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Produced by the UNEP GEO team
Division of Early Warning and Assessment (DEWA)
in collaboration with the Division of GEF Coordination (DGEF)

Contacts:
Marion E. Cheatle
Head, Global Environment Outlook Section
Tel: (254-2) 623520; Fax: (254-2) 623944; E-mail: Marion.Cheatle@unep.org

Ahmed Djoghlaif
Director, Division of GEF Coordination (DGEF)
Tel: (254-2) 624165; Fax: (254-2) 520825; E-mail: Ahmed.Djoghlaif@unep.org

Contributing editor: Robert Lamb
Cover photos: Munyaradzi Chenje
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CHANGE and CHALLENGE

A state of the environment briefing for the Global Environment Facility

The UNEP Global Environment Outlook (GEO) project addresses one of the important objectives of Agenda 21: the role of information in sustainable development. GEO is designed to provide policy-makers with the information they need to make wise decisions about the future of the environment - one of the pillars of sustainable development. It is intended to promote consensus on identifying the global and regional issues that the international community needs to address, and on prioritizing environmental problems and action.

The third GEO report was published just a few months before the World Summit on Sustainable Development (WSSD) to provide a foundation for the WSSD review of policies for sustainable development.

The study takes a unique look at the policy and environmental impacts of the past 30 years. It also outlines four policy approaches for the next three decades and compares the likely impacts on people and their natural environments.

GEO-3, which was prepared by more than 1 000 individuals and 40 institutions from around the world, concludes that a great deal of environmental change has already taken place since the establishment in 1972 of the United Nations Environment Programme.

Convening just one month after WSSD, the Second GEF Assembly provides an opportunity for member countries to look back over the achievements of the Facility during its first decade — the decade since Rio — and to set the directions of the GEF in light of global environmental trends, recent multilateral agreements, and the outcomes of WSSD.

To this end, UNEP has prepared this briefing based on GEO reports, especially tailored to the GEF needs and requirements.

I am confident that this state of the environment overview for the GEF, that looks back over the past 30 years and to the outlook for the next 30 years, will assist that process.



A handwritten signature in black ink, which appears to read 'Klaus Töpfer'.

Klaus Töpfer
Executive Director
United Nations Environment Programme

FOREWORD

INTRODUCTION

This booklet draws upon the UNEP Global Environment Outlook (GEO) reports to highlight recent developments in the focal areas of the GEF. It combines a global overview of each focal area with a round up of key trends in the GEF priority regions – Africa, Asia and the Pacific, Eastern Europe, Latin America and the Caribbean, and West Asia.

The booklet was prepared by the United Nations Environment Programme Division of GEF Coordination (DGEF) and the Division of Early Warning and Assessment (DEWA). It is based on findings published in *GEO-2000* (1999) and *GEO-3* (2002), the latest in UNEP's flagship state-of-the-environment report series.

The summarized extracts that follow highlight developments in the GEF's established focal areas of biological diversity, climate change, ozone layer depletion and international waters. They also touch on current concerns in land degradation, primarily desertification and deforestation, and persistent organic pollutants (POPs), two topics to be proposed for adoption as additional focal areas at the second GEF Assembly, this document's principal intended readership.

The GEF was established in 1991 as a partnership of UNEP, the United Nations Development Programme (UNDP) and the World Bank. It is a mechanism that provides new, and additional, grant and concessional funding to help tackle concerns in the areas noted above.

As well as acting as the financial mechanism to the Convention on Biological Diversity (CBD) and UN Framework Convention on Climate Change (UNFCCC), the GEF is the financial mechanism to the Cartagena Protocol on Biosafety and the interim financial mechanism to the Stockholm Convention on POPs. Policy response measures under the GEF are part of the integrated environmental assessment on which this booklet is based. In highlighting environmental change and challenges facing the international community, each of the focal area sections in the booklet presents global and regional summaries of the recent conditions and trends as well as key international initiatives taken to address priority issues. Graphics and boxes adapted from *GEO-3* provide more detailed insights. Also featured are representative examples from the GEF's extensive portfolio of activities around the world, to give an idea of their broad scope and practical orientation.

The Outlook section draws on *GEO-3*'s special analysis of four scenarios developed to take advance stock of some of the environmental implications of potential policy responses to current conditions, projected over the time horizon of the next 30 years. As in foregoing sections, the GEF focal areas form the basis for the selection of notional future situations presented in this text.

The final section of the booklet briefly highlights the major outcomes of the World Summit on Sustainable Development as they relate to the GEF activities and focal areas.

Perhaps the major message of both *GEO-2000* and *GEO-3* (and hence of the booklet in hand) is that the environment continues to deteriorate even though progress is being made in many areas. As a response mechanism, the GEF has played a major role in some of the success to date. Since the restructuring of the GEF in 1994, membership has grown to 171 countries and there are more than 1 000 GEF-supported projects worldwide.

The GEO project and process

A Governing Council decision of May 1995 called on UNEP to produce a comprehensive and regular report on the state of the global environment. Two major strands of activity arose from this decision: a cooperative, integrated environmental assessment process and a report series. The initial task was to agree, through dialogue and consensus, on the priority issues and assessment agendas. These consultations embraced inclusive and multidisciplinary ideals, with an eye to the added value of building environmental assessment capacity in every region to reliable and compatible levels, through training and 'learning by doing' initiatives.

Tracking environmental change

At the core of the present-day assessment process that arose from these beginnings is a coordinated global network of collaborating centres (CCs). Their agenda includes integrated assessments along lines agreed between scientific and policy professionals in a regular round of regional scientific and policy consultations. But they also fulfil a watchdog role, retrieving and channelling environmental

reports and alerts from the grassroots up.

Almost all regional inputs to the GEO assessments now originate from the CCs. An array of specialized research institutions supplies expertise on issues and themes that transcend regional concerns or link several lines of enquiry together. In addition, GEO can call on the support of working groups for assessment methodology, process planning and similar structural essentials.

Through the system-wide Earthwatch network, other UN agencies supply a wealth of substantive data and knowledge from their own projects and points of view, on shared environmental care and sustainable development concerns and goals. These peer institutions also assist in the review process, helping to ensure that the performance of GEO matches expectations.

Informing and responding

GEO reporting and fact-finding activities hinge on the critical role of information - and universal access to it - in sustainable development. This

need was underlined at the 1992 UNCED summit and in Agenda 21, a decisive factor in the launch of GEO. It was further endorsed by the Ministerial Declaration adopted at the First Global Ministerial Environment Forum in Malmö, Sweden, in May 2000.

UNEP's response to the information mandate is its flagship output, the GEO report series, issued at regular intervals in print and electronic formats. Separate national and regional or sub-regional assessments are also published, as are technical and other background reports.

Most of the data that underpin GEO are also available on the Internet through the GEO Data Portal. Some 300 dynamic data sets can be accessed and downloaded. Easy to operate tools enable users to explore and picture statistical and geographical assessment data in chart, table or map form and on scales that range from national to global. Other activities include GEO for Youth, an outreach project involving young people.

GLOBAL PERSPECTIVE

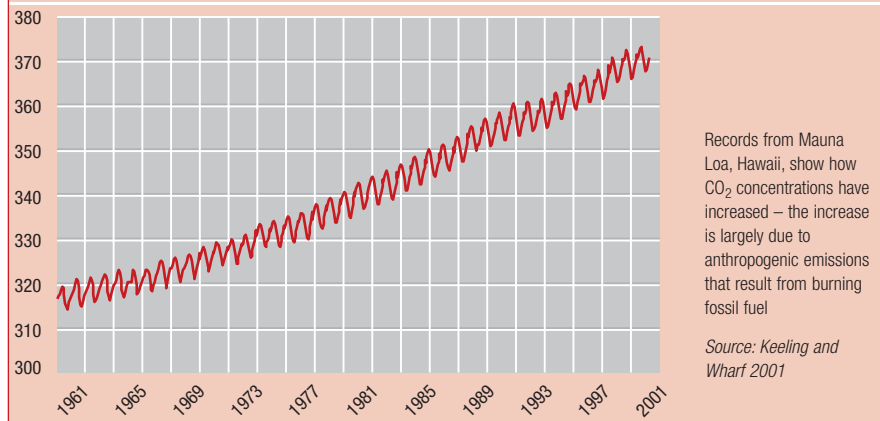
In its 2001 assessment of levels of greenhouse gases (GHGs) in the atmosphere, the Intergovernmental Panel on Climate Change (IPCC) presented 'new and stronger evidence that most of the warming observed over the last 50 years is attributable to human activities'. The 1990s are 'very likely' to have been the warmest decade and 1998 the warmest year since records began in 1861. The rise of 10–20 cm in sea level over the past 100 years appears to be linked to a $0.6 (\pm 0.2) ^\circ\text{C}$ rise in air temperatures recorded over the same period. Although CO_2 accounts for more than 60 per cent of the additional greenhouse effect accumulated since industrialization, the concentrations of other greenhouse gases such as methane (CH_4), nitrous oxide (N_2O), halocarbons and halons have also increased. Some of these gases are also ozone-depleting substances regulated under the Montreal Protocol (see Ozone section).

Greenhouse gas emissions are unevenly distributed between countries and regions. In general, industrialized countries are responsible for the majority of historical and current emissions. For example, more than half of all CO_2 emissions in 1998 came from the member countries of the Organization for Economic Cooperation and Development (OECD), where average per capita emissions were about three times the world average. Their share of global CO_2 emissions has, however, decreased by around 11 per cent since 1973 and developing countries are likely to contribute up to 50 per cent of emissions by 2035.

The impacts of global warming and climate change will not be uniform. Some effects could be beneficial for some regions. However, regional changes in climate have already affected diverse physical and biological systems in many parts of the world. Mid- to high-latitude growing seasons have lengthened. Poleward and altitudinal shifts of plant and animal ranges have been observed. Natural systems at risk of climate change include glaciers, atolls, polar and alpine ecosystems, prairie wetlands and remnant native grasslands.

Even though the impact of climate change on biodiversity to date remains unclear, the

Carbon dioxide concentrations at Mauna Loa, Hawaii (parts per million by volume)

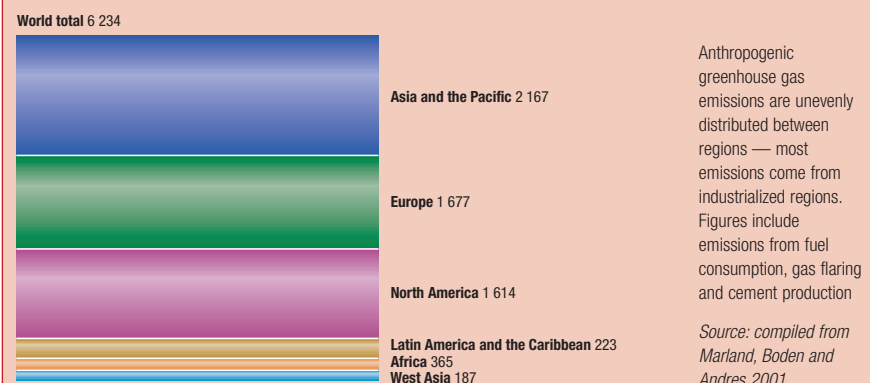


increasing incidence of coral reef bleaching may be a consequence of recent rises in global ocean temperature. Reports of coral bleaching have increased greatly since 1989. The most significant mass bleaching was associated with the 1997–98 El Niño Southern Oscillation (ENSO) event, when all ten reef provinces of the world were affected. In some areas, most notably the Indian Ocean, this event was followed by mass mortality, where up to 90 per cent of all the corals died over thousands of square kilometres. Climate change also represents an important additional stress on some ecosystems already affected by increasing resource demands, unsustainable management practices and pollution. It can also be expected to reduce the ability of some environmental systems to provide, on a sustained basis, key goods and services needed for successful economic and social development, including adequate food, clean air and water, energy, safe shelter and low levels of diseases. It has also been implicated in the decline of amphibians in tropical montane forests and of some

populations of migratory birds because of unfavourable variations in climatic conditions.

Systems that are vulnerable include agriculture and forestry. Forests both influence and are influenced by climate change: they play an important role in the global carbon cycle, and their management or destruction could significantly affect the course of global warming in this century. If projected climate changes materialize, the impacts on forests are likely to be regionally varied, dramatic and long-lasting, affecting both the distribution and composition of forests. Land degradation, floods, fires and droughts are expected to reduce crop yields and worsen food deficits in many countries around the tropics and sub-tropics, where widespread poverty undermines people's capacity to cope with change. Climate change is also likely to affect human health through changes in availability of freshwater, and the distribution of vector-borne diseases such as malaria and dengue fever.

Carbon dioxide emissions by region, 1998



Climate change – regional highlights**■ Africa**

Africa contributes less than 3.5 per cent of global CO₂ emissions with Northern and Southern Africa being responsible for 80 per cent of the region's total. However, Africa is the most vulnerable region in terms of projected decreases in water and food security, because widespread poverty limits adaptive capacity. The following are some of the projected climate change impacts on the region:

- Current projections for sea level rise over the next century indicate that human settlements in the Gulf of Guinea, Senegal, Gambia, Egypt and along the East African coast, including the Western Indian Ocean islands, would be at high risk of flooding and land recession.
- Climatic variability and associated floods and droughts result in increased risks of crop failure, reducing food security and leading to higher incidences of malnutrition and disease.
- Grain yields would decrease for many IPCC scenarios, diminishing food security, particularly in small food-importing countries.
- Desertification would be exacerbated by reductions in average annual rainfall, run-off and soil moisture, especially in Southern, Northern and Western Africa.
- Significant extinctions of plant and animal species would occur, affecting rural livelihoods, tourism and genetic resources.

■ Asia and the Pacific

Asia is a leading source among developing regions of CO₂ emissions from human or associated sources and almost half the world's total methane emissions originate in South Asia. Northwest Pacific and East Asia sub-regions, and the Pacific Island countries will be particularly vulnerable to sea level rise because many of their human settlements and industrial facilities are located in coastal or lowland areas. Some of the likely climate change impacts include the following:

- Dramatic impacts from extreme weather events can be expected on terrestrial biodiversity, subsistence cropping and forest food sources in the small Pacific island developing states.
- Decreases in agricultural productivity and aquaculture due to thermal and water stress, sea-level rise, floods and droughts, and tropical cyclones would diminish food security in many countries of arid, tropical and temperate Asia; agriculture would expand and productivity would increase in northern areas.
- Climate change would exacerbate existing threats to biodiversity due to habitat loss and population pressure in Asia.
- Some species with restricted climatic niches and which are unable to migrate due to fragmentation of the landscape, soil differences or topography could become endangered or extinct.

■ Europe

Although many European countries are enthusiastic proponents of the global climate change treaty, the region is still a major emitter of anthropogenic greenhouse gases. Most CO₂ emissions are from fossil fuel burning, mainly for energy generation. In 1990-2000, emission levels fell by 8 per cent in nine countries of Central and Eastern Europe (CEE), thanks partly to reforms but also because of recession and declining industrial output. Even so, Europe will struggle to achieve reductions prescribed in the Kyoto Protocol. Climate change is projected to have some positive effects on agriculture in Northern Europe but productivity would decrease in Southern and Eastern Europe.

■ Latin America and the Caribbean

The region is the source of 10 per cent of global anthropogenic emissions and nearly half the world's total CO₂ emissions arising from land-use change, especially deforestation. Intentional biomass burning to convert land to other uses accounts for part of this output. Many low-lying small Caribbean islands are at risk of sea level rise, along with parts of Latin America's largest coastal cities. Changes in the water cycle may pose a danger to arid and semi-arid zones, affecting the production of cereals and livestock as well as hydroelectric power generation. Another likely impact of climate change is the rapid spread into new areas of malaria and other epidemic disease vectors. There is plentiful yet largely unrealized scope for renewable energy and more setting aside of forests as carbon sinks. Other threats due to climate change, include the following:

- Yields of important crops would decrease in many locations in Latin America, even when the effects of increased CO₂ are taken into account; subsistence farming in some regions of Latin America could be threatened.
- The rate of biodiversity loss would increase.

■ West Asia

Sea level rise is expected to have a damaging impact on island countries such as Bahrain and on several low-lying coastal areas around the Arabian Peninsula. Changes in the pattern of temperature and rainfall are likely to accelerate desertification and reduce food production in many parts of the region. Per capita CO₂ emissions increased in West Asia from 4.7 tonnes a year in 1972 to 7.4 tonnes a year in 1998, reflecting trends in population growth and in agricultural and industrial development. In some countries, such as Kuwait, Qatar and the United Arab Emirates, CO₂ emissions fell from previously high levels, in response to clean air laws and introduction of cleaner energy and industrial processes.

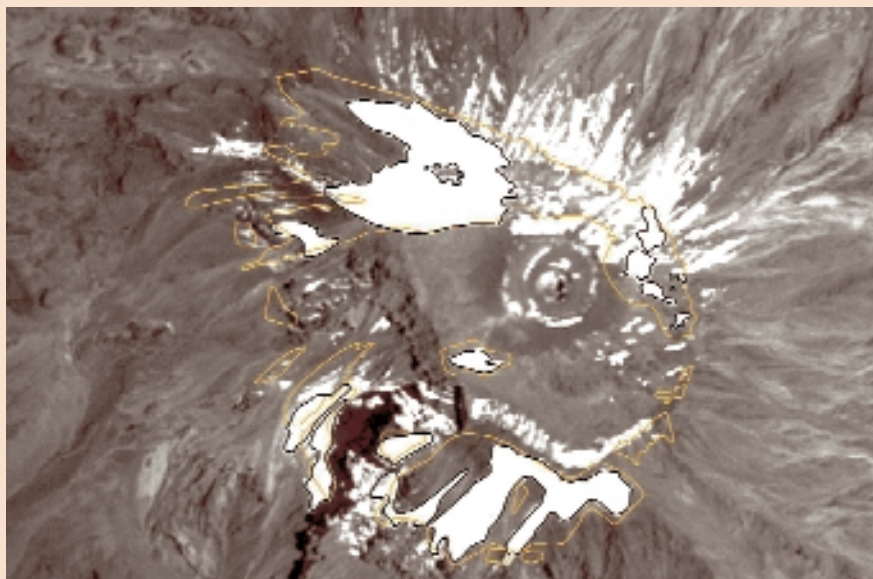
Snows of Kilimanjaro shrinking

Mount Kilimanjaro in Tanzania, Africa's highest mountain, has lost 82 per cent of the ice cap it had when first surveyed in 1912 and some 55 per cent of the glaciers it had in 1962, as a result of regional warming effects believed to be linked to global warming.

Map shows the extent of the glacier in 1962 (yellow outline, based on geological survey) and in 2000 (black outline, based on Landsat imagery and aerial survey).

Landsat data: USGS/EROS Data Center

Photographs: Christian Lambrechts, UNF/UNEP/KWS/University of Bayreuth/WCST



INTERNATIONAL ACTION

The international community has advanced climate and atmosphere agendas with notable determination. The UN Framework Convention on Climate Change (UNFCCC), which was adopted in 1992, called for industrialized countries to return to 1990 emission levels of CO₂ and other greenhouse gases by the year 2000. Now the Kyoto Protocol to UNFCCC, adopted in December 1997, has set definite greenhouse gas reduction targets for most industrialized countries, including an 8 per cent reduction below 1990 levels for the EU and many Central European countries within agreed time limits. The decision taken by the United States in 2001 to withdraw its commitment to greenhouse gas emission cuts agreed in the Kyoto Protocol, did not prevent other developed countries from setting more detailed rules for emissions reduction at a conference in Bonn in July 2001. They also agreed upon ways to boost implementation of UNFCCC, including an undertaking to provide new assistance of US\$410 million a year by 2005 for implementing UNFCCC in developing countries. No new reduction targets were set for developing countries but the Protocol offers mechanisms whereby industrialized countries can invest in measures that limit greenhouse gas emissions in developing countries in return for emission credits allowing less stringent emission reductions at home.

From the GEF portfolio: Boosting renewable power access and use in Sri Lanka

Initiated through the World Bank in 1997, an ongoing project supported by the GEF in Sri Lanka has piloted installation of solar home power generation systems in rural areas lacking access to grid electricity. A trusted national microfinance provider, Sarvodaya, issues loans that enable participants to buy the systems and have them installed under credit agreements that also include a 10-year warranty for the photovoltaic module that collects the solar energy. A one-year warranty for the system as a whole and a maintenance service for the first three years, also form part of the deal. Sarvodaya pays the supplier and assumes responsibility for repayment and collections.

The project has also supported private sector participation in grid electricity generation and has backed mini-hydro schemes and wind farm projects in addition to solar home systems. By June 2001, some 7 000 rural households around Sri Lanka had been electrified thanks to the project, generating additional capacity amounting to 345 KW.

Some issues not settled at Bonn were finalized at the seventh Conference of the Parties in October and November 2001 in Marrakesh, Morocco, including a compliance system and procedures for accounting, reporting and reviewing information. The resulting Marrakesh Accords paved the way to a comprehensive, multilateral approach to climate negotiations that is expected to bolster future international responses to climate and atmosphere issues. Among other multilateral actions and regional trends relating to climate issues are:

- National communications to the UNFCCC from 13 African countries providing detailed inventories of carbon emissions and sinks, and a waste management blueprint for South Africa designed to curb solid waste dumping and burning;

- Steps by countries involved in the Asia Least Cost Greenhouse Gas Abatement project, backed by the GEF and UNDP, to reduce emissions in the energy sector; and
- Detailed national inventories of GHGs completed by three West Asian countries.

OZONE LAYER DEPLETION

The protection of the Earth's stratospheric ozone layer has presented one of the major challenges over the past 30 years, spanning the fields of environment, trade, international cooperation and sustainable development. Ozone layer depletion has now reached record levels, especially over the Antarctic and recently also in the Arctic. Current average ozone losses are 6 per cent in the northern mid-latitudes in winter and spring, 5 per cent in southern mid-latitudes all year round, 50 per cent in the Antarctic spring and 15 per cent in the Arctic spring. The resulting increases in harmful ultraviolet irradiation amount to 7 per cent, 6 per cent, 130 per cent and 22 per cent respectively.

Ozone depletion is caused by a number of chemicals known as ozone-depleting substances (ODS), the most notorious of which are the chlorofluorocarbons (CFCs). ODS were mainly used in refrigerators, air conditioners, aerosol sprays, insulating and furniture foams, and firefighting equipment, and their production peaked in the late 1980s as the demand for such goods grew. Ozone depleting halocarbons also contribute some 14 per cent to the overall global warming effect of GHGs.

Levels of chlorine in the atmosphere are still increasing, although at a steadily slowing rate thanks to measures being taken under the Montreal Protocol. Some of the regional impacts of ozone layer depletion include:

- A roughly 10 per cent per decade rise in ultraviolet radiation in Australia and New Zealand, reducing by 20 per cent the time it takes for exposed skin to be sunburnt;
- A measurable 50 per cent decline in the thickness of the ozone layer over parts of northern Europe in winter and spring; and
- A record expansion of the Antarctic ozone hole to over 28 million km² in September 2000.

Other regions where ozone layer depletion causes special concern are the countries of southern Latin America and northernmost North America.

INTERNATIONAL ACTION

International cooperation has been the key to protecting the stratospheric ozone layer. Nations agreed in principle to tackle a global problem before its effects became evident or its existence scientifically proven. In 1975, the UNEP Governing Council called for a meeting to coordinate activities on protecting the ozone layer. A Coordinating Committee on the Ozone Layer was established the following year to undertake an annual scientific review. Strict curbs on ODS production and consumption in Canada and the United States during the 1980s set the pace for concerted international action. Negotiations eventually led to the Vienna Convention for the Protection of the Ozone Layer, which was finally agreed upon by 28 countries in March 1985.

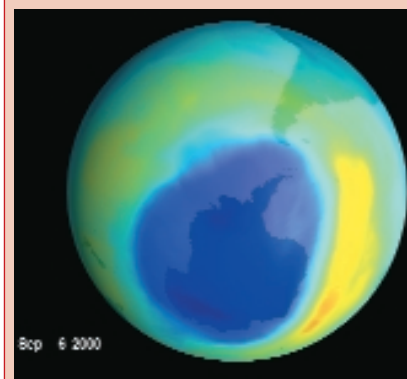
By December 2001, 182 Parties had ratified the Vienna Convention and 181 the Montreal Protocol on Substances that Deplete the Ozone Layer. The protocol originally required only a 50 per cent cut in consumption of five widely used CFCs by the end of 1999 and a halt in consumption of three halons. Subsequent amendments meant that by 2000, 96 ozone-depleting substances (ODS) were subject to such controls.

World production of major CFCs

Production has declined sharply since peaking around 1998 but impacts will take longer to ease off.

World production of the three ozone-depleting CFCs in widest use peaked around 1998 and has since tailed off to very low values. Almost every party to the Montreal Protocol has now taken measures to phase out ODS with the result that, by 2000, the total consumption of ODS had been reduced by 85 per cent. Recent breakthroughs have included an end to all ODS production in the Russian Federation by December 2000 and significant phasing out of ODS production and use in CEE countries. A 21 per cent cut in CFC production has been achieved in Latin America and the Caribbean and total phase-out in Brazil. New legislation for phase-out is now in place in Argentina, Mexico and Venezuela. China and India are the largest producers of CFCs in the Asia and the Pacific region. China has made a commitment to phase out consumption of ODS by 2010.

The Antarctic ozone hole



In September 2000 the hole reached a record size of 28.3 million km², three times the area of the US

Source: NASA 2001

Some CFC molecules can persist in the atmosphere for as long as 100 years and the long-term measures being taken can only succeed if all countries continue to honour their treaty commitments. Some trafficking and unlicensed use of new (not recycled) CFCs has been reported, ranging from 20 000 to 30 000 tonnes a year. The thinning of the ozone layer threatens human health through diseases such as skin cancer, eye cataracts and immune deficiency; affects flora and fauna; and also influences the planet's climate.

The Multilateral Fund

The Montreal Protocol provides a 10-year period of grace for developing countries to marshal phase-out measures. It also provides a financial mechanism to meet the costs of such measures. By 2000, the Multilateral Fund to the Montreal Protocol had disbursed more than US\$1.1 thousand million for capacity building and projects to phase out ODS in 114 developing countries. The GEF has provided additional funding for similar measures in CEE countries not eligible for Multilateral Fund support.

GLOBAL PERSPECTIVE

A total of 261 river basins, covering 45.3 per cent of the Earth's total land area (excluding Antarctica), are shared by two or more countries. The principal sources of water for human use are lakes, rivers, soil moisture and relatively shallow groundwater aquifers. About 2 billion people, approximately one-third of the world's population, depend on groundwater which supplies about 20 per cent of global water withdrawals annually. Many rural dwellers depend entirely on groundwater. Wetlands, which are an important freshwater ecosystem influencing species distribution and biodiversity as well as human settlements and activities, may cover at least 12.8 million km² globally.

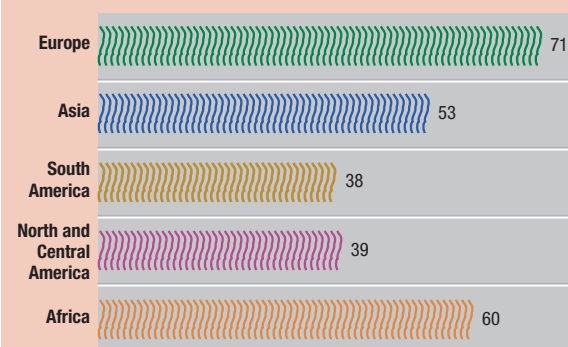
The GEF agenda

The GEF agenda for international waters promotes a cross-sectoral approach to addressing environmental problems through three broad programme areas:

- Restoring waterbodies;
- Integrated land and water resource management; and
- Contaminant reduction.

Between 1991 and 2001, the GEF allocated US \$0.46 billion to 60 projects, mainly regional or global in scope, contributing significantly to the implementation of global and regional agreements on the protection and restoration of freshwater and marine systems.

Numbers of international river basins



Note: the Jurado, shared by Colombia and Panama, is included in South America

Source: Wolf and others 1999

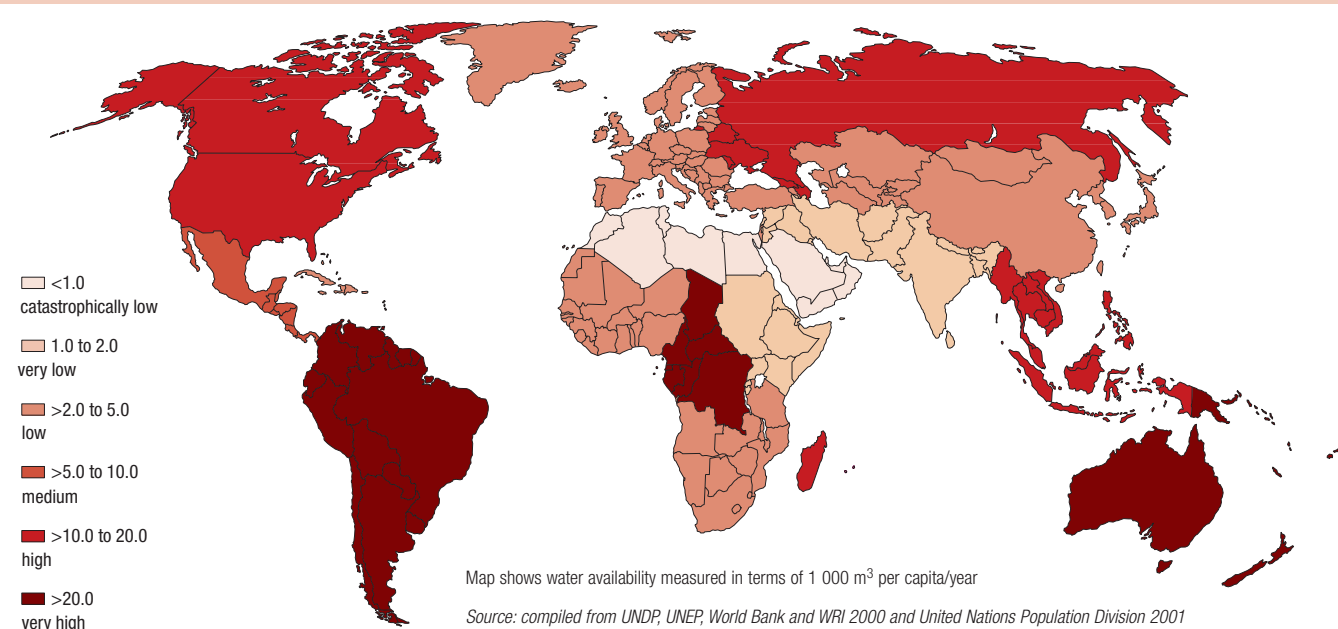
Human activities, including agriculture and settlements, have caused serious damage to freshwater ecosystems and contributed to the loss of about 50 per cent of the world's wetlands during the 20th century. A 1992 review of Ramsar sites showed that 84 per cent were either threatened or experiencing ecological changes. About 60 per cent of the world's largest 227 rivers have been strongly or moderately fragmented by dams, diversions or canals. While this infrastructure has resulted in increased food production and hydroelectricity, it has also displaced millions of people in different parts of the world and caused irreversible damage to associated ecosystems.

The damage to ecosystems reduces water quality and quantity, leading to a reduction in the effective availability of water for human use. According to the World Commission on

Water, more than half of the world's major rivers are 'seriously depleted and polluted, degrading and poisoning the surrounding ecosystems, threatening the health and livelihood of people who depend on them'. Sources of pollution include untreated sewage, chemical discharges, petroleum leaks and spills, dumping in old mines and pits, and agricultural chemicals that are washed off or seep into the ground from farm fields.

Groundwater resources are vulnerable to a variety of threats, including overuse and contamination. When use exceeds natural recharge over a long period, groundwater levels drop. Overpumping of groundwater can lead to salt-water intrusion in coastal areas. In Madras, India, for example, saltwater intrusion has moved 10 km inland, contaminating wells.

Water availability by sub-region in 2000 (1 000 m³ per capita/year)



International waters – regional highlights

■ Africa

Africa experiences large spatial variations in rainfall, with 95 per cent of the total falling in the central and southwestern wet equatorial zone. Severe droughts have been recorded in the Sahel and in the Northern, Eastern and Southern subregions over the past 30 years. Water stress is widespread and on the increase in many countries, undermining food security and human and animal health. In places, large volumes of river water are moved between basins to even out supply disparities. In South Africa, for example, inter-basin transfers of water from high-rainfall areas to large urban centres have tended to leave downstream habitats and farms dry and depleted. In the Seychelles and Mauritius, impressive water savings have been achieved through desalination, rationing and wastewater recycling. Coastal and marine habitats are under pressure from mining of sand dunes, clearing of mangroves, coral extraction, tourist resort development and commercial overkill of fish, crustacean and shellfish stocks. In Southern Africa, the annual fish catch per capita fell from nearly 30 kg in 1972 to less than 10 kg in 1998. The catch level has remained at a standstill elsewhere, suggesting fully exploited stocks rather than conservation advances, though catch limits and marine reserves are being introduced in some waters.

■ Asia and the Pacific

Many countries have taken steps to introduce integrated water resources management policy reforms and regulatory frameworks. There has been striking progress too, with water-sharing pacts between South Asian countries, such as the Indus Basin accord between India and Pakistan, and the Water Sharing Treaty between Bangladesh and India. Yet China's Yellow River, India's Ganges and Central Asia's Amu and Syr Darya are still rated the world's most polluted rivers. Coastal and marine resources such as fisheries, mangroves and coral reefs are also under pressure from pollution and from intrusive urban and tourism development. Fisheries decline has prompted many countries to turn to aquaculture to improve production and retain export markets. In several cases, fresh problems have arisen, such as salinization of irrigation water and clearing of mangroves. Another emerging threat is the introduction of invasive species like the black-striped mussel into vulnerable marine habitats such as seagrass beds in the Pacific.

■ Europe

Parts of Central and Eastern Europe (CEE) and Mediterranean countries suffer water stress, but Europe as a whole is rich in water. Water quality and pollution concerns centre on nitrate overload in agricultural soils, and phosphorus from domestic and industrial wastewater running off into seas, lakes, rivers and groundwater. In some CEE countries, use of nitrogen-phosphorus fertilizers has been steadily curtailed and wastewater treatment increased since the 1990s but groundwater pollution remains a stubborn problem in some areas. Over 2 700 groundwater sources around the Russian Federation were identified as polluted in 1999. Pollution and other agents of marine and coastal degradation have levelled off and lessened in a few places during the past decade. But the waters of the Adriatic, the Black Sea, the Baltic and other closed or semi-closed seas remain prone to a range of pollution dangers from shipping and land-based sources.

■ Latin America and the Caribbean

Irrigated farming has spread rapidly in recent decades but many state-run irrigation systems have proved wasteful and inefficient. Transfer of ownership to water user groups has improved standards in Mexico and elsewhere. In South America, especially in Argentina and Brazil, a large proportion of water withdrawals is used for industry, mostly by the energy, mining and petroleum sectors. Domestic supplies fall short in many areas (both urban and rural) and clean water supplies and sanitation are still unavailable to many. Agricultural wastes and industrial discharges are key sources of water pollution. Untreated urban sewage is a problem in and around big cities. Oil and gas industry activities pose a conspicuous threat to marine and coastal ecosystems and urban growth and tourism infrastructure have physically altered coastal areas. Several oil pollution incidents in the past 30 years have led to tighter regulation. Overexploitation of fisheries resources and the problems of by-catch and discards have become features of the regional fisheries regime. The catch from the region's seas has generally increased over the past 30 years. From 1985 to 1995, many South American countries doubled or tripled their catch, and Colombia's catch increased five-fold. However, in 1998 the regional catch dropped considerably to 11.3 million tonnes (15.9 per cent of the global total), due to adverse climatic factors caused by the El Niño.

■ West Asia

In countries of the Gulf Cooperation Council (GCC), petroleum industry operations and desalination plants are significant marine pollution hazards. In the Mashriq, the main threat is from rivers that discharge urban wastes and agricultural or industrial chemicals into the sea. About 1.2 million barrels of oil are spilled in the region every year from ballast water discharges in the ROPME Sea Area (Regional Convention for Cooperation on the Protection of the Marine Environment from Pollution), Red Sea and Mediterranean. Dredging and land reclamation works are degrading habitats along the western coasts of countries in the ROPME Sea Area. Regional conflicts have complicated the search for solutions to these and other problems. A rapid shift of populations from rural to urban (mainly coastal) areas has added to the pressures. Freshwater sources are scarce and water stress is ubiquitous. Agriculture accounts for over 80 per cent of water consumption. Groundwater pumping has lowered water tables and led to saltwater intrusion in some coastal areas. Several countries still lack integrated water management plans. River-sharing has made some progress under three regional action plans but disputes linger. Completion of new dams in Turkey currently threatens to affect water quality and quantity in the Euphrates River, which flows into Syria and Iraq, and feeds the farmlands and estuaries of the Shatt-al-Arab.

About one-third of the world's population lives in countries suffering from moderate-to-high water stress - where water consumption is more than 10 per cent of renewable freshwater resources. Some 80 countries, which are home to 40 per cent of the world's population, were suffering from serious water shortages by the mid-1990s. The three major factors causing increased water demand over the past century were population growth, industrial development and the expansion of irrigated agriculture.

One of the greatest environmental threats to health for many of the world's poorer populations, remains the continued use of untreated water. While the percentage of people served with improved water supplies increased from 4.1 billion in 1990 to 4.9 billion in 2000, 1.1 billion people still lack access to safe drinking water and 2.4 billion lack access to improved sanitation. Most of these people are in Africa and Asia. Lack of access to safe water supply and sanitation results in hundreds of millions of cases of water-related diseases, and more than 5 million deaths every year.

The GEF focal area of international waters is also concerned with aquatic biodiversity, particularly with regard to invasive species. Invasive species have been a major threat to native species through the effects of predation, alteration of habitat or disruption of ecosystem processes. Notable aquatic examples include the introduction of the predatory Nile perch *Lates niloticus* to Lake

From the GEF portfolio: Saving the Danube and Black Sea from nutrient pollution

Pollution by nitrates and other nutrient chemicals and wastes discharged from human sources such as farms, towns and factories is a priority concern of the 17 countries that border the River Danube and Black Sea. Since 1991, a succession of projects funded by the GEF and activated by UNDP, UNEP and World Bank, has identified nutrient pollution as the main factor behind eutrophication and other quality problems affecting these shared waters. Wildlife, human and animal health, ecosystems, biodiversity, economic activities and natural resources are all adversely affected. A strategic action programme that combines the outcomes of foregoing investigations, analyses and consultations has evolved out of this web of activity. It specifies policy, legal and institutional reforms and financial measures required to tackle nutrient pollution at source and reduce nutrients to balanced levels. Countries involved in the programme are now in a position to commit to:

- Adopting and implementing pollution prevention steps to reduce discharges, restore nutrient 'sinks' and clean up or head off potential toxic 'hot spots';
- Capping nutrient releases to the Black Sea at 1997 levels; and
- Agreeing reduction goals to be formalized in protocols or annexes to the Danube and Black Sea conventions.

In addition, the European Union, GEF implementing agencies and other donors will raise existing commitments to toxic nutrient reduction to greater prominence in their programmes. Private sector, NGO and community-based projects will pilot techniques for reducing non-point source pollution and restoring nutrient balance through integrated land management and water management partnerships. Nutrient reduction efforts in individual countries, backed by a GEF and World Bank Investment Fund, will focus on wetlands restoration, wastewater treatment and curbs on agricultural pollution. UNDP and UNEP will implement a technical assistance programme for regional capacity building around Black Sea shores and a matching component for the Danube basin will be implemented by UNDP alone. Mechanisms have also been set in place to facilitate cooperation and coordination between agencies and governments.

Victoria around 30 years ago, which contributed to the apparent extinction of 250 endemic species of cichlid fishes. In Eastern and Southern Africa, the widespread invasion of the water hyacinth (*Eichhornia crassipes*) is a contributor to deteriorating water quality and blocks water channels, disrupting flow patterns. The number of aquatic introductions rose rapidly during

the second half of the 20th century.

In many coastal areas, mounting pressure from overcrowding, urbanization, industrial operations, tourism and agricultural run-off has degraded habitats and resources on land and offshore. Sewage is the most prevalent source of marine contamination and coastal discharges of untreated sewage have escalated during the past 30 years. Rising levels of nitrogen pollution from agricultural and other sources have caused blooms of toxic phytoplankton and other signs of marine and coastal water eutrophication. More and more areas are being affected and at increasing frequency, most notably in enclosed or semi-enclosed seas such as the Black Sea. The natural flow of sediment between land and sea has been altered, mainly by expansion of urban and industrial infrastructure. These changes are another significant threat to vulnerable coastal habitats.

The *GEO-3* overview of global conditions concluded that 'overall, coastal and marine degradation not only continues but has intensified' apart from progress on 'relatively few issues in relatively few, mostly developed countries'.

From the GEF portfolio: Bermejo River Basin management

Implemented by UNEP and supported by GEF funds, this project has helped Bolivia and Argentina co-manage the shared waters of the Bermejo River and its basin. A strategic action programme (SAP) has been developed, based on analysis of the results of fact-finding investigations into such transboundary issues as accelerated sedimentation from soil erosion, and massive surges of water that can cause flooding far downstream. Government agencies, local communities and NGOs from both sides of the border have worked together towards a shared understanding of problems, causes and possible solutions. Solutions that show promise of economic and ecological sustainability have been put to the test in pilot demonstrations in which local people participate very actively. Different stakeholders also participate in workshops that range from local to bi-national in scope. Among developments from the 1997-1999 project are that:

- The necessary institutional, legal and information management foundations are now in place for enhancing and restoring environmental quality throughout the river basin;
- Protecting the basin's natural resources and ecosystems is now a feasible prospect and the required planning and financial instruments, human resources and skills to achieve this over the SAP's 20-year timeframe have been identified or already exist; and
- The comprehensive, cross-border and participatory character of the project offers a potentially valuable model for river sharing efforts in other parts of Latin America.

Managing water wisely

Some 120 ministers of water attending the Second World Water Forum held at The Hague in March 2000 adopted a declaration aimed at achieving world water security. The declaration noted the following as the main challenges of this new century:

- **Meeting basic needs:** to recognize that access to safe and sufficient water and sanitation are basic human needs and are essential to health and well-being, and to empower people, especially women, through a participatory process of water management.
- **Securing the food supply:** to enhance food security, particularly of the poor and vulnerable, through the more efficient mobilization and use, and the more equitable allocation of water for food production.
- **Protecting ecosystems:** to ensure the integrity of ecosystems through sustainable water resources management.
- **Sharing water resources:** to promote peaceful cooperation and develop synergies

between different uses of water at all levels, whenever possible, within and, in the case of boundary and transboundary water resources, between states concerned, through sustainable river basin management or other appropriate approaches.

- **Managing risks:** to provide security from floods, droughts, pollution and other water-related hazards.
- **Valuing water:** to manage water in a way that reflects its economic, social, environmental and cultural values for all its uses, and to move towards pricing water services to reflect the cost of their provision. This approach should take account of the need for equity and the basic needs of the poor and the vulnerable.
- **Governing water wisely:** to ensure good governance, so that the involvement of the public and the interests of all stakeholders are included in the management of water resources.

Source: World Water Forum 2000

INTERNATIONAL ACTION

While shared rivers can be a source of conflict due to competition, they can also encourage greater international cooperation. This is particularly evident today with the increase in the number of initiatives related to river basin management regimes and institutions committed to bilateral and/or multilateral management of transboundary water resources. In 1966, the Helsinki Rules, laid the foundation for international principles for shared watercourses and influenced many specific river treaties. The Rules were subsequently followed up by various international efforts, including the work of the UN International Law Commission, which led in 1997 to the United Nations Convention on the Law of the Non-Navigational Uses of International Watercourses.

The International Network of Basin Organizations (INBO) was set up in 1996. By 1998, INBO had 125 member organizations in 49 countries. Among other things, it promotes sustainable development of river basins, development of improved human resources and tools for managing water resources, and better retrieval and sharing of information and practical know-how.

Concern over growing problems related to groundwater resources has galvanized the international community, governments and other stakeholders to start addressing them. For example, the Second World Water Forum at The Hague in March 2000 organized a special workshop on groundwater. Some of the recommendations arising from the workshop included the need to raise public awareness and 'improve information availability, quality and accessibility to stakeholders, technical specialists and policy-makers'.

One of the earliest comprehensive water conferences was held in 1977 in Mar del Plata, Argentina. The focus on human needs led to the International Drinking Water Supply and Sanitation Decade (1981-90) and efforts of the United Nations and other international organizations to provide basic water services. The concept of meeting basic water needs was reaffirmed during the 1992 Earth Summit in Rio de Janeiro and expanded to include ecological water needs. A declaration issued by ministers attending the Second World Water Forum, stated seven key challenges of the new century (see box above) that will need to be tackled if this dismal and unequal situation is to be turned around.

The Global Programme of Action for the Protection of the Marine Environment from Land-based Activities, adopted in 1995, recognizes the fundamental physical linkages between land use, freshwater sources, river basins, coastal zones and oceans, requiring an integrated approach to achieve sustainable management. Projected climate change impacts have added urgency to this need. In addition to the Global Programme of Action and its regional offspring, the UN Convention on the Law of the Sea (UNCLOS), which now has 136 parties, is a key umbrella agreement encompassing a wide range of maritime concerns, including environmental protection.

Agreements that respond specifically to marine and coastal pollution issues include the London Dumping Convention (1972) and its Protocol of 1996, the 1989 Basel Convention on the Control of Transboundary Movement of Hazardous Wastes and their Disposal, and the Convention on the Prevention of Pollution from Ships (MARPOL). An array of regional seas programmes, action plans and accompanying regional conventions continues to provide a framework for effective environmental problem-solving and cooperation between maritime countries.

Recognition of the special needs of small island developing states led to the adoption in 1994 of the Barbados Programme of Action on the Sustainable Development of Small Island States. Global agreements aimed at sustainable fisheries exploitation include an Agreement on the Conservation and Management of Straddling and Highly Migratory Fish Stocks, adopted in 1995, and the Code of Conduct for Responsible Fisheries developed by FAO.

Since 1998, the GEF has funded a Global International Waters Assessment (GIWA) project, looking into action priorities and ways to frame sustainable solutions to water problems at national, regional and global levels. GIWA will provide a systematic health-check on environmental conditions and problems (including their social causes) in transboundary water bodies, including marine and coastal areas.

GLOBAL PERSPECTIVE

Biodiversity is defined in *GEO-3* as the 'variability among living organisms from all sources, including terrestrial, marine and other aquatic ecosystems, and the ecological complexes of which they are part, [including] diversity within species (genetic diversity), between species and of ecosystems'. The database maintained by the Committee on Recently Extinct Organisms lists 58 fish species and one mammal species recorded as extinct between 1970 and 2002, while assessments by BirdLife International indicate that nine bird species became extinct during this period. Extinctions among less studied groups are not accurately known. The concern is that the current rate of extinction is many times higher than the 'background' rate that has persisted over long periods of geological time (one bird or mammal species lost only every 500 to 1 000 years).

There is a clear link between biodiversity and human well-being. People rely on wild plants and animals for medicines and crop genetic resources. Of the world's 25 most sought-after drugs in 1997, 10 originated as natural substances. Healthcare for over 75 per cent of people worldwide means reliance on traditional medicines extracted directly from nature. Food security too, can hinge on biodiversity, in addition to the value of having a wild gene pool. Biodiversity also provides vital environmental services that

Globally threatened vertebrate species by region

	Mammals	Birds	Reptiles	Amphibians	Fishes	Total
Africa	294	217	47	17	148	723
Asia and the Pacific	526	523	106	67	247	1 469
Europe	82	54	31	10	83	260
Latin America and Caribbean	275	361	77	28	132	873
North America	51	50	27	24	117	269
West Asia	0	24	30	8	9	71
Polar	0	6	7	0	1	14

Note: 'Threatened species' include those categorized by IUCN in 2000 as Critically Endangered, Endangered and Vulnerable (Hilton-Taylor 2000); adding totals for each region does not give a global total because a species may be threatened in more than one region

Source: compiled from the IUCN Red List database (Hilton-Taylor 2000) and the UNEP-WCMC species database (UNEP-WCMC 2001a)

are hard to quantify and often overlooked. Fewer species and conversion of natural areas could mean reduced environmental services because resources such as energy, water and nutrients are retained in greater amounts by more diverse ecosystems. Species diversity may also help buffer natural ecosystems against adverse impacts of human activity.

In a recent global survey, habitat loss was found to be the principal factor affecting 83 per cent of threatened mammals and 85 per cent of threatened birds. Habitat modification arises from many different types of land use change, including agricultural development, logging, dam construction, mining and urban development. Over the past 30 years, land conversion has been more intensive in tropical regions than elsewhere and remains the principal driver of biodiversity loss. Worldwide about 1.2 million km² of land have been converted to cropland during this period. Forests, which support at least half the world's natural biodiversity, have borne the most conspicuous losses. FAO data show that between 1980 and 1995 forest cover in developing countries shrank by an estimated 2 million km² — an average annual loss of 130 000 km². Species-rich habitats such as the tropical dry forests of Central America have virtually disappeared. Other ecosystems that have come under heavy pressure from human activities leading to loss of habitat, habitat quality and species diversity are coral reefs, wetlands and other freshwater, marine and coastal ecosystems.

Other important direct drivers of biodiversity loss include climate change, pollution, over-harvesting of natural resources and the

introduction of exotic species. Key underlying causes include human population growth, unsustainable consumption habits, increasing production of waste and pollutants, urban development, international conflict and continuing inequities in the distribution of wealth and resources. On islands, introductions of alien species have been the most significant direct cause of extinction. In the past 200 years, Australia has lost more mammalian species than all the rest of the world, largely owing to introductions of placental mammals, which have become predators and competitors to the endemic marsupials.

The GEF biodiversity agenda

Between 1991 and 2001, the GEF allocated approximately US\$1.4 billion for conservation and sustainable use of biodiversity resources around the world and leveraged US \$2.8 billion in co-financing. This funding is distributed among 470 projects in developing countries and countries with economies in transition (CEITs) in four types of ecosystems: arid and semi-arid, coastal and freshwater, forest, and mountain. The projects support diverse activities to promote conservation, encourage sustainable use of resources, and enhance the sharing of benefits at local, national, and global levels. In addition, these projects have supported the Convention on Biological Diversity in areas such as alien invasive species, biosafety, taxonomy, World Heritage sites, and indigenous communities.

GMOs, biotechnology and biosafety

Genetically modified organisms (GMOs) and the biotechnology industry in general could play a large part in increasing agricultural yields and enhancing food security throughout the world. But there is consumer scepticism in some countries about the motivation of GMO developers and the efficacy of safeguards against potential hazards such as genetic transfers between introduced GM crops and native plants, with possible impacts on biodiversity, plant health or human health. Adopted in January 2000, the Cartagena Protocol on Biosafety was developed as a subsidiary agreement to the Convention on Biological Diversity to ensure that recipient countries have adequate opportunity and capacity to assess the potential hazards of cross-border trade or accidental releases of GMOs.

Biodiversity – regional highlights**■ Africa**

Africa is famous for the richness of its wildlife and the diversity of its ecosystems, including the world's most species-rich desert, the Succulent Karoo, and four other areas internationally recognized as 'biodiversity hot spots'. Natural biodiversity in Africa's forests, wetlands and plains underpins local subsistence uses. Wildlife tourism, a vital source of foreign exchange in many countries, is no less essential. Some 70 per cent of wild plant species in North Africa are used as medicines, food and forage or as part of agroforestry systems and many are put to more than one use. Habitat loss and degradation pose significant threats to biodiversity, especially in dryland areas. In humid areas, the bushmeat trade has also had a damaging impact. Up to 50 per cent of wetlands in Southern Africa have been degraded by draining for agricultural or urban development, pollution by effluent discharges and other causes. Building livelihoods that reconcile human needs with biodiversity can be difficult for people who depend on natural resources for subsistence. In some places, armed conflict and natural disasters exacerbate this problem, as coping mechanisms may undermine efforts to manage ecosystems responsibly. Elsewhere, however, dramatic successes have been scored. Conservation in the Western Indian Ocean islands, for instance, enabled Mauritian kestrel and pink pigeon populations to recover from single figures to several hundreds each in recent years.

■ Asia and the Pacific

The region supports a very high level of species diversity. In the belt linking the Hindu Kush and the Himalayas alone up to 25 000 plant species grow, 10 per cent of the world total. Two previously unclassified large mammal species, an ox and a deer, have been discovered recently in Viet Nam and Laos. Many species confined to oceanic islands in the region have fallen prone to extinction and those that survive in these isolated habitats continue to run a high risk, especially birds and molluscs. Habitat loss is the main pressure but introductions of invasive non-native species and unsustainable harvesting are important subsidiary causes. For example, a carnivorous snail introduced from Florida onto Moorea, French Polynesia, to help control the giant African land snail, preyed on several native endemic species of snail to the point of extinction of all seven in the wild. Some 21 per cent of the region consists of forest areas and many indigenous peoples rely on them for timber and non-timber goods such as rattan, bamboo, resins, waxes, nuts, honey, spices and traditional medicines. Commercial timber extraction and replacement of natural forests with tree farms and plantations have caused widespread habitat losses. If current trends persist, Indonesia's lowland forests will be destroyed by 2005 on Sumatra and by 2010 on Kalimantan, with further heavy loss of biodiversity. A succession of major dam construction projects has also had adverse effects on biodiversity in Asia.

■ Europe

The European landscape has been significantly altered by deforestation, drainage of wetlands, urban and industrial development, mining, road construction, pollution and changes to rivers and coastlines, as well as agricultural expansion and intensification. About 45 per cent of Europe is used for agriculture, placing wild habitats and species under direct pressure from agricultural activities, as well as limiting the space available to natural ecosystems. Large mammals such as the polar bear, wolf, lynx and bison now occupy only small relics of their original habitat and others, such as the taipan and the saiga, have become extinct. Around 260 vertebrate species are classified as critically endangered, endangered or vulnerable. Countries in Central and Eastern Europe still possess a wealth of well-preserved landscapes, ecosystems and species that are rare or already extinct in Western Europe, however, economic transition in Eastern Europe has caused biodiversity funding to dry up. In Bulgaria, for example, domestic financing collapsed in the mid-1990s and up to 90 per cent of all biodiversity financing now comes from the EU and bilateral funds. Despite substantial contributions from countries such as the Netherlands, Germany and Switzerland, though, foreign aid rarely exceeds 10-15 per cent of required funding.

■ Latin America and the Caribbean

The region contains seven of the world's 25 biodiversity hot spots and many highly productive rivers, lakes and marine ecosystems. Seven per cent of the world's coral reefs are found in the Caribbean. Cloud forests and other humid montane forests rank among the most threatened habitat types in the region and are also home to many wild relatives and gene pools of crops such as potatoes, maize and beans. Lowland tropical rainforests have also been a prime focus of conservation concern. The forests of eastern coastal Brazil are among the most endangered habitats on earth. The most species-rich habitat in the world, the Brazilian Amazon has been converted to agriculture and other uses across large parts of its original natural extent, a process often spearheaded by logging, mining and road building projects. An underlying pressure on the Amazon has been a tenfold increase in the region's human population since 1960. Illegal trade in plants and animals is a significant threat to biodiversity in Brazil, Colombia, Mexico, Peru and elsewhere. In some countries, permits to capture and market certain animals have been granted to private operators in line with CITES recommendations and national legislation.

■ West Asia

The seas around West Asia are rich in marine species but are at risk from pollution, including oil spills and discharges of untreated urban wastes. Other pressures include sand dredging, ocean warming and invasions of non-indigenous species. Terrestrial biodiversity abounds in hot spots like the Socotra Islands off Yemen and many migratory birds cross the region and feed or breed in its wetlands and wilderness areas. Drainage and water extraction have degraded many wetlands and watercourses, including the famed lower Mesopotamia marshlands. Mammals and birds are hunted to excess in many parts of the region. Schemes for captive breeding and reintroduction of Arabian oryx, Houbara bustard and certain gazelle species have been set up and maintained in Jordan, Oman, Saudi Arabia and Syria. Most West Asian countries have ratified the Convention on Biological Diversity (CBD) and some have ratified CITES. Many also adhere to requirements of regional agreements, such as MAP (the Mediterranean Action Plan) or the Regional Organization for the Protection of the Environment of the Red Sea and Gulf of Aden (PERSGA).

INTERNATIONAL ACTION

A rapid response to the long-term downward trend in species diversity, the CBD entered into force in December 1993, one and a half years after 164 heads of state signed the Convention at the UN Conference on Environment and Development Summit in June 1992. By the end of 2001, the CBD had been ratified by 182 governments. The Cartagena Protocol on Biosafety (see box on GMOs) was adopted in January 2000. The GEF was appointed to operate as the Convention's interim financial mechanism. The CBD has an important normative role in reconciling many approaches to conserving species and ecosystems within one sustainable development framework. Its three main goals are:

- The conservation of biodiversity;
- Sustainable use of the components of biodiversity; and
- Sharing benefits arising from use of genetic resources in a fair and equitable way.

Earlier multilateral initiatives to safeguard threatened species, their habitats, or both, resulted during the 1970s and 1980s in the Convention on International Trade in

Safeguards over wildlife

CITES and the monitoring network known as TRAFFIC (Trade Records Analysis for Flora and Fauna in International Commerce) continue to tackle problems and issues that arise from trade in protected wild species and wildlife products. The estimated value of global trade in wildlife products is US\$10 000 million a year. Its unlawful underside is organized trafficking in such products as rhino horn or elephant ivory from animals slaughtered illegally in the wild. The CITES secretariat, Interpol, the World Customs Union and several wildlife NGOs, have been establishing networks and organizing training of customs officials, border police, wildlife wardens and other relevant compliance authorities.

Endangered Species of Wild Fauna and Flora (CITES, see box above), the Convention on the Conservation of Migratory Species of Wild Animal (CMS) and the Ramsar Convention on Wetlands of International Importance especially as Waterfowl Habitat.

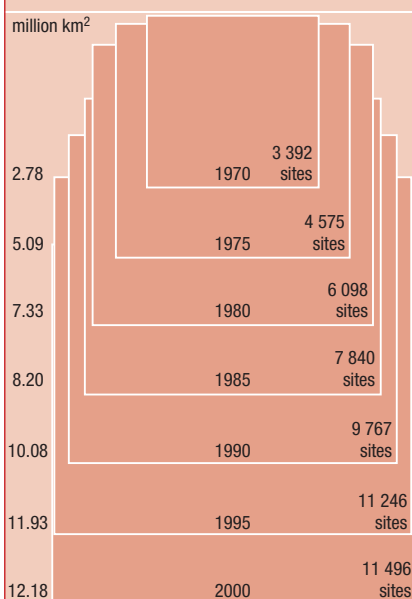
Various measures have been used to address the problem of habitat conversion and loss. The designation of protected areas, such as national parks, is one of the most widely used approaches for conserving habitats. In addition to national parks, a total of 167 sites have now been designated as natural heritage sites under the World Heritage Convention. The total area of protected sites has increased continuously during the past three decades from less than 3 million km² in 1970 to more than 12 million km² by the late 1990s (see figure), indicating

continuing efforts by governments to establish protected areas.

In 1997, in response to concerns over invasive species, UNEP, IUCN and research partners set up a Global Invasive Species Programme (GISP). It has been reviewing current knowledge with a view to developing new problem-solving tools. The Global Biodiversity Information Facility is an assessment tool that aims to improve the way information on biodiversity's scientific aspects is collected and presented. The Millennium Ecosystem Assessment, now under way, aims to provide a mechanism that combines the assessment needs not only of the CBD and the Ramsar Convention but also of the UN Convention to Combat Desertification. Regional responses to the biodiversity challenge take various innovative forms, among them:

- The planned Natura 2000 network will earmark more than 10 per cent of EU territory for conservation, and an Emerald Network for non-EU states will operate along similar, though less binding lines;
- The Andean Pact nations of Bolivia, Colombia, Ecuador, Peru and Venezuela have enacted a law, effective since July 1996, which seeks to regulate genetic resources prospecting and exploitation; and
- Governments and NGOs in Canada, Mexico and the US have collaborated on a North American Waterfowl Management Plan to conserve migratory waterfowl.

Global number and area of protected sites by year



Note: areas of more than 1 000 ha, IUCN categories I–VI

Source: compiled from Greene and Paine 1997 and UNEP-WCMC 2001b

From the GEF portfolio: Managing Ghana's coastal wetlands

Implemented by the World Bank, the Coastal Wetlands Management Project in Ghana has been set up to protect key coastal wetland areas through active collaboration between people who rely on these ecosystems for livelihood and other stakeholders. Local people have worked with a national NGO, the Ghana Wildlife Society, and the state Wildlife Department to plan and implement management and conservation programmes. Wildlife Service staff received specialized training and significant gains in capacity building, as well as major achievements in conservation and sustainable use of biodiversity were realized. In addition to supporting work to monitor biodiversity and identify sustainable

development options, this GEF-backed project has come up with management strategies for the wetlands that safeguard critical bird habitat without alienating local resource users. Five wetland ecosystems have been designated as Ramsar sites, increases in migratory bird populations have been noted in three locations and local communities have been empowered to manage and use wetland resources responsibly. Destruction of mangroves for fuelwood and habitat encroachment have been reduced and all stakeholders have learned the importance of cooperation in conservation efforts. This project is Ghana's first major attempt at community-based collaborative management of natural areas.

PERSISTENT ORGANIC POLLUTANTS

Persistent organic pollutants (POPs) are fat-soluble toxic chemicals that accumulate over many years in the environment and in human or animal tissues. A few of them, the polychlorinated biphenyls (PCBs), dioxins and furans, enter the air, land or water as industrial exhausts or by-products. Most are the residues of persistent organochlorine pesticides such as dieldrin, dichlorodiphenyltrichloroethane (DDT) or heptachlor, that have been banned in many countries. Despite these restrictions, some are still in widespread production and use.

Research into the distance that airborne residues travel and into their effects on human (especially infant) health has given rise to renewed concern. In some parts of the world, notably in polar regions, POPs may enter the environment from far distant sources yet can build up to levels higher than in their source regions (see box). Health risks to humans and other higher animals include glandular and hormone imbalances, immune system breakdowns, birth abnormalities, developmental defects and neurological disorders.

A UNEP survey published in 1996 revealed that aldrin, DDT, dieldrin and toxaphene were still being manufactured in a handful of developing countries. Some countries export such products even while outlawing their use at home. Reports from the 60 countries that participated in the survey also showed that farm chemicals containing nine different POPs were still being imported in over 20 cases.

INTERNATIONAL ACTION Supporting implementation of the Stockholm Convention

Boosting the scope of governments, especially in developing countries, to identify, reduce and finally eliminate sources of POPs has long been acknowledged as a crucial step towards curbing toxic chemical levels in the air, water and soil. The Stockholm Convention on Persistent Organic Pollutants, adopted in May 2001 and expected to enter into force in 2004, is the positive outcome of decades of international concern over POPs. In September 2002, the convention had 151 signatories and 21 parties.

The convention covers an initial list of 12 chemicals or groups of chemicals. Eight are pesticides: aldrin, chlordane, DDT, dieldrin, endrin, heptachlor, mirex and toxaphene. Two of them, PCBs and hexachlorobenzene, are industrial chemicals, though the latter is sometimes also used as a pesticide. Two are toxic by-products of combustion and industrial processes, the dioxins and furans.

Exemption is granted for continued use of DDT until 2025 in ongoing programmes of malaria control in developing countries. Existing equipment such as electrical transformers containing PCBs can also continue in use until PCB-free replacements are available. Phasing-out of the manufacture, import or use of POPs in developing and transition countries is to be funded on an interim basis by developed

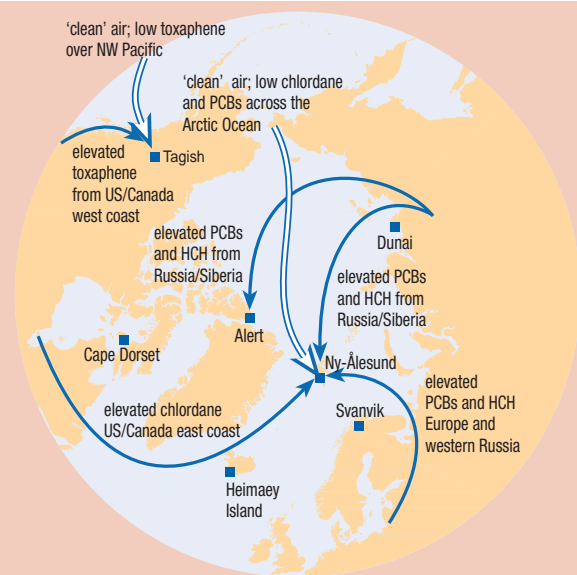
GEF and POPs

The Global Environment Facility is the designated interim principal entity to operate the financial mechanism of the Stockholm Convention. Concurrent with the adoption of the Convention, the GEF Council in May 2001, approved the "Initial guidelines for enabling activities for the Stockholm Convention on Persistent Organic Pollutants". The guidelines provide a framework for GEF support to the implementation of the Stockholm Convention through building national capacity to meet the obligations of the convention. At the same time the council approved the UNEP-led project, "Development of National Implementation Plans for the Management of Persistent Organic Pollutants", designed to act as a pilot in this endeavour.

In step with the negotiation of the Stockholm Convention, the GEF Council has been considering proposals for a GEF operational programme related to persistent organic pollutants, and the designation of POPs as a focal area. As a result the Council decided in May 2002, to recommend that the GEF Assembly designates POPs as a new focal area in direct support of the aims of the Stockholm Convention. Such designation would provide additional opportunities, within the GEF, for programming support for countries pursuing national plans to phase out, reduce, eliminate and dispose of POPs, and for specific phase out steps.

countries through the GEF. New chemicals may be added to the target POPs list in future, subject to a scientific review process.

Long-range transport of pollutants to the Arctic



Some persistent toxic substances, including POPs and mercury, can become volatile in warm air and be transported by air masses. After deposition, they can re-enter the atmosphere again and continue their journey, becoming long-distance contaminants. The process can continue until they reach the cooler polar areas where they condense on to particles or snow flakes in the air, which eventually land on the ground.

Due to the combination of harsh climate conditions with physico-chemical properties of persistent toxic substances, the polar regions, and the Arctic in particular, create a sink for these substances, which may result in their levels being higher than in the source regions. The implementation of the Stockholm Convention on Persistent Organic Pollutants may lead to a reduction in deposition of POPs in the polar regions.

Pathways and sources for POP-contaminated air coming from outside the Arctic

HCH = hexachlorocyclohexane
PCBs = polychlorinated biphenyls

Source: AMAP 1997

Assessment and information

UNEP, through its Chemicals Unit, is currently implementing with GEF financing a global assessment of the extent and nature of the threats posed by persistent toxic substances, including POPs (see box). UNEP also organizes a POPs Information Clearing House providing open access to:

- An inventory database collating toxicological and regulatory information on POPs;
- An alternatives database on safer chemical substitutes and non-chemical options;
- Survey data on POPs use, production, emission and control in over 70 countries; and
- A list of remedial actions taken by governments and international organizations.

Action to promote alternatives to the use of POPs

Various UN agencies and international agricultural research institutes have urged integrated pest management (IPM) practices that reduce dependence on persistent chemicals by replacing them with safer control methods, including biological control agents. UNEP and FAO, with GEF financing, are developing a programme to promote IPM in West Africa. A focus for private sector efforts is the Global Crop Protection Federation, which promotes wise use of pesticides and the prevention of poisoning and misuse off the farm.

The GEF is financing actions to support the phase out of DDT as a means of malaria vector control through a UNEP-led project in Central America and Mexico, and a similar initiative, involving collaboration between UNEP and WHO, is being developed in Africa. Through the World Bank, the GEF is developing a programme to deal with chemical stockpiles in Africa.

Under a UN Institute for Training and Research/Inter-Organization Programme for the Sound Management of Chemicals (UNITAR/IOMC) project to promote the preparation and implementation of action plans, major efforts have been made by the IOMC organizations to provide guidance to

Regionally-based assessment of persistent toxic substances

Previously, few data have been available on the origins, production, use, pathways and deposition of persistent toxic substances in most regions of the world. The Regionally-based Assessment (RBA) of Persistent Toxic Substances (PTS), implemented by UNEP with close to US\$ 2.7 million in GEF funding, includes assessment of the 12 POPs targeted by the Stockholm Convention. The RBA complements the Global International Waters Assessment, and has the ultimate goal of prioritizing issues and areas for future GEF interventions. Its main aims are to:

- Assess exposure and threat from PTS to the environment;
- Demonstrate their transboundary nature and analyse the major transport mechanisms;
- Identify the major sources of the substances concerned; and

- Analyse socio-economic implications of (and possible solutions to) the problems.

The project will produce a report on each of the regions around the world which will then be used to produce a global overview identifying priorities and suggesting solutions. Findings are still incomplete but key issues that have emerged so far include:

- Threats posed by large stockpiles of unwanted chemicals in most countries;
- Continued unintentional and unmonitored emissions of PTS as by-products of industry and burning of waste; and
- The extent to which POPs and other PTS travel through the environment, posing risks to people and wildlife far from their source.

countries in developing profiles or specific aspects of the necessary infrastructure for the 1998 Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade (known for short as PIC) and POPs reduction in pesticide use. These aspects include capacity building, disposal of obsolete pesticides, chemical disaster preparedness and establishment of poison control facilities. The PIC procedure, developed in the 1970s and 1980s, provides an important mechanism for formally obtaining and disseminating the decisions of importing countries on whether to receive future shipments of chemicals banned, or severely restricted, by governments of participating countries.

On the industry side, Crop Life International (CLI), formerly Global Crop Protection Federation and the *Groupeement Internationale des Federations des Associations des Producteurs des Pesticides* (GIFAP) are now playing more proactive roles in promoting judicious use of pesticides and reducing toxic exposures and misuse.

Campaigning NGOs or private voluntary organizations active on POPs issues include:

- Greenpeace, including its lobbying for the development of the POPs Convention;

- The Pesticide Action Network (PAN) coalition, notable for its work with FAO on obsolete stockpiles of pesticides and its lobbying for the PIC Convention; and

- The World Wide Fund for Nature (WWF), with its global toxics initiative, which has focused on POPs, endocrine disrupting chemicals and pesticides.

In relation to the POPs Convention negotiations, many public sector NGOs organized themselves into the International POPs Elimination Network (IPEN), which has brought together academic, community-based environmental, indigenous and public health groups. It is a unique attempt by public interest NGOs to self-organize around issues on chemicals. Also in relation to the POPs issues, the indigenous people in the Arctic, perceiving a threat to their way of life from distant sources of chemicals, have organized themselves into an effective negotiating force.

LAND DEGRADATION

■ GLOBAL PERSPECTIVE

Land degradation was estimated in 1991 to be worsening at a rate of 5 to 6 million ha every year. By 1996, it had affected nearly 2 000 million ha (15 per cent) of the world's land area. Land degradation can have multiple causes and impacts. Deforestation is the biggest single cause of land degradation, followed by agricultural activities, overexploitation of vegetation and industrial activities. Climate change can also figure both as a cause and effect of degradation. If loss of soil organic matter resulting from degradation were curbed, more carbon could be stored in soils and in plant cover rather than released into the atmosphere, a potentially significant carbon sequestration gain.

Another key cause is loss of natural ground cover during conversion of marginal drylands, wilderness areas or forests to agricultural uses. Even in productive agricultural zones, inappropriate land management policy and practice (sometimes prompted by overcrowding, food deficits and national debt) can give rise to waterlogging, salinization, soil erosion, loss of soil fertility and, in the worst cases, outright desertification. Irrigated drylands and mountain soils are especially vulnerable. Over-reliance on agrochemicals is a less self-evident factor behind land degradation. Others are acidification, toxic chemical residues and disasters such as floods or droughts. Inequitable land tenure can play a part in raising the likelihood of

Extent and causes of land degradation

Degradation extent	Cause
580 million ha	Deforestation — vast reserves of forests have been degraded by large-scale logging and clearance for farm and urban use. More than 220 million ha of tropical forests were destroyed during 1975–90, mainly for food production.
680 million ha	Overgrazing — about 20 per cent of the world's pasture and rangelands have been damaged. Recent losses have been most severe in Africa and Asia.
137 million ha	Fuelwood consumption — about 1 730 million m ³ of fuelwood are harvested annually from forests and plantations. Woodfuel is the primary source of energy in many developing regions.
550 million ha	Agricultural mismanagement — water erosion causes soil losses estimated at 25 000 million tonnes annually. Soil salinization and waterlogging affect about 40 million ha of land globally.
19.5 million ha	Industry and urbanization — urban growth, road construction, mining and industry are major factors in land degradation in different regions. Valuable agricultural land is often lost.

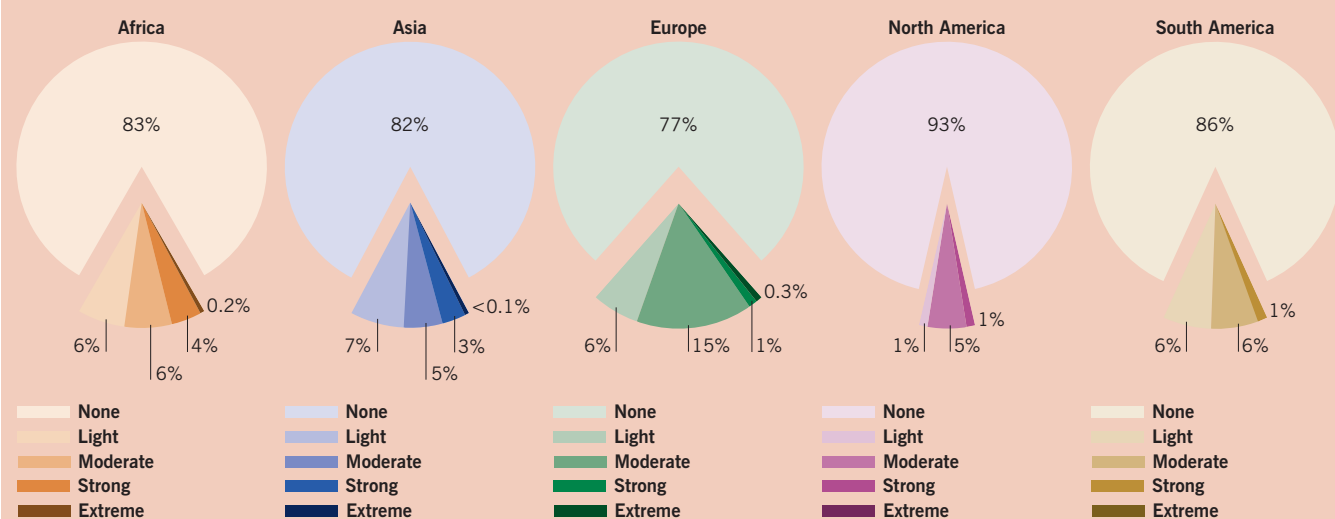
Source: FAO 1996

degradation. So, too, can the spread of urban settlements, transport networks, industrial developments and other human infrastructure.

The main types of soil degradation are water erosion, wind erosion, chemical degradation, and physical degradation. These impacts can considerably lower the productive capacity of land. They also reduce the soil's ability to filter out pollutants and act as a buffer for soil acidity or alkalinity. Soil degradation also limits the contribution soils can make to critical life

support cycles such as the hydrological or nitrogen cycle and to maintaining natural habitats and biodiversity. In the worst cases, land degradation leads to outright desertification, defined by the UN Convention to Combat Desertification as 'land degradation in arid, semi-arid and dry sub-humid areas' and estimated to affect between one-third and half the world's surface area. Despite improvements in soil conservation techniques and general recognition of the urgent need to slow the rate of land degradation, there are no clear signs of progress.

Extent and severity of land degradation



Source: UNEP 1992

Land degradation – regional highlights

■ Africa

Desertification is an ever-present risk in almost 50 per cent of Africa's drylands. Some 60 per cent of African households rely on agriculture for a livelihood. By 1999, 32 per cent (202 million ha) of potentially cultivable land was cultivated and 906 million ha of grasslands were permanently grazed. There have been substantial cereal production gains in recent decades but these came about mainly through expansion of the agricultural boundary into marginal lands, natural forests and wetlands. Such conversion carries an almost inevitable risk of land degradation. In many areas, loss of natural vegetation cover has exposed soils to wind and water erosion. Sediment can fill dams and rivers with silt, cutting output from hydropower plants and increasing the risk of flood disasters in settled estuary and river margins. In addition, nutrient depletion sharply reduces agricultural yields, a shortfall that Africa's many low-income or subsistence farmers cannot afford to remedy by using fertilizers. Millions of people in at least 16 countries have faced food shortages in recent years, through crop failures or distribution breakdowns linked to civil unrest or conflict. Land tenure is a hot political issue in many parts of sub-Saharan Africa. More equitable access to permanent farmland could do much to forestall land conversion.

■ Asia and the Pacific

Degradation affects over 104 million ha of land around the region. Land use changes driven by rapidly expanding populations are part of the problem. Needy people without access to prime land and resources are driven to exploit marginal lands or forest areas, especially around timber extraction sites. Water erosion is at its most severe in the Himalayas, Central Asia, China, the South Pacific islands and Australia. Wind erosion seriously affects many countries, including Afghanistan, China, India, Iran and Pakistan. In India, as much as 27 per cent of soil had suffered erosion by 1997, critically reducing agricultural potential. Over half of Asia's 1 977 million ha of drylands are also affected by desertification. Soil erosion, compaction and salinization are key symptoms; others are weed infestations and loss of soil fertility. A critical underlying cause is extraction of groundwater and surface water for irrigation to levels that exceed the land's drainage capacity or the tolerance of crops to sub-surface salts (salinization). A more recently emerging but very widespread problem is contamination of soils and pastures by urban, industrial or agricultural chemicals and wastes, especially heavy metals.

■ Europe

Land use in Europe is determined to a large extent by the competing demands of farming, forestry, environmental care or amenity uses and mounting pressure to develop urban, industrial and transport infrastructure. Erosion, mainly water-induced, remains a problem in the black soil regions of the Republic of Moldova, the Russian Federation and the Ukraine. In the Commonwealth of Independent States, 475 million ha (79 per cent) of cultivated land is affected by erosion in 12 countries. The collapse of centrally planned economies in the late 1990s in much of Central and Eastern Europe put an end to state subsidies for large collective farms and the highly intensive agricultural techniques associated with them. The environmental outcomes have been largely beneficial, including substantial reforestation. Soil contamination by industrial chemicals, inadequate waste disposal and mining, and military activities nevertheless persists in many areas. So, too, do soil salinization and waterlogging, mainly the relics of giant irrigation and hydro-power schemes. Soil acidification from acid rain has decreased throughout Europe by 50 per cent since the 1980s, mainly owing to reductions in sulphur emissions. Where it persists, however, it continues to cause grave concern.

■ Latin America and the Caribbean

Water and wind erosion are widespread agents of land degradation, affecting over 14 per cent of territory in South America and 26 per cent in Central America. Rapid urban growth and land conversion are key underlying causes. Between 1972 and 1999, the boundary of permanent arable land advanced by over 35 per cent of its former extent in South America, by over 21 per cent in Meso-America and in the Caribbean by 32 per cent, while region-wide the area under irrigation grew by some 2 per cent a year. Forest has been cleared in Argentina, Brazil and elsewhere on a vast scale for cattle ranching or farming of cash crops for export. Tax incentives and subsidies have boosted this trend in many countries. Expansion of infrastructure such as roads and settlements has led to further clearance of natural areas. A threefold rise in use of chemical fertilizers in 1972-97 led to widespread nitrification of soils and water, a hazard to human health. Salinization of irrigated soil affects much of the region and in places has led to desertification, most notably in Argentina, Brazil, Chile, Mexico and Peru. Behind many of these problems lie inequitable patterns of land tenure and ineffective land reform programmes.

■ West Asia

Desertification and land degradation are common across this region of extensive arid and semi-arid lands. In Iraq, Jordan, Syria and over the whole Arabian Peninsula the desertification of rangelands is a pressing problem. Conflict and unrest in and around West Asia have led governments to adopt policies aimed at national self-sufficiency and consequently develop sizeable agricultural sectors. As a result, irrigated land area more than doubled between 1972 and 1999 from nearly 3 to over 7 million ha. In many cases, these policies have had damaging impacts on land and water resources. Wind erosion is a key agent of land degradation and overgrazing is among the factors that have hastened its effects on rangelands. Grazing intensity has more than doubled in recent decades and in places livestock concentrations exceed the land's carrying capacity by a factor of four or more. Recent policy moves have led to the introduction of range reserves in some parts of the region.

INTERNATIONAL ACTION

The UN Convention to Combat Desertification (UNCCD) came into effect in 1996. It commits its parties (of which there were 177 by December 2001) to develop practical national programmes involving local stakeholders and non-governmental organizations. It also has detailed regional annexes for dealing with specific problems in areas such as the Sahel and the Northern Mediterranean. A 20-year global effort to curb desertification could cost US\$10-22 billion a year yet UNCCD's funding is a fraction of this sum. Most industrialized countries do not see desertification as a problem that has global relevance.

Among other multilateral environmental agreements that relate to land degradation or contamination issues are the Stockholm Convention on Persistent Organic Pollutants (see POPs section), the Convention on

Biological Diversity and the Ramsar Convention on Wetlands. The latter two include provisions for curbing loss of natural vegetation. The World Water Forum held in March 2000 led to the informal adoption of 'water visions' for all the regions of the world, many of which take account of land issues.

International scientific bodies that monitor land degradation include the Intergovernmental Panel on Climate Change, which among other things, tracks the effects of global warming on agriculture and vice versa. A significant new initiative is the Millennium Ecosystem Assessment, launched in 2001. It is a bid to understand the goods and services provided by key ecosystems such as farmlands or forests and the processes that underlie and link them.

Several regional groupings pursue agendas that urge safeguards over land or land use.

The Maghreb Arab Union and the Southern African Development Community, as well as the Economic Community of West African States and the Permanent Interstate Committee for Drought Control in the Sahel have all submitted sub-regional plans for incorporation into UNCCD. Several countries in West Asia are on a similar track. In Asia and the Pacific, regional initiatives are proving elusive but some larger countries have developed far-reaching national initiatives or frameworks for tackling urgent land issues. India, for instance, has mounted at least six such initiatives since 1990. In Latin America, members of the Amazonian Pact, Sustainable Development Commission, Central American Integration System and the Andean Pact have all agreed to fight land degradation or to set up monitoring and control networks to track and prevent it.

Forest loss

FAO calculated in 2000 that almost one-third of the world's land area is forested, all but 5 per cent of it by naturally occurring rather than planted trees. Forest cover is steady or even increasing in places but is shrinking in most developing countries. From a total world cover of almost 4 000 million ha in 1990, the world's forest area had receded by nearly 94 million ha by the year 2000, an average rate of just under a quarter of 1 per cent a year. Tropical forests still bear the heaviest losses, at rates that run close to 1 per cent a year. Of the 16.1 million ha of natural forests annually lost to deforestation or replaced by plantations in the 1990s, 15.2 million ha were in the tropics. Nearly 70 per cent of losses arose from land conversion to agricultural uses, the rest mainly from overgrazing, logging and fuelwood gathering.

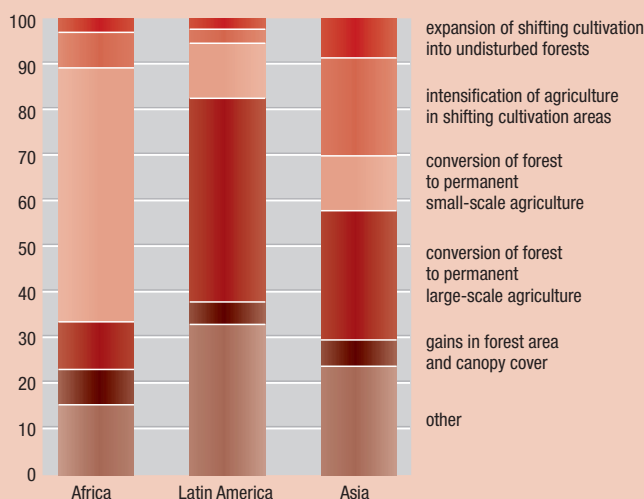
Following concerns expressed at the 1972 Stockholm Conference, international initiatives for conservation and sustainable management of tropical forests have been in the making for three decades. In the 1980s, the International Tropical Timber Organization (ITTO) and the Tropical Forestry Action Plan (TFAP, reconstituted in 1995 as the National Forestry Action Program) were set up, linking the concerns of commerce, governments and NGOs. In addition to the principles of sustainable forest management outlined in Agenda 21 and in the Forest Principles adopted at the 1992 UNCED Summit, the three international conventions developed as part of the UNCED process (UNFCCC, CBD and UNCCD)

have significant indirect bearing on the future of the world's forests and forest lands. During the late 1990s, under the auspices of the UN Commission on Sustainable Development, the Intergovernmental Panel on Forests (IPF) and the Intergovernmental Forum on Forests (IFF), set in motion a process intended to lead to 'a common vision' for managing, conserving and sustainably developing forests of all kinds. Nearly 300 proposals for action have arisen from the IPF/IFF process and the United Nations Forum on Forests (UNFF) was set up in October 2000 to pursue them.

A Collaborative Partnership on Forests (CPF) was also established by 11 international

organizations within and outside the UN system with agendas relating to forests, to help put UNFF proposals for action into practice and speed adoption of policy measures by stakeholder governments. The main operative means of the UNFF is a programme of work extending over several years and a plan of action. An inaugural session of the UNFF in June 2001 failed to create an agreed mandate or an accountable procedure for implementing IPF/IFF proposals for action. Despite the proliferation of organizations, ways and means, current assessments reveal no significant progress towards arresting deforestation and the degradation processes associated with it.

Causes of forest area change (percentage of total) by region



In the 1990s, almost 70 per cent of deforested areas were changed to agricultural land. In Latin America, most conversion was large-scale, whereas in Africa small-scale agricultural enterprises predominated

Source: FAO 2001b

GEO-3 emphasizes that the next 30 years will be as crucial as the past 30 for shaping the future of the environment. Old troubles will persist and fresh challenges will emerge as increasingly heavy demands are placed upon resources that, in many cases, are already in a fragile state. The increasing pace of change and degree of interaction

between regions and issues has made it more difficult than ever to look into the future with confidence. *GEO-3* uses four scenarios to explore what the future *could* be, depending on different policy approaches. It is now generally accepted that scenarios do not predict. Rather, they paint pictures of possible futures and explore

the differing outcomes that might result if basic assumptions are changed. The *GEO-3* scenarios, which span developments in many overlapping areas including population, economics, technology and governance, are described in the boxes that follow. They are:



Markets First

Most of the world adopts the values and expectations prevailing in today's industrialized countries. The wealth of nations and the optimal play of market forces dominate social and political agendas. Trust is placed in further globalization and liberalization to enhance corporate wealth, create new enterprises and livelihoods, and so help people and communities to afford to insure against — or pay to fix — social and environmental problems. Ethical investors, together with citizen and consumer groups, try to exercise growing corrective influence but are undermined by economic imperatives. The powers of state officials, planners and lawmakers to regulate society, economy and the environment continue to be overwhelmed by expanding demands.



Policy First

Decisive initiatives are taken by governments in an attempt to reach specific social and environmental goals. A coordinated pro-environment and anti-poverty drive balances the momentum for economic development. Environmental and social costs and gains are factored into policy measures, regulatory frameworks and planning processes. All these are reinforced by fiscal levers or incentives such as carbon taxes and tax breaks. International 'soft law' treaties and binding instruments affecting environment and development are integrated into unified blueprints and their status in law is upgraded, though fresh provision is made for open consultation processes to allow for regional and local variants.



Security First

This scenario assumes a world of striking disparities where inequality and conflict prevail. Socio-economic and environmental stresses give rise to waves of protest and counteraction. Discord becomes increasingly prevalent, the more powerful and wealthy groups focus on self-protection, creating enclaves akin to the present day 'gated communities'. Such islands of advantage provide a degree of enhanced security and economic benefits for dependent communities in their immediate surroundings but they exclude the disadvantaged mass of outsiders. Welfare and regulatory services fall into disuse but market forces continue to operate outside the walls.

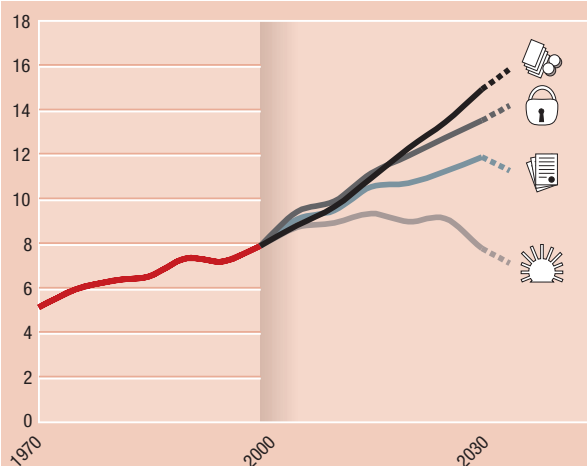


Sustainability First

A new environment and development paradigm emerges in response to the challenge of sustainability, supported by new, more equitable values and institutions. A more visionary state of affairs prevails, where radical shifts in the way people interact with one another and with the world around them stimulate and support sustainable policy measures and accountable corporate behaviour. There is much fuller collaboration between governments, citizens and other stakeholder groups in decision-making on issues of close common concern. A consensus is reached on what needs to be done to satisfy basic needs and realize personal goals without beggaring others or spoiling the outlook for posterity.

Elements of each of the four possible futures highlighted above can be observed in today's world, as can the trends and drivers that could push the world in the direction of one or another of them. Which scenario — or which combination of scenarios — prevails in reality is a matter partly of contingency and partly of choice.

Carbon dioxide emissions from all sources (billion tonnes carbon/year)



Carbon dioxide is emitted above all from the use of fossil fuels. For all four scenarios, it is assumed that stabilization of primary energy use is first reached at the end of the 21st century.

Source: IMAGE 2.2 (see *GEO-3* technical annex)

ENVIRONMENTAL IMPLICATIONS

Some of the environmental implications arising out of the four scenarios explored for *GEO-3* fall within the GEF focal areas.

Climate change

- In the *Markets First* and *Security First* scenarios, the absence of effective policies to reduce emissions of CO₂ and other greenhouse gases, as well as slow transfer of technology, lead to significant increases in emissions over the next 30 years.
- Policy actions taken under a *Policy First* scenario, such as carbon taxes and investments in non-fossil-fuel energy sources, effectively curb growth in global emissions and lead to actual reductions, beginning around 2030.
- The *Sustainability First* scenario implies dramatic behavioural shifts, along with improved production and conversion efficiencies, resulting in a very rapid levelling off of emissions followed by a decline by the middle of the 2020s.

Time lags in the climate system mean that changes in emissions patterns will have a delayed effect on the atmospheric concentrations of CO₂ and even more so on the actual changes in climate. Strong links between climate change and other environmental issues, specifically local and regional air pollution, will further affect the rates of temperature change. In the long term, the dynamics of a world resembling *Markets First* or *Security First* imply much faster and greater overall temperature rises.

Delays in the response of the climate system are also apparent in other ways. For instance, there is very little difference, by 2032, between the scenarios in terms of sea level rise. The total increase since the beginning of the century is approximately 10 cm, yet this level and rate of rise has serious implications for coastal and low-lying regions throughout the world, implying that adaptation measures are important to consider along with attempts to reduce emissions.

International waters

Looking ahead to the coming decades, global climate change may have a strong impact on the local availability of freshwater. Growing populations and increased economic activity, particularly in agriculture, will lead to increased demand

for freshwater in most scenarios. The two regions most affected by severe water stress are Asia and the Pacific, and West Asia, and a closer examination of these two regions demonstrates some of the key challenges associated with this issue.

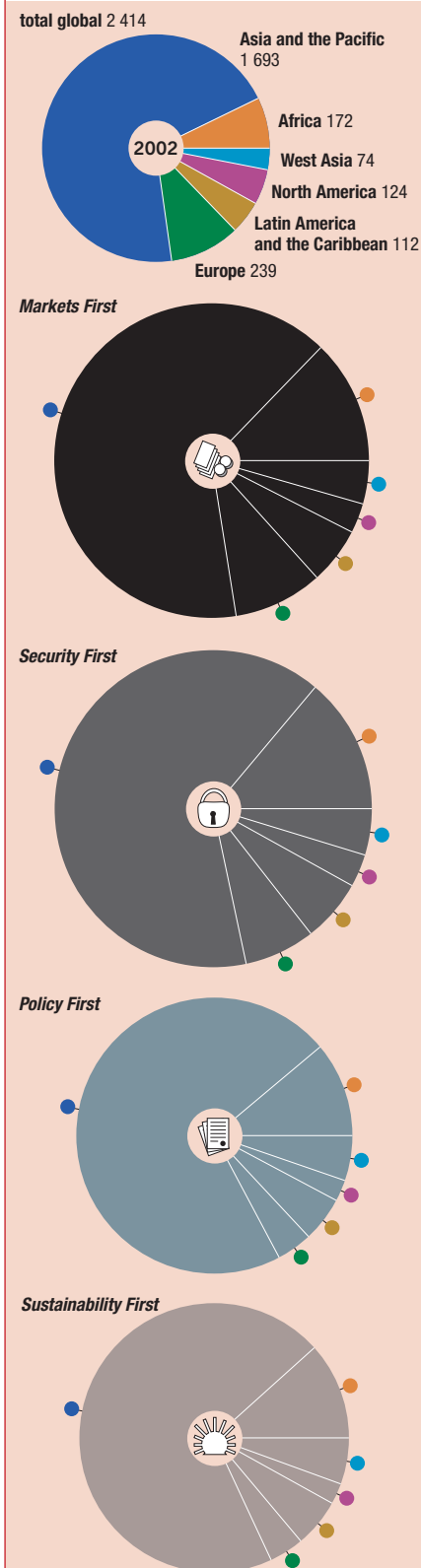
Water stress may also become a key issue in Central and Eastern Europe over the next 30 years, particularly under the *Markets First* and *Security First* scenarios, with economic development and population increases leading to sharp increases in overall water demand.

In 2002, close to 1 700 million people (more than 50 per cent of the population) in Asia and the Pacific, and 74 million people (almost 90 per cent of the population) in West Asia live under severe water stress. Moving towards 2032, in Asia and the Pacific:

- Growth in demand for water is especially high under the *Markets First* scenario, and water withdrawals increase in all sectors, particularly to meet increasing irrigation needs. These increases lead to an expansion of areas with severe water stress, and more people are affected throughout the region.
- In *Security First*, growth in demand is tempered by slower economic growth and no further expansion in irrigated areas, rather than any significant efforts to become more efficient. However, high population growth under this scenario more than offsets these trends.
- As the effective policies of a *Policy First* world and the lifestyle changes associated with a *Sustainability First* scenario combine with greater regional cooperation and technology transfer, water withdrawals remain at current levels or even decrease in most of the region. Robust economic growth under each of these scenarios is tempered by policies such as water pricing, and more efficient use of water in agriculture due to advances in biotechnology. However, because population growth offsets these trends, the total number of people living in areas under severe water stress continues to increase across Asia, even in the *Policy First* and *Sustainability First* scenarios.

West Asia is one of the most water-stressed regions of the world, a problem that continues to increase as water demand

Number of people living in areas with severe water stress (million persons)



All the pie charts show total global impacts. The top pie shows the current situation, the relative size of the others reflects the magnitude of impacts by 2032 under the four scenarios.

Source: WaterGAP 2.1

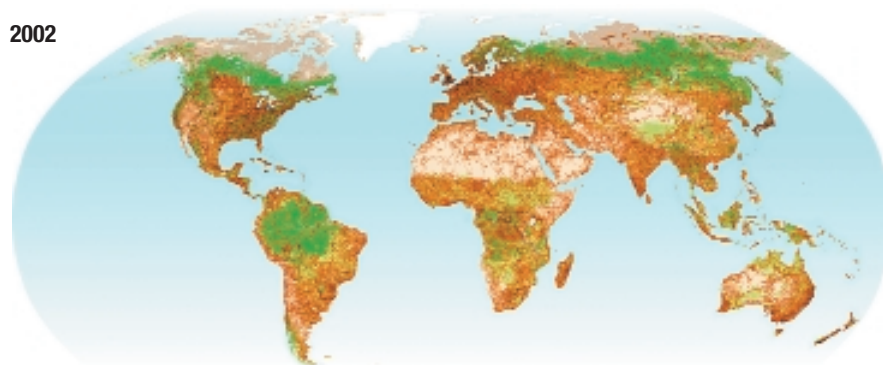
exceeds available resources, owing to population growth and expansion of different development sectors.

- Under a *Markets First* scenario, deteriorating water quality and increasing competition between sectors (mainly between the domestic and agricultural sectors) hamper food production and lead to conflicts, increasing water-related health problems and areas with severe water stress. Over 200 million people are affected by 2032.
- The same holds true for a *Security First* scenario, with water withdrawals being slightly higher than in the *Markets First* scenario due to more water-cooled thermal electricity production.
- Under the *Policy First* scenario, reductions in irrigated areas, combined with structural changes in the way water is used in industry, lead to reductions in total water withdrawals. The area under water stress is stabilized by adopting strategic water resources management to increase water use efficiency and resource depletion.
- Reductions in irrigated areas and more efficient water use by industry also occur in *Sustainability First*, leading to reductions in total water withdrawals. Furthermore, the increase of freshwater made available by desalination technology and lowered demands, achieved through the wide application of biotechnology in food production and a decrease in population growth rate in the region, help to counteract the effects of additional demand related to higher economic growth. Although total withdrawals drop in these last two scenarios, water scarcity persists and demand continues to exceed available water resources.

The impact of water stress in the different scenarios also depends on relations between individual countries in West Asia and on the region's relations with other regions, as about 60 per cent of surface water resources originate from outside West Asia. In *Security First*, conflicts and tension increase within the region, as well as with countries outside the region, eventually leading to water wars. These concerns ease in *Policy First* and *Sustainability First* as countries negotiate agreements on the equitable sharing of surface water resources.

Ecosystems impacted by infrastructure expansion

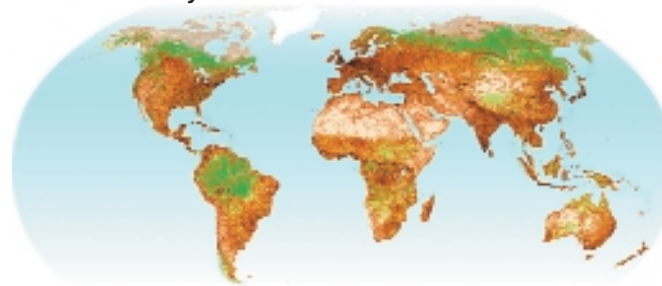
2002



2032: *Markets First*



2032: *Sustainability First*



Source: GLOBIO

Biodiversity

Biodiversity conservation represents another major environmental challenge at the global level, and will continue under threat if there is no strenuous policy action to curb human activity. Built-up areas increase in nearly all regions and scenarios, with the introduction of new infrastructure possibly leading to uncontrolled resource exploitation.

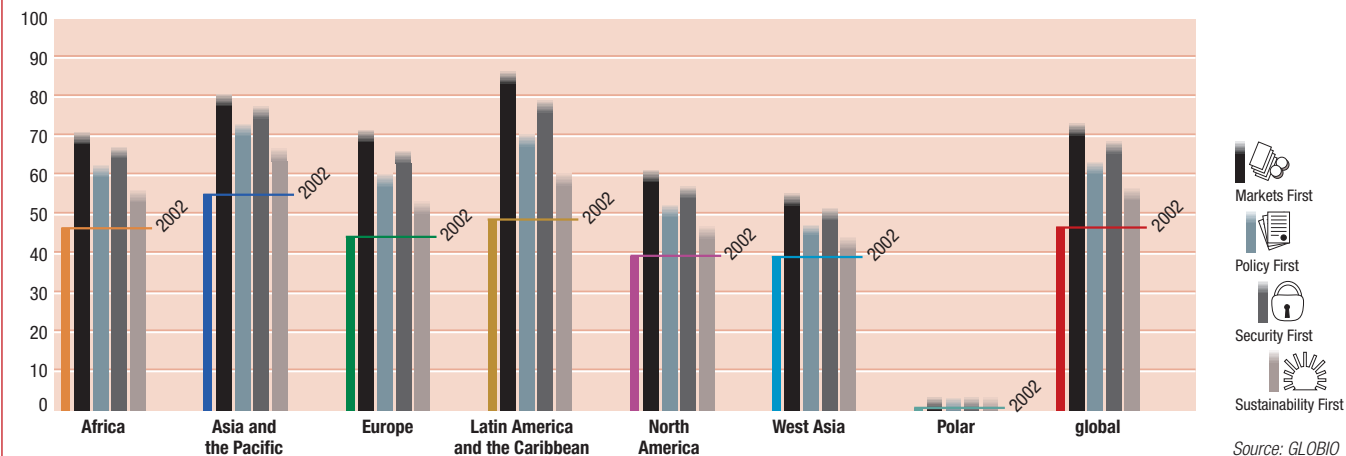
- In both *Markets First* and *Security First*, these resource-driven processes accelerate, with further disruption of remaining wilderness areas and severe impacts on biodiversity and indigenous peoples.
- A *Policy First* world brings additional areas under protection and introduces mitigation measures. However, as in the

previous century, these are carried out at rates far below that of development.

- Even under *Sustainability First* conditions, increasing impacts from infrastructure as well as continued growth in consumption of fuels, minerals and goods and services from natural resources, cannot be completely avoided.

Together with further land conversion and the growing impacts of climate change, these developments severely deplete biodiversity in most regions in all scenarios, with particular pressure being placed on coastal ecosystems. Much attention will have to be focused on this challenge in the coming decades in order to begin to alter current trends.

Land area impacted by infrastructure



Land degradation

Increases in infrastructure as well as unsustainable agricultural practices will result in increased land degradation in many parts of the world. Several of the key issues are demonstrated by a closer look at Africa and Latin America and the Caribbean.

In Africa, there is an increasing risk of land degradation, loss of forests, and increased exploitation of remaining forests.

- Stronger economic growth in the region under *Policy First* and *Sustainability First* conditions, implies that the risk of land degradation is higher than in *Markets First*. However, the translation from risk to actual degradation may be mediated in a number of ways. For example, easier access to support services under these two scenarios helps farmers to manage soils better and policies based on integrated land management become commonplace in the region.
- At the other end of the spectrum, in a *Security First* scenario, a combination of inequitable land distribution, poor farming methods, unfavourable land tenure systems and inefficient irrigation systems leads to declining productivity of grazing and agricultural lands.
- Similar problems arise in *Markets First* as better quality agricultural land is taken over for commodity and cash crop production.

Land and forest degradation as well as forest fragmentation remain among the most relevant environmental issues in Latin America and the Caribbean in all scenarios.

- Significant loss of forest area and high levels of exploitation of existing forests occur in a *Markets First* scenario.
- In a *Security First* world, the control over forest resources by transnational companies that create cartels in association with the national groups in power promotes the expansion of some forest areas, but this is not enough to stop overall deforestation. As well, under both of these scenarios, the agricultural frontier continues to expand into rainforest ecosystems, posing significant risks for land degradation.
- More effective management remedies some of these problems in *Policy First*, as policies to promote forest plantations are enacted and institutional strengthening creates better forest control.
- Land degradation resulting from deforestation stops almost completely in *Sustainability First*. As in the *Policy First* scenario, enforcement of direct and indirect regulations leads to improvements in controlling soil erosion, dramatically reducing the amount of cropland lost to degradation.

LESSONS FROM THE FUTURE

The environmental implications of the various scenarios illustrate the legacy of past decades and the level of effort that will be needed to reverse powerful trends. The different outcomes under the *GEO-3* scenarios clearly demonstrate the crucial role and importance of policy decisions in shaping tomorrow's world. Some of the major lessons include the following:

- There can be significant delays between changes in human behaviour and their environmental impacts. This means:
 - much of the environmental change that will occur over the next 30 years has already been set in motion by past and current actions; and
 - many of the effects of environmentally relevant policies put into place over the next 30 years will not be apparent until long afterwards.
- Achieving widely agreed environmental and social goals will require dramatic and coordinated action starting now and continuing for a number of years. Steps must include policies based on prevention and adaptation.
- Important linkages exist between different environmental issues and between environmental and broader social issues. It follows that:
 - policy can be made more effective by looking for synergies or 'co-benefits'; and
 - care must be taken to avoid conflicts between policies.
- The establishment of strong institutions for environmental governance is a prerequisite for almost all other policies.
- Not all policy instruments are appropriate for all situations.
- The achievement of environmental goals will require decisive action, will encounter unforeseen eventualities and will not happen overnight. For better or worse, the fate of this endeavour is in our hands.

■ WORLD SUMMIT ON SUSTAINABLE DEVELOPMENT OUTCOMES

Three months after the launch of *GEO-3* in May 2002, the international community gathered in the South African city of Johannesburg between 26 August and 4 September at a world summit, which brought together world leaders to recharge international efforts to achieve sustainable development.

The two-week World Summit on Sustainable Development (WSSD), culminated in a number of documents. Among them is the Plan of Implementation, which commits the international community to strengthen the sustainable development agenda. The plan outlines a number of important areas for the Global Environment Facility. The following are some of the more specific decisions that relate to the GEF:

- Under the section related to changing unsustainable patterns of consumption and production, the plan calls for the utilization of financial instruments and mechanisms, particularly the GEF, to

provide financial resources to developing countries, especially the least developed countries and small island developing states. There would be several intended purposes for this funding support, the first of which would be to enable such countries to meet their capacity needs for training and technical know-how. It is hoped that funding support would also work to strengthen national institutions in reliable, affordable, economically viable, socially acceptable and environmentally sound energy. Included in this would be the promotion of energy efficiency and conservation, renewable energy and advanced energy technologies, such as cleaner fossil fuel technologies.

- Under the section on protecting and managing the natural resource base of economic and social development, the Plan of Implementation calls on the Second GEF Assembly to take action on the recommendations of the GEF Council. These recommendations concern the designation of land degradation (desertification and deforestation) as a focal area of the GEF in order to support

the successful implementation of the UN Convention to Combat Desertification. The assembly should also consider making the GEF a financial mechanism of the CCD. In this way, it would be possible to take the decisions of the CCD Conference of the Parties into account, while recognizing the complementary roles of the GEF and the Global Mechanism of the convention in providing and mobilizing resources for the elaboration and implementation of action programmes.

- The section on sustainable development of small island developing states calls for the acceleration of national and regional implementation of the Programme of Action, with adequate financial resources. Included in this is the transfer of environmentally sound technologies, through the GEF focal areas, and assistance for capacity-building from the international community. It also calls for the support of freshwater programmes for small island developing states, including through the GEF focal areas.

Sustainable development challenges and commitment

In a political declaration adopted at the end of the summit - The Johannesburg Declaration on Sustainable Development - world leaders highlighted challenges facing humanity today. The following are the challenges of significance to GEF activities:

- We recognize that poverty eradication, changing consumption and production patterns, and protecting and managing the natural resource base for economic and social development are overarching objectives of, and essential requirements for, sustainable development.
- The deep fault line that divides human society between the rich and the poor and the ever-increasing gap between the developed and developing worlds pose a major threat to global prosperity, security and stability.
- The global environment continues to suffer. Loss of biodiversity continues, fish stocks

continue to be depleted, desertification claims more and more fertile land, the adverse effects of climate change are already evident, natural disasters are more frequent and more devastating and developing countries more vulnerable, and air, water and marine pollution continue to rob millions of a decent life.

Committing themselves to sustainable development, the world leaders declared, among other things, that:

- We welcome the Johannesburg Summit focus on the indivisibility of human dignity and are resolved through decisions on targets, timetables and partnerships to speedily increase access to basic requirements such as clean water, sanitation, adequate shelter, energy, health care, food security and the protection of biodiversity.

- We are committed to ensure that women's empowerment and emancipation, and gender equality are integrated in all activities encompassed within Agenda 21, the Millennium Development Goals and the Johannesburg Plan of Implementation.
- We recognize the reality that global society has the means and is endowed with the resources to address the challenges of poverty eradication and sustainable development confronting all humanity. Together we will take extra steps to ensure that these available resources are used to the benefit of humanity.
- We undertake to strengthen and improve governance at all levels, for the effective implementation of Agenda 21, the Millennium Development Goals and the Johannesburg Plan of Implementation.

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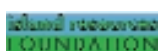
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United Nations Environment Programme

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