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Chapter 3

International Environmental Indicator Initiatives

In 1987, the World Commission on Environment and Development (WCED or the Brundtland Commission) noted the “limited capability for ... combining basic and comparable data needed for authoritative overviews of key environmental issues and trends” and that without these overviews “the information needed to help set priorities and develop effective policies will remain limited” (WCED 1987, 321). Reporting efforts on the state of the global environment or on regions shared by more than one nation face numerous challenges. These include the lack of consistency among monitoring programmes, reporting methods, and data, among others. There are also gaps in country capabilities for studying, analyzing, and reporting on environmental issues (NIRO 2003b).

The United Nations Environment Programme (UNEP) was one of the first agencies to try to overcome these obstacles to reporting on the state of the global environment. It produced an annual state-of-the-environment report from 1973 through 1992 and the biennial *Environmental Data Report* from 1987–1988 through 1993–1994 (Paris 2000). UNEP’s work in environmental reporting continues with the GEO series described below, and today it is joined by numerous other efforts to provide both data and analyses on the state of the environment, at an international level. Increasingly, these initiatives include the development and use of environmental indicators.

The Millennium Development Goals (MDGs), which commit the international community to work towards a world free of poverty, hunger, disease, and gender inequity, also include a set of environmental indicators: The eight indicators inform the seventh goal, “Ensure environmental sustainability”. They are populated by data from harmonized sources, so are consistent and allow for comparison, but they are very limited in scope and address primarily the environments of developing countries (UN 2004).

This section looks at the Commission for Sustainable Development (CSD) and UNEP’s environmental indicator initiatives, both prompted by the 1992 Earth Summit’s call for better indicators for regular and reliable global overviews, and at the OECD’s environmental indicators for its member countries.

UN Commission for Sustainable Development

Agenda XXI, adopted at the 1992 Earth Summit in Rio de Janeiro, recommends the harmonized development of national, regional, and global-level sustainable development (SD) indicators, and regular reporting and data provision with a suitable common set of regularly updated indicators (Box 20).

“The United Nations Conference on Environment and Development (The Earth Summit) held in 1992 recognized the important role that indicators can play in helping countries to make informed decisions concerning sustainable development. Agenda 21 calls for the harmonization of efforts, including the incorporation of a suitable set of these indicators in common, and regularly updated and widely accessible reports and databases”.

Source: Shah 2004, 1.

Box 20: The 1992 Earth Summit called for harmonizing indicator efforts

The United Nations Commission on Sustainable Development (CSD) was created in December 1992 to monitor and report on the implementation of the Earth Summit agreements. The CSD recognized an urgent need for global action to combine national and international information efforts and to promote comparability, accessibility, and quality of that information (Luxem and Bryld 1997; UN DESA 2003b). It began a work programme, with the goal of providing national decision-makers with a list of indicators to use in national policies and in reports to the CSD and other international agencies.

Countries are encouraged to adopt and use this set as a starting point for their national indicator programs

Conceptual and organizational framework

The CSD approved its five-year Work Programme on Indicators of Sustainable Development in 1995. It included strategies for defining SD indicators, making them accessible to decision-makers at the national level, elucidating their methodologies, and providing training and other capacity-building initiatives (Mortensen 1997). Coordinated by the UN Department for Economic and Social Affairs (DESA), Division for Sustainable Development, the Programme organized the chapters of Agenda XXI under four major themes—social, economic, environmental, and institutional (Shah 2004). A preliminary working list of 134 indicators published in 1996 used the driving force–state–response (DSR) framework and was subjected to voluntary national testing and expert-group consultation. The framework evolved into one focusing on themes and sub-themes of sustainable development rather than exclusively on the Agenda XXI chapters. Reasons for the change include the fact that the DSR framework is less suited to social and economic indicators than to environmental ones and that the theme framework better assists national policy decision-making and performance measurement (Luxem and Bryld 1997; Shah 2004; UN DESA 2004a).

Selection process

The Programme selected indicators in accordance with a number of criteria that are similar to those used by other organizations, differing only in their particular focus on the relevance to Agenda

XXI and all aspects of sustainable development. Using these criteria, the CSD and its Secretariat worked in close cooperation with a large number of international governmental and non-governmental organizations and national governments to select the indicators. It was guided by three principles: the development and use of indicators at a national level; building on existing national and international indicator work undertaken by other organizations and countries; and the cooperation and collaboration of a wide range of experts. Methodology sheets were developed for each indicator through a broad international consultation process (Gallopín 1997; Luxem and Bryld 1997).

Products and contents

The final product, published in 2001—*Indicators of Sustainable Development: Guidelines and Methodologies*—is a detailed description of 15 sustainable development themes and 38 sub-themes, a final proposed framework, and a core set of 58 indicators with their methodology sheets. Nineteen of the 58 are environmental indicators. The methodology sheets describe policy relevance, underlying methodology, data availability, and sources for each indicator (UN DESA 2001a). Governments began preparing national reports in 1993 and in 1997 the results of submissions between 1994 and 1996 were published in a series of country profiles, on the occasion of the five-year review of the Earth Summit (Rio + 5). A second series of country profiles was released for the 2002 World Summit on Sustainable Development in Johannesburg. This 2002 country profile series provides a comprehensive overview of the status of national-level Agenda XXI implementation (Luxem and Bryld 1997; Shah 2004; UN DESA 2003b; UN DESA 2004a). This series report is available at: <http://www.un.org/esa/sustdev/natlinfo/indicators/indisd/indisd-mg2001.pdf>.

Toronto, Canada.

UNEP/MorgueFile.com



Box 21: CSD environmental indicators

Climate change	<ul style="list-style-type: none">• Emissions of greenhouse gases
Ozone layer depletion	<ul style="list-style-type: none">• Consumption of ozone-depleting substances
Air quality	<ul style="list-style-type: none">• Ambient concentrations of air pollutants in urban areas
Agricultural land	<ul style="list-style-type: none">• Arable and permanent crop land area• Use of fertilizers• Use of agricultural pesticides
Desertification	<ul style="list-style-type: none">• Land affected by desertification
Forests	<ul style="list-style-type: none">• Forest area as a per cent of land area• Wood harvesting intensity
Urban areas	<ul style="list-style-type: none">• Area of formal and informal settlements
Oceans and marine	<ul style="list-style-type: none">• Algae concentration in coastal waters• Per cent population living in coastal areas
Fisheries	<ul style="list-style-type: none">• Annual catch by major species
Freshwater	<ul style="list-style-type: none">• Annual withdrawal of ground- and surface water as a per cent of total available water• BOD in water bodies• Concentration of faecal coliform in freshwater• Per cent population w/ adequate sewage disposal facilities• Per cent population w/ access to safe drinking water
Biodiversity	<ul style="list-style-type: none">• Area of selected key ecosystems• Protected area as a percentage of total area• Abundance of selected key species
Energy and consumption	<ul style="list-style-type: none">• Per capita annual energy consumption• Material use intensity

Source: Adapted from UN DESA 2004a.

Ongoing work

The indicators are not final or definitive, but can be adjusted to fit national conditions, priorities, and capabilities. Countries are encouraged to adopt and use this set as a starting point for their national indicator programmes. Wide adoption and use of the core set is meant to help improve information consistency at the international level. Box 21 shows the CSD's list of issues and associated environmental indicators.

United Nations Environment Programme: GEO Indicators

Like the CSD's indicator initiative, the United Nations Environment Programme's *Global Environment Outlook* (GEO) project was initiated in response to Agenda XXI's environmental reporting requirements. It also responds to a UNEP Governing Council decision in 1995 that requested

the production of a comprehensive global state of the environment report. One of GEO's goals is to promote consensus on identifying the global and regional issues the international community needs to address and on prioritizing environmental problems and action.

UNEP has been reporting on the state of the global environment through the *Global Environment Outlook* (GEO) series of reports since 1997. There are two key elements of GEO: a cooperative, integrated environmental assessment process, and a report series. The former involves a participatory process between UNEP and a global network of collaborating and associated centres. The reports are issued at regular intervals in print and electronic formats. The three global reports published to date—GEO-1 (1997), GEO-2000, and GEO-3 (2002)—have described the state of the world's environment through thematic, qualitative appraisals of key environmental issues and trends, analysis of

Box 22: GEO Year Book indicators (2003)

Climate change	<ul style="list-style-type: none">• CO₂ emissions• global average glacier mass balance
Ozone layer depletion	<ul style="list-style-type: none">• CFC consumption
Forests	<ul style="list-style-type: none">• global forest cover
Oceans and marine	<ul style="list-style-type: none">• living marine resources catch
Freshwater	<ul style="list-style-type: none">• total and per capita water use• population with access to improved sanitation• population with access to improved water supply
Biodiversity	<ul style="list-style-type: none">• threatened species• protected areas
Energy and consumption	<ul style="list-style-type: none">• energy use
Natural disasters	<ul style="list-style-type: none">• number people killed and number affected by natural disasters

Source: Adapted from UNEP 2004a.

relevant socioeconomic driving forces, and assessment of policy responses in all the world's regions. They also identify emerging issues and look at potential future scenarios. The next comprehensive GEO report (GEO-4) is due in 2007.

Until recently, the GEO reports did not include a standard set of indicators, although they made use of indicators as a reporting tool. In 2003, a new series was launched with the release of a year book, which includes a set of indicators that will be used in the annual publication. This will allow for the tracking of trends in these issues over time. The full comprehensive GEO reports will no longer be published biennially but rather at five-year intervals.

Separate national and regional or sub-regional assessments are also published, as are technical and other background reports. In 2002, UNEP released *North America's Environment: A Thirty-Year State of the Environment and Policy Retrospective*, a data-rich integrated environmental assessment of North America emphasizing the linkages between policy and the environment. Most of the data that underpin the GEO reports are available on the Internet through the GEO Data Portal. Some 400 different variables, as national, sub-regional, regional and global statistics or as geospatial data sets (maps), can be accessed and downloaded (UNEP 2002a; 2002b).

Conceptual and organizational framework

GEO analyzes environmental issues using the DPSIR framework and focuses on integrated reporting—that is, revealing the links among

socioeconomic, environmental, and policy issues, as well as producing and communicating policy-relevant information on those key interactions. The reports also identify emerging issues and attempt to envision future policy options and priorities, based on current and past experience and using a scenario approach to examine a range of future outcomes related to possible policy decisions taken today (Pinter, Zahedi, and Cressman 2000). In the *GEO Year Book*, UNEP continues to rely on the PSR model, with the conviction that despite the model's drawbacks, key trends in pressure, state, and response dynamics for major environmental issues can still be captured successfully. It notes that, not surprisingly, several of the indicators in the report coincide with those selected for monitoring inter-

The GEO Indicators are a set of selected quantitative parameters which reflect headline trends for the major global and regional environmental issues addressed under the GEO reporting process (UNEP 2004, 66).

nationally agreed-upon environmental goals and targets, including those in the Millennium Declaration (Millennium Development Goals—MDGs) and the World Summit on Sustainable Development (WSSD) Plan of Implementation (UN DESA 2004b; UNEP 2004a).



This cypress bay is a haven for many different species of wildlife.

Dot Paul/UNEP/NRCS

Selection process

GEO is produced through a participatory process in each region of the world, involving stakeholders and experts in disciplines related to environment and development issues, especially policy-makers, regional organizations, and NGOs (Pinter, Zahedi, and Cressman 2000). In keeping with the participatory orientation of the GEO process, the selection of themes and indicators for the GEO year books are based upon a collaborative/comprehensive tracking and stocktaking process established with many partners.

Products and contents

The first *GEO Year Book* was released in March 2003 and the second (2004/5) at the beginning of 2005. This new annual series highlights significant environmental events and achievements during the year, with the aim of raising awareness of emerging issues from scientific research and other sources. It includes a selected set of trend indicators (Box 22 shows the indicators used in the 2003 edition), providing a consistent and harmonized oversight of major environmental changes on an annual basis, which makes it easy to track major environ-

mental issues over the years. The GEO indicators are grouped by environmental thematic areas and issues. For each issue, only one or two indicators, or a few at most, are presented. These are considered to be the most suitable and reliable indicators currently available to illustrate the particular issue. The year books include an overview section that looks at the major issues, a section devoted to a special theme, and one that looks at the future; the 2003 edition, for example, contains a short section on key issues for “Small Island Developing States” and includes a feature section focusing on freshwater and one on emerging challenges and new findings. The feature focus of the 2004/5 edition is “Gender, Poverty, and Environment”. Definitions of terms used, data sources, and technical notes are provided in an Annex. The indicators are presented at the global, regional and, in a few cases, sub-regional level, based on the regional classification used in the GEO-3 report. All data and documentation were extracted from the GEO Data Portal (UNEP 2002b; UNEP 2004a). The year book can be accessed at: <http://www.unep.org/geo/yearbook/103.htm>.

Ongoing work

Future annual statements will be released at the beginning of every year in between the comprehensive GEO reports.

Organisation for Economic Co-operation and Development

The OECD's indicator initiative began in 1991 in response to an OECD Council Recommendation on Environmental Indicators and Information requesting it to "further develop core sets of reliable, readable, measurable and policy-relevant environmental indicators". This advice was reiterated in 1998 with another Recommendation to "further develop and use indicators to measure environmental performance" and again with the OECD's environmental strategy for the first decade of the 21st century, which laid out the goal of measuring progress through indicators and further developing and using indicators and targets to measure environmental progress at the national level (NIRO 2003b). Environmental indicators work at the OECD is conducted as part of its three-year programme, which began in April 1998, to help member countries measure progress towards sustainable development.

The OECD has developed a number of sets of indicators, using harmonized concepts and definitions that respond to different needs: A core set of environmental indicators measures progress on the environmental front and includes some 50 indicators that reflect the main concerns in OECD countries. Another set of indicators focuses on sectoral trends of environmental significance, their interaction with the environment, and related

economic and policy considerations. It is designed to help integrate environmental concerns into sectoral policies, with each set focusing on a specific sector (transport, energy, household consumption, tourism, agriculture). A third set is derived from the OECD work on natural resource and environmental expenditure accounts and focuses on the efficiency and productivity of material resource use. In addition, a small set of key indicators—10 to 13 of them—selected from the core set, is published to help raise public awareness, compare environmental performance across OECD nations, and focus attention on key issues of common concern (Lealess 2002; OECD 2003; OECD 2004b).

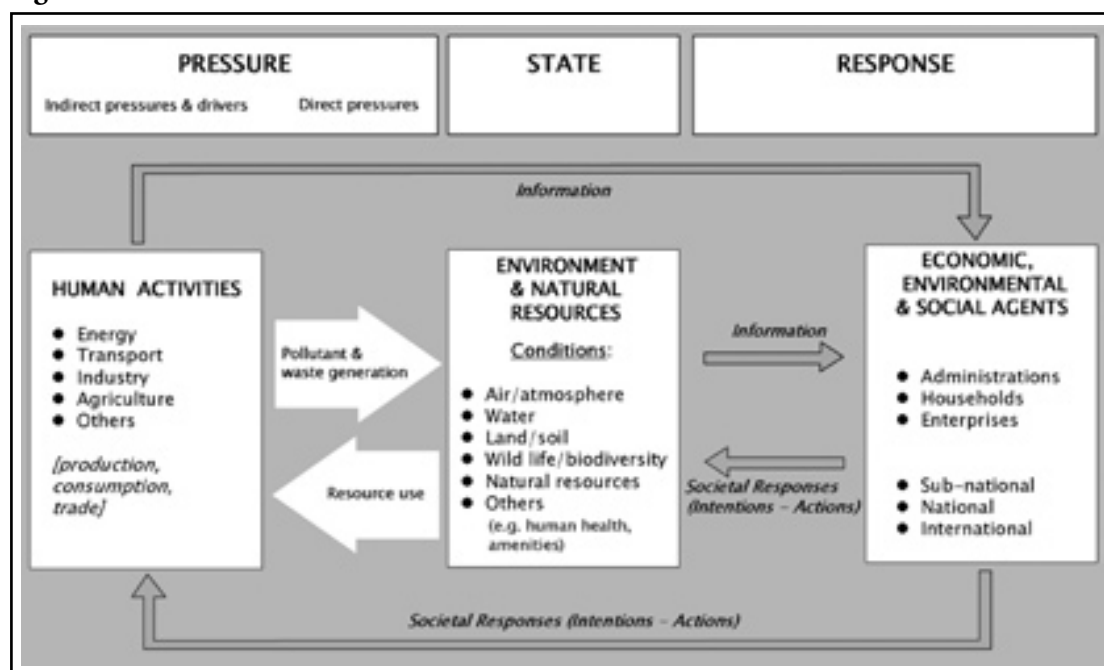
Data largely come from the *OECD Environmental Data—Compendium*, which has been published every two years since 1985. These data are the result of a biennial data collection and treatment process that includes a detailed questionnaire sent to member countries. Data are harmonized through the work of the OECD Working Group on Environmental Information and Outlooks (OECD 2004b).

OECD environmental indicators are regularly published and used in the OECD's work in reviewing countries' environmental performance and in monitoring the implementation of the OECD Environmental Strategy.

Conceptual and organizational framework

One of the OECD's major contributions to the field of environmental indicators is its efforts to harmonize individual member initiatives by developing a common approach and conceptual frame-

Figure 29: OECD's PSR framework



Source: OECD 2003, 21 <http://www.oecd.org/dataoecd/7/47/24993546.pdf>

work. It focuses mainly on indicators to be used in national, international, and global decision making, but is also applicable to the sub-national or ecosystem level. OECD helped to pioneer the use of the PSR model (Figure 29) during the 1980s and early 1990s and its work on this conceptual framework influenced similar activities by a number of countries and international organizations (Linster 1997).

OECD's various sets of indicators were developed with recognition that there is no unique set of indicators, that indicators are only one tool among others, and that they need to be interpreted in context. Another OECD contribution is its work on monitoring progress towards sustainable development by elaborating indicators that measure the decoupling of environmental pressure from economic growth (OECD 2003; OECD 2004b).

Selection process

The development of harmonized international environmental indicators is done in close cooperation with OECD member countries, building on agreement among them to use the PSR model as a common reference framework and to identify indicators using three basic criteria: policy relevance

and utility for users, analytical soundness, and measurability. Member countries agree to use the OECD approach at the national level by adapting indicator sets to suit national circumstances and to interpret them in context to acquire their full meaning (OECD 2003).

Products and contents

In 2001, the OECD identified a shortlist of environmental indicators, *Key Environmental Indicators*, selected from the OECD core set of environmental indicators and closely related to its other environmental indicators sets. The key indicators are updated every year and the list is available for free. The set consists of ten theme areas, each of which has one main indicator for which data are available for a majority of OECD countries, and has possibly also one or more supplementary "medium term" indicators, representing those that require further development related to basic data availability, underlying concepts, and definitions (Box 23). The indicators are interpreted in the text, with a description of main policy challenges, a comparison of each nation's performance, and historical trends for the OECD as a whole. Related indicators from the core set are listed for reference, pointing users

Box 23: OECD set of key environmental indicators*

Climate change	<ul style="list-style-type: none"> • CO₂ emission intensities • Index of GHG emissions
Ozone layer	<ul style="list-style-type: none"> • Indices of apparent consumption of ODS • One index of apparent consumption of ODS
Air quality	<ul style="list-style-type: none"> • SO_x and NO_x emission intensities
Waste	<ul style="list-style-type: none"> • Municipal waste generation intensities • Total waste generation intensities • Material flows
Freshwater (quality)	<ul style="list-style-type: none"> • Waste water treatment connection rates • Pollution loads to water bodies
Freshwater (resources)	<ul style="list-style-type: none"> • Intensity of use of water resources
Forests	<ul style="list-style-type: none"> • Intensity of use of forest resources
Fish	<ul style="list-style-type: none"> • Intensity of use of fish resources
Energy	<ul style="list-style-type: none"> • Intensity of energy use • Energy efficiency index
Biodiversity	<ul style="list-style-type: none"> • Threatened species • Species and habitat or ecosystem diversity • Area of key ecosystems

**Main indicators in bold.*

Source: Adapted from OECD 2004b.

Box 24: OECD environmental indicators

Drivers	<ul style="list-style-type: none">• GDP• population growth and density
Climate change	<ul style="list-style-type: none">• CO₂ emission intensities• GHG concentrations
Ozone layer depletion	<ul style="list-style-type: none">• ozone-depleting substances• stratospheric ozone
Air quality	<ul style="list-style-type: none">• air emission intensities• urban air quality
Waste	<ul style="list-style-type: none">• waste generation• waste recycling
Agricultural land	<ul style="list-style-type: none">• intensity of use of nitrogen and phosphate fertilizers• nitrogen balances• livestock densities• intensity of use of pesticides
Forests	<ul style="list-style-type: none">• intensity of use of forest resources• forest and wooded land
Fisheries	<ul style="list-style-type: none">• fish catches and consumption
Freshwater	<ul style="list-style-type: none">• river quality• waste water treatment• intensity of use of water resources• public water supply and price
Biodiversity	<ul style="list-style-type: none">• threatened species• protected areas
Energy and consumption	<ul style="list-style-type: none">• energy intensities• energy mix• energy prices• private consumption• government consumption
Transportation	<ul style="list-style-type: none">• road traffic and vehicle intensities• road infrastructure densities• road fuel prices and taxes
National responses (expenditures)	<ul style="list-style-type: none">• pollution abatement and control expenditures• trends in official development assistance as % GNP

Source: Adapted from OECD 2001.

to more ample and detailed information if desired (Lealess 2002). *Key Environmental Indicators* is available online at: <http://www.oecd.org/dataoecd/32/20/31558547.pdf>.

A special document combines indicators from the four sets described above to produce a set of environmental indicators. The first *Environmental Indicators: Towards Sustainable Development* was published in 1994, followed by two other editions, in 1998 and 2001 (OECD 2001). The 2001 edition of the OECD Environmental Indicators report is an update of the 1998 edition. It includes

indicators selected from the OECD core set, some socioeconomic and sectoral indicators with environmental significance, and others that were endorsed by OECD environment ministers at their meeting in May 2001. There are nine environmental themes in one section, and in another section are six socio-economic themes related to environmental issues, most of which act as pressures. Each thematic sub-section includes a statement about the issue it covers and its importance; an overview of related OECD work; how it fits in the PSR framework; references; and a summary of major trends. It

also presents the key indicators. Box 24 gives a list of the indicators in this publication.

Ongoing work

The OECD continues to review and improve its programmes and indicators. Its indicator sets are regularly refined to evolve as scientific knowledge, policy concerns, and data availability change and improve. The quality of data, data consistency, and data gaps are of particular concern. The set of key indicators is expected to eventually include issues such as toxic contamination, land and soil resources, and urban environmental quality, for example (OECD 2003). The organization is employing strategies to identify areas in which collaboration is possible to improve overall quality and comparability and to create a methodology guide for data monitoring, collection, and documentation. It is also considering how member countries can exchange information and learn about metadata standards from each other and how to promote the exchange of information with non-members and other international organizations (OECD 2003; EC 2004b).

Other initiatives

World Resources Institute

World Resources Institute (WRI), an independent nonprofit organization, is a world leader in generating harmonized environmental data at the global level. Every two years since 1986, it publishes a lengthy and authoritative assessment of the health of global ecosystems. In recent years, WRI's biennial report has been produced in collaboration with the United Nations Development Programme (UNDP), the United Nations Environment Programme (UNEP) and The World Bank (Keating 2001). This is a global reporting series, which provides timely statistics and analysis of environmental issues. The front section of each edition highlights a major theme, which is analyzed with data-rich prose. The second section, "Global Conditions and Trends", is consistently presented in each edition. This section is devoted to a broad compilation of standardized national-level environmental and social reference data covering the issues of biodiversity and protected areas; forests and grasslands; coastal, marine, and inland waters; agriculture and food; freshwater; atmosphere and climate; energy and resource use; and safe water and sanitation. The report's foreword is a forum for the collaborating agencies to promote policy recommendations. In collaboration with UNEP, UNDP, and The World Bank, the World Resources Institute was one of the earliest organizations to publish sets of national data for a global perspective

on environmental media (Parris 2000; IISD 1997; IISD 2004a). The report does not include a set of graphic indicators.

In 2000, WRI expanded its data provision service to include an online, searchable database called EarthTrends, which includes country profiles, data tables with complete time series data, detailed metadata reporting on research methodologies, and an evaluation of the information's reliability. It also includes feature articles analyzing current environmental trends. The site gathers data from the world's leading statistical agencies and is supported by The World Bank, UNEP, the Netherlands Ministry of Foreign Affairs, the Swedish International Development Agency (SIDA), UNDP, and the Rasmussen Foundation (WRI 2004). Like UNEP's Data Portal, EarthTrends is a valuable source of data for multilateral environmental reporting.

Of WRI's large number and variety of projects geared towards promoting sustainability, a few are involved in developing environmental indicators; they include the Material Flow Analysis project, the Pilot Analysis of Global Ecosystems (PAGE), and a project oriented towards assessing environmental and human water scarcity, freshwater biodiversity, and wetlands goods and services (WRI 2004).

Worldwatch Institute

Another major player among initiatives that use indicators to report on the state of the global environment is the Worldwatch Institute. It produces an annual *State of the World* report and a shorter annual report called *Vital Signs* that use indicators to track trends. Issued every year since 1984, the *State of the World* publications report on "progress towards a sustainable society". They each consist of some 8–10 chapters written by staff members, covering the salient environmental issues of the year in data-rich text (Worldwatch Institute 2004).

Vital Signs covers "the environmental trends that are shaping our future" through the use of key indicators to track trends in environmental change. These include trends in food production, agricultural yields, energy consumption and production, atmospheric issues, the economy, transportation, communication, health and social issues, and military and governance features. Two pages are devoted to each indicator, with one displaying graphic representations of the indicator and a table of the data, and the other providing interpretation and context. A number of the key indicators are repeated from year to year. The publication contains a second section on special features that is dedicated to tracking new and emerging issues and bringing these to the reader's attention. One of the distinctive characteristics of this report is the

inclusion of many driver and response indicators that are usually lacking in many other indicator initiatives. These indicators show trends in issues such as perverse subsidies to activities that harm the environment and the shift to taxing these activities. Other examples of driver indicators include trends in automobile production, meat consumption, and agricultural subsidies. Examples of response indicators include those that track trends in wind-generating capacity and solar-cell production, the market in pollution controls, bicycle production, and biomass energy use.

Common issues

A glance at the boxes listing the indicators in each of the reports surveyed above (Boxes 21–24) makes plain the similarity in the choice of issues selected by international agencies involved in creating sets of indicators for environmental reporting at the global level. Box 25 shows the issues or themes addressed by the reports.

Common indicators

It follows that there should also be considerable similarity in the environmental indicators that have been developed for the issue areas in all three international initiatives. Table 3 lists the issue areas, with the corresponding indicators that are generic to at least two of the three initiatives described in this chapter.

Analysis

UNEP and OECD populate the indicators with data and publish these, but the CSD's list of indicators functions as a "menu" for individual nations, so there is no common data set, and no central agency that collects and reports on the indicators. OECD's issues reflect the concerns of member countries, while those identified by UNEP and the CSD are more inclusive, since they also reflect those of developing nations. The CSD and OECD include population and economic growth as well as development assistance in their sets of indicators, since the CSD's mandate extends to all aspects of sustainability and the OECD measures environmental sustainability in relation to economic growth. The OECD also provides indicators of pollution abatement and control expenditures and official development assistance to show national responses to both national and global environmental and sustainability problems.

Table 3 shows that there are a total of 21 similar or common indicators found in all the international reports, reflecting a much greater correspondence among them than found when comparing the indicators in the four North American reports. In a

Box 25: International environmental issue areas

- Drivers (GDP, population, consumption)
- Climate change
- Ozone layer
- Air quality
- Waste
- Freshwater
- Coastal and marine ecosystems
- Fisheries
- Forests
- Agricultural land
- Biodiversity
- Protected areas
- Energy and transportation
- Natural disasters
- National responses (expenditures)

Source: Compiled by author from UN DESA 2004a; UNEP 2004a; OECD 2004b; OECD 2001.

hierarchy ranging from international to ecosystem-level issues and indicators, it is obvious that the lower the level, the more the indicators focus on characteristics specific to the area and the greater the differences in the issues and indicators selected to portray the regions. Such was the case in the cross-border case studies in Chapter 2 (see Box 19). As also noted about the North American reports, response indicators among the international indicator initiatives are fewer in number, with impact and pressure indicators the most represented.

An integration of North American and international indicators

Table 4 (page 58) compares generic indicators common to North America with those most used in the international reports. It reveals that there is a good deal of overlap between them, with similar indicators for a number of issues. There are gaps, however: indicators for indoor air, toxic substances, land use, coastal and marine ecosystems, grasslands and shrublands, and urban areas are not commonly found in either the North American or international reports. OECD confirms the gaps in a number of these indicators, including pollution from toxic substances (toxic metals, organic compounds, and fibres); population and area exposed to air pollutants; effects of air pollutants on human health and on the environment; and indoor air pollution. As will be seen in Chapter 4, lack of data is often the main reason for these gaps (OECD 2002b).

Table 3: Indicators common to at least two international initiatives

<i>Issue area</i>	<i>Common indicators</i>
Drivers (population, GDP, consumption)	• per capita GDP
Climate change	• per capita CO ₂ emissions • total annual CO ₂ emissions
Ozone layer	• ODS consumption
Air quality	• ambient concentrations of SO ₂ and NO ₂
Waste	• generation of industrial, hazardous, and radioactive waste, and municipal solid waste (MSW) • waste recycling and reuse
Freshwater	• water use as % of annual renewable water • % total population with access to improved sanitation • % population with access to improved water supply
Fisheries	• total fish catches
Forests	• forest harvests as % annual growth • forest area as % of total land area
Agricultural land	• fertilizer use/unit agricultural land area • pesticide use/unit agricultural land area
Biodiversity	• # of known mammals, birds, fish, reptiles, amphibians, and vascular plants • threatened species as % of species known
Protected areas	• protected area as % of total land area
Energy and transportation	• per capita energy use • energy use/GDP
National responses (expenditures)	• official development assistance as % GNP

Source: Compiled by author from UN DESA 2004a; UNEP 2004a; OECD 2004b; OECD 2001.

Issues common to the North American reports but not represented by most international initiatives include acid deposition and wetlands. Although not exclusively North American issues of concern, they are of particular significance to Canada and the United States. Internationally important issues that some of the North American reports surveyed neglect include climate change, fish resources, protected areas, natural disasters, and expenditures. Neither the Heinz report nor the EPA draft report includes indicators of climate change. The ecosystem focus of the former precludes this issue and the EPA chose not to report on greenhouse gas emissions due to the “complexities of this issue” (US EPA 2003, 1–11). Some indicators important for developing countries have less significance in Canada and the United States, such as population with access to improved sanitation and population with access to improved water supply.

The results of this exercise in identifying common indicators among national and international indicator initiatives is confirmed by recent work conducted by Environment Canada during its deliberations on a strategy for environmental indicators and state-of-the-environment reporting in Canada. A background paper notes the need to work on improving the overlap between national and international issues and indicators (NIRO 2003b). Table 5 (page 59) integrates the most commonly used indicators from both the national and the international initiatives as a starting point in compiling a list of candidate indicators for North America.

Based on the lessons learned from this study, the following section examines the challenges in developing multilateral indicators and makes some recommendations for future environmental indicator initiatives for the North American region.

Table 4: Indicators common to North American and international initiatives

<i>Issues</i>	<i>Common North American indicators</i>	<i>Common international indicators</i>
Drivers (population, GDP, consumption)	<ul style="list-style-type: none"> • % change in population, GDP per capita, and energy use 	<ul style="list-style-type: none"> • per capita GDP
Energy and transportation	<ul style="list-style-type: none"> • trend in gasoline use by motor vehicle 	<ul style="list-style-type: none"> • per capita energy use • energy use/GDP
Climate change		<ul style="list-style-type: none"> • per capita CO₂ emissions • total annual CO₂ emissions
Ozone layer	<ul style="list-style-type: none"> • ODS production • O₃ levels over North America 	<ul style="list-style-type: none"> • ODS consumption
Air quality	<ul style="list-style-type: none"> • criteria pollutants emissions • concentrations in average annual PM_{2.5} levels • O₃ concentrations by region 	<ul style="list-style-type: none"> • ambient concentrations of SO₂ and NO₂
Acid deposition	<ul style="list-style-type: none"> • change in wet sulphate deposition • change in wet nitrate deposition 	
Indoor air		
Toxic substances		
Waste	<ul style="list-style-type: none"> • municipal solid waste (MSW) management 	<ul style="list-style-type: none"> • generation of industrial, hazardous, and radioactive waste, and municipal solid waste (MSW) recycling and reuse
Land use		
Freshwater	<ul style="list-style-type: none"> • municipal water extraction 	<ul style="list-style-type: none"> • water use as % of annual renewable water • % total population with access to improved sanitation • % population with access to improved water supply
Wetlands	<ul style="list-style-type: none"> • % land area in wetlands 	
Coastal and marine		
Fisheries		<ul style="list-style-type: none"> • total fish catches
Forests	<ul style="list-style-type: none"> • timber harvest • area of forest cover • forest bird populations • area burned in forest wildfires • area of protected forest 	<ul style="list-style-type: none"> • forest harvests as % of annual growth • forest area as % of total land area
Agricultural land	<ul style="list-style-type: none"> • % farmland susceptible to water erosion 	<ul style="list-style-type: none"> • fertilizer use/unit agricultural land area • pesticide use/unit agricultural land area
Grasslands and shrublands		
Biodiversity	<ul style="list-style-type: none"> • # threatened species or % of all species 	<ul style="list-style-type: none"> • # of known mammals, birds, fish, reptiles, amphibians, and vascular plants • threatened species as % of species known
Protected areas		<ul style="list-style-type: none"> • protected area as % of total land
Urban areas		
Natural disasters		<ul style="list-style-type: none"> • human loss due to natural disasters
National responses (expenditures)		<ul style="list-style-type: none"> • total official development assistance as % of GNP

Source: Compiled by author from OECD 2004b; UN DESA 2004a; UNEP 2004a; EC 2003a; US EPA 2003; NRTEE 2003; Heinz Center 2002; OECD 2001.

Table 5: Integration of common national and international environmental indicators

Issue	Common indicators drawn from all the reports surveyed
Drivers (population, GDP, consumption)	<ul style="list-style-type: none"> • per capita GDP • % change in population, GDP per capita, and energy use
Climate change	<ul style="list-style-type: none"> • per capita CO₂ emissions • total annual CO₂ emissions
Ozone layer	<ul style="list-style-type: none"> • ODS consumption • ODS production • O₃ levels over North America
Air quality	<ul style="list-style-type: none"> • criteria pollutants emissions • ambient concentrations of SO₂ and NO₂ • concentrations in average annual PM_{2.5} levels • O₃ concentrations by region
Acid deposition	<ul style="list-style-type: none"> • change in wet sulphate deposition • change in wet nitrate deposition
Indoor air	
Toxic substances	
Waste	<ul style="list-style-type: none"> • generation of industrial, hazardous, radioactive, and MSW • MSW management (recycling and reuse)
Land use	
Freshwater	<ul style="list-style-type: none"> • municipal water extraction • water use as % of annual renewable water • % total population with access to improved sanitation • % population with access to improved water supply
Wetlands	<ul style="list-style-type: none"> • % land area in wetlands
Coastal and marine	
Fisheries	<ul style="list-style-type: none"> • total fish catches
Forests	<ul style="list-style-type: none"> • forest harvests as % annual growth • forest area as % of total land area • forest bird populations • area burned in forest wildfires • area of protected forest
Agricultural land	<ul style="list-style-type: none"> • fertilizer use/unit agricultural land area • pesticide use/unit agricultural land area • % farmland susceptible to water erosion
Grasslands and shrublands	
Biodiversity	<ul style="list-style-type: none"> • # of known mammals, birds, fish, reptiles, amphibians, and vascular plants • # threatened species or % of all species
Protected areas	<ul style="list-style-type: none"> • protected area as % of total land
Urban areas	
Energy and transportation	<ul style="list-style-type: none"> • per capita energy use • energy use/GDP • trend in gasoline use by motor vehicles
Natural disasters	<ul style="list-style-type: none"> • human loss due to natural disasters
National responses (expenditures)	<ul style="list-style-type: none"> • total official development assistance as % GNP

Source: Compiled by author from OECD 2004b; UN DESA 2004a; UNEP 2004a; EC 2003a; US EPA 2003; NRTEE 2003; Heinz Center 2002; OECD 2001.

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