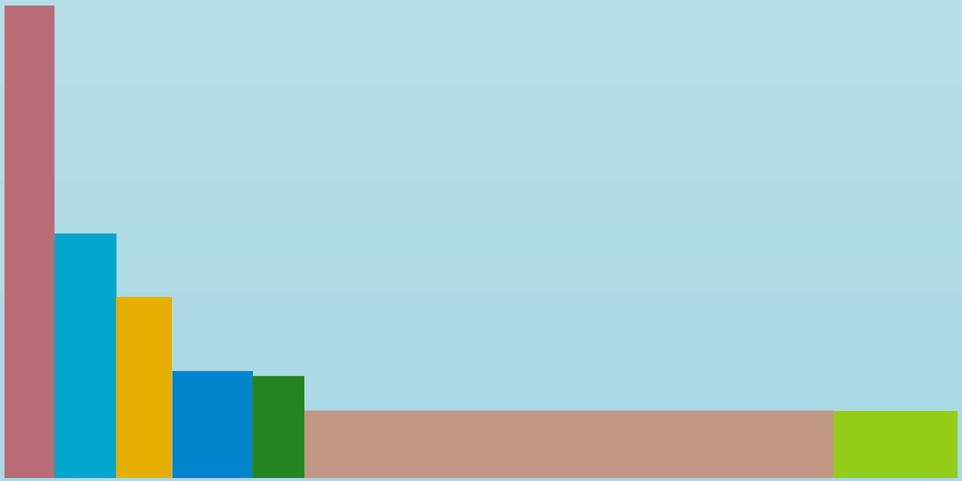
WWF

LIVING PLANET REPORT 2002



UNEP WCMC

REDEFINING PROGRESS

THE UNEP WORLD CONSERVATION MONITORING CENTRE
was established in 2000 as the world biodiversity information and assessment centre of the United Nations Environment Programme (UNEP). UNEP-WCMC provides objective, scientifically rigorous and focused information on global biodiversity.

REDEFINING PROGRESS
is an Oakland, California based think-tank that works to expose the inadequacy of equating economic growth with progress; embrace's nature's limits as a path to true sustainability; promotes pricing systems that incorporate social and environmental costs; and advocates care-taking of common assets.

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FOREWORD

At the Earth Summit in Rio de Janeiro, world leaders committed themselves to the goal of sustainable development. The term sustainable development has since entered into everyday language, and yet it remains an elusive concept. Indeed, it is now used by governments, industry, and non-governmental organizations to mean almost anything they want it to mean. However, in truth, it is a very simple idea. Before the Rio Summit, WWF, along with our partner organizations IUCN–The World Conservation Union and UNEP, published *Caring for the Earth*, a report subtitled "A strategy for sustainable living". We defined sustainable development as "improving the quality of human life while living within the carrying capacity of supporting ecosystems", and this definition remains as valid today as it was then.

The years after Rio have seen improvements in the quality of life for people in many parts of the world, yet we continue to exact an unacceptable price from the Earth's ecosystems at the same time. The past decade has witnessed fires on an unprecedented scale in the tropical forests of Brazil and Indonesia, coral bleaching that has left vast areas of reef in the Caribbean, Indian, and Pacific Oceans as ghosts of their former selves, the collapse of commercially valuable fish stocks in the Atlantic, the ecological devastation of the Black Sea, the Aral Sea, and Lake Chad, and the continual loss of precious wetland and freshwater ecosystems around the world.

What has this to do with sustainable development? We live on a bountiful planet, but not a limitless one. The Earth has a limited capacity to yield its renewable resources. Provided that this capacity is not diminished, the Earth will continue to provide food, materials, energy, and freshwater each year, in perpetuity, for the benefit of all humanity.

Ensuring access to basic resources and improving the health and livelihoods of the world's poorest people cannot be tackled separately from maintaining the integrity of natural ecosystems. We rely on the living biosphere to provide food, materials, water, and, importantly, to absorb carbon dioxide. By continuing to abuse the biosphere, and through the inequitable sharing of the Earth's resources, we undermine the chances of eradicating poverty, and put the whole of humanity under the threat of global climate change.

This report is about measuring human pressure on the Earth, and how that pressure is distributed among countries and regions. The Living Planet Index is a measure of the state of natural ecosystems, according to the abundance of animal species they support, while the ecological footprint compares countries' consumption of natural resources with the Earth's biological capacity to regenerate them. These two measures do not take into account all of the conditions necessary to achieve sustainable development. But unless we recognize the ecological limits of the biosphere, we cannot claim to be sustainable.

Dr Claude Martin
Director General, WWF International

Figure 1:
LIVING PLANET INDEX,
1970–2000

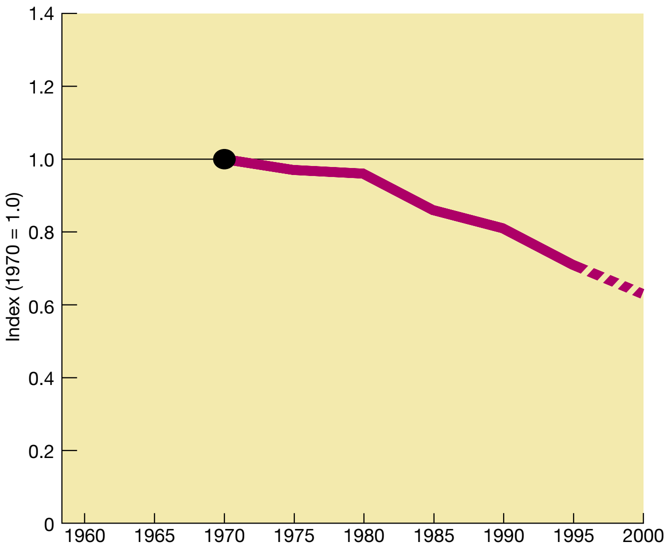


Figure 2:
WORLD ECOLOGICAL FOOTPRINT,
1961–99

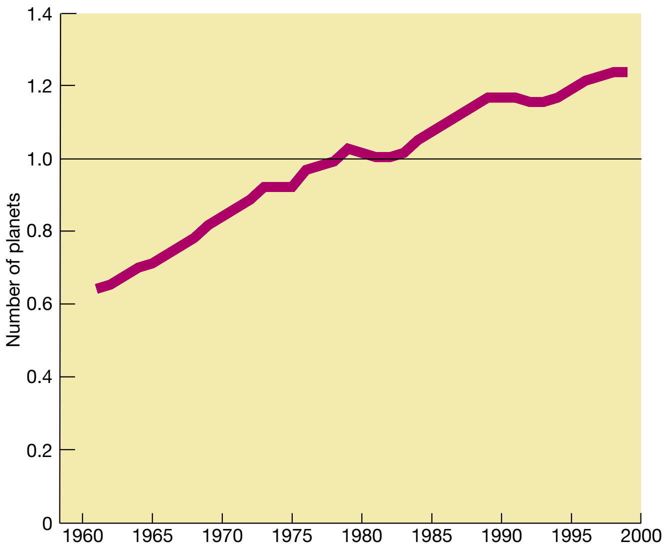


Figure 1: The Living Planet Index is the average of three sub-indices measuring changes in forest, freshwater, and marine ecosystems (see opposite). It fell by 37 per cent between 1970 and 2000. The dotted line indicates the most recent period, for which fewer data are available.

Figure 2: The ecological footprint is a measure of humanity's use of renewable natural resources. It grew by 80 per cent between 1961 and 1999, to a level 20 per cent above the Earth's biological capacity. It is expressed as number of planets, where one planet equals the total biologically productive capacity of the Earth in any one year. Natural resource consumption can exceed the planet's productive capacity by depleting the Earth's natural capital, but this cannot be sustained indefinitely.

THE LIVING PLANET INDEX

The Living Planet Index is an indicator of the state of the world's natural ecosystems. It is calculated as the average of three separate indices which relate to the abundance of forest, freshwater, and marine species. The index shows an overall decline of about 37 per cent between 1970 and 2000 (see Figure 1).

The forest species population index is a measure of the trends in populations of 282 bird, mammal, and reptile species living in forest ecosystems around the world. The freshwater index comprises populations of 195 species of birds, mammals, reptiles, amphibians, and fish from lakes, rivers, and wetland ecosystems. The marine index includes 217 bird, mammal, reptile, and fish species found in marine and coastal ecosystems.

All three indices declined over the 30 year period: terrestrial species populations fell by about 15 per cent on average, marine populations declined by about 35 per cent, and freshwater species populations fell by about 54 per cent. Among the world's biogeographic regions, it appears that tropical and southern temperate regions are losing biodiversity the fastest, whereas northern temperate regions appear to be more stable, or in slower decline since 1970. This does not necessarily imply that northern ecosystems are in a better state than southern or tropical ecosystems, merely that there has been relatively little change in northern ecosystems by comparison over the past 30 years. Also, an analysis of species suggests that birds are generally faring better than other groups.

Time-series population data used in these indices were gathered from numerous published sources. It has not been possible to ascribe confidence limits to the index because of uncertainties within the underlying population data.

Figure 3: The forest species population index shows a 15 per cent decline on average in 282 populations of species of birds, mammals, and reptiles living in forest ecosystems.

Figure 4: The freshwater species population index shows a decline of 54 per cent on average in 195 species of birds, mammals, reptiles, amphibians, and fish living in lakes, rivers, and wetland ecosystems.

Figure 5: The marine species population index shows a decline of 35 per cent on average in 217 species of birds, mammals, reptiles, and fish living in coastal and marine ecosystems.

Figure 3:
FOREST SPECIES POPULATION INDEX, 1970–2000

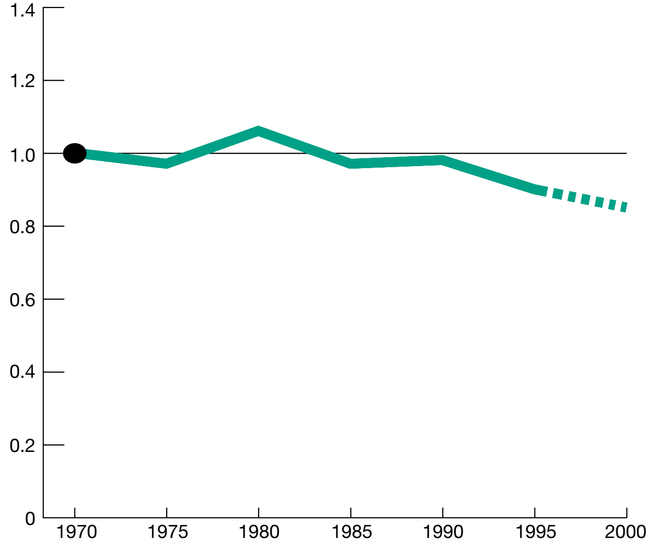


Figure 4:
FRESHWATER SPECIES POPULATION INDEX, 1970–2000

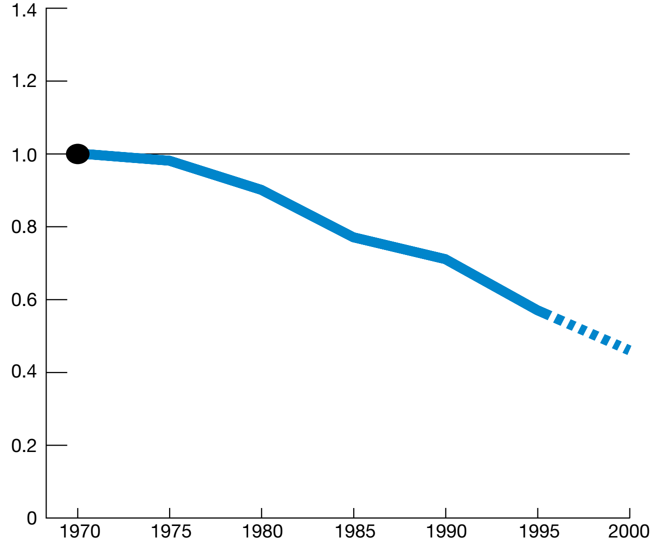
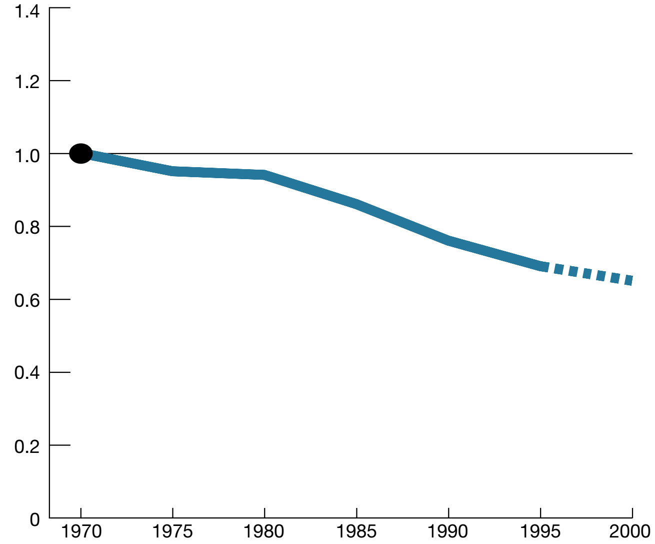


Figure 5:
MARINE SPECIES POPULATION INDEX, 1970–2000



THE ECOLOGICAL FOOTPRINT

The ecological footprint compares renewable natural resource consumption with nature's biologically productive capacity. A country's footprint is the total area required to produce the food and fibres that country consumes, sustain its energy consumption, and give space for its infrastructure. People consume resources from all over the world, so their footprint can be thought of as the sum of these areas, wherever they are on the planet.

The global ecological footprint covered 13.7 billion hectares in 1999, or 2.3 global hectares per person (a global hectare is 1 hectare of average biological productivity). This demand on nature can be compared with the Earth's productive capacity. About 11.4 billion hectares, slightly less than a quarter of the Earth's surface, are biologically productive, harbouring the bulk of the planet's biomass production. The remaining three-quarters, including deserts, ice caps, and deep oceans, support comparatively low concentrations of bioproductivity. The productive quarter of the biosphere corresponded to an average 1.9 global hectares per person in 1999. Therefore human consumption of natural resources that year overshot the Earth's biological capacity by about 20 per cent.

The global ecological footprint changes with population size, average consumption per person, and the kinds of production systems, or technologies, in use. The Earth's biological capacity changes with the size of the biologically productive area, and its average productivity per hectare. Hence changes in population, consumption, and technology can narrow or widen the gap between humanity's footprint and the available biological capacity. It is apparent that, since the 1980s, humanity has been running an ecological deficit with the Earth (see Figure 2).

Figure 6: The ecological footprint per person for all countries with populations over 1 million.

Figure 7: Humanity's ecological footprint grew at an average rate of 1.6 per cent per year from 1961 to 1999. (World population grew slightly faster at 1.8 per cent per year.)

Figure 8: The ecological footprints of seven regions of the world in 1999. The footprint per person of high income countries was on average over six times that of low income countries, and over three times greater than the Earth's biological capacity.

Figure 6:
ECOLOGICAL FOOTPRINT PER PERSON, by country, 1999

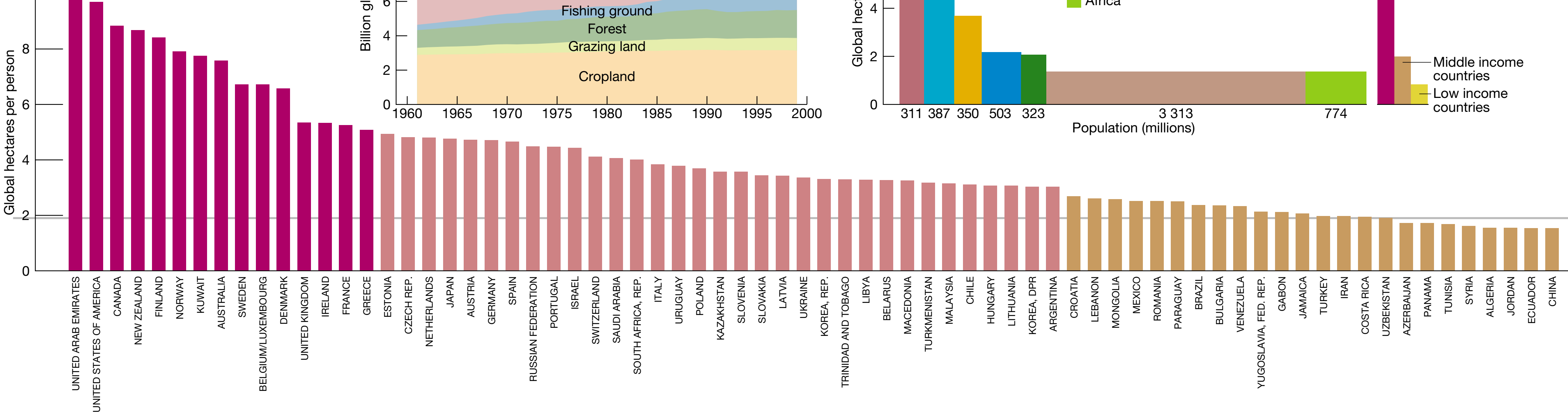


Figure 7:
WORLD ECOLOGICAL FOOTPRINT, 1961–99

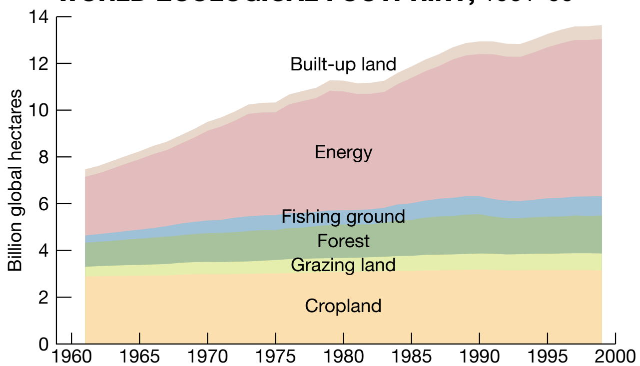
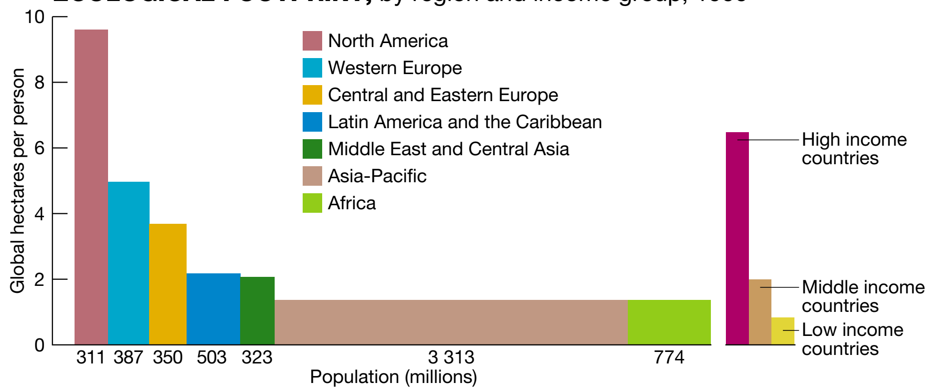
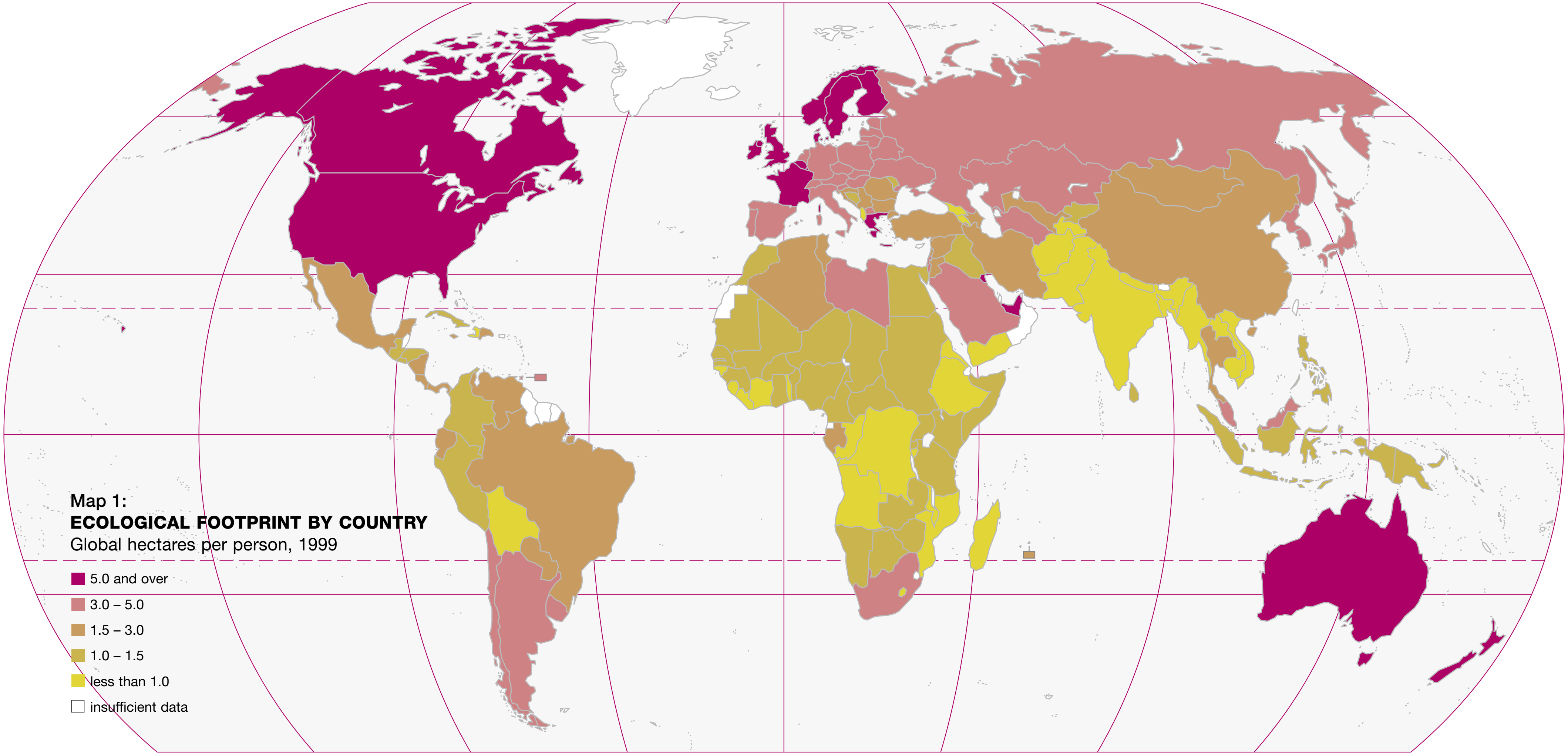
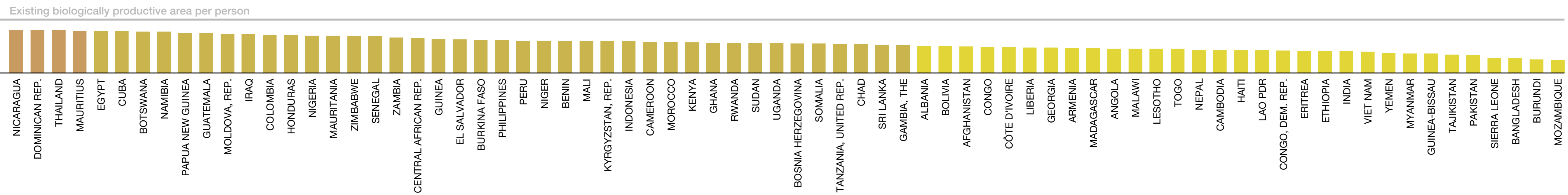


Figure 8:
ECOLOGICAL FOOTPRINT, by region and income group, 1999




Map 1:
ECOLOGICAL FOOTPRINT BY COUNTRY
Global hectares per person, 1999
5.0 and over
3.0 – 5.0
1.5 – 3.0
1.0 – 1.5
less than 1.0
insufficient data


Existing biologically productive area per person
NICARAGUA
DOMINICAN REP.
THAILAND
MAURITIUS
EGYPT
CUBA
BOTSWANA
NAMIBIA
PAPUA NEW GUINEA
GUATEMALA
MOLDOVA, REP.
IRAQ
COLOMBIA
HONDURAS
NIGERIA
MAURITANIA
ZIMBABWE
SENEGAL
ZAMBIA
CENTRAL AFRICAN REP.
GUINEA
EL SALVADOR
BURKINA FASO
PHILIPPINES
PERU
NIGER
BENIN
MALI
KYRGYZSTAN, REP.
INDONESIA
CAMEROON
MOROCCO
KENYA
GHANA
RWANDA
SUDAN
UGANDA
BOSNIA HERZEGOVINA
SOMALIA
TANZANIA, UNITED REP.
CHAD
SRI LANKA
GAMBIA, THE
ALBANIA
BOLIVIA
AFGHANISTAN
CONGO
CÔTE D'IVOIRE
LIBERIA
GEORGIA
ARMENIA
MADAGASCAR
ANGOLA
MALAWI
LESOTHO
TOGO
NEPAL
CAMBODIA
HAITI
LAO PDR
CONGO, DEM. REP.
ERITREA
ETHIOPIA
INDIA
VIET NAM
YEMEN
MYANMAR
GUINEA-BISSAU
TAJIKISTAN
PAKISTAN
SIERRA LEONE
BANGLADESH
BURUNDI
MOZAMBIQUE

CROPLAND FOOTPRINT

A country's cropland footprint is the area required to produce all the crops which that country consumes, including cereals, fruits and vegetables, roots and tubers, pulses, nuts, tea, coffee, sugar, and vegetable oils, as well as tobacco, cotton, jute, and rubber. It also includes crops grown to feed animals whose meat, milk, or eggs are consumed in that country (meat from free-ranging animals is accounted for in the grazing land footprint).

Within each country, the footprint accounts distinguish between two types of cropland: marginal cropland includes lower quality land used for growing sorghum, millet, olives, and fodder grass, and standard cropland includes all other crops. Cropland that is unharvested, temporarily grazed, or fallow land is also included as standard cropland. The cropland footprint does not take account of land lost each year to erosion, salinization, or degradation.

The cropland footprint of the average North American was nearly three times the world average, at 1.55 global hectares, whereas the cropland footprint of an average African or Asian was less than 0.40 global hectares. Worldwide, there were approximately 0.53 global hectares of cropland available per person in 1999.

Figure 9: The cropland footprint per person, by country, compared with the globally available area in 1999.

Figure 10: While population almost doubled, the world's cropland footprint grew by less than 10 per cent between 1961 and 1999, mainly because crop yields improved as a result of increased irrigation and fertilizer use.

Figure 11: The cropland footprints of seven regions of the world in 1999. There was a 3.5-fold difference between high and low income countries, per person.

Figure 9:
CROPLAND FOOTPRINT PER PERSON, by country, 1999

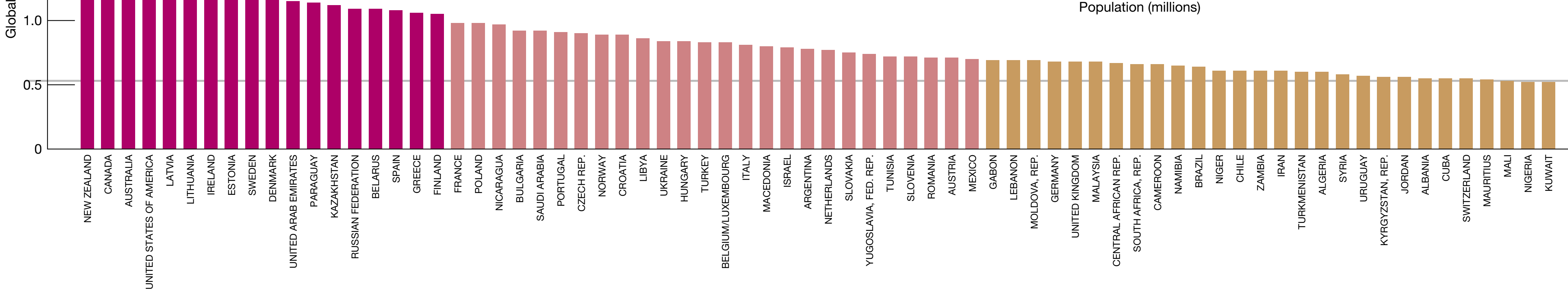


Figure 10:
WORLD CROPLAND FOOTPRINT, 1961–99

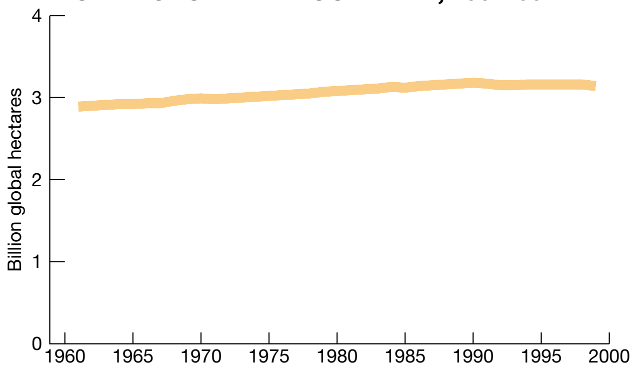
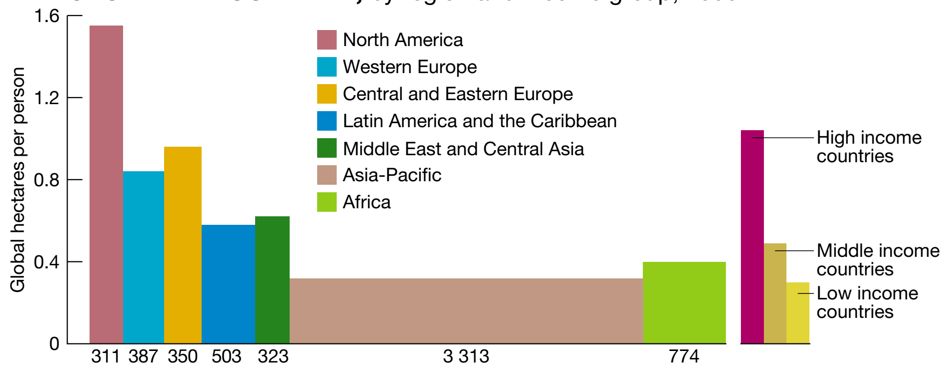
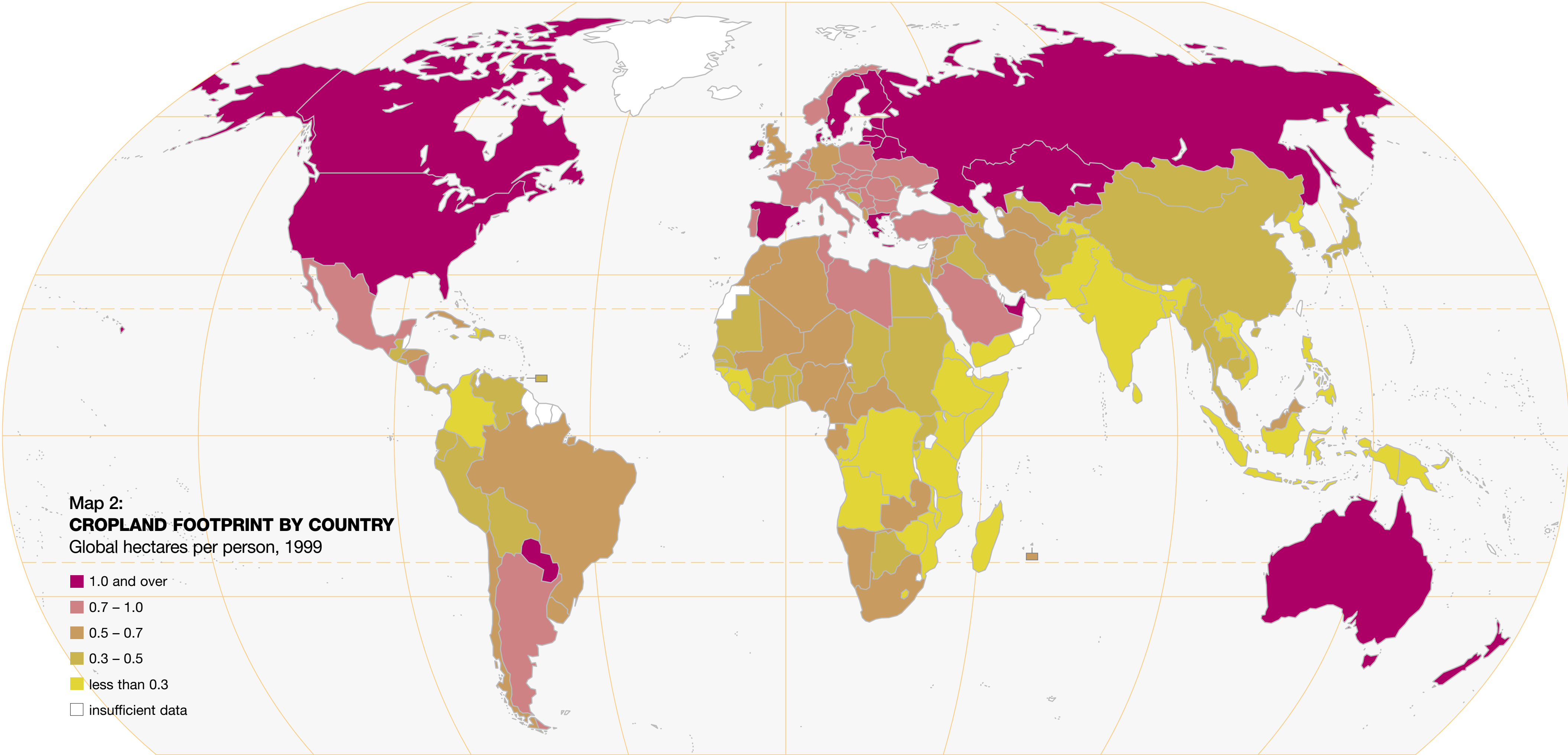
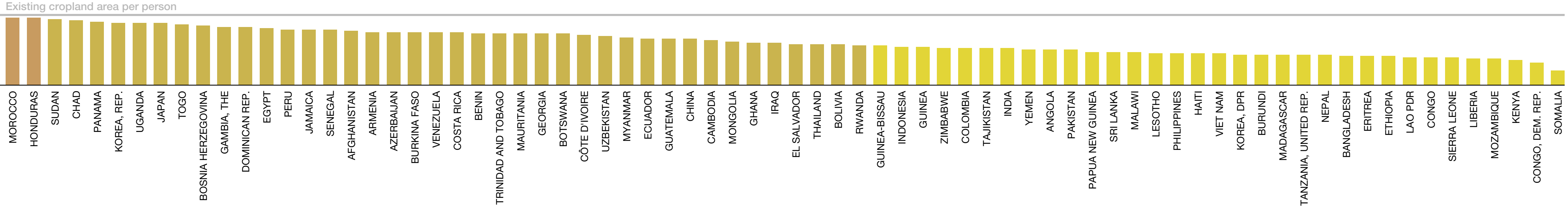


Figure 11:
CROPLAND FOOTPRINT, by region and income group, 1999





Map 2:
CROPLAND FOOTPRINT BY COUNTRY
Global hectares per person, 1999



GRAZING LAND FOOTPRINT

A country's grazing land footprint corresponds to its consumption of meat, dairy products, hides, and wool that come from livestock which are not crop-fed, but occupy permanent pastures. The world's grazing livestock population comprises mainly cattle, sheep, and goats, but also includes horses, asses, and camels, which, though a small proportion worldwide, are important in some regions.

Humanity's grazing land footprint grew from 0.41 billion global hectares in 1961 to 0.73 billion global hectares in 1999. This increase came largely at the expense of forest land.

In 1999, the world average grazing land footprint was 0.12 global hectares per person. In contrast, the grazing land capacity may be as large as 0.27 global hectares per person. The grazing land footprint does not take account of land lost to over-grazing or erosion. Due to poor data on grazing land productivities, the ratio between capacity and demand for grazing products is uncertain.

Figure 12: Some low income countries had a comparatively large grazing land footprint because a high proportion of their land was less productive than the world average, and suitable only for grazing.

Figure 13: Humanity's demand for grazing land increased by 80 per cent between 1961 and 1999.

Figure 14: There was an eight-fold disparity between the grazing land footprints per person of high income and low income countries in 1999, mainly due to the greater amount of meat and dairy products in the diets of the richer nations.

Figure 12:
GRAZING LAND FOOTPRINT PER PERSON, by country, 1999

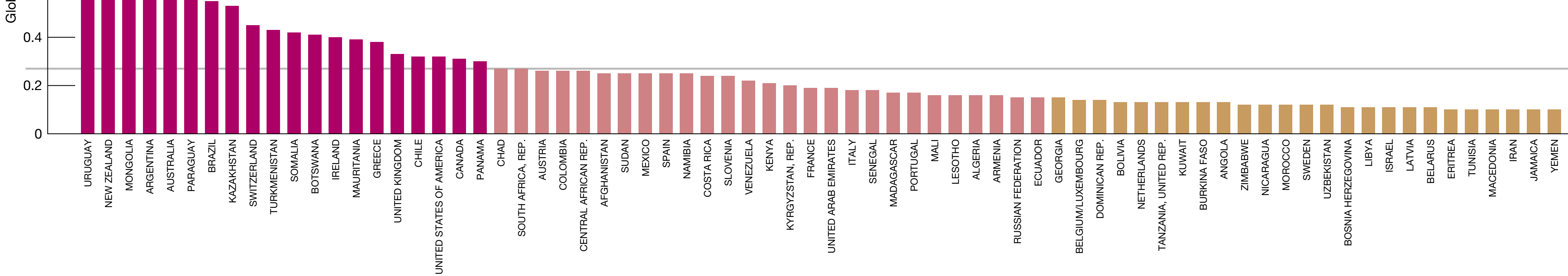


Figure 13:
WORLD GRAZING LAND FOOTPRINT, 1961–99

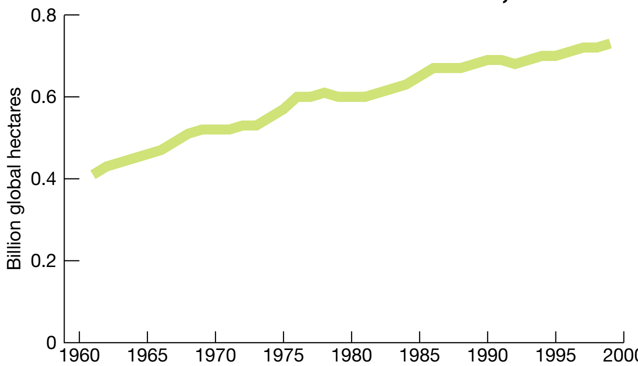
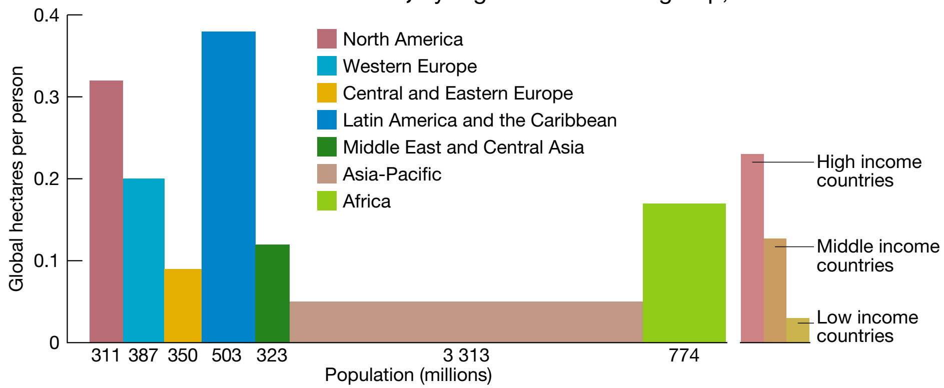
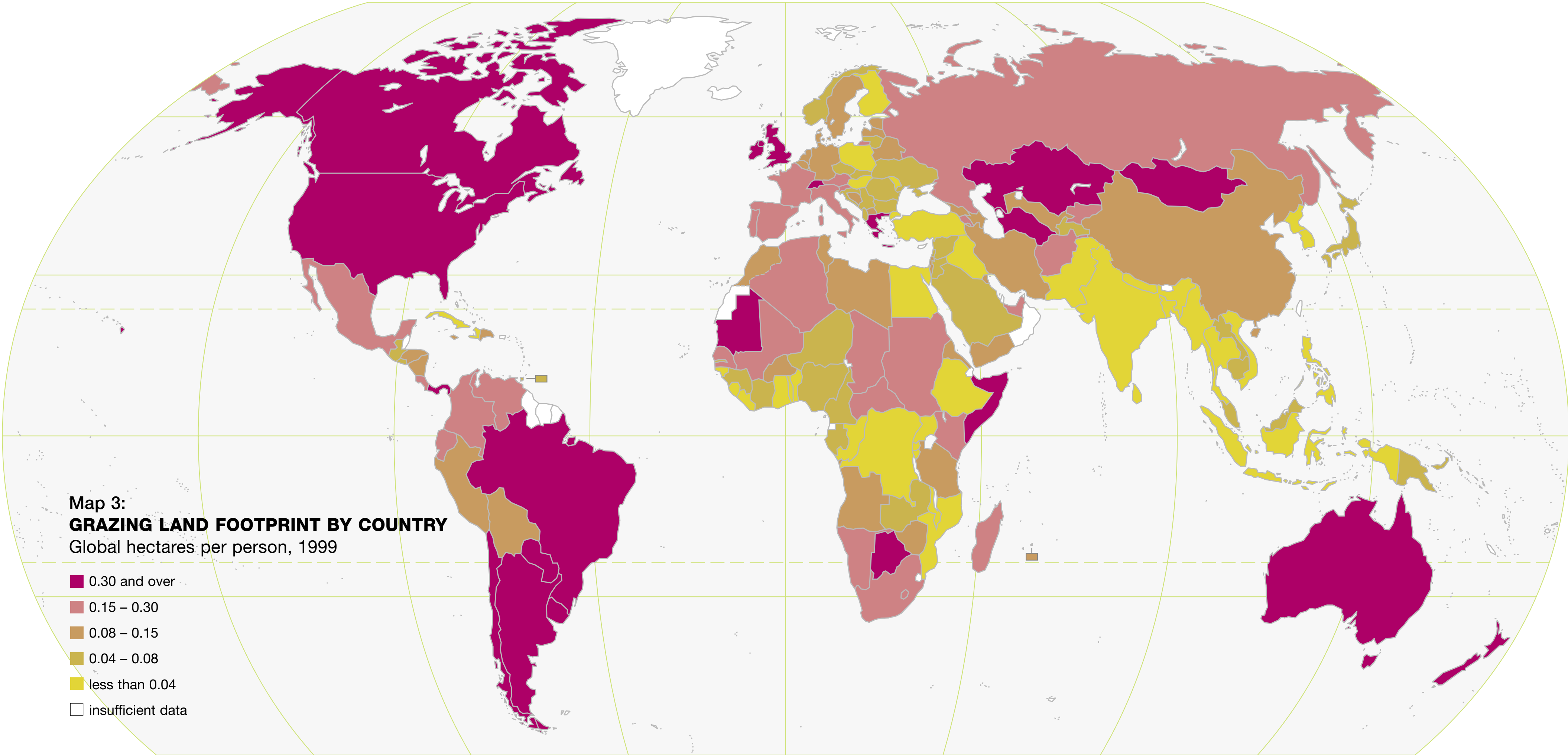
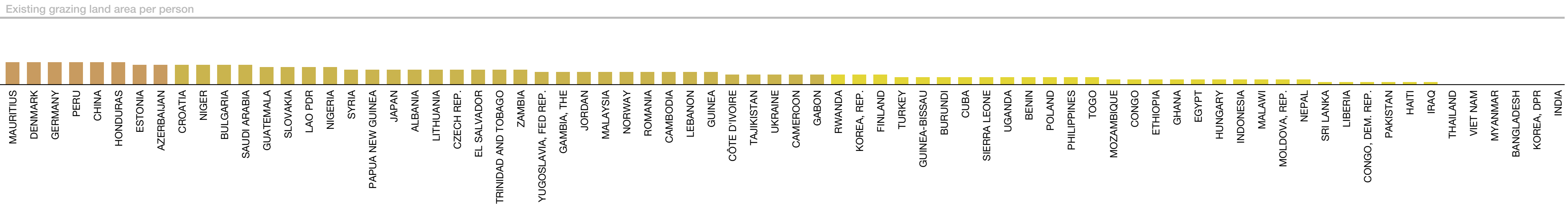


Figure 14:
GRAZING LAND FOOTPRINT, by region and income group, 1999





Map 3:
GRAZING LAND FOOTPRINT BY COUNTRY
Global hectares per person, 1999



FOREST FOOTPRINT

A nation's forest footprint is the area required to produce the forest products which that nation consumes. This includes all timber products, whether in the form of sawnwood, wood-based panels, or fibreboard, as well as pulp, paper, and paperboard. It does not include non-timber forest products such as wild fruit, nuts, fibres, or bushmeat. Wood or charcoal burnt as fuel are included in the energy footprint.

To calculate the national forest footprint, the national consumption of forest products is converted into the forest area required to produce them. The forest footprint does not reflect the quality of forests or the sustainability of forestry activities in each country. It only compares each country's recorded consumption.

The world average forest footprint in 1999 was about 0.3 global hectares per person. According to the Food and Agriculture Organization of the United Nations, there were approximately 3.8 billion hectares of forest in 1999. With a biological productivity 35 per cent higher than average land, these 3.8 billion hectares correspond to 5.1 billion global hectares of biocapacity, or 0.9 global hectares per person.

The fact that the average forest footprint is well within the Earth's biological capacity suggests that the world's forests could meet the demand for wood products, as long as forestry activities worldwide maintain the highest standards of sustainable management. However, this would not address the loss of tropical forests due to the large scale conversion of forested land to cropland or grazing land.

Figure 15: Countries with high consumption of wood products per person tend to be those with extensive forests. This is potentially sustainable, and makes good ecological sense as long as their consumption remains within their forests' biological capacity.

Figure 16: The world's forest footprint grew by about 50 per cent between 1961 and 1999.

Figure 17: There was a four-fold gap between the forest footprints per person of high and low income countries.

Figure 15:
FOREST FOOTPRINT PER PERSON, by country, 1999

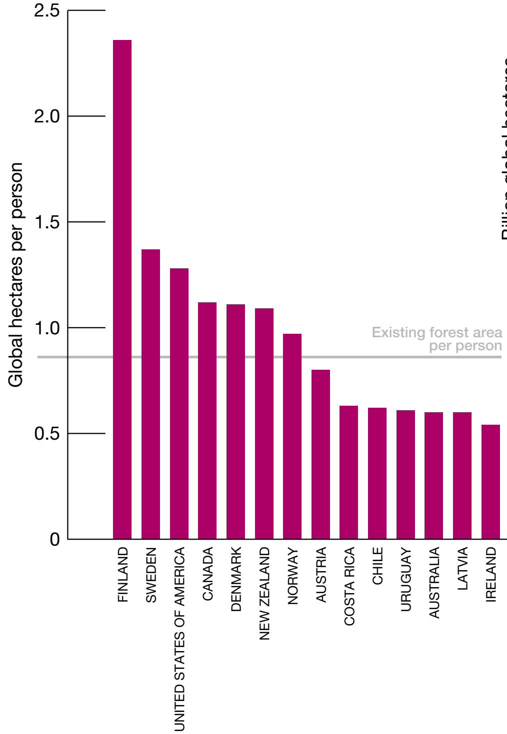
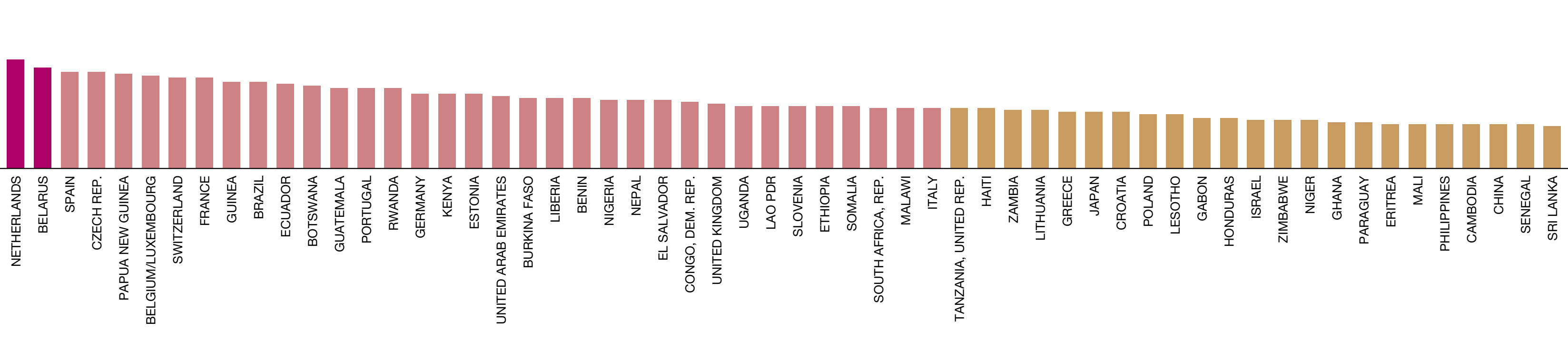



Figure 16:
WORLD FOREST FOOTPRINT, 1961–99

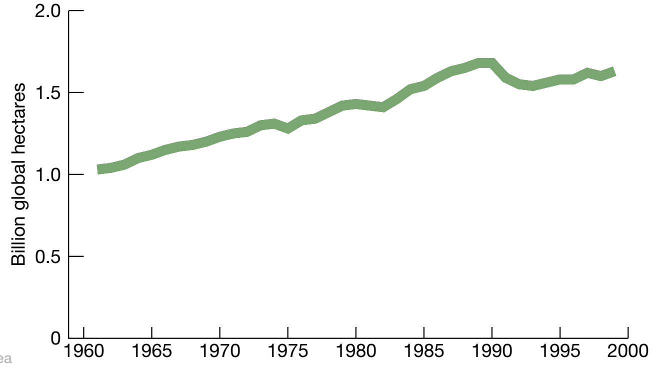
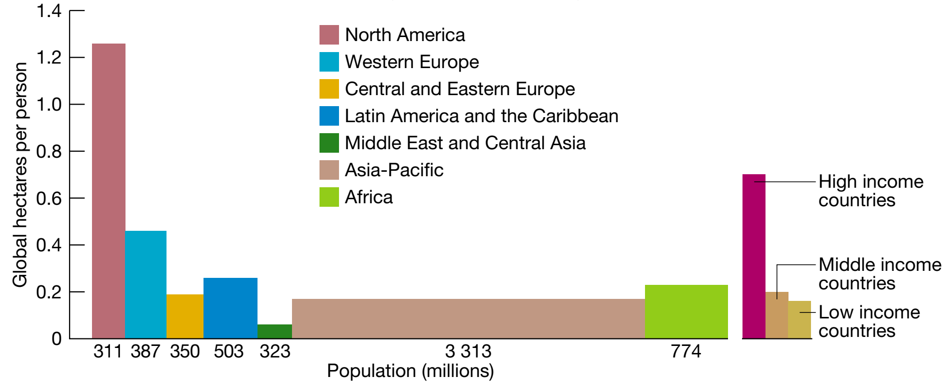
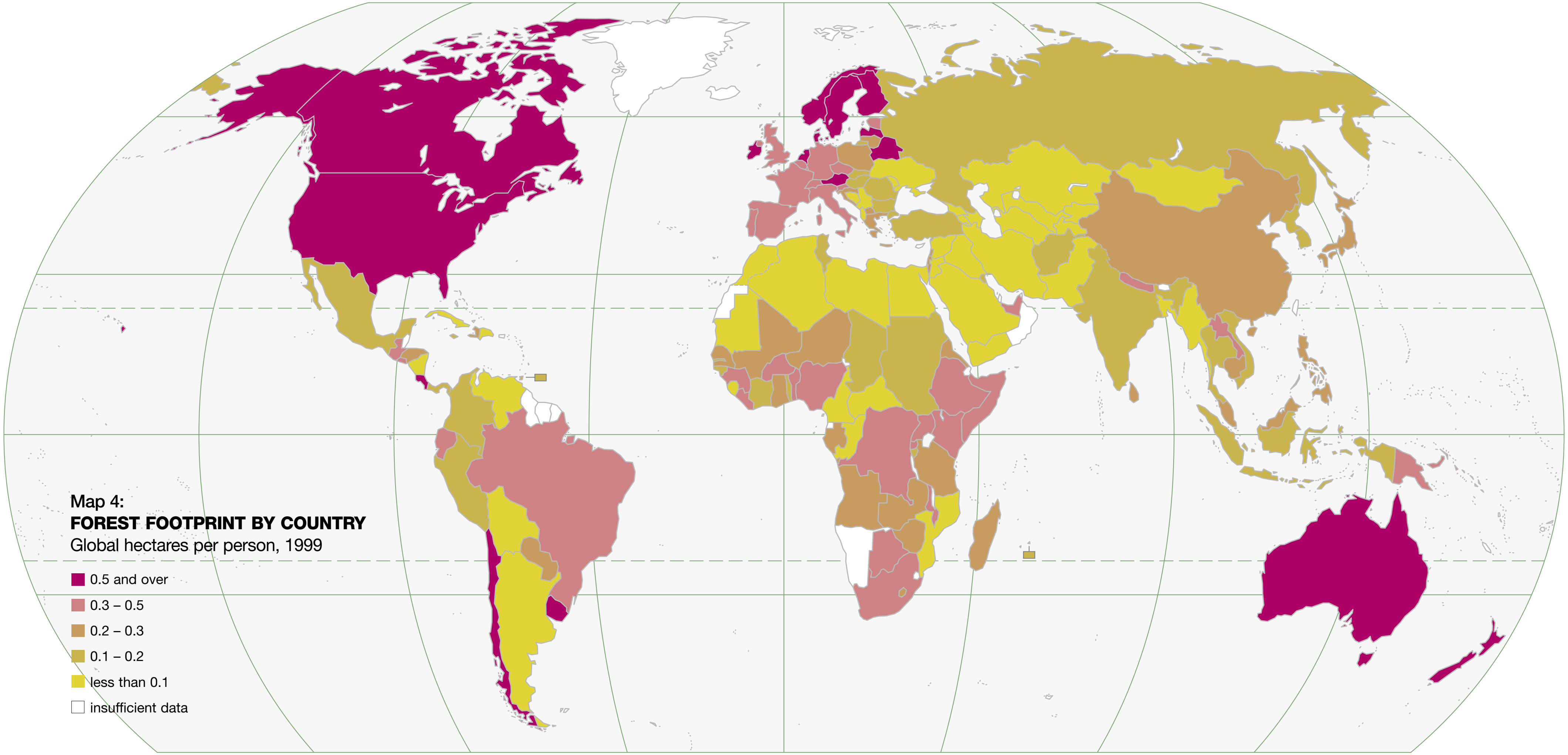


Figure 17:
FOREST FOOTPRINT, by region and income group, 1999





Map 4:
FOREST FOOTPRINT BY COUNTRY
Global hectares per person, 1999

FISHING GROUND FOOTPRINT

The fishing ground footprint of a country is the area required to produce the fish and seafood products that country consumes. This includes all the marine and freshwater fish, crustaceans (such as shrimp), and cephalopods (such as squid), as well as all fishmeal and oils that are fed to animals and farmed fish. It also includes an additional component in most countries – roughly 40 per cent – to allow for bycatch, which is generally discarded back to the sea.

Not all fish species are equal in terms of their requirements for biological productivity. A kilogram of fish which lives high up the food chain, such as cod, on trophic level four, will have a footprint ten times larger than a kilogram of fish one level below, such as herring, on trophic level three, because the production of a kilogram of cod requires ten times as much of the ocean's primary production. Consequently, a country's fishing ground footprint takes account of the kinds of fish, as well as the quantity, it consumes.

World average fish consumption in 1999 was about 22 kilograms per person per year, which equates to a footprint of 0.14 global hectares per person. The average biological productive capacity of the seas, which was also about 0.14 global hectares per person, is calculated by dividing the world's estimated sustainable yield of fish by the productive sea area, which primarily consists of the continental shelves.

Figure 18: The fishing ground footprint per person for all countries with populations above 1 million: many island nations with small populations would show large fishing ground footprints per person, but are not included here.

Figure 19: The global fishing ground footprint grew rapidly, by 2.6 per cent per year on average, between 1961 and 1999.

Figure 20: While seafood provides the primary source of protein for many people living in the world's poorest coastal regions, there is, on average, a 14-fold difference in fish and seafood consumption per person between high and low income countries.

Figure 18:
FISHING GROUND FOOTPRINT PER PERSON, by country, 1999

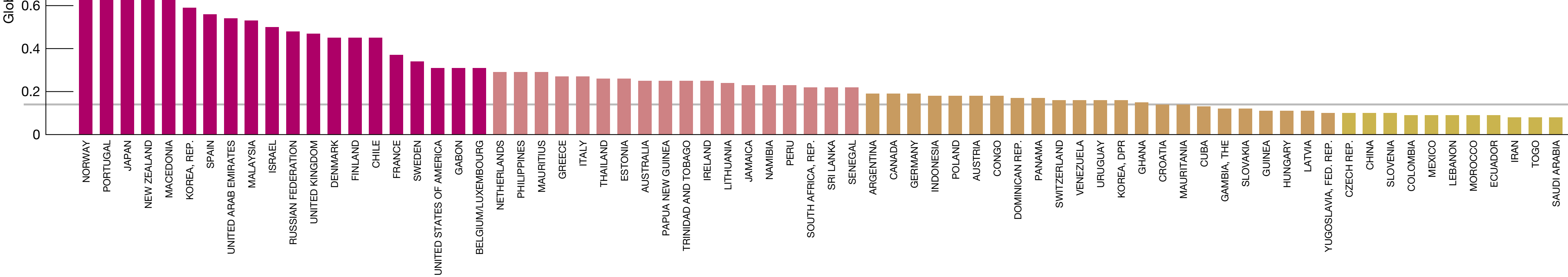


Figure 19:
WORLD FISHING GROUND FOOTPRINT, 1961–99

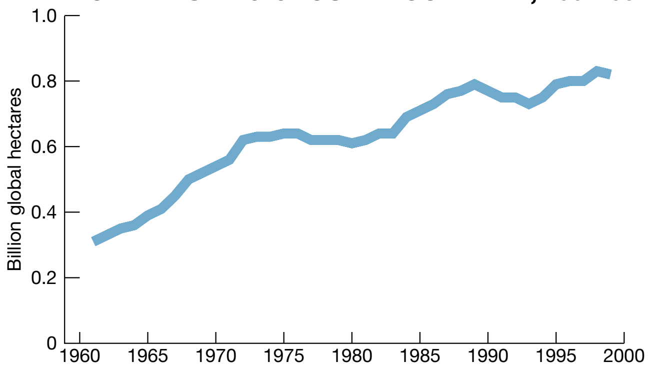
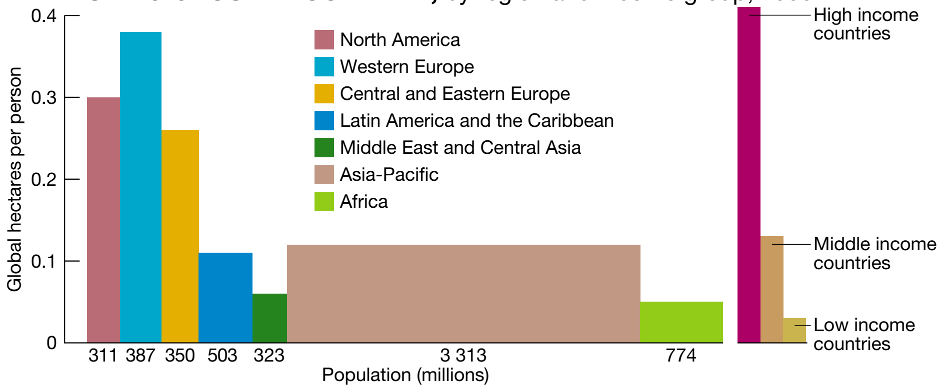
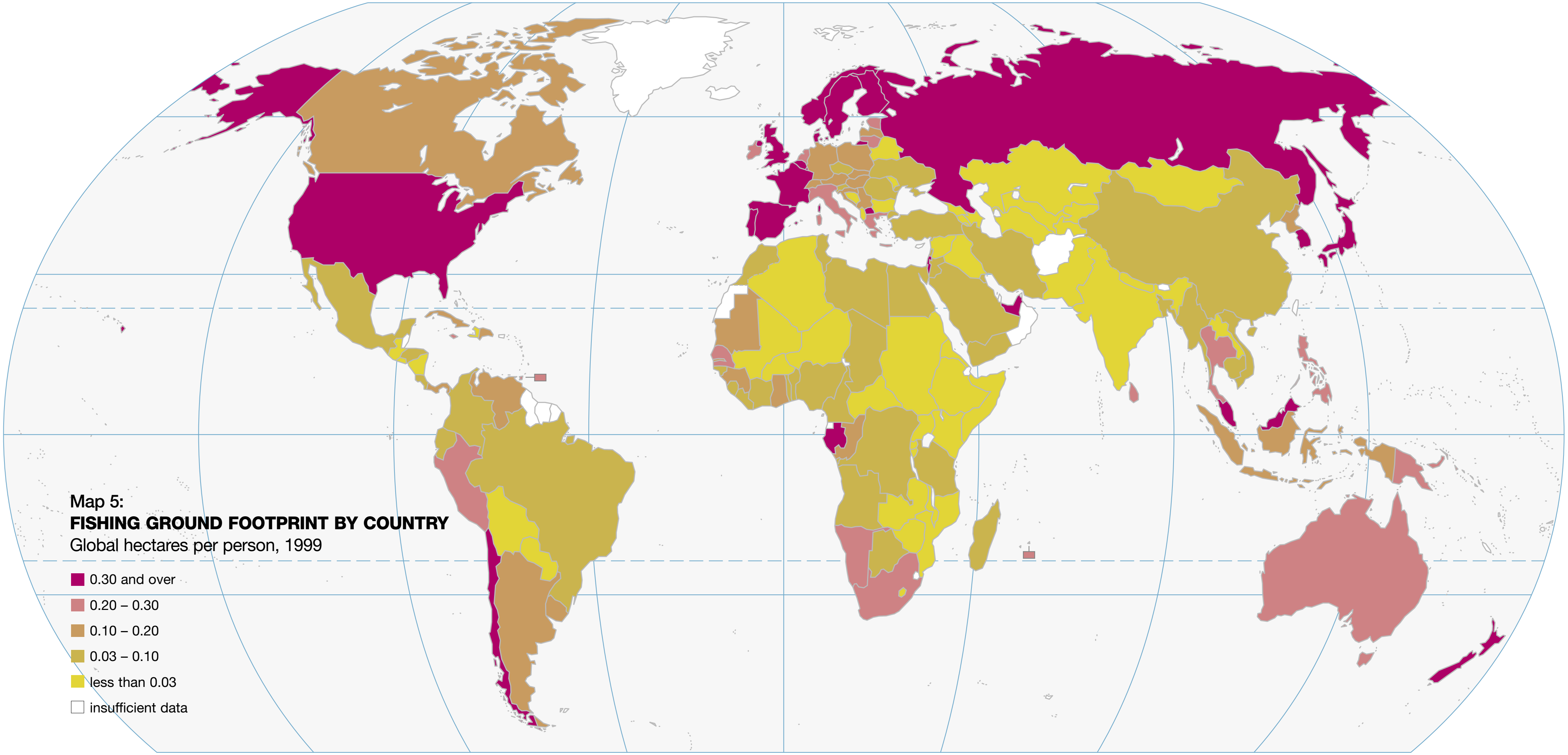
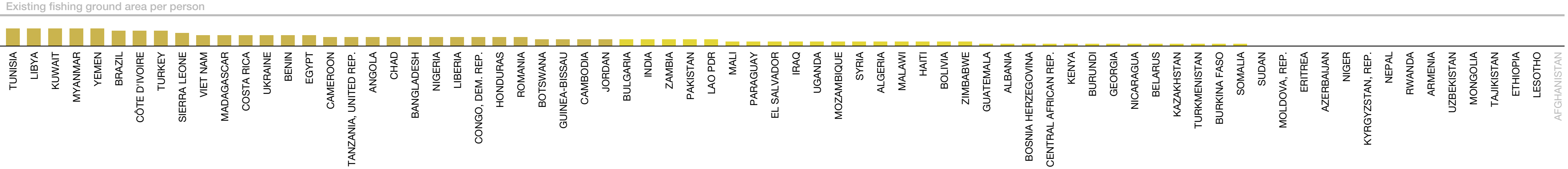


Figure 20:
FISHING GROUND FOOTPRINT, by region and income group, 1999





Map 5:
FISHING GROUND FOOTPRINT BY COUNTRY
Global hectares per person, 1999



ENERGY FOOTPRINT

A country's energy footprint represents the area required to sustain its energy consumption. It encompasses four types of energy: fossil fuels (coal, oil, and natural gas), biomass (fuelwood and charcoal), nuclear, and hydro.

The footprint of fossil fuel combustion is calculated as the area of forest that would be required to absorb the resulting carbon dioxide (CO_2) emissions, excluding the proportion that is absorbed by the oceans. The footprint of biomass fuel is calculated as the area of forest needed to grow the biomass. These two calculations result in approximately the same area requirement per unit of energy consumed.

Nuclear power is included in the energy footprint, and counted as being equivalent to fossil fuel per unit of energy, even though nuclear power stations do not produce CO_2. Excluding nuclear power would reduce the world energy footprint by less than 4 per cent. The footprint of hydropower is the area occupied by hydroelectric dams and reservoirs.

National and regional energy footprints are adjusted for the energy embodied in traded goods. This means that the energy used to make a product manufactured in one country but consumed in another is subtracted from the footprint of the producer-country and added to that of the consumer-country.

Figure 21: National energy footprint per person (see Table 2 for the four separate elements).

Figure 22: The energy footprint was the fastest growing component of the global ecological footprint between 1961 and 1999, increasing at an average rate of more than 2.6 per cent per year.

Figure 23: Of all the components of the ecological footprint, the energy footprint per person shows the greatest disparity between rich and poor, with a 16-fold difference between high and low income countries.

Figure 21:
ENERGY FOOTPRINT PER PERSON, by country, 1999

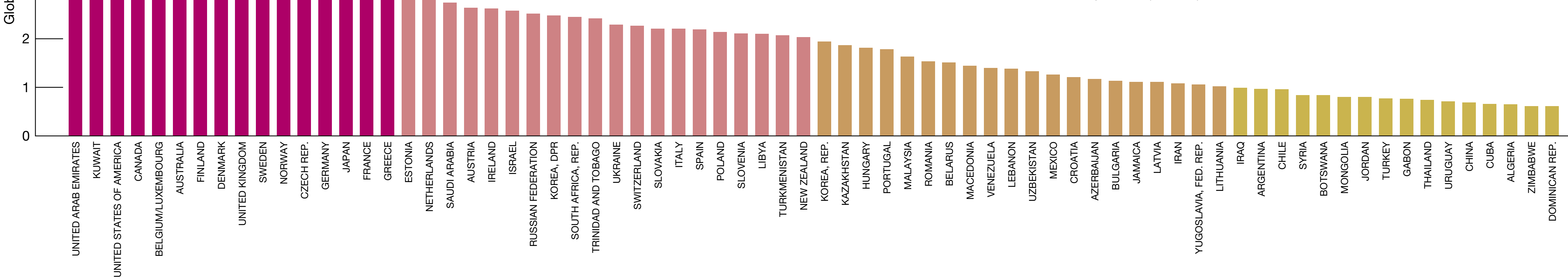


Figure 22:
WORLD ENERGY FOOTPRINT, 1961–99

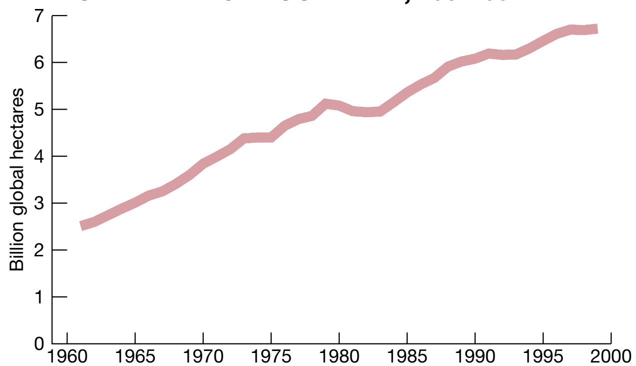
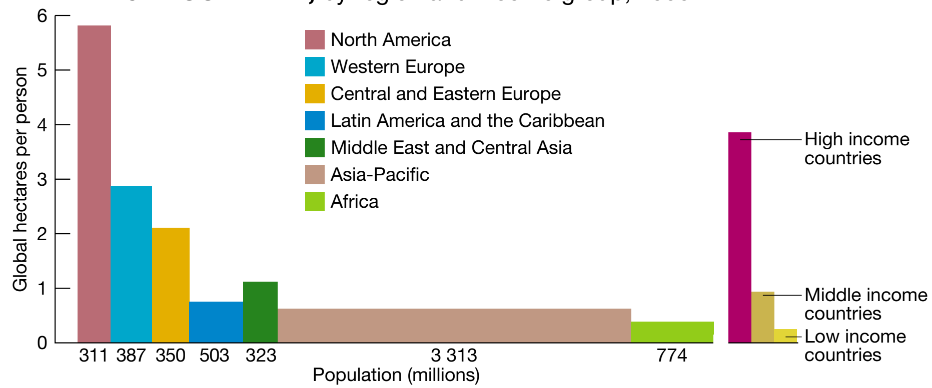
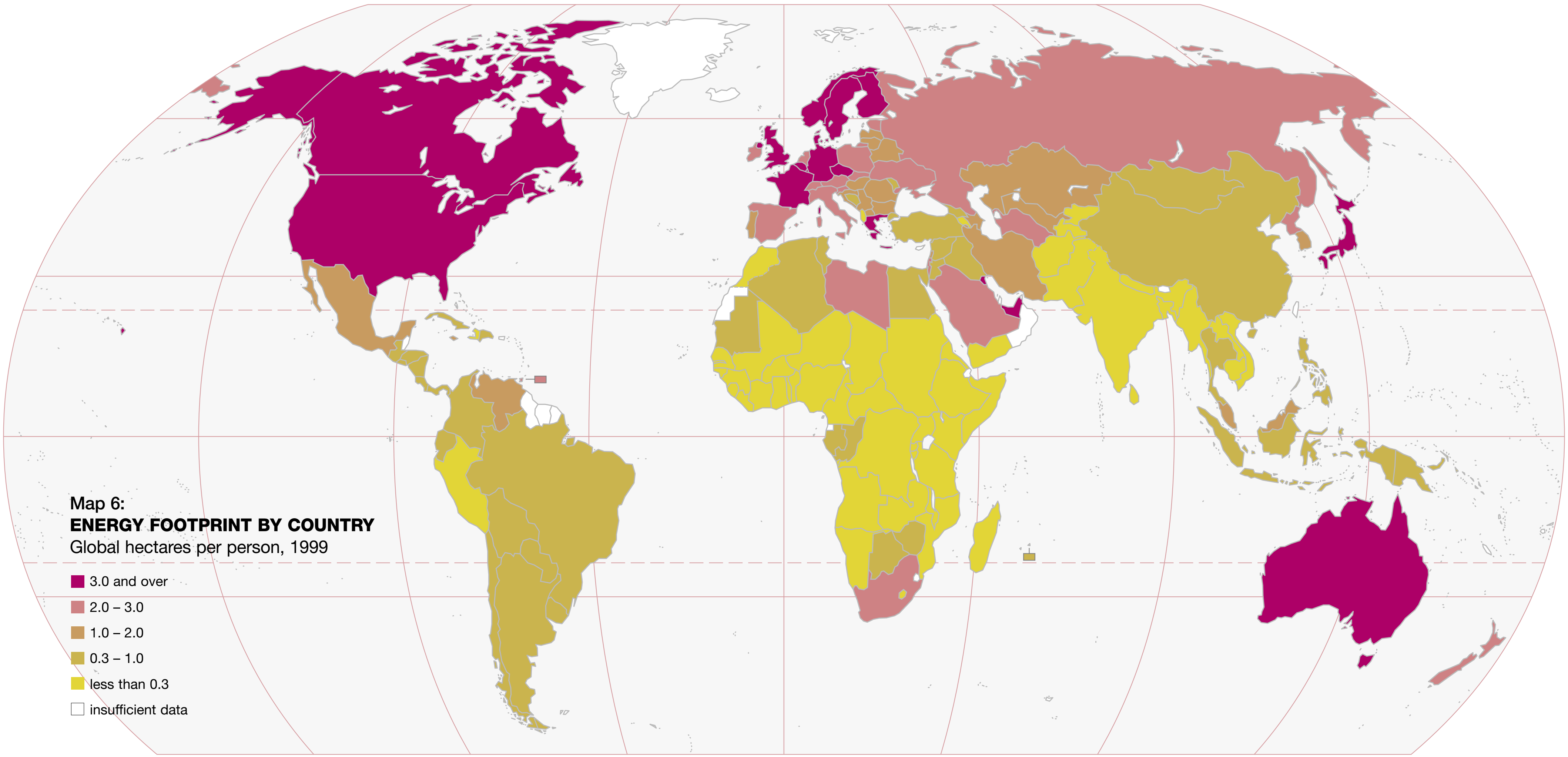
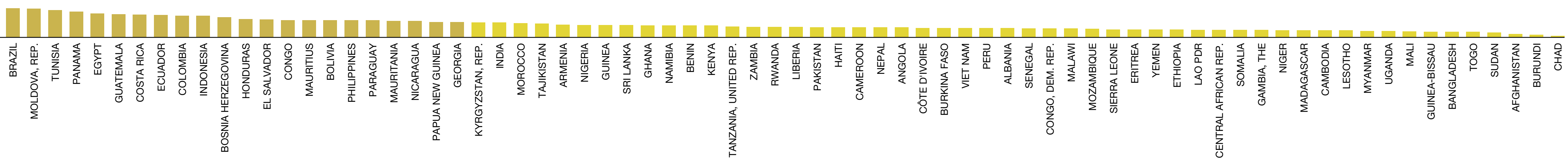


Figure 23:
ENERGY FOOTPRINT, by region and income group, 1999





Map 6:
ENERGY FOOTPRINT BY COUNTRY
Global hectares per person, 1999



WATER WITHDRAWALS

Only 2.5 per cent of the world's 1.4 billion cubic kilometres of water is freshwater, and 70 per cent of it is locked up in polar icecaps. The Earth's hydrological cycle constantly replenishes the freshwater supply, but less than 1 per cent of the world's freshwater is available as a renewable resource. Since much of that is geographically inaccessible, or not accessible throughout the year, it is estimated that more than half of what is actually available is used by humanity.

Natural ecosystems, especially wetlands and forests, capture water and stabilize seasonal flows, while recharging groundwater and improving water quality. Conserving these ecosystems is vital to maintaining the supply of renewable freshwater, yet half the world's wetlands were lost to development over the last century. Pollution from agriculture, industrial and municipal sewage, and salinization from irrigation have also reduced the availability of clean freshwater. About 1.2 billion people, a fifth of the world's population, do not have access to clean drinking water.

Water withdrawal measures the quantity of water taken from a source such as a river or lake, and used for agricultural, industrial, or domestic purposes. The water is not necessarily consumed, as it may be returned after it has been used, although with a reduction in its quality. Withdrawal does not include the use of rainfall in agriculture.

Figure 24: The high level of water use in Central Asian countries, where freshwater resources are scarce, is mainly due to large-scale irrigation of crops, particularly cotton.

Figure 25: Global water use doubled between 1960 and 2000, in line with world population.

Figure 26: World average water use is about 550 cubic metres per person per year, including water used in agriculture and industry, which compares with over 1 000 cubic metres per person per year in the Middle East and Central Asia and over 1 600 cubic metres per person per year in North America. High income countries used twice as much water per person as low income countries, on average.

Figure 24:
WATER WITHDRAWALS PER PERSON, by country, 2000 (estimate)

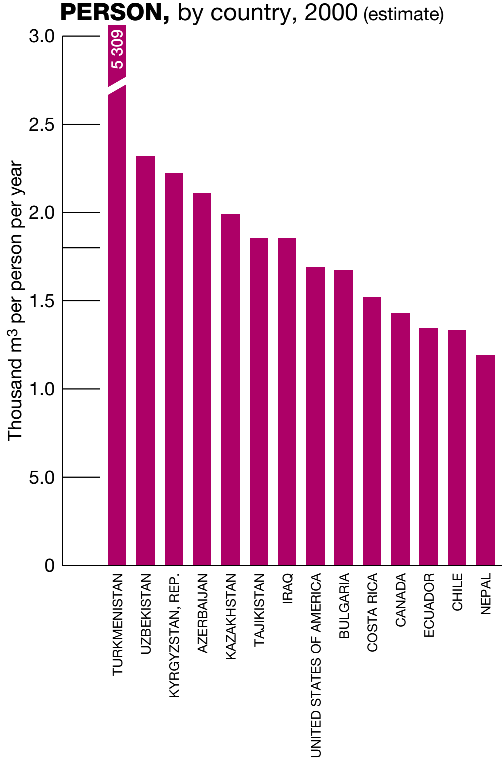
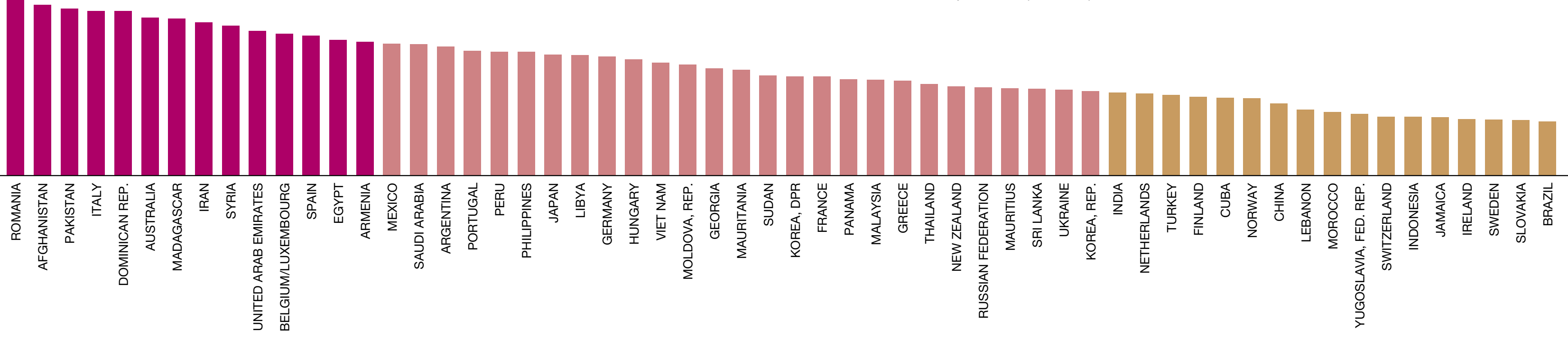



Figure 25:
WORLD WATER WITHDRAWALS, 1960–2000 (estimate)

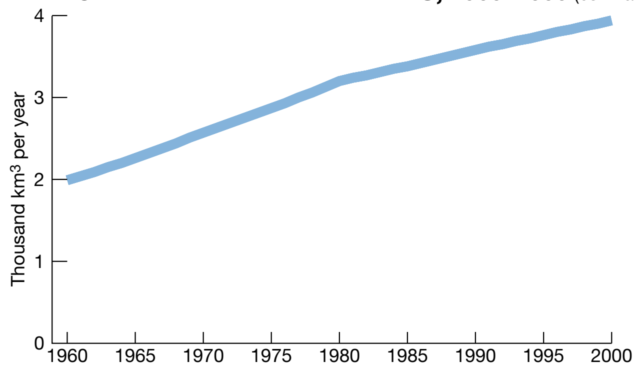
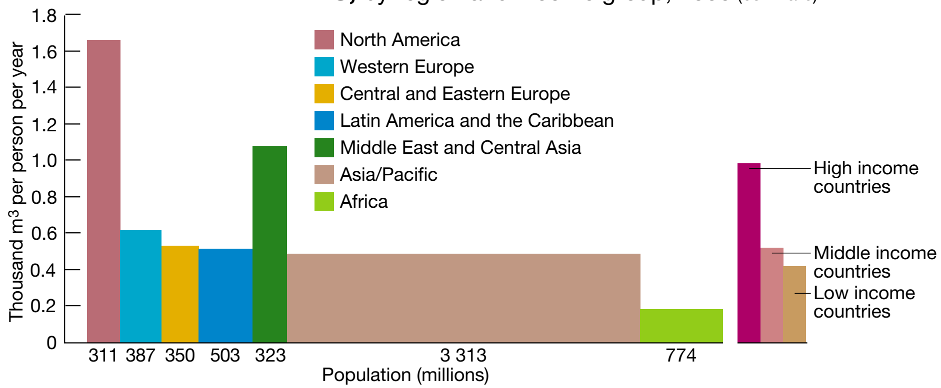
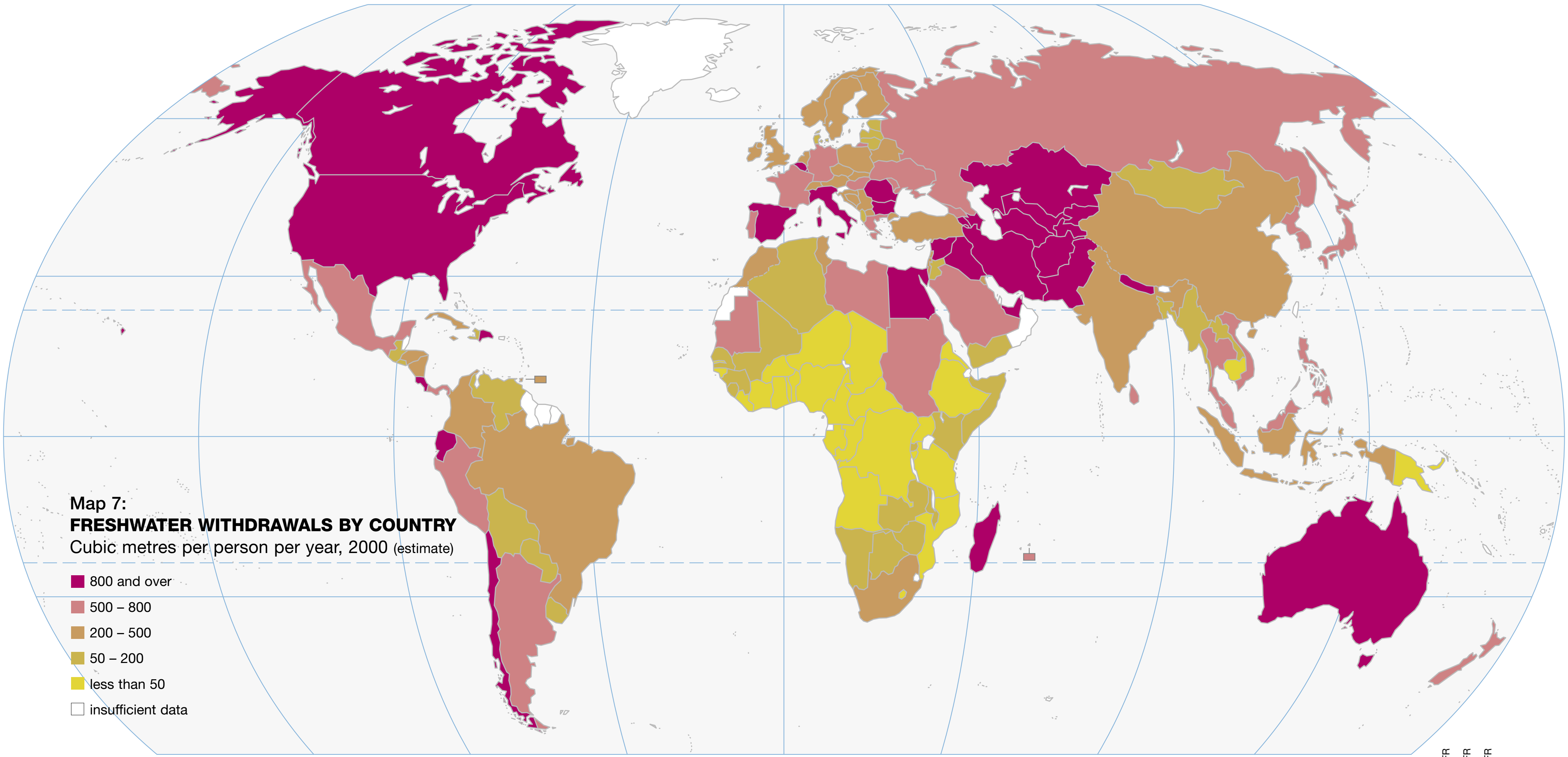


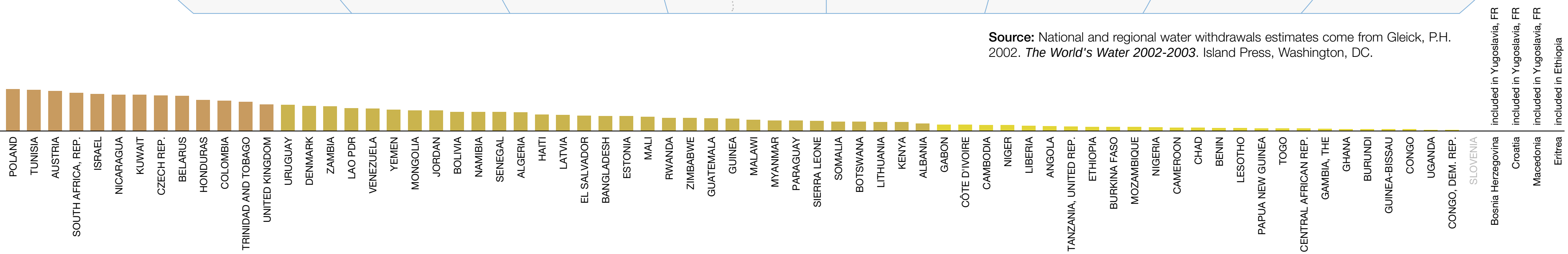
Figure 26:
WATER WITHDRAWALS, by region and income group, 2000 (estimate)





Map 7:
FRESHWATER WITHDRAWALS BY COUNTRY
Cubic metres per person per year, 2000 (estimate)

Source: National and regional water withdrawals estimates come from Gleick, P.H. 2002. *The World's Water 2002-2003*. Island Press, Washington, DC.



SCENARIOS AND PROJECTIONS

While the previous sections have looked at past trends, this part of the report asks how some of those trends are likely to develop in the future. The projections are based on scenarios of world population, natural resource consumption, and carbon dioxide (CO_2) emissions for the next 50 years made by the United Nations and other international agencies.

The UN median population projection estimates that the global population will reach just under 9 billion by 2050, and peak in the second half of the century. Two scenarios of CO_2 emissions have been selected from the Intergovernmental Panel on Climate Change *Special Report on Emissions Scenarios* (IPCC 2000b). Both are compatible with the UN median population projection.

The first, IPCC A1, assumes there will be rapid economic growth over the next 50 years, rapid development of more efficient technologies, further globalization, and a substantial reduction in the regional differences in per capita income. The world's energy supply will depend equally on fossil fuels and non-fossil energy sources. The second, IPCC B1, is also based on increasing globalization and regional integration, but puts a greater emphasis on environmental protection and less on economic growth. The global economy will be more dependent on the service and information sectors, and technology will become more resource-efficient.

Scenarios for agriculture, forestry, and fisheries from the Food and Agriculture Organization of the United Nations (FAO) estimate likely trends in the consumption of natural resources from now to the years 2015 and 2030. The projections include the consumption of cereals, oilcrops, sugar, pulses, roots and tubers, meat and dairy products, forest products (excluding fuelwood), and fish and seafood. These have been extended to 2050 to cover the same period as the population and CO_2 scenarios.

All these scenarios assume, crucially, that the Earth's existing biological capacity will be able to sustain continued population and economic growth over the next 50 years. In other words, the scenarios do not incorporate feedbacks or constraints on future growth imposed by the Earth's natural ecosystems.

The three sets of scenarios – population, CO_2, and natural resources – were used to project the ecological footprint forward from 2000 to 2050. In addition, estimates of the world's future landuse composition, also taken from the IPCC scenarios, were used to project the Earth's future biologically productive capacity to the year 2050.

Figure 27: World population, which doubled between 1960 and 2000, will increase by a further 50 per cent to 9 billion over the next 50 years.

Figure 28: If these scenarios are taken as high and low extremes, global emissions will rise to between 11.7 and 16.0 billion tonnes of carbon per year by 2050, a rise of between 70 per cent and 130 per cent above the 2000 level.

Figure 29: World cereals consumption will grow by 66 per cent, consumption of forest products will increase by 120 per cent, and meat and fish consumption will grow by 100 per cent from 2000 to 2050.

Figure 27:
WORLD POPULATION, UN MEDIAN PROJECTION, 1950–2050

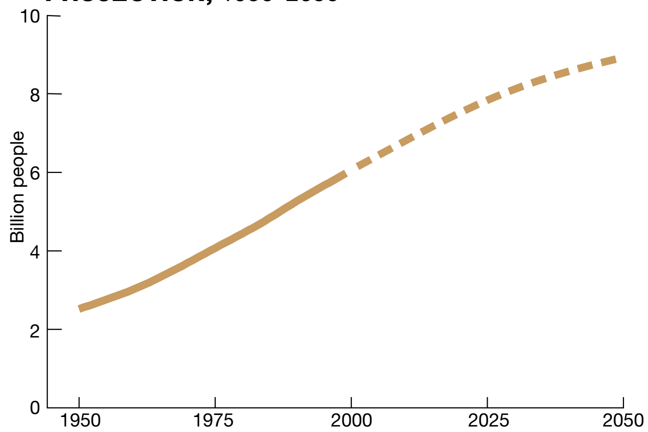


Figure 28:
IPCC CO_2 EMISSIONS SCENARIOS, 1950–2050

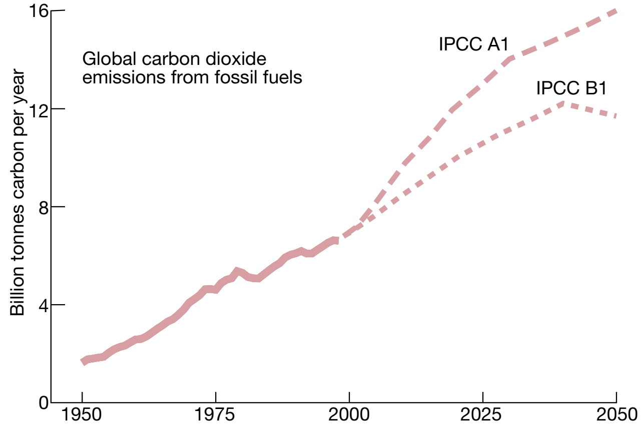
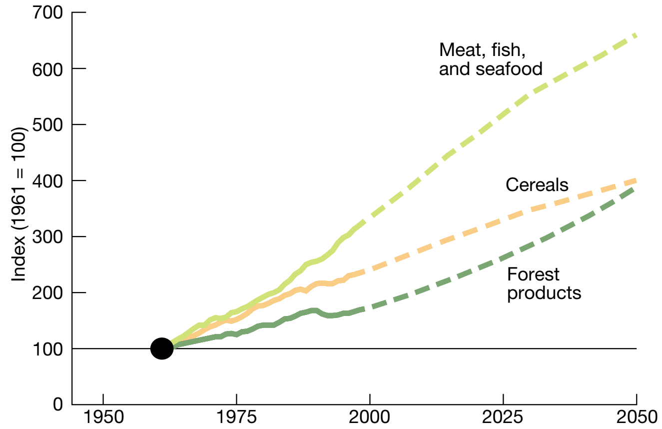


Figure 29:
FAO NATURAL RESOURCES CONSUMPTION PROJECTIONS, 1961–2050



Ecological footprint and human welfare
Based on the UN, IPCC, and FAO reference scenarios, which assume slowed population growth, steady economic development, and more resource-efficient technologies, the world's ecological footprint will continue to grow between 2000 and 2050 from a level 20 per cent above the Earth's biological capacity to a level between 80 and 120 per cent above it (Figure 30). In these scenarios, 9 billion people in 2050 would require between 1.8 and 2.2 Earth-sized planets in order to sustain their consumption of crops, meat, fish, and wood, and to hold CO_2 levels constant in the atmosphere.

For this projection to become reality, the limited capacity of global ecosystems must prove capable of supporting the additional load. The ecological footprint projection, however, merely documents the demands of human consumption in comparison with the biologically productive capacity of the planet; it does not imply whether such a future is possible.

The World3 computer model was developed to explore what may happen when the human footprint exceeds global capacity (see Meadows et al. 1992). World3 simulates trends using over 350 variables which describe the global system, and incorporates feedbacks between ecosystems, population, and economic growth. In order to simplify comparison of the model results with the reference scenarios, the results were summarized as two indicators: the human ecological footprint (HEF) and an index of human welfare (HWI). The model variable HEF is an approximation of the ecological footprint based on three components: agricultural land, urban-industrial land, and CO_2 absorption land. The model variable HWI is an approximation of the UN's human development index, based on three measures of development: average life expectancy, educational level, and world economic product.

Two World3 scenarios were chosen: a standard scenario, which assumes no policy changes over the next 50 years; and an accelerated technology scenario, which assumes significant improvements in resource efficiency. In the standard scenario, the HEF grows and peaks around 2040 at about 150 per cent above the Earth's biological capacity, while the HWI climbs to around 20 per cent above the 2000 level in 2030 but then falls away rapidly, as the Earth's productive ecosystems are no longer able to sustain high levels of human consumption. In the accelerated technology scenario the HEF reaches a maximum of 60 per cent above biological capacity in 2020 and then declines back to the 2000 level by 2050, as more resource-efficient technologies reduce the footprint, while the HWI climbs and remains at almost 20 per cent above 2000 levels.

These scenarios are not intended to be forecasts, but maps of possible futures to guide policy choices.

Figure 30: Humanity's use of biological resources is projected to increase from 20 per cent above the Earth's biological capacity in 2000 to between 80 and 120 per cent above biocapacity in 2050.

Figure 31: The HEF increases between 2000 and 2050 to around 150 per cent above the Earth's biological capacity in the standard scenario, whereas it returns to about 20 per cent above biological capacity by 2050 in the accelerated technology scenario.

Figure 32: The HWI grows to about 20 per cent above the 2000 level in both scenarios, but while it remains there in the accelerated technology scenario it falls below the 2000 level by 2050 in the standard scenario.

Figure 30:
GLOBAL ECOLOGICAL FOOTPRINT, 1961–2050

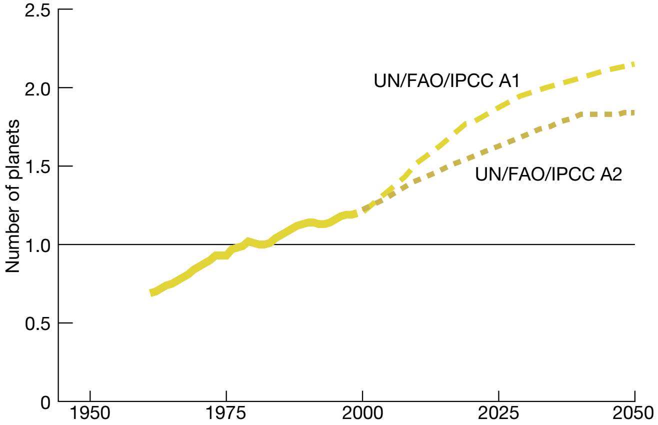


Figure 31:
WORLD3 HEF (HUMAN ECOLOGICAL FOOTPRINT), 1950–2050

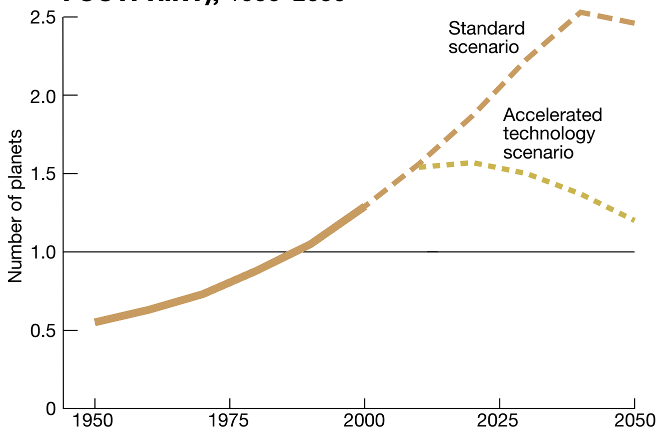
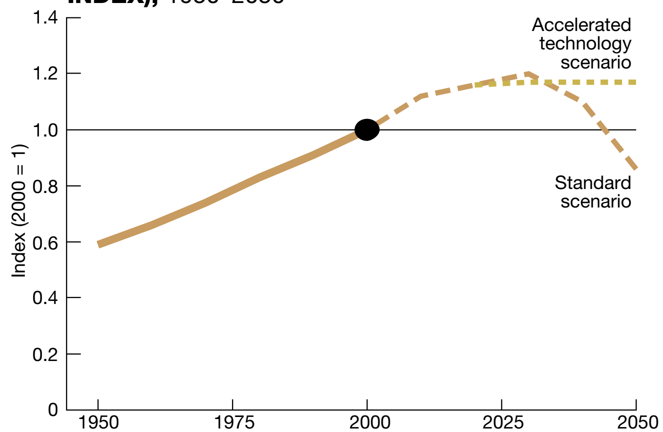


Figure 32:
WORLD3 HWI (HUMAN WELFARE INDEX), 1950–2050



POLICY OPTIONS

The scenarios show that, to be sustainable, humanity's consumption of renewable natural resources must stay within the limits of the Earth's biological capacity over the long term. Ecological footprint analysis indicates the level of ecological deficit reduction that is needed, but not what actions to take.

Three factors determine the size of the ecological footprint: the efficiency of the production systems used to harvest renewable resources and deliver goods and services to consumers, the level of consumption per person, and the number of consumers. In addition, the Earth's biological capacity is determined by the health of ecosystems, which can be improved and maintained through good management and conservation.

Using the range of economic and regulatory instruments available, government policies can reduce the ecological deficit by addressing four issues (see Figure 33):

1. Production: improve the resource-efficiency with which goods and services are produced.
2. Consumption: consume resources more efficiently and redress the disparity in consumption per person between high and low income countries.
3. Population: control population size.
4. Ecosystems: protect, conserve, and restore natural ecosystems and biodiversity to maintain biological productivity and ecological services.

1. Promote resource-efficient production systems
- rapidly move energy supply away from fossil fuels towards renewable sources and promote energy-efficient technologies, buildings, cities, and transport systems
- switch subsidies from production-based incentives that support wasteful or destructive agricultural, forestry, fishery, or energy systems to incentives that encourage long-term sustainability
- use the tax system to internalize the environmental costs of production and recycle the revenues into subsidies that encourage sustainable production systems
- transfer technology and build capacity to enable developing countries to leapfrog directly to resource-efficient and sustainable production systems.

2. Encourage equitable and sustainable consumption
- promote markets for sustainably produced goods and services by implementing stringent environmental standards and certification for food, materials, and energy
- ensure the polluter pays the full environmental costs of food, materials, water, and energy, whilst ensuring access to basic resources for all
- establish international trade agreements that give fair access to markets in high income countries and discourage low income countries from externalizing their environmental production costs
- minimize consumer waste and recycle recoverable resources from the waste stream.

3. Promote education and health care to control human population
- provide universal primary education for boys and girls
- create better access to secondary education and economic opportunities for women
- reduce child mortality and prevalence of widespread communicable diseases
- provide adequate health care and birth control facilities for all, particularly in low income countries.

4. Conserve natural and managed ecosystems and maintain ecological services
- establish and maintain networks of protected areas covering all terrestrial, freshwater, and marine ecosystem types, including no-fishing zones, and restore degraded ecosystems
- protect soil from erosion and degradation caused by intensive agriculture or overgrazing, and preserve existing cropland for agriculture rather than urban and industrial development
- protect river basins, wetlands, and watershed ecosystems to sustain freshwater supply
- eliminate the use of toxic chemicals that degrade ecosystem functioning.

Figure 33: **POLICIES FOR ELIMINATING THE ECOLOGICAL DEFICIT**

Table 1: THE LIVING PLANET THROUGH TIME

See notes on pages 28/29	Global population (billion)	Total ecological footprint (billion global ha)	Cropland footprint (billion global ha)	Grazing land footprint (billion global ha)	Forest footprint (ex. fuelwood) (billion global ha)	Fishing ground footprint (billion global ha)	Total energy footprint (billion global ha)	Built-up land (billion global ha)	Biocapacity (billion global ha)	World ecological footprint (number of planets)	Water* withdrawals (thousand km³/year)	Living Planet Index	Forest species population index	Freshwater species population index	Marine species population index
1960											1.99				
1961	3.08	7.47	2.89	0.41	1.03	0.31	2.51	0.32	10.90	0.69	2.04				
1962	3.14	7.62	2.90	0.43	1.04	0.33	2.60	0.32	10.91	0.70	2.09				
1963	3.20	7.81	2.91	0.44	1.06	0.35	2.74	0.33	10.92	0.72	2.15				
1964	3.27	8.04	2.92	0.45	1.10	0.36	2.88	0.33	10.93	0.74	2.20				
1965	3.34	8.24	2.92	0.46	1.12	0.39	3.01	0.34	10.94	0.75	2.26				
1966	3.41	8.47	2.93	0.47	1.15	0.41	3.16	0.35	10.95	0.77	2.32				
1967	3.48	8.65	2.93	0.49	1.17	0.45	3.25	0.36	10.97	0.79	2.38				
1968	3.55	8.92	2.96	0.51	1.18	0.50	3.41	0.36	10.98	0.81	2.44				
1969	3.62	9.19	2.98	0.52	1.20	0.52	3.60	0.37	11.00	0.84	2.51				
1970	3.70	9.50	2.99	0.52	1.23	0.54	3.84	0.38	11.00	0.86	2.57	1.00	1.00	1.00	1.00
1971	3.77	9.70	2.98	0.52	1.25	0.56	3.99	0.39	11.01	0.88	2.63				
1972	3.85	9.94	2.99	0.53	1.26	0.62	4.15	0.39	11.02	0.90	2.69				
1973	3.92	10.24	3.00	0.53	1.30	0.63	4.38	0.40	11.04	0.93	2.75				
1974	4.00	10.32	3.01	0.55	1.31	0.63	4.40	0.41	11.05	0.93	2.81				
1975	4.07	10.32	3.02	0.57	1.28	0.64	4.40	0.42	11.06	0.93	2.87	0.97	0.97	0.98	0.95
1976	4.15	10.66	3.03	0.60	1.33	0.64	4.65	0.42	11.05	0.97	2.93				
1977	4.22	10.82	3.04	0.60	1.34	0.62	4.79	0.43	11.05	0.98	3.00				
1978	4.29	10.96	3.05	0.61	1.38	0.62	4.86	0.44	11.06	0.99	3.06				
1979	4.37	11.28	3.07	0.60	1.42	0.62	5.12	0.45	11.07	1.02	3.13				
1980	4.44	11.25	3.08	0.60	1.43	0.61	5.08	0.46	11.13	1.01	3.20	0.96	1.06	0.90	0.94
1981	4.52	11.14	3.09	0.60	1.42	0.62	4.96	0.46	11.13	1.00	3.24				
1982	4.59	11.16	3.10	0.61	1.41	0.64	4.94	0.47	11.14	1.00	3.27				
1983	4.67	11.27	3.11	0.62	1.46	0.64	4.95	0.48	11.15	1.01	3.31				
1984	4.75	11.61	3.13	0.63	1.52	0.69	5.15	0.48	11.18	1.04	3.35				
1985	4.84	11.87	3.12	0.65	1.54	0.71	5.36	0.49	11.21	1.06	3.38	0.86	0.97	0.77	0.86
1986	4.92	12.15	3.14	0.67	1.59	0.73	5.53	0.50	11.27	1.08	3.42				
1987	5.01	12.39	3.15	0.67	1.63	0.76	5.67	0.51	11.29	1.10	3.46				
1988	5.10	12.68	3.16	0.67	1.65	0.77	5.91	0.52	11.32	1.12	3.50				
1989	5.18	12.86	3.17	0.68	1.68	0.79	6.02	0.53	11.34	1.14	3.54				
1990	5.27	12.93	3.18	0.69	1.68	0.77	6.08	0.54	11.38	1.14	3.58	0.81	0.98	0.71	0.76
1991	5.35	12.93	3.17	0.69	1.59	0.75	6.19	0.55	11.37	1.14	3.62				
1992	5.43	12.84	3.15	0.68	1.55	0.75	6.16	0.55	11.38	1.13	3.65				
1993	5.51	12.84	3.15	0.69	1.54	0.73	6.17	0.55	11.40	1.13	3.69				
1994	5.59	13.03	3.16	0.70	1.56	0.75	6.30	0.56	11.40	1.14	3.72				
1995	5.67	13.26	3.16	0.70	1.58	0.79	6.46	0.57	11.39	1.16	3.76	0.71	0.90	0.57	0.69
1996	5.74	13.44	3.16	0.71	1.58	0.80	6.61	0.58	11.39	1.18	3.80				
1997	5.82	13.59	3.16	0.72	1.62	0.80	6.70	0.58	11.38	1.19	3.83				
1998	5.90	13.59	3.16	0.72	1.60	0.83	6.69	0.59	11.38	1.20	3.87				
1999	5.98	13.65	3.14	0.73	1.63	0.82	6.72	0.60	11.36	1.20	3.90				
2000											3.94	0.63	0.85	0.46	0.65

Table 2: ECOLOGICAL FOOTPRINT AND BIOCAPACITY

1999 data unless otherwise specified	Population	Total ecological footprint	Cropland footprint	Grazing land footprint	Forest footprint (ex. fuelwood)	Fishing ground footprint	Total energy footprint	Included in total energy				Built-up land
See notes on pages 28/29	(millions)	(global ha/person)	(global ha/person)	(global ha/person)	(global ha/person)	(global ha/person)	(global ha/person)	CO_2 from fossil fuels (global ha/person)	Fuelwood (global ha/person)	Nuclear (global ha/person)	Hydro (global ha/person)	(global ha/person)
WORLD	**5 978.7**	**2.28**	**0.53**	**0.12**	**0.27**	**0.14**	**1.12**	**0.99**	**0.06**	**0.08**	**0.00**	**0.10**
High income countries	**906.5**	**6.48**	**1.04**	**0.23**	**0.70**	**0.41**	**3.86**	**3.40**	**0.03**	**0.42**	**0.01**	**0.25**
Middle income countries	**2 941.0**	**1.99**	**0.49**	**0.13**	**0.20**	**0.13**	**0.94**	**0.86**	**0.06**	**0.02**	**0.00**	**0.09**
Low income countries	**2 114.2**	**0.83**	**0.30**	**0.03**	**0.16**	**0.03**	**0.25**	**0.17**	**0.08**	**0.00**	**0.00**	**0.06**
AFRICA	**774.3**	**1.36**	**0.40**	**0.17**	**0.23**	**0.05**	**0.39**	**0.27**	**0.11**	**0.01**	**0.00**	**0.12**
Algeria	29.8	1.55	0.60	0.16	0.07	0.02	0.65	0.63	0.01	0.00	0.00	0.06
Angola	12.8	0.87	0.27	0.13	0.20	0.04	0.20	0.11	0.08	0.00	0.00	0.03
Benin	6.1	1.15	0.39	0.03	0.35	0.05	0.24	0.06	0.17	0.00	0.00	0.09
Botswana	1.5	1.48	0.39	0.41	0.41	0.03	0.18	id	0.18	0.00	0.00	0.07
Burkina Faso	11.2	1.18	0.40	0.13	0.35	0.01	0.19	0.03	0.16	0.00	0.00	0.11
Burundi	6.3	0.48	0.23	0.03	0.10	0.01	0.05	0.01	0.04	0.00	0.00	0.05
Cameroon	14.6	1.11	0.66	0.04	0.06	0.04	0.20	0.05	0.15	0.00	0.00	0.10
Central African Rep.	3.6	1.25	0.67	0.26	0.08	0.01	0.15	0.02	0.14	0.00	0.00	0.08
Chad	7.6	1.02	0.49	0.27	0.11	0.04	0.03	0.01	0.03	0.00	0.00	0.07
Congo	2.9	0.92	0.21	0.02	0.06	0.18	0.35	0.19	0.16	0.00	0.00	0.10
Congo, Dem. Rep.	49.6	0.80	0.17	0.01	0.33	0.04	0.18	0.02	0.17	0.00	0.00	0.07
Côte d'Ivoire	15.7	0.92	0.38	0.04	0.12	0.07	0.19	0.07	0.13	0.00	0.00	0.10
Egypt	66.7	1.49	0.43	0.02	0.06	0.05	0.48	0.47	0.01	0.00	0.00	0.46
Eritrea	3.5	0.79	0.22	0.10	0.22	0.00	0.16	0.05	0.11	0.00	0.00	0.08
Ethiopia	64.9	0.78	0.22	0.02	0.31	0.00	0.16	0.01	0.14	0.00	0.00	0.08
Gabon	1.2	2.12	0.69	0.04	0.25	0.31	0.76	0.37	0.39	0.00	0.00	0.06
Gambia, The	1.3	1.00	0.44	0.05	0.16	0.12	0.15	0.07	0.07	0.00	0.00	0.08
Ghana	18.9	1.07	0.32	0.02	0.23	0.15	0.24	0.05	0.19	0.00	0.00	0.10
Guinea	8.0	1.21	0.29	0.05	0.43	0.11	0.25	0.05	0.19	0.00	0.00	0.09
Guinea-Bissau	1.2	0.70	0.30	0.03	0.17	0.03	0.11	0.05	0.06	0.00	0.00	0.05
Kenya	30.0	1.09	0.19	0.21	0.37	0.01	0.24	0.07	0.17	0.00	0.00	0.07
Lesotho	2.0	0.86	0.24	0.16	0.27	0.00	0.14	id	0.14	0.00	0.00	0.05
Liberia	2.7	0.91	0.20	0.01	0.35	0.04	0.21	0.04	0.16	0.00	0.00	0.11
Libya	5.2	3.28	0.86	0.11	0.06	0.08	2.10	2.08	0.02	0.00	0.00	0.07
Madagascar	15.5	0.88	0.23	0.17	0.21	0.05	0.14	0.02	0.12	0.00	0.00	0.08
Malawi	11.0	0.87	0.25	0.02	0.30	0.02	0.18	0.02	0.16	0.00	0.00	0.11
Mali	11.0	1.14	0.53	0.16	0.22	0.02	0.12	0.02	0.10	0.00	0.00	0.09
Mauritania	2.6	1.33	0.39	0.39	0.01	0.14	0.33	0.33	0.00	0.00	0.00	0.07
Mauritius	1.2	1.50	0.54	0.09	0.12	0.29	0.35	0.34	0.00	0.01	0.00	0.12
Morocco	29.3	1.10	0.51	0.12	0.04	0.09	0.29	0.28	0.00	0.00	0.00	0.06
Mozambique	17.9	0.47	0.20	0.02	0.03	0.02	0.17	0.02	0.16	0.00	0.00	0.02
Namibia	1.7	1.47	0.65	0.25	id	0.23	0.24	0.24	id	0.00	0.00	0.10
Niger	10.5	1.15	0.61	0.08	0.24	0.00	0.14	0.03	0.11	0.00	0.00	0.08

1999 data unless otherwise specified *See notes on pages 28/29*	Biocapacity (global ha/person)	Cropland biocapacity (global ha/person)	Grazing land biocapacity (global ha/person)	Forest biocapacity (global ha/person)	Fishing ground biocapacity (global ha/person)	Ecological deficit (global ha/person)	Ecological footprint 1996 (global ha/person)	Biocapacity 1996 (global ha/person)	Water* withdrawals 2000 est. (thousand m3/ person/year)	Water* resources 2000 est. (thousand m3/ person/year)
WORLD	**1.90**	**0.53**	**0.27**	**0.86**	**0.14**	**0.38**	**2.39**	**1.98**	**0.55**	**8.89**
High income countries	**3.55**	**1.13**	**0.71**	**1.10**	**0.37**	**2.93**	**6.49**	**3.66**	**0.98**	**9.65**
Middle income countries	**1.89**	**0.47**	**0.35**	**0.84**	**0.12**	**0.10**	**2.11**	**1.93**	**0.52**	**11.10**
Low income countries	**0.95**	**0.30**	**0.08**	**0.44**	**0.06**	**-0.11**	**0.89**	**0.98**	**0.42**	**5.55**
AFRICA	**1.55**	**0.36**	**0.26**	**0.71**	**0.10**	**-0.18**	**1.36**	**1.68**	**0.19**	**6.64**
Algeria	0.54	0.24	0.15	0.08	0.01	1.01	1.92	0.68	0.14	0.45
Angola	5.88	0.21	1.65	3.53	0.46	-5.01	1.04	6.44	0.04	14.38
Benin	1.05	0.41	0.03	0.46	0.05	0.10	1.07	1.09	0.02	4.16
Botswana	3.92	0.18	0.95	2.39	0.33	-2.43	2.01	4.25	0.07	9.07
Burkina Faso	0.94	0.38	0.13	0.33	0.00	0.24	1.16	0.98	0.03	1.45
Burundi	0.53	0.23	0.09	0.14	0.01	-0.05	0.53	0.61	0.01	0.52
Cameroon	3.92	0.70	0.04	2.99	0.09	-2.81	1.26	4.30	0.03	17.71
Central African Rep.	6.20	0.65	0.28	5.19	0.00	-4.95	1.49	6.63	0.02	38.74
Chad	1.68	0.45	0.34	0.69	0.12	-0.65	1.04	1.85	0.02	5.91
Congo	9.05	0.11	1.31	7.37	0.16	-8.13	1.09	9.77	0.01	279.19
Congo, Dem. Rep.	3.36	0.16	0.11	2.92	0.09	-2.56	0.65	3.66	0.01	19.69
Côte d'Ivoire	2.00	0.73	0.44	0.68	0.05	-1.08	1.15	2.10	0.05	5.13
Egypt	0.78	0.29	id	0.00	0.02	0.71	1.56	0.78	0.81	1.27
Eritrea	0.75	0.15	0.10	0.30	0.12	0.03	0.77	0.71	†	0.13
Ethiopia	0.46	0.21	0.02	0.09	0.06	0.32	0.81	0.52	0.03	28.87
Gabon	28.70	0.55	1.30	24.52	2.26	-26.57	2.92	31.02	0.05	132.79
Gambia, The	0.93	0.31	0.05	0.18	0.32	0.07	0.90	0.85	0.02	6.43
Ghana	0.89	0.40	0.10	0.21	0.09	0.18	1.08	0.97	0.02	2.66
Guinea	2.01	0.25	0.22	1.07	0.39	-0.80	1.19	2.02	0.09	28.75
Guinea-Bissau	4.19	0.34	0.03	1.56	2.20	-3.49	0.78	4.51	0.01	22.88
Kenya	1.05	0.16	0.29	0.52	0.00	0.04	1.18	1.15	0.07	1.00
Lesotho	0.71	0.12	0.46	0.08	0.00	0.15	0.90	0.73	0.02	2.27
Liberia	3.26	0.17	0.27	2.12	0.59	-2.34	1.15	4.39	0.04	71.25
Libya	0.93	0.40	0.08	0.08	0.31	2.34	3.53	1.07	0.72	0.09
Madagascar	1.86	0.23	0.42	0.90	0.23	-0.99	0.95	2.04	0.94	19.37
Malawi	0.82	0.28	0.07	0.28	0.08	0.05	0.87	0.83	0.09	1.70
Mali	1.42	0.56	0.17	0.55	0.06	-0.28	1.21	1.53	0.11	7.96
Mauritania	2.65	0.16	0.83	0.10	1.48	-1.32	1.22	2.93	0.63	4.42
Mauritius	1.28	0.17	0.01	0.14	0.84	0.22	1.66	1.39	0.52	1.87
Morocco	0.87	0.28	0.13	0.12	0.29	0.24	1.26	1.22	0.38	1.04
Mozambique	1.87	0.19	1.14	0.49	0.03	-1.40	0.79	1.96	0.03	11.04
Namibia	5.04	0.51	1.26	1.17	2.00	-3.57	1.33	5.89	0.14	26.26
Niger	0.91	0.66	0.09	0.09	0.00	0.24	1.08	0.77	0.05	3.01

1999 data unless otherwise specified	Population (millions)	Total ecological footprint (global ha/person)	Cropland footprint (global ha/person)	Grazing land footprint (global ha/person)	Forest footprint (ex. fuelwood) (global ha/person)	Fishing ground footprint (global ha/person)	Total energy footprint (global ha/person)	Included in total energy				Built-up land (global ha/person)
								CO_2 from fossil fuels (global ha/person)	Fuelwood (global ha/person)	Nuclear (global ha/person)	Hydro (global ha/person)	
Nigeria	110.8	1.33	0.52	0.07	0.34	0.04	0.25	0.10	0.15	0.00	0.00	0.11
Rwanda	7.1	1.06	0.30	0.04	0.40	0.00	0.21	0.02	0.19	0.00	0.00	0.12
Senegal	9.2	1.31	0.42	0.18	0.22	0.22	0.18	0.10	0.08	0.00	0.00	0.09
Sierra Leone	4.3	0.54	0.21	0.03	0.00	0.06	0.16	0.04	0.12	0.00	0.00	0.08
Somalia	8.4	1.05	0.11	0.42	0.31	0.01	0.15	id	0.15	0.00	0.00	0.06
South Africa, Rep.	42.8	4.02	0.66	0.27	0.30	0.22	2.45	2.33	0.05	0.07	0.00	0.11
Sudan	30.4	1.06	0.50	0.25	0.14	0.00	0.10	0.05	0.05	0.00	0.00	0.07
Tanzania, United Rep.	34.3	1.03	0.23	0.13	0.30	0.04	0.22	0.02	0.20	0.00	0.00	0.11
Togo	4.4	0.86	0.46	0.03	0.11	0.08	0.11	0.07	0.04	0.00	0.00	0.07
Tunisia	9.4	1.69	0.72	0.10	0.16	0.08	0.55	0.50	0.05	0.00	0.00	0.08
Uganda	22.6	1.06	0.47	0.03	0.31	0.02	0.13	0.01	0.12	0.00	0.00	0.10
Zambia	10.2	1.26	0.61	0.06	0.29	0.03	0.21	0.06	0.14	0.00	0.01	0.07
Zimbabwe	12.4	1.32	0.28	0.12	0.24	0.02	0.61	0.47	0.13	0.02	0.00	0.04
MIDDLE EAST AND CENTRAL ASIA	**323.3**	**2.07**	**0.62**	**0.12**	**0.06**	**0.06**	**1.12**	**1.11**	**0.01**	**0.00**	**0.00**	**0.09**
Afghanistan	21.2	0.95	0.41	0.25	0.15	0.00	0.07	0.02	0.05	0.00	0.00	0.06
Armenia	3.8	0.88	0.40	0.16	0.00	0.00	0.26	0.25	id	0.00	0.00	0.06
Azerbaijan	8.0	1.73	0.40	0.08	0.04	0.00	1.17	1.16	id	0.00	0.00	0.04
Georgia	5.3	0.91	0.39	0.15	id	0.01	0.31	0.30	id	0.00	0.01	0.05
Iran	69.2	1.98	0.61	0.10	0.01	0.08	1.08	1.08	0.00	0.00	0.00	0.10
Iraq	22.3	1.38	0.32	0.01	0.00	0.02	0.99	0.99	0.00	0.00	0.00	0.03
Israel	5.9	4.44	0.79	0.11	0.24	0.50	2.58	2.57	0.00	0.01	0.00	0.22
Jordan	4.8	1.55	0.56	0.05	0.06	0.03	0.80	0.79	0.00	0.00	0.00	0.05
Kazakhstan	16.3	3.58	1.12	0.53	0.02	0.01	1.87	1.87	0.00	0.00	0.00	0.03
Kuwait	1.8	7.75	0.52	0.13	0.11	0.08	6.67	6.66	id	0.01	0.00	0.24
Kyrgyzstan, Rep.	4.8	1.14	0.56	0.20	0.02	0.00	0.30	0.28	0.00	0.00	0.02	0.05
Lebanon	3.4	2.61	0.69	0.05	0.21	0.09	1.38	1.35	0.02	0.01	0.00	0.19
Saudi Arabia	19.6	4.07	0.92	0.08	0.07	0.08	2.74	2.71	0.00	0.03	0.00	0.18
Syria	15.8	1.62	0.58	0.06	0.03	0.02	0.84	0.84	0.00	0.00	0.00	0.08
Tajikistan	6.0	0.66	0.28	0.04	0.01	0.00	0.28	0.26	0.00	0.00	0.02	0.05
Turkey	65.7	1.98	0.83	0.03	0.15	0.07	0.77	0.75	0.02	0.00	0.00	0.11
Turkmenistan	4.6	3.18	0.60	0.43	0.01	0.01	2.07	2.07	id	0.00	0.00	0.06
United Arab Emirates	2.6	10.13	1.15	0.19	0.36	0.54	7.74	7.72	id	0.02	0.00	0.16
Uzbekistan	24.5	1.91	0.37	0.12	0.01	0.00	1.33	1.33	0.00	0.00	0.00	0.08
Yemen	17.6	0.71	0.27	0.10	0.01	0.08	0.16	0.16	id	0.00	0.00	0.10
ASIA-PACIFIC	**3 312.7**	**1.37**	**0.32**	**0.05**	**0.17**	**0.12**	**0.63**	**0.55**	**0.06**	**0.02**	**0.00**	**0.08**
Australia	18.9	7.58	1.64	0.62	0.60	0.25	4.35	4.31	0.02	0.00	0.01	0.11
Bangladesh	134.6	0.53	0.22	0.00	0.10	0.04	0.11	0.06	0.05	0.00	0.00	0.06
Cambodia	12.8	0.83	0.34	0.05	0.22	0.03	0.14	0.02	0.12	0.00	0.00	0.05
China	1 272.0	1.54	0.35	0.09	0.22	0.10	0.69	0.64	0.05	0.00	0.00	0.09
India	992.7	0.77	0.28	0.00	0.11	0.03	0.30	0.24	0.05	0.00	0.00	0.05
Indonesia	209.3	1.13	0.29	0.02	0.14	0.18	0.44	0.30	0.14	0.00	0.00	0.06

1999 data unless otherwise specified	Biocapacity (global ha/person)	Cropland biocapacity (global ha/person)	Grazing land biocapacity (global ha/person)	Forest biocapacity (global ha/person)	Fishing ground biocapacity (global ha/person)	Ecological deficit (global ha/person)	Ecological footprint 1996 (global ha/person)	Biocapacity 1996 (global ha/person)	Water withdrawals 2000 est. (thousand m3/ person/year)	Water resources 2000 est. (thousand m3/ person/year)
Nigeria	0.88	0.51	0.13	0.10	0.03	0.45	1.50	0.88	0.03	2.17
Rwanda	0.92	0.26	0.04	0.50	0.01	0.14	1.16	1.15	0.10	0.82
Senegal	1.49	0.30	0.25	0.70	0.16	-0.18	1.22	1.55	0.14	4.15
Sierra Leone	1.07	0.14	0.14	0.43	0.29	-0.52	0.88	1.28	0.08	32.88
Somalia	1.06	0.08	0.46	0.43	0.04	-0.02	1.07	1.17	0.07	1.37
South Africa, Rep.	2.42	0.60	0.93	0.56	0.23	1.60	3.81	2.72	0.29	1.08
Sudan	2.04	0.47	0.26	1.20	0.03	-0.98	1.15	2.32	0.60	5.16
Tanzania, United Rep.	1.29	0.22	0.31	0.64	0.02	-0.26	1.18	1.40	0.03	2.64
Togo	0.81	0.47	0.09	0.14	0.04	0.05	0.89	0.88	0.02	2.57
Tunisia	1.00	0.55	0.11	0.06	0.21	0.69	1.64	1.11	0.31	0.42
Uganda	0.89	0.48	0.03	0.21	0.07	0.18	1.10	0.96	0.01	2.94
Zambia	2.67	0.56	0.83	1.17	0.04	-1.41	1.51	3.08	0.19	12.70
Zimbabwe	1.42	0.26	0.45	0.66	0.01	-0.11	1.41	1.43	0.10	1.61
MIDDLE EAST AND CENTRAL ASIA	**0.97**	**0.51**	**0.14**	**0.13**	**0.09**	**1.10**	**2.33**	**1.01**	**1.08**	**2.57**
Afghanistan	0.78	0.39	0.27	0.06	0.00	0.16	0.97	0.83	1.02	2.54
Armenia	0.50	0.23	0.14	0.05	0.02	0.38	0.88	0.53	0.80	2.87
Azerbaijan	0.90	0.32	0.08	0.11	0.36	0.82	1.69	0.91	2.11	3.87
Georgia	0.92	0.29	0.15	0.40	0.01	-0.01	0.86	0.93	0.64	11.68
Iran	0.89	0.47	0.10	0.14	0.09	1.08	2.12	0.91	0.92	1.80
Iraq	0.23	0.14	0.01	0.04	0.00	1.15	1.43	0.35	1.85	4.17
Israel	0.57	0.27	0.03	0.03	0.02	3.86	5.02	0.58	0.28	0.35
Jordan	0.16	0.07	0.01	0.03	0.00	1.39	1.96	0.25	0.16	0.14
Kazakhstan	3.33	1.60	1.10	0.25	0.36	0.25	3.75	2.58	1.99	6.47
Kuwait	0.40	0.01	0.02	0.00	0.12	7.35	9.38	0.46	0.27	0.01
Kyrgyzstan, Rep.	0.99	0.53	0.22	0.11	0.06	0.15	1.24	0.96	2.22	4.53
Lebanon	0.50	0.28	0.00	0.02	0.01	2.11	2.56	0.57	0.39	1.47
Saudi Arabia	0.98	0.49	0.07	0.07	0.16	3.09	5.52	1.07	0.79	0.11
Syria	0.61	0.43	0.06	0.04	0.00	1.00	1.83	0.90	0.89	2.86
Tajikistan	0.31	0.21	0.02	0.01	0.01	0.35	0.75	0.37	1.86	2.50
Turkey	1.23	0.77	0.03	0.28	0.02	0.75	2.30	1.43	0.48	3.05
Turkmenistan	2.02	0.62	0.59	0.01	0.73	1.16	2.89	1.63	5.31	5.51
United Arab Emirates	1.26	0.15	0.00	0.19	0.76	8.88	11.87	1.32	0.86	0.06
Uzbekistan	0.68	0.38	0.08	0.04	0.09	1.23	1.88	0.70	2.32	2.01
Yemen	0.52	0.14	0.13	0.02	0.13	0.19	0.87	0.55	0.16	0.23
ASIA-PACIFIC	**1.04**	**0.32**	**0.22**	**0.35**	**0.08**	**0.32**	**1.45**	**1.05**	**0.49**	**4.78**
Australia	14.61	4.38	4.94	2.30	2.86	-7.03	8.57	16.21	0.94	21.13
Bangladesh	0.30	0.18	0.00	0.04	0.02	0.23	0.53	0.28	0.11	9.43
Cambodia	1.36	0.34	0.05	0.82	0.10	-0.54	0.71	1.46	0.05	42.48
China	1.04	0.33	0.44	0.14	0.03	0.51	1.62	0.98	0.43	2.22
India	0.68	0.28	0.00	0.31	0.04	0.09	0.83	0.67	0.50	1.89
Indonesia	1.82	0.29	0.03	1.17	0.27	-0.69	1.22	1.93	0.35	13.35

1999 data unless otherwise specified	Population	Total ecological footprint	Cropland footprint	Grazing land footprint	Forest footprint	Fishing ground footprint	Total energy footprint	Included in total energy				Built-up land
	(millions)	(global ha/person)	(global ha/person)	(global ha/person)	(ex. fuelwood) (global ha/person)	(global ha/person)	(global ha/person)	CO_2 from fossil fuels (global ha/person)	Fuelwood (global ha/person)	Nuclear (global ha/person)	Hydro (global ha/person)	(global ha/person)
Japan	126.8	4.77	0.47	0.06	0.28	0.76	3.04	2.53	0.00	0.51	0.01	0.16
Korea, DPR	22.1	3.04	0.23	0.00	0.11	0.16	2.48	2.43	0.04	0.00	0.01	0.07
Korea, Rep.	46.4	3.31	0.47	0.04	0.14	0.59	1.94	1.70	0.00	0.23	0.00	0.13
Lao PDR	5.2	0.82	0.21	0.07	0.31	0.03	0.15	0.02	0.14	0.00	0.00	0.04
Malaysia	21.8	3.16	0.68	0.05	0.21	0.53	1.63	1.49	0.06	0.07	0.00	0.07
Mongolia	2.5	2.58	0.33	1.34	0.10	0.00	0.80	0.79	0.01	0.00	0.00	0.01
Myanmar	47.1	0.70	0.36	0.00	0.08	0.08	0.13	0.05	0.08	0.00	0.00	0.05
Nepal	22.5	0.83	0.23	0.02	0.34	0.00	0.20	0.03	0.16	0.00	0.00	0.05
New Zealand	3.7	8.68	3.03	1.60	1.09	0.71	2.03	1.92	id	0.06	0.05	0.22
Pakistan	137.6	0.64	0.27	0.01	0.08	0.03	0.20	0.16	0.04	0.00	0.00	0.05
Papua New Guinea	4.7	1.42	0.25	0.06	0.47	0.25	0.31	0.10	0.21	0.00	0.00	0.07
Philippines	74.2	1.17	0.24	0.03	0.22	0.29	0.35	0.25	0.10	0.00	0.00	0.05
Sri Lanka	18.7	1.00	0.25	0.01	0.21	0.22	0.25	0.15	0.09	0.00	0.00	0.06
Thailand	62.0	1.53	0.31	0.00	0.16	0.26	0.74	0.64	0.10	0.00	0.00	0.05
Viet Nam	77.1	0.76	0.24	0.00	0.18	0.05	0.19	0.11	0.07	0.00	0.00	0.10
LATIN AMERICA AND THE CARIBBEAN	**503.2**	**2.17**	**0.58**	**0.38**	**0.26**	**0.11**	**0.75**	**0.65**	**0.08**	**0.01**	**0.01**	**0.10**
Argentina	36.6	3.03	0.78	0.86	0.09	0.19	0.97	0.92	0.01	0.04	0.01	0.14
Bolivia	8.1	0.96	0.31	0.13	0.09	0.02	0.35	0.32	0.03	0.00	0.00	0.06
Brazil	168.2	2.38	0.64	0.55	0.43	0.07	0.59	0.46	0.12	0.00	0.01	0.09
Chile	15.0	3.11	0.61	0.32	0.62	0.45	0.96	0.83	0.12	0.00	0.01	0.15
Colombia	41.4	1.34	0.28	0.26	0.15	0.09	0.44	0.36	0.07	0.00	0.01	0.11
Costa Rica	3.9	1.95	0.40	0.24	0.63	0.05	0.46	0.28	0.17	0.00	0.01	0.17
Cuba	11.2	1.49	0.55	0.03	0.06	0.13	0.66	0.64	0.02	0.00	0.00	0.05
Dominican Rep.	8.2	1.53	0.44	0.14	0.09	0.17	0.61	0.59	0.01	0.00	0.00	0.08
Ecuador	12.4	1.54	0.35	0.15	0.42	0.09	0.45	0.37	0.08	0.00	0.00	0.08
El Salvador	6.2	1.19	0.31	0.06	0.34	0.02	0.36	0.22	0.13	0.00	0.00	0.11
Guatemala	11.1	1.42	0.35	0.07	0.40	0.01	0.47	0.25	0.21	0.02	0.00	0.10
Haiti	8.0	0.82	0.24	0.01	0.30	0.02	0.20	0.06	0.14	0.00	0.00	0.06
Honduras	6.3	1.34	0.51	0.09	0.25	0.04	0.37	0.18	0.19	0.00	0.00	0.08
Jamaica	2.6	2.07	0.42	0.10	0.12	0.23	1.11	1.09	0.02	0.00	0.00	0.10
Mexico	97.4	2.52	0.70	0.25	0.13	0.09	1.26	1.18	0.03	0.05	0.00	0.08
Nicaragua	4.9	1.53	0.97	0.12	0.02	0.01	0.33	0.18	0.15	0.00	0.00	0.08
Panama	2.8	1.72	0.48	0.30	0.16	0.17	0.52	0.45	0.06	0.00	0.01	0.08
Paraguay	5.4	2.51	1.14	0.56	0.23	0.02	0.35	0.14	0.14	0.00	0.06	0.21
Peru	25.2	1.15	0.42	0.09	0.12	0.23	0.19	0.13	0.05	0.00	0.00	0.10
Trinidad and Tobago	1.3	3.30	0.39	0.06	0.11	0.25	2.42	2.37	0.00	0.06	0.00	0.07
Uruguay	3.3	3.79	0.57	1.64	0.61	0.16	0.71	0.46	0.23	0.00	0.02	0.10
Venezuela	23.7	2.34	0.40	0.22	0.06	0.16	1.40	1.37	0.01	0.00	0.02	0.09
NORTH AMERICA	**310.9**	**9.61**	**1.55**	**0.32**	**1.26**	**0.30**	**5.82**	**5.26**	**0.05**	**0.49**	**0.02**	**0.37**
Canada	30.5	8.84	2.18	0.31	1.12	0.19	4.74	4.19	0.03	0.45	0.08	0.31
United States of America	280.4	9.70	1.48	0.32	1.28	0.31	5.94	5.38	0.06	0.50	0.01	0.37

1999 data unless otherwise specified	Biocapacity (global ha/person)	Cropland biocapacity (global ha/person)	Grazing land biocapacity (global ha/person)	Forest biocapacity (global ha/person)	Fishing ground biocapacity (global ha/person)	Ecological deficit (global ha/person)	Ecological footprint 1996 (global ha/person)	Biocapacity 1996 (global ha/person)	Water withdrawals 2000 est. (thousand m3/ person/year)	Water resources 2000 est. (thousand m3/ person/year)
Japan	0.71	0.13	0.01	0.28	0.13	4.06	4.68	0.74	0.72	3.40
Korea, DPR	0.81	0.19	0.00	0.47	0.08	2.23	3.57	0.80	0.59	3.22
Korea, Rep.	0.73	0.15	0.00	0.18	0.27	2.58	3.36	0.75	0.50	1.49
Lao PDR	4.49	0.26	0.07	4.08	0.04	-3.68	0.69	4.82	0.17	58.25
Malaysia	3.39	0.83	0.01	2.03	0.44	-0.24	3.90	3.72	0.57	26.01
Mongolia	6.43	0.25	2.77	3.40	0.00	-3.85	2.70	7.79	0.16	12.72
Myanmar	1.62	0.38	0.00	1.00	0.18	-0.92	0.71	1.72	0.08	21.19
Nepal	0.58	0.22	0.02	0.28	0.01	0.25	0.85	0.63	1.19	8.63
New Zealand	22.95	3.05	13.68	5.51	0.44	-14.28	8.08	23.34	0.53	105.59
Pakistan	0.39	0.24	0.01	0.06	0.03	0.25	0.68	0.40	1.00	2.75
Papua New Guinea	14.00	0.35	0.01	12.51	1.07	-12.58	1.43	15.07	0.02	166.49
Philippines	0.56	0.21	0.02	0.20	0.10	0.61	1.32	0.65	0.74	6.38
Sri Lanka	0.51	0.19	0.01	0.21	0.04	0.50	0.99	0.50	0.52	2.66
Thailand	1.37	0.48	0.00	0.75	0.09	0.15	2.08	1.44	0.55	6.78
Viet Nam	0.84	0.30	0.00	0.31	0.13	-0.08	0.76	0.80	0.67	11.06
LATIN AMERICA AND THE CARIBBEAN	**4.02**	**0.64**	**0.66**	**2.38**	**0.23**	**-1.84**	**2.30**	**4.17**	**0.52**	**36.18**
Argentina	6.66	2.01	2.93	1.01	0.57	-3.63	3.51	6.66	0.77	21.98
Bolivia	6.39	0.33	0.14	5.80	0.06	-5.43	1.08	6.90	0.15	74.74
Brazil	6.03	0.73	0.65	4.44	0.10	-3.65	2.47	6.23	0.32	48.66
Chile	4.23	0.46	0.83	0.98	1.80	-1.13	3.95	4.71	1.33	60.61
Colombia	2.53	0.24	0.50	1.65	0.02	-1.19	1.55	2.64	0.23	54.80
Costa Rica	2.31	0.44	0.54	1.12	0.03	-0.36	2.12	2.55	1.52	29.59
Cuba	1.10	0.44	0.02	0.55	0.03	0.39	1.46	1.03	0.47	3.40
Dominican Rep.	0.74	0.31	0.14	0.18	0.03	0.78	1.27	0.72	0.98	2.47
Ecuador	2.61	0.37	0.18	1.61	0.37	-1.07	1.76	2.80	1.34	34.16
El Salvador	0.53	0.27	0.08	0.05	0.02	0.67	1.25	0.53	0.12	4.00
Guatemala	1.20	0.35	0.09	0.64	0.01	0.21	1.39	1.27	0.09	9.10
Haiti	0.26	0.14	0.00	0.03	0.03	0.56	0.82	0.27	0.13	1.79
Honduras	1.56	0.48	0.09	0.84	0.06	-0.22	1.67	1.74	0.23	14.79
Jamaica	0.59	0.21	0.06	0.14	0.08	1.49	2.19	0.61	0.35	3.64
Mexico	1.69	0.51	0.31	0.51	0.27	0.83	2.42	1.80	0.79	4.62
Nicaragua	3.09	0.93	0.51	1.46	0.11	-1.56	1.67	3.32	0.27	41.90
Panama	3.09	0.37	0.39	2.13	0.11	-1.37	2.20	3.31	0.58	51.81
Paraguay	6.67	1.71	1.95	2.68	0.06	-4.16	2.61	7.03	0.08	61.14
Peru	5.31	0.33	0.55	3.91	0.43	-4.16	1.43	5.58	0.74	74.55
Trinidad and Tobago	0.81	0.13	0.00	0.36	0.24	2.49	4.05	0.83	0.22	2.86
Uruguay	4.57	0.82	2.73	0.39	0.52	-0.78	3.27	4.28	0.20	42.46
Venezuela	3.28	0.28	0.23	2.62	0.04	-0.95	2.66	3.40	0.17	51.02
NORTH AMERICA	**6.15**	**1.94**	**1.26**	**1.99**	**0.59**	**3.46**	**9.44**	**6.28**	**1.66**	**17.44**
Canada	14.24	3.46	1.25	7.24	1.91	-5.40	7.81	14.59	1.43	94.56
United States of America	5.27	1.77	1.26	1.42	0.44	4.43	9.62	5.35	1.69	8.92

1999 data unless otherwise specified	Population	Total ecological footprint	Cropland footprint	Grazing land footprint	Forest footprint (ex. fuelwood)	Fishing ground footprint	Total energy footprint	Included in total energy				Built-up land
	(millions)	(global ha/person)	(global ha/person)	(global ha/person)	(global ha/person)	(global ha/person)	(global ha/person)	CO_2 from fossil fuels (global ha/person)	Fuelwood (global ha/person)	Nuclear (global ha/person)	Hydro (global ha/person)	(global ha/person)
WESTERN EUROPE	**387.4**	**4.97**	**0.84**	**0.20**	**0.46**	**0.38**	**2.88**	**2.45**	**0.02**	**0.41**	**0.01**	**0.21**
Austria	8.1	4.73	0.71	0.26	0.80	0.18	2.64	2.37	0.08	0.16	0.03	0.14
Belgium/Luxembourg	10.2	6.72	0.83	0.14	0.46	0.31	4.68	3.83	0.01	0.84	0.00	0.30
Denmark	5.3	6.58	1.21	0.09	1.11	0.45	3.45	3.24	0.02	0.19	0.00	0.26
Finland	5.2	8.42	1.05	0.04	2.36	0.45	4.07	3.04	0.17	0.84	0.02	0.45
France	59.0	5.26	0.98	0.19	0.45	0.37	3.04	2.09	0.01	0.93	0.01	0.23
Germany	82.0	4.71	0.68	0.09	0.37	0.19	3.08	2.69	0.01	0.38	0.00	0.29
Greece	10.6	5.09	1.06	0.38	0.28	0.27	3.03	2.89	0.02	0.12	0.00	0.07
Ireland	3.8	5.33	1.37	0.40	0.54	0.25	2.62	2.61	0.00	0.01	0.00	0.15
Italy	57.5	3.84	0.81	0.18	0.30	0.27	2.21	2.10	0.02	0.08	0.01	0.07
Netherlands	15.8	4.81	0.77	0.13	0.54	0.29	2.89	2.82	0.00	0.07	0.00	0.19
Norway	4.4	7.92	0.89	0.05	0.97	2.62	3.18	2.68	0.03	0.26	0.20	0.22
Portugal	10.0	4.47	0.91	0.17	0.40	1.01	1.78	1.75	0.01	0.01	0.01	0.21
Spain	39.9	4.66	1.08	0.25	0.48	0.56	2.19	1.88	0.01	0.29	0.00	0.09
Sweden	8.9	6.73	1.21	0.12	1.37	0.34	3.21	1.49	0.13	1.53	0.05	0.48
Switzerland	7.2	4.12	0.55	0.45	0.45	0.16	2.27	1.51	0.03	0.69	0.04	0.25
United Kingdom	59.5	5.35	0.68	0.33	0.32	0.47	3.33	2.99	0.00	0.34	0.00	0.21
CENTRAL AND EASTERN EUROPE	**349.9**	**3.68**	**0.96**	**0.09**	**0.19**	**0.26**	**2.11**	**1.96**	**0.02**	**0.12**	**0.00**	**0.07**
Albania	3.1	0.96	0.55	0.06	0.07	0.01	0.19	0.15	0.02	0.00	0.01	0.08
Belarus	10.2	3.27	1.09	0.11	0.50	0.01	1.51	1.50	0.01	0.00	0.00	0.06
Bosnia Herzegovina	3.8	1.05	0.45	0.11	0.01	0.01	0.41	0.40	id	0.00	0.00	0.06
Bulgaria	8.0	2.36	0.92	0.08	0.13	0.03	1.13	0.89	0.03	0.21	0.00	0.07
Croatia	4.7	2.69	0.89	0.08	0.28	0.14	1.21	1.16	0.04	0.00	0.00	0.09
Czech Rep.	10.3	4.82	0.90	0.06	0.48	0.10	3.15	2.88	0.01	0.25	0.00	0.13
Estonia	1.4	4.94	1.27	0.08	0.37	0.26	2.91	2.81	0.09	0.01	0.00	0.05
Hungary	10.0	3.08	0.84	0.02	0.19	0.11	1.81	1.51	0.03	0.26	0.00	0.11
Latvia	2.4	3.43	1.43	0.11	0.60	0.11	1.11	0.93	0.13	0.04	0.01	0.07
Lithuania	3.7	3.07	1.39	0.06	0.29	0.24	1.02	0.96	0.05	0.00	0.00	0.07
Macedonia	2.0	3.26	0.80	0.10	0.21	0.63	1.44	1.38	0.06	0.00	0.00	0.09
Moldova, Rep.	4.3	1.38	0.69	0.02	0.04	0.00	0.58	0.58	0.00	0.00	0.00	0.05
Poland	38.6	3.70	0.98	0.03	0.27	0.18	2.14	2.13	0.01	0.00	0.00	0.10
Romania	22.5	2.52	0.71	0.05	0.12	0.04	1.53	1.42	0.02	0.08	0.01	0.07
Russian Federation	146.2	4.49	1.09	0.15	0.19	0.48	2.52	2.36	0.02	0.13	0.01	0.05
Slovakia	5.4	3.44	0.75	0.07	0.17	0.12	2.21	1.93	0.01	0.27	0.01	0.11
Slovenia	2.0	3.58	0.72	0.24	0.31	0.10	2.11	2.07	0.02	0.01	0.01	0.11
Ukraine	50.0	3.37	0.84	0.04	0.09	0.05	2.29	1.99	0.01	0.29	0.00	0.06
Yugoslavia, Fed. Rep.	21.1	2.14	0.74	0.05	0.10	0.10	1.06	1.06	0.00	0.00	0.00	0.09

NOTES

High income countries: Australia; Austria; Belgium; Canada; Denmark; Finland; France; Germany; Greece; Ireland; Israel; Italy; Japan; Korea, Rep.; Kuwait; Netherlands; New Zealand; Norway; Portugal; Slovenia; Spain; Sweden; Switzerland; United Arab Emirates; United Kingdom; United States of America

Middle income countries: Algeria; Argentina; Belarus; Bolivia; Botswana; Brazil; Bulgaria; Chile; China; Colombia; Costa Rica; Croatia; Cuba; Czech Rep.; Dominican Rep.; Ecuador; Egypt; El Salvador; Estonia; Gabon; Georgia; Guatemala; Hungary; Indonesia; Iran; Iraq; Jamaica; Jordan; Kazakhstan; Korea, Dem. Rep.; Latvia; Lebanon; Libya; Lithuania; Macedonia; Malaysia; Mauritius; Mexico; Morocco; Namibia; Panama; Papua New Guinea; Paraguay; Peru; Philippines; Poland; Romania; Russian Federation; Saudi Arabia; Slovakia; South Africa, Rep.; Sri Lanka; Syria; Thailand; Trinidad and Tobago; Tunisia; Turkey; Ukraine; Uruguay; Uzbekistan; Venezuela; Yugoslavia, Fed. Rep.

Low income countries: Afghanistan; Albania; Angola; Armenia; Azerbaijan; Bangladesh; Benin; Bosnia Herzegovina; Burkina Faso; Burundi; Cambodia; Cameroon; Central African Rep.; Chad; Congo;

1999 data unless otherwise specified	Biocapacity (global ha/person)	Cropland biocapacity (global ha/person)	Grazing land biocapacity (global ha/person)	Forest biocapacity (global ha/person)	Fishing ground biocapacity (global ha/person)	Ecological deficit (global ha/person)	Ecological footprint 1996 (global ha/person)	Biocapacity 1996 (global ha/person)	Water withdrawals 2000 est. (thousand m3/person/year)	Water resources 2000 est. (thousand m3/person/year)
WESTERN EUROPE	**2.13**	**0.79**	**0.28**	**0.69**	**0.16**	**2.84**	**5.03**	**2.22**	**0.62**	**5.35**
Austria	2.78	0.68	0.35	1.57	0.00	1.95	4.79	2.78	0.30	10.89
Belgium/Luxembourg	1.13	0.40	0.14	0.27	0.01	5.59	6.38	1.24	0.85	1.64
Denmark	3.24	1.78	0.07	0.35	0.78	3.33	7.18	3.42	0.19	2.46
Finland	8.61	0.96	0.03	7.00	0.16	-0.19	8.01	9.17	0.47	21.82
France	2.88	1.43	0.34	0.78	0.10	2.38	5.50	2.91	0.59	3.35
Germany	1.74	0.70	0.11	0.62	0.03	2.96	4.76	1.70	0.71	2.20
Greece	2.34	0.99	0.85	0.18	0.24	2.76	5.12	2.46	0.57	5.53
Ireland	6.14	1.57	2.22	0.53	1.66	-0.81	5.84	6.54	0.34	13.99
Italy	1.18	0.59	0.16	0.29	0.05	2.67	3.72	1.16	0.98	2.92
Netherlands	0.79	0.24	0.10	0.07	0.18	4.02	5.43	1.00	0.49	5.67
Norway	5.94	0.60	0.06	2.72	2.13	1.98	8.08	6.12	0.46	88.95
Portugal	1.60	0.46	0.14	0.71	0.08	2.88	4.45	1.57	0.74	7.11
Spain	1.79	0.89	0.37	0.39	0.04	2.86	4.52	2.06	0.84	2.80
Sweden	7.34	1.13	0.15	5.37	0.15	-0.61	6.54	7.65	0.33	20.23
Switzerland	1.82	0.27	0.66	0.60	0.01	2.30	4.30	2.07	0.35	6.75
United Kingdom	1.64	0.52	0.41	0.13	0.36	3.70	5.46	1.81	0.20	2.06
CENTRAL AND EASTERN EUROPE	**3.00**	**0.92**	**0.15**	**1.68**	**0.19**	**0.67**	**3.90**	**3.14**	**0.53**	**16.82**
Albania	0.75	0.39	0.06	0.16	0.06	0.21	1.14	0.74	0.06	6.10
Belarus	2.57	0.96	0.22	1.33	0.00	0.71	3.85	2.85	0.27	5.64
Bosnia Herzegovina	1.11	0.27	0.11	0.67	0.00	-0.06	1.07	1.23	†	†
Bulgaria	1.84	0.94	0.07	0.72	0.04	0.52	2.43	1.60	1.67	24.68
Croatia	2.13	0.80	0.14	0.82	0.27	0.56	2.78	2.07	†	†
Czech Rep.	2.32	0.97	0.12	1.09	0.01	2.50	4.78	2.38	0.27	5.71
Estonia	4.15	1.01	0.18	2.71	0.19	0.79	5.51	4.18	0.11	9.03
Hungary	1.75	1.06	0.04	0.54	0.00	1.33	3.30	1.83	0.69	12.23
Latvia	4.56	1.38	0.23	2.79	0.09	-1.14	3.22	4.34	0.12	14.77
Lithuania	3.02	1.43	0.14	1.37	0.01	0.05	3.88	3.29	0.07	6.75
Macedonia	1.46	0.67	0.08	0.62	0.00	1.79	2.92	1.43	†	†
Moldova, Rep.	0.82	0.68	0.04	0.04	0.01	0.56	1.53	0.84	0.66	2.62
Poland	1.63	0.93	0.05	0.54	0.01	2.07	3.90	1.71	0.32	1.45
Romania	1.37	0.75	0.10	0.40	0.03	1.15	2.99	1.27	1.16	9.24
Russian Federation	4.84	0.97	0.22	3.17	0.41	-0.35	4.57	4.95	0.53	30.77
Slovakia	2.35	0.74	0.14	1.35	0.01	1.08	3.61	2.48	0.33	5.73
Slovenia	2.24	0.27	0.25	1.60	0.01	1.34	3.99	2.37	id	id
Ukraine	1.47	0.96	0.09	0.30	0.05	1.90	3.61	1.59	0.51	2.75
Yugoslavia, Fed. Rep.	1.21	0.71	0.07	0.33	0.01	0.93	2.36	1.26	0.37	11.13

Congo, Dem. Rep.; Côte d'Ivoire; Eritrea; Ethiopia; Gambia, The; Ghana; Guinea; Guinea-Bissau; Haiti; Honduras; India; Kenya; Kyrgyzstan, Rep.; Lao PDR; Lesotho; Liberia; Madagascar; Malawi; Mali; Mauritania; Moldova, Rep.; Mongolia; Mozambique; Myanmar; Nepal; Nicaragua; Niger; Nigeria; Pakistan; Rwanda; Senegal; Sierra Leone; Somalia; Sudan; Tajikistan; Tanzania, United Rep.; Togo; Turkmenistan; Uganda; Viet Nam; Yemen; Zambia; Zimbabwe

Table includes all countries with populations greater than 1 million, except Bhutan, Oman, and Singapore, for which insufficient data were available to calculate the ecological footprint and biocapacity figures.
id = insufficient data
0.00 = less than 0.005
Totals may not add up due to rounding

* Water withdrawals and resources estimates come from Gleick, P.H. 2002. *The World's Water 2002-2003*. Island Press, Washington, DC.
† Withdrawals and resources data for Bosnia Herzegovina, Croatia, and Macedonia are included in the figures for Yugoslavia, Fed. Rep.; withdrawals data for Eritrea are included in the figures for Ethiopia.

TECHNICAL NOTES

LIVING PLANET INDEX

The Living Planet Index is generated by averaging three separate indices for forest, freshwater, and marine species populations. Each is set at 1.00 in 1970 and given an equal weighting. The population data for all species used in the index were gathered by UNEP-WCMC.

Forest species population index

The forest species population index is the average of two indices relating to temperate and tropical forests respectively. The temperate forest component of the index is calculated from the change over time in the populations of 231 temperate forest species. The tropical forest component is based on the change over time in populations of 51 tropical forest species. The species in the index are predominantly birds and mammals. The bias in the data towards temperate forests and birds and mammals reflects the concentration of research effort over the past 30 years. In many cases the data are not for an entire species, but just one sub-population of that species.

The last five years of the index, 1995-2000, are based on fewer population datasets than the part of the index covering 1970-95. The reliability of this recent part of the index is therefore much lower. This will improve as new data become available in future years.

Freshwater species population index

The freshwater species population index is the average of six regional indices relating to Africa, Asia-Pacific, Australasia, Europe, Latin America and the Caribbean, and North America respectively. The six indices between them contain time-series data on 195 species populations, comprising 8 African species, 31 Asia-Pacific species, 8 Australasian species, 56 European species, 11 Latin American and Caribbean species, and 81 North American species. In many cases the data are not for an entire species, but just one sub-population of that species. More data are available from Europe and North America than any other region of the world, which is a reflection of research effort over the past 30 years. The index is the average of all six regional sub-indices, with equal weight given to each region. The last five years of the index, 1995-2000, are based on fewer population datasets than the part of the index relating to the years 1970-95. The reliability of this part of the index is therefore much lower.

Marine species population index

The marine species population index is the average of six sub-indices which relate to the North Pacific, North Atlantic, Indian, South Pacific, South Atlantic, and Southern Oceans respectively. The six indices between them contain time-series data on 217 species populations, comprising 72 North Pacific species, 65 North Atlantic species, 16 Indian Ocean species, 17 South Atlantic species, 35 South Pacific species, and 12 Southern Ocean species. In many cases, the data are not for an entire species, but just one sub-population of that species. Inevitably, the index is dominated by those species which people have an interest in monitoring. More data are available on populations from the northern hemisphere and temperate waters than from the southern hemisphere or tropical waters. To give equal weight to data from different oceans, the marine species population index is the average of all six ocean sub-indices. The last five years of the index, 1995-2000, are based on fewer population datasets than the part of the index relating to the years 1970-95. The reliability of this part of the index is therefore much lower.

ECOLOGICAL FOOTPRINT

The ecological footprint is a measure of the amount of the Earth's biological productivity that a human population – the global population, a country, an individual – occupies in a given year. The analysis is based primarily on data published by the Food and Agriculture Organization of the United Nations (FAO), the International Energy Agency (IEA), and the Intergovernmental Panel on Climate Change (IPCC). Other data sources include studies in peer-reviewed science journals or thematic collections.

The ecological footprint represents the biologically productive land and water areas required to produce the resources consumed and assimilate the wastes generated by a given population using prevailing technology. The global ecological footprint represents the fraction of the productive biosphere required to maintain the material throughput of the human economy, under current management and production practices.

Ecological footprint calculations are based on seven assumptions:

1. It is possible to keep track of most of the resources people consume and the wastes they generate.

2. Most of these resource and waste flows can be measured in terms of the biologically productive area necessary to maintain these flows (those resource and waste flows that cannot be measured are excluded from the assessment).

3. By weighting each area in proportion to its usable biomass productivity (that is, its annual production of usable biomass), the different areas can be expressed in terms of a standardized average productive hectare. These standardized hectares, called "global hectares", represent hectares with usable biomass productivity equal to the world's average that year. Usable refers to the portion of biomass used by humans, reflecting the anthropocentric assumptions of the footprint measurement.

4. Since these areas stand for mutually exclusive uses, and each global hectare represents the same amount of biomass production potential for a given year, they can be added up to a total representing the aggregate human demand.

5. Nature's supply of usable bioproductivity can also be expressed in global hectares of biologically productive space.

6. Human demand expressed in ecological footprints and nature's supply expressed in global hectares of biological capacity (or biocapacity) can be directly compared to each other.

7. Area demand can exceed area supply. For example, a forest harvested at twice its regeneration rate appears in footprint accounts at twice its area. This phenomenon is called "ecological overshoot".

The results underestimate human demand on nature and overestimate the available biological capacity by:

- choosing the more conservative footprint estimates when in doubt
- leaving out human activities for which there are insufficient data
- excluding those activities that systematically erode nature's capacity to regenerate. They consist of:
  - uses of materials for which the biosphere has no significant assimilation capacity (e.g. plutonium, polychlorinated biphenyls (PCBs), chlorofluorocarbons (CFCs))
  - processes that irreversibly damage the biosphere (e.g. species extinction, aquifer depletion, deforestation, desertification).

For consistency and to keep the accounts cumulative, each area is only counted once on both the footprint side and the biocapacity side, even if an area provides two or more ecological services at once. As mentioned, the accounts include the productivity of cropland at the level of current yields, with no deduction for possible degradation. The energy use for agriculture, including fertilizers, is included in the energy footprint.

The ecological footprint methodology is in constant development, adding detail and better data as they become available. In this report we use the most current national accounts methodology.

A nation's consumption is calculated by adding imports to, and subtracting exports from, domestic production (net consumption = domestic production + imports – exports). Domestic production is adjusted for production waste and, in the case of crops, the amount of seeds necessary for growing the crops in the first place.

This balance is computed for more than 200 categories, such as cereals, timber, fishmeal, and cotton. These resource uses are translated into global hectares by dividing the total amount consumed in each category by its global average productivity, or yield. Biomass yields, measured in dry weight, are taken from FAO statistics. To relate the productivity of sea space to the productivity of land space, the ability of fisheries to provide food energy is compared with that of pastures. CO_2 emissions from fossil fuel, minus the percentage absorbed by oceans, are divided by the carbon assimilation capacity of forests. Some of the resource categories are primary resources (such as raw timber or milk), while others are manufactured products derived from primary resources (such as paper or cheese). For example, if 1 tonne of pork is exported, the amount of cereals and energy required to produce this tonne of pork is translated into a corresponding biologically productive area and then subtracted from the exporting country's footprint. This amount is added to the importing country's footprint.

Despite these adjustments for trade, some consumption activities, such as tourism, are attributed to the country where they occur rather than to the travellers' countries of origin. This distorts the relative size of some countries' footprints, but does not affect the global result.

Cropland, forest, and grasslands vary in bioproductivity. In order to produce footprint results in a single measure – the "global hectare" or gha – the calculations normalize bioproductive areas across nations and area types to account for differences in land and sea productivity.

"Equivalence factors" relate the average primary biomass productivities of the different types of land to the global average primary biomass productivity for a given year. A hectare of land with world-average productivity has an equivalence factor of 1. For example, every hectare of pasture is assigned an equivalence factor of 0.47, since, on average, pasture is about half as productive as the average bioproductive hectare of the Earth's surface.

"Yield factors" account for the difference in productivity of a given type of land across different nations. For example, a hectare of pasture in New Zealand will produce more meat on average than a hectare of pasture in Jordan, therefore the yield factor for New Zealand pasture is higher than that for Jordanian pasture.

To calculate the biocapacity of a nation, each of the six different types of bioproductive area within that nation's borders is multiplied by the equivalence factor for that type (constant for every country) and the yield factor for that type (specific for each country). Every year has its own set of equivalence factors and yield factors since biological productivities change over time. The six types of bioproductive area are described below.

Area types of the ecological footprint

The accounts include six bioproductive area types for human activities:

- cropland for growing crops for food, animal feed, fibre, oil crops, and rubber
- grazing land for grazing animals for meat, hides, wool, and milk
- forest area for harvesting timber or wood fibre for paper
- fishing grounds for catching fish
- built-up land for accommodating infrastructure for housing, transportation, and industrial production
- energy land for sequestering the excess CO_2 from burning fossil fuel, or to replace it with biomass, for harvesting fuelwood, and for nuclear energy and hydropower.

Once the human impacts are expressed in global hectares, these footprint components are added up.

Growing crops occupies arable land, the most productive land type. FAO estimates that there are about 1.5 billion hectares of cropland worldwide. Using FAO harvest and yield data for 74 major crops, we traced the use of arable land for crop production (FAO 2001). These accounts are underestimates, since other impacts from current agricultural practices, such as long-term damage from topsoil erosion, salinization, and contamination of aquifers with agro-chemicals, are not included due to lack of consistent datasets.

Grazing animals requires grassland and pasture area. Worldwide, there are 3.5 billion hectares of natural and semi-natural grassland and pasture. We calculated the demand for pasture using FAO data (FAO 2001).

Harvesting timber for lumber and paper and **gathering fuelwood** require natural or plantation forests. Worldwide there are 3.8 billion hectares of forests according to FAO's most recent survey, the *Forest Resource Assessment 2000*. We estimated forest areas and productivities using a variety of sources (FAO 2000a, FAO/UNECE 2000, IPCC 1997). Consumption figures for timber and fuelwood come from FAO (2001). The footprint of fuelwood is calculated using timber growth rates that are adjusted upward to reflect the fact that more forest biomass than merely roundwood is used for fuel, and that less mature forests can be used for fuelwood production.

Fishing requires productive fishing grounds. Most of the ocean's productivity is located on continental shelves. Excluding inaccessible or unproductive waters, these comprise 2.0 billion hectares. Although a mere fraction of the ocean's 36.3 billion hectares, these 2.0 billion hectares provide over 95 per cent of the marine fish catch. Inland waters consist of an additional 0.3 billion hectares, making for 2.3 billion hectares of potential fisheries out of the 36.6 billion hectares of ocean and inland water that exist on the planet. We used FAO fish catch figures (FAO 2001, FAO 2000b), and compared them with FAO's "sustainable yield" figure of 93 million tonnes per year (FAO 1997a). The accounts include both fish catch for fishmeal and fish for direct human consumption. Also, we assumed an additional bycatch according to the species composition of national fish catches, except for Norway, where fishing vessels are required to land their bycatch.

Accommodating infrastructure for housing, transportation, industrial production, and capturing hydroelectric power occupies built-up land. This space is the least documented, since low-resolution satellite images are not able to capture dispersed infrastructure and roads. Using data from Tellus POLSTAR (SEI 1998) and Eurostat (2000), we used a global total of 0.3 billion hectares of built-up land. We assume that built-up land replaces arable land, as human settlements are predominantly located in the most fertile areas of a country.

Burning fossil fuel can be translated into a bioproductive area through either CO_2 sequestration or biomass energy replacement. Burning fossil fuel adds formerly locked away carbon to the atmosphere. We calculate the fossil fuel footprint by estimating the biologically productive area needed to sequester enough carbon emissions to avoid an increase in atmospheric CO_2. Since the world's oceans absorb about 35 per cent of the CO_2 emissions from fossil fuel combustion (IPCC 2001), we account only for the remaining 65 per cent, based on each year's capacity of world-average forests to sequester carbon. This capacity is estimated by taking a weighted average across 26 main forest biomes (IPCC 2001, IPCC 1997, FAO 1997b, Dixon et al. 1994). Sequestration capacity may change as the atmospheric CO_2 level and global temperature increase over the next century. Alternatively, the fossil fuel footprint can be calculated by determining the amount of biologically productive area that, left alone, is able to replace the consumed energy. This approach, using fuelwood as nature's energy currency, leads to roughly the same area requirements.

Nuclear power is also included in the energy footprint, with each thermal unit of energy counted at par with one from fossil energy. We chose this parity because of inconclusive data about the long-term area demand of nuclear power. Excluding nuclear power would reduce the global energy footprint by less than 4 per cent.

The **hydropower** footprint is the area occupied by hydroelectric dams and reservoirs, and is calculated for each country using the US average ratio of area to power output, for lack of better data.

The net **embodied energy in trade** (which by definition balances out at zero for the globe as a whole) is calculated using trade statistics broken down into 109 categories. The energy intensities used for each category stem from a variety of sources (IVEM 1999, Hofstetter 1992).

To illustrate, Table 3 shows the results of these accounts for the world in more detail. On the left, it lists the average ecological footprint per person worldwide, and on the right the biologically productive areas in both true hectares and global hectares.

Table 3: THE WORLD'S ECOLOGICAL FOOTPRINT AND BIOCAPACITY, 1999

DEMAND Global footprint per person		SUPPLY Global biocapacity per person			
	Footprint (gha/person)		Bioproductive area (ha/person)	Equivalence factor (gha/ha)	Biocapacity (gha/person)
Growing crops	0.53	Cropland	0.25	2.11	0.53
Grazing animals	0.12	Grazing land	0.58	0.47	0.27
Harvesting timber	0.27	Forest	0.64	1.35	0.86
Fisheries	0.14	Fishing grounds	0.39	0.35	0.14
CO_2 emissions	0.99	Land set aside for CO_2 absorption	0.00	1.35	0.00
Fuelwood	0.06	Included as forest			
Nuclear power	0.08	not applicable			
Hydropower	0.003	not applicable			
Settlements and infrastructure	0.10	Built-up area	0.05	2.11	0.10
Total demand	**2.28**	**Total supply**	**1.90**	**1.00**	**1.90**

WATER WITHDRAWALS

The ecological footprint methodology does not take the use of water resources into account. For this reason, we have included separate data on water withdrawals per person. Withdrawals include the use of water from sources such as rivers and lakes for agricultural, industrial, and domestic purposes. The use of rainwater for agriculture is not included. Just as the ecological footprint may be compared with available biocapacity, a country's water withdrawals can be compared with the size of its annual renewable water resource. These data are given, per person, in Table 2. Water withdrawals are not exactly analogous to ecological footprints, however. Whereas footprints measure consumption of resources by the final end-user, water withdrawals may be an input to the production of a commodity which is exported and consumed in another country. Some products of this sort, such as cotton, have a very large demand for water. The data on water withdrawals and resource availability are taken from Gleick (2002).

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GLOSSARY

biological capacity or biocapacity: The total biological production capacity per year of a biologically productive space, for example inside a country. It can be expressed in "global hectares".

biologically productive space: The land and water area that is biologically productive. It is land or water with significant photosynthetic activity. Marginal areas with patchy vegetation and non-productive areas are excluded.

ecological deficit: The amount by which the ecological footprint of a population (e.g. a country or region) exceeds the biological capacity of the space available to that population.

ecological footprint: A measure of how much productive land and water an individual, a city, a country, or humanity requires to produce the resources it consumes and to absorb the waste it generates, using prevailing technology.
This land could be anywhere in the world. The ecological footprint is measured in "global hectares".

ecological overshoot: The situation when human demand exceeds nature's supply at the local, national, or global scale.

equivalence factor: A factor which translates a specific land-use area (e.g., hectares of world-average cropland) into global hectares, representing biologically productive hectares with world average productivity. Each year has its own set of equivalence factors since the relative productivity of various ecosystem or land-use types varies. In a given year, all countries have the same set of equivalence factors, since they are scaled to global productivity. See also "yield factor".

global hectare or gha: 1 hectare of biologically productive space with world-average productivity. In 2002 the biosphere has 11.4 billion hectares of biologically productive space corresponding to roughly one quarter of the planet's surface. These 11.4 billion hectares of biologically productive space include 2.0 billion hectares of ocean and 9.4 billion hectares of land. The land space is composed of 1.5 billion hectares of cropland, 3.5 billion hectares of grazing land, 3.8 billion hectares of forest land, 0.3 billion hectares of inland waters, and 0.3 billion hectares of built-up land. 1 global hectare is hence a hectare representing the average capacity of one of these 11.4 billion hectares. Thus a hectare of highly productive land represents more "global hectares" than the same surface of less productive land. Global hectares allow the meaningful comparison of the ecological footprints of different countries, which use different qualities and mixes of cropland, grazing land, and forest.

trophic level: The level in the food-chain at which an organism feeds. Primary producers such as phytoplankton or grass, using photosynthesis to convert sunlight into biomass, are on the first trophic level. An antelope feeding on grass would be on the second trophic level; a lion would be on the third.

yield factor: A factor which describes the extent to which a land-use category of a given country (e.g. German cropland) is more productive than the world average in that same category (i.e. world average cropland). Each country has its own set of yield factors. See also "equivalence factor".

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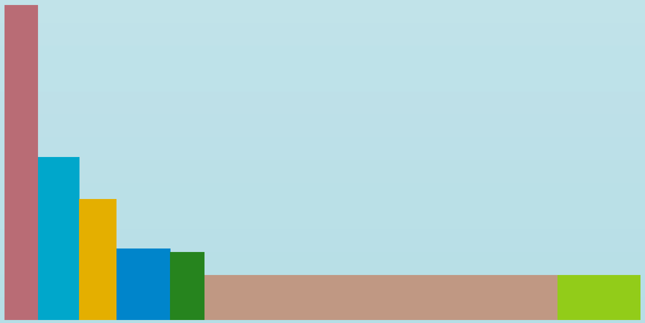

WWF (also known as World Wildlife Fund in the US and Canada) is one of the world's largest and most experienced independent conservation organizations, with almost 5 million supporters and a global network active in 90 countries.

WWF's mission is to stop the degradation of the planet's natural environment and to build a future in which humans live in harmony with nature by:
– conserving the world's biological diversity
– ensuring that the use of renewable natural resources is sustainable
– promoting the reduction of pollution and wasteful consumption.

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