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A FRAMEWORK
FOR THE DEVELOPMENT OF
ENVIRONMENT STATISTICS

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A FRAMEWORK
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ENVIRONMENT STATISTICS

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NOTE

Symbols of United Nations documents are composed of capital letters combined with figures. Mention of such a symbol indicates a reference to a United Nations document.

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PREFACE

The present report presents a Framework for the Development of Environment Statistics (FDES) which has been prepared as part of the Statistical Office of the United Nations Secretariat/United Nations Environment Programme joint project on environment statistics. The Statistical Commission of the United Nations discussed a draft of the framework at its twenty-first session and requested the publication of the revised framework at its twenty-second session.*

The objective of the framework is to assist in the development, co-ordination and organization of environment statistics at the national and international levels. The Statistical Office has developed the present conceptual framework in close collaboration with numerous governmental and non-governmental institutions, international organizations and experts in the field. Their contributions are gratefully acknowledged.

The framework is based on existing national and international approaches to the development and organization of environment statistics, and it combines elements of the most commonly applied structures. Particular national environmental conditions and statistical capabilities may necessitate further refinement and adaptation of the framework. Changing environmental trends and priorities, accompanied by corresponding data requirements, call for a continuous critical review of the purposes of the framework, and periodic revisions are expected.

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* Official Records of the Economic and Social Council, 1983, Supplement No. 2 (E/1983/12 and Corr.1), para. 86 (d).

CONTENTS

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Abbreviations

CES   Conference of European Statisticians

ECE   Economic Commission for Europe

FDES   Framework for the Development of Environment Statistics

FSDS   Framework for the Integration of Social and Demographic Statistics

ISIC   International Standard Industrial Classification of All Economic Activities

SNA   System of National Accounts

SSDS   System of Social and Demographic Statistics

UNEP   United Nations Environment Programme

1.   <u>Environment statistics</u> are multi-disciplinary, their sources are dispersed, and a variety of methods are applied in their compilation. They generally provide a synthesis of data from various subject areas and sources to assist in the formulation and evaluation of integrative socio-economic and environmental policies (paras. 13, 14, 17 and 19).

> The <u>scope</u> of environment statistics includes the media of the natural environment (air/climate, water, land/soil), the biota found within these media, and human settlements (para. 12). Environment statistics describe the quality and availability of natural resources, human activities and natural events that affect the environment, the impacts of these activities and events and social responses to these impacts (paras. 13 and 35).

> Environment statistics are compiled, stored and disseminated by government departments, central statistical services, research institutes, local authorities and international organizations (para. 17). The same institutions are also the <u>major users</u> of environment statistics. Further demand for environmental data arises from business and industry, scientists, the mass communication media and the general public (paras. 19 and 20).

> <u>Methods of data collection</u> include censuses, surveys, the use of administrative records and monitoring networks (para. 17).

2.   The <u>Framework for the Development of Environment Statistics</u> (FDES) assists in the development, co-ordination and organization of environment statistics. In particular, FDES may be utilized for:

>   (a)   <u>Reviewing environmental problems</u> and concerns and determining the quantifiable aspects (paras. 30 and 54-56);

>   (b)   <u>Identifying variables</u> for statistical descriptions of the quantifiable aspects of environmental concerns (paras. 30, 57 and 58);

>   (c)   <u>Assessing data requirements, sources and availability</u> (paras. 30, 59 and 60);

>   (d)   <u>Structuring data bases</u>, information systems and statistical publications (paras. 30 and 61).

3.   FDES relates components of the environment to information categories (para. 32), as shown in the figure below setting out the <u>format of the framework.</u>

	Information categories			
Components of the environment	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				

The components of the environment represent the scope of environment statistics (paras. 33 and 34).

The information categories reflect a sequence of action, impact and reaction. Human activities and natural events exert impacts on the environment which in turn provoke individual and social responses. A further category provides reference and background information (paras. 35-37).

The framework contents consists of statistical topics which are the quantifiable aspects of general environmental concerns. The determination of statistical topics is an important step towards the identification of statistical variables required for the quantification of environmental concerns (paras. 38-47).

4.   FDES does not specify statistical parameters, indicators, classifications, tabulations or methods of data collection. Statistical concepts, definitions and methodologies will be suggested in international guidelines for selected environmental areas which will be prepared by the Statistical Office of the United Nations Secretariat for consideration by the Statistical Commission. The guidelines are based on FDES in order to avoid overlapping and inconsistencies among the various statistical fields (para. 58).

INTRODUCTION

5.   The first initiatives pertaining to the development of environment statistics at the international level came from the Conference of European Statisticians (CES) of the Economic Commission for Europe (ECE) and led to a meeting in March 1973 on statistics for environmental studies and policies. The meeting recognized the need for developing international recommendations or guidelines for a system of environment statistics as a long-term objective. Initially, work was to focus on data requirements and on the development of a minimum statistical data base. It was recommended, however, that general characteristics of a system should be established simultaneously to ensure the coherence of the statistics developed. 1/

6.   A seminar on environment statistics, held at Warsaw in October 1973 under the auspices of CES and the Senior Advisers to ECE Governments on Environmental Problems, confirmed the views of the March meeting on statistics for environmental studies and policies. A system of environment statistics was considered to be the ultimate objective of long-term statistical work, and it was recommended that immediate priority should be given to pollution-related data and the continuing exchange of information on national work in the area of environment statistics. 2/

7.   Taking into consideration the global environmental concerns expressed at the United Nations Conference on the Human Environment 3/ and proceeding from the deliberations of the two ECE meetings referred to above, a draft programme of international work in the field of environment statistics was submitted by the Statistical Office of the United Nations Secretariat to the Statistical Commission at its eighteenth session in 1974. The Commission advocated a step-by-step approach that would concentrate on the needs for and the availability of environment statistics and on providing methodological guidelines, rather than on the building of complex systems. 4/

8.   In response to the request for assessing data needs and sources, the Statistical Office carried out a survey of country practices and plans. The results of the survey indicated that the statistical work concerning such a complex subject as the environment might benefit from structuring the field of environment statistics. Therefore the Statistical Commission, at its twentieth session in 1979 requested the Statistical Office to explore the feasibility of developing a framework for the organization of environment statistics. 5/ A further survey of frameworks and approaches in the field of environment statistics was undertaken. 6/ The survey revealed both the need for and the feasibility of designing a framework for the development and organization of environment statistics at the national and international levels.

9.   The first draft of an international framework had been prepared by the time the Statistical Commission convened its twenty-first session (January 1981). The draft was discussed in regional workshops and utilized in pilot projects in developing countries. It was also reviewed by specialized agencies, regional commissions and experts in the field of environment statistics. Although the first version of the framework was considered too complex for world-wide application, it was widely considered to be a useful and encouraging beginning. The Statistical Commission therefore requested that the framework should be revised. 7/ The revised version was reviewed by a group of experts in September 1982. At its twenty-second session, in 1983, the Statistical Commission requested the publication of the revised framework. 8/

I. THE NATURE OF ENVIRONMENT STATISTICS

10. The Statistical Office has conducted a variety of activities to assess the needs for and the availability of environment statistics to provide a better understanding of their scope and character. These activities include a survey of country practices and plans, regional workshops, pilot country projects and the examination of national and international approaches to the organization and publication of environment statistics. 9/ The major findings of these activities are analysed in the following paragraphs.

A. Definition, scope and characteristics

11. The survey of country practices and plans specifically addressed the question of how to define environment statistics. In most cases, countries found it easier to list component elements of such statistics than to provide a general definition. This reflects the fact that there is no generally accepted model or classification of the environment. No attempt is made, therefore, to establish an a priori definition that goes beyond the broad concept of statistics related to the environment. Only the scope of such statistics, as perceived by major users and producers of environmental data, is examined.

12. The major objective of regional workshops conducted in the Caribbean region, Latin America, Asia and the Pacific, and Africa was the identification of the scope and content of environment statistics as perceived by developing countries. The workshops brought together users and producers of statistics and revealed a large variety of environmental concerns for which statistics should be collected. For industrialized countries, environment statistics compendiums were examined for an indication of the scope and coverage of environment statistics. A comparison of the contents of these compendiums with the concerns identified in the regional workshops showed that the scope of environment statistics is similar in developing and developed countries. Both groups of countries include the media of the natural environment (air, land/soil, water), human settlements, natural disasters, pollution and natural resources within the scope of environment statistics. 10/ However, priorities assigned to different areas of environment statistics may vary among countries.

13. The survey of country practices and plans and the regional workshops also identified a number of characteristics of environment statistics. In particular, it was found that environment statistics:

    (a) Cover natural phenomena and human activities that exert impacts on the enviroment, the impacts on the environment and on human welfare, and means of improving environmental conditions;

    (b) Provide a synthesis of data from different subject areas and statistical sources;

    (c) Cover both qualitative and quantitative aspects of the environment;

    (d) Consist of conventional statistics, monitoring data and remote sensing information.

14. The outstanding feature of environment statistics is their extensive coverage of diversified subjects from the natural sciences, sociology, demography and economics. They comprise economic data from production units (enterprises, establishments), ecological data (referring to appropriate geographical units), data from monitoring stations and social and demographic data (from households and individuals). Frequently, many of these data are produced for purposes other than environmental. Consequently, a wide variety of data sources must be considered in compiling environment statistics.

B. Data needs, sources and uses

15. The general need for and potential uses of environment statistics can be derived to some extent from the perceived scope of environment statistics described above. Specific needs and uses depend on the particular environmental setting, data availability and the information requirements of national and international environmental legislation and administration.

16. The pilot projects of the Statistical Office have included an assessment of data gaps, comparing data availability with information needs. Major data needs have been identified in the areas of water quality and supply, land use and degradation, desertification, deforestation, natural disasters, ecosystems, pollution and waste discharge and their health effects, conservation of natural resources, human settlements and the environmental impacts of development plans, programmes and projects.

17. The surveys, pilot projects, and research undertaken in connection with the establishment of a Directory of Environment Statistics 11/ revealed a dispersion of environmental data sources over a wide variety of primary and secondary data producers. Governmental and intergovernmental bodies, central statistical services, research institutes, local authorities and non-governmental organizations produce and use environmental data. The methods of data collection also vary considerably in countries; they include censuses, surveys, the use of administrative records and monitoring from ground stations and the air (including remote sensing).

18. The pilot projects also indicated a considerable lack of co-ordination of relevant statistical activities. This has led to delays in the transfer of information from sources to users, to the under-use of available data and to duplication of data collection. A mechanism for better co-ordination and organization is needed in these cases to provide comprehensive and up-to-date information to environmental planners and managers. Central statistical offices or, alternatively, interdepartmental committees were suggested as the appropriate co-ordinators of the collection and dissemination of environmental data in the regional workshops.

19. Considering the variations, over time and between countries, in environmental issues and priorities, it is difficult to list a priori specific uses of environment statistics which could at the same time be suggested as the potential data requirements of countries. Planners and policy makers have frequently voiced a need for comparable information on various subjects for integrated socio-economic and environmental development planning. Such information is expected to assist in the formulation of compatible social, economic and environmental goals and in the design and evaluation of sectoral and regional programmes and projects. It is

therefore not surprising that most compendiums of environment statistics state the integration of the widely dispersed environmental data as their major objective.

20.   Policy makers and administrators are not the only users of environment statistics.   Further demand for environmental data arises from business and industry, scientists, the mass communication media, the general public and international organizations.   International organizations, in particular, require internationally comparable data to assess and resolve cross-boundary, regional and global environmental problems. 12/

II. THE FRAMEWORK APPROACH TO ENVIRONMENT STATISTICS

A. Framework versus system

21. Environment statistics are multi-disciplinary in character, their sources are dispersed and a variety of methods are applied in their compilation. Better co-ordination and organization are needed in this complex area of statistics. Statistical frameworks and systems have been successfully applied to this end in the fields of social, demographic and economic statistics. Statistics on economic stocks and flows are integrated in the System of National Accounts (SNA). 13/ A System of Social and Demographic Statistics (SSDS) attempted to develop an information system on population stocks and flows. 14/ This approach was later abandoned in favour of the less rigid Framework for the Integration of Social and Demographic Statistics (FSDS). 15/

22. The concept of a statistical system has established itself primarily in the area of national accounting. The general characteristics of a system such as SNA are typical of most statistical systems. SNA is founded on a widely accepted theoretical model of the economic exchange/flow system; it connects all parts and variables of the system through accounting identities; it can be aggregated and disaggregated using a monetary numéraire, and it applies generally accepted concepts, definitions and classifications.

23. SSDS aimed at similar properties. However, there are important differences between national accounting and social and demographic statistics. In the social and demographic field, no general theory for connecting stocks, flows and structural changes of the population is available, a natural numéraire is lacking and, though some statistical standards exist, they are far from being commonly applied. Work has been shifted, therefore, from developing a system (SSDS) to a framework approach (FSDS). FSDS identifies fields of social concern with an illustration of classifications and selected indicators for application in developing countries. 16/

24. The international discussion of environment statistics has advocated a similar move from the original system approach to a more flexible framework (see paras. 5-8 above). Most of the above arguments against an international system of social and demographic statistics, namely, the lack of a generally accepted theory and standards and of a common numéraire, hold for environment statistics as well. FDES has been designed, therefore, as a tool to assist in the development, co-ordination and organization of environment statistics and indicators. This is achieved through the identification of statistical topics which constitute the framework contents. Statistical concepts, definitions, classifications or tabulations are not suggested as part of this framework. They will be described in guidelines for selected fields of environment statistics (see para. 58 below).

B. Current approaches to the organization of environment statistics

25. Various national and international efforts have been made towards developing a system or framework for environment statistics, either for a planned programme of statistics or for presenting available data in a coherent statistical publication. These efforts were surveyed by the Statistical Office of the United Nations Secretariat in order to identify those common characteristics which could be incorporated into a widely applicable international framework. 17/ The survey

showed that while no two countries have the same approach to developing and organizing environment statistics, there are many common elements in the structures of their systems, frameworks and publications. These elements can be subsumed under four basic approaches, namely, the media approach, the stress-response approach, the accounting approach and the ecological approach. The existing national and international approaches indicate a preference for the combination of the media and the stress-response approaches.

26. The media approach organizes environmental issues from the perspective of the major environmental components of air, water, land/soil and the man-made environment. It aims at assessing the state of the environmental media at different points in time rather than at monitoring processes of environmental change continuously. The media approach complies with conventional statistical and administrative concepts and classifications and the popular perception of the environment. It does not permit, however, the analysis of interactions between human activities and the environment.

27. The stress-response approach was developed in recognition of the inadequacy of the media approach for the description of processes of environmental change. It focuses on impacts of human intervention within the environment (stress) and the environment's subsequent transformation (environmental response). The original approach was developed by Statistics Canada as a "Structural Framework for the Stress-Response Environmental Statistical System". 18/ The stress-response framework relates a set of activities that exert stress on the environment (such as waste generation, extraction of natural resources and the production of hazardous substances) to the following data categories:

(a) Measures of stressors, that is, of human and natural activities which possess the potential to degrade the quality of the natural environment, to affect the health of man, to threaten the survival of species, to place pressures on non-renewable resources, and to cause a deterioration in the quality of human settlements;

(b) Measures of stress, that is, of the elements that place pressures on and contribute to the breakdown of the natural and man-made environment such as the emission of pollutants;

(c) Measures of environmental response, that is, of the observed effects of stress on the natural and man-made environment;

(d) Measures of collective and individual response, that is, of man's reactions to environmental changes such as environmental protection and conservation;

(e) Measures of stocks, that is, of the stocks of natural resources, man-made structures and potentially hazardous substances.

28. The resource accounting approach aims at tracing 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. Actual accounts have been prepared in Norway for energy, minerals, fish, forests and land. 19/ As far as possible, the system has been made compatible with SNA. Material (stock and flow) accounts are distinguished from environmental accounts. The environmental accounts are the least developed, both theoretically and in practice; they are intended to record

waste flows between the economic system and the stock of environmental resources by means of emission accounts and to describe changes in environmental quality by state (of the environment) accounts. 20/

29. Ecological approaches to statistical data collection and analysis include a variety of models, monitoring techniques and ecological indices. They deal with such diverse topics as the assessment of population diversity and dynamics, of biomass production and of the productivity, stability and resilience of ecosystems.

C. Purposes and properties of the framework

30. The need for a framework which assists in the development, co-ordination and organization of environment statistics has been described above. Use of such a framework is envisaged for the following specific purposes:

    (a) The review of environmental problems and concerns and the determination of their quantifiable aspects;

    (b) The determination of variables for statistical descriptions of the quantifiable aspects of environmental concerns;

    (c) The assessment of data requirements, sources and availability;

    (d) The structuring of data bases, information systems and statistical publications.

The proposed framework has been used for most of these purposes by the Statistical Office (see chap. IV below).

31. With the above purposes in mind, the following properties of an internationally applicable framework have been identified and used as criteria in designing FDES:

    (a) Flexibility. Sufficient flexibility allows the adjustment of the framework to particular environmental conditions, priorities and statistical capabilities, as well as the incorporation of emerging knowledge about environmental phenomena and assessment methods. Flexibility is accomplished by keeping the framework on a sufficiently general level and by leaving it up to its users to expand and modify it or to select and rearrange its components. A compromise has to be found, however, between flexibility and the need to maintain the basic structure and logic of the framework;

    (b) Consistency. Consistency in concepts, definitions and classifications permits linkage of the different parts and elements of a statistical system. Definitions and classifications in FDES are quite rudimentary to allow for maximum flexibility. Certain minimal conceptual, procedural and taxonomic criteria are, however, applied consistently throughout the structure and contents of FDES. These criteria relate to the breakdown of the environment, to a set of information categories and to the application of both these aspects in determining the framework contents;

    (c) Comprehensiveness. A framework for environment statistics should permit access to the whole spectrum of current and potential environmental concerns, whether the objective is to deal with all of them or with only a selection of them.

III. A FRAMEWORK FOR THE DEVELOPMENT OF ENVIRONMENT STATISTICS

A. Structure of the framework

32. The FDES format has evolved from the joint consideration of the scope and nature of environment statistics (see chap. I) and the purposes and properties of such a framework (see chap. II). A synthesis of these factors has resulted in a two-way table which relates basic components of the environment to various categories of information, as shown in the figure below setting out the format of the framework.

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				

33. The components of the environment are based on the description of the scope of environment statistics established through the initial surveys and research of the Statistical Office (see para. 12 above). The natural environment includes 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. 21/

34. To remain flexible, the components of the environment are presented in a highly aggregated manner in the framework. The intention is to not pre-empt choices of disaggregation. Framework users may opt for a more detailed or selective breakdown of the environment in accordance with their specific needs and conditions.

35. The information categories are based on the recognition that environmental problems are the result of human activities and natural events. They reflect a sequence of action, impact and reaction. Relevant information, therefore, refers to social and economic activities and natural events, their impacts on the environment and the responses to these impacts by Governments, non-governmental organizations, enterprises and individuals. A further category of reference and background information is 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.

36. The categories of activities, impacts of activities and responses to impacts imply certain cause and effect relationships which constitute a principle of organization within the framework. A particular set of causes and effects, however, is not specified since the columns under each information category list activities and impacts independently of each other. No one-to-one relationship is established in the framework tables (see sect. D below) between an activity, its impact and the social response to the impact. A number of activities or responses may be the cause of a number of impacts. Agricultural activities, for example, may cause deforestation and soil erosion through inappropriate land use, and mining and forestry may aggravate the impacts on forests and soil. Therefore the underlying assumptions involving relationships should not be viewed as established facts but rather as a challenge for statistical verification. The framework helps to identify and organize the various types of information which may be useful for tracing and verifying actual cause and effect relationships.

37. Any breakdown in a sequence of action, impact and reaction is arbitrary to some extent. Current activities may reflect responses to impacts of previous activities, and environmental impacts may result from social and economic activities as well as from responses to earlier impacts. Test applications of the framework, however, have shown that its information categories permit the grouping of data according to common substantive and institutional features. Social and economic activities can be described to some extent by existing social, demographic and economic statistics. Monitoring data have to be used extensively for statistics of environmental impacts. Public and private responses can be covered by statistics on governmental, commercial and household activities classified by function rather than output (see para. 49 below). Much data on background conditions are routinely collected by statistical offices. Routine collection of data on the stocks and use of natural resources might evolve in the context of resource accounting. Inventories of emission and species are usually established as starting points for the monitoring of pollution and living resources.

B. Contents of the framework

38. The contents of the framework consist of those aspects of general environmental concerns which can, at least theoretically, be subjected to statistical description and analysis. The determination of statistical topics constitutes an important step towards the identification of the variables required for the statistical analysis of environmental concerns. The framework does not deal with statistical variables. They are the subject of detailed guidelines for selected areas of environment statistics and are discussed further below (see paras. 57 and 58).

39. An attempt has been made to cover most of the quantifiable aspects of the environmental concerns in the framework tables (see sect. D, below). However, the lists of statistical topics are not necessarily exhaustive. Individual topics vary considerably in their level of aggregation. This is not necessarily a major drawback since the level of detail can be decided by users according to their particular needs. The pilot projects have shown that the framework's generality and flexibility permit such modification without changes in its basic structure.

40. The statistical topics exhibit characteristics of both the environmental component and the information category under which they are presented in the framework tables. The statistical topics are reviewed for each information category. For an analysis of a particular environmental component, the framework can be read horizontally across the information categories.

1. Social and economic activities, natural events

41. Human activities and natural events include those which may have a direct impact on the components of the environment under which they are shown. Human activities consist mostly of production and consumption, but they may also include activities in pursuit of non-economic goals. They produce environmental impacts through the direct use or misuse of natural resources or through the generation of waste in production and consumption processes. Natural events and disasters are also included in this information category because human activities frequently contribute to natural disasters. Disastrous events have been triggered by human activities, for example, increased flood discharge resulting from deforestation. Moreover, the mere occupation of hazardous areas may be the reason for a natural event turning into a disaster.

42. Factors or trends of human action for which a direct environmental impact cannot be established, but which may have a significant influence on activities that do have an impact are listed as background conditions under the fourth information category. Measures of environmental policy and management are shown in the response category of environmental information. It may not always be easy to distinguish between response and impact activities; for instance, where the response is part of a change in a production process which creates new environmental impacts.

2. Environmental imparts of activities/events

43. The statistical topics under this information category represent impacts of socio-economic activities (including those of environmental responses) and natural events on the components of the environment and ultimately on human welfare. Environmental impacts may be harmful or beneficial. Even a single activity may have positive effects accompanied by negative effects. For example, river damming may control floods and provide hydropower, but may simultaneously prevent natural fertilization of adjacent land and may upset ecological balances.

44. Environmental impacts usually relate to the environmental component under which they are displayed. In some instances, in the case of acid rains for example, where a distinct sequence of impacts (i.e, air pollution, acid precipitation, water pollution, disruption of ecosystems) can be established, impacts on other environmental components are also shown.

3. Responses to environmental impacts

45. Individuals, social groups, non-governmental organizations and public authorities respond to documented or anticipated environmental impacts of human activities and natural events. Their responses are activities designed to prevent, control, counter, reverse or avoid negative impacts and to generate, promote or reinforce positive ones. Such activities include appropriate policies and the programmes and projects to implement them. They comprise the monitoring and control of pollutants, the development and application of environmentally sound technologies, changes in consumption patterns, sustainable management and use of natural resources and relief actions in the case of natural and man-made disasters.

4. Inventories, stocks and background conditions

46. Statistical topics in this category are intended to bring into perspective those in the other information categories. They include the stocks of natural resources and refer to inventories of habitat, infrastructure and emissions as well as to economic, demographic, meteorological or geographical background conditions.

47. A direct link between the stock data presented in this information category and the interaction or impact data of the other information categories can be established by means of balance sheets or resource accounting (see para. 50 below). For other topics, namely, production and consumption patterns, price/cost structures and changes and trends in urbanization and industrialization, these links are not so obvious. These topics shed light on the settings within which specific activities and their impacts take place.

C. Relationships to national and resource accounting systems

48. FDES does not contain recommendations for statistical concepts, definitions, classifications and tabulations, as does SNA. Therefore direct linkages through common concepts and classifications have not yet been established between FDES and SNA or any other accounting system. However, concepts, definitions and classifications are being developed at present through guidelines for statistics in selected environmental areas. These guidelines are based on FDES and will employ the concepts and classifications of SNA as far as possible. A compatible system of environment statistics might consequently evolve after the major environmental fields have been covered by the guidelines.

49. A number of relationships can be developed more easily. Many of the activities in the first information category of FDES are also listed in the economic activity classification employed in SNA. 22/ To relate these activities to particular environmental impacts, they would have to be broken down and regrouped by technical processes and/or uses of environmental resources. Such a classification would inevitably cut across the boundaries of the ISIC divisions and groups. It should be easier to identify environmental responses of government agencies in the classification of the functions of government of SNA. 23/ This classification includes various environmental aspects under housing, recreation and culture, agriculture, forestry, fishing and hunting, mining and transportation. It also indicates the classes which contain relevant information on the protection of the environment. A corresponding functional breakdown of industry 24/ and household expenditures would facilitate the estimation of the costs of
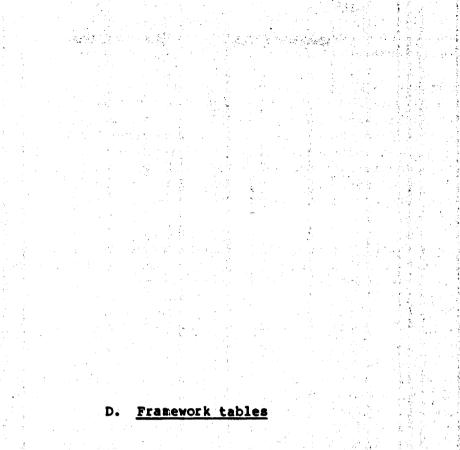
environmental policy. There are, however, considerable problems in distinguishing environmental responses from economic activities; for instance, in the case of production processes modified to comply with environmental regulations.

50. The framework's information categories of activities, impacts, responses and stocks are also reflected in the resource accounting approach which assesses the stocks, extraction and use of, as well as environmental impacts, on selected resources (see para. 28 above). Stocks or reserves of natural resources are listed in FDES under the information category of inventories, stocks and background conditions. The extraction, harvesting and use of natural resources are shown as part of the category of social and economic activities, and changes in the availability and quality of natural resources are listed under the environmental impact category.

51. The accounting for stocks of natural resources and certain aspects of the man-made environment is part of SNA only to the extent that these stocks represent accumulated investment in the development of resources, such as land improvement, construction of oil wells and timber tracts. International guidelines on statistics of tangible assets 25/ expand on the concept of stocks of assets to include the total value of the stock of natural resources. A distinction is made in the guidelines between non-reproducible tangible assets (land, timber tracts and forests, subsoil assets and extraction sites, fisheries and historical monuments) and reproducible tangible assets (which include fixed assets and inventories in human settlements and bioproductive systems). Physical changes between the opening and closing of assets at two points in time are presented as capital formation, retirements, and scrapping and reconciliations. Scrapping and reconciliations, in particular, are reflected in the impact information category as depletion, growth/increase and losses (due to natural disasters/events) of natural resources.

52. In the light of the limitations of the SNA approach to accounting for natural resources, an attempt has been made to supplement SNA with materials/energy balances. 26/ These balances are designed to account for all major physical flows of materials comprehensively and in detail in terms of processes of extraction, production and consumption. This approach has been considered to be a long-term venture because the statistical data base for such an exercise is still inadequate in most countries.

D. Framework tables

Framework for the Development of Environment Statistics

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	Agricultural and livestock production (including land clearing, irrigation, grazing, harvesting, use of fertilizers and pesticides)	Proliferation, depletion, extinction of species	Protection of endangered species	Inventory of species and genetic resources
	Forestry and logging	Depletion/growth of forests and woodlands	Protection of habitat (land use regulation and zoning, national parks, reserves and protected areas)	Inventory of vegetation cover (e.g., forest inventory)
	Firewood and charcoal production	Impacts of pollution on vegetation cover (e.g., from acidic precipitation)	Forest management (including afforestation)	Inventory of emissions hazardous to flora
	Competing land use (e.g., settlements, agriculture, forestry, transportation, mining, recreation)	Changes of habitats/ecosystems (including species diversity)	Alternative production and storage processes (e.g., agriculture, firewood production, energy)	Land use and characteristics
	Emissions hazardous to flora	Impacts on land/soil (e.g., desertification and erosion due to removal of vegetation cover, biochemicals in soils)	Pollution monitoring and control	Socio-economic factors affecting flora (population growth, density, migration, food and energy production and consumption)
	Natural disasters (e.g., floods, droughts, storms, earthquakes, pests)	Changes in water régime (from deforestation and removal of other vegetation)	Health protection (food quality control, alternative food resources)	Weather/climate
	Climatic changes	Climatic impacts	Prevention and mitigation of natural disasters (e.g., forecasting, flood control, pest management)	
		Human health and welfare impacts (e.g., food contamination, crop losses from natural disasters, post-harvest losses, productivity/cost changes in agriculture, forestry, tourism and recreation)		
2. Fauna	Livestock production	Proliferation, depletion, extinction of species	Hunting, fishing and breeding regulations and control	Inventory of species and genetic resources
	Hunting, trapping and game propagation	Migration of species	Protection of habitat (land-use regulation and zoning, national parks, reserves and protected areas)	Inventory of habitats/ecosystems
	Fishing	Contamination of species	Pollution monitoring and control	Inventory of emissions hazardous to fauna
	Use of draught animals	Changes of habitats/ecosystems (including species diversity)	Health protection (food quality control, alternative food resources)	Land use and characteristics (e.g., agriculture, tourism, settlements)
	Competing land use (e.g., agriculture, ranching, settlements, wildlife, recreation)	Human health and welfare impacts (nutrition-related effects, zoonoses, productivity/cost changes in livestock production, hunting and fishing, impacts of wildlife on agriculture, recreation and tourism)	Prevention and mitigation of natural disasters (e.g., forecasting, pest control)	Socio-economic factors affecting fauna (population growth, density and migration, food production and consumption)
	Emissions hazardous to fauna			Weather/climate
	Natural disasters (e.g., droughts, fires, pests)			

Framework for the Development of Environment Statistics (continued)

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
3. Atmosphere	Wind and solar energy generation	Climatic changes	Weather and climate prediction and control	Emission inventory (types, sources of air pollutants)
	Air transportation	Air quality (ambient concentrations of air pollutants)	Monitoring and control of air pollution	Inventory of areas vulnerable to air pollution and climate/weather extremes
	Weather/precipitation control	Biological and ecological impacts (contamination and destruction of species, disruption of ecosystems, e.g., by acidic precipitation)	Alternative land use, production processes and consumption patterns (e.g., alternative energy sources)	Land use and characteristics (including topographical conditions)
	Land use affecting climate (deforestation, desertification, drainage, irrigation, urban sprawl, infrastructure)	Impacts on land, water and artifacts related to air pollution (e.g., from acidic precipitation)	Health protection	Socio-economic factors affecting air quality and weather/climate conditions (population growth and density, urbanization, industrialization, transportation, production and consumption patterns)
	Emission of air pollutants from stationary and mobile sources (industry, agriculture, households, transportation)	Human health and welfare impacts (morbidity and mortality associated with air pollution and natural disasters, productivity/cost changes)	Prevention and mitigation of natural disasters	
	Natural disasters and events (e.g., volcanic eruptions, floods, droughts, storms, heat waves, cold fronts)			
	Climatic changes			
4. Water (a) Fresh-water	Water withdrawal (surface water, ground water, other sources)	Water quantity (water levels, flow and supply)	Conservation and development of water resources (for industrial, domestic and agricultural use, including water restoration)	Inventory of water resources
	Water use (industrial, domestic and municipal, agricultural)	Water quality (ambient concentrations of biological contaminants, chemical substances and suspended solids, chemical and physical characteristics)	Water treatment (primary, secondary, tertiary)	Inventory of aquatic ecosystems
	Instream water use (hydro-power generation, transportation, fishing, recreation)	Biological and ecological impacts (e.g., eutrophication, contamination and destruction of biota)	Conservation of aquatic ecosystems and their biota	Emission inventory (types, sources of discharges/water pollutants)
	Waste water and discharges (including sedimentation)	Water-related impacts on climate and land (e.g., quality of precipitation, erosion, salination, water logging, flood and drought areas)	Pollution monitoring and water quality control	Land use and characteristics (e.g., type of vegetation cover, built-up area, soil types, vulnerability)
	Natural disasters (e.g., floods, landslides, droughts)	Human health and welfare impacts (water-borne diseases, impacts of natural disasters, productivity/cost changes in water-using activities)	Health protection	Socio-economic factors affecting water use (population growth, density and migration, production and consumption activities, infrastructure, water budgets)
	Climatic changes		Prevention and mitigation of natural disasters and events (e.g., flood control and relief, afforestation, terracing, forecasting and early warning)	Hydrological balance

Framework for the Development of Environment Statistics (continued)

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
(b) Marine water	Non-consumptive water use (tidal energy generation, transportation, fishing, recreation) Water withdrawal and use (desalination, consumption) Competing coastal land use (e.g., infrastructure development, tourism, recreation, exploitation of mangrove areas and coral reefs) Seabed mining (including offshore oil drilling) Emissions (from the coast and rivers, sea-dumping, oil spills) Natural disasters (storms, tsunamis)	Ambient concentrations of pollutants (marine waters and coastal areas) Biological and ecological impacts (proliferation, depletion, extinction and contamination of marine biota, disruption of habitats/ecosystems) Human health and welfare impacts (e.g., water-borne diseases, impacts of natural disasters, impacts on tourism and recreation)	Conservation and development of marine waters and coastal areas (e.g., marine parks and reserves) Conservation of ecosystems (marine/coastal) Pollution monitoring and control Health protection Prevention and mitigation of natural disasters (forecasting, relief, reconstruction)	Inventory of ecosystems (marine/coastal) and species Emission inventory (types, sources of marine water pollutants) Coastal land use and characteristics Socio-economic factors affecting the use of marine waters (population growth, density and migration, industrialization and infrastructure development, tourism) Weather/climate
5. Land/soil				
(a) Surface	Land use (agricultural and livestock production, forestry and logging, mining and quarrying, human settlements, transportation and communication, recreation) Waste and waste water discharge onto land (from production and consumption activities) Natural disasters (e.g., earthquakes, landslides, volcanic eruptions, tidal waves, floods, droughts)	Land/soil gain/loss (e.g., land development, loss of agricultural land to competing land uses, erosion) Land/soil quality (erosion, desertification, water logging, salination, alkalinization, ambient concentration of soil pollutants) Terrestrial ecosystems (e.g., changes in energy, material and nutrient flows, system productivity, species growth and diversity) Human health and welfare impacts (e.g., soil-borne diseases, impacts of natural disasters, road and rail accidents, productivity/cost changes in land-based activities such as agriculture, tourism and recreation)	Land use regulation and zoning Conservation of soils and ecosystems (e.g., afforestation, protected areas, desertification control, alternative environmentally sound production methods) Waste disposal (including recycling) and pollution monitoring and control Prevention and mitigation of natural disasters (e.g., early warning, land-use policies, relief)	Inventory of soil/land (including land use and tenure, land characteristics and topographical conditions) Inventory of vulnerable areas (e.g., disaster-prone areas, wetlands) Inventory of terrestrial ecosystems Emission inventory (types and sources of solid and liquid wastes and soil pollutants) Socio-economic factors affecting land use (population growth, density and migration, urbanization, industrialization, rural development, production and consumption patterns) Weather/climate

Framework for the Development of Environment Statistics (continued)

Components of the environment	Social and economic activities, natural events	Environmental impacts of activities/events	Responses to environmental impacts	Inventories, stocks and background conditions
		Information categories		
(b) Sub-surface	Mining and treatment of metallic and non-metallic minerals	Depletion/increase of mineral (including energy) reserves	Reclamation and rehabilitation of land	Inventory of mineral resources (reserves of metallic and non-metallic minerals and energy resources)
	Extraction of energy resources (fossil fuels, geothermal and nuclear resources)	Land disturbance (e.g., open pits, waste disposal)	Conservation of land and ecosystems (e.g., mining regulations and control, protected areas)	Inventory of ecosystems
		Ambient concentrations of air and water pollutants		Emission inventory (types, sources of discharges related to mining)
	Discharges (dusts and air pollutants, acid drainages, tailings, liquid wastes, radioactive waste disposal)	Disruption of ecosystems	Recycling, substitution of mineral resources (including energy resources)	Land use and characteristics (land-use categories, vulnerable and protected areas, topographical and geological characteristics)
		Human health and welfare impacts (e.g., mining accidents, contamination of mine workers, productivity/cost changes in mining operations, impacts of land disturbance on recreation and tourism)	Pollution monitoring and control	Socio-economic factors affecting demand and supply of mineral resources (price/cost fluctuations, demographic factors, production and consumption patterns)
			Health protection (e.g., for mining operations)	
6. Human settlements	Population growth and migration	Urban sprawl and concentration (conversion of land to urban use, population density and concentration)	Housing policies and programmes (e.g., low-cost housing and community services, rehabilitation and upgrading, housing finance, building codes and regulations, alternative construction technologies, slum clearance)	Inventory of buildings, facilities and infrastructure (e.g., type, condition, ownership)
	Construction (residential, non-residential)	Housing shortage and occupancy, access to utilities and community services		Inventory of hazardous industries, workplaces and activities
	Utilities (energy and water supply)	Marginal housing (slum and squatter settlements, decline of inner cities, sub-standard rural housing)	Land policies and control (zoning, resettlement and land development)	Emission inventory (types, sources of pollutants in settlements)
	Transportation (public, private)		Self-help housing and community development programmes	Land use (pattern, land tenure) and characteristics
	Land use in human settlements (residential, industrial, commercial, transportation and other infrastructure, social, cultural and recreational)	Ambient concentrations of waste and pollutants	Monitoring and quality control of working environment	Socio-economic factors affecting human settlements (e.g., demographic factors, industrialization, rural development, informal sector, labour market, cost/price structure and development, income distribution)
		Noise (level, exposure)		
	Emissions and waste discharges	Biological and ecological impacts (especially from urban sprawl and infrastructure development)	Conservation of energy and water, alternative construction technology	Weather/climate
		Climatic impacts		

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Framework for the Development of Environment Statistics (continued)

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
Human settlements (continued)	Hazardous activities in workplaces Natural disasters (e.g., earthquakes, landslides, floods, hurricanes)	Human health and welfare impacts (e.g., contamination, communicable diseases, occupational diseases and work accidents, traffic congestion and accidents, impacts of natural disasters, crime and delinquency)	Pollution monitoring and control (including waste disposal and recycling) Health protection (health services and sanitation) Prevention and mitigation of natural disasters	

IV. APPLICATION OF THE FRAMEWORK

53. FDES has been designed as a tool for the development, co-ordination and organization of environment statistics at the national and international levels. The following illustrates how the framework can be used to meet this general objective by serving the various purposes described earlier (see para. 30, above).

A. Review of environmental problems, concerns and related statistical topics

54. A review of environmental problems will usually be the first step taken to establish a programme of environment statistics in a country or region. The review can be based on an analysis of reports on the state of the environment, research on particular environmental impacts or a survey of environmental problems by means of questionnaires distributed to appropriate institutions and experts. Further evaluation of the relative importance of environmental problems by experts and decision makers will assist in determining high-priority concerns on which statistical activities should focus. The presentation of environmental concerns within the framework format permits the concerns to be matched with the statistical topics listed in FDES so that the quantifiable aspects of each concern may be specified.

55. A pilot study in the Pacific Islands, undertaken for the Statistical Office, proceeded in this manner. Regional concerns were identified by studying environmental country reports and by sending a questionnaire to experts in the field. The experts were asked to provide a ranked priority list of the most significant environmental concerns. A combined general list for the Pacific region was compiled in the framework format.

56. The actual matching of environmental concerns with the statistical topics of FDES was carried out in another pilot project in the Dominican Republic. An extensive list of environmental concerns, topics and statistical parameters, prepared by the Department of Environmental Planning of the Technical Secretariat of the President, was cross-referenced to the statistical topics of FDES for the area of freshwater. Table 1 illustrates this effort, presenting statistical topics for selected environmental concerns in the framework format.

Table 1. Application of FDES: statistical topics for selected freshwater concerns

(Dominican Republic)

Information categories

Social and economic activities, natural events	Environmental impacts of activities/events	Responses to environmental impacts	Inventories, stocks and background conditions
Agricultural water use - irrigation	Environmental pathology	Sanitation	Inventory of surface waters
1. Technology applied	1. Type and extent of water depletion	1. Water treatment	1. Rivers
2. Users	2. Concentration of chemical pollutants in water	2. Planning of water supply	2. Lakes and lagoons
3. Consumption for cultivation, by technology applied	3. Concentration of pathogenic micro-organisms	3. Waste water disposal	3. Reservoirs
4. Type of water drawing (direct, regulated, gravity, pumping)	4. Costs of use/activity		
5. Drainage	5. Health impacts of contaminated water (water-borne diseases)		

Source: Dominican Republic, Proyecto Piloto de Información Ambiental para el Desarrollo: Informe Final, vol. I (Santo Domingo, 1983), in Spanish only.

B. Determination of the statistical variables

57. For the quantification of statistical topics, those statistical variables which are representative of the main characteristics of the statistical topics need to be identified. The selection and definition of variables for specific purposes, or for characteristics reflecting these purposes, is a central methodological concern in any field of applied statistics. For some environmental fields, statistical methodology already exists and should be referred to in delineating statistical variables. For other fields, methodology still needs to be developed.

58. At the international level, the Statistical Office has been requested by the Statistical Commission to assist countries in developing concepts, definitions, classifications and methods of data collection and dissemination for selected areas of environment statistics by providing international guidelines. A sectoral approach requires a common framework to minimize the overlap of subject areas and to ensure the consistency of concepts and classifications. The Statistical Office has utilized FDES in preparing outlines for guidelines in the areas of freshwater, human settlement and energy statistics. To date, draft guidelines which list statistical variables, definitions and classifications in the framework format have been prepared for the area of freshwater statistics. The variables suggested for a selected statistical topic in each of the information categories of FDES are shown in table 2. The variables included in the guidelines represent key variables which have been selected on the basis of relative importance and data availability. A further subset of priority variables is marked with an asterisk.

Table 2.   Application of FDES: Guidelines for freshwater statistics - Selection of variables

Information categories

Social and economic activities, natural events	Environmental impacts of activities/events	Responses to environmental impacts	Inventories, stocks and background conditions
Waste water and discharges	Ground- and surface-water quality	Responses to pollution - preventive and purification measures	Water storage (inventory) of water resources)
(a) Industrial waste water (m³)	(a) Biological variables (µg/l)	*(a) Population served by municipal waste water	*(a) Ground-water volume in aquifers (km³)
(b) Waste water from sewage systems (m³)	(b) Chemical variables (µg/l)	*(b) Dwellings served by municipal waste water treatment plants (number)	(b) Lakes and reservoirs, volume (km³)
(c) Domestic waste water outside sewage systems (m³)	(c) Physical variables (suspended and total dissolved solids, conductivity, salinity, radioactivity)	*(c) Industrial plants with waste water treatment (number)	*(c) Lakes and reservoirs, area (km²)
(d) Other waste water (m³)	(d) Bacteriological variables (most probable number per 100 ml)	*(d) Animal waste treatment facilities (number, volume treated)	(d) Snow and glaciers, volume (km³)
*(e) Discharged substances (tons)	*(e) Water quality classes	(e) Oil waste reception facilities (number, volume treated)	(e) Rivers and canals, volume (km³)
(f) Discharges from ships (tons)		(f) Expenditure for water-treatment (monetary units)	(f) Rivers and canals, length (km)
*(g) Estimated discharges from non-point sources due to agricultural practices (including forestry) (tons)		(g) Changes in production processes, agricultural practices (verbal description)	(g) Wetlands, volume of water (km³)
(h) Total transport of substances at river mouths (tons)			(h) Wetlands, area (km²)

*   Priority variables.

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C. Assessment of data requirements, sources and availability

59. After the statistical variables that are the most relevant for statistical descriptions of environmental concerns and statistical topics have been identified, data requirements for environmental planning and policy can be expressed in terms of these variables. Data needs are usually expressed by data users rather than by producers such as national statistical services. This was the case in the Dominican Republic where, in the first phase of the pilot project, a long list of environmental concerns, topics and parameters representing the data requirements for development planning was prepared by government agencies. For the pilot projects in Fiji and Kenya, interministerial committees of environmental managers provided information on data needs.

60. Those experiences confirmed that the needs for environment statistics are primarily expressed by decision makers. Data needs should be formulated more rigidly, however, in terms of statistical variables in order to determine the extent to which they can be satisfied by available statistics. FDES has been used in comparing data needs and sources in Fiji and Kenya. In both countries, these efforts have gone far beyond a simple listing of sources and variables and include data coverage, periodicity, quality, collection methods and the relevance of data for environmental policies. Table 3 illustrates the approach in Kenya for selected variables in each information category.

Table 3. Application of FDES: freshwater - Availability of data for selected statistical topics

(Kenya)

Information/categories statistical topics	Statistical variables (unit of measurement)	Data availability	Relevance of data to environmental policy	Periodicity	Coverage	Data quality	Data sources	Data collection	Remarks
Social and economic activities, natural events: water withdrawal	Municipal use (m³)	A	C	Annual	U	G	MOWD	Administrative records	
	Rural use	C	C	..	..	..	..	..	
	Industrial recirculation (m³)	B	C	Annual	U	V	MOWD, MOI	Ad hoc surveys	At selected sites only
	Irrigation (thousands of m³/year)	B	C	Irregular	S	V	MOWD, MOA	..	
Environmental impacts of activities/events: water quality	For example, suspended solids	B	C	Annual	S	V	MOWD	Monitoring	
Responses to environmental impacts: water treatment	Sewage purification systems (number)	A	C	Annual	S	G	MOWD	Annual returns	
	Investments/expenditures (KE, thousands)	A	C	Annual	N	G	MOWD, CBS	Annual estimates	
Inventories, stocks and background conditions	For example, run-off area (km²)	A	C	Irregular	N	V	MOWD, CBS, UON, MOA	Geographical mapping	
	Rivers, number and length (km)	A	C	-	N	-	MOA	Geographical mapping	

Source: Kenya, Ministry of Economic Planning and Development, Central Bureau of Statistics, A Pilot Project on Environmental Statistics in Kenya, vol. I (Nairobi, 1980/1981).

Notes

Data availability: A: available; B: partially available; C: not available.
Relevance of data to environmental policy: C: crucial; I: important; P: potentially important; M: marginally relevant.
Coverage: G: global; R: regional; N: national; S: subnational (province, district); R: rural; U: urban; In: international.
Data quality: G: good; V: varies in quality; Pr: poor.
Data sources: CBS: Central Bureau of Statistics; MOA: Ministry of Agriculture; MOI: Ministry of Industry; MOWD: Ministry of Water Development; UON: University of Nairobi.
Two dots (..) indicate that data are not available or are not separately reported.
A hyphen (-) indicates that the item is not applicable.

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D. Structuring of information systems and statistical publications

61. FDES has not yet been applied in establishing or modifying environmental data banks, information systems or publications. For the preparation of compendiums of environment statistics, criteria of existing frameworks or statistical systems have been applied. Where these criteria were not available, the structures of the publications typically reflected a media approach which describes the environmental components of air, water, land and man-made structures and settlements. 27/ It is anticipated that the environmental components, information categories and statistical topics of FDES will be used for developing the basic structure and components of information systems and statistical publications.

Notes

1/   See Conference of European Statisticians, report of the Meeting on Statistics for Environmental Studies and Policies, Geneva, 19-23 March 1973 (CES/AC.40/5).

2/   See Conference of European Statisticians and Senior Advisers to ECE Governments on Environmental Problems, "Conclusions of the Seminar on Environmental Statistics, Warsaw, 15-19 October 1973" (CES/SEM.6/11-EMV/SEM.1/11).

3/   See Report of the United Nations Conference on the Human Environment, Stockholm, 5-16 June 1972 (United Nations publication, Sales No. E.73.II.A.14 and corrigendum).

4/   Official Records of the Economic and Social Council, Fifty-eighth Session, Supplement No. 2 (E/5603 and Corr.1), chap. V.

5/   Official Records of the Economic and Social Council, 1979, Supplement No. 3 (E/1979/23), para. 143 (d) (ii).

6/   Survey of Environment Statistics: Frameworks, Approaches and Statistical Publications, Statistical Papers, Series M, No. 73 (United Nations publication, Sales No. E.82.XVII.4).

7/   Official Records of the Economic and Social Council, 1981, Supplement No. 2 (E/1981/12), para. 148 (f).

8/   Ibid., 1982, Supplement No. 2 (E/1983/12 and Corr.1), para. 86 (d).

9/   See Survey of Environment Statistics ...

10/   For a detailed tabulation, see Survey of Environment Statistics ..., table 11.

11/   Statistical Papers, Series M, No. 75 (United Nations publication, Sales No. E.83.XVII.12).

12/   See, for example, The World Environment 1972-1982: A Report by the United Nations Environment Programme (Dublin, Tycooly International Publishing Limited, 1982), p. 623.

13/   A System of National Accounts, Studies in Methods, Series F, No. 2, Rev. 3 (United Nations publication, Sales No. E.69.XVII.3).

14/   See Towards A System of Social and Demographic Statistics, Studies in Methods, Series F, No. 18 (United Nations publication, Sales No. E.74.XVII.8).

15/   See Studies in the Integration of Social Statistics: Technical Report, Studies in Methods, Series F, No. 24 (United Nations publication, Sales No. E.79.XVII.4), para. 10.

16/   See Improving Social Statistics in Developing Countries: Conceptual Framework and Methods, Studies in Methods, Series F, No. 25 (United Nations publication, Sales No. E.79.XVII.12).

17/   See Survey of Environment Statistics ...

18/   See Statistics Canada, Towards a Comprehensive Framework for Environment Statistics: A Stress-response Approach, (Ottawa, 1979), p. 80.

19/   Central Bureau of Statistics, Resource Accounts, (Oslo, Norway, 1981).

20/   Peter Longva, A System of Natural Resource Accounts, (Oslo, Norway, Central Bureau of Statistics, 1981).

21/   Report of Habitat: United Nations Conference on Human Settlements, Vancouver, 31 May-11 June 1976 (United Nations publication, Sales No. E.76.IV.7 and corrigendum), chap. II, sect. C.

22/   SNA uses the International Standard Industrial Classification of All Economic Activities (ISIC) to classify establishment-type units according to kind of economic activity. See A System of National Accounts, Studies in Methods, Series F, No. 2, Rev. 3 (United Nations publication, Sales No. E.69.XVII.3), paras. 5.82-5.85.

23/   Classification of the Functions of Government, Statistical Papers, Series M, No. 70 (United Nations publication, Sales No. E.80.XVII.17).

24/   See, for example, the "Draft Classification of Outlays of Industries by Purpose (COIP)" (ST/ESA/STAT/83), in which outlays on pollution abatement and control are specified as a separate item.

25/   See Guidelines on Statistics of Tangible Assets, Statistical Papers, Series M, No. 68 (United Nations publication, Sales No. E.80.XVII.2). The guidelines will be fully taken into account in the current revision of SNA.

26/   See "Environment statistics - Draft guidelines for statistics on materials/energy balances: report of the Secretary-General" (E/CN.3/492).

27/   See Survey of Environment Statistics ..., para. 179.