuel prices—are compiled by the International Road Federation (IRF) through questionnaires sent to national organizations. The IRF uses a hierarchy of sources to gather as much information as possible. The primary sources are national road associations. Where such an association lacks data or does not respond, other agencies are contacted, including road directorates, ministries of transport or public works, and central statistical offices. As a result, the compiled data are of uneven quality. The coverage of each indicator may differ across countries because of differences in definitions. Comparability also is limited when time-series data are reported. Moreover, the data do not capture the quality or age of vehicles or the condition or width of roads. Thus comparisons over time and between countries should be made with caution.

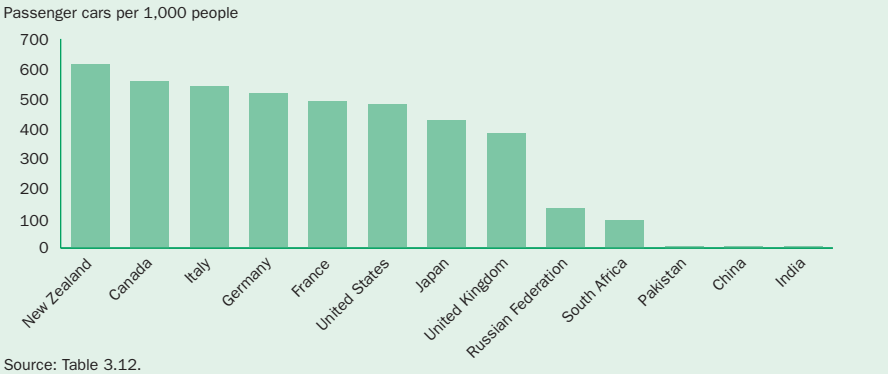
The data on fuel prices are compiled by the German Agency for Technical Cooperation (GTZ) from its global network of regional offices and representatives as well as other sources, including the Allgemeiner Deutscher Automobil Club (for Europe) and a project of the Latin American Energy Organization (OLADE,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

Definitions

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

3.12a

High-income countries have many more passenger cars per 1,000 people than developing countries do



Source: Table 3.12.

Data sources

The data on vehicles and traffic are from the IRF's electronic files and its annual World Road Statistics. The data on fuel prices are from the GTZ's electronic files.

3.13 Air pollution

	City	City population	Particulate matter	Sulfur dioxide	Nitrogen dioxide
		thousands 2005	micrograms per cubic meter 1999	micrograms per cubic meter 1995–2001[a]	micrograms per cubic meter 1995–2001[a]
Argentina	Cordoba City	1,592	52	..	97
Australia	Melbourne	3,663	15	..	30
	Perth	1,484	15	5	19
	Sydney	4,388	22	28	81
Austria	Vienna	2,190	39	14	42
Belgium	Brussels	1,027	31	20	48
Brazil	Rio de Janeiro	11,469	40	129	..
	Sao Paulo	18,333	46	43	83
Bulgaria	Sofia	1,045	83	39	122
Canada	Montreal	3,511	22	10	42
	Toronto	5,060	26	17	43
	Vancouver	2,125	15	14	37
Chile	Santiago	5,623	73	29	81
China	Anshan	1,459	99	115	88
	Beijing	10,849	106	90	122
	Changchun	3,093	88	21	64
	Chengdu	3,478	103	77	74
	Chongquing	4,975	147	340	70
	Dalian	2,709	60	61	100
	Guangzhu	976	74	57	136
	Guiyang	2,467	84	424	53
	Harbin	2,898	91	23	30
	Jinan	2,654	112	132	45
	Kunming	1,748	84	19	33
	Lanzhou	1,788	109	102	104
	Liupanshui	2,118	70	102	..
	Nanchang	1,742	94	69	29
	Pinxiang	1,563	80	75	..
	Quingdao	2,431	..	190	64
	Shanghai	12,665	87	53	73
	Shenyang	4,916	120	99	73
	Taiyuan	2,516	105	211	55
	Tianjin	9,346	149	82	50
	Urumqi	1,467[b]	61	60	70
	Wuhan	6,003	94	40	43
	Zhengzhou	2,250	116	63	95
	Zibo	2,775	88	198	43
Colombia	Bogota	5,442[b]	33	..	..
Croatia	Zagreb	908[b]	39	31	..
Cuba	Havana	2,192	28	1	5
Czech Republic	Prague	1,164	27	14	33
Denmark	Copenhagen	1,091	24	7	54
Ecuador	Guayaquil	2,387	26	15	..
	Quito	1,514	34	22	..
Egypt, Arab Rep.	Cairo	11,146	178	69	..
Finland	Helsinki	1,103	22	4	35
France	Paris	9,854	15	14	57
Germany	Berlin	3,328	25	18	26
	Frankfurt	668[b]	22	11	45
	Munich	2,318	22	8	53
Ghana	Accra	1,970	31	..	..
Greece	Athens	3,238	50	34	64
Hungary	Budapest	1,670	26	39	51
Iceland	Reykjavik	164[b]	21	5	42
India	Ahmedabad	5,171	104	30	21
	Bangalore	6,532	56	..	..

About the data

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

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

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

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

The data on 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 have been extracted from a complete set of estimates developed by the World Bank's Development Research Group and Environment Department in a study of annual ambient concentrations of particulate matter in world cities with populations exceeding 100,000 (Pandey and others 2003).

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

3.13 Air pollution

	City	City population	Particulate matter	Sulfur dioxide	Nitrogen dioxide
		thousands 2005	micrograms per cubic meter 1999	micrograms per cubic meter 1995–2001[a]	micrograms per cubic meter 1995–2001[a]
India	Calcutta	14,299	153	49	34
	Chennai	6,915	..	15	17
	Delhi	15,334	187	24	41
	Hyderabad	6,146	51	12	17
	Kanpur	3,040	136	15	14
	Lucknow	2,589	136	26	25
	Mumbai	18,336	79	33	39
	Nagpur	2,359	69	6	13
	Pune	4,485	58		
Indonesia	Jakarta	13,194	103	..	..
Iran, Islamic Rep.	Tehran	7,352	71	209	..
Ireland	Dublin	1,033	23	20	..
Italy	Milan	4,007	36	31	248
	Rome	2,628	35	..	..
	Torino	969[b]	53	..	..
Japan	Osaka	2,626[b]	39	19	63
	Tokyo	35,327	43	18	68
	Yokohama	3,366[b]	32	100	13
Kenya	Nairobi	2,819	49	..	..
Korea, Rep	Pusan	3,527	43	60	51
	Seoul	9,592	45	44	60
	Taegu	2,510	49	81	62
Malaysia	Kuala Lumpur	1,392	24	24	..
Mexico	Mexico City	19,013	69	74	130
Netherlands	Amsterdam	1,157	37	10	58
New Zealand	Auckland	1,152	15	3	20
Norway	Oslo	808	23	8	43
Philippines	Manila	10,432[b]	60	33	..
Poland	Lodz	944	45	21	43
	Warsaw	2,204	49	16	32
Portugal	Lisbon	1,977	30	8	52
Romania	Bucharest	1,764	25	10	71
Russian Federation	Moscow	10,672	27	109	..
	Omsk	1,132	28	20	34
Singapore	Singapore	4,372	41	20	30
Slovak Republic	Bratislava	456[b]	22	21	27
South Africa	Capetown	3,103	15	21	72
	Durban	2,643	29	31	..
	Johannesburg	3,288	30	19	31
Spain	Barcelona	4,424	43	11	43
	Madrid	5,145	37	24	66
Sweden	Stockholm	1,729	15	3	20
Switzerland	Zurich	984	24	11	39
Thailand	Bangkok	6,604	82	11	23
Turkey	Ankara	3,594	53	55	46
	Istanbul	9,760	62	120	..
Ukraine	Kiev	2,623	45	14	51
United Kingdom	Birmingham	2,215	17	9	45
	London	7,615	23	25	77
	Manchester	2,193	19	26	49
United States	Chicago	8,711	27	14	57
	Los Angeles	12,146	38	9	74
	New York	18,498	23	26	79
Venezuela, RB	Caracas	3,276	18	33	57

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

Definitions

• City population is the number of residents of the city or metropolitan area as defined by national authorities and reported to the United Nations. • Particulate matter refers to fine suspended particulates less than 10 microns in diameter that are capable of penetrating deep into the respiratory tract and causing significant health damage. The state of a country's technology and pollution controls is an important determinant of particulate matter concentrations. • Sulfur dioxide is an air pollutant produced when fossil fuels containing sulfur are burned. It contributes to acid rain and can damage human health, particularly that of the young and the elderly. • Nitrogen dioxide is a poisonous, pungent gas formed when nitric oxide combines with hydrocarbons and sunlight, producing a photochemical reaction. These conditions occur in both natural and anthropogenic activities. Nitrogen dioxide is emitted by bacteria, motor vehicles, industrial activities, nitrogenous fertilizers, combustion of fuels and biomass, and aerobic decomposition of organic matter in soils and oceans.

Data sources

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

3.14 Government commitment

	Environmental strategies or action plans	Biodiversity assessments, strategies, or action plans	Participation in treaties					
			Climate change[b]	Ozone layer	CFC control	Law of the Sea[c]	Biological diversity[b]	Kyoto Protocol
Afghanistan	..	..	2002	2004	2004	..	2002	..
Albania	1993	..	1995	1999	1999	2003[f]	1994[f]	..
Algeria	2001	..	1994	1992	1992	1996	1995	..
Angola	..	..	2000	2000	2000	1994	1998	..
Argentina	1992	..	1994	1990	1990	1995	1994	2001
Armenia	..	..	1994	1999	1999	2002[f]	1993[d]	2003[f]
Australia	1992	1994	1994	1987	1989	1994	1993	..
Austria	..	..	1994	1987	1989	1995	1994	2002
Azerbaijan	1998	..	1995	1996	1996	..	2000[e]	2000[f]
Bangladesh	1991	1990	1994	1990	1990	2001	1994	2001[f]
Belarus	..	..	2000	1986	1988	..	1993	..
Belgium	..	..	1996	1988	1988	1998	1996	2002
Benin	1993	..	1994	1993	1993	1997	1994	2002[f]
Bolivia	1994	1988	1995	1994	1994	1995	1994	1999
Bosnia and Herzegovina	..	..	2000	1992	1992	1994[g]	2002[f]	..
Botswana	1990	1991	1994	1991	1991	1994	1995	2003[f]
Brazil	..	1988	1994	1990	1990	1994	1994	2002
Bulgaria	..	1994	1995	1990	1990	1996	1996	2002
Burkina Faso	1993	..	1994	1989	1989	..	1993	..
Burundi	1994	1989	1997	1997	1997	..	1997	2001[f]
Cambodia	1999	..	1996	2001	2001	..	1995[f]	2002[f]
Cameroon	..	1989	1995	1989	1989	1994	1994	2002[f]
Canada	1990	1994	1994	1986	1988	2003	1992	2002
Central African Republic	..	..	1995	1993	1993	..	1995	..
Chad	1990	..	1994	1989	1994	..	1994	..
Chile	..	1993	1995	1990	1990	1997	1994	2002
China	1994	1994	1994	1989	1991	1996	1993	2002[e]
Hong Kong, China	..	..	..	..	..	..	..	..
Colombia	1998	1988	1995	1990	1993		1994	2001[f]
Congo, Dem. Rep.	..	1990	1995	1994	1994	1995	1996	..
Congo, Rep.	..	1990	1997	1994	1994	..	1994	..
Costa Rica	1990	1992	1994	1991	1991	1994	1994	2002
Côte d'Ivoire	1994	1991	1995	1993	1993	1994	1994	..
Croatia	2001	2000	1996	1991	1991	1994[g]	1996	..
Cuba	..	..	1994	1992	1992	1994	1994	2002
Czech Republic	1994	..	1994	1993	1993	1996	1993[e]	2001[e]
Denmark	1994	..	1994	1988	1988	2004	1993	2002
Dominican Republic	..	1995	1999	1993	1993	..	1996	2002[f]
Ecuador	1993	1995	1994	1990	1990	..	1993	2000
Egypt, Arab Rep.	1992	1988	1995	1988	1988	1994	1994	..
El Salvador	1994	1988	1996	1992	1992	..	1994	1998
Eritrea	1995	..	1995	..	..	..	1996[f]	..
Estonia	1998	..	1994	1996	1996	..	1994	2002
Ethiopia	1994	1991	1994	1994	1994	..	1994	..
Finland	1995	..	1994	1986	1988	1996	1994[d]	2002
France	1990	..	1994	1987	1988	1996	1994	2002[e]
Gabon	..	1990	1998	1994	1994	1998	1997	..
Gambia, The	1992	1989	1994	1990	1990	1994	1994	2001[f]
Georgia	1998	..	1994	1996	1996	1996[f]	1994[f]	1999[f]
Germany	..	..	1994	1988	1988	1994[f]	1993	2002
Ghana	1992	1988	1995	1989	1989	1994	1994	2003[f]
Greece	..	..	1994	1988	1988	1995	1994	2002
Guatemala	1994	1988	1996	1987	1989	1997	1995	1999
Guinea	1994	1988	1994	1992	1992	1994	1993	2000[f]
Guinea-Bissau	1993	1991	1996	2002	2002	1994	1995	..
Haiti	1999	..	1996	2000	2000	1996	1996	..

3.14a

The Kyoto Protocol on climate change

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

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

The protocol's rules focus on:

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

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

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

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

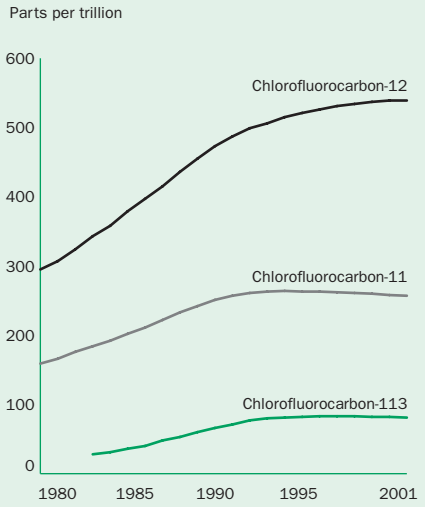
The table contains the latest information on dates of signature and ratification from the Secretary-General of the United Nations, the depository of the Kyoto Protocol. The dates are those of the receipt of the instrument of ratification, acceptance, approval, or accession. With a total of 141 countries accounting for at least 55 percent of global greenhouse gas emissions, the Kyoto Protocol finally came into force and became a legally binding treaty on February 16, 2005.

Government commitment

	Environmental strategies or action plans	Biodiversity assessments, strategies, or action plans	Participation in treaties					
			Climate change[b]	Ozone layer	CFC control	Law of the Sea[c]	Biological diversity[b]	Kyoto Protocol
Honduras	1993	..	1996	1993	1993	1994	1995	2000
Hungary	1995	..	1994	1988	1989	2002	1994	2002[f]
India	1993	1994	1994	1991	1992	1995	1994	2002[f]
Indonesia	1993	1993	1994	1992	1992	1994	1994	2004
Iran, Islamic Rep.	..	..	1996	1990	1990	..	1996	..
Iraq	..	..	..	..	..	1994	..	..
Ireland	..	..	1994	1988	1988	1996	1996	2002
Israel	..	..	1996	1992	1992	..	1995	2004
Italy	..	..	1994	1988	1988	1995	1994	2002
Jamaica	1994	..	1995	1993	1993	1994	1995	1999[f]
Japan	..	..	1994	1988	1988	1996	1993[d]	2002[d]
Jordan	1991	..	1994	1989	1989	1995[f]	1993	2003[f]
Kazakhstan	..	..	1995	1998	1998	..	1994	..
Kenya	1994	1992	1994	1988	1988	1994	1994	..
Korea, Dem. Rep.	..	..	1995	1995	1995	..	1994[e]	..
Korea, Rep.	..	..	1994	1992	1992	1996	1994	2002
Kuwait	..	..	1995	1992	1992	1994	2002	..
Kyrgyz Republic	1995	..	2000	2000	2000	..	1996[e]	2003[f]
Lao PDR	1995	..	1995	1998	1998	1998	1996[e]	2003[f]
Latvia	..	..	1995	1995	1995	..	1995	2002
Lebanon	..	..	1995	1993	1993	1995	1994	..
Lesotho	1989	..	1995	1994	1994	..	1995	2000[f]
Liberia			2003	1996	1996	..	2000	2002[f]
Libya	..	..	1999	1990	1990	..	2001	..
Lithuania	..	..	1995	1995	1995	2003[f]	1996	2003
Macedonia, FYR	..	..	1998	1994	1994	1994[g]	1997[f]	2004[f]
Madagascar	1988	1991	1999	1996	1996	2001	1996	2003[f]
Malawi	1994	..	1994	1991	1991	..	1994	2001[f]
Malaysia	1991	1988	1994	1989	1989	1996	1994	2002
Mali	..	1989	1995	1994	1994	1994	1995	2002
Mauritania	1988	..	1994	1994	1994	1996	1996	..
Mauritius	1990	..	1994	1992	1992	1994	1992	2001[f]
Mexico	..	1988	1994	1987	1988	1994	1993	2000
Moldova	2002	..	1995	1996	1996	..	1995	2003[f]
Mongolia	1995	..	1994	1996	1996	1996	1993	1999[f]
Morocco	..	1988	1996	1995	1995	..	1995	2002[f]
Mozambique	1994	..	1995	1994	1994	1997	1995	2005[f]
Myanmar	..	1989	1995	1993	1993	1996	1995	2003[f]
Namibia	1992	..	1995	1993	1993	1994	1997	2003[f]
Nepal	1993	..	1994	1994	1994	1998	1993	..
Netherlands	1994	..	1994	1988	1988	1996	1994[d]	2002[f]
New Zealand	1994	..	1994	1987	1988	1996	1993	2002
Nicaragua	1994	..	1996	1993	1993	2000	1995	1999
Niger	..	1991	1995	1992	1992	..	1995	2004
Nigeria	1990	1992	1994	1988	1988	1994	1994	..
Norway	..	1994	1994	1986	1988	1996	1993	2002
Oman	..	..	1995	1999	1999	1994	1995	2005[f]
Pakistan	1994	1991	1994	1992	1992	1997	1994	..
Panama	1990	..	1995	1989	1989	1996	1995	1999
Papua New Guinea	1992	1993	1994	1992	1992	1997	1993	2002
Paraguay	..	..	1994	1992	1992	1994	1994	1999
Peru	..	1988	1994	1989	1993	..	1993	2002
Philippines	1989	1989	1994	1991	1991	1994	1993	2003
Poland	1993	1991	1994	1990	1990	1998	1996	2002
Portugal	1995	..	1994	1988	1988	1997	1993	2002[e]
Puerto Rico	..	..	..	..	..	..	..	..

3.14b

Global atmospheric concentrations of chlorofluorocarbons have leveled off



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

	Environmental strategies or action plans	Biodiversity assessments, strategies, or action plans	Participation in treaties					
			Climate change[b]	Ozone layer	CFC control	Law of the Sea[c]	Biological diversity[b]	Kyoto Protocol
Romania	1995	..	1994	1993	1993	1996	1994	2001
Russian Federation	1999	1994	1995	1986	1988	1997	1995	2004
Rwanda	1991	..	1998	2001	2001	..	1996	2004[f]
Saudi Arabia	..	..	1995	1993	1993	1996	2001[e]	2005[f]
Senegal	1984	1991	1995	1993	1993	1994	1994	2001[f]
Sierra Leone	1994	..	1995	2001	2001	1994	1994[e]	..
Singapore	1993	1995	1997	1989	1989	1994	1995	..
Slovak Republic	..	..	1994	1993	1993	1996	1994[e]	2002
Slovenia	1994	..	1996	1992	1992	1995[g]	1996	2002
Somalia			..	2001	2001	1994	..	..
South Africa	1993	..	1997	1990	1990	1997	1995	2002[f]
Spain	..	..	1994	1988	1988	1997	1995	2002
Sri Lanka	1994	1991	1994	1989	1989	1994	1994	2002[f]
Sudan	..	..	1994	1993	1993	1994	1995	2004
Swaziland			1997	1992	1992	..	1994	..
Sweden	..	..	1994	1986	1988	1996	1993	2002
Switzerland	..	..	1994	1987	1988	..	1994	2003
Syrian Arab Republic	1999	..	1996	1989	1989	..	1996	..
Tajikistan	..	..	1998	1996	1998	..	1997[e]	..
Tanzania	1994	1988	1996	1993	1993	1994	1996	2002[f]
Thailand	..	..	1995	1989	1989	..	2004	2002
Togo	1991	..	1995	1991	1991	1994	1995[d]	2004[f]
Trinidad and Tobago	..	..	1994	1989	1989	1994	1996	1999
Tunisia	1994	1988	1994	1989	1989	1994	1993	2003[f]
Turkey	1998	..	2004	1991	1991	..	1997	..
Turkmenistan	..	..	1995	1993	1993	..	1996[e]	1999
Uganda	1994	1988	1994	1988	1988	1994	1993	2002[f]
Ukraine	1999	..	1997	1986	1988	1999	1995	2004
United Arab Emirates	..	..	1996	1989	1989	..	2000	2005[f]
United Kingdom	1995	1994	1994	1987	1988	1997[f]	1994	2002
United States	1995	1995	1994	1986	1988	..	..	..
Uruguay	..	..	1994	1989	1991	1994	1993	2001
Uzbekistan	..	..	1994	1993	1993	..	1995[e]	1999
Venezuela	..	..	1995	1988	1989	..	1994	..
Vietnam	..	1993	1995	1994	1994	1994	1994	2002
West Bank and Gaza	..	..	..	..	..	..	..	..
Yemen, Rep.	1996	1992	1996	1996	1996	1994	1996	2004[f]
Yugoslavia, Fed. Rep.	..	..	2001	1992	1992	2001[g]	2002	..
Zambia	1994	..	1994	1990	1990	1994	1993	..
Zimbabwe	1987	..	1994	1992	1992	1994	1994	..

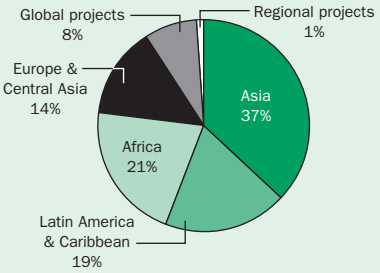
a. Ratification of the treaty. b. The years shown refer to the year the treaty entered into force in that country. c. Convention became effective November 16, 1994. d. Acceptance. e. Approval. f. Accession. g. Succession.

3.14c

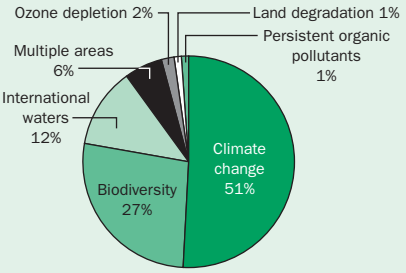
Global focus on biodiversity and climate change

Allocation of funds for Global Environment Facility programs, 1991–2005
Total allocation: $23,108 million

By region



By focal area



Source: Global Environment Facility data.

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 (box 3.14a). These plans are a continuing process in which governments develop comprehensive environmental policies, recommend specific actions, and outline the investment strategies, legislation, and institutional arrangements required to implement them.

Biodiversity profiles—prepared by the World Conservation Monitoring Centre and the IUCN—provide basic background on species diversity, protected areas, major ecosystems and habitat types, and legislative and administrative support. In an effort to establish a scientific baseline for measuring progress in biodiversity conservation, the United Nations Environment Programme (UNEP) coordinates global biodiversity assessments.

To address global issues, many governments have also signed international treaties and agreements launched in the wake of the 1972 United Nations Conference on Human Environment in Stockholm and the 1992 United Nations Conference on Environment and Development (the Earth Summit) in Rio de Janeiro, which produced Agenda 21—an array of actions to address environmental challenges:

- The Framework Convention on Climate Change aims to stabilize atmospheric concentrations of greenhouse gases at levels that will prevent human activities from interfering dangerously with the global climate.
- The Vienna Convention for the Protection of the Ozone Layer aims to protect human health and the environment by promoting research on the effects of changes in the ozone layer and on alternative substances (such as substitutes for chlorofluorocarbons) and technologies, monitoring the ozone layer, and taking measures to control the activities that produce adverse effects.
- The Montreal Protocol for 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 (UNDP), and the World Bank manage the GEF according to the policies of its governing body of country representatives. The World Bank is responsible for the GEF Trust Fund and is chair of the GEF.

Definitions

• Environmental strategies and action plans provide a comprehensive, cross-sectoral analysis of conservation and resource management issues to help integrate environmental concerns with the development process. They include national conservation strategies, national environmental action plans, national environmental management strategies, and national sustainable development strategies. The year shown for a country refers to the year in which a strategy or action plan was adopted. • Biodiversity assessments, strategies, and action plans include biodiversity profiles (see About the data). • Participation in treaties covers five international treaties (see About the data). • Climate change refers to the Framework Convention on Climate Change (signed in New York in 1992). • Ozone layer refers to the Vienna Convention for the Protection of the Ozone Layer (signed in 1985). • CFC control refers to the Montreal Protocol for Chlorofluorocarbon Control (formally, the Protocol on Substances That Deplete the Ozone Layer, signed in 1987). • Law of the Sea refers to the United Nations Convention on the Law of the Sea (signed in Montego Bay, Jamaica, in 1982). • Biological diversity refers to the Convention on Biological Diversity (signed at the Earth Summit in Rio de Janeiro in 1992). The year shown for a country refers to the year in which a treaty entered into force in that country. • Kyoto Protocol refers to the protocol on climate change adopted at the third conference of the parties to the United Nations Framework Convention on Climate Change, held in Kyoto, Japan, in December 1997 (for more details see box 3.14a).

Data sources

The data are from the Secretariat of the United Nations Framework Convention on Climate Change, the Ozone Secretariat of the UNEP, the World Resources Institute, the UNEP, the U.S. National Aeronautics and Space Administration's Socioeconomic Data and Applications Center, and Center for International Earth Science Information Network.

3.15 Toward a broader measure of savings

	Gross national savings	Consumption of fixed capital	Net national savings	Education expenditure	Energy depletion	Mineral depletion	Net forest depletion	Carbon dioxide damage	Particulate emission damage	Adjusted net savings
	% of GNI 2003	% of GNI 2003	% of GNI 2003	% of GNI 2003	% of GNI 2003	% of GNI 2003	% of GNI 2003	% of GNI 2003	% of GNI 2003	% of GNI 2003
Afghanistan	..	..	..	..	..	..	..	..	..	..
Albania	18.2	9.6	8.6	2.8	0.9	0.0	0.0	0.3	0.1	10.2
Algeria	43.1	11.0	32.1	4.5	37.5	0.1	0.1	1.2	0.7	–2.9
Angola	22.2	11.0	11.2	4.4	43.6	0.0	0.0	0.5	..	–28.5[a]
Argentina	21.9	11.3	10.6	3.2	6.3	0.1	0.0	0.6	1.6	5.2
Armenia	17.2	8.6	8.6	1.8	0.0	0.1	0.0	1.1	2.0	7.3
Australia	19.7	16.1	3.6	4.5	1.3	1.4	0.0	0.5	0.1	4.9
Austria	22.7	14.5	8.2	5.6	0.1	0.0	0.0	0.2	0.2	13.3
Azerbaijan	22.2	15.0	7.2	3.0	45.4	0.0	0.0	5.0	1.0	–41.2
Bangladesh	28.4	5.8	22.6	1.3	2.0	0.0	0.8	0.4	0.3	20.5
Belarus	21.2	9.3	12.0	5.4	2.0	0.0	0.0	3.0	0.0	12.4
Belgium	24.0	14.4	9.6	3.0	0.0	0.0	0.0	0.2	0.2	12.2
Benin	4.8	8.2	–3.4	2.7	0.0	0.0	1.1	0.3	0.3	–2.4
Bolivia	12.0	9.2	2.8	4.8	8.7	0.9	0.0	1.2	0.7	–3.8
Bosnia and Herzegovina	10.3	9.3	1.0	..	0.1	0.0	0.0	2.0	0.4	..
Botswana	35.6	11.8	23.8	5.6	0.0	0.3	0.0	0.4	..	28.7[a]
Brazil	19.1	10.8	8.4	3.9	3.1	1.1	0.0	0.4	0.2	7.4
Bulgaria	13.3	10.5	2.8	3.0	0.1	0.4	0.0	1.8	2.1	1.3
Burkina Faso	6.6	7.6	–1.0	2.4	0.0	0.0	1.0	0.2	0.5	–0.2
Burundi	22.4	5.9	16.5	4.1	0.0	0.1	14.0	0.3	0.1	6.2
Cambodia	21.0	7.8	13.3	2.0	0.0	0.0	0.9	0.1	0.1	14.2
Cameroon	11.9	9.2	2.7	2.3	5.2	0.0	0.0	0.5	0.7	–1.4
Canada	20.5	13.0	7.5	6.9	4.7	0.1	0.0	0.4	0.2	9.0
Central African Republic	11.6	7.5	4.2	1.6	0.0	0.0	0.0	0.1	0.4	5.2
Chad	11.9	8.3	3.7	1.4	0.0	0.0	0.0	0.0	..	5.1[a]
Chile	24.5	10.1	14.4	3.8	0.4	5.9	0.0	0.6	1.0	10.3
China	47.9	9.2	38.7	2.0	2.9	0.2	0.0	2.2	1.0	34.5
Hong Kong, China	34.3	12.5	21.8	2.8	0.0	0.0	0.0	0.2	0.0	24.5
Colombia	14.6	10.2	4.4	3.1	7.7	0.3	0.0	0.6	0.1	–1.1
Congo, Dem. Rep.	..	6.6	..	0.9	2.2	0.0	0.0	0.3	0.0	..
Congo, Rep.	29.8	11.9	17.9	5.9	49.3	0.2	0.0	0.6	..	–26.3[a]
Costa Rica	15.3	6.0	9.3	4.9	0.0	0.0	0.3	0.3	0.3	13.4
Côte d'Ivoire	14.8	9.2	5.6	4.5	2.6	0.0	0.6	0.4	0.6	5.8
Croatia	22.2	12.0	10.2	..	1.1	0.0	0.0	0.6	0.3	..
Cuba	..	..	..	6.1	..	..	..	..	..	..
Czech Republic	22.4	12.5	9.9	4.0	0.1	0.0	0.0	0.9	0.1	12.8
Denmark	23.5	15.2	8.3	7.9	0.7	0.0	0.0	0.2	0.1	15.2
Dominican Republic	29.4	5.5	23.9	2.3	0.0	0.5	0.0	1.1	0.2	24.3
Ecuador	25.1	10.6	14.5	3.2	15.1	0.0	0.0	0.6	0.1	1.9
Egypt, Arab Rep.	20.1	9.3	10.9	4.4	7.7	0.1	0.2	1.1	1.4	4.8
El Salvador	16.4	9.8	6.6	2.4	0.0	0.0	0.5	0.3	0.2	8.0
Eritrea	3.0	5.6	–2.5	1.4	0.0	0.0	0.0	0.4	0.5	–2.0
Estonia	19.2	14.6	4.6	6.3	0.6	0.0	0.0	1.8	0.2	8.3
Ethiopia	18.4	5.9	12.5	4.0	0.0	0.1	12.6	0.5	0.3	2.9
Finland	24.5	16.2	8.2	7.0	0.0	0.0	0.0	0.3	0.1	14.8
France	20.0	12.7	7.3	5.2	0.0	0.0	0.0	0.2	0.0	12.3
Gabon	36.4	12.8	23.5	2.7	24.5	0.0	0.0	0.5	0.1	1.1
Gambia, The	8.8	7.8	1.0	3.4	0.0	0.0	0.6	0.5	0.7	2.5
Georgia	14.8	16.1	–1.3	4.3	0.4	0.0	0.0	1.0	2.5	–1.0
Germany	20.3	14.9	5.4	4.2	0.1	0.0	0.0	0.2	0.1	9.3
Ghana	..	7.2	..	2.8	0.0	1.1	2.3	0.6	0.2	..
Greece	20.3	8.8	11.5	3.1	0.1	0.1	0.0	0.4	0.7	13.5
Guatemala	13.9	10.1	3.8	1.6	0.9	0.0	0.9	0.3	0.2	3.1
Guinea	10.3	8.0	2.3	2.0	0.0	1.4	1.7	0.3	0.6	0.2
Guinea-Bissau	–5.7	6.9	–12.6	..	0.0	0.0	0.0	0.6	..	..
Haiti	..	1.8	..	1.5	0.0	0.0	1.3	0.3	0.2	..

Toward a broader measure of savings

	Gross national savings	Consumption of fixed capital	Net national savings	Education expenditure	Energy depletion	Mineral depletion	Net forest depletion	Carbon dioxide damage	Particulate emission damage	Adjusted net savings
	% of GNI 2003	% of GNI 2003	% of GNI 2003	% of GNI 2003	% of GNI 2003	% of GNI 2003	% of GNI 2003	% of GNI 2003	% of GNI 2003	% of GNI 2003
Honduras	23.6	5.6	18.0	3.5	0.0	0.1	0.0	0.5	0.2	20.8
Hungary	17.7	12.4	5.3	5.0	0.5	0.0	0.0	0.6	0.4	8.9
India	24.8	9.6	15.1	3.9	2.4	0.3	0.9	1.5	0.7	13.2
Indonesia	18.8	5.4	13.4	1.3	8.8	1.3	0.0	0.8	0.5	3.3
Iran, Islamic Rep.	42.7	10.0	32.8	4.6	33.2	0.1	0.0	1.7	0.7	1.7
Iraq	..	..	..	..	..	..	..	..	..	..
Ireland	26.4	12.6	13.8	5.7	0.0	0.1	0.0	0.3	0.1	19.0
Israel	14.2	14.7	–0.5	6.8	0.0	0.1	0.0	0.4	0.0	5.8
Italy	18.7	13.7	5.0	4.4	0.1	0.0	0.0	0.2	0.2	8.9
Jamaica	20.0	11.4	8.6	6.0	0.0	1.1	0.0	0.9	0.3	12.2
Japan	26.7	15.9	10.8	3.2	0.0	0.0	0.0	0.2	0.4	13.5
Jordan	28.1	10.6	17.5	4.4	0.4	1.0	0.0	1.2	0.7	18.6
Kazakhstan	28.1	10.5	17.5	4.4	38.9	0.6	0.0	4.1	0.4	–22.1
Kenya	13.1	8.0	5.1	6.1	0.0	0.0	0.6	0.4	0.2	9.9
Korea, Dem. Rep.	..	..	..	..	..	..	..	..	..	..
Korea, Rep.	31.5	12.4	19.2	3.0	0.0	0.0	0.0	0.5	0.8	20.9
Kuwait	24.8	7.2	17.6	5.0	50.8	0.0	0.0	0.7	2.0	–30.9
Kyrgyz Republic	15.1	8.0	7.1	3.2	1.2	0.0	0.0	2.3	0.2	6.5
Lao PDR	19.1	7.8	11.3	1.8	0.0	0.0	0.0	0.2	0.2	12.8
Latvia	20.5	10.8	9.7	5.1	0.0	0.0	0.0	0.6	0.3	13.8
Lebanon	–7.9	11.4	–18.4	2.5	0.0	0.0	0.0	0.6	0.6	–18.1
Lesotho	–2.4	6.9	–9.3	7.3	0.0	0.0	1.7	..	0.4	..
Liberia	0.6	7.4	–6.7	..	0.0	0.3	5.3	1.0	0.0	..
Libya	..	..	..	..	..	..	..	..	..	..
Lithuania	15.8	10.3	5.5	5.2	0.0	0.0	0.0	0.7	0.7	9.3
Macedonia, FYR	17.6	10.2	7.4	4.9	0.0	0.0	0.0	1.7	0.3	10.3
Madagascar	12.0	7.6	4.4	1.7	0.0	0.0	0.0	0.2	0.2	5.6
Malawi	–6.5	6.7	–13.2	4.4	0.0	0.0	2.3	0.3	0.2	–11.6
Malaysia	36.3	11.6	24.8	5.3	12.1	0.0	0.0	1.0	0.1	17.0
Mali	15.6	8.0	7.6	2.1	0.0	0.0	0.0	0.1	0.5	9.2
Mauritania	8.7	7.4	1.3	3.7	0.0	18.8	0.8	2.1	..	..
Mauritius	26.3	10.9	15.4	3.3	0.0	0.0	0.0	0.3	..	18.3[a]
Mexico	18.7	10.5	8.2	5.1	6.2	0.1	0.0	0.5	0.5	6.0
Moldova	17.0	6.8	10.1	3.5	0.0	0.0	0.0	2.8	0.5	10.3
Mongolia	18.1	10.9	7.1	5.7	0.0	2.4	0.0	4.6	0.5	5.3
Morocco	27.9	9.7	18.2	4.8	0.0	0.3	0.1	0.6	0.2	21.8
Mozambique	12.6	7.4	5.2	3.8	0.0	0.0	0.0	0.3	0.4	8.3
Myanmar	..	..	..	0.9	..	..	..	..	..	..
Namibia	31.5	12.3	19.3	7.4	0.0	0.3	0.0	0.3	0.2	25.9
Nepal	31.6	2.4	29.2	3.2	0.0	0.0	4.2	0.4	0.1	27.7
Netherlands	23.3	15.2	8.1	4.9	0.7	0.0	0.0	0.2	0.4	11.7
New Zealand	21.9	10.8	11.1	6.9	0.9	0.1	0.0	0.3	0.0	16.6
Nicaragua	21.6	8.8	12.7	3.7	0.0	0.1	1.0	0.6	0.0	14.7
Niger	4.6	7.1	–2.5	2.3	0.0	0.0	3.1	0.3	0.4	–4.1
Nigeria	20.3	9.2	11.1	0.9	42.1	0.0	0.0	0.5	0.8	–31.4
Norway	30.3	15.9	14.4	6.1	6.9	0.0	0.0	0.2	0.1	13.3
Oman	..	..	..	3.7	..	..	..	..	..	..
Pakistan	22.7	7.8	14.9	2.3	3.7	0.0	0.9	0.9	1.0	10.7
Panama	24.0	8.0	15.9	4.3	0.0	0.0	0.0	0.4	0.3	19.5
Papua New Guinea	..	9.6	..	..	13.5	8.3	0.0	0.6	0.0	..
Paraguay	8.2	9.1	–0.9	3.9	0.0	0.0	0.0	0.4	0.4	2.2
Peru	18.1	10.4	7.6	2.6	1.1	1.5	0.0	0.3	0.6	6.6
Philippines	22.8	8.0	14.8	2.8	0.2	0.2	0.2	0.7	0.4	16.0
Poland	17.1	11.4	5.7	5.1	0.5	0.1	0.0	1.2	0.7	8.3
Portugal	..	15.3	..	5.7	0.0	0.0	0.0	0.3	0.4	..
Puerto Rico	..	..	..	..	..	..	..	..	..	..

3.15 Toward a broader measure of savings

	Gross national savings	Consumption of fixed capital	Net national savings	Education expenditure	Energy depletion	Mineral depletion	Net forest depletion	Carbon dioxide damage	Particulate emission damage	Adjusted net savings
	% of GNI 2003	% of GNI 2003	% of GNI 2003	% of GNI 2003	% of GNI 2003	% of GNI 2003	% of GNI 2003	% of GNI 2003	% of GNI 2003	% of GNI 2003
Romania	18.5	10.5	8.1	3.6	3.2	0.0	0.0	1.2	0.2	7.1
Russian Federation	29.8	10.8	19.0	3.5	29.6	0.3	0.0	2.8	0.6	–10.7
Rwanda	11.7	6.7	5.0	3.5	0.0	0.0	3.3	0.3	0.0	4.8
Saudi Arabia	35.3	10.0	25.3	7.2	49.2	0.0	0.0	1.1	1.0	–18.8
Senegal	13.9	8.5	5.4	3.7	0.0	0.1	0.3	0.5	..	8.2[a]
Serbia and Montenegro	–6.5	10.4	–16.9	..	1.0	0.1	0.0	1.6	0.2	..
Sierra Leone	1.6	6.7	–5.1	3.9	0.0	0.0	5.5	0.4	0.4	–7.6
Singapore	44.8	14.4	30.4	2.3	0.0	0.0	0.0	0.5	0.4	31.8
Slovak Republic	24.2	11.4	12.8	4.0	0.1	0.0	0.0	0.9	0.1	15.7
Slovenia	25.5	12.6	12.9	5.3	0.0	0.0	0.0	0.4	0.2	17.7
Somalia	..	..	..	..	..	..	..	..	..	..
South Africa	16.3	13.3	3.0	7.6	1.1	0.9	0.2	1.5	0.2	6.6
Spain	23.3	12.9	10.4	4.3	0.0	0.0	0.0	0.2	0.4	14.0
Sri Lanka	21.7	5.2	16.5	2.9	0.0	0.0	0.6	0.3	0.3	18.1
Sudan	22.4	8.9	13.5	0.9	0.0	0.0	0.0	0.2	0.6	13.6
Swaziland	14.2	9.4	4.8	5.1	0.0	0.0	0.0	0.2	0.1	9.7
Sweden	23.1	13.9	9.2	7.7	0.0	0.1	0.0	0.1	0.0	16.7
Switzerland	..	14.9	..	4.9	0.0	0.0	0.0	0.1	0.2	..
Syrian Arab Republic	28.0	9.7	18.3	3.5	33.1	0.1	0.0	1.7	0.8	–13.9
Tajikistan	–7.6	7.6	–15.2	2.0	0.2	0.0	0.0	3.4	0.2	–17.0
Tanzania	9.4	7.4	2.0	2.4	0.0	0.5	0.0	0.3	0.2	3.4
Thailand	31.1	15.0	16.2	3.6	2.0	0.0	0.3	1.0	0.4	16.1
Togo	2.0	7.9	–5.9	4.2	0.0	0.7	3.3	0.9	0.3	–6.9
Trinidad and Tobago	25.9	12.2	13.7	3.9	38.5	0.0	0.0	2.0	0.0	–22.8
Tunisia	22.9	10.0	12.9	6.4	3.7	0.4	0.1	0.6	0.3	14.1
Turkey	19.2	7.0	12.3	3.3	0.2	0.0	0.0	0.6	1.2	13.5
Turkmenistan	..	9.4	..	..	..	0.0	0.0	7.4	0.3	..
Uganda	17.6	7.3	10.3	1.9	0.0	0.0	5.9	0.2	0.0	6.2
Ukraine	26.6	19.0	7.5	6.4	6.4	0.0	0.0	5.9	1.0	0.6
United Arab Emirates	..	..	..	..	..	..	..	..	0.0	..
United Kingdom	14.3	11.4	2.9	5.3	0.9	0.0	0.0	0.2	0.1	7.0
United States	13.5	11.8	1.6	4.8	1.2	0.0	0.0	0.4	0.3	4.7
Uruguay	13.0	11.0	2.0	2.4	0.0	0.0	0.3	0.3	1.9	1.9
Uzbekistan	23.4	7.8	15.6	9.4	61.0	0.0	0.0	9.1	0.6	–45.7
Venezuela, RB	22.1	7.4	14.6	4.3	37.2	0.4	0.0	1.0	0.0	–19.6
Vietnam	27.1	8.0	19.1	2.8	8.1	0.0	0.7	1.0	0.4	11.6
West Bank and Gaza	–22.8	8.1	–31.0	..	0.0	0.0	0.0	..	..	..
Yemen, Rep.	19.2	8.9	10.3	..	37.6	0.0	0.0	1.2	0.5	..
Zambia	15.9	8.1	7.8	2.0	0.0	1.2	0.0	0.4	..	8.2[a]
Zimbabwe	..	..	..	6.9	..	..	..	..	0.5	..
World	20.8 w	12.6 w	8.2 w	4.4 w	2.3 w	0.1 w	0.0 w	0.5 w	0.3	9.4 w
Low income	23.1	8.9	14.2	3.4	5.8	0.3	0.9	1.2	0.6	8.7
Middle income	27.9	10.1	17.8	3.7	9.0	0.4	0.0	1.4	0.7	10.1
Lower middle income	30.7	9.8	20.9	3.2	7.9	0.4	0.0	1.6	0.7	13.4
Upper middle income	22.1	10.7	11.4	5.0	11.4	0.3	0.0	0.8	0.6	3.3
Low & middle income	27.2	9.9	17.3	3.7	8.5	0.4	0.2	1.3	0.6	10.0
East Asia & Pacific	41.8	9.2	32.6	2.3	3.9	0.3	0.1	1.8	0.8	28.1
Europe & Central Asia	21.9	10.7	11.2	4.1	11.2	0.1	0.0	1.9	0.6	1.5
Latin America & Carib.	19.5	10.3	9.2	4.2	6.4	0.7	0.0	0.5	0.5	5.3
Middle East & N. Africa	31.2	10.0	21.3	5.5	30.7	0.1	0.1	1.2	0.8	–6.2
South Asia	24.9	9.0	15.9	3.5	2.4	0.3	0.9	1.4	0.7	13.8
Sub-Saharan Africa	16.9	10.6	6.3	4.7	8.0	0.5	0.6	0.9	0.4	0.7
High income	19.3	13.2	6.1	4.6	0.8	0.0	0.0	0.3	0.3	9.3
Europe EMU	21.3	13.9	7.5	4.6	0.1	0.0	0.0	0.2	0.2	11.6

Note: The cutoff date for data in the table is February 2005; later revisions are not captured in this table.
a. Adjusted net savings do not include particulate emission damage.

Toward a broader measure of savings

About the data

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

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 national savings by making four adjustments. First, estimates of capital consumption of produced assets are deducted to obtain net national savings. Second, current public expenditures on education are added to net national savings (in standard national accounting these expenditures are treated as consumption). Third, estimates of the depletion of a variety of natural resources are deducted to reflect the decline in asset values associated with their extraction and harvest. And fourth, deductions are made for damages from carbon dioxide and particulate emissions.

The exercise treats public education expenditures as an addition to savings effort. The adjustment made to savings goes in the right direction. 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. Researchers should keep this in mind when using the depletion estimates. In general, the data on energy and mineral depletion should not be considered a substitute for energy and mineral gross domestic product.

A positive net depletion figure for forest resources implies that the harvest rate exceeds the rate of natural growth; this is not the same as deforestation, which represents a change in land use (see Definitions for table 3.4). In principle, there should be an addition to savings in countries where growth exceeds harvest, but empirical estimates suggest that most of this net growth is in forested areas that cannot be exploited economically at present. Because the depletion estimates reflect only timber values, they ignore all the external and nontimber benefits associated with standing forests.

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

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

For a detailed methodological note see www.worldbank.org/data.

Definitions

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

Data sources

Gross national savings are derived from the World Bank's national accounts data files, described in the Economy section. Consumption of fixed capital is from the United Nations Statistics Division's National Accounts Statistics: Main Aggregates and Detailed Tables, 1997, extrapolated to 2003. The education expenditure data are from the United Nations Statistics Division's Statistical Yearbook 1997 and from the UNESCO 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 a World Bank working paper, "Estimating National Wealth" (Kunte and others 1998). The unit damage figure for carbon dioxide emissions is from Fankhauser (1995). The estimates of damage from particulate emissions are from Pandey and others (2003). The conceptual underpinnings of the savings measure appear in Hamilton and Clemens (1999).