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Miscellanea

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Environment Statistics Programme of the United Nations

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Abstract: Environment statistics encompasses a wide spectrum of disciplines, ranging from the natural to the social sciences. Environmental data are dispersed among governmental and non-governmental organizations as well as other agencies. An organized approach towards standardized data collection, processing and dissemination of environment statistics is required. This article describes the United Nations' efforts to achieve this goal.

Key words: Environment statistics; statistical framework; environmental accounting; United Nations Statistical Office; human settlements statistics.

1. Introduction

Environmental issues are currently in the forefront of the political arena both globally and nationally. Government leaders can no longer ignore the fact that whatever damage is being done to the environment is going to have a tremendous effect on future generations. There is a need to measure this effect and its relevance for all spheres of socio-economic development planning and policy making.

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Several countries, especially in Europe, have been collecting environment statistics and, at this stage, have well established programmes. However, for much of the world, particularly the developing world, environment statistics programmes, per se, are non-existent. For a given country, it is not a question of insufficient data, rather, for the most part there is a plethora of data collected by various ministries, offices, non-governmental organizations, and United Nations agencies to name a few sources. Much of the data overlaps or is dispersed among these widely differing sources, and the fundamental problem lies in co-ordination and harmonization of data collection, processing, and dissemination.

What has been lacking is an organized approach towards standardized data collec-

tion and dissemination of environment statistics. The environment statistics programme of the United Nations Statistical Office was established with the objective of developing and promoting methodologies that could be implemented at national and international levels. The following provides a description of this programme, setting out its history, current activities, and some expectations for the future.

2. Historical Development

The United Nations Conference on the Human Environment (Stockholm 1972) led to deliberations of developing an international system of environment statistics. It was recommended that Governments and the Secretary-General of the United Nations, the latter in consultation with the appropriate United Nations agencies, facilitate research on environmental socio-economic and cultural indicators of the quality of human settlements (United Nations (1973)).

The first initiatives pertaining to the development of environment statistics at the international level stemmed from two ECE meetings in 1973. The need for developing international recommendations or guidelines for a system of environment statistics as a long-term objective was recognized.

Given the global environmental concerns expressed at the United Nations Conference on the Human Environment and the outcomes of the two ECE meetings referred to above, a draft programme of international work in the field of environment statistics was submitted by the United Nations Statistical Office to the Statistical Commission at its eighteenth session in 1974 (United Nations (1974)).

The Statistical Commission, at its twentieth session in 1979, approved a joint United Nations Environment Programme (UNEP)/ Statistical Office programme and requested that the programme concentrate on the following:

a. developing guidelines on concepts, definitions, classifications, and methodologies;
b. exploring the feasibility of developing an overall structure or framework for the organization of environment statistics;
c. organizing pilot country studies in order to gain basic experience and to test the suitability and feasibility of the various elements of the programme, particularly those in (a) and (b) above;
d. completing a survey of country practices and plans (United Nations (1979a)).

Since then, the Commission confirmed at its ensuing sessions the priority it attached to the programme and provided guidance on its implementation.

3. Scope and Nature of Environment Statistics

In response to the request for assessing data needs and sources, the United Nations Statistical Office, in 1977, carried out a world-wide survey of environmental concerns, country practices, data needs, as well as of plans and priorities for establishing environment statistics in developing countries.

Environment statistics was found to be multi-disciplinary and to encompass the natural sciences, sociology, demography, and economics. In particular, it was stressed that environment statistics:

a. cover natural phenomena and human activities that affect the environment and in turn affect human living con-

ditions;

b. refer to the media of the natural environment, i.e., air, water, land/soil, and to the man-made environment which includes housing, working conditions, and other aspects of human settlements;

c. should provide a synthesis of data from different subject areas and statistical sources to facilitate integrated socio-economic and environmental planning and policies.

4. Approaches to the Development of Environment Statistics

A comparative analysis of data availability and the co-ordination of data handling activities were called for due to the multi-disciplinary nature of environment statistics and the variety of data producers and users. As mentioned earlier, a number of national and international efforts had been undertaken to develop a system or framework for environment statistics, either for a planned programme of environment statistics, or to organize available data into a coherent statistical publication. These efforts were surveyed by the Statistical Office of the United Nations in order to identify those common characteristics which could be incorporated into a widely applicable international framework (United Nations (1982)).

It appeared that while countries differed in their approaches to developing and organizing environment statistics, there were common elements in the structures of their frameworks and publications. The following four prototype approaches summarize these elements.

a. Media approach

The media approach organizes environmental issues from the perspective of the major environmental components (media) of air, land/soil, water, and the man-made environment. It focuses on a static rather than a dynamic approach, in other words, on the state of the environmental media at different points in time rather than on processes of environmental change. It was found that most countries seemed to follow, at least partly, the approach described here.

b. Stress-response approach

The stress-response approach reflects the inadequacy of the media approach for the description of processes of environmental change. The approach focuses on the transformation of the environment (environmental response) caused by the effects of human intervention with the environment (stress). The original approach was developed by Statistics Canada as a Structural Framework for the Stress-Response Environmental Statistical System (Rapport and Friend (1979)). This framework relates a set of activities that exert stress on the environment to data categories of stressors, stress, environmental response, collective and individual response, and stocks of natural resources and man-made structures.

c. Accounting approach

The resource accounting approach sets out to trace the flow of natural resources from their extraction (harvest) from the environment, through successive stages of processing and final use, to their return to the environment as waste or to the economic sector for recycling. Natural resource accounts have been prepared, for instance, in Norway for energy, minerals, fish, forests, and land. (Central Bureau of Statistics, Oslo (1981)). More recently, monetary environmental accounting approaches have

explored the possibility of incorporating environmental costs and benefits into the System of National Accounts (SNA) as elaborated further below.

d. Ecological approaches

Ecological approaches to statistical data collection and analysis comprise a variety of models, monitoring techniques and ecological indices in a broad field that could be labelled statistical ecology. This field addresses the interface between quantitative ecology and relevant quantitative methods (Patil (1979)), including diverse topics such as the assessment of population diversity and dynamics, biomass production, and the productivity, stability, and resilience of ecosystems. Selected ecosystems have been monitored in this way, utilizing only a limited number of indicators.

The existing national and international approaches indicated a preference for the combination of the media and the stress-response approaches. The next step in the work of the Statistical Office was, therefore, to present a systematic approach to the organization and development of environment statistics based on these two approaches.

5. Framework for the Development of Environment Statistics

At the international level, initial attempts by various programmes sought to develop a system of environment statistics parallel to those in the economic and socio-demographic fields, namely the System of National Accounts (SNA) (United Nations (1968)) and the System of Social and Demographic Statistics (SSDS) (United Nations (1975)). However, in the case of SSDS, the absence of a common *numéraire* which allows for aggregation and the lack of a comprehensive theory led to the abandonment of the system approach in favour of a Framework for Developing and Integrating Social and Demographic Statistics (FSDS) (United Nations (1979b)). It soon became obvious that the same factors applied to the field of environment statistics and, therefore, a framework (rather than a system) approach to the development of environment statistics was developed by the United Nations Statistical Office (Bartelmus (1987)).

The first draft of an international framework had been prepared by the time the Statistical Commission convened its twenty-first session in 1981. The draft had been discussed in regional workshops carried ou for Africa, the Caribbean, Latin Americ and the Pacific. These were designed t identify major environmental concerns i the regions, specify national needs fo environment statistics, identify data gaps. discuss the structure and organization o environment statistics, and to lay the foundation for countries to develop a continuous programme of environment statistics.

It was also used in pilot projects implemented in Kenya, Fiji, and the Dominican Republic. These were designed to identify priority data needs through a systematic assessment of environmental concerns or problems with major data categories, and to test the framework's capability of organizing the compilation and dissemination of priority data.

The draft framework was revised to take into account comments of the Statistical Commission and was published as *A Framework for the Development of Environment Statistics* (FDES) (United Nations (1984)).

FDES was envisaged for the following purposes:

a. reviewing environmental problems and concerns and determining their quantifiable aspects;

Table 1. Format of the framework

Components of the environment	Information categories			
	Social and economic activities, natural events	Environmental impacts of activities/ events	Responses to environmental impacts	Inventories, stocks, and background conditions
1. Flora				
2. Fauna				
3. Atmosphere				
4. Water (a) Freshwater (b) Marine water				
5. Land/Soil (a) Surface (b) Sub-surface				
6. Human settlements				

Source: United Nations (1984)

b. identifying variables for statistical descriptions for the quantifiable aspects of environmental concerns;
c. assessing data requirements, sources, and availability;
d. structuring data bases, information systems, and statistical publications.

FDES relates components of the environment to information categories as shown in Table 1 which sets out the format of the framework.

The components of the environment were established through the initial surveys and research of the Statistical Office. The natural environment consists of the environmental media of air, water, and land/soil, as well as the biota found in these media. The man-made environment is represented by human settlements which consist of physical elements, namely shelter and infrastructure, and services to which these elements provide the material support.

The information categories were based on the recognition that environmental problems are the result of human activities and natural events. They reflect a sequence of action, effect, and reaction. Relevant information, therefore, refers to social and economic activities and natural events, their effects on the environment and the responses to these effects by governments, non-governmental organizations, enterprises, and individuals. A further category of reference and background information was added. Such information brings into perspective human interaction with the environment by means of resource and emission inventories and social, demographic, and economic background material.

FDES does not specify statistical parameters, indicators, classifications, tabulations, or methods of data collection. Statistical concepts, definitions, and methodologies were to be suggested in further methodological reports in different environ-

mental areas, based on FDES in order to avoid overlapping and inconsistencies in concepts and methods among the various statistical fields. It does, however, present statistical topics which are those aspects of environmental concerns which can, at least in theory, be subjected to statistical description and analysis.

6. Technical Reports of Environment Statistics

The first two reports are a further elaboration of FDES providing lists of variables that could be used in the assessment of the statistical topics of FDES. More detailed recommendations of statistical tabulations and analysis for selected areas of environment statistics will be presented in future technical reports.

The technical report entitled *Concepts and Methods of Environment Statistics: Human Settlements Statistics* was published in 1988 by the Statistical Office. Its major purpose is to propose concepts, definitions and classifications for statistical variables that describe environmental and related socio-economic aspects of human settlements. Specific criteria used in selecting these variables were the following:

a. relevance to environmental aspects of human settlements and to corresponding FDES topics;
b. data availability and access;
c. degree of sensitivity to change to environmental and human settlements conditions;
d. international comparability.

Table 2 presents the statistical topics of human settlements in the FDES format (United Nations (1988a)). An illustrative example of variables selected for the statistical topic B.2.1 "Ambient Concentration of Pollutants and Wastes" is shown in Table 3.

A draft of a second report entitled "Concepts and Methods of Environment Statistics: Statistics of the Natural Environment," has been prepared.[2] It is expected to be published in 1990 after further consultation and discussion with international organizations and experts in the field. It follows the structure of FDES in terms of its four basic information categories which have been described above. Table 4 presents the statistical topics for statistics of the natural environment.

The two reports do not provide recommendations for the implementation of a statistical programme. However, they do provide at least a starting point for the identification of appropriate statistical series and should also help to determine relevant classifications, data sources, and tabulations in further methodological reports on high-priority areas of environment statistics.

7. Environmental Accounting

Parallel to the development of environment statistics the accounting approach to the compilation and organization of environmental data was also examined by the Statistical Office. Draft guidelines for statistics on materials/energy balances (MEB), which were seen as a module of a larger system of environment statistics were developed (United Nations (1976a)). The primary purpose of MEB was to trace the extraction and transformation of energy from natural resources, through several successive stages of processing, to final use, and eventually back to the environment as waste or for secondary use.

However, at that time the Statistical Commission concluded that the MEB approach could not be implemented in the short run because countries lacked the

[2] By Anthony Friend, a consultant to the United Nations, with the support of Statistics Canada.

Table 2. Framework for the development of environment statistics – human settlements

Social and economic activities, natural events A	Environmental impacts of activities/events B	Responses to environmental impacts C	Stocks, inventories, and background conditions D
1. *Settlements growth and change* 1.1 Population growth and change 1.2 Construction of shelter and infrastructure 1.3 Utilities (energy and water supply) 1.4 Transport 1.5 Land use in human settlements 2. *Other activities* 2.1 Emission and waste discharge 2.2 Hazardous activities at work-place (not developed) 3. *Natural events*	1. *Conditions of shelter, infrastructure and services* 1.1 Housing 1.2 Access to infrastructure and services 1.3 Human settlements sprawl and dispersion 2. *Conditions of life-supporting resources* 2.1 Ambient concentration of pollutants and wastes 2.2 Biological and ecological impacts (not developed) 2.3 Microclimates (not developed) 3. *Health and welfare conditions in human settlements* 3.1 Exposure and health effects 3.2 Settlements-related damage and accidents 3.3 Perception of the quality of life in human settlements	1. *Human settlements policies and programes* 2. *Pollution monitoring and control* 2.1 Environmental standards 2.2 Monitoring 2.3 Treatment, disposal and reuse of discharges 2.4 Expenditure for pollution control 3. *Prevention and hazard mitigation of natural disaster*	1. *Stocks of shelter and infrastructure* 1.1 Housing stock 1.2 Non-residential buildings and other physical infrastructure 2. *Environmental inventories* 2.1 Emissions 2.2 Hazardous work environment and industries (not developed) 2.3 Human settlements vulnerable to natural disasters 3. *Background conditions* 3.1 Land use 3.2 Demographic and social conditions 3.3 Economic situation 3.4 Weather/climate conditions

Source: United Nations (1988a)

Table 3. Ambient concentration of pollutants and wastes

Variables (Unit of measurement)	Classifications
a. Ambient concentration of air pollutants (micrograms per cubic metre)	Type of pollutant Location of monitoring stations
b. Air monitoring stations (number)	Classes of ambient concentrations Type of pollutant Location of monitoring stations Type of area
c. Concentrations in acid precipitation	(Will be presented in a report on statistics of the natural environment – in preparation)
d. Noise monitoring stations (number)	Classes of noise levels Location of monitoring stations
e. Ambient concentration of water pollutants	(Will be presented in a report on statistics of the natural environment – in preparation)

Source: United Nations (1988a)

necessary statistical capabilities. Therefore, only the energy part of this approach was further developed in balances that showed energy flows from the production of primary energy, through conversion processes, to the stage of final consumption (United Nations (1988b)).

More recently, UNEP and the World Bank organized workshops to re-examine the feasibility of physical and monetary accounting in the areas of natural resources and the environment and to develop alternative macro-indicators of ecologically adjusted and sustainable income and product. The workshops led to a consensus that adequate progress had been made to link environmental accounting to the SNA within a framework of satellite accounts, and to incorporate certain aspects of environmental accounting in the ongoing revision of the SNA. Bartelmus, Stahmer, and van Tongren (1989) proposed a framework for integrated environmental and economic accounting. The main features of the framework are shown in Table 5.

The framework comprises the following two groups of accounting tables:

a. the supply and use/value tables which describe the flows of goods and services produced and their use by economic (production) activities and final demand, accounting for environmental protection services and environmental costs as intermediate consumption;
b. opening and closing balance sheets of economic and environmental assets and changes therein between the beginning and the end of the accounting period.

Table 5 also illustrates that the "stock" assets of balance sheets are linked to the "flow" accounts of the use tables via accounts of tangible wealth accumulation which form an integral part of both groups of tables (Bartelmus (1989)).

The framework will serve as the basis for a Handbook of Environmental Accounting which is being prepared in collaboration

Table 4. Framework for the development of environment statistics – natural environment

Social and economic activities, natural events A	Environmental impacts of activities/events B	Responses to environmental impacts C	Stocks and inventories D
1. *Use of natural resources and related activities* 1.1 Agriculture 1.2 Forestry 1.3 Hunting and trapping 1.4 Fisheries 1.5 Minerals, mining and quarrying 1.6 Energy production and consumption 1.7 Water use for human activities 1.8 Land use and environmental restructuring	1. *Resource depletion and increase* 1.1 Biological resources 1.2 Changes in stocks and flows of cycling systems 1.3 Depletion of non-renewable resources 2. *Environmental quality* 2.1 Atmospheric pollution 2.2 Water quality 2.3 Soil and land quality 3. *Quality of biota and ecosystems* 4. *Human health and environmental disasters*	1. *Resource management* 2. *Pollution monitoring and control* 3. *Prevention and hazard mitigation of natural disasters* 4. *Non-government (individual) responses*	1. *Biological resources* 1.1 Agricultural stocks 1.2 Forest stocks 1.3 Fish stocks 1.4 Fauna and flora inventories 2. *Non-renewable resources* 2.1 Minerals and mining 3. *Energy stocks* 3.1 Non-renewable energy sources 3.2 Renewable energy sources 4. *Biospheric cycling systems* 4.1 Hydrological systems 4.2 Atmospheric cycling systems 4.3 Lithospheric cycling systems 5. *Ecosystems*
2. *Waste loadings and biochemicals* 2.1 Application of biochemicals 2.2 Waste loadings in water, air, land			
3. *Natural events*			

Table 5. Framework for integrated environmental – economic accounting (consolidated)

Supply	Economic activities	Imports
Goods and services	517	75

Opening Balance Sheets
2,753

+ (plus)

Use/Value added				Tangible Wealth Accumulation			
				Economic assets		Environment assets	
	Economic activities	Exports	Final consumption	Reproducible and renewable assets	Non-renewable assets	Environment assets used by economic activities (−)	Assets of economic activities destroyed (+)
Goods and services	224	74	217	77			
GDP	293						
Environmental protection services from final demand	19		− 19				
GDP, environmentally adjusted	274						
Total environmental cost	52			− 25	30	− 95	38
thereof: depletion	6			− 25	− 5	− 1	25
degradation	46				− 27	− 32	13
transfers					62	− 62	
Sustainable GDP	222						
Consumption of fixed capital	26			− 26			
Sustainable NDP	196						
Total	517	74	198	26	30	− 95	38

+ (plus)

Revaluation
531

= (equals)

Closing Balance Sheets
3,340

Source: Bartelmus (1989)

with the World Bank, UNEP, and other organizations.[3] The Handbook will provide guidance and examples of methodologies for users of statistics on environmental accounting in monetary terms in consistency with the SNA. It is intended that the Handbook will be issued as part of the SNA Handbook series and fully cross-referenced in the revised SNA itself. It is anticipated that once a first draft is completed later this year, it will be tested in several countries and the experience used to revise the text prior to its final publication.

8. Compilation and Dissemination of Environment Statistics

The Statistical Office has not yet embarked upon data collection, processing, and dissemination of environment statistics. The results of the regional workshops and pilot country studies undertaken by the Statistical Office suggested that a global programme on environment statistics would best be carried out by the regional commissions at the regional level in co-operation with international organizations and donor agencies. The programme will also aim at establishing national environment statistics, supported by technical co-operation and training. The Statistical Office would assist in the implementation and co-ordination of these programmes to the extent its resources permitted (United Nations (1989a)).

As part of this programme an "experimental compendium" entitled *Environment Statistics in Europe and North America* has been published by the ECE (United Nations (1987)). A second edition of this compendium will be published in 1991. The ECA is in the process of compiling an "*African Compendium on Environment Statistics*" (not yet published). The United Nations Environment Programme (UNEP) has published a second edition of its *Environmental Data Report* which contains a wide variety of environmental and resource information that has been provided by government agencies, non-governmental organizations, and the scientific community (UNEP (1989)). The Statistical Office does not envisage comprehensive data collection at the global level until a sufficient number of regional and national programmes of environment statistics have been established.

9. Co-operation and Co-ordination

At its nineteenth session (8–19 November 1976), the Statistical Commission stressed the importance of co-ordination in the field of environment statistics (United Nations (1976b)). The Statistical Commission, at its twenty-fifth session (6–15 February 1989), stressed the need to strengthen the co-ordinating role of the Statistical Office in the promotion of regional programmes of environment statistics (United Nations (1989b)). To this date, the Economic Commission for Europe (ECE) and the Economic Commission for Africa (ECA) have established environment statistics programmes. The methodological work of ECE has been integrated, as far as possible, into the technical reports prepared by the Statistical Office and, it is hoped that the other regional commissions will play a greater role in the future by establishing their own programmes of environment statistics.

Co-ordination among the different bodies within the United Nations system is carried out by the Sub-Committee on Statistical Activities of the Administrative Committee on Co-ordination (ACC). In a review of international environmental data bases and

[3] The Jessie Smith Noyes Foundation and the Ford Foundation have provided financial support for the preparation of the first draft of this Handbook.

data collection it was found that many agencies are active in the areas of environmental data collection and environmental monitoring. UNEP, in particular, co-ordinates inter-agency efforts on global monitoring through the Global Environmental Monitoring System (GEMS).

10. Future Work

It is expected that the methodological work on concepts, definitions, and classifications of environment statistics will provide a common ground for the establishment of national and international environment statistics, thus enhancing the comparability of such statistics. Considering the complex nature of this rapidly developing field of statistics, the technical reports will undoubtedly be tentative and experimental. Further revisions, resulting from feedback from country and regional applications, are therefore expected. Such feedback is considered essential for the further refinement and standardization of statistical concepts and methods.

The technical report series on environment statistics of the Statistical Office could be expanded to examine in-depth selected areas of high priority in the development of national environment statistics programmes. For example, these reports could deal with environmental issues that cut across the structure of FDES, such as energy, industry and environment, pollution, or particular ecological systems.

The Statistical Commission, at its twenty-fifth session (6–15 February, 1989) reaffirmed the high priority of work on environment statistics and emphasized the importance of further methodological development of this area. It was recommended that a group of specialists from countries interested in co-operating to advance this work should be established to assist the Statistical Office in the development and implementation of the environment statistics programme (United Nations (1989b)).

In response to this recommendation, an Inter-governmental Working Group on the Advancement of Environment Statistics has recently been established and will be holding its first meeting in May 1990. The topics to be addressed by this group include methodology, international data collection, technical co-operation, and programmatic development and co-ordination.

The environment statistics programme of the United Nations aims to assist developing countries in establishing environment statistics programmes and data bases by applying the methodologies developed through technical co-operation projects and training workshops. The Statistical Office will support these activities within the limits of available resources and will monitor and tor and promote the co-ordination of the regional programmes to ensure compatibility as far as possible. In this manner, it is hoped that internationally comparable environment statistics will become available in the long run without duplication of effort.

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