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THE WAY FORWARD

ENVIRONMENTAL INFORMATION MANAGEMENT IN THE CARIBBEAN

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GLOSSARY OF ACRONYMS

AMA	Agencia de Manejo Ambiental (Environmental Management Authority)
CEHI	Caribbean Environmental Health Institute
CARICOM	Caribbean Community Secretariat
CIDEA	Environmental Education, Information and Dissemination Centre
CDCC	Caribbean Development and Cooperation Committee
ECLAC	Economic Commission for Latin America and the Caribbean
EIM	Environmental Information Management
EMA	Environmental Management Authority
EPA	Environmental Protection Agency
GEF	Global Environment Fund
GIS	Geographic Information System
IDRC	International Development Research Center
IMA	Institute of Marine Affairs
IOC	Intergovernmental Oceanographic Commission (IOCARIBE)
NEAP	National Environmental Action Plan
NEIS	National Environmental Information System
NGO	Non-governmental Organization
NRCA	Natural Resources Conservation Authority
NRMU	Natural Resources Management Unit
OECS	Organization of Eastern Caribbean States
POA	Programme of Action for Small Island Developing States
SIDS	Small Island Developing States
SRS	Satellite Remote Survey
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
USAID	United States Agency for International Development
IDB	Inter-American Development Bank
FAO	Food and Agriculture Organization
GEMCO	Guyana Environmental Management Conservation Organization

DEFINITIONS

Below are definitions for some terms as used within the context of this report:

Data

Data consists of numerical observations or statistics that describe some aspect of the environment; e.g. water quality, demographics, etc.

Information

Information is analyzed data; i.e. data which have been collected and processed by selection, interpretation and analysis to yield results which can assist in increasing the awareness and knowledge of the user about a particular issue or topic. Information must therefore be available in a format which the user can understand and assimilate.

Knowledge

Knowledge is the understanding and assimilation of information by the user to facilitate informed decisions and choices.

Environment

Environment refers to the natural environment and its resource base.

Environmental Information Initiatives

Environmental Information Initiatives include projects and programmes, the activities of which lead to:

- The provision of environmental information services;
- The development of systems for the management of environmental data and information;
- Extensive generation of data and information for the management of natural resources.

Environmental Information Management

Environmental Information Management encompasses the following activities:

(a) Collection of data and information from numerous sectors and disciplines, e.g. natural resources, health, socio-economics, demographics etc.;

(b) Definition of standard methodologies for the collection, storage and retrieval of relevant data and information;

(c) Establishment of communication mechanisms and procedures governing the flow and dissemination of data and information;

(d) Building of capacity in multidisciplinary skills required to manage data and information in various disciplines and sectors;

(e) Use of available and appropriate information technologies in all facets of the environmental information management process;

(f) Availability of adequate financial resources;

(g) An environmental information policy which provides direction for the realization of items (a)-(f) above.

I INTRODUCTION

Background

The effective management of resources for human sustainable development requires a range of data and information as inputs to decision-making at all levels. Agenda 21 recognizes that "there already exists a wealth of data information that could be used for the management of sustainable development. Finding the appropriate information at the required time and at the relevant scale is a difficult task." Chapter 40 in Agenda 21 identifies two programme areas which need to be implemented to ensure that "decisions are based increasingly on sound information". These programme areas are bridging the data gap and improving data availability.

Objectives recognized as important in executing the above programme areas were:

- Achievement of more cost-effective and relevant data collection and assessment by better identification of users, in both public and private sectors and their information needs at the local, provincial, national and international levels;

- Strengthening national capacities to collect and use multisectoral information in decision-making processes and the enhancement of capacities to collect and analyze data and information for decision-making;

- Developing or strengthening the means of ensuring that planning for sustainable development in all sectors is based on timely, reliable and usable information;

- Making relevant information accessible in the form and at the time required to facilitate its use.

Recommendations from regional meetings

This study was executed within the context of recommendations from two major meetings in the region. The first was held in November 1994, as a Regional Users Consultation of environmental information in the Insular Caribbean. This meeting was convened under the auspices of the Environment Assessment Programme for Latin America and the Caribbean of the United Nations Environment Programme (UNEP) in collaboration with the Institute of Marine Affairs (IMA) and the Economic Commission for Latin America and the Caribbean/Caribbean Development and Cooperation Committee (ECLAC/CDCC). The objectives of the consultation were to:

- Discuss the type and degree of assistance countries would need for their environmental assessment programmes and associated data and information management activities; and

- Deliberate the role of UNEP in facilitating the fulfilment of these assessment and information management needs within the context of sustainable development.

One of the major recommendations emanating from this meeting was the "execution of an environmental needs assessment for the Caribbean Region which would include the identification of data and information management requirements, training needs and information management structures."

The second meeting, the Caribbean Meeting of Experts on the Implementation of the SIDS Programme of Action (POA), was convened in May 1995. Its objective was to review progress towards implementation of the POA, to discuss constraints to the effective implementation of the Programme and to agree on priority areas for action. Three of the recommendations of this meeting dealt with information in support of the implementation of the SIDS-POA; these recommendations were as follows:

(a) A survey of information resources and needs should be undertaken for the designated priority areas of the SIDS-POA. Based on the results of the survey, a proposal should be prepared for implementation of national and regional information management programmes, for sustainable development, which would include data collection and analysis, repackaging and dissemination of information for decision makers at all levels and utilizing new information technologies, where appropriate. The proposal should be prepared with inputs from multidisciplinary teams at national and regional levels;

(b) Information management and training should be promoted since this is crucial for the full and effective utilization of information technologies in the subregion.

(c) The ECLAC Port of Spain office should be designated the coordinating institution for regional and international initiatives in information for sustainable development.

In accordance with the above developments, ECLAC/CDCC and UNEP, with the support of IDRC commissioned the execution of this study on environmental information needs in the Caribbean.

Terms of reference

The following are the terms of reference of the study:

(a) Identify and detail ongoing and planned environmental information initiatives in the region by international governmental organizations, environmental non-governmental organizations and bilateral donors in terms of programmes, target groups, expected outputs and sources of financing;

(b) Identify the priority needs of different categories of users for environmental information;

(c) Identify mechanisms for national and regional institutions to respond to these needs; and

(d) Formulate a concept proposal for a regional strategy to strengthen the capability of Caribbean governments and regional institutions for environmental data and information management.

Methodology

During the mobilization of the project, collaboration was established with the Caribbean Environmental Health Institute (CEHI) when it was determined that this organization was planning to conduct a similar exercise, focusing on environmental health. It was agreed that the surveys would aim to be complementary in scope and that information would be exchanged accordingly. Consequently this project avoided interviews with organizations which were likely to be interviewed by the CEHI consultant. It was also agreed that the findings of the surveys would be shared and the regional strategy would be devised in consultation with both project teams.

The following mechanisms were used for collecting information:

(a) A questionnaire was prepared for use as a guide in conducting interviews. The information captured focused on organizational functions and needs, constraints to information management and the identification of project initiatives which were ongoing or planned for execution and which sought to address the needs expressed by interviewees.

(b) Interviews were held with representatives from the public and private sectors, non-governmental organizations and representatives from bilateral and multilateral agencies in six countries -Barbados, Cuba, Guyana, Jamaica, Saint Lucia and Trinidad and Tobago. (A listing of institutions visited and the personnel interviewed is at Annex I). The countries were considered to be representative of the region, based on:

(c) Perceived project activity and development of public sector information initiatives to support environmental management, cultural background, the presence of regional and subregional organizations, size, location of representatives of bilateral and multilateral agencies.

(d) The headquarters of multilateral and bilateral agencies were contacted to obtain further information on projects which were ongoing in the region or which were in the pipeline for execution;

(e) Searches were conducted on World Wide Web pages to identify and acquire profiles on project activities which were being planned for the Caribbean subregion;

(f) Preliminary results of this project were presented at the UNEP's INFOTERRA Seminar on "Facilitating Access to Environmental Information in the Caribbean Region", held in Kingston, Jamaica, 29 November to 1 December 1995;

(g) An initial progress report was discussed at an interagency meeting in Mexico City (early November 1995);

(h) The first draft of the report was circulated to selected persons, after which a first version of the report (including those comments) was finalized in early 1996;

Team members on the project were Ms. Barbara Gumbs (UNEP consultant), Mr. Erik Blommestein (ECLAC/CDCC), and Mr. Norberto Fernandez (UNEP DEAI-LAC).

II ENVIRONMENTAL INFORMATION INITIATIVES

There are several ongoing initiatives in the subregion to support the management of the environment. Some of these initiatives are policy instruments which have vested responsibility for the environment in designated agencies and ministries. Others are programmes and projects which are supported by national, regional and donor institutions.

Institutional responses

Government policy initiatives

The countries visited are at different stages in the institutional development of environmental management. The governments of Cuba, Jamaica and Trinidad and Tobago have established institutions with responsibility for environmental management and protection. Saint Lucia's National Environment Commission was established in 1995. Guyana's Environmental Protection Agency (EPA) is expected to become operational in 1997. The scope of responsibilities of each of the above agencies is included in Annex VII. In other countries of the subregion National Sustainable Development Councils are being established to facilitate the implementation of the SIDS Programme of Action and Agenda 21. Responsibilities of each of the above agencies, explicitly or implicitly, include a component of information management.

In Jamaica, the Natural Resources Conservation Authority (NRCA), was established in 1991 and has the responsibility for coordinating the development of a National Environmental Information System (NEIS). Accordingly, NRCA is engaged in conducting an information audit to determine the data available within the organization, to establish the minimum data requirement for the execution of various functions within the NRCA mandate and to determine the configuration and specific requirements for a Geographic Information System (GIS).

In Cuba, the Environmental Education, Information and Dissemination Centre (CIDEA), of the National Environmental Agency, was established in 1994 with responsibility for the management of information for environment and development; the establishment, coordination and operation of a national system for data and information on environment and development; the development of environmental indicators, and the preparation, issue and publication of systematic assessments of the national environmental situation (State of the Environment reports).

In Trinidad and Tobago, the EMA, established in 1995, is responsible for the establishment of the NEIS. The focus of the NEIS will be on the computerized storage and retrieval of a variety of information, the upgrading of information technology facilities in associated agencies and the provision of "selected extracts" to users in the government and in the private sector.

In Guyana, an Act of Parliament established the EPA in May 1996. The EPA will develop and maintain a NEIS.

The National Environment Commission was established in Saint Lucia in March 1995 to "provide an appropriate and effective basis for sustained environmental management, through the implementation of activities contained in a proposed National Environmental Action Plan (NEAP)."

These institutional mandates are evidence of the growing awareness of the importance of information in the management of the environment in the Caribbean. Specifically this awareness is most acute at the technical level in the public and private sectors and NGOs. Influenced by national legislation this awareness is reflected in a need and demand for accurate data and information. This increased demand has exposed the weaknesses in the current management of environmental data and information. These will be discussed in more detail in the following chapter.

Non-Governmental Organizations (NGOs)

Several major environmental NGOs are making significant contributions to data collection, public education and the building of capacity for environmental information management at the local level. The Caribbean Conservation Association (CCA) is focusing on the implementation of an information management programme for Caribbean environmental materials and on the dissemination of information for public education. The South Coast Conservation Foundation is working with the local fishermen in the Portland Bight of Jamaica in the practice of co-management within the context of an integrated coastal zone management programme. In Guyana, the Guyana Environmental Management Conservation Organization (GEMCO), conducts ecological research (and makes recommendations based on the data obtained) on activities which may have significant impact on the environment. The Saint Lucia National Trust is working on progressing from the collection of scientific data to the incorporation of this data into a management system for Saint Lucia's national parks.

In some countries it is recognized that all potential stakeholder sources should assist in data collection exercises and the validation of the data collected. These stakeholders include local residents who have lived in an area for a considerable length of time. Stakeholder participation can be made more efficient through NGO programmes with the requisite orientation courses and training in the use of simple monitoring equipment.

Private sector initiatives

In some countries the private sector has shown initial interest in the provision of environmental information services; particularly where there are gaps in information provision by the State.

In Jamaica, for example, consultants contract a private sector company to produce aerial photographs. Difficulty in obtaining relevant aerial photographs from the designated government department provided the opportunity for this entrepreneur. Similarly, in Barbados a private entrepreneur has found an opportunity in the supply of GIS data layers to Government and private sector clients. In Cuba, the former Cuban Institutes of Hydrography and Geodesy and Cartography

were integrated in a state-owned company, Geocuba, which provides services in cartography, marine studies, GIS and Satellite Remote Survey (SRS) analysis, monitoring and assessments, information services, research and environmental consulting.

There are mixed reactions from the public sector to these private sector initiatives. It seems, however, that few countries have seriously considered what the role of the private sector could or should be in furthering increased availability and access to environmental information.

Regional data and information networks

Although an in-depth assessment of existing networks was not attempted, discussions were held with some network coordinators or focal points. There is a wide variety of regional networks in the Caribbean; some work well, some are struggling while others are all but moribund.

Some networks exchange information through newsletters, such as CARICOM's Fisheries Newsnet or the Sea Grant in the Caribbean newsletter. Others focus on the creation and maintenance of regional databases on socio-economic and environmental data and information. AMBIONET, CARISPLAN (socio-economic), CEIS (energy), INFONET (general OECS), and UNEPNet, are available as information resources.

Several network coordinators indicated that the system of national focal points they employed was not always working well. The lack of response from the focal points and the difficulties experienced in obtaining country information were among the problems most often cited. Network coordinators offered the following explanations for the lack of response:

- Inquiries submitted to national focal points do not always match the strengths and priorities of the national focal point;
- Not all focal points are client-oriented;
- Focal point duties are usually carried out by individuals in addition to their normal workload and responsibilities. Also in small countries the same individual may be called upon to perform focal point duties for two or three networks;
- Often, regional information systems have been established in an attempt to fill information voids at the national level. However, in the absence of strong national systems, regional systems reflect the national deficiencies. Alternatively, these regional entities have to commit considerable human and financial resources to obtain the national information inputs.

The availability in the region of new communications, such as Internet, will influence and change the way existing networks are operating. For some it will facilitate information exchange, while others might become obsolete if a refocusing of their activities is not pursued.

Information technology

The Caribbean region is increasingly utilizing information technologies in the management of the environment; however, their level of use differs across the region and within a country or organization.

Internet access

By 1997 most countries in the Caribbean will have access to full services on the Internet. This development could provide the communication infrastructure for networking among all generators, suppliers and users of environmental information. In Cuba, however, the lack of connectivity to Internet remains a major constraint to information exchange. However, UNEPNet is providing communications to Cuba.

Internet connectivity can provide a platform for the exchange of data and information among Caribbean countries in the management of the environment. The preparation of home pages for the World Wide Web (WWW) is being pursued primarily by the business community, as is the case of the Tourist Boards and Hotel Associations and NGOs such as the Island Resources Foundation, or the Environmental Foundation of Tobago. Similarly, national institutions such as the NRCA of Jamaica have also established home pages while other national institutions are in the process of establishing a WWW presence. Regional networks, such as CEPNET and AMBIONET have also established home pages. Local training for the preparation of such pages is currently being introduced; web design has attained high levels in some countries of the region.

Geographic Information Systems (GIS)

The major users of GIS in the countries visited are government agencies. Other users include universities and the private sector (consulting and petrochemical companies). Many of the systems in use in government institutions were acquired as part of projects funded by different donors; consequently, the tendency is for each institution to establish its own GIS system independently of other agencies. A different situation has been observed in Cuba where the State-owned company, Geocuba, has developed several products for handling geographic data and information, including their own software for image processing and GIS analysis, and a Data Centre, through which the different databases can be searched.

In most cases there is scant coordination among institutions, however, some coordination initiatives are being undertaken by land information committees and physical planning departments. The independent and isolated development of GIS applications result in duplication of data collection and data coverage, the use of various scales for base maps and in a lack of standards for spatial data quality.

In the past information programs have emphasized equipment and software. Issues such as training, capacity of governments to sustain project efforts after the life of the project, retaining trained staff, interface comparability of data sets and information management were of secondary importance. This has resulted in many incompatible systems which are underutilized. The full benefits in the utilization of GIS technology are still to be realized. One of the reasons for the existing limited sharing of data and resources among agencies at the national level, is the lack of concerted programmes for the formulation of data specifications, data formats and data set standards. A few countries in the region are executing projects aimed at establishing Land Information Systems. The execution of these projects, which require data input from different agencies, warranted the formation of Land Information Councils. Such Councils, consisting of agency representatives at the technical and policy levels, are acting as catalysts in the initiation of discussions and use of GIS standards among participating agencies.

Satellite Remote Sensing (SRS)

The Institute of Marine Affairs is the designated CARICOM Regional Remote Sensing Centre. As such, IMA is responsible for training and technology transfer in the application of SRS in natural resources management. Two projects utilizing SRS, together with other data gathering mechanisms, demonstrate the practical application of this technology to the subregion. In one project, IMA staff with the required oceanographic expertise, and utilizing SRS and other methodologies, monitor the coastal zone and the Exclusive Economic Zone of Trinidad and Tobago. In another project executed in collaboration with the University of the West Indies (UWI), imagery covering the area from Puerto Rico to Venezuela was used in the examination of Caribbean marine diversity. While IMA has mounted training programmes since 1989, expected follow-up requests from the Region have not materialized to any significant degree. A structured marketing programme in the Region is required. Apart from the need for financial resources, IMA sees itself constrained in its marketing effort by its need to develop further skills in the interpretation of satellite imagery in different fields.

The software development done at Geocuba, includes a PC-based software package which allows geometric correction of satellite images, advanced capabilities for image processing, digitizing, GIS analysis and graphic and cartographic editing, transformation of analog data into digital, as well as direct digitization of cartographic data. Geocuba can provide users with color and panchromatic aerial photos, AVHRR data, processed images, and services for the analysis of these data. The data/information is used to produce agency reports, databases, for development planning and approval, preparation of reports for the different Ministries, research reports, national state-of-the-environment reports and for public dissemination in print and electronic media.

Ongoing and planned projects and programmes

By the end of November 1996 over 550 ongoing or planned projects and programmes related to the SIDS Programme of Action had been identified. These projects and programmes have been entered in a database as part of this project. Work on this database will continue under a combined effort by ECLAC/CDCC, IDRC, UNEP and UNDP. The full database is available through ECLAC/CDCC's AMBIONET home page. UNEP/ROLAC may extend the database concept to the whole of Latin America. Some of the projects and programmes focus on mitigation or on reduction of impacts, while others focus on strengthening the institutional capacity. Almost all have significant information components, such as the application of information technologies like GIS, strengthening of monitoring systems or the conduct of inventories and surveys. The geographic scope can range from specific sites (like the proposed GEF project for the Havana Bay), to parts of a country (like the Saint Lucia coastal zone management plan), to the whole country (like the combined coastal zone management projects in Barbados). Other projects and programmes have a subregional (like the Amazonian projects carried out by the Amazonian Cooperation Treaty Countries secretariat in Guyana and Suriname, Central American projects for Belize or the ENCORE project in the OECS), Caribbean (the activities of the UNEP Caribbean Environment Programme) or even wider focus.

Programmes were examined to determine those which had, as part of their objectives, the development of systems for managing environmental data and information, the provision of information services and the generation of data and information, e.g. baseline data or data for monitoring and assessment. Using this definition at least 150 projects included information components. Below is a summary table indicating the level of project activity in each of the priority areas of the SIDS Programme of Action.

Priority sector	No. of Projects	No. of projects with Informationcomponent
Climate change and sealevel rise	13	5
Natural and environmental disasters	12	3
Waste management	84	22
Coastal and marine resources	155	58
Freshwater resources	69	11
Land resources	174	50
Energy resources	47	10
Tourism resources	51	10
Biodiversity resources	108	41
Transportation and communication	55	6
Science and technology	37	20
Capacity building	263	107

The above groupings have not taken into consideration those projects with a major sectoral focus, which would of necessity generate data as input to execution of the project itself, e.g. monitoring systems for coastal waters in sewerage projects. Geographic scope of the programmes is similar to that of the coastal programmes.

Further examination of the information projects reveals that there is only one project in one country which has a user needs survey of a priority area in the SIDS-POA as its major focus, i.e. biodiversity resources in Montserrat.

In the area of economic and environmental accounting, the Jamaican Government appears to be the only one which is taking action, in a formal way, to address this need. A proposal is under preparation to devise a system jointly with several national stakeholders to address, inter-alia, a framework for an integrated environmental and economic accounting system.

It is noted that several projects with a sectoral focus and those which focus on capacity building have built-in provisions for GIS applications. Large GIS programmes are being carried out in the OECS and in Guyana and Suriname. However only two projects have a major thrust in the use of remote sensing for land use mapping; in one case the land use application is from a national perspective and in the other the scope of the project is region-wide (the Caribbean).

There is a major initiative to strengthen the national environmental information system in Jamaica through a project supported by the United States Agency for International Development (USAID). A component of this project includes mounting a Bulletin Board to assist in locating data and information. In Trinidad and Tobago, the World Bank and UNDP are supporting the establishment of the Environmental Authority while the World Bank, GEF and IDB and UNDP are providing resources to Guyana for their establishment of an Environmental Protection Agency.

At the regional level, the programmes of ECLAC/CDCC and UNEP focus on strengthening environmental information management at the national and regional levels. Both AMBIONET and CEPNET's aim is to establish an open, decentralized network which provides the means for increased information exchange and communication among all actors, as well as the development of stronger national capabilities for the management of environmental information. While AMBIONET focuses on sustainable development and the integration of environmental and socio-economic information, CEPNET focuses on the integrated management of coastal resources. Although the implementation of CEPNET suffered delays since its approval in 1993, it is now expected to regain momentum during the second part of 1996. Both organizations collaborate closely in the implementation of both programmes.

SIDSNET and the United Nations Sustainable Development Networking Programme (SDNP) promote the use of computer mediated communications, especially through Internet, and of related information and communications technologies, to enhance information exchange and collaboration among key stakeholders, for sustainable human development. Initial steps are being taken to establish a Sustainable Development Network in Jamaica, Cuba, Haiti and Trinidad and Tobago. Feasibility

studies are expected to start shortly. The studies in the Dominican Republic and Guyana have been completed.

SIDSNET, the proposal for the Small Island Developing States Network, was developed to facilitate information exchange on various aspects of sustainable development relating to small islands. A revised feasibility study was prepared in mid-1996.

In terms of building capacity specific to data management and to biodiversity, the Bahamas is executing a country study which will provide "hands-on" capability in methodologies, technologies and skills in data management. Antigua and Barbuda also plan to develop this capability through the execution of a country study with GEF funds.

There are several projects which have set out to collect baseline data for specific ecosystems at the national level. However, there still appears to be a wide gap in fulfilling this need at the national level.

One of the information projects which is now complete is the FAO/UNDP Integrated Coastal Fisheries Project in the Gulf of Paria in Trinidad and Tobago. A bibliography on the Gulf of Paria and a GIS database are some of the information outputs from this project. Mechanisms are being sought to support continued development of this project.

An overview of the programmed initiatives with primary objectives in data and information management, indicate that there is little overlap in specific activities in the same country. However, there are similar activities in different countries; these activities, where they do not form part of a regional initiative, will require coordination within the subregion - if only from the standpoint of sharing experiences and methodologies with counterparts in other countries.

At the donor level there is scope for collaboration and cooperation. The most useful phase to achieve this is when projects are being conceived. However it is difficult to achieve such collaboration. The review of project documents indicates that there is overlap and duplication of effort, particularly in regional projects and programmes which aim at capacity building, but these are also the projects for which funding is limited and where duplication of effort can result in exasperation by governments and donors alike.

The causes for limited collaboration and coordination include competition among executing and donor agencies, sheer lack of knowledge of other activities and limited funding and time for coordination and collaboration efforts. However a major factor underlying the problems of coordination may be the lack of internal information management systems and restrictions which may apply within donor agencies regarding access to information.

Land information committees

Jamaica, Trinidad and Tobago and more recently, Guyana, are working at the national level towards the establishment of land information management systems to improve the administration of land titling and to introduce the use of unique land parcel numbers throughout the country. There are many agencies which participate in the administration of land titles including those responsible for approvals for rural and urban land use, mining and logging concessions, etc. Staff in these agencies have had to work together to determine data definition, audits, data transfer standards, data sharing and the use of GIS technology for data acquisition. The formation of Land Information Councils or Land Information Committees has fostered some measure of cooperation among a cross-section of agencies which must work together to execute this project.

III CONSTRAINTS AND USER NEEDS (Part 1)

Constraints

Environmental data and information are multidisciplinary; sources are dispersed and a variety of methods and institutions are used in their compilation. Like sources, users also cover a broad variety of interests and needs. The scattering of data, sources and users poses a challenge to environmental information management (EIM) in that any information system needs to be designed to deliver this information to a broad-based clientele.

Agenda 21 recognizes that there is already a wealth of data and information that can be used for the management of sustainable development. It also recognizes that much of this information is not well managed.

In an attempt to focus on the perceived lack of management, the study included two questions related to the management of information.

The first question asked what problems or shortcomings the interviewees have met in their organization while trying to use data and information.

The second question asked the interviewees to identify problems in getting data and information from other national agencies and institutions.

The survey results indicate that 55 out of 62 (or 89 percent) interviewees met problems in their organizations in trying to use data and information. Also 54 out of 62 (or 87 percent) stated that they had problems in getting data and information from other national agencies and institutions. The tables below summarize the findings.

Problems in own organization

PROBLEM	NUMBER	PERCENTAGES
Access to data and information	40	65 %
Availability of data	32	50 %
Staff	30	48 %
Quality of data and information	24	39 %
Training deficiencies	18	29 %
Hardware tools	12	19 %

(n=62)

Problems in sharing information

PROBLEM	NUMBER	PERCENTAGE
Lack of policy	37	60%
Location of data	36	58%
Lack of coordination	34	55%
Inadequate data	25	40%
Restrictions	22	35%

Absence of explicit information policies

The absence of explicit information policies and a generally weak public sector approach to information management are factors which restrict environmental information management. Public sector policies and public sector reform programmes have not addressed information management in a holistic manner. Much attention has been given to upgrading of hardware and software. However, issues such as mechanisms to facilitate access to government data and information, the management of government records, and mechanisms for sharing and coordination of data inputs across departments and agencies have not been addressed.

Increased environmental awareness and demand for information at the political, industrial and NGO level, could serve as a catalyst to re-engineer public sector information management policies. Some of the environmental information policy deficiencies have been addressed in specific environmental legislation such as the NRCA Act in Jamaica, the EMA Act in Trinidad and Tobago and the EPA Act in Guyana.

Limited collaboration for information and data sharing

In the public sector in particular, there are systems for vertical coordination in terms of flow of information. However, serious deficiencies exist in terms of horizontal collaboration within and among agencies and among the government, the private sector, NGOs and other groups.

Few agencies visited have implemented an internal information management strategy which sets out agreed procedures and guidelines for the storage, retrieval, generation, access and declassification and release of data and information.

The lack of an internal communication and information policy precludes accurate inputs in decision-making and can result in a duplication of effort. Communication gaps can even exist in small departments. For example, in one section of a ministry digitized maps done under a project by an outside consultant. At the same time technical staff of another section of the same ministry was

carrying out the same digitizing process. It was only after two months that the two sections found out about each other's efforts.

Furthermore, the lack of an internal information management strategy precludes awareness of new and additional information needs which must be met if an agency is to respond to changing mandates and responsibilities.

Inter-agency collaboration for data and information sharing is weak. Few government agencies and departments consider the potential use that others have for the data and information which they generate. In general there is no framework to establish, guide and strengthen routine working linkages across agencies at the level of data and information generation and management. These weak inter agency links become even weaker with links between government agencies and the private sector and/or NGOs.

Provision is not made to encourage common use of the data collected. As a result there is duplication in data collection and a reluctance in sharing it. This situation therefore brings into focus the need for inter-agency agreement and collaboration on issues such as data ownership, data compatibility, the use of agreed nomenclature and standards relating to data quality and methodologies for data collection. Such issues require the inputs of sector specialists attached to all agencies which generate and use environmental data and information.

In the absence of structured inter-institutional communication mechanisms there are informal, personal networks. In some cases interviewees expressed that without this network they would not be able to function.

In the absence of an information dissemination policy and faced with bureaucratic obstacles, people have often resorted to informal networks of like-minded people sharing information. Such networks can include certain government departments, private sector individuals and NGOs. Its characteristic is that it is individual-based and oriented. The first reaction of almost all interviewees forming part of such an informal network was that they had no problems in accessing data and information from other government departments and agencies. It was only after probing that problem areas emerged. Some of these were:

- Contacts are highly personalized and access to information is, at times, subverted by personal dislikes.
- While the informal network may exist, invariably there are individuals, agencies or government departments which are not part of this network and from whom it is difficult to obtain information.
- Often one gets the information if one finds out (sometimes by accident) that this information exists.

- If one is not a member of such a network it may be difficult if not impossible to obtain the information sought.

Without the network it may be impossible to function

Informal sharing of data and information will be always important. However from an inter-institutional perspective there must be formal mechanisms and policies to permit rapid and effective flow of information and collaboration in environmental management. As important as informal networks may be, they should be seen to reinforce agreements for sharing of data and information - and not as the only means to acquiring data and information. Failure to address this constraint will continue to add to the problem and will also contribute to a depletion of institutional memory over time.

Information access

Data and information exist but their location, retrieval and/or acquisition are difficult. In some cases reports are not being catalogued or filed following institutional procedures or data and information may be scattered among various agencies or both. In other cases individuals who feel threatened or need to demonstrate their authority, withhold the circulation of information and data. Another problem is institutional restrictions. For example, in many countries access to environmental impact statements or water quality data is restricted.

This situation has resulted in incomplete data sets, cost increases (because already existing, but inaccessible, data must be regenerated), duplication of data collections or decisions taken without the proper information inputs.

Interviewees indicated that difficulty in accessing data and information was influenced by several factors including the following:

- Bureaucratic procedures for obtaining permission. In many instances there is no policy for releasing data and information; consequently it is easier and probably "safer" to reject a request for data and information than to answer it.

- Many Caribbean governments still function according to Official Secrecy Acts which preclude dissemination of certain data/information. It was noted that this factor was one of the contributors to some government decisions being taken without having the proper information.

- The perception of possible damage to the performance of economic sectors, particularly tourism. On several occasions, members of the mission were informed that, for example, bathing water quality data was not available because it was feared that its release would damage the tourism industry.

- Providing information may cause embarrassment to government or to the institution which provides this information. This is particularly so when this information can be used as a productivity indicator.

- Fear of plagiarism. Sources of national data and information made available to third parties are not always acknowledged.

- Non-compliance with procedures for lodging copies of reports with designated depositories, and/or government documentation centres.

- Power of ownership of information whereby there is a desire to control how the data is used by others, if it can be used at all.

- Information not or no longer available in machine readable format. Much baseline information is lodged in common files and subsequently filed away. While such information may constitute a formidable, potential database, the lack of access diminishes much of its value as retrieving such information may not be cost effective.

- The absence of information management strategies guided by an institutional information policy. Such a policy would inform the generation, use and dissemination of data and information as well as the application of information technologies in the management of data and information.

- Data and information are available but their format may not be appropriate or their quality is questionable. Many agencies have individual data sets which they require for their own work programmes. Those data sets are developed for specific purposes. Consequently, the original methodologies for data collection, storage format, analyses and presentation are tailored to meet the objectives of that agency. Frequently, information is then presented either too aggregated or from too narrow a perspective to be of much use for other agencies.

- Data and information may not exist. This factor has affected the efficacy of all aspects of environmental management.

- However, while there are data gaps, it was recognized that there exists a wealth of data within and outside the region that are now not utilized because of the constraints of location, access and retrieval.

Human Resource Development

The lack of adequately trained staff was identified as a major constraint in executing environmental management programmes. This deficiency was seen from three dimensions:

(a) Unavailability of staff with specialized skills e.g. taxonomy, geographical information systems;

(b) Sub-critical mass of trained environmental specialists available in public sector institutions e.g.; environmental economics and documentation;

(c) Continuous drain of qualified professionals from the public to the private sector - especially in the advanced information technology fields.

The last constraint of high staff turnover can cause irregular collection of field data (if not complete abandonment) and reinforces delays between collection of data and analysis and publication. It also affects the efficacy of human resource development in that recent staff is inadequately trained. Salary differences between the public and private sector and career development considerations are among the reasons for high staff turnover.

Lack of training affects all aspects of information management. In the OECS countries, for example, weaknesses exist in methodologies, sample preparation, analytical procedures, equipment use, data recording, data analysis and report preparation (OECS-ENCORE, 1993). In Jamaica, NGOs indicated that basic data collection and interpretation were lacking.

Financial resources

The allocation of financial resources to information management activities is generally not a priority in the Caribbean - both in the public and private sectors. Where allocations have occurred, these often relate to the acquisition of computers and software and not to programmes dedicated to seminal issues on information management within the organization.

In the face of public sector financial constraints, structural adjustment programs, public sector reform and a reassessment of its role, and the lack of an information culture, it is unrealistic to assume that these constraints will be removed in the short to medium term.

Therefore any strategy which attempts to strengthen information management in the subregion needs to take into consideration that in the short to medium term additional government resources are unlikely to be forthcoming.

There is little evidence that information providers aggressively market their services and the availability of their resources. This reflects deficiencies in training, failure to recognize market

opportunities, deficiencies in building client relationships and a lack of appreciation of the value of the data and information resource held by the agency.

Scattered and incomplete sources make the collection and use of information a painstaking and costly process. Private sector consultants indicated a willingness to pay for good quality information. The availability of such information would reduce their cost of collecting or generating data and information, or contribute to a reduction of uncertainty and risk in project design or construction.

For example, in Guyana CEMCO engineering estimated that the lack of access to data and information which were previously collected but inadequately stored could increase construction costs for the sea defense programme by as much as 10 per cent or roughly US$14m.

In several agencies staff were aware of the potential income which could be earned from the provision of data and information. With the exceptions of a few agencies (e.g. statistical offices and mapping units), there are generally no guidelines or mechanisms in place to allow for the receipt of fees - and in some cases for the release of the data/information.

For example, the Fisheries Division in Trinidad and Tobago stated that GIS data layers were not made available because these were costly to reproduce and no fees could be charged.

Throughout the region there is a need to consider and pursue options and mechanisms for cost recovery of information products and services. This is particularly important since an improved availability of quality data and information will depend on this approach.

III CONSTRAINTS AND USER NEEDS (Part 2)

User needs

Attempts were made to cover a wide range of user groups. The emphasis was on their functional role (e.g. economic planning, physical planning, environmental management, resource management, environmental consultants, research, documentation centres, etc.). Interviewees included government departments and ministries, quasi-government organizations, private sector and NGO entities, universities, regional and international institutions and donors. The various categories have separate roles in the environmental arena and consequently differ in their information needs. Based on discussions with interviewees it is clear that their needs reflect an institutional perspective and a prominent national focus. The needs according to each category of user are identified in Annex IV. Information needs have also been analyzed and classified according to the priority areas in the SIDS-POA (see Annex V).

The above mentioned groupings were used to assist in providing different dimensions to the needs which exist in the subregion. The classification by category of user and by priority areas in the SIDS-POA, will assist in presenting a macro-perspective for future action at the regional level. At the country level, needs varied from country to country depending on the country's access to resources and specific institutional mandates. Since it was not possible to visit all categories of institutions (users) in each country, the needs identified and listed for each category of users might not be exhaustive, but they are representative of the needs which exist in the subregion.

Types of information

Of 50 institutions visited the following distribution of the kinds of information considered most useful emerged:

Kind of information	Number
Statistics	44
Full documents	32
Fact sheets	23
Bibliographies	17
Abstracts and ex. summaries	17
Indicators	15
GIS	14
Remote sensing	13
Maps and charts	12
Other	7

(n=50)

Regardless of the groupings under which the needs are presented, there are common macro-needs which exist across the region; these are:

The need for baseline data

The availability of baseline data is critical to the effective management of the environment and the implementation and efficacy of monitoring programmes. Often the data and information necessary for the day to day management of natural resources is not available. In other cases baseline data is collected during the execution of projects and programs, but there is no system for incorporating the raw data into national (or even institutional) data or information networks for subsequent use. The coverage of baseline data is therefore spotty and uneven and the quality of the data is uncertain. All countries identified the need for a coordinated system to integrate data and information from various institutions or sources, and for the creation of computerized databases, starting with baseline data which already exists.

There is a need to strengthen the continuing collection of baseline data in all priority areas of the SIDS-POA, through the sourcing of trained human resources, provision of necessary equipment and the establishment of inter-agency agreements for collaboration in the collection of baseline data.

It should be noted that with changing environmental mandates and responsibilities, not all institutions are fully aware of the type and range of data and information which they would require in order to fulfil their mandate.

It will therefore be necessary to establish, as soon as possible, the minimum data requirements for each institutional responsibility within the national environmental framework.

The need to locate existing data/information

The primary need is knowledge of the availability of existing national data, particularly within the national domain. This lack of knowledge is a major deficiency in the region. The absence of national directories or meta-databases for environmental data and information was a major concern in all the countries visited. An urgent need exists for the provision of information in the public domain on the location of data and information, the source of origin, parameters measured and conditions of access.

Data and information located in international sources, either from the Caribbean subregion or the rest of the world, are also required by Governments, industry and NGOs on short notice - particularly in the case of an environmental crisis (such as the Omai spill in Guyana).

Among the types of information required are: international environmental regulations, international standards on pollutant levels, decisions and requirements of environmental conventions, national and environmental regulations (particularly those which could affect regional and international trade), environmentally friendly technology which is in use in the Wider Caribbean region, environmental programmes and activities of NGOs in the Caribbean region (as well as those in the Pacific region), environmental projects and initiatives which are in the pipeline or which are in progress in the subregion.

The need for good data quality

Decisions on environmental plans and policies and natural resource management, and the preparation of environmental impact assessments and state-of-the-Environment reports require reliable data and information. At times interviewees expressed little confidence in the quality of data available to them. There is need for the establishment of measures which would assist in improving the quality and reliability of data currently being collected across all sectors. Concern was also expressed for agreement on methodologies for data collection and the documentation of these methodologies to facilitate wide utilization of the data by users.

The need for linkages between environmental and socioeconomic data

Failure to recognize the role of linking natural resource data, demographic data and socio-economic data in the planning process has been deplored by several government agencies and NGOs throughout the Caribbean. Population units and environmental units are looked at as separate and distinct units with specific functions.

There is need to incorporate environmental parameters in the setting of economic policy as well as a need to include economic parameters in environmental policy-making. There seems to be little awareness of what kind of environmental information can or could assist economic policy-making. Agencies react differently to this problem. In Jamaica, the Planning Institute used as an example the need to determine the environmental consequences of a J$1 billion injection in the Jamaican economy. In Saint Lucia, the planning agency posed the question about methods to estimate the economic impacts of environmental policy making. The development of environmental indicators would assist in responding to such policy issues.

Some of the offices, for example the Statistical Institute of Jamaica and the Statistical Office in Saint Lucia, are aware of the increase in the demand for such information from the public and private sectors. Others like the statistical offices in Barbados and Guyana indicated that there was little demand for environmental data.

The need for human resource development

The need for training at all levels was recognized by most institutions. Like environmental information needs the training needs differ widely according to the institution's mandate and the progress that institution has made in developing an information strategy. Hence training needs range from specialized training in methodology or equipment skills to sensitization programmes for senior level government officials, private sector initiatives and NGO administrators. There is need for training programmes for technical personnel in ministries, to facilitate the institution of a holistic approach which would incorporate socio-economic and environmental parameters into the planning process.

There is increasing recognition of the benefits of utilizing GIS, remotely sensed data and image processing as a means for gathering and organizing data for environmental management. The recognition of the benefits is primarily by those who have been exposed to applications through the execution of projects.

This awareness, however, is much less at the non-technical level. In this context there is need for sensitization programmes for senior level government officials, private sector executives and NGO administrators.

At the technical level, training is required in basic geographic concepts to enable professionals to develop an appreciation and confidence in working with spatial parameters. In addition to the use and application of GIS technology, a need for the development of skills in interpretation of remote sensing imagery was identified.

Information specialists, in response to increased demand for services, are facing new challenges in the management of environmental data and information. There is need to upgrade the skills of these specialists. Training courses must incorporate sessions on the sourcing of information, repackaging of data and information, technologies in use for the integrated management of environmental data and information, and the creation and management of spatial, economic and bibliographic databases.

Training sessions in simple analytical techniques are required by environmental NGOs; these skills will enhance their contribution to environmental management.

The need for formal inter-agency collaboration

Interviewees identified the need for formal inter-agency collaboration in data and information collection, generation and management. At the national level, there are inter-agency relationships for environmental matters through, for example, national committees, where a Head or Director usually represents the agency. However, there are still many obstacles which need to be overcome to achieve effective collaboration in the collection, and management of data and information. Some of these obstacles cannot be dealt with 'by decree', especially when: (a) individuals and/or departments perceive that their power base may be threatened; or (b) that the release of data may expose low productivity and other deficiencies. The situation in Cuba is different since there is an inherent centralized management approach.

Cuba, Jamaica and Trinidad and Tobago have produced state-of-the-Environment reports of different types. Guyana has declared its intention to do so in their respective Environmental Acts. To be able to produce such reports, it is necessary to access and share data and information from a variety of national agencies and institutions. Therefore, mechanisms are needed not only to access and exchange the data/information needed, but also to overcome any resistance to contribution and to encourage full participation by relevant agencies.

These mechanisms should not be restricted to inter-agency collaboration only; the benefits obtained from the participation of all sectors of the society in sharing data and information are far-reaching.

Needs of the regional institutions

A separate set of needs was identified by regional institutions, in support of their regional mandates. These needs are:

(a) The establishment of reliable national data and information for use in planning for regional sustainable development programmes in the Caribbean;

(b) Information on national capabilities, gaps, weaknesses and needs in all aspects of environmental management;

(c) Information on planned and ongoing environmental initiatives in the region to facilitate coordination and reduce duplication of activities, maximizing the use of resources. This need was also reflected in discussions with bilateral and multilateral agencies which operate in the subregion.

IV. CONCLUSIONS

This study examined the needs for environmental information based on interviews with various categories of users. At the institutional level, needs reflected specific mandates of the organization. However when these needs were analyzed there were common elements at the macro-level - both in terms of constraints and actual needs.

Constraints

Two major constraints which relate directly to environmental data and information are:

(a) Information access, which is affected by three types of circumstances:

i) Difficulty in locating specific data sets and information which have been already compiled by various agencies;

ii) Data is available, but the format of the data is not appropriate or the quality is questionable;

iii) Data does not exist; this factor has affected the efficacy of all aspects of environmental management.

(b) Lack of adequately trained staff. This constraint was seen from three perspectives:

i) Unavailability of staff with specialized skills e.g. in taxonomy, geographical information systems, environmental economics and documentation;

ii) Sub-critical mass of trained environmental specialists available in public sector institutions;

iii) Continuous brain-drain from the public to the private sector- especially in the advanced information technology fields.

Needs

The macro-needs which were identified by users are applicable to all priority areas of the SIDS-POA. These needs can be grouped broadly under the following headings:

Data/information management

- Baseline data
- Data Quality
- Formal mechanisms for inter-agency collaboration for collection and sharing of data
- Systems for the location of existing data/information

Capacity building

- Development of indicators

- Linkages between environmental and economic data

- GIS sensitization and interpretation of remote sensing satellite imagery

- Simple analytical techniques for environmental NGOs

- Continuing education courses for information specialists in:
  - sourcing of information, repackaging of data and information;
  - use of technologies for the integrated management of environmental data and information;
  - creation and management of spatial, economic and bibliographic databases;

- Provision of environmental intelligence on topics which include:
  - Decisions and requirements of environmental conventions;
  - National and environmental regulations which could affect regional and international trade;
  - Environmentally friendly technology which is in use in the wider Caribbean;
  - Environmental programmes and activities on NGOs in the Caribbean Region as well as those in the Pacific Region;
  - Environmental projects and initiatives which are in the pipeline or which are in progress in the Region.

Gaps in programmed initiatives

A comparison of information initiatives with macro information needs indicates a deficiency in ongoing projects in the following areas:

(a) National regional approaches to the collection of baseline data. The technology is available to support this thrust;

(b) Development of capacity to enable information specialists in the region to be proactive in management and delivery of information to different user groups;

(c) Data management including a mechanism for locating and assessing data for use at the national and regional levels;

(d) Development of capacity for the integration of environmental and economic data in development planning and environmental accounting;

(e) Development of capacity and wide use of the application of remotely sensed data to the management of natural resources in the Caribbean;

(f) Sensitization programmes for GIS applications - outside the scope of specific project activity.

V. ELEMENTS OF A CARIBBEAN STRATEGY FOR ENVIRONMENTAL INFORMATION MANAGEMENT

Any strategy to address the needs and constraints associated with environmental information management in the Caribbean requires a concerted approach at both national and regional levels. Such a strategy will require a focus on those common elements which will enable Caribbean countries to work together to satisfy environmental information needs. In addition, this strategy will require Caribbean countries to commit themselves to strengthening or establishing a national mechanism to achieve the objectives of improved availability and exchange of information for environmental management. Components of such a mechanism must address:

- Access to data and information;
- Availability of data and information;
- Communication and information flow;
- Human resource development;
- Telecommunications infrastructure;
- Institutional strengthening.

Recognized constraints in implementation of the proposed strategy

The proposed strategy has been made in full recognition that there are existing constraints which need to be dealt with for the implementation of elements of this strategy. Some of these constraints are highlighted below:

- Lack of explicit information policies may remain a constraint. While some countries may wish to address this constraint, others will not. Hence any strategy which concentrates on establishing a broader national information policy framework may be doomed to failure.

- Lack of adequate financial resources will also continue to be an operational constraint. Therefore cost recovery and marketing of information products needs to be incorporated as alternatives in the strategy.

- Lack of recognition in certain sections of government that environmental data and information are crucial for sound national planning.

Notwithstanding these formidable constraints, there are indications for cautious optimism. Foremost, is the growing realization that environmental management is multidisciplinary and requires information inputs from all sectors and all strata of society. Caribbean governments have also committed themselves to the implementation of the SIDS Programme of Action and Agenda 21. In this commitment, the region does primarily depend on the mobilization of national resources through domestic budgetary allocations or through loan resources.

In addition to the above indications, more and more, governments and sectors of society are realizing the need for incorporating environmental issues and concerns in their national development planning and policy-making, and related national environmental programmes. Evidence of this development is seen in the formation of land information councils (e.g. Jamaica, Trinidad and Tobago, Guyana), and in the development of networks (e.g. CIGBnet in Cuba, and SDNP national focal points in the Dominican Republic, Haiti and Jamaica.

Considerations in determining elements of the proposed strategy

The following considerations were taken into account in determining elements of the proposed strategy. These considerations were influenced by the findings of this study.

- The need for complementarity with existing developments at the national and regional levels. The ultimate objective is for elements of the strategy to be mutually consistent with, and re-inforce national goals.

- Respect for national decisions with reference to definition of responsibilities for data acquisition and the management of information resources. Agencies and institutions in each country have their individual mandates and responsibilities in respect of the collection and management of specific types of data and information. A strategy requiring participation of these agencies in any national effort must recognize their continuing responsibility for the management of a specific information resource.

- Utilization of information technology which favours decentralized and open systems for facilitating access and exchange of data and information.

- The need for building an awareness among various user groups, such as the public and private sector, NGOs and community groups and academia.

- Recognition that expressed needs are primarily for national level environmental data and information.

Proposed strategy

Goal

The goal of this proposed strategy is to strengthen the capacity of Caribbean governments to satisfy their information needs for the achievement of sustainable development.

Elements of a strategy

A. Execution of institutional audits of environmental data and information

An environmental information audit determines inter alia the location of data and information - regardless of format and location, the level of control exerted, requirements for information, training and the application of information technology, the flow of information, data and information gaps and the identification of problems which need to be addressed. These findings provide relevant input for assisting in the compilation of an institutional environmental information policy. Such a policy provides guidance for effective environmental data and information management. One by-product of an audit is the compilation of a directory of information resources within the organization.

From a national perspective, an information audit at the institutional level is a basic building block towards satisfying the need for locating existing environmental data and information. This step is necessary for the compilation of a national metadatabase or catalogue of databases.

B. Database catalogues or metadatabases

A metadatabase is a database which provides information about other databases; in other words it is a catalogue which can be used to find data and information at the institutional and national levels. In this catalogue, short descriptions assist the searcher to initially determine the possible applicability of the data to the user's needs.

The steps required in the creation of a metadatabase is one of the catalysts which could be used to initiate and strengthen inter-agency collaboration. The public and private sectors, the NGO community and academic institutions should participate in this exercise. Each of the participating institutions may need to develop its intra-institutional metadatabase for its own internal information and data resources.

C. Information coordination councils/committees

Representatives of organizations, suppliers and users of environmental data and information, need to deliberate, and agree on major issues associated with environmental information management. Such issues included monitoring of information needs, information policies and strategies inter alia for data collection, standards, custodianship, access, dissemination, collaboration and sharing of data and joint data collection efforts - at the national and regional levels.

Coordination councils/committees can provide the forum for discussions on the above issues and for ensuring proper coordination and collaboration among agencies. These councils or committees will need to meet on a regular basis to address issues which may arise in the actual provision of information support. Institutional representatives appointed to the Council should be those who are senior members of staff and who can make commitments on behalf of the institution.

At the national level, an environmental information manager should be charged with the coordination and implementation of strategies and activities for which there was consensus. This individual will have a pivotal role in liaising with institutions and agencies for monitoring the management of environmental data and information flow, for example, managing and coordinating the production of different GIS data layers by individual institutions. The purpose in the designation of a national environmental information manager is embedded in the concept that information is a resource, much the same as financial resources and human resources and, consequently, it should be managed as such.

D. Infrastructure to link dispersed databases and sources of information

Computer and telecommunications technologies have become the backbone through which environmental data and information can be captured and disseminated. These technologies when used appropriately can contribute to improved environmental information management, through the provision of a convenient base for sharing of data and information among multisectoral specialists.

While there are large amounts of data and information residing in any country, locating, accessing and retrieving this data and information is a major constraint to any potential information user. At the same time, an attempt to centralize all the data and information would be an impossible task and an inadvisable strategy. Hence an approach is suggested which allows for integration of separate systems and databases which are located in different organizations and agencies. This approach should allow multiple users to have simultaneous access to data and information held on a variety of host computers in various organizations, with access provided through file servers. These participating organizations will continue to hold their own specific environmental data and information, with the attending responsibility and accountability for information management - based on agreed standards for national data and information custodians. Technologically, such infrastructure will consist of an arrangement of databases, servers and communication software linking the participating institutions and users.

E. Capacity Building

Capacity building is perhaps the most crucial factor in any attempt to improve the management of environmental information. While the provision of equipment and physical resources is an important aspect of capacity building, the dimension of human resource development is paramount in the improvement of environmental information management. The needs which were expressed by interviewees, for example, the demand for improved and extended baseline data, improved data quality, establishment of links between environmental and economic data, the application of information technology and the preparation and presentation of reports on the environment, among others, require a skilled and competent human resource base.

Approaches to human resource development are best coordinated at the regional level given the small critical mass in both trainees and trainers at the national level. This approach is applicable to the course content for formal programmes as well as to the important aspect of public education

and the development of public awareness. This infers the strengthening of the coordination function of regional bodies in order to reduce duplication of resources and to strengthen national efforts in capacity building. For example, development of environmental education is a priority at the national level. Each country is attempting to produce material, which, if available and known to others can also be used "as is" or suitably modified for use.

At another level strengthening and/or establishing linkages among the subregion's universities, research organizations and professional bodies for environmental data and information analysis can provide a ready resource for not only research on environmental issues affecting the subregion but also as a focal point for the exchange of information not only for the academic community but also for the wider public through panel discussions and public seminars.

Annex 1

DUTIES OF AGENCIES RESPONSIBLE FOR THE ENVIRONMENT

Cuba

The Environmental Management Agency (AMA) 1994

AMA is in charge of directing and controlling the execution of the National Environmental and Development Programme, based on the strategy established by the Ministry of Science, Technology and Environment.

AMA is the Cuban national focal point for international environmental issues. Several specialized national centres and institutes are affiliated to the AMA. One of them is the Environmental Education, Information and Dissemination Centre (CIDEA). CIDEA is responsible for environmental information management for development. Accordingly the Centre is charged with the following functions:

(a) Design, coordination and execution, together with other AMA dependencies and government agencies, of a National Environment and Development Information System to evaluate the state of the environment and the results of national environmental management;

(b) Design, coordination and execution, together with other AMA dependencies and government agencies, the National Environmental Quality Network which will process and evaluate data and information and prepare periodic information on the state of environmental quality;

(c) Coordination, establishment and updating of the group of indicators considered part of the national environment and development information system;

(d) Provision of data and information on the state of the environment and development to national and international institutions, in coordination with the National Statistics Office and the Ministry of Economy and Planning;

(e) Execution of its responsibilities as the Cuban National Technical Focal Point for UNEP's INFOTERRA network, and UNEP's Environmental Training Network;

(f) Coordination, execution, promotion and control of information and educational activities aimed at increasing environmental and development consciousness in all productive fields, services and the public in general;

(g) Coordination, promotion and the provision of assistance to NGOs and main

groups in the environmental decision making process and the use of environmental policies in their areas of competence.

Guyana

The Government of Guyana prepared a Draft Environmental Protection Bill (7th September, 1995). According to the Draft, the ACT is to provide for the management, conservation, protection and improvement of the environment, the prevention or control of pollution, assessment of the environmental impact of economic development and the sustainable use of natural resources and for matters incidental thereto or connected therewith. Public consultations on the Bill are being held.

The Bill makes provision for the establishment of the Environmental Protection Agency (EMA) as the focal point for all environmental matters. The EPA will coordinate the environmental management activities of all persons, organization and agencies in Guyana.

In terms of information management, the Bill indicates that the EPA, inter alia, may:

- "conduct and coordinate compilation of resource inventories, surveys and ecological analyses to monitor and obtain information on the social and biophysical environment with special reference to environmentally sensitive areas ...
- monitor and coordinate monitoring of trends in the use of natural resources and their impact on the environment

Furthermore, the EPA shall:

- compile ... a list of approved persons who have the qualifications and experience to carry out environmental impact assessments.
- produce physical accounts in accordance with modern accounting standards to record the natural capital of Guyana.
- carry out surveys to obtain baseline information on the natural resources of Guyana including eco-systems and micro eco-systems, population counts, species identification, location and condition and to make such surveys, studies and information available to members of the public at their request and upon payment of the cost of copies.
- provide general information to the public on the state of the environment by regular reports.

- maintain and make available to members of the public during normal working hours a register of all projects notified to the Agency, all environmental impact assessments carried out and all permits granted."

Jamaica

The Natural Resources Conservation Authority (NRCA) is the agency responsible for the management of the environment. The Authority was established by ACT 9 of 1991 of Parliament. The functions of the NRCA as established by this Act are inter alia:

(a) "to take such steps as are necessary for the effective management of the physical environment of Jamaica so as to ensure the conservation, protection and proper use of its natural resources;

(b) to promote public awareness of the ecological system of Jamaica and their importance to the social and economic life of the Island;

(c) to manage such national parks, marine parks, protected areas and public recreational facilities as may be prescribed;

(d) to advise the Minister on matters of general policy relating to the management, development conservation and care of the environment;

(e) to perform such other functions pertaining to the natural resources of Jamaica as may be assigned to it by the Minister or by or under this Act of any other enactment."

In the execution of the above mandate, NRCA is responsible for inter alia:

(a) developing, implementing and monitoring plans and programmes;

(b) formulating and establishing ambient air quality standards, an air pollution monitoring system and index as well as codes of practice;

(c) investigating the effects of pollutants on the environment and taking the appropriate corrective measures;

(d) undertaking studies, encouraging and promoting research on techniques which could improve the management of pollution and the conservation of natural resources;

(e) conducting seminars and training programmes and gathering and disseminating information relating to environmental matters.

Saint Lucia

The National Environment Commission was confirmed by Cabinet via Cabinet Conclusion Number 450 of 23 March, 1995. The general functions of the National Environment Commission are as follows:

(a) To provide guidance and advice to Cabinet and to para-statal and non-governmental organizations (NGOs) on environmental matters.

(b) To coordinate the inputs of Governmental and non-Governmental Organizations, as well as private sector agencies and interests in the implementation of the National Environmental Action Plan.

(c) To mobilize financial and technical resources in support of environmental projects and activities, especially at the community level.

(d) To monitor and evaluate the implementation of the NEAP.

(e) To assist with the design and delivery of training programmes/workshops in environmental management/sustainable development.

(f) To organize and/or supervise applied research in accordance with the NEAP.

Trinidad and Tobago

The Environmental Management Authority was established by an Act of Parliament in March 1995. Below are the general functions entrusted to the Authority.

General functions

a. Recommend National Environmental Policy;
b. Develop and implement policies re wise use of the environment;
c. Coordinate environmental management functions;
d. Make recommendations for the rationalization of all government entities performing environmental functions;
e. Promote educational and public awareness programmes on the environment;
f. Develop and establish national environmental standards and criteria . Monitor compliance with the standards, criteria and programmes relating to the environment;
h. Take all appropriate actions for the prevention and control of pollution and conservation of the environment;
i. Establish and co-ordinate institutional linkages locally, regionally and internationally;
j. Perform other functions as prescribed;
k. Undertake anything incidental or conducive to the performance of any of the foregoing functions.

With reference to information, the Authority has the responsibility for compiling information relating to the environment.

Annex 2

DATA AND INFORMATION NEEDS - KEY

Needs which were identified during the execution of this project have been grouped under priority areas outlined in the document entitled Programme of Action for Small Island States. These priority areas are as follows:

I. Climate Change and Sealevel Rise
II. Natural and Environmental Disasters
III. Management of Wastes
IV. Coastal and Marine Resources
V. Freshwater Resources
VI. Land Resources
VII. Energy Resources
VII. Tourism Resources
IX. Biodiversity Resources
X. National Institutions and Administrative Capacity
XI. Regional Institutions and Technical Cooperation
XII. Transport and Communication
XIII. Science and Technology
XIV. Human Resource Development

I. Climate Change and Sea-level Rise

a. Baseline, historical and current data on meteorology, oceanography, sedimentation patterns etc.
b. Tide charts, aerial photographs, satellite imagery, monitoring stations
c. Development of indicators for monitoring and assessment of sea-level rise
d. Numerical wave models
e. National coordination of data on soils, wind, currents and waves
f. Developments relating to the implementation of programmes relating to conventions
g. Policy on access to meteorological data by private meteorological services in terms of the institution of fees or provision of the data free of charge
h. Regional information support to assist participants to prepare for meetings and negotiations on relevant international and regional conventions.
i. Developments in the national and regional implementation of programmes relating to conventions
j. Inventories of relevant data sets and attention to issues relating to location, data collection and frequency of data collection
k. Information management systems to facilitate public access to specific data-sets and information for decision-making and participation in environmental management.

II. Natural and Environmental Disasters

a. Socio-economic and demographic data
b. Development plans - before actual implementation of projects
c. Developments in the national and regional implementation of programmes relating to conventions
d. Inventories of relevant data sets and attention to issues relating to location, data collection and frequency of data acquisition
e. Information management systems to facilitate public access to specific data sets and information for decision-making and environmental management

III. Management of Wastes

a. Socio-economic and demographic data
b. Data on the generation of hazardous waste
c. Data on the generation and spatial distribution of solid waste
d. Development of indicators for monitoring, assessment and management of waste
e. Identification of preliminary environmental indicators in use in other countries
f. Promotion of successful cases to demonstrate the use of environmental technologies in the Caribbean
g. Data on pollution flows in channels and coastal areas
h. Establishment of a regional electronic data exchange system for Regional Port State Control.
i. Regional information support to assist participants to prepare for meetings and negotiations on relevant international and regional conventions.
j. Developments in the national and regional implementation of programmes relating to conventions
k. Emission discharge and pollution standards used in other countries
l. Numerical parameters used by different countries to establish pollution control standards
m. Inventories of relevant data sets and attention to issues relating to location, data collection and frequency of data acquisition
n. Information management systems to facilitate public access to specific data sets and information for decision-making and participation in environmental management
o. Development plans - before actual implementation of projects
p. Data on attitudes, social behaviour and practices
q. Statistics on the impact of environmental education programmes

IV. Coastal and Marine Resources

a. Socio-economic, demographic and bio-physical data
b. Pollution flows in coastal areas
c. Erosion statistics

d. Land use capability
e. Development of indicators for monitoring and assessment of resources
f. Development of biological indicators
g. Disaggregation of data on fish catch
h. Data on the economics of fisheries - specifically as changes occur from artesenal to industrial operations
i. Reliable baseline data
k. Historical data on water quality
l. Inventories of relevant data sets and attention to issues relating to location, data collection and frequency of data acquisition
m. Information management systems to facilitate public access to specific data sets and information for decision-making and participation in environmental management
n. Refinement of modelling capabilities for coastal conservation programmes
o. Regional information support to assist participants to prepare for meetings and negotiations on relevant international and regional conventions.
p. Developments in the national and regional implementation of programmes relating to conventions
q. Development plans - before actual implementation of projects
r. Data on attitudes, social behaviour and practices
s. Statistics on the impact of environmental education programmes
t. Impact of stress on resources
u. Data on carrying capacity of ecosystems

V. Freshwater Resources

a. Socio-economic, demographic and bio-physical data
b. Development of indicators for monitoring and assessment of toxicity levels for pesticides, chemicals and herbicides
c. Tide charts
d. Data on runoff and its influence on the movement of fish
e. Access to information from the International Register of Potentially Toxic Chemicals
f. Water quality data
g. Agricultural water standards in use in the Caribbean and in other tropical countries
h. Inventories of relevant data sets and attention to issues relating to location, data collection and frequency of data acquisition
i. Information management systems to facilitate public access to specific data sets and information for decision-making and participation in environmental management
j. Development plans - before actual implementation of projects
k. Data on attitudes, social behaviours and practices
l. Statistics on the impact of environmental education programmes
m. Data on carrying capacity of ecosystems

VI. Land Resources

a. Socio-economic, demographic and bio-physical data
b. Land use capability
c. Forest vegetation patterns
d. Case studies on park management
e. Inventory of timber stocks and data on the extraction of timber
f. Damage caused by logging practices in the forest
g. Animal migration within the forest
h. Changes in temperature and humidity within the forest
i. Baseline data on flora and fauna
j. Baseline data on air quality
k. Data on erosion
l. Development of indicators for the management of national parks
m. Regional information support to assist participants to prepare for meetings and negotiations on matters relating to relevant international and regional conventions.
n. Inventories of relevant data sets and attention to issues relating to location, data collection and frequency of data acquisition
o. Information management systems to facilitate public access to specific data sets and information for decision-making and participation in environmental management
p. Development plans - before actual implementation of projects
q. Impact of stress on resources
r. Data on carrying capacity of ecosystems
s. Data on attitudes, social behaviour and practices
t. Statistics on the impact on environmental education programmes

VII. Energy Resources

a. Use of new and renewable energy
b. Inventories of relevant data sets and attention to issues relating to location, data collection and frequency of data acquisition
c. Information management systems to facilitate public access to specific data sets and information for decision-making and participation in environmental management
d. Development plans - before actual implementation of projects

VIII. Tourism Resources

a. Socio-economic, demographic and bio-physical data
b. Data on generation and spatial distribution of solid waste
c. Development of indicators for the management of national parks
d. Data for the development of indicators for monitoring and assessment

e. Data on carrying capacity of ecosystems
f. Data on the impact of stress on tourism resources
g. Data on water quality
h. Data on attitudes, social behaviours and practice
i. Statistics on the impact of environmental education programmes
j. Case studies on park management
k. Baseline data
l. Identification of flora and fauna - endemics
m. Regional archiving of monitoring data on water quality and water quantity
n. Inventories of relevant data sets and attention to issues relating to location, data collection and frequency of data acquisition
o. Information management systems to facilitate public access to specific data sets and information for decision-making and participation in environmental management
p. Regional information support to assist participants to prepare for meetings and negotiations on matters relating to relevant international and regional conventions.
q. Development plans - before actual implementation of projects

IX. Biodiversity Resources

a. Socio-economic, demographic and biophysical data
b. Case studies on park management
c. Indicators for the management of national parks
d. Data for the development of environmental indicators
e. Baseline data on flora and fauna - extent of endemics
f. Comprehensive data and information on species listed in the SPAW Protocol
g. Data on the impact on stress on biodiversity resources
h. Data on the carrying capacity of ecosystems
i. Regional information support to assist participants to prepare for meetings on relevant international and regional conventions and negotiations
j. Developments in the national and regional implementation of programmes relating to conventions
k. Rainfall runoff and its influence on movement of fish
l. Inventory of timber stocks and data on the extraction of timber
m. Damage caused by logging practices in the forest
n. Animal migration within the forest
o. Statistics on the impact of environmental education programmes
p. Inventories of relevant data sets and attention to issues relating to location, data collection and frequency of data acquisition
q. Information management systems to facilitate public access to specific data sets and information for decision-making and participation in environmental management

X. National Institutions and Administrative Capacity

a. Systems for institutionalizing procedures for data gathering and sharing of data and information among agencies - including output from geographical information systems
b. Inventories of relevant data sets and attention to issues relating to location, data collection and frequency of data acquisition
c. Information management systems to facilitate public access to specific data sets and information for decision-making and participation in environmental management
d. Improvement of storage and dissemination of information; computerization of manual files and records to facilitate rapid retrieval of data and information
e. Determination of a policy on the establishment of a National Oceanographic Data Centre and recognition of this centre by IOCARIBE
f. Improvement in telecommunications facilities
g. Acquisition of satellite imagery
h. Further development of national geographical information systems for application in environmental management
i. Electronic mail access to allow greater communication among agencies responsible for environmental management
j. Creation of linkages among national, regional and international institutions which have a focus on environmental education
k. Professional information management capacity
l. Information policy governing the sale and release of data and reports by government agencies
m. Establishment of cost recovery mechanisms for information products generated by government departments
n. Incorporation of environmental data into national accounts
p. Development of indicators for monitoring, assessment and management of environmental resources and priority areas and for the preparation of reports on the state of the environment

XI. Regional Institutions and Technical Cooperation

a. Strengthening of programmes to further sensitize government planners to the linkages associated with demographics, environmental management and development planning
b. Utilization of expertise in the Region to explore options and positions with reference to environment issues facing the Region.
c. Inventories of relevant data sets and attention to issues relating to location, data collection and frequency of data acquisition
d. Information management systems to facilitate public access to specific data sets and information for decision-making and participation in environmental management

XII. Transport and Communication

a. Establishment of a regional electronic data exchange system for Regional Port State Control
b. Improvement in telecommunications facilities
c. Electronic mail access to allow greater communication among agencies responsible for environmental management

XIII. Science and Technology

a. Documentation of the availability and use of environmentally friendly technologies in the Region
b. Identification and monitoring of environmental issues which can affect regional and international trade

XIV. Human Resource Development

a. Modern methodologies and techniques for information management
b. Management of data for the generation of meaningful environmental reports
c. Training in information analysis and the repackaging of information from various sources for different target groups
d. GIS data processing
e. Further development of skills in the interpretation of satellite imagery in various fields
f. Indicators: training of statisticians in the compilation of various indicators for environmental monitoring and assessment
g. Sensitization programmes to promote the application of indicators to environmental management
h. Training of economists in quantitative skills required for environmental accounting and in methodologies for incorporating environmental accounting in the planning process
i. Sensitization programmes for government planners in recognition of the linkages between demographics, environmental management and national development planning
j. Basic courses in statistical analyses for NGOs and community based organizations
k. Demonstration of best practices linking corporate environmental programmes to the "bottom line" of the corporation
l. Specialist training in environmental management, EIA methodologies and the assessment of EIAs

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