Chapter 6

Future Directions in the Development of Environment Statistics

Priorities in Strengthening Environmental Statistical Systems

In most developing countries, environmental policy is being redefined and efforts to develop national policy frameworks are under way. The common elements of emerging environmental policies are

(i) a commitment to the goal of sustainable development;
(ii) a strengthened role for environmental institutions vis-a-vis sectoral and central government agencies;
(iii) a firm legal basis for setting policies, their implementation, and their enforcement;
(iv) increased responsibilities of regional and local governments for environmental management;
(v) separation of the regulatory and economic development roles of government;
(vi) adoption of the polluter-pays principle;
(vii) recognition of "new actors" involved in environmental issues: the public, NGOs, sector interest groups, private enterprise, independent research institutes, and labor unions; and
(viii) strengthening of cooperation with international institutions and programs, with which contact in the past has been limited.

The new context for environmental policy is also transforming the roles of and expectations about environmental data, statistics, and information. Environmental information is no longer a tool in the preparation and implementation of government plans. Instead,

strengthened environmental statistical systems focus on several objectives, providing (i) accurate and reliable environmental information to meet national and international demands; (ii) a tool for monitoring and enforcing compliance with regulations and environmental policies; (iii) an instrument for policy integration; and (iv) a means of communicating with and informing decision makers, the public, the private sector, NGOs, and interest groups.

Priority should be attached to strengthening the availability of quality environmental information in those areas or regions with the greatest risks to human health and irreversible environmental changes. The information generated should support the implementation of priority environmental action programs. The close cooperation of health and relevant sectoral ministries, together with environment ministries, is essential for this purpose.

Reliable information is required by foreign and domestic investors. For example, environmental factors can restrict investment, and appropriate information is required to resolve difficulties that may arise.

On the basis of priorities and resource availability, steps should be taken to promote medium-term to longer term consolidation and expansion of environmental information systems. Attention should concentrate primarily on environmental conditions and trends. To date, much of this information has not reached managers. There is opportunity for environment statistics to strengthen sector policy integration efforts, especially in the priority energy sector. Objective, credible information can support dialogue between and coordinated policy actions by environment and sectoral ministries.

Strengthening the environmental statistical systems in the selected countries requires a framework with clear objectives and a strategy for implementation and evaluation of performance. The challenge is to improve existing systems by upgrading the quality of present arrangements; where necessary, eliminating or reassigning elements that do not meet users' needs or are not cost-effective; and progressively filling in the most important gaps.

Several weaknesses in the coverage of existing environmental information systems are apparent. At the overall system level, the principal weakness in the developing countries is a lack of a comprehensive and integrated information system linked spatially (across ecoregions) and temporally. Data weaknesses are also identifiable: poor coverage of biological indicators of water quality,

and water pollution in rivers and heavy metal levels in lakes; limited data on marine pollutants originating from the coast; little data on pesticide use on arable and crop land; and gaps in air quality data concerning estimates of national carbon monoxide and hydrocarbon emissions, lead emissions, CFC usage, and urban air quality. Data on population exposure to noise from traffic, airports, and other sources are deficient. Wastewater treatment information does not give the number of households connected to sewage schemes, capacity of treatment systems, and degree of treatment prior to disposal. Solid waste and hazardous waste data are weak in terms of specifying volumes and sources (household, industrial, construction sites etc). Data on ecosystems and biodiversity are sparse.

Once the framework and priority elements of the environmental statistical system have been established, attention should focus on the methods used to collect information. Explicit criteria to guide the choice of data collection methods and technologies should be specified. Such criteria should include cost-effectiveness, flexibility for future modification and extension, ability to deliver essential and reliable information on priority environmental issues to decision makers, and ability to harmonize with international standards and classifications. The tendency for state-of-the-art technology to "drive" environmental information systems should be firmly resisted.

Existing approaches to data collection and environmental monitoring need to be improved, particularly integrated monitoring systems. The extension of monitoring networks is a priority task in all of the reviewed countries. There is an urgent need to improve the compatibility, comparability, reliability, and accessibility of data by linking various sectoral networks and to slowly extend their spatial coverage. Critical issues requiring attention include the number and distribution of monitoring sites, balance between ambient and point source monitoring, and reliability of the data generated by monitoring stations. Complementing this effort, sample surveys should be encouraged for preparing SOERs. This will require training of statisticians and environmental professionals in sample survey techniques.

The potential for cross-media and multiple-exposure monitoring should be assessed. Such monitoring can clarify transmedia movement of pollutants and their synergistic effects on environmental quality and human health. Biological monitoring, such

as for effluent discharges, can often be applied more easily than physical-chemical monitoring, and at much less cost. Other possibilities for data collection and monitoring include the use of environmental impact assessments (EIAs) and environmental audits of firms' performance, and independent monitoring by enterprises and research institutes.

Institutional Arrangements and Decision Making

Environment ministries are emerging as key actors in developing and implementing environmental statistical systems. Statistical offices will continue to have important roles to play, including coordinating the collection of data by various government departments, integrating the national environmental monitoring system with the national statistical system, reinforcing the consistent use of internationally agreed-upon definitions and terminology, and meeting specific information requests. These new responsibilities need to be clearly distinguished from those of environment ministries.

It is to be noted that much of the statistical analysis of environment data will be done by the agencies producing those data themselves, not by the statistics agency. As noted earlier, much of the statistical analysis methodologies require skills found in the data–producing agencies themselves. Staff of the statistics agency may benefit from some training in those methodologies, but it would be impractical to try to transfer those skills from the data producers to the statistics agency. For example, ways of expressing and quantifying land degradation are the expertise of agriculture personnel. Observations and measurements of data on water are best done by the water resource department; those on pollution, by the environment department. The statistics agency's job is mainly to compile the statistics generated by the responsible sectoral or functional agencies (e.g., forestry, mining, agriculture, industry, etc.)

The various sector agencies collecting environmental information require a framework for the coordination of information flows within and between ministries. The framework is essential for environment and sector policies to be better integrated. Ministries of health and social affairs, agriculture, forestry, transport, water management, energy, and industry and trade may all be collect-

ing environmental information for their specific sectors. This may create problems of administration, duplication, and nonsharing of information.

Decentralization of power is an integral part of democratization in the countries. As a result, debates on centralization versus decentralization of environmental management are emerging, often centered around the appropriate mix of decision-making powers between different levels of government (including local city authorities). Ensuring that local needs are balanced against national needs in a coherent, comprehensive environmental information system is a particular concern.

Strengthening environmental statistical systems also involves extensive training and extension of the existing skills base. In general, there exists a relatively highly educated workforce with technical skills in natural resource conservation and environmental science and technology, the so-called "hard sciences." Nevertheless, monitoring personnel do not always have appropriate training, guidance, or support. Bilateral and multilateral training efforts in capacity building, EIA, and air and water quality monitoring techniques are expanding the existing technical skills. The need for training and support is particularly acute at the subnational level.

Strengthening Partnerships

Research institutes play an important role in the collection of environmental data. These institutes were well supported in the past and were usually attached to specific ministries. As a result, the staff are often well trained and motivated, and have good contacts with international scientific networks. Where research institutes have a demonstrated capacity to generate quality environmental information, governments should continue to provide support at an adequate level. Multilateral and bilateral programs could also provide support by working, where appropriate, with research institutes.

The strengthening of environmental statistical systems must take place within the perspective of their costs and benefits. Implementing the polluter-pays principle to "internalize" the costs of use, or degradation, of environmental resources is the cost-allocation principle adopted in Western countries. In theory, the polluters should pay the full cost of damages caused by their activities.

Where monitoring activities can clearly reveal specific polluting activities, the polluter-pays principle suggests that the cost of monitoring should be borne by the polluter. This will be the case for emissions from large stationary sources. Regulations requiring firms to disclose emissions data could be enacted. However, there are many cases where this is not feasible, such as when the polluter is not identifiable, or when the enterprises are small or medium size. Nevertheless, all over the world monitoring of ambient environmental conditions at present generally is financed by public sources.

The allocation of expenses between central agencies or ministries and local authorities' budgets is often made according to the division of responsibilities. Some transfer of resources from the national budget to local authorities may be justified when the latter carry out national responsibilities locally, such as operating part of an environmental monitoring network. The manner in which money from public budgets is allocated to different national environmental programs (air, water resources management, fauna and flora, etc.) should be consistent with environmental policy priorities. Sufficient funding should be made available within those different programs for monitoring work at the field and policy levels.

External assistance from bilateral and multilateral sources to develop and extend environmental statistical systems has been important. Such support can provide only a fraction of the resources required, but is nevertheless significant because of the transfer of experience, their demonstration effect, and the provision of models that can be adapted as appropriate. Activities include establishing model air and water quality monitoring systems in the most severely polluted regions, assistance in setting up and using environmental databases, equipping regional laboratories, promoting staff secondments to work in advanced countries and international organizations, and funding the participation of country representatives at international meetings. Generally, the greatest needs appear to be for technical assistance, training, and exchanges of personnel, especially at the local level.

In strengthening environmental information systems, opportunities exist for establishing partnerships between the public and private sectors to meet information supply needs. For example, enterprises could collect environmental information in accordance with government-specified guidelines and standards, and subject to

verification procedures. Opportunity would then exist for enterprises to choose whether to collect the information using in-house specialists or to contract the work out to private research institutes or consultancies. Other possibilities for information collection include cooperative arrangements between the government and NGOs, labor groups, and the scientific community. This could be a cost-effective and efficient way to obtain and disseminate environmental information, which reduces as well the financial burden for government administrative and statistical offices.

The emergence of distinct public and private sectors requires new institutional arrangements to ensure that governments have access to the information that they require for policy purposes and that the rights of private enterprises and individuals are adequately protected. In a more market-oriented economy, enterprises may be reluctant to supply information to public bodies because of commercial confidentiality and cost. Principles of confidentiality must be well defined, usually reinforced by appropriate legislation, with guaranteed protection of information on individual survey forms. Public authorities for their part will need to be clear as to what types of information they require and why, ensure that cost-effective approaches are used so as to minimize reporting burdens on the private sector, and develop appropriate information dissemination strategies that take account of confidentiality concerns. For all groups that will be involved, this is very much a new experience.

Participating in international cooperative efforts in environmental information collection and dissemination is an integral part of system design. The significance of such cooperation derives from three principal reasons. First, the transboundary nature of some pollution problems (such as greenhouse gases, ozone, and acid rain) highlights the importance of having a well-developed domestic monitoring system linked to international monitoring systems, which permits meaningful comparisons of information. Second, to survey the compliance of countries signatory to international conventions and agreements, comparable information must be collected on an international scale. Third, links to international information systems provide countries with an opportunity to cooperate in developing cost-effective technical, institutional, and financial approaches to problems. Regional activities, often cofunded bilaterally or by international institutions, are already evident and provide a solid base for extension.

Efforts to further integrate the environmental statistical systems of the selected countries into the largest international framework could focus on several initiatives. First, the development of regional information networks will help reduce duplication, enable information to be collected and compared on the basis of standard methodologies, and provide opportunity for staff secondment to broaden experience and skills.

Second, because international comparisons of environmental data rely on the availability of high quality data inputs, there is a responsibility to strengthen domestic capabilities in and coordination of information collection, treatment, and dissemination. Where data are to be supplied on a regular basis, a single permanent contact point should be established. Some sharing of responsibilities between environment ministries and central statistical offices is necessary, and the division of labor should be clear. This would prevent duplication of efforts and reduce at the international level the confusion resulting from having different sets of data originating in one country.

Summary

It is evident that serious efforts are being made to strengthen and restructure environmental statistical systems in these countries, concomitant with reforming existing institutional arrangements and upgrading technical skills. Some progress has been achieved, but much still remains to be done.

(i) Despite the existence of a wealth of data, the purpose of collection and its coverage need to be better focused to support the work of decision makers. The role of environmental information needs to be reoriented to better match the governments's new role of monitoring and regulating market-based economic activity. Timely and reliable information can have an important influence in integrating environmental considerations into economic sector restructuring and in monitoring outcomes.

(ii) There is a need to improve the quality of the data collected and to establish confidence in the reliability of environmental information. Data collection mecha-

nisms have to be reviewed and appropriate technology for environmental statistical systems chosen. The cost-effectiveness of technology should be a major criterion.

(iii) Institutional arrangements for environmental information need to be improved and the respective institutional roles unambiguously defined. A clear division of tasks between environment and statistical offices has to be established. Much more than they did in the past, all relevant agencies should supply credible, objective information to support decision making for sustainable development.

(iv) The responsibilities of central and local governments need to be made clearer, taking account of the requirements for coordination, cost-effectiveness, and responsiveness to decision making needs at the different levels of government.

(v) Further efforts are needed to integrate the environmental statistical systems of these countries into the larger international framework. Such integration will benefit from specific activities jointly conducted by countries and international organizations such as ADB, European Community (EC), International Bank for Reconstruction and Development (IBRD), OECD, UNSD, and WHO.

(vi) Imaginative and broadly targeted environmental information and communication programs need to be devised to improve public awareness of environmental issues. Opportunities include consolidating the limited experience with state-of-the-environment reporting and developing environmental indicators.

Linking the Environment Statistics Framework with Policy Through State-of-the-Environment Reporting

The SOER, whether at the national, subregional, or regional level, is commonly prepared to monitor trends in achieving the goals of environmentally sound and sustainable development. The assessment of the state of the environment should, through statistics, aim at the following:

(i) informing governments and concerned organizations in the region and elsewhere about the state of the environment with respect to both the prevailing human conditions and the status of the natural resources, in a consistent and comprehensive manner;
(ii) providing information, based on empirical evidence, on the various stresses placed on the human condition and the natural resource base;
(iii) assisting in the process of informed planning by presenting information in a framework that is comprehensive and easily understood, thereby facilitating analysis of cause-effect relationships, and forming the basis of policies, strategies, and action plans;
(iv) illustrating policies, strategies, and action plans undertaken at national, subregional, and regional levels, including both institutional and technological aspects;
(v) indicating, as far as practicable, gaps in the present state of knowledge and information and the need for new information, as well as for investments in research and development; and
(vi) Improving public understanding about the state of the environment through a better informed public debate about these issues at all levels.

A framework should help in integrating multisectoral data, identify areas where data are inadequate, and indicate weak links in institutional networks that need strengthening. To support environmental assessment activities, the framework should possess a good database, with data from relevant and appropriate case studies. Importantly, the database will need to be sensitive to the level of application of the information.

A well-documented format can serve as the basis of information for the monitoring of state-of-the-environment reporting. The database can be the knowledge base for spatial and tabular data for catalyzing decision making on environment and development issues. It can also serve as a tool in implementing and following up national environment management strategies that were produced for member countries. The database can be developed under four categories:

(i) biophysical environment, i.e., land use, topography, land tenure, soil types, village boundaries, conservation areas, flora and fauna, etc.;

(ii) socioeconomic environment, i.e., human activities, agriculture, forestry, transportation, energy and tourism; and human conditions, size, growth, and distribution, health aspects;

(iii) natural disasters, i.e., floods, droughts, susceptibility to cyclones, earthquakes, etc.; and

(iv) policies and institutions, i.e., responses by governments and government agencies.

To ensure the participation of all sectors, the framework can be broken down into seven components as follows:

(i) Data processing and information flow, including the mechanism to process data collected from various sectors into useful information.

(ii) Integration of biophysical and socioeconomic data, to assess the impact of human activities on the condition of natural resources. Integration of these two types of data will identify, according to the problems posed, the critical linkages between them. For problems to be addressed appropriately, the linkage needs to be a unique cause-and-effect relationship.

(iii) Technological support or utilization of GIS to integrate multisectoral data so as to derive useful information to catalyze decision making; selection of technology based on the capacity of data that it can analyze, frequency of the data, cost-effectiveness, and user friendliness.

(iv) Development of indicators/indices and identification of issues. Given the pressures on environment and development, the traditional sole reliance on economic indicators as a means of measuring progress is no longer sufficient. Hence, environment indicators are also being developed to present information on environment conditions and natural resources. These indicators can be of various types designed to

(a) reflect the quality of the environment;

(b) indicate the impact or stress on the environment, resulting from human actions;
(c) evaluate the costs and benefits of environmental measures; and
(d) indicate sustainable development trends.

(v) Outputs-inputs for state-of-the-environment reporting, legislation and action plans. Analysis of the problems and the information regarding the options will provide inputs to various SOERs, legislative and regulatory measures, and action plans at national, regional, and global levels. Similarly, a model should be developed to test the effectiveness of different policies and strategies.

(vi) Establishment and strengthening of a decentralized network of institutions to collect and analyze data on the environment. The objective of the network is to improve the acquisition, storage, analysis, exchange, and dissemination of environment data.

(vii) National perspectives. At the national level, the framework aims to
(a) ensure an integrated national system for measurement of environment quality,
(b) maintain a data set for assessing the state of the environment, and
(c) develop national baseline data to evaluate the effective integration of environment and development information.

Most importantly, the framework should be designed to enable governments to meet their environment reporting obligations efficiently and to formulate action plans realistically.

Institutional Issues

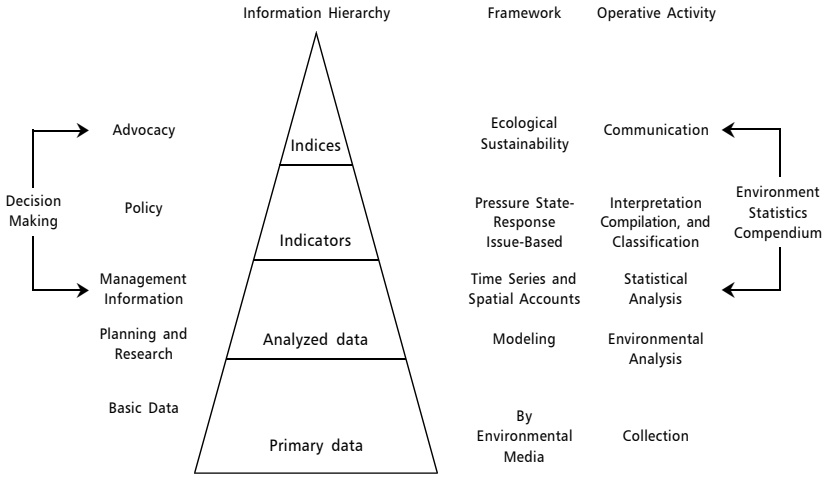
This section mainly addresses the question of what to include in a compendium of environment statistics, how best to organize that compendium, and what framework to apply. For this discussion, the reader is referred to Figure 6.1, which shows the conventional

information pyramid. The important questions are (i) What should be included in the environment statistics compendium? (ii) What are the respective roles of the statistics agency and the environment agency? (iii) Why should the database be structured in terms of collection, analysis, compilation, interpretation, and communication? (iv) How will the compendium be sustained? (v) How is a framework for the development of environment statistics formulated and why is it important?

Structuring the Database

Figure 6.1 shows a "pile" of environment-related data or information organized into layers, as in a pyramid, with a very wide base and a very narrow top to indicate increasing levels of data aggregation (from base to top). Because the lower layers are used to build the upper layers, the result is increasing information content (i.e., degree of consolidation and simplification) as one moves to the top of the pyramid. The actual number of indicators and indices is very much smaller than the amount of primary and secondary data.

Figure 6.1
Data Aggregations and Their Uses



Primary data, at the base of the pyramid, are data obtained from monitoring of field activities. An example is daily measured concentrations of various key pollutants in a river sampling station, or an inventory of plant species found along a transect. These are raw data and as yet not analyzed. The operative activity here is data collection. Obviously collection will remain a decentralized activity.

On top of the base of primary data is a layer that may be referred to as "information," that is, data that have been analyzed (e.g., screened for reliability and accuracy as well as aggregated to show averages or total over time). There are, of course, many ways of analyzing environmental interactions. Data might be combined to derive new information as in combining rainfall and river flow data to derive so-called rainfall/runoff ratios. The process may be referred to as environmental analysis. Another way of analyzing is to simply aggregate the data to show time-series patterns or cross-sectional patterns of the aggregated data. The latter is referred to as statistical analysis. For the purpose of this project, interest is limited to statistical analysis and the operative activity is data compilation and classification.

Statistical analysis of environmental data is not as simple as taking averages, deriving measures of variability, or adding up totals. For the most part as in statistical hydrology, a discipline underlines the process. The expertise for statistical analysis of data would remain with the data producers themselves (e.g., the water department) and it seems impractical to attempt to transfer that expertise to the statistics agency, which has its own area of expertise, usually demography and socioeconomics. Following these premises much of the analysis–including statistical analysis–of environment data would remain with the data producers. Selected information would be passed on to the statistics agency for inclusion in the compendium. The statistics agency's role is mainly to compile and classify the information.

It should be noted that, invariably, the contents of the primary data and analyzed data layers of the pyramid would be organized by media, that is to say, water, land, or air – which also reflects the functional areas of the data-producing agencies (e.g., irrigation department forestry department, etc.). They may also be organized by sector as in industry, human settlements, or energy.

The next level is the so-called indicator. An indicator may be an aggregation of several statistics, or it may simply be a selected statistic. The point to remember is that an indicator must indicate

something. In other words, while primary and analyzed data may to a large extent be characterized as basic or neutral information, indicators are purposeful information. They are purposeful in the sense that they are linked to defined environmental management concerns and objectives, say, the control of pollution or the conservation of biodiversity. For example, statistics on sulfur emissions are a relevant indicator for assessing the degree of pollution from power plants or diesel-based motor vehicles. In short, indicators are issue driven. They are not neutral information that may be used for any arbitrary purpose. Common issues found in DMCs include deforestation, land degradation, water supply, and water and air pollution.

The implication is that environmental indicators should be organized to indicate the environmental concern and management objectives they are related to. The next implication is that it is the environment agency that is in the best position to identify those indicators. However, the indicators may have to be derived from information produced by a variety of agencies. Here the statistics agency is in a better position to both compile and disseminate the indicators.

Unlike primary and analyzed data that may be organized according to media or economic sector, indicators are preferably organized by environmental issue. This is where a framework becomes useful, that is a framework that will allow one to classify the indicators according to some logical structure of cause, effect, and remedy. The operative activity here is interpretation, specifically for policy-making and decision-making purposes. Note that this is also what a SOER is supposed to do. In fact, indicators provide the basis for an SOER.

The uppermost layer of the pyramid consists of indices that are more aggregated indicators, such as a water quality index, which would combine elements of quantity and quality. Environmental or ecological indices, in general, attempt to capture aspects of the ecosystem or resource sustainability. The important thing to remember with indices is that there should not be a large number of them and that they should be able to convey information in a simple yet comprehensive manner. Take the example of gross national product (GNP). It shows what a single number can do when its significance is widely understood. Here the operative activity is communication.

What to Include in the Compendium

An issue that keeps coming back is how to define the coverage of environment statistics. Its coverage does not refer to merely physical, biological, and socioeconomic types of information. It is obviously impractical to attempt to compile everything in the information pyramid; a compendium on environment statistics cannot aim to cover the whole of the information pyramid.

With reference to the pyramid, only the upper layer of information needs to be in the environment statistics compendium. These include the ecological indices, the indicators, and part of the analyzed data. That part of the analyzed data to be included in the compendium are those available as time-series statistics such as monthly or annual averages, and variations and totals for various environment parameters (e.g., stream flow). They may also be resource and environment accounts (e.g. forest accounts).

Through a consultative process during the course of RETA 5555, a number of crucial indicators were identified for the region (Appendix 1). DMCs may wish to include all or some of the indicators in their compendium.

Organizing the Compendium

The next question is how to organize the environment statistics. The compendium is essentially a well-organized compilation of statistics, tables, and charts, accompanied by brief explanatory notes on the information. It is not a textual or narrative interpretation of environmental information, or an attempt to explain why a certain environmental problem is occurring or what is being done about it. The explanation is for the SOER to make with the use of the statistics compendium.

The point is that the compendium and the SOER are different publications. The compendium is a simple characterization while the SOER is 80 percent explanation and 20 percent data. The compendium could serve as the database of the SOER, and as such can be used as a reference for readers of the SOER. The compendium may thus be organized (i.e., the content classified) so that it supports the analytical framework of the SOER, e.g., a PSR format.

Also, the compendium is a publication of the statistics agency, whereas the SOER is a publication of the environment agency. Saying that the compendium and the SOER are different publications does not mean to undermine their interdependence. On the one hand, the compendium could serve as the official database of the SOER. A common criticism of existing SOERs, especially those written by consultants, is the use of data source from outside of the country (e.g., data from WRI or the World Bank, some of which may be controversial and open to challenge). This is often because information from those external sources are better organized or are more readily available. The ideal is for the SOER to depend on one official database that is also reliable and readily available.

On the other hand, use of the compendium to support an SOER could provide a useful framework for organizing the content of the compendium, as in the adoption of a PSR format typical of most SOERs. The SOER also provides a ready user of the compendium and one capable of explaining the information supplied by the compendium. For policy makers and the general public, it is the explanation or interpretation of environment issues that matters, not so much the source statistics. This is not to suggest that the SOER is the most important use of the compendium, nor that it should drive the design of the compendium. However, it is the present most relevant use for a compendium and, especially by itself, is an important step toward institutionalizing environment statistics.

As for the compendium, its contents can be organized into essentially three parts. Part I will be a summary of important ecological indices (if already developed) as well as selected environment indicators. This summary can be published separately. Part 2 will be a compilation, with brief explanatory notes, of core environment indicators and statistics so arranged that they show a logical matrix of cause, effect, and remedy (e.g., the PSR format of the SOER) and further organized under headings identifying key environment issues. The environment issues may, in turn, be grouped according to physical environment media (e.g., land, air, water), biological media (e.g., biodiversity), or economic sector (e.g., human settlements, industry, energy) to show trends more readily. Much of the information should be presented in the form of charts or diagrams. Part 3 can include a compilation of supporting statistics mostly in tabular form (e.g., resource and environment physical account).

For now, core indicators will have to be identified or developed in a supply-driven fashion, i.e., relying on whatever data are available to develop the indicators. As such, the indicators may not yet adequately reflect the nature of the environment issue or management objective that such indicators are supposed to show over time. Nevertheless, a more demand-driven approach may evolve, whereby data collection becomes tailored to supply information for the key indicator.

Need for a Framework for Developing Environment Statistics

A framework is useful to focus environment statistics on important issues and to identify relevant statistical variables to characterize those issues in terms of causes, effects, and remedies. Because of the very wide area that environment statistics must cover, a framework helps to avoid the mere compilation of voluminous information. An underlying structure will allow use of such information for policy making, SOER, and public information.

In addition to providing a structure that will relate environment statistics to key environment concerns, a framework should also specify the arrangements for coordinating and organizing the data collection inasmuch as many sources will be involved. The tasks will include assessing the data requirements and inventorying the data available as well as their sources; and specifying the procedures for setting up and maintaining the database, and publishing the compendium itself.

The framework itself does not have to state explicitly the statistical parameters, methodologies, or detailed procedures for tabulating data. It is primarily a structure or format for how information is to be organized so that it is clear to the user how the statistics address important issues and how they show linkages of causes and effects. It also provides a strategy for integrating widely dispersed environmental data. Guidance on data collection and tabulation methodologies can be obtained from guidelines or handbooks available from various sources such as the UN statistics office and ESCAP. Such details need not be specified in the framework. The framework contents are mainly statistical topics related to key environmental issues identified.

It is also important to make a distinction here between a statistical framework and a statistical system. A framework is mainly

a general design, which can be adapted to a country's specific concerns, including data limitation. In contrast, a statistical system such as the SNA is founded on standardized concepts, data definitions, and classification. This is possible with SNA because the theoretical aspects of economic accounting on which it is based are fairly well established, plus the fact that in SNA we are dealing with a standard monetary numeraire. In the case of the environment, the scope is very broad, environment system linkages are not well understood, and there is no standard numeraire.

Thus, the FDES should not be confused with a statistical system even though over time, as more information becomes available and as the understanding of environment system linkages improves, the framework could facilitate the evolution of a statistical system. Even then, it may not be possible to expect that such a system would be the same for all countries. This is again because environmental statistics are issues-based and, although global environmental concerns may be common, the way environmental issues are identified and assessed may differ from one country to another. Still, a common framework by which to understand the causes and effects (as well as remedies) underlying those issues is possible.

In sum, a framework for developing environment statistics should cover

(i) the environmental problem and concerns that are important for the country, possibly grouped according to environmental media (i.e., land, water, air);
(ii) the statistical topics by which to describe and quantify those concerns in terms of their underlying causes and effects as well as responses or remedies; and
(iii) an action plan for coordinating and organizing the database, and assessing data availability and their sources.

It is also important to keep in mind certain properties that the framework should possess:

(i) The framework should be flexible; that is, it should be kept at a sufficiently general level so that it can be expanded or modified to suit local environment conditions, priorities, and data limitations.

(ii) It should be comprehensive and allow the coverage of a broad range of environmental concerns and linkages between environment, economic, and social systems.

(iii) It should have a consistent structure so that for any environmental issue identified, the information can be grouped according to cause, effect, and responses, in a consistent and logical manner.

Initiating the Development of Environment Statistics

The following discussion highlights some points to bear in mind in the development of environment statistics.

Institutional coordination

Focal points are important for national and international communication and between the statistics agency (e.g., CBS) and the environment office (e.g., Environmental Protection Agency [EPA][5]). EPA can supply monitoring data and technical expertise, while CBS can offer the benefits of its statistical system to give the data a wider meaning and a wider audience. To create and control such efforts, a steering committee outside EPA and CBS may be set up, preferably at a high level, to promote closer collaboration and prevent turf wars.

A typical feature of environment statistics is that many data refer to physical parameters (e.g., air quality, emissions to water) that the CBS never measures directly, but instead obtains from the technical agencies that measure them. Further, the CBS is not qualified to use raw data but relies on validated data appearing in technical reports, e.g., water quality in the X river in 199Y. The typical task of the CBS is to select and aggregate data, with a view to fitting them into the environment statistics framework.

[5] EPA is taken here as a generic term for environmental registering, measuring, and monitoring agencies. A list and description of these agencies may constitute an important step in setting up environment statistics. Likewise, CBS should be taken as a generic name for all national statistical bureaus.

Producing environment statisticians

Most statisticians are not well-versed in the natural sciences (e.g., physics, chemistry, ecology), but are trained in the social sciences and economics. This makes it very important that statisticians devoting themselves to this new field of statistics acquire a minimum of knowledge in the sciences. Introductory literature in the environmental sciences is available in many countries. UNEP for example, has published many instructive books and reports. In-country courses are more useful, if available. Agencies such as EPA usually give local training courses, suggest literature on certain topics, and are able to help where books fail to instruct.

Setting up the database for environment statistics

The following is a logical order of activities for setting up a database for environment statistics:

(i) Make an inventory of the environmental problems of the country.

(ii) Choose the most pressing problems that could very well be addressed through a national meeting of all important agencies and institutions involved, thus making the activities widely known to the people that matter. In this case, press coverage should be ensured so as to reach a larger audience.

(iii) Compile an overview of currently available data to serve as a first publication and as hard evidence of the activities and a useful catalogue on which to base further steps.

(iv) Start the statistical process, not by devising new and costly surveys, but by utilizing existing data sources first (especially applicable to activity statistics: production, traffic, import/export, etc.) and identifying data gaps and omissions. Existing statistics could thus be used at a minimal cost and with maximum possibilities to link up with other existing statistics. Then, and only then, can an agency say that it has exhausted existing possibilities and advocate new surveys. Even then, setting up new surveys, e.g., on emissions—as an addition to quality monitoring data from EPA—might

be too costly and take too long. In that case, shortcuts should be taken to produce data in a consistent, although simplified way. An example of such an approach would be the WHO Rapid Assessment Method for emissions to air, water, and soil, which makes use of emission factors (Economopoulos 1983).

(v) Disseminate and discuss results.

Extent of coverage

An important consideration, especially for large countries, is the coverage of environment statistics in terms of both subject and geographical areas. Assuming that only limited funds, staff, knowledge, and experience are available, a reasonable scope of work should be defined. Rivers for which no water quality monitoring system is available can hardly be covered by statistics. As for area coverage, urban zones and other areas where several environmental problems appear combined or where severe single problems arise, and for which data are available may be selected rather than try to cover the country as a whole. In any case, it would seem better to gain experience on a small scale at first.

Linkup with existing international monitoring programs

Several UN bodies are active in environmental monitoring, both in developing methodology and in gathering, processing, and disseminating data. UNEP and WHO, which are working together in the GEMS, and FAO, which is working on soil quality, should be mentioned in this context. The finer details of methodology are not so much a cause of concern for CBS as for EPA. UNEP publishes many booklets and reports that are accessible to a wide audience. Being linked to global monitoring programs like GEMS has these advantages:

(i) International comparability is enhanced.

(ii) International contacts linked to methodological issues are better ensured.

A focal point should be identified for the purpose of national and international networking, and simple media like printed newsletters, or the new medium Internet may be considered.

First compendium as a tactical goal

A first compendium is relatively easy to assemble, but sustained efforts to produce regular additions to meaningful time-series data will prove much harder.

Handbooks and Manuals

Handbooks and manuals help in identifying important variables necessary for monitoring the state of the environment and in developing appropriate methodologies and standards for the collection and compilation of environmental data. Environmental conditions and statistical priorities in particular countries may well demand different selections and formulations of statistical topics and related variables. The list of variables identified should therefore be broad enough to accommodate all needs. Handbooks can also be useful to environmental experts who are directly or indirectly involved in the collection and compilation of environment statistics but have no adequate background in statistics.

Compared with social, demographic, and economic statistics, the development of environment statistics is still in its infancy, and the methods, techniques, and choice of variables will improve over time with the interaction of producers and users of the data. Handbooks can be helpful by including an important area of environment statistics, namely: emission and environmental quality-related statistics. A number of other important areas such as land use, land degradation, desertification, biodiversity and wildlife, natural disasters and marine environment, which are of major concern to the developing countries of the region, should also be incorporated in the handbooks.

It is important to recall that national statistics offices do not generally collect biophysical data. A large part of their effort is devoted to identifying data sources and making the arrangements for regular data acquisition. For example, they can send questionnaires to environmental agencies to select parameters from large in-house data banks such as those maintained by a meteorological office. Handbooks can assist in the identification and selection of these data sources and relevant statistical variables.

Statistics offices basically collect and compile statistical data from such sources as surveys of households, agricultural farms, and manufacturing establishments. A good portion of environment databases can be created by recasting such data into environmentally relevant categories. There is also an opportunity to obtain statistics by modifying questionnaires and by redesigning the surveys. For example, questions on fuelwood uses and sources can be added to household surveys. Of course, there is also the possibility of introducing new surveys devoted to the collection of environment statistics, such as surveys of industrial pollution abatement practices, recycling activities, and waste generation and deposition. Handbooks should provide numerous examples of such surveys.

Recommendations of the Concluding Workshop

It is evident that RETA 5555 has successfully achieved its objectives. Nevertheless, more effort needs to be exerted by the participating DMCs as well as by ADB to sustain the progress achieved through this Project.

Workshop participants made the following recommendations:

(i) An informal Manila Group for Environment Statistics/ Indicators and Environmental Accounting could be established to discuss the problems or constraints faced by various participating DMCs working on environment statistics and to share knowledge and experience in addressing problems that they encounter. The contributions of Indonesia, Malaysia, and Philippines will be very valuable and useful in these discussions since these countries are already in a relatively advanced stage in the development of this type of statistics. This Manila Group may have, as its core committee members, experts from ADB's Statistics Division and the Office of Environment and Social Development; other international organizations such as the UN-ESCAP, UNSD, SACEP, etc.; and consultants. Representatives from the DMCs may be included as members of this committee. This group could have annual meetings in

various countries, with the host country providing logistical support for organizing workshops. The Bank may consider providing some financial assistance toward meeting the expenses for organizing these workshops. The annual meetings will certainly help in knowledge sharing and enhancing the learning process on various aspects of environment statistics in the participating countries.

(ii) Phase 2 of the Project could cover more DMCs where the concept of environment statistics could be established and the process of institutional strengthening for this development initiated. This would not only extend the domain or coverage of the concept and awareness of environment statistics into a wider arena but also help strengthen the ADB Statistical Database System (SDBS) further.

(iii) Under RETA 5555, all participating DMCs identified their present and future priority environmental concerns. As the countries indicated in response to the questionnaire survey, the indicators for addressing the present environmental concerns have generally been identified. The identification of country-specific environmental indicators representing future environmental concerns could be included as an activity under phase 2 of the Project.

(iv) Another priority task that could be taken up during phase 2 of the Project is the development of a common set of core indicators for all participating DMCs. As stated earlier, the infrastructure and training needed to collect data on these indicators, especially for countries that are weak in these aspects, may also be taken up in this phase.

(v) Finally, the key environmental indicators identified by the Bank (Appendix 1) could also include additional indicators for flora and fauna to address these two environmental components as per the UN-FDES format. This will assist the Bank in monitoring the status of biodiversity in the DMCs and in developing a database on genetic diversity within its SDBS. Assess-

ment of these indicators will also assist the Bank in planning future strategies for the preservation of biodiversity.

Need for Training

Training will benefit all groups involved in collecting and disseminating environment statistics.

(i) Basic training covering terminology, definitions, environmental sampling, and analysis, is needed for statisticians in the field of environment for better appreciation of environmental issues. This will also help DMCs to identify the environmental indicators most appropriate for them.

(ii) Basic appreciation training for policy makers is required to educate them on the importance of environment statistics.

(iii) Training will strengthen the interrelationships between statisticians and environmentalists which will result, in turn, in a better understanding of the type of environment statistics data required and their units of measurement to develop appropriate environmental indicators.

Training Modalities

National proposals for training may be submitted to ADB by various DMCs, indicating priority areas of training, itemized costs of training in those priority areas, and the necessary infrastructure. Technical assistance from the Bank could be provided for these high-priority areas for individual countries. This could be considered by ADB in phase 2.

Subregional training in various DMCs that possess adequate training facilities and expertise could be arranged for their neighboring countries, e.g., India for SAARC countries, Philippines for ASEAN countries, Vanuatu for South Pacific countries, etc. Such arrangements would maximize gains and minimize costs.

Environment specialists should handle the training. Extracts from the UN/ESCAP Operational Handbook would be useful training materials for sampling and analytical methods.

Scope and Content of Training

The training should start with identifying the target group. Training for appreciation should be given to decision makers and senior-level executives; Compilers and users of environment statistics data should be given rigorous training, including field visits (sampling) and laboratory demonstration (analysis) programs.

Future Work

The overriding objective of the Bank's technical assistance program is capacity building in the DMCs. In this light, one specific purpose of the RETA was to play a catalytic role in the sustained development of environment statistics in the DMCs. The bulk of future work now rests on the concerned agencies of the DMCs. While the Bank RETA was successful in creating the basic infrastructure, the work needs to be continued and further developed by the countries themselves.

All the participating countries have prepared their FDESs based on their own requirements. These requirements might change over time as the countries progress through the different phases of development. The frameworks will therefore have to be revised and updated periodically, as and when required. From the point of view of convenience and comparability across the countries, the participating countries were encouraged to adopt the UN-FDES. However, it does not mean that the country framework will not change in the future. The countries should be able to decide for themselves which particular framework would be more appropriate to suit their conditions and requirements.

Similarly, compendiums of environment statistics have been prepared, utilizing administrative records as well as other existing data in the countries. No country has made any attempt to collect additional basic data for this purpose; the idea was to first organize available data in a manner that will be useful to planners, decision makers, and other users. In the future, however, some environment surveys may have to be conducted to collect and compile specific environment data that are otherwise not easily available. Environment surveys can be expensive and will need specific expertise to conduct. The NSOs as well as concerned environment-related agencies should

examine the possibility of including some relevant environment-related questions in the schedules of various surveys that they undertake on a regular basis. The compendiums are also expected to provide major inputs for the SOERs, which the countries produce periodically. Therefore, it may be worthwhile to publish the compendium at least once every two or three years.

A typical feature of environment statistics is that many data refer to physical parameters (e.g., air quality, emissions to water, etc.) that the NSOs never measure directly but obtain from the concerned environment agencies, which have the equipment and the expertise to measure and interpret the data collected. Further, as the NSOs are not qualified to use raw data, they rely on validated data appearing in technical reports. The typical task for them would be to select and aggregate data with a view to fitting them into the environment statistics framework. As the statisticians themselves are not in a position to produce environment-related statistics, nor to scientifically interpret them, they will need technical support from their counterparts in the environment agencies. Hence, strong and close coordination will be required between NSOs and environment agencies.

Though the subject of environment statistics is relatively new for most DMCs, the latter can always learn from the experiences of the developed countries. Therefore, NSOs should exert maximum efforts to share the experiences and expertise of the developed countries. They can also benefit by asking to be on mailing lists for technical reports and methodological documents prepared by concerned agencies in developed countries. It will always be worthwhile to maintain close contact with such agencies and acquire technical reports and documents that they produce occasionally.

Methodologies for the collection and compilation of environment statistics are not well-developed. As environment statistics represent a new field, statisticians often are not familiar with the techniques and methodologies used to generate environment statistics. On the other hand, environment experts who are acquainted with these methodologies often are not quite familiar with statistical surveys and sampling techniques. Therefore, it is necessary to conduct intensive training in environment statistics where both statisticians and environment experts could be jointly trained in methodologies for environment statistics. The participating countries may think about

conducting different levels of training in environment statistics on a regular basis. They may also explore and avail themselves of training opportunities in environment statistics that are available at the regional and international levels.

Compared with socioeconomic and demographic statistics, environment statistics are relatively underdeveloped. But the methods, techniques, and choices of variables for environment statistics will improve over time with the interaction of the data producers and users. The country-specific FDESs identify the variables for the collection of environment statistics, their sources, and the availability of such statistics. However, not enough technical documents and handbooks are being produced, even in the developed countries and at the international level, to provide methodological guidance to staff involved in the collection and compilation of environment statistics. ESCAP is preparing a handbook on environment statistics, which will be useful to environment experts directly or indirectly involved in the collection and compilation of environment statistics. When it becomes available, the handbook is also expected to fill, to some extent, the general dearth of methodological publications concerning environment statistics. The scope and coverage of the ESCAP handbook is, however, rather limited, and needs to be expanded and improved. Therefore, countries participating in the RETA will be in a good position to contribute in this regard, since they have already developed their own country-specific frameworks on environment statistics. If environment statistics have to develop at par with socioeconomic and demographic statistics, all the countries will need to make concerted efforts to prepare handbooks and technical guidelines to assist staff in data collection and compilation.

In most developing countries, people who make policies and decisions increasingly demand that the producers of environment statistics provide key environmental indicators. Certainly, indicators are an efficient way of measuring environmental issues as they are a small, succinct set of data summarizing the key environmental problems in a country. The production of indicators is a very worthwhile goal, but developing an agreed-upon set for a country entails substantial cost. This work can build on the collection and presentation of readily available data intended for the SOER. As developed countries and international agencies have already developed key indicators on the environment and sustainable

development, there is no point in developing these indicators again. Instead, interested DMCs could use these indicators as a starting point to further develop indicators relevant to their conditions.

Finally, considerable resources are required to develop environment statistics. Such resources are not likely to be obtained in the near future as statistics is not a priority area in many developing countries. Moreover, the recent financial crisis has impacted negatively on scarce government resources, part of which could have been available for statistics development. Maximum efforts will thus have to be made to convince government authorities of the need for support in the field of environment statistics. The participating countries have made a beginning in establishing a separate cell for environment statistics in their NSOs. Such cells will have to be strengthened over time. Staff involved in the development of environment statistics will also need further training. There is therefore a need to develop the capability of NSOs to provide training in environment statistics to their personnel and other interested parties.