

Review of Data Needs



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Main Messages

Global research programmes and rapidly improving technologies for collecting environmental information and presenting it in engaging ways are informing the debate about present and future environmental challenges.

Nevertheless, deficiencies in scientifically credible data on the environment – in particular time series on such issues as freshwater quantity and quality, groundwater depletion, ecosystem services, loss of natural habitat, land degradation, and chemicals and waste – are a major handicap in developing evidence-based policies.

Official environment statistics is still an emerging field, with poor availability and quality of data in many countries. Environment statistics, mostly collected or compiled by national statistical offices, are one of the most important sources of information for assessment reports like *GEO-5*, but global and regional reports from the United Nations and other agencies regularly show gaps, or use old data or estimates.

Capacity development to support environmental information, especially in developing countries, needs to be stepped up significantly. Different countries often use different approaches to produce data on the same issue, making comparisons difficult. This highlights the need for regular monitoring and, to allow comparisons across nations

and regions, the harmonization of approaches to those that follow international standards. Also of high priority are the coordination at country level of existing – if fragmented – scientific and environmental data; the provision of easy access to a range of potential users, for example on the internet; and linking this data with official statistics that are used for policy making.

International cooperation is essential, since environmental problems do not follow national boundaries. Some of the many global and regional initiatives supporting environmental information are mentioned in this review. International cooperation and sharing of comparable data are especially important in addressing global issues such as climate change, and tackling environmental problems related to transboundary watercourses, oceans and seas, and polar regions. At present, cooperation mechanisms are much stronger in some areas than others.

Adequate information does exist to develop effective environmental policies; data gaps rarely justify inaction. However, more systematic data collection efforts can help governments to assess their progress towards international goals, improve the focus of their policies and monitor their impact, and direct scarce resources to address the most critical environmental challenges.

BACKGROUND

This review provides a snapshot of the data on which *GEO-5* is based, highlights some of the limitations in the data that are currently available, describes some global and regional programmes that are supporting environmental information, and identifies some of the highest priorities for promoting more effective environmental monitoring in countries and regions.

The review is intended to have a practical, rather than a detailed, technical focus. In line with the request of the Global Intergovernmental and Multi-Stakeholder Consultation, it focuses on data relevant to track the state and trends of the environment (Part 1), and touches more briefly on data needs relating to policy responses (Parts 2 and 3).

DEFINITIONS

Data: “facts and statistics used for reference or analysis” (COD 2003). Data is used here to mean points of information, normally collected through some kind of scientific method. An example of a point of data or “datum” is a measurement of the temperature in downtown Cairo at 8:00am.

Datasets: collections of data on a particular issue, for example historical temperature records for downtown Cairo.

Information: “facts or knowledge provided or learned as a result of research or study” (COD 2003). Information is used here as a broader term, including facts, data, anecdotes and the results of analysis that are understood, correctly or incorrectly, by the person using them; for example, the best time to visit Cairo is in the cooler months between November and March.

Statistics: is used here to describe official data collected by national statistical offices.

Environment statistics: statistics that describe the state of and trends in the environment, covering the media of the natural environment (air and climate, water, land and soil), the biota within the media and human settlements (OECD 2007).

INTRODUCTION

The factual and scientific quality of an assessment such as *GEO-5* relies to a large extent on what data are available on the state and trends of the environment. Economic and social data are important to analyse the drivers and socio-economic impacts of environmental change (Box 8.1) and consider possible responses and scenarios. Indices, obtained by combining and packaging data on a number of variables, can be used to summarize information and make it easier to communicate and understand, and a variety of other tools can be used to visualize, present and disseminate data and information.

The availability of information relies on activities such as data collection, for example measurements of pollution levels in air and water, sea surface temperature, or images from satellite remote sensing that can be used to produce land-cover maps; monitoring programmes involving regular, comparable

Box 8.1 The three principal data gaps on drivers of global environmental change

Human migration

Data are needed on where migrants come from and where they go, with respect to both international migration and internal migration, and also regarding both permanent and temporary migration. Data would ideally include timing, numbers and geographic locations.

Agricultural systems

Basic information is needed on inflows and outflows of nutrients and water, as well as other important resource flows.

Environmental footprints for economic production

At the level of country and product, information is needed on energy and water inputs and key pollution outputs in order to understand how patterns of production and consumption affect environmental systems.

measurements or time series; analysis of data to produce information that policy makers can use, such as comparisons of trends over time or progress towards established targets; and the interpretation of results to explain patterns and trends. Existing gaps and capacity-building needs relate to all these areas.

Rapid advances in information technology, remote sensing, geographic information systems (GIS), global positioning systems (GPS), database management, measuring instruments, data visualization tools, social media and the internet offer unprecedented opportunities to collect and disseminate information. The trend towards digital data has opened up new possibilities for state-of-the-environment reporting, allowing users to directly access and download data, maps and other information, in addition to the more traditional periodic, analytical reports such as *GEO*. That said, many national statistical offices have not yet been able to exploit this potential to modernize their statistical systems, an area that could benefit from international coordination and support.

Internationally comparable data are necessary to track environmental changes at the regional and global level. Most data to track the state and trends of the environment are collected at the country level, but both availability and quality remain poor in a large number of countries. Many do not produce internationally comparable data because they follow their own national guidelines or a modified version of international guidelines.

Data are produced by a wide range of public and private sources but these are often scattered and difficult to compare globally. In addition, privately produced data may be protected by intellectual property rights and available only at cost; although in the absence of property rights, data may not have been collected at all.

In 2009, the United Nations reported: “*Environment statistics frequently lack one or more of the standard attributes of high-quality statistics, namely, relevance, accuracy, timeliness, accessibility, interpretability and coherence. The fact that environment statistics are ad hoc, widely dispersed and of varying degrees of quality clearly underlines the need for a framework, that is, a basic organizing structure to guide environment statistics* (UN 2009).”

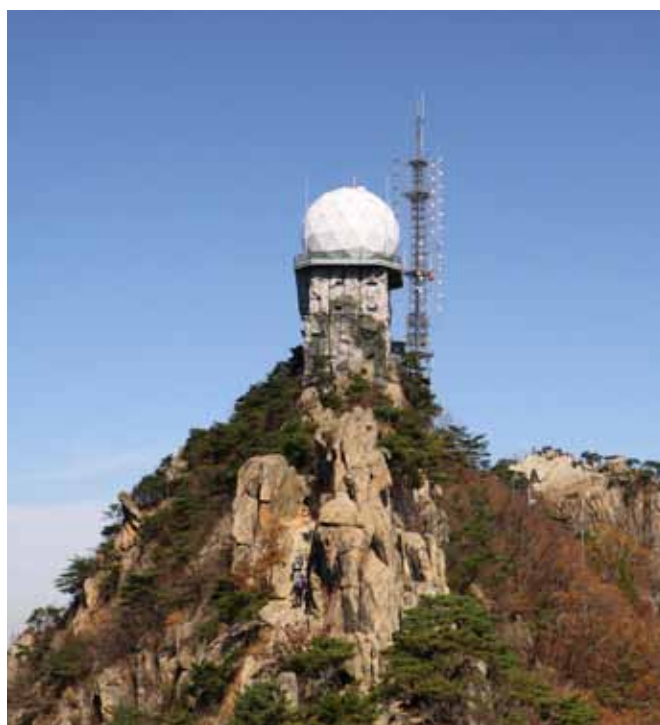
INTERNATIONAL PROGRAMMES SUPPORTING ENVIRONMENTAL INFORMATION

A number of international programmes support data collection and analysis, and coordinate, compile, disseminate and present data and information on various issues relating to the state of the environment. It is important to note that environmental data and information from UN sources often rely on statistics collected by national governments.

The United Nations has developed a core set of Indicators of Sustainable Development in response to the 2002 World Summit on Sustainable Development (WSSD) and decisions of the UN Commission on Sustainable Development (CSD). The latest revision of these indicators, published in October 2007, contains a core set of 50 indicators covering poverty, governance, health, education, demographics, natural hazards, atmosphere, land, oceans, seas and coasts, freshwater, biodiversity, economic development, global economic partnership, and consumption and production patterns (UN 2007b).

The *Framework for the Development of Environment Statistics* (UN 1984) serves as a template and guide for countries to develop and organize environmental and related socio-economic data. The United Nations Statistics Division (UNSD) has endorsed a work programme to update this framework with a view to transforming it into a hub for a broader range of producers of environment statistics, including not only traditional statistical data-collection instruments of national statistical systems but also information from scientific monitoring. The update aims to improve coordination of environmental data within countries, and improve coordination of environmental, economic and social data (UN 2009).

Data collection, dissemination, training and capacity-building programmes in environment statistics are coordinated by an Intersecretariat Working Group on Environment Statistics (IWG-ENV), convened by the UNSD. The UNSD/UNEP Questionnaire on Environment Statistics covers the themes of water, air, land and waste (UN 2011). The UNSD also collects specific data on the status of national environmental-economic accounting (UN 2007a) and has developed a System of Environmental-Economic Accounting (SEEA) under the United Nations Committee of Experts on Environmental-Economic Accounting (UNCEEA). The Committee for the Coordination of Statistical Activities (CCSA) coordinates the statistical data work of UN entities and international partners, such as the Organisation for Economic Co-operation and Development (OECD) and the Statistical Office of the European Union (Eurostat),



Mount Gwanaksan weather station, Republic of Korea. © *Matteus/iStock*

and exchange of data between UN entities is facilitated by the UN data mechanism (data.un.org).

Prominent sets of indicators and indices relate to the Millennium Development Goals (MDGs), in particular ten indicators related to MDG 7 on ensuring environmental sustainability; the United Nations Development Programme (UNDP) Human Development Index (HDI); Yale University’s Environmental Performance Index and the OECD’s Core and Key Environmental Indicators as well as the Core Set of Indicators of the European Environment Agency (EEA). A number of environment-related, global and regional conventions have monitoring and reporting programmes, and many of the convention secretariats, such as that for the Montreal Protocol, support countries with the collection, monitoring, interpretation and analysis of data in their area of responsibility (UNEP 1999).

Geospatial data, from technologies such as satellite remote sensing and networks of weather stations and ocean buoys, are another important source of environmental information. Large, international global-change research programmes and initiatives such as the Group on Earth Observations System of Systems (GEOSS) offer new opportunities to access this type of information. GEOSS was set up to provide decision-making support tools to a wide variety of users by linking existing and planned observation systems around the world, and supporting the development of new systems where gaps exist. It also promotes common technical standards that make it possible to combine data from many different observation instruments into coherent datasets. In addition, the GEOSS Data Sharing Principles have encouraged satellite operators to enable greater access to data (GEO 2010).

Table 8.1 Environmental Data Explorer: data providers

Updated information and web links to data providers can be found on the Environmental Data Explorer website (geodata.grid.unep.ch).	Organisation for Economic Co-operation and Development (OECD)
Biodiversity Indicators Partnership (BIP)	Programme for the Endorsement of Forest Certification (PEFC) International
Bureau de Recherches Géologiques et Minières (BRGM)	Ramsar Convention Bureau
Carbon Dioxide Information Analysis Center (CDIAC)	Secretariat of the Basel Convention
Center for Environmental Systems Research (CESR)	Secretariat of the Convention on Biological Diversity (CBD)
Center for International Earth Science Information Network (CIESIN)	Secretariat of the United Nations Convention to Combat Desertification (UNCCD)
Centre for Research on the Epidemiology of Disasters (CRED)	Secretariat of the United Nations Framework Convention on Climate Change (UNFCCC)
Colorado Center for Astrodynamic Research	United Nations Children's Fund (UNICEF)
Commonwealth Scientific and Industrial Research Organisation (CSIRO)	United Nations Development Programme (UNDP)
Conservation International (CI)	United Nations Educational, Scientific and Cultural Organization (UNESCO)
Environmental Systems Research Institute (ESRI)	United Nations Environment Programme (UNEP)
European Commission Joint Research Centre (JRC) – Institute for Environment and Sustainability (IES)	UNEP/GRID-Arendal
European Space Agency (ESA)	UNEP Global Environmental Monitoring System – Water Programme (GEMS Water)
Food and Agriculture Organization of the United Nations (FAO)	UNEP World Conservation Monitoring Centre (UNEP-WCMC)
Forest Stewardship Council (FSC)	United Nations Refugee Agency (UNHCR) (formerly United Nations High Commissioner for Refugees)
Global Footprint Network (GFN)	United Nations Office of Legal Affairs (OLA)
Global Land Cover Facility (GLCF)	United Nations Population Division (UNPD)
Intergovernmental Panel on Climate Change (IPCC)	United Nations Statistics Division (UNSD)
International Centre for Tropical Agriculture (CIAT)	United States Geological Survey (USGS)
International Energy Agency (IEA)	University of California at Berkeley Museum of Vertebrate Zoology
International Groundwater Resources Assessment Centre (IGRAC)	University of Maryland (UMD)
International Labour Organization (ILO)	University of Montana Department of Ecosystem and Conservation Sciences
International Organization for Standardization (ISO)	Water Footprint Network (WFN)
International Union for the Conservation of Nature (IUCN)	World Development Indicators (WDI), World Bank
IUCN and UNEP World Conservation Monitoring Centre – World Database on Protected Areas (WDPA)	World Energy Council (WEC)
National Aeronautics and Space Administration (NASA), United States	World Glacier Monitoring Service (WGMS)
NASA Goddard Space Flight Center (GSFC)	World Health Organization (WHO)
National Center for Ecological Analysis and Synthesis (NCEAS), United States	WHO – Second Administrative Level Boundaries dataset project (SALB)
National Marine Fisheries Service, United States	WHO/UNICEF – Joint Monitoring Programme (JMP) for Water Supply and Sanitation
National Geophysical Data Center (NGDC), United States	WHO/UNICEF – Roll Back Malaria
National Oceanic and Atmospheric Administration (NOAA), United States	World Bank
Netherlands Environment Assessment Agency (PBL)	
Nuclear Energy Agency (NEA)	

UNEP's Environmental Data Explorer (geodata.grid.unep.ch) compiles and presents a wide range of economic, social and environmental data covering more than 500 variables, which can be used to track the state and trends of the environment in support of GEO and other environmental assessments. Updated lists of data providers and variables can be accessed on the Data Explorer (Table 8.1).

THEMATIC GAPS

Many global programmes focus on supporting and compiling data collected at the national level. In almost all thematic areas, data availability is geographically unbalanced and data

are generally scarcer in developing countries. Data collected at sub-national levels – for example on urban air quality – tend to be even more fragmented. Variables that are linked to industrial activities and organized sectors of the economy – including some sources of carbon dioxide (CO₂) emissions – are easier to measure and monitor. Other issues, including forest cover, can be assessed on a broad scale using satellite remote sensing. However, the effects of environmental change, such as air or water pollution eroding human health, may be spread over wide areas and be difficult both to measure and to attribute to a particular cause. These limitations present a serious challenge to measuring the consequences of environmental change.

Research on both scientific and policy aspects of the state of the environment is continuously developing and countries face greater challenges in collecting data on newly emerging issues. Data collection and monitoring in the polar regions, on the high seas and in the upper atmosphere rely on international cooperation programmes.

Atmosphere

- Climate data remain limited in some regions, with marked scarcity in developing countries. Understanding temperature changes at finer resolution than continental scales – and attributing them to human or natural causes – remains difficult, and is complicated by factors such as land-use change and pollution (IPCC 2007). The impacts of climate change and extreme events depend on a range of economic, social, geographic, cultural, institutional, governance and environmental factors, such as levels of wealth and education, disability and health status, as well as gender, age and social status. In general, data on disasters and measures to reduce disaster risk are lacking at the local level (IPCC 2011).
- Data relating to emissions of greenhouse gases, ozone-depleting substances and many other pollutants have improved in recent years as they are required and supported by a number of international programmes and conventions, including the United Nations Framework Convention on Climate Change (UNFCCC) and the Montreal Protocol. The policy relevance of emissions data can be increased by disaggregating them by sector, for example transport, and by such sub-sectors as road, air and water transport and type of fuel and engine. Data availability is more limited for countries that are not Parties to the relevant conventions; gaps are often filled through the use of model estimates.
- There are many gaps in air quality data relating to pollutants that are not the focus of global conventions – nitrates, sulphates, tropospheric ozone, particulate matter and black carbon – especially in developing countries, and, even where data are available, they can be fragmented and difficult to access. Indoor air pollution is a leading cause of death, especially in low-income countries, with a disproportionate impact on women; WHO's programme to assess the global burden of disease uses estimates of the effects of indoor air pollution, because it is impractical to monitor inside people's homes (WHO 2010, 2009).



Sugar cane, one of the world's major biofuel crops. Important gaps in data on the production and use of biofuels remain. © Wendy Townrow/iStock

Land

Different methods of assessing land cover and use continue to yield very different results. In general, there are many deficiencies in the available data on these issues.

- The extent of drylands in the world is uncertain because of different classifications and methodologies used by different programmes (ICTSD 2007).
- The limited globally comparable data on land degradation – an essential information base for dryland nations to address the problem – date from the Global Assessment of Human Induced Soil Degradation (GLASOD) in 1990 (UN 2004), although new estimates using satellite data are being developed.
- There is no comprehensive and complete global database of wetlands, and different estimates of global wetlands extent are very inconsistent (Lehner and Döll 2004; Finlayson *et al.* 1999).
- Remote sensing has advanced knowledge of land cover and land use, but reliable information on changes is limited as data from different points in time are often not comparable because of changing sensor technology, insufficient ground truthing and a lack of agreement on ecosystem delineations. There are multiple definitions for forest, for example.
- Satellite-derived estimates of urban area, less than 0.5 per cent of global land cover, are four- to sixfold lower than previous estimates based on global urban population maps (Schneider *et al.* 2009).
- Two recent FAO reviews of deforestation showed very different trends for 2000–2005, with one based on national reports showing a slower rate of deforestation than in the past, while the other, based on remote sensing, suggests a faster rate (FAO and EC-JRC 2011; Hansen *et al.* 2010).
- Baseline data and monitoring of changes in carbon stocks are needed, and evidence is still emerging of the significant carbon sequestration potential of rangelands and grasslands.
- Data on biofuels – including the extent of production and use – are fragmented and incomplete at the global level, although datasets can be found at the national level in some countries.
- The International Fund for Agricultural Development (IFAD) is monitoring a set of indicators to assess country performance in ensuring that poor people have access to land and tenure security (IFAD 2008). Governments could apply these and other social, economic and environmental indicators (Bach *et al.* 2009) to evaluate the impacts of land-use changes and large-scale international land deals in Africa or elsewhere.

Water

- Comprehensive data on water quality and quantity remain a priority; mapping and the compilation of an inventory of



A Nepali girl drinking from a city fountain on Patan Durbar Square, Kathmandu, where local residents sometimes queue for hours waiting for their turn to collect clean drinking water. © Wendy Townrow/iStock

transboundary aquifer systems will be a major task for the Transboundary Water Assessment Programme (UNEP 2011a).

- In general, data on groundwater, including availability, quality, extraction, uses, management and legislation, are more limited than data on surface waters. Rectifying this should be a priority since groundwater is being extracted unsustainably in many regions. Additionally, limited data are available on groundwater contamination from substances such as nitrates and arsenic.
- Information on access to drinking water and sanitation has improved to track the MDG 7 target; sex-disaggregated data on these issues remain a high priority.
- No global datasets are available to evaluate trends in all water-related diseases, although global trend data on cholera are used as a proxy.
- UN-Water compiles information on the state and trends of integrated water management approaches (UN-Water 2008a).
- Exchange of comparable information, as well as joint monitoring and assessment, is necessary for long-term, sustainable and reliable cooperation in managing transboundary waters (UN-Water 2008b).

Box 8.2 Glacier monitoring in the Himalayas

Glaciers in the Himalayas and other high mountains in Asia are the source of the continent's major rivers, supporting vulnerable, densely populated river basins downstream. Understanding fluctuations in the mass of glaciers is essential for decision making on water resources, agriculture and disaster risk reduction in downstream areas. Changes in the mass of glaciers depend on a multitude of complex elements, including the glacier's size, the microclimate, local topography, altitude range, aspect in relation to the sun, and variations in influences of the Indian monsoons and the deserts of Central Asia and western China. There is also huge uncertainty about how snow and glacial melting in the Himalayan region will continue to respond to climate change, and how such change will affect ecosystems and human well-being.

The ability to measure the area and length of glaciers has been improved through remote sensing, although there are still limitations, including access to appropriate satellite images and confirmation of results through field

surveys (ground truthing). Glacier length and area alone, however, are not the only significant factors: thickness is also important but is much more difficult to measure. Lack of sufficient Himalayan meteorological data and monitoring stations has also been a major handicap in drawing conclusions on the impact of climate change on glaciers, snow cover and associated phenomena such as glacial lake outburst floods. Another challenge is that the Himalayas are spread across eight countries with different financial capabilities and socio-economic objectives, meaning that international coordination may be required to strengthen a long-term programme in the region.

"We have anecdotal evidence that glaciers may be receding, but we need precise and carefully vetted data, both through satellite imaging and ground surveys." Indian Prime Minister Manmohan Singh

Source: Jacob *et al.* 2012; UNEP 2009b; Haeberli 2008; Zemp *et al.* 2008

- Comparable data are needed on water resource efficiency by sector and country, water footprint, and movements of virtual water in traded products.
- A body of research and a number of initiatives are improving data on emerging issues relating to oceans and marine ecosystems, including ocean acidification, marine litter, water quality for bathing, carbon sequestered by marine organisms, the status of coral reefs and algal blooms. All regions have at least some information on fisheries status and trends but, in general, there are major gaps in global coverage of data on the marine environment as a whole, especially in areas beyond national jurisdiction, and consistent time series are rarely maintained (UNEP and IOC-UNESCO 2009).
- The availability of data on glaciers and ice coverage is improving through observation networks and remote sensing (Box 8.2), but information on permafrost is mostly still at the research stage, with monitoring taking place in only a few areas.

Biodiversity

Data on the state of biodiversity, such as protected areas and threatened species, is improving but uneven (BIP 2010). For instance, there is better data on birds and mammals than on invertebrates and plants. In general, monitoring is least extensive in tropical regions, although they contain the greatest share of global biodiversity (UNEP 2011a).

- Data on invasive species populations, when available, are probably substantial underestimates, especially for many

developing countries. Addressing this gap is a high priority for small islands, which suffer heavily from invasive alien species.

- Countries will report on the Aichi Biodiversity Targets 2011–2020 under the Convention on Biological Diversity (CBD). A recent review evaluates adequacy of existing observation systems to support reporting on these targets and identifies a number of data gaps (GEO BON 2011).
- Under the previous 2010 Biodiversity Indicators Partnership (BIP 2010), indicators for themes such as the status of access and benefit sharing, as well as traditional knowledge, could not be fully developed because of a lack of comprehensive data.
- A substantial effort has been made in the past to gather data on natural resources that are consumed directly, such as fish and timber, but data quality is not adequate to monitor changes in the composition of fish catches that result from fishing down the food web.
- There is a lack of data allowing the linking of trends in the state of biodiversity with the drivers of biodiversity loss, such as changes in habitat extent, ocean acidification, overfishing and chemicals.
- There is no comprehensive assessment of the number and extent of community-managed protected areas.
- Initiatives such as the Millennium Ecosystem Assessment (MA) and The Economics of Ecosystems and Biodiversity (TEEB) have pioneered approaches to assess and value a

broader range of ecosystem goods and services – for example regulating services including the value of ecosystems for disaster risk reduction, and cultural services – but the ability of most national statistical systems to support these approaches is still limited.

Chemicals and waste

- The effects of chemicals on human health and the environment have only been assessed against modern standards (USEPA 2005) for a small number of substances. Data on the effects at different dosages or concentrations, or the effects of combined exposure to multiple chemicals, are at an even earlier stage of research or are absent. In addition, risk assessment procedures often use average adult data, so risks to children also need to be considered.
- Many chemicals became established items of commerce before systematic assessments were made (Lowell Center for Sustainable Production 2003), and concerns have arisen over unsuspected properties such as endocrine disruption, which can damage the hormonal and reproductive system of people and animals (UNEP 2010).
- Chemicals legislation in a number of developed countries, such as the European Commission's REACH programme, has established data inventories that are greatly improving access to information on issues such as chemical toxicity and socio-economic impacts (EC 2012).
- Many new materials containing nanoparticles are produced and widely marketed, but safety testing has been limited even though some potential for human exposure has been identified (Morris *et al.* 2011; Sass *et al.* 2006).
- Data on hazardous wastes at the international level are mainly provided through reports submitted to the Secretariat of the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal, but the number of national reports is declining and the data they contain can be sparse and difficult to interpret. Data on transboundary movements of hazardous wastes is satisfactory according to a recent analysis report, in part since data from Parties that report also include information on transboundary movements involving Parties that do not. Nonetheless, more data are needed about the generation of hazardous wastes and their treatment by importing states. Concerns have also been expressed about the quality of some of the data, and data do not cover illegal movements or generation and disposal in the informal sector (Basel Convention 2010).
- Reliable data about waste generation, collection and management worldwide are lacking, especially in most developing regions. Municipal and household waste should be a particular priority together with industrial and hazardous waste. Data collection on municipal and household waste is complex and time-consuming, and there is a risk of



Rusty fuel and chemical drums in the Arctic. © Vladimir Melnik/iStock

double-counting from different sources, for example waste collection companies and disposal facilities.

- In most high-income countries, severely polluted sites have already been identified and remediated, but in many low- and middle-income countries, pollution hotspots are poorly documented, and sometimes are completely unknown to local and national governments (Blacksmith Institute 2011).
- Long-term monitoring programmes for persistent organic pollutants (POPs) in the environment and in human tissue need to be maintained and expanded, in particular in the southern hemisphere (UNEP 2009a).
- The long-term monitoring of marine pollution faces financial and institutional capacity constraints, especially in developing countries (UNEP/GPA 2006).

Policy and responses

- Quantitative targets can spur the collection of data to track whether the targets are being met, but only a few international goals – such as the MDG 7 targets for water and sanitation – include quantitative environmental targets.
- Some information is available on the implementation status of ecolabelling, certification and similar programmes; on protected areas; and on ratification and implementation of conventions. This comes from convention secretariats or compilations such as ECOLEX (www.ecolex.org).
- Limited data are available on issues such as environmental expenditures, green investments, green gross domestic product accounting, trends in and effectiveness of payment for ecosystem service (PES) schemes, environmental crimes and environmental policy effectiveness.
- Governments and other stakeholders can monitor environmental policies by looking at their implementation status, such as the extent of protected areas or of compliance with vehicle emissions regulations, or at their impact, such as trends in species extinction risk or in air quality.

Social and economic issues

- Social and economic data and indices – for example census data and conventional gross domestic product (GDP) – have a solid history that is difficult to match in the environmental domain. A number of initiatives, such as the System of Environmental-Economic Accounting (SEEA) (UN *et al.* 2003) and UNEP's Green Economy Initiative (UNEP 2011c), have supported the development of environmental and social indicators to complement GDP, and are starting to be applied in different countries worldwide.
- Basic data on population trends and distribution are improving. Socio-economic data relating more closely to the state of the environment – on issues such as poverty-



A team of divers conducting coral reef resilience surveys off the northwestern coast of Pemba Island, Tanzania. © J Tamelander/IUCN

environment and environment-security links – are still based mainly on proxy data and case studies. Tools such as the T-21 model of the Millennium Institute (UNEP 2011b) combine environmental and socio-economic data and produce policy-relevant information, for example to demonstrate how resource depletion could affect GDP.

- Sex-disaggregated data on issues relating to the environment are generally lacking, especially for developing countries, making it difficult to analyse and understand disparities in natural resource use and management structures.
- Data on resource use and efficiencies as well as material flows are improving, but solid baseline data on issues such as resource stocks are often lacking.
- The availability of data on energy production and consumption, including renewable energy, are also improving through the International Energy Agency and other organizations (IEA 2011).

REGIONAL INITIATIVES AND PRIORITIES

Many regional programmes aim at strengthening environmental information on the basis of the specific needs, development status and priority environmental issues of countries in each region. Table 8.2 lists a selection of these programmes and regional priority needs.

Table 8.2: Selected regional initiatives and priorities for environmental information

<p>Africa</p>	<ul style="list-style-type: none"> • United Nations Statistics Division (UNSD), the African Centre for Statistics and UNEP are supporting countries in developing a core list of indicators for Africa, based on the Commission on Sustainable Development (CSD) indicators, the Millennium Development Goals (MDGs) and the New Partnership for Africa's Development (NEPAD) • Sub-regional organizations like the Economic Community for West African States (ECOWAS) are increasing their involvement, based on programmes in related areas like food security and economic development • In general, Africa is a high-priority region for capacity development in environment statistics
<p>Asia and the Pacific</p>	<ul style="list-style-type: none"> • Overall, Asian countries have a relatively high response rate to the UNSD/UNEP Questionnaire on Environment Statistics, whereas the response rate from Pacific countries is low (UN 2011); development in the region varies widely between countries • Regional organizations provide support on certain issues, such as compilation of statistics from various sources by the Economic and Social Commission for Asia and the Pacific (ESCAP) and the Asian Development Bank • A number of programmes exist on specific themes and/or covering different sub-regions, for instance: <ul style="list-style-type: none"> - Commonwealth Scientific and Industrial Research Organisation (CSIRO)/UNEP Asia-Pacific Material Flows - Association of Southeast Asian Nations (ASEAN) Centre for Biodiversity - UNEP/ South Asian Association for Regional Cooperation (SAARC) South Asia Environment Outlook - Acid Deposition Monitoring Network in East Asia (EANET) - Clean Air Initiative – Asia (data on issues such as air quality, energy and transport in Asian cities) - Mekong River Commission (for example water level data)
<p>Europe</p>	<ul style="list-style-type: none"> • The European Commission, Eurostat and the European Environment Agency (EEA) are the main sources of environmental data in Western and Central Europe, and they are extending their related capacity-building efforts into Central Asia • Eurostat collects, produces, analyses and disseminates statistics on the state of and pressures on the environment – as well as a range of related economic and social data – based largely on data provided by national statistical offices of its member states (Eurostat 2010) • EEA and its member and cooperating countries operate the European Environment Information and Observation Network (EIONET) for multi-country data collection, organization and dissemination • Eurostat and OECD circulate a Joint Questionnaire on the State of the Environment covering member states of both organizations • Environmental data and information are more sparse in European countries that are not members of either organization, including a number of countries in Eastern and South Eastern Europe; one priority in many of these countries is to restore monitoring networks and related data time series that were discontinued in the 1990s (UNECE 2003) • The Helsinki Commission for the Baltic Sea, the OSPAR Commission for the North-East Atlantic, the Barcelona Convention for the Mediterranean Sea and the Black Sea Commission operate data programmes covering their respective marine areas • The pan-European scientific monitoring network of the UNECE Convention on Long Range Transboundary Air Pollution (CLRTAP) has been pivotal in providing the evidence identifying the most important European air quality issues
<p>Latin America and the Caribbean</p>	<ul style="list-style-type: none"> • A number of regional initiatives are promoting and coordinating environment statistics in the region, including: <ul style="list-style-type: none"> - the Latin American and Caribbean Initiative for Sustainable Development (ILAC, 32 agencies from 24 countries as of end 2011) - the Working Group on Environmental Statistics of the Statistical Conference of the Americas (15 institutions from 10 countries) - sub-regional initiatives such as the Andean Community Indicators and the Caribbean Community (CARICOM) Indicators • According to a recent survey of national statistical offices and environment ministries in the region, 81% of the participating institutions had an environment statistics programme, although only 36% had a specific budget dedicated to it; other significant institutional challenges remain in many countries (ECLAC 2011)
<p>North America</p>	<ul style="list-style-type: none"> • Data and information to track the state of the environment is collected and analysed by a variety of government agencies as well as academic and other institutions, including Environment Canada, the US Environmental Protection Agency (EPA) and the National Oceanic and Atmospheric Administration (NOAA) • US government and academic institutions also collect and provide access to global environmental data on a number of issues including sea level, surface temperature, land cover and coral bleaching (Table 8.1)
<p>West Asia</p>	<ul style="list-style-type: none"> • The Abu Dhabi Global Environmental Data Initiative (AGEDI), in partnership with UNEP, promotes enhanced collection, dissemination and use of environmental data and information. These and other organizations are co-sponsoring the Global Network of Networks initiative, aimed at effective access to the world's expanding pool of environmental data • A core set of environmental indicators for West Asia, developed by the League of Arab States (LAS) in partnership with the Economic and Social Commission for West Asia (ESCWA) and UNEP, has been established by countries of the region on a voluntary basis • An Arab Environmental Information Network is being developed under the umbrella of LAS, with support from UNEP and in collaboration with ESCWA, AGEDI and other organizations • In many countries of the region, official statistics on the environment are rarely generated, difficult to access and scattered among different institutions, and reporting is fragmented (UNEP 2006); major thematic gaps and priorities include data on land salinization, coastal and marine pollution, disasters, waste management and transport (UNEP 2006)

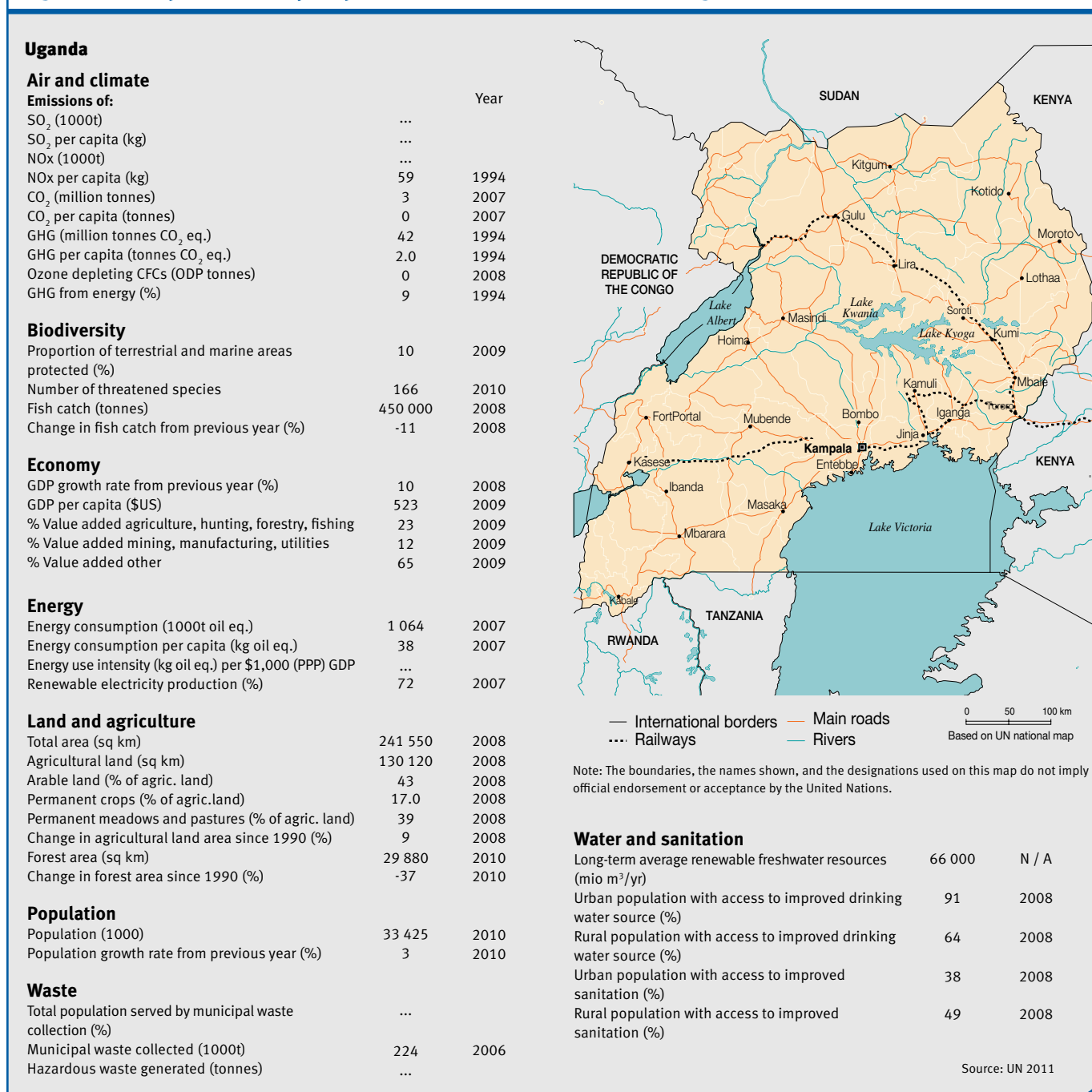
Source: (UN 2011)

NATIONAL CAPACITY NEEDS

Data collected at the national level are some of the most important sources of information to track the state and trends of the global environment. Environment statistics is an emerging field in most countries, and many have only scattered data (UN 2011). Most developing countries currently have no comprehensive environmental observation system. Data may exist but are often discontinuous, making it difficult to establish a baseline to measure change over time or progress against targets. The recent UNDP/UNEP/GEF synthesis of National Capacity Self-Assessments

noted that more than 90 per cent of the 119 participating countries identified “information management and knowledge” as a capacity need. While selecting a list of environmental indicators and collecting information was more straightforward in many countries, the main challenge involved managing this information and coordination of the organizations involved, including research institutions and programmes. National environmental management information systems need to be strengthened, as well as the skill sets of associated staff. Measures to address this include application of standards, use of communication

Figure 8.1 Example of a country snapshot on environment statistics, from Uganda





Flooded houses in the aftermath of tropical storm “Hanna”, Haiti. Better information on disaster risk is a growing priority in most regions.

© Marco Dormino/UN Photo

technologies and networks, as well as capacity development, public awareness activities and environmental education. In addition, while many stakeholders recognized the value of traditional knowledge for environmental management, few countries felt it was captured well, if at all, and used to develop environmental policies and programmes (UNDP *et al.* 2010).

Recent assessments of the status of national environmental information include the National Capacity Self-Assessments, the UNSD/UNEP Questionnaire on Environment Statistics, and various regional and bilateral needs assessments. UNSD country snapshots (Figure 8.1) summarize the environment statistics that are available, and indicate those that are not, from each country. The specific needs to strengthen environmental information vary in each country, but normally relate to the following issues.

- Collection of high-quality data that adequately cover a full range of established core indicators that can be used to monitor the state and trends of the environment, such as the UN Sustainable Development Indicators (UN 2007b), and that are coherent and comparable. Figure 8.2 provides general information on the existing and planned thematic coverage of national environment statistics programmes.
- Establishment of long-term monitoring programmes in priority areas – based on consistent support in terms of funding and personnel, amongst others – collecting data that are reliable and are available in comparable time series (UNECE 2003).
- Developing the necessary in-country expertise and capacity for data collection, quality assessment, analysis and interpretation on different themes.

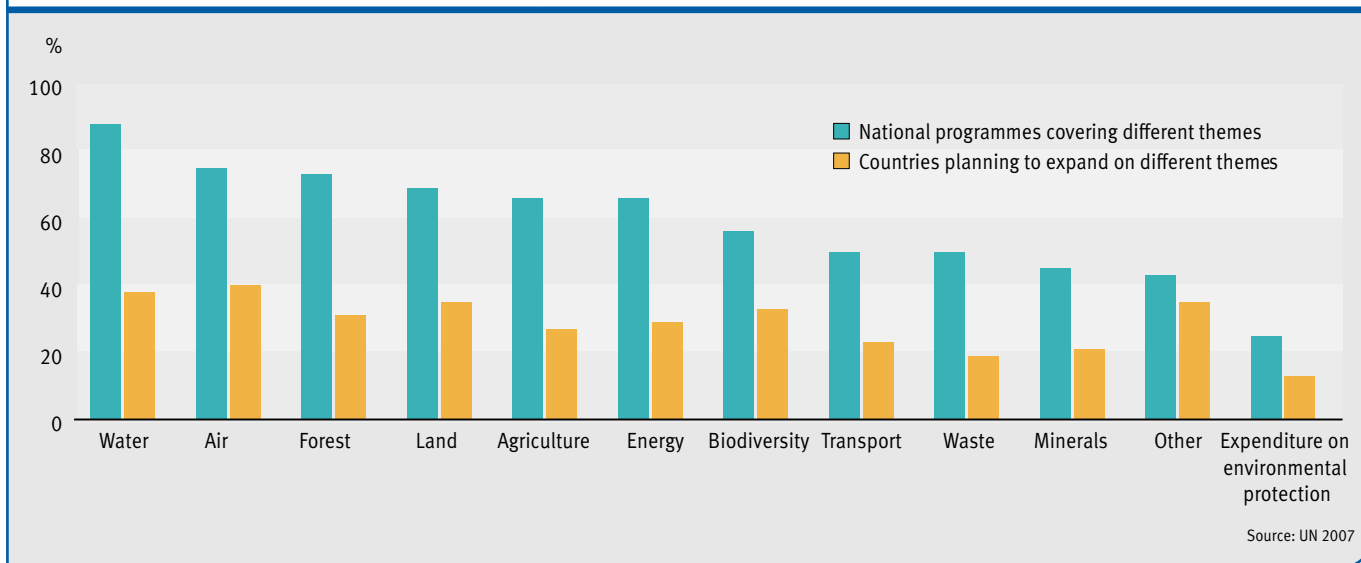
- Strengthening institutional arrangements and expertise for coordination of environmental and scientific information that exist in-country but may be fragmented, based on clear roles and responsibilities of different agencies, and the incorporation of economic, social and environmental data into national statistical systems.
- Promoting the easy accessibility of data and information (UNCED 1992) for a range of users and the general public, addressing language barriers as well as cost, security and intellectual property concerns, providing on-line access and harnessing other new technologies to disseminate and present environmental information.
- Supporting institutional and other arrangements that increase the use of national data, indicators and information, for instance for environmental assessments; policy making; convention reporting; and educational, scientific and awareness-raising purposes.

“The challenges posed by environment statistics are generally greater than for most other types of statistics... Most significant perhaps is the fact that a national statistical office must rely heavily on other agencies to collect and supply the bulk of the primary data. Such a high degree of interdependence between different government bodies demands close cooperation and collaboration.”

ADB 2002

Scale is very important with respect to environmental data. Some environmental problems are global, such as climate change; others are best addressed and monitored at a regional level, or

Figure 8.2 National environment statistics programmes and thematic coverage, 2007



at the level of maritime area (for example fish stocks) or watershed (for example water availability and quality). Many types of air pollution are best monitored at the municipal level. Other issues affect ecosystems, for instance Amazon deforestation affects parts of several countries in South America. The boundaries of an ecological zone, and the scale on which environmental problems occur, will rarely if ever coincide with national or provincial borders or other official geographic delineations (ADB 2002). Nevertheless, government programmes – national statistics in particular – are important

for ensuring consistent, long-term support to data collection and dissemination, and the use of scientifically credible information for policy making. In strengthening these programmes, it is useful to consider how environment statistics can be collected at scales relevant to the problems concerned.

Many of the constraints on environmental data at the national level are strongly linked with the availability of financial and human resources. The cost of national environmental information systems may vary greatly in different countries, and it is important to ensure that methods for data collection, analysis and dissemination are clear and cost effective (ADB 2002). In order to strengthen the collection of environmental data in countries and, where possible, to improve consistency with international standards it is also important that environmental information supports national policy goals and that policy makers understand its value to their constituency, with international financial support, capacity building and technical assistance available when needed.

CONCLUSIONS

Sound environmental assessments must be underpinned by high-quality scientific environmental, social and economic data. Environmental data are also important to monitor the impacts of environmental policies and programmes. As described in this review, a large number of initiatives are collecting, supporting and improving access to environmental information at the global, regional and national levels. Ongoing and future priorities include promoting, where possible, the use of common standards for data collection and analysis, increased data sharing, consistent time series of environmental observations, capacity building to strengthen environment statistics in a wider range of countries, and harnessing new technologies to communicate environmental information effectively to policy makers and the public.



Wildebeest crossing the Mara River during the great migration between Kenya and Tanzania. © SimplyCreativePhotography/iStock

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