

HEALTH-AND-ENVIRONMENT INDICATORS IN THE CONTEXT OF SUSTAINABLE DEVELOPMENT

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“Indicators are a way of seeing the big picture by looking at a small piece of it” (Jackson Community Council, quoted in Plan Canada 1999)

1. INTRODUCTION

This paper introduces the concept of health-and-environment indicators in the context of sustainable development, placing special emphasis on perspectives and approaches adopted by WHO, and where appropriate other international agencies and institutions.

1.1 Information for decision-making

Chapter 40 of Agenda 21¹, which deals with information for decision-making, states that “in sustainable development, everyone is a user and provider of information in the broad sense” (UN 1993). Whilst health, environment and development problems differ in various parts of the world, as do priorities in respect of their management, there is a need in all situations for decision-makers and the public to have ready access to accurate information on health hazards associated with the linkages between development and the environment.

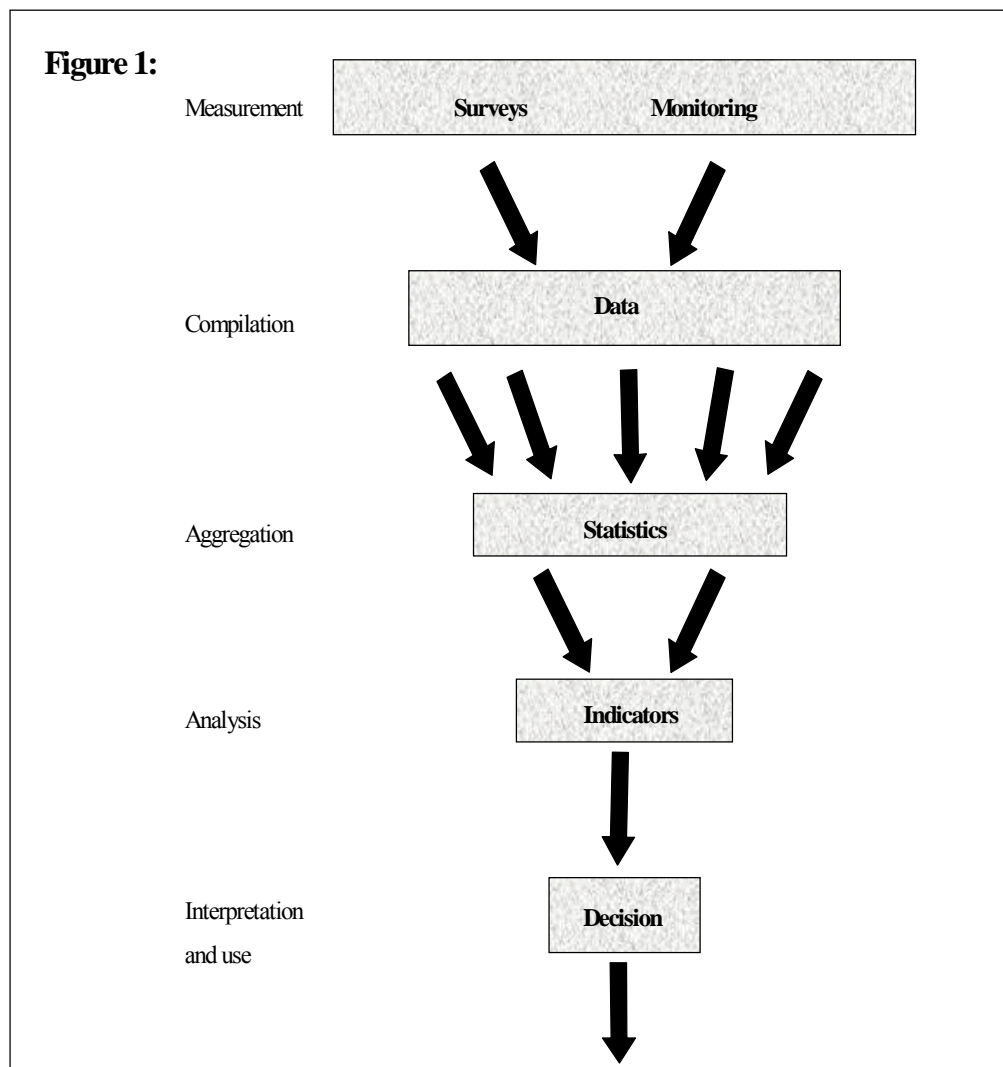
Information is needed to monitor and assess trends, identify and prioritize problems, develop and evaluate policies and plans, guide research and development, set standards and guidelines, monitor progress and inform the public. It is important that this data be conveyed in a readily comprehensible way, but with due regard to the complexities and uncertainties inherent in the data.

Whilst frequently there is an abundance of data and information (of variable quality) available from monitoring and surveillance programmes, this information may not always be in a policy-relevant form for decision-makers. Thus the information may be of limited use in informing the public and decision-makers of key health and environment problems and their causes, or of possible management actions needed.

¹ Agenda 21 is the global action plan on sustainable development which arose out of the the United Nations Conference on Environment and Development (UNCED) held in Rio in 1992.

1.2 Role of indicators

Indicators can play an important role in turning data into relevant information for decision-makers and the public. Importantly, they can help to simplify a complex array of information with respect to the health-environment-development nexus. In this way they provide a “synthesis” view of existing conditions and trends which informs decision-making. They have become well-established and widely used in many different fields, from economics to ecology to health, and can be used at the global, regional, national, local or neighbourhood level, as well as at the sectoral level (Hammond et al 1995) (see Figure 1, Briggs et al 1996).



The Chambers Dictionary defines an indicator as being “... something that provides an indication, a pointer...any device for exhibiting conditions for the time being”. Others have defined an indicator as “a piece of information which is part of a specific management process, and has

been assigned a significance beyond its face value” (UNEP/RIVM 1994). The Scientific Committee on Problems of the Environment (SCOPE) has described indicators in terms of two key characteristics, namely a) indicators quantify information so its significance is more readily apparent, and b) indicators simplify information about complex phenomenon so as to improve communication (Peterson 1997).

Briggs et al (1996), building on these definitions, have defined an environmental health indicator as : “An expression of the link between environment and health, targeted at an issue of specific policy or management concern and presented in a form which facilitates interpretation for effective decision-making”. Embodied in this definition is the concept of a linkage between a factor in the environment and a health outcome.

One example of an indicator is GDP (Gross Domestic Product), which is a way of assessing aspects of economic development in a country. The infant mortality rate (IMR) is an indicator of the health status of a community. The rise in ambient temperatures worldwide is an indicator of climate change. The number of public complaints received by a local authority is an indicator of the level of satisfaction with the quality of services provided. In the field of ecology, the presence or absence of an “indicator species” can be used to assess the particular conditions which prevail in an ecosystem.

1.3 Criteria for indicators

Different types of decisions and issues will require different types and levels of indicators to be developed. To be really useful, indicators should be user-driven, and not just technically relevant or relevant to the providers of data. The actual choice of indicators will depend on factors such as the purpose for which they are to be used, and the target audience. Sometimes the same set(s) of indicators developed can serve many purposes, in other situations distinct sets of indicators for specific purposes may be needed.

Many organizations have attempted to define criteria for the construction and selection of indicators. These might relate to whether the indicators are concerned with policy relevance, analytical soundness or measurability for example. They could be assessed according to various factors such as transparency, scientific validity, robustness, sensitivity and the extent to which they are linkable (Peterson 1997). Or they could be assessed according to whether they are relevant to the issue they are intended to describe, whether they relate to changes in policy and

practice, or whether or not they are resonant or “strike a chord” with their intended audience (Peterson 1997).

Criteria which could be used in the development of indicators are given in the box below. It should be noted however, that the applicability of the criteria will depend on the indicator in question, and the purpose of the indicator to be used. For example if the main concern was with long-term environmental change, criteria would emphasise factors such as responsiveness to changes in the environment and human activities, capacity to provide early warnings of pending changes, sensitivity to changes in the environment and so on. If the indicators were primarily to inform the general public, the criteria would focus on factors such as simplicity, ease of interpretation, and attractiveness to a range of stakeholders. No single set of criteria will be applicable to all indicators derived. Indeed, if all indicators selected were to conform with all desired criteria, very few indicators would be in existence. Each situation will have its own priorities for data collection and analysis.

CRITERIA FOR INDICATORS

Of general relevance

- related to a specific question or issue of concern
- health-related and linked to environment/development factors
- sensitive to changes in the conditions of interest
- provide early warning of pending changes

Scientifically sound

- unbiased and representative of the conditions of concern
- scientifically credible, reliable and valid
- based on best available data of acceptable quality
- robust and unaffected by minor changes in methodology/scale used for their construction.
- consistent and comparable over time and space

Applicable to users

- have relevance to policy and management needs
- based on data which are available or can be collected/monitored with a reasonable financial/time resource input
- easily understood and usable by potential users
- acceptable to stakeholders

Source : Modified and adapted from Briggs et al 1996

2. NATURE AND CHARACTERISTICS OF INDICATORS

Indicators may be specific, or they may be composite, which condense a wide range of information on different (but related) phenomena into a single measure or index. In practice however, the construction of composite indicators is challenging, and demands high levels of statistical and measurement competence in weighting and combining various variables. It may be difficult to test or verify composite indicators, since they may not relate to specific, measurable conditions. Also, it can be confusing if there are variable effects of the individual components.

Composite indices can nevertheless be useful in summarizing data and information for decision-makers. For example in the construction of indicators for global climate change, the individual greenhouse gases contributing to global warming can be weighted by their global warming potential or health absorbing capacity and expressed in terms of “carbon dioxide equivalents”. A similar approach has been adopted as a weighting scheme for ozone-depleting gases (Peterson

1997). Many air quality indices have also been devised, such as the Pollutant Standard Index (PSI) developed in the US in the 1970s, as well as water quality indices to aggregate variables associated with water use.

In the development field, the Human Development Index has been commonly used, which combines information on life expectancy at birth, educational level and level of income. A gender-related development index (GDI) has also been developed by UNDP. In the field of health, the “DALY” is an example of a composite measure of the burden of disease based on the concept of disability-adjusted life years, which combines the years of healthy life lost due to premature death, disability or disease (Murray and Lopez 1996).

Descriptive indicators can be useful in obtaining baseline information on which to formulate subsequent policy options and plans, and assess trends. At all levels (global, regional, local), indicators which describe the overall state (quality) of the environment, and which highlight factors influencing environmental quality, as well as potential impacts on human health, can be useful. They can provide an overview, or snapshot of a situation, or a profile of environment-and-health conditions, thereby exhibiting trends. In this regard, the indicator framework described in the last section, has application.

Indicators which describe the various policy responses taken to address problems can be of particular use. In developing countries in particular, where the data base necessary to construct indicators may be limited, but the problems (and solutions) well known, it may be more appropriate to focus on the development of response, or action indicators, than on indicators relying on data from extensive monitoring programs (Peterson 1997). Performance indicators, which measure whether agreed targets and goals have been met, may be particularly useful. These have been extensively used in the private sector.

3. INTERNATIONAL INDICATOR INITIATIVES

3.1 Sustainable development indicators

Many intergovernmental and nongovernmental organizations, as well as various countries, have developed indicators of sustainable development, supported by the statistical office of the United Nations. The Commission on Sustainable Development has been instrumental in coordinating the development of indicators for sustainable development. In the early-to-mid 1990s organizations

such as the OECD (1993), UNEP, RIVM (1994), the World Resources Institute (WRI) (1995), the World Bank (1994), SCOPE (1995) and others became centrally involved in the development of indicators to monitor environmental trends. The OECD approach has been to develop indicators for assessing countries' environmental performance. The World Resources Institute has also developed environmental indicators for measuring and reporting on environmental policy performance in the context of sustainable development (Hammond et al 1995).

To date, around 130 indicators of sustainable development have been compiled by the Commission on Sustainable Development (UN 1996), which deal respectively with social aspects of sustainable development, economic aspects, environmental aspects and institutional aspects. The indicators are being tested at the national level by countries throughout the world. Based on analysis of the testing results and review of developments in other international indicator sets, a core set of indicators for sustainable development (and related methodologies) will be developed as a tool to support national-level decision-making. The core set is based on the policy priorities of Agenda 21 and will be presented for endorsement to the Commission on Sustainable Development at its 9th session.

(See Annex 1: SELECTED SUSTAINABLE DEVELOPMENT INDICATORS)

3.2 Housing and urban indicators

Work on indicators which is indirectly of relevance to health includes that done by the UNCHS on indicators for housing and urban areas (UNCHS 1995), which constitutes a monitoring package for cities and the shelter sector. The key indicators for this work were endorsed by the Commission on Human Settlements in May 1995, and constituted a set of indicators collected by countries as part of their preparation for HABITAT 11. Governments were urged to collect information on at least the key indicators for one or more cities. The indicators developed cover the areas of socioeconomic development, infrastructure, transport, environmental management, local government, housing affordability, availability and provision, as well as general background indicators. Data has been collected from cities all over the world.

UNCHS has also collected data on specific issues of concern relative to the quality of housing, such as on overcrowding (UNCHS 1995), for which indicators have been developed according to whether they are associated with causes of the problem, the health outcomes or responses to the

situation.

(See Annex 2: HOUSING AND URBAN INDICATORS)

3.3 Social Indicators of development

Social indicators of development have been compiled by the World Bank (1966) to assess reductions in poverty. These include indicators of priorities, supplementary indicators of access to basic services and social safety nets, and indicators of human resources, natural resources, socioeconomic expenditure and investment in human capital. In combination, they allow monitoring of social conditions at the country level and provide a framework for assessing human welfare.

(See Annex 3: SOCIAL INDICATORS OF DEVELOPMENT)

3.4 Health indicators

WHO (through both headquarters and the regional offices) has developed indicators (and targets) to assess its “Health-for-All” (HFA) policy. The purpose of the HFA indicators has been to guide member states in the evaluation of their national strategies for HFA, and to follow-up on the implementation of the Global Strategy. HFA indicators developed previously have dealt respectively with trends in policy development, socioeconomic development, health and environment, health resources, health systems, health services and health status. The framework used was based mainly on health services, health status, health determinants and health resources. Various regions have also been involved in the development of HFA indicators, as have individual countries (van de Water et al 1996). A new set of targets, incorporating indicators, has been developed in respect of the renewed HFA policy (WHO 1998).

(See Annex 4: SELECTED INDICATORS FOR THE THIRD EVALUATION OF HFA)

Global indicators are also used for reporting purposes in the World Health Report of WHO.

(See Annex 5: GLOBAL HEALTH INDICATORS (WHO))

Health and health-related indicators are also extensively used in the various regions of WHO

(See Annex 6: HEALTH AND HEALTH-RELATED INDICATORS IN THE

AMERICAS)

WHO has also developed various programme indicators to monitor the health of infants and young children, the health of women and the health of the general population. The indicators have been categorized according to whether they are outcome-related (concerned with health status or death), process-related (concerned with health care delivery and management), or whether they are determinants (for example behavioural factors or environment/development factors which influence health outcomes). The indicators are intended to be used by public health administrators and health programme and service managers (WHO 1996). Work has also been done in specialized content areas in WHO, such as on indicators for assessing vitamin A deficiency (WHO 1996), or on indicators for monitoring national drug policies (WHO 1994). (See Annex 7: WHO PROGRAMME INDICATORS)

Much work has also been done on indicators for environmental health (WHO 1995). The publication entitled “Linkage Methods for Environment and Health Analysis” (Briggs et al 1996) deals with methods for linking health and environmental data, and the application of indicators to quantify and monitor environmental health conditions. Field studies have been carried out to obtain information on aspects of environmental health status and particular environmental health problems in the respective study areas (WHO 1995). No uniform set of EHIs has been recommended by WHO, however suites of indicators which can be selected from for various purposes have been compiled (von Schirnding, in press), as well as updated methodology sheets for construction of selected indicators.

(See Annex 8: ENVIRONMENTAL HEALTH INDICATORS)

Baseline indicators have been developed by the WHO European Healthy Cities project, which cover health, demography, health services, the environment and socioeconomic status. This represents the first systematic effort to collect and analyse a wide array of data from cities across Europe (WHO 1996). It has provided important insights into the way in which indicators are understood by various countries, as well as relevant information on the availability of data, and its reliability and validity. The indicators were formally adopted by participating cities in 1990, and information collected on the 53 agreed indicators from cities over the period 1992 to 1994. (See Annex 9: HEALTHY CITIES INDICATORS)

WHO has published a set of guiding principles to evaluate programmes to ensure food safety,

which addresses issues in respect of the preparation of country profiles and data bases, concepts and processes associated with evaluation, and the development of indicators for the evaluation of programmes to ensure food safety, as well as for various aspects of food safety evaluation (WHO 1989).

4. CORE INDICATORS

There has occurred a lot of debate and interest in the concept of a set of “core” indicators which can be used on a global basis to examine overall trends in environment and health conditions worldwide (see previous section on international indicator initiatives). Opponents of such a concept have argued that environment and health problems and priorities for their management differ significantly and substantially in various regions of the world, as do monitoring and analytical capabilities, and resource availability, making it problematic to establish a core set of indicators which have universal applicability. Problems in standardizing definitions, and difficulties in ensuring quality control procedures on a worldwide basis are further complicating factors.

On the other hand, most countries, regardless of their level of development, or of other socio-political or cultural realities have to deal with certain problems which are of universal significance. In the environmental domain these might include air quality, water and sanitation, food safety, waste disposal, or toxic substances for example. Whilst the specific dimensions of these problems will differ from country to country and within countries, sets of universally applicable indicators could be valuable in terms of improving shared knowledge on factors impacting on the state of the global environment, and their effects. Common sets of indicators have other obvious benefits - they enable aggregation at various levels - local, country, regional, global. They also provide momentum to countries in achieving uniform and rigorous standards. There may also be national reporting requirements under international treaties which may necessitate standardized indicators internationally.

The identification of a limited number of common indicators, based on those currently accepted and widely used by countries, is thus a potentially important tool for the harmonization and rationalisation of indicators. Establishing agreement on such a limited set will significantly lessen the data reporting burden on countries. Where user needs are similar, indicators should be harmonised. Efforts by government departments, agencies, NGOs, civil society and the donor community should be coordinated, and should aim to strengthen data collection and management.

To the extent possible, existing data should be drawn upon, paying due recognition to the limitations of the data.

The common country assessment (CCA) indicator framework, developed by the United Nations Development Group (UNDG) as an indicator framework following UN conferences and summits, is being used by UN funds and programmes in over 100 countries. The UN Statistics Division, together with UNDG will be analysing the lessons learned from the CCA indicator experience. The CCA indicator framework, anticipating changes in the environmental indicators, includes provision for further review of environmental indicators, in order to maintain concordance between the two indicator sets.

Both the UN Statistics Division and UNDG are working with a selected number of countries to assess a) to what extent the national statistical system is involved in the CCA indicator effort and what the impacts are of the CCA indicator requirements on the national statistical system; b) which indicators are being used; c) what the data gaps are; d) how the UN Development Assistance Framework (UNDAF)-CCA indicator process is related to other policy processes (for example, IMF/World Bank Poverty Reduction Strategies for countries qualifying for enhanced debt relief); and e) what targeted programmes are being proposed to address the lack of data or data quality (UN 2000).

(See Annex 10: UNION OF SELECTED CORE INDICATOR SETS)

Whilst standard, internationally agreed sets of indicators thus fulfill a major international role for between-country comparisons, nations may require other specific indicators to enable them to develop and evaluate national policies and plans. Any core set of indicators will always have to be augmented in view of the particular national, regional and local policy concerns. Some indicators will naturally be more relevant at a national or global level (health aspects of climate change for example) whilst others will be more locally relevant (drainage problems, or problems with solid waste for example). Information on these indicators could be collected and obtained at different geographical levels of resolution, for example at the local, national or global levels.

The roles and responsibilities in respect of various environment and health management functions at different tiers of government, the degree of decentralization of powers and functions, and other factors such as data availability and quality will influence the extent to which it makes sense to examine data at different levels for international comparison purposes. Regardless at

what level the data is aggregated and examined however, most information will normally need to be collected in the first instance, at the lowest level of resolution as is practicable and feasible.

The following issues could have particular relevance at the global, national and local levels respectively, although it should be recognized that there are no rigid boundaries and the situation will vary from setting to setting, depending on the sources and the factors influencing their control (for example local issues impact on global issues, and vice versa). At the national level, the setting of policies and standards may be fundamental, whilst at the local level, service delivery and implementation of policies is normally of key importance. Many issues require management over different tiers of government.

Health and Environment Issues of Significance at Local, National and Global Levels		
Local	National	Global
Dust	Hazardous waste	Climate change
Noise	Toxic chemicals	Transboundary pollution
Solid waste	Food safety	Ozone depletion
Water and sanitation	Ambient air pollution	Acid deposition
Pests	(major industrial/mobile sources)	Marine pollution

The following two examples illustrate the use of indicators at the regional, and the local levels, respectively.

EXAMPLE : A REGIONAL APPROACH TO ENVIRONMENTAL HEALTH MONITORING : EASTERN MEDITERRANEAN COUNTRIES

Background

Several regional conferences and seminars in the Eastern Mediterranean Region have recognized that the lack of reliable data on environmental health constitutes a major constraint to effective development of environmental health programmes. The Beirut Declaration of Action for a Healthy Environment considered regional collaboration in environmental health information systems an urgent and important issue.

With support from the World Health Organization Regional Office for the Eastern Mediterranean Region (WHO/EMRO), and the International Development Research Centre (IDRC), the WHO Regional Centre for Environmental Health Activities (CEHA) undertook a number of initiatives aimed at the development of country-specific environment and health indicators, and is encouraging the development of a set of core indicators for information exchange at a regional level.

Resulting from a series of studies and regional meetings, the following set of environmental health indicators have been proposed, and are now being considered for application in the Eastern Mediterranean Region:

water supply

- proportion of population with access to an adequate amount of safe water in the dwelling or within a convenient distance from the dwelling.

sanitation

- proportion of population with access to a sanitary facility for human excreta disposal in the dwelling or located within a convenient distance from the user's dwelling.

solid waste

- proportion of houses served by regular waste removal services.

food safety

- incidence of outbreaks of food-borne poisoning/year.

air pollution

- annual number of deaths amongst children under the age of five years from acute respiratory infections;
- percentage of population in un-electrified dwellings.

health care waste

- proportion of untreated healthcare waste.

Atallah S, Ali Khan MZ. Towards a regional approach for environmental health monitoring in WHO's Eastern Mediterranean countries. Presented at the WHO Symposium on the Role of Epidemiology in Decision-making. Annual Meeting of the International Society for Environmental Epidemiology, 15-19 August 1998, Boston, USA.

EXAMPLE : COTONOU, BENIN

Under the umbrella of the multi-country Health and Environment Analysis for Decision-making (HEADLAMP) initiative, a field study on environment and health indicators was undertaken in Cotonou, Benin. The work in Cotonou was undertaken by the Centre Régional pour le Développement et la Santé (CREDESA). In order to select environment and health indicators, routine statistical and epidemiological data from the health services were assessed, and patient records were reviewed to determine the morbidity and mortality rates for common diseases. In addition, a literature review of previous environment and health studies was conducted, and interviews held with politicians and officials of the Ministry of the Environment. The population of Cotonou and the local authorities were invited to comment. The results of preliminary investigations indicated inequity in the distribution of the five most common diseases across Cotonou. For example levels of malaria and diarrhoeal disease were twelve times higher in one zone than in another.

Indicators Selected

- % of the population with access to a sufficient quantity of safe drinking water;
- % of people served by public garbage removal service;
- % of people exposed to higher concentration of health damaging air pollution (indoors and outdoors separately);
- % of people covered by primary health care;
- % of the eligible population that have been fully immunised according to the national immunisation policies;
- prevalence of malaria;
- prevalence of intestinal helminths among children aged 2 to 15 years;I.% of people who obtain drinking-water only from unprotected and contaminated wells;
- % of people affected by permanent floods at home;
- % of people with adequate lighting at home.

Experiences in Cotonou indicated that a number of factors affected the selection and use of indicators. These included:

- the high degree of environmental health inequity across the zones of Cotonou;
- the quality of routine data required improvement;
- cross-sectoral consultation and collaboration is required to improve the environment and health information management system;
- there is an opportunity to increase the participation on communities in the definition and assessment of environment and health indicators in Cotonou.

Source: Soton et al 1997

There is now a relatively large amount of data available on environment and health conditions worldwide over a long period of time. Much useful data has been generated through various global monitoring programmes such as the former UNEP/WHO Global Environmental Monitoring System (GEMS) network (WHO 1990, UNEP/WHO 1993). There have now occurred improvements in field monitoring techniques, and advances in modeling and computing have resulted in an increase in the amount of data available with respect to the state of the environment at different levels, for example at the global, regional and local levels. State of environment reports, audits, monitoring programmes and censuses are useful sources of data at all levels.

**Examples of regularly published global reports containing detailed
health and/or environment information**

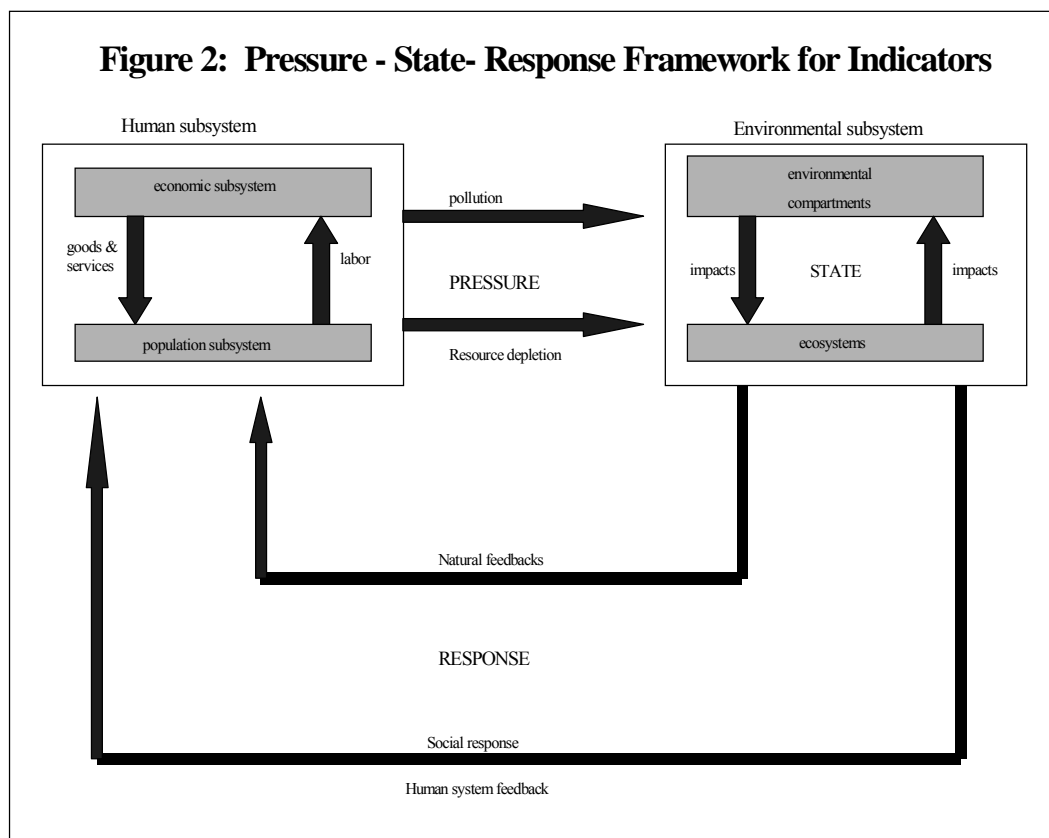
Report title	Organization	
Global environment outlook	UNEP, Nairobi	
Human development report	UNDP, New York	
State of the world's children	UNICEF, New York	
United Nations statistical yearbook	UN, New York	
Vital signs	Worldwatch Institute Washington	
State of the world	Worldwatch Institute Washington	
State of world rural poverty	IFAD, Rome	
World development report	World Bank, Washington	
World health report	WHO, Geneva	
World health statistics annual	WHO, Geneva	
World resources report	World Resources Institute Washington	

The quality and quantity of health information has also been improving over the years, with advances in health information systems and in health reporting. There are several international information sources available on environmental health effects, such as the Environmental Health Criteria series produced by WHO, UNEP and ILO, the International Register of Potentially Toxic Chemicals, monographs on carcinogenicity of chemical substances produced by the International Agency for Research on Cancer (IARC), and various WHO guideline documents such as those on drinking water quality and air quality.

Obtaining relevant data at country level remains a significant problem however, particularly in poor countries, where there is often inadequate coverage, and problems such as misclassification of illnesses and quality control in measurements are common. Nevertheless most countries have some sort of health information system, even if fairly rudimentary and the recording systems incomplete. Problems in data coverage and data quality occur in almost all countries, to a greater or lesser degree.

5. LINKAGES AND FRAMEWORKS

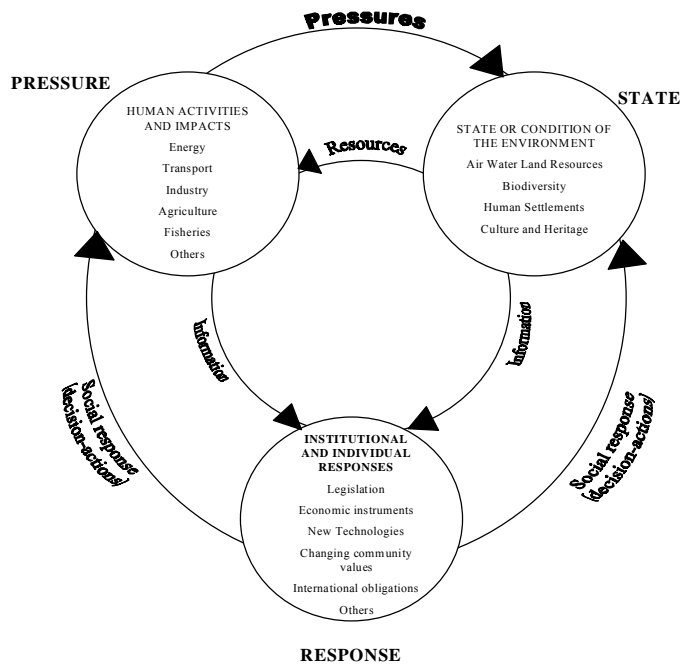
It is important for decision-makers not only to obtain better data on, but also to obtain an enhanced understanding of, the linkages between the complexity of factors in the environment-development process affecting human health. An indicator framework for presenting the various linkages between factors influencing health in the context of environment and development has been developed, which is an adaptation of the “Pressure-State-Response” (P-S-R) framework developed by OECD (OECD 1993) (in turn based on earlier work done by the Canadian government) (See Figure 2, WRI 1995).



The P-S-R framework has been particularly useful in representing the way in which pollution affects the environment, for example by looking at the various pressures exerted on the environment, which affect the “state” (quality) of the environment, and which consequently demand a “response” to dealing with the situation. This framework has been criticised for being linear and one- directional, and various adaptations have been proposed. One such example is a

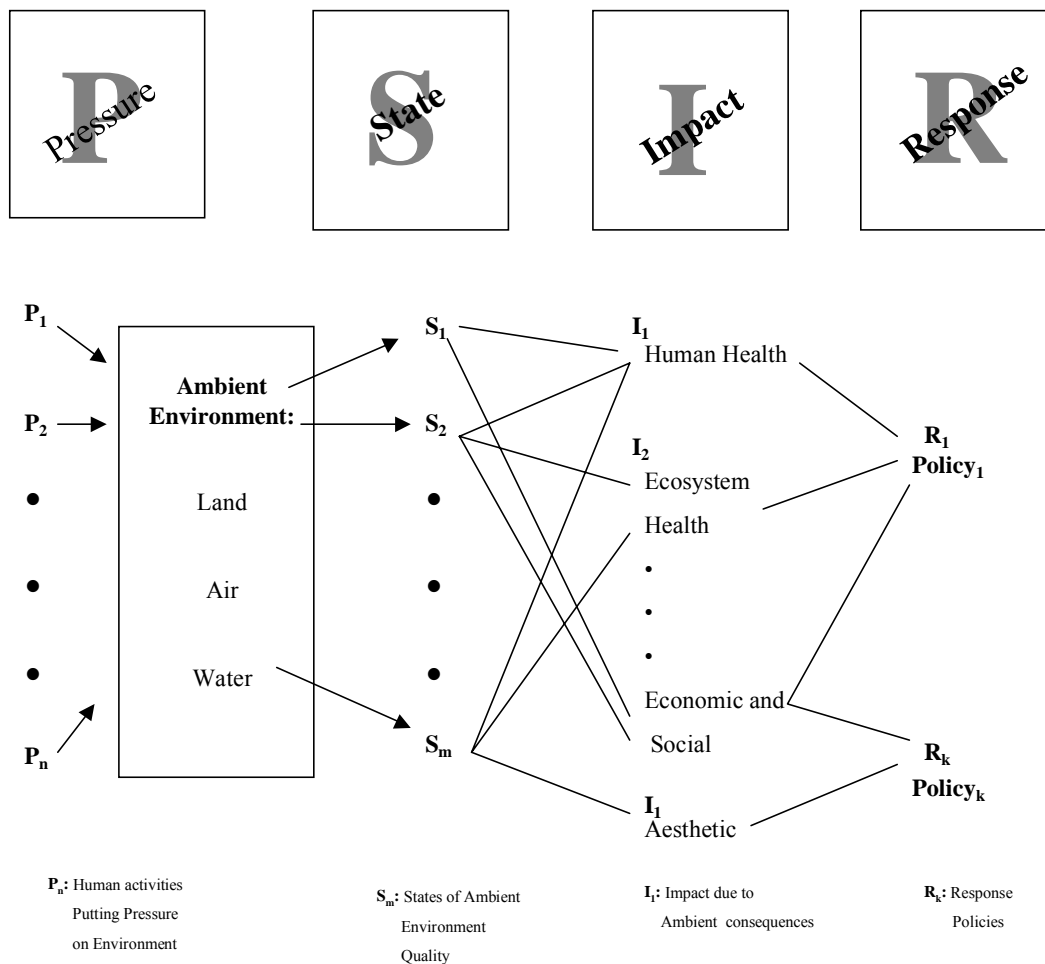
model developed by the Commonwealth of Australia, indicating the feedback loops in circular fashion (Commonwealth of Australia 1994) (See Figure 3).

Figure 3:



Other adaptations to the P-S-R framework have made provision for the broader driving forces and pressures on the environment, as well as for impacts that result from these. A framework referred to as the P-S-I-R framework (Pressure-State-Impact-Response) has been developed which makes provision for impacts such as human health impacts, ecosystem impacts, or economic and social impacts (Harvard 1996) (See Figure 4).

Figure 4:



D-P-S-E-E-A Framework

From the perspective of human health impacts, both exposures and the actual resulting human health effects need to be represented. These aspects have been taken into account in a further adaptation of the framework for health purposes, referred to as the the “D-P-S-E-E-A” framework, which represents Driving forces, Pressures, State, Exposures, Health effects, and Actions (WHO 1995, Briggs et al 1996, von Schirnding in press). It is a descriptive representation of the way in which various driving forces generate pressures which affect the state of the environment, and, ultimately, human health, through the various exposure pathways by which people come into contact with the environment.

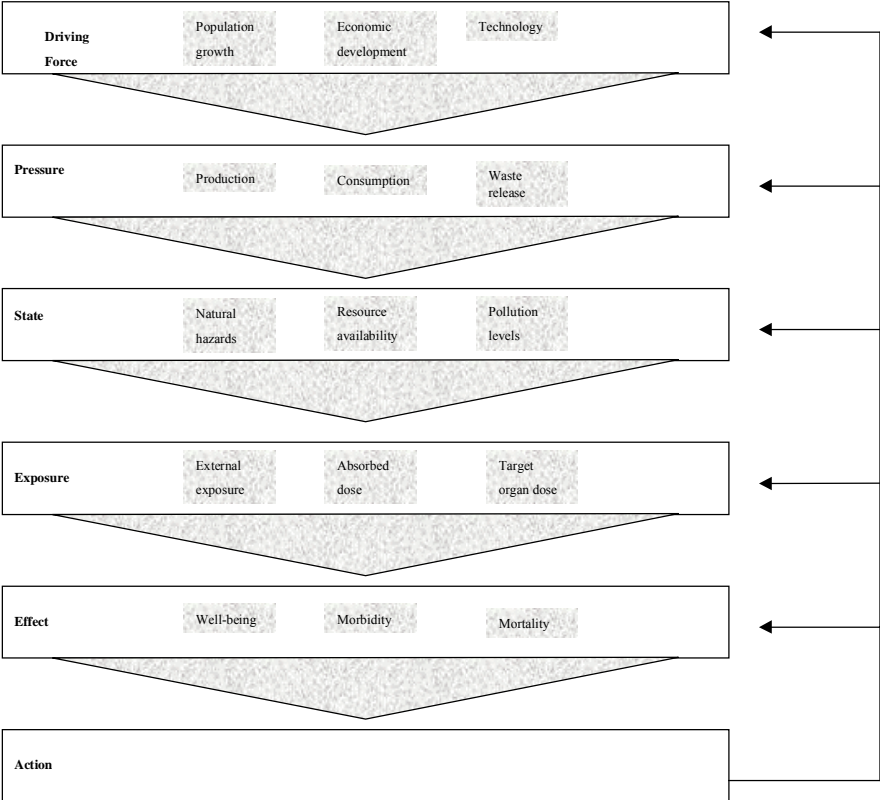
People may become directly “exposed” to potential hazards in the environment when coming into direct contact with these media through breathing, drinking or eating for example. A variety of health effects may subsequently occur, ranging from minor, subclinical effects (i.e. effects which may not yet have manifested in overt symptoms) through to illness and sometimes death,

depending on the intrinsic harmfulness of the pollutant, the severity and intensity of exposure and the susceptibility of the individuals exposed (for example the elderly, the young and the sick may often be more susceptible than others).

Various actions can be implemented at different points in the framework, and may take different forms. They might involve the development of policy, standard setting, technical control measures, health education measures, or treatment of people with diseases.

Whilst the D-P-S-E-E-A framework, like the P-S-R framework on which it is based, represents the various components in a linear fashion in order to more clearly articulate the connections between factors influencing health and the environment, in reality the situation is much more complex, with various interactions occurring at different levels between various components. The different components of the D-P-S-S-E-A framework are given in the figure below. The framework can be applied to information gathering and indicator development at the national level, at the sectoral level, or indeed at the community or neighbourhood level (Hammond et al 1995). (See Figure 5, WHO 1997)

Figure 5:



6. SUMMARY

This paper has attempted to give a broad overview of issues relevant to the development and use of health-and-environment indicators in the broader context of sustainable development. Criteria for the construction of indicators are given, and their key characteristics are highlighted. Selected international indicator initiatives are discussed, as well as the concept and use of core indicators in policy and planning. Finally, an organizational framework for the consideration of health-environment-development linkages is presented, which can be useful for the development of health-and-environment indicators in various contexts. Emphasis is placed on work done within the UN system, in particular that of WHO, and examples of suites of indicators developed and in use are given in the tables in the appendices. Existing environmental monitoring and surveillance systems will be discussed in an accompanying paper.

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