Handbook on Environmental Data and Information

Chapter I

Environmental Information and Their Sources in Pakistan

Introduction:

Like any other country, environmental data and information play a key role in the preparation and implementation of plans, programmes and projects in Pakistan not only by the government but also by the private sector, multilateral organizations as well as NGOs and other interest groups. They also serve as a tool in monitoring and enforcing compliance with regulations/ standards and environmental policies. While providing an important instrument for policy integration, they also assist in informed decision making. Consequently, it has become imperative to deliver essential and reliable information on priority environmental issues to decision makers, and ability to harmonize with international standards and classifications. This handbook has therefore, been designed to develop an efficient system of data and information on environment that could meet the growing demand of various governmental agencies, environmentalists and general public for data on various aspects of environment in Pakistan.

In order to improve environmental statistical system and information the Government of Pakistan has launched a three pronged strategy under its National Environmental Management Information System (NEMIS) project to streamline the development of a national compendium of environmental statistics, provincial/regional environmental profiles and the national state of environment reports on a regular basis. Some important issues here are that what should be the contents of these three entities, how they should be organized and what framework should be followed therein. In this connection, the compendium is usually defined as a well-organized compilation of statistics, tables, and charts, accompanied by brief explanatory notes on the information. State of the Environment (SOE) report on the other hand is a textual or narrative interpretation of environmental information. It attempts to give explanation of environmental problems, the reason for their occurrence and what is being done about these. The compendium and the SOE are different publications. “The compendium is a simple characterization while the SOE is 80 percent explanation and 20 percent data” In contrast, the Provincial/Regional Profile is to provide an outline of environmental information related to a Province/Region. It should include the statistical information and explanatory notes and also highlight significant environmental problems of the Province or region which may vary for example in Khyber Pakhtoonkhwa and Northern Areas problems related to mountains and glaciers may be more important whereas for Sind and Baluchistan problems of marine environment may be more significant.

Production of all three types of documents mentioned above, demand development of an information system, whereby data is collected, compiled, processed and analyzed for appropriate interpretation in the relevant document.

Data and Information Type and Their Hierarchy:

The type and structure of data is often explained through information pyramid, whereby primary or raw data, is at the base of the pyramid, while processed or refined data is in the upper layers of the pyramid ranging from analyzed data to indicators and indices (Fig. 1).

Primary Data:

Primary or raw data is collected from monitoring or field activities. An example is daily temperature or rainfall measured at a meteorological station or various key pollutants in air measured at a monitoring station in a city or sediment flow in a river measured at a sampling station, or an inventory of plant or animal species found in an area. These are raw data as yet.

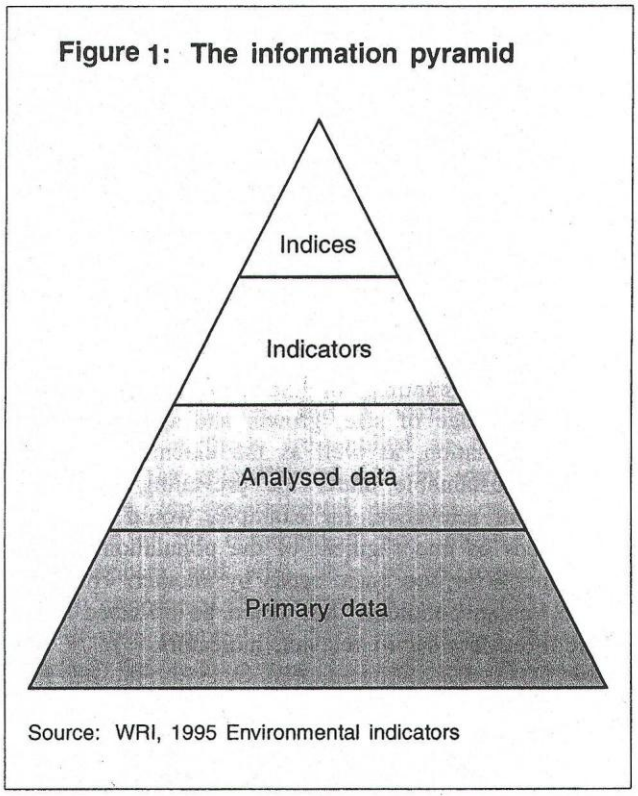

Figure 1: The information pyramid

Source: WRI, 1995 Environmental indicators

Analyzed Data:

One step above the base is a layer which 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 such as average monthly temperature or rainfall or average concentration of key pollutants at specific time periods or sediment flow average or total temperature, rainfall or pollution over time. The analysis may also involve environmental interactions. For example, data might be interrelated to obtain new information such as rainfall and river flow data is used to get rainfall/runoff ratios. This process is usually referred as environmental analysis. Analysis may also involve aggregating the data to show time-series patterns or cross-sectional patterns of the aggregated data. Analysis of

environmental data, however, is not just taking averages or deriving measures of variability, or adding up totals. At advanced level, it may involve interrelations between climate variables to analyze past and future changes in climate. Likewise it may analyze the relationship between glacial melt and river flows. The contents of the primary and analyzed data layers of the pyramid should be organized by environmental media i.e. land, water or air – which also reflects the functional areas of the data-producing agencies (e.g. Agriculture Ministries/ Departments, Soil Survey, WAPDA, Irrigation department forestry departments, EPAs etc.). They may also be organized by sector as in industry, human settlements, or energy.

Indicator:

The next data/ information level in the pyramid (fig.1) is the indicator. An environmental indicator may be an aggregation of several statistics, or it may simply be a selected statistic. It is important in the sense that an indicator must indicate something. As opposed to primary and analyzed data, which may to a large extent be characterized as basic or neutral information, indicators provide purposeful information to the stakeholders about the status of the environment. For example an indicator gives information on changes in a system. An example is the rate of soil loss which is an important indicator of environmental stability in arid and semi arid regions of Pakistan. 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 environmental issues in Pakistan include deforestation, land degradation, water supply, and water and air pollution. The implication is that environmental indicators should be so organized as to indicate the environmental concern and management objectives they are related to.

A study commissioned by the Government of Pakistan on National Environmental Sustainable Indicators has proposed ninety two core indicators (NEC Consultants, 2008). . Unlike primary and analyzed data that may be organized according to media or economic sector, indicators preferably need to be organized by environmental issue. This is where a framework is needed to classify the indicators according to some logical structure of driving force or cause or pressure, effect (impact and state), and remedy (Response), which forms the basis for the preparation of the State of the Environment reports. For example, the pressure on the environment is caused by the application of pesticides and one result of this is an impact on the levels of pesticides in groundwater (Fig. 2). In this case the primary state indicators are the levels of chemical residues in groundwater. These are monitored by measurement against agreed quality standards. The response to increasing levels of chemical residues in groundwater is to use the financial instrument of taxation to modify the levels of pesticide use that are responsible for the pressure (Hardi & Pinter 1995). The framework is also helpful in distinguishing among different types of indicators in terms of their usefulness at different stages of the decision making process. State indicators for example, can help in the identification of problem and pressure

indicators provide the causal relationships while response indicators assist in analyzing the adequacy of response and are helpful in policy evaluation. The ninety two core indicators proposed for Pakistan in various themes under Pressure-State-Impact-Response framework are given in Annex 1.

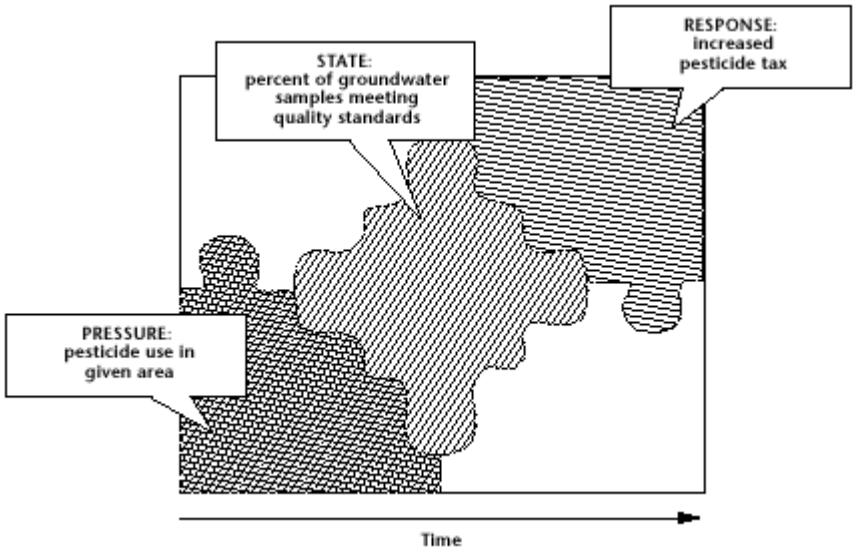

Fig. 2 Application of Pesticide and Related Indicators in PSR Framework

Indices:

The uppermost layer of the pyramid consists of aggregated indicators, referred to as index. A good example of this is the most commonly used index of economy – the gross national product (GNP). It shows how much important a single number can become when its significance is widely understood. In terms of environmental information most common indices are those of water or air quality, which combine elements of quantity and quality in the respective media i.e. water or air. Environmental or ecological indices, in general also attempt to capture aspects of the ecosystem or resource sustainability. It is important to note that there should not be too many indices and that they should be able to convey information in a simple yet comprehensive manner.

Database and Information System:

The database and information system development, which is a major task of National Environmental Information System (NEIMS), is necessary to support the preparation and updating the three documents mentioned earlier i.e. Compendium of Environmental Statistics, Provincial/ Regional Profiles and the State of the Environment Reports. The main objectives of this database/ information system are:

a. generation, rationalization, harmonization and integration of standardized data and information to support the production of the three documents

b. incorporation of means to access and the use of existing data derived from many

different sources and disciplines into a rational system.

c. development and use of a core or critical data-set and indicators for use in the above documents

d. use of indicators, assessment methodologies and tools to enhance capacities at the national and provincial/regional level arid where necessary, at the local level

Current Status of Data Availability and their Shortcomings:

A large number of governmental and Semi-governmental organizations as well as NGOs are involved in the collection, compilation, storage, dissemination and analysis of environment and environment-related sectoral information and data in Pakistan. Examples of such data are those on land-use which are usually collected by the Ministry of Food, Agriculture and Livestock, which also maintains data on fertilizer and pesticide use. Data and information on land degradation is maintained by several organizations, such as Soil Conservation Departments, Soil Survey of Pakistan as well as Agriculture and Irrigation departments. Water resources related information is compiled by Ministries or Departments responsible for development of water resources. Statistics on forests, flora and fauna is the responsibility of Inspector General of Forest and Provincial Forest Departments, which also have detailed statistics on protected areas. The data on marine environment is maintained by several organizations depending on the scope of the information, for example oceanographic data is compiled by the National Institute of Oceanography, Maritime Security Agency as well as port authorities and harbour departments. Information on marine fisheries is usually the responsibility of Department of. Fisheries while marine pollution aspects are covered by Environment Protection Agencies.

Published environment related information in Pakistan comes primarily from Government Departments particularly the Ministry of Environment, and Environmental Protection Agencies. In addition a vast spectrum of areas such as atmosphere, water, land use, energy, flora and fauna, biodiversity, streams flow, glaciers and natural hazards are covered by other government departments. Moreover, environmental research organizations and researchers are also important contributors. Among research organizations again Governmental research organizations like Pakistan Council for Research in Water Resources, National Wildlife Council, Hydrocarbon Research Institute and Pakistan Agricultural Research Council provide some examples of research organizations, which generate useful environmental information and data within their own sphere. NGOs are also making important contribution to environmental data and information. In this connection publication of Provincial Conservation Strategies and in some cases provincial State of Environment reports of IUCN in Pakistan are very important contributions to environmental information at the provincial level.

Environmental data collection process in human settlements is somewhat more complicated where several management agencies are involved on the same or different aspects. These agencies include land survey, land records and public health departments, municipalities, public works departments, development authorities, civic organizations and NGOs. Moreover, in most cases ad hoc specific surreys are the basis for assessing the gravity of environmental pollution. These surveys primarily concerning air or water

pollution in urban centres, record data at a few selected stations and may have been collected by the EPAs, universities or research organizations.

In the national, provincial or local context, the data compiled by each agency varies according to its own policies and objectives. There is also a variation in definitions and classification even on the same sectoral aspects when data and information is collected by two different government agencies. For example there is a considerable variation in land use data of land revenue department and that of Space and Upper Atmosphere Research Commission (SUPARCO). One is assembled from revenue records and the other is extracted from satellite images. Moreover, the .methods and procedure for measurements of data are not the same creating discrepancies in the final information collected. In case of ad hoc surveys on pollution for example, no attempt is made to compute an aggregate index.

So far not much progress has been made in the country on developing standardized concepts, definitions and classifications for statistical variables that describe environmental issues and can be compiled by a central agency. Much work also remains to be done in promoting regular collection and processing of data in an integrated manner, and for analyzing the data needs of users in the field of environment. Although a large number of sectoral data are collected regularly as specified above it is rare that those data are coordinated, and standardized for publication in the form of aggregate environmental compendium. Hopefully, the ongoing efforts under NEIMS project of the Ministry of Environment will lead to the standardization and promote coordination among various government agencies in the development of national environmental data base and information system.

References:

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Hardi & Pinter (1995),

NEC Consultant (2008), National Environmental Sustainable Development Indicators Study, Lahore

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Chapter II

Compendium of Environmental Statistics

Compared with social, demographic, and economic statistics, the development of environment statistics in Pakistan is still in its infancy. The first Compendium on Environment Statistics was prepared in 1998 under the Technical Assistance of Asian Development Bank. It was revised in 2004 (GoP, 2005). No doubt it is a very good initial effort but still much of the data in the compendium is in the form of primary or raw data and it has no information on indices and little information on the indicators identified in the study commissioned by the Ministry of Environment (NEC Consultant, 2008). In addition the Compendium needs to have a balanced coverage of physical environment media (e.g., land, air, water), biological media (e.g., biodiversity), and economic sector (e.g., human settlements, industry, energy) to show trends more readily.

Much of the information presented in the compendium is on demographic and socio-economic indicators. The coverage of biological indicators of water quality, and water pollution in rivers and heavy metal levels in lakes is poor; no 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 is also needed to give the number of households connected to sewage schemes, capacity of treatment systems, and degree of treatment prior to disposal. Chemicals and hazardous waste data are missing in terms of specifying volumes and sources (household, industrial, construction sites etc). Data on ecosystems and biodiversity are also sparse.

Organization of the Contents:

It is important to organize the contents of compendium of environmental statistics into essentially three parts. Part I should be a summary of important ecological indices (to be developed if not already developed) as well as selected environment indicators. As stated earlier 92 indicators have already been proposed by the study commissioned by the Ministry of Environment (NEC Consultant, 2008). Part 2 should 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 (as has been explained in the Pressure- state-response framework PSR format of the SOE given in the section of SoE) 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., natural and agricultural 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. Part 3 can include a compilation of supporting statistics mostly in tabular form (e.g. tables showing environmental interactions and resource and environment physical account).

Physical Environment

Land-Related Issues

The first level of data reflecting land-related problems concerns land use. Land use describes the utilization of land for crops, pastures, forests and woodlands, wasteland and wilderness areas. Although the data on pastures and cropland are available, no data exist for wilderness areas in Pakistan. This lack prevents assessing the current situation properly, especially considering the loss of habitat for its precious species as a problem and also about soil erosion due to inappropriate land use.

Land degradation is observed to be a major problem in Pakistan therefore data on land quality assumes special importance here. A good parameter for judging the trend in land quality is land or soil capability. It is recommended that data on land productivity be collected and included in the compendium as well as provincial environmental profiles. To understand or predict the changes taking place in land use, data on the movement of population are very important. However, such data are not available in Pakistan and may be included in future in the population census.

In terms of interrelationships this section should also have data on agriculture i.e information on area under principal crops; performance of crop production; use of agricultural inputs; consumption of pesticides province/ region wise and their effect on soil. There should also be a section on natural disasters providing information on frequently occurring natural disasters; recent natural disasters in Pakistan; major earthquakes; number of drought-prone districts and damages due to droughts. Information on mining should also be included giving data on number of mines, production of minerals, mining machinery and consumption of explosives in mining.

Water-Related Issues

Foremost on the list of water-related issues is the availability of potable water. Satisfactory data for total availability of renewable water resources and water withdrawal rates should be made available sector wise. Data on surface water quality and quantity be given; the presence of coliform in water is a well-accepted index that should also be included. Data on groundwater consumption need to be generated in the light of acknowledged problems such as the lowering of water tables, land subsidence, and saltwater intrusion. Among related statistics information on rainfall performance during the last 20 years; and its relationship to water flow in streams and ground water resources may be included.

Because most urban sewage is being dumped into the sea and in view of the occurrence of oil spills, data on marine pollution are important to relate it to the carrying capacity of coastal water. Natural disasters like floods and cyclones are common and need to be cited

as major environmental concerns. A record of the time and types of disasters and, more often than not, the number of deaths caused by water related natural disasters (though the accuracy of the data is not always ensured) is important along with the number of people injured and affected. Without these data, it is difficult to estimate the extent of success in protecting people against such natural disasters.

Biological Environment

The Section on Biodiversity should be divided into three sections - flora, forests and fauna. The section on flora should include statistics on plant species of Pakistan and the Provinces/regions, those which are rare, vulnerable, endangered and extinct. It should also have tables on measure undertaken for the conservation and protection of flora like the establishment of protected areas such as Biosphere Reserves, Botanical Gardens and Gene Banks etc. Information on agro biodiversity should also be added.

The section on forests should give information on percentage of forest area to total geographic area (province-wise). Deforestation is a major problem faced by Pakistan. Fortunately, area under forest is monitored regularly in the country. Good data exist for productive forest areas and fuel wood production. Data on average annual reforestation are also maintained; however, data on forest quality are not easily available. Areas classified as forest area may be already degraded forest and some indication of the quality of the forest is necessary. Some indices also have to be devised for assessing the condition of the mangrove swamps, coral reefs, and sea grasses.

The data sets on fauna or wildlife (large animals) should include the major bio-geographic habitats in Pakistan, estimated number of species in various regions, national parks and wildlife sanctuaries and reserves. Habitat loss is not well recorded. The data on the factors that threaten wildlife are also needed. Figures on trade in mammal skin are important for the same reason. It is also important to collect data on trade involving wildlife, which includes trade in live primates and reptiles, mammal skin, and Hobara Bustard. However, wildlife in forests does not consist of just large animals. Data on other forms of wildlife like plants and their diversity, insect habitants and so on, as well as on ecology are needed.

Atmospheric Data

The data on atmosphere needs to be divided into four sections. The first section on ambient air quality should give the air quality data in major cities and compare these to the standards and may relate this to impact on human health. Air quality data are still difficult to obtain and it is desirable that gaps be filled soon. In addition, worldwide estimates of emissions are of uneven quality. The problem is further aggravated by the fact that data are often collected and analyzed on an ad hoc basis.

The next section on Noise should give information on the ambient noise standards; average noise levels in various metropolitan cities and effects of noise pollution on human health. The following section should be on the greenhouse gases giving

information on the key greenhouse gases and the share of Pakistan in global green house emission.

In order to derive interrelationships, between energy, industry and greenhouse gas emissions, it will be appropriate to include here a section on energy and industry to give information on installed capacity of utilities; electricity generation and actual power supply position, different fuels consumption in Pakistan and their production as well as statistics on renewable energy resources. On industries, it will be useful to give information on the number of registered industrial establishments in Pakistan and the status of pollution control in various categories of industries..

Socio - Economic Indicators and Data

Population-related data are essential to assess the existing and predicted pressures that will be exerted on the environment. Although the collection of environment statistics is a relatively new task for nations, the collection of socioeconomic information has a much longer history. Basic demographic data have been collected through population census. . Hence, it does not come as a surprise that complete data exist for population growth; labor force distribution of the population by age; birth and death rates; life expectancy; fertility rate; infant, child, and maternal mortality rates, and so on. It would be important to compare infant mortality rate and expectation of life at birth with safe water supply and sanitation.

Environmental degradation is often closely related to the deterioration of human health. Hence, health statistics form an important part of environment statistics. Accessibility of the basic infrastructure facilities is another aspect of environment statistics that should not be underrated. Lack of a proper sanitation system leads to water pollution; therefore, countries will need to collect data on health and access to infrastructure facilities. The current status of health and infrastructure statistics shows that much needs to be improved on this front. Information on the percentage of the population with access to health services and records on people affected by major diseases like malaria and cholera are also needed and adequately maintained. In terms of human settlements it would be important to include information on housing, slums and basic facilities, number of households, their size, number of rooms per housing unit, water supply system and toilet installation by rural and urban, and homeless population.

Pakistan faces the problem of energy shortage, and it is looking for more efficient ways to produce and consume energy. Such problems can be studied from the available data on production, consumption, and trade of energy, but time series data are not available. The most crucial energy problem faced by the country is the accelerated use of nonrenewable fossil fuels. To address this concern, data on coal and oil reserves are needed. The production of uranium and nuclear energy might be very small for some of the countries, but no information on uranium is available. Pakistan does not have data on a nuclear reactor under construction either. For the rural areas, the principal energy source is biomass based fuels. It is observed that some data are available on the shortage of fuel wood, which is indicative of the seriousness of the problem. However, systematic data

collection on sources of fuel wood and their trends is not done. Such data will be useful for analyzing the fuel shortage problem.

Waste disposal is becoming a major problem for Pakistan. However, data on waste generation is sketchy. For example, no data on annual municipal waste or industrial waste generation is collected on regular basis. Likewise data for hazardous waste are not maintained. Although, the disposal of hazardous waste is a more difficult task, but data on the generation of other waste is also very important as it will give some idea of the size of the problem of waste generation and disposal.

Framework of the Compendium:

The contents and framework of the compendium should be continuously refined to accommodate contemporary issues and concerns. For example the present compendium on Environmental Statistics of Pakistan has four sections – socio economic activities and natural events, environmental impacts of socio economic activities and natural events, responses to environmental impacts and inventories, stocks and background conditions. In name the various heading refer to pressure-state-Impact-response framework (Fig. 2) but the themes included within this framework do not fit them. For example the response section describes climate, temperature, rainfall, pressure and wind, which is state and not response. Response actually is policies and strategies, laws, regulations, environmental expenditures, institutional aspects etc. Similarly the Impact Section includes themes like population growth etc. which are to be included under pressure rather than impacts. The framework and thematic coverage therefore needs completed revision. A possible format is suggested in annexure 2. Based on indicator's study some of the possible tables that could be added to the compendium are given in the second section of this Handbook.

In terms of overall qualitative assessment of the data on core environment statistics presented in the compendium of environmental statistics of Pakistan, the criteria for evaluation are mainly depth and specificity of coverage. The presentation of data related to the atmospheric environment clearly shows that inventories of greenhouse gases are missing and ozone-depleting substances have not been presented in any detail. Water availability is the most crucial problem of the country, but the data have not been presented in an adequate manner - in terms of either availability across sources or demand across sectors. Data related to forests is also scanty. Rate of deforestation is not presented. The data on number of species, endangered species, etc., are not adequately presented. Coastal and marine problems have not provided any data related to either pressure factors or status. Basic data related to the very important urban problem of sanitation has not been reported. Data related to municipal solid waste disposal have not been presented. In the case of all four areas of core environment statistics—atmospheric, aquatic, terrestrial, and urban environment—wherever data presentation is inadequate, it is not clear from the compendiums whether data do not exist or whether there were problems in accessing the data.

It is therefore suggested that while improvements are incorporated in the compendium, it will also help if NEMIS project could start publishing missing data and information on

individual themes of vital importance to the country such as Forests and Biodiversity, Climate Change and Energy, Land Resources, Glaciers and Water Resources and solid waste etc.

References:

Government of Pakistan (2005), Compendium of Environmental Statistics of Pakistan, Bureau of Statistics, Islamabad.

Chapter III

State of the Environment Report

The need for issuing periodic state of the environment reports has been globally recognized at both national and international levels.

International Recognition of SoE Need:

The Rio Declaration in its principle 10 points towards the responsibility of the government to inform the citizens of the state of environment at different levels, adoption of participatory approach and the process of informed decision making. Some other principles of Rio Declaration indicate the broad areas of policy and programmes, which among others should form the substance of the report.

In consonance with Rio Principles, Agenda 21 (UNDESA, 1992) also highlights the need for periodic assessment of the state of environment at national, regional and global levels. This assessment is particularly crucial to the needs and work of the United Nations Commission on Sustainable Development, the main function of which is to monitor the progress in the implementation of Agenda 21. Agenda 21 also calls for enhancing the understanding of the changing environmental conditions and the human dimension of the causes and consequences of environmental change, which falls with in the scope of SoE.

National Requirements:

Besides the Rio Declaration and Agenda 21, Pakistan Environmental Protection Act 1997 (GOP, 1997)……..under clause (6d) the functions of Federal EPA mentions that it will….."Prepare and publish an annual National Environment Report on the state of the environment." While under clause (4f) the functions of Environmental Protection Council mentions that it will "consider the National Environment Report and give appropriate directions thereon."

Objectives of the State of Environment Report:

A state of the environment report fundamentally discusses:

- the status and trend in the quality of the natural ***resources*** and environment
- the relationship between the status and change in environmental quality and human activities
- society's response to these changes
- issues which reflect environmental policy challenges

The state of environment report is therefore much more than a purely scientific study, an

explanation or, as may be the case with some governmental reports, a justification for governmental policies. Nor it is a prescription for the maladies of the future. It is primarily a comprehensive document prepared with the best available tools to be used by the decision makers, the scientists as well as the public and produced, among others, with the following objectives in view:

a. To inform the public, Government and the concerned organizations about the state of environment in respect of both the prevailing human condition and the status of the natural resources in a consistent and comprehensive manner

b. To provide information, on the basis of empirical evidence, on the various stresses placed on the human condition and the natural resource base;

c, To assist in the process of informed planning by presenting information in a comprehensive and easily understandable framework that facilitates analyses of cause – effect relationships and forms the basis for policies, strategies and action plans;

d To illustrate and review environmental policies, strategies and action plans undertaken at the national, and where applicable, at sub-regional and regional levels including the economic, social, institutional and technological aspects;

e. To indicate, as far as practicable, gaps in the present state of knowledge and information, and the need for new information as well as well as for investment on research and development for improving the data base.

f.. To improve public understanding about the state of the environment in order to encourage a better informed public debate and to strengthen the role of major groups including business and industry.

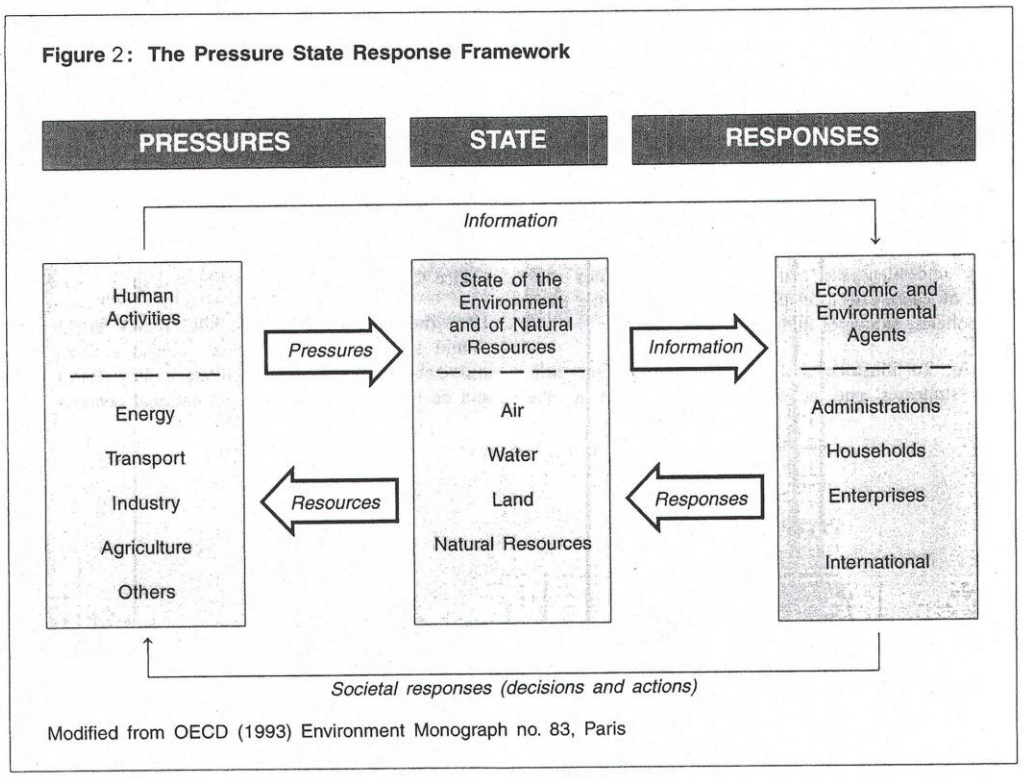
g. To promote precautionary approach in the implementation of environmental policies and programmes.

It may also be stated here that a state of the environment report may turn out to be an exercise in futility if its credibility comes under question. Currently, although important, environment may not be a significant factor in the political process. However, with increasing awareness of its being a determinant of quality of life, it will gain in importance in the context of politically significant issues, which could create the possibility of emergence of a credibility gap between what is stated in the report and the commonly perceived situation. It is, therefore, important that a state of the environment report reflects national consensus.

In summary the characteristics of SoE report are that it should respond to fundamental questions relating to sustainable development, facilitate policy formulation and decision making and reflect national consensus.

Framework and Format:

Although there is some variation in the formats of SoE reports, basically the most widely accepted framework for state of environment reporting is the Pressure-State-Response (PSR) framework (Fig. 3). Human activities exert *Pressure or Stress* (Pressure box) on the environment and change its quality or status (State box). Society responds to these changes through environmental, general, economic and sectoral policies (the societal response box). The nomenclature driving force – state – response is also used instead of Pressure – State – Response.



In Pakistan, the first state of environment report was produced in 1987under the title, "Environmental Profile of Pakistan" (GOP, 1987). This report followed the Pressure-State – Response framework. The Second State of Environment report was prepared in 2005, which was not published (). This report did not follow the same framework. It however, discussed the major environment and development trends and key issues of concern.

It is desirable, however, that the next state of environment report should follow the standard pressure – state – response framework. Under the Pressure, it should discuss the demographic and development trends and relate the pressure thus generated on the environment under the heading population, development and environment. The pressure generated by extreme natural events such as earthquakes, and floods should also be covered in this section.

The next section should discuss the state and impacts on natural and human ecosystems. The coverage of natural ecosystem would involve terrestrial, aquatic and atmospheric ecosystems, while the coverage of human ecosystem would involve such elements as human settlements, health, energy and waste etc. The third section should cover the response of the Government in terms of institutional and legislative developments as well as the response of major groups. The final section should be on the way forward including the challenges and opportunities. The outline of the report has been provided in annexure 3.

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Chapter IV

Provincial / Regional Environmental Profiles

Introduction:

While the National Environmental Compendium and National State of Environment report cover the information at the national level and provide data and information for comparative analysis between the provinces/regions, the Provincial/Regional profile will cover the information at the Provincial/Regional level and comparative study of various districts within the provinces/regions. So the difference is primarily in the geographical coverage and issues of focus, which may vary in different provinces/ regions.

The coverage of the issues will vary for example in Sind and Baluchistan Provinces coastal environment will receive a lot of focus of attention, while in NWFP and Gilgit-Baltistan glacier and snowfields as well as forests will be a major focus of attention. A logical order of activities for setting up a database for environment statistics at the provincial/regional level will be as follows

(i) Make an inventory of the environmental problems of the province/region.
(ii) Besides collecting overall statistics, choose and highlight the most pressing problems that could very well be addressed through all important agencies and institutions involved, thus making the activities widely known to the people that matter.
(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, 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.
(v) Disseminate widely and discuss results.

Extent of coverage

An important consideration is the coverage of environment statistics in terms of both subject and hierarchy of geographical areas in the Province/region. 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 trying to cover the province/region as a whole.

Framework and Format:

The Pressure – state – response framework, applies to Provincial/ Regional Profiles too. However it will be more important to focus on state or issues first as these, as pointed out above will vary in different provinces/ regions. These may vary in intensity and nature

from acute water scarcity as in Baluchistan to depletion of water in Indus delta in Sind, resulting in intrusion of sea water to melting of glaciers in Gilgit/ Baltistan and Khyber Pakhtoonkhwa.

The state or issues section should be followed by the pressure section which may emanate as a result of growing population or economic activities. This should be followed by a section on response in terms of both action by various actors as well as perception and attitudes. Finally the emerging challenges should be summarized in the end. The detail structure of the Profile has been given in annexure 4.

Annex.1

Proposed Core Environmental Indicators for Pakistan by PSIR Framework

Theme	Sub-theme	Sr. No.	Core Environmental Indicators	PSIR Framework			
				P	S	I	R
Atmosphere	Air Pollution	1	Emissions of CO_2, SO_2, NO_x, CH_4 and PM by road vehicles and industry (tonnes per annum)	*			
		2	Ambient concentrations of CO, SO_2, NO_x, CH_4 and MC in major urban areas (ug/m^3)		*		
		3	NEQS for air emissions				*
		4	Number of vehicles using CNG as replacement fuel for petrol (% and number)				*
	Climate Change	5	Global emissions of CO_2, SO_2, and NO_x (tonnes per annum)	*			
		6	Consumption of ozone depleting substances (tonnes per annum)	*			
		7	Sea level rise at the coasts of Pakistan (mm)			*	
		8	Change in Pakistan mean temperature at observatory points (^oC)			*	
		9	Change in Pakistan mean rainfall at observatory points (mm)			*	
		10	Number of weather related disasters in a year (number)			*	
		11	Number of people under threat due to sea level rise (number)			*	
		12	Coastal area lost per annum due to sea level rise (hectare)			*	
Land	Land Use	13	% and area in land use distribution (% and hectare distribution)		*		
		14	Protected area as % of total land area (%)				*
	Soil	15	Area effected by soil erosion (% and hectare)			*	
	Water Logging & Salinity	16	Area effected by water logging and salinity (% and hectare)			*	
	Forest	17	Total area under forest inclusive of AJK & NA (% and hectare)		*		
		18	Total area under coniferous forest inclusive of AJK & NA(% and hectare)		*		
		19	Total area under farm plantation (inclusive of irrigation plantation, farmland trees and linear plantations) (% and hectare)		*		
		20	Area effected by deforestation (% and hectare)			*	
		21	Total area under protected forest (% and hectare)				*
	Rangelands	22	Population density of the grazing life stock in the rangelands (number of livestock by type per hectare)	*			
	Agriculture	23	Urban sprawl on agricultural lands (hectares/annum)	*			
		24	Use of fertilizer (tonnes/arable hectare)	*			
		25	Use of agricultural pesticides (tonnes/arable hectare)	*			
		26	Arable land per capita (hectare/capita)		*		
	Watersheds	27	Reduction of forest cover in the watersheds (hectares/year)			*	
		28	Land affected by wind and water erosion (% and hectares)		*		
Water	Water Resources	29	Industrial and agricultural water consumption per GDP (AF/GDP million)	*			
		30	Water efficiencies in industrial and agricultural sectors (change in MAF/GDP)				*
	Groundwater Resources	31	Annual withdrawals of groundwater (MAF)	*			
		32	Domestic consumption of groundwater per capita (M^3/capita/annum)	*			
		33	Total fresh groundwater resources (MAF)		*		
		34	Annual groundwater recharge by dry and wet years (MAF)		*		
		35	Concentration of physio-chemical and bacteriological pollutants in groundwater at major locations (mg/litre)		*		
	Surface Water Resources	36	Annual withdrawals of surface water (MAF)	*			
		37	Annual surface water consumption by major sectors (MAF and % distribution)	*			
		38	Annual industrial and municipal discharges into the surface water (million gallons)	*			

		39	Average annual surface water availability (MAF)		*		
		40	Annual per capita availability of surface water (M^3/capita)		*		
		41	Concentration of physio-chemical and bacteriological pollutants in surface water (mg/litre)		*		
		42	% of population connected with oxidation ponds in rural areas and wastewater treatment plants in urban areas (%)				*
	Marine Water	43	Industrial, agriculture and municipal discharges directly into marine water bodies (MAF)	*			
		44	Concentration of oil, N and P in the coastal waters (mg/litre)		*		
		45	% of population in coastal areas connected with oxidation ponds in rural areas and wastewater treatment plants in urban areas (%)				*
Biodiversity	Eco-systems	46	Inventory of ecological zones (numbers)		*		
		47	Important eco-systems under threat (locations, numbers, and hectares)			*	
		48	Total endemic terrestrial species by ecological regions (inventory)		*		
		49	Conservation areas by eco-systems (hectares)				*
	Flora	50	Total inventory of flora species (numbers)		*		
		51	Total number of endemic and threatened flora species (species inventory)		*		
	Fauna	52	Total inventory of fauna species (numbers)		*		
		53	Total number of endemic and threatened fauna species (species inventory)		*		
Energy	Non Renewable – Fossil Fuels	54	Annual fossil fuels supplies and consumption (TOE)	*			
		55	Total fossil fuels proven reserves by type (TOE)		*		
		56	Total fossil fuels imports (TOE)		*		
	Renewable Energy	57	Total renewable energy production by type (TOE)				*
	Energy Efficiency	58	Manufacturing sector growth rate (%)	*			
		59	Energy shortage (TOE)			*	
		60	Annual total energy consumption by sectors (TOE and distribution by % and TOE consumption by sectors)		*		
		61	Annual energy consumption per capita (MBTU/capita/annum)		*		
		62	Improvement in the energy efficiency per GDP (TOE/GDP)				*
Minerals (excluding energy)	Minerals	63	Annual extraction of mineral resources by type (tonnes)	*			
		64	Life time of proven reserves by type (on the basis of present and future extraction trends in years)		*		
Human Settlements	Demography	65	Population growth rates (national, rural, and urban in %)	*			
		66	Population living below poverty line (national, rural, and urban in %)			*	
		67	% of population living in slum and marginal areas (national, rural, and urban)	*			
		68	Under 5 mortality rate (national, rural, and urban per 1000 births)			*	
	Water Supply	69	Access to clean water (% of population served at national, rural, and urban)		*		
		70	Incidence of diarrhoea in children under 5 (%)			*	
	Sanitation	71	Access to sanitation services (% of population served at national, rural, and urban)		*		
	Solid Waste	72	Total municipal solid waste generation (national, rural, and urban in tones)	*			
		73	Total municipal solid waste collection (national, rural, and urban in tones)		*		
		74	Solid waste generation rate per capita (kg/capita/day)			*	
		75	Area contaminated by toxic waste (hectare)			*	
		76	Access to solid waste collection services (% of population served at national, rural, and urban levels)				*
		77	Total and % of municipal solid waste safely disposed (national, rural, and urban in %)				*

		78	Total generation of hazardous waste (national, rural and urban in tonnes)	*			
		79	Safe disposal of hazardous waste (national, rural, and urban in tonnes)				*
		80	Total generation of hospital waste (national and urban in tonnes)	*			
		81	Safe disposal of hospital waste (national and urban in tonnes)				*
	Transportation	82	Number of vehicles in use by type per 1000 persons		*		
		83	% of urban population exposed to high concentrations of CO, SO_2, NO_x, PM_{10} and Pb (ug/m^3)			*	
	Public Health	84	Prevalence of environmental related diseases by type (% of population effected by diseases)			*	
		85	% of population with access to basic health care facilities (%)				*
		86	Health and nutrition expenditures (Rupees and % of GDP)				*
Environmental Economics	Economics	87	GNP per capita (US $)	*			
		88	Environmental degradation cost per annum (Rupees)			*	
		89	Environmental protection budget as % of national budget (Rupees in million and %)				*
Natural Disasters	Natural Disasters	90	Frequency of natural disasters (number)	*			
		91	Cost and number of injuries and fatalities related to natural disasters (Rupees and number)			*	
		92	Number of human settlements and population vulnerable to natural disasters (number)			*	

Source: NEC Consultant (2008), National Environmental Sustainable Indicators Study, Final Report.

Annex.2

EXPLANATORY NOTES/TECHNICAL NOTES

INTRODUCTION

PART I. SOCIO ECONOMIC ACTIVITIES AND NATURAL EVENTS - PRESSURE

1.1 Settlements growth and change

1.1.1 Population growth and change
1.1.2 Construction of shelter and infrastructure
1.1.3 Utilities (Energy and Water Supply)
1.1.4 Transportation
1.1.5 Land use in human settlements

1.2 Use of natural resources and related activities

1.2.1 Agriculture
1.2.2 Forestry
1.2.3 Fishery
1.2.4 Minerals, mining and quarrying
1.2.5 Energy production and consumption
1.2.6 Water use for human activities
1.2.7 Land use and environmental restructuring

1.3 Waste loading and application of biochemicals

1.4 Natural events

PART II. STATE AND IMPACTS OF ACTIVITIES/EVENTS – STATE AND IMPACTS

11, 1 Resources depletion and increase
11.2 Environmental quality
11.3 Health and natural disaster

PART III. RESPONSES TO ENVIRONMENTAL IMPACTS

111.1 Resource management and rehabilitation
111.2 Pollution monitoring and control
111.3 Prevention and mitigation of Disasters due to Natural Hazards
I I I.4 Non-government responses

PART IV. STOCKS INVENTORIES AND BACKGROUND CONDITIONS

IV.1 Flora and fauna inventory
1V.2 Emissions
1V.3 Hazardous work environment and industries
IV.4 Land inventory
1V.5 Socio-demographic conditions
IV.6 Economic situation
1V.7 Weather/climate condition

Annexure. 3

Suggested Format of the State of Environment Report

1. Pressure

1.1 Population, environment and development trends

2. State and Impact

2.1 Natural Ecosystems

2.1.1 Land
2.1.2 Forest and biodiversity
2.1.3 Fresh water
2.1.4 Atmosphere
2.1.5 Coastal and marine environment

2.1 Human Ecosystems

2.1.1 Human settlements
2.1.2 Food security
2.2.3 Waste
2.2.4 Energy
2.2.5 Human health

3. Response

3.1 Public authority action: institution and legislation
3.2 Public authority action: policy measures
3.3 Major groups: Perception and contribution
3.4 Education, research and awareness raising

4. Way Forward

4.1 Challenges and opportunities

Annexure. 4

Suggested Format of the Provincial/ Regional Profiles

1. State and Impact (Issues)

1.1 Land (Shrinkage and degradation)
1.2 Deforestation (Habitat and biodiversity loss)
1.3 Fresh water (Scarcity and degradation)
1.4 Atmosphere (Pollution and climate change)
1.5 Coastal and marine environment (Erosion and pollution)
1.6 Waste
1.7 Human health

2. Pressure

2.1Population
2.2 Land
2.3 Agriculture and Fisheries
2.4 Industries and transport
2.5 Energy
2.6 Peace and security

3. Response

3.1 Perception and attitudes
3.2 Responses by public authorities.
3.3 Major groups: Perception and contribution

4. Way Forward

4.1 Challenges and opportunities