AN INVENTORY AND EVALUATION OF EXISTING NATIONAL ENVIRONMENTAL DATA FOR THE DEVELOPMENT OF AN ENVIRONMENTAL INFORMATION SYSTEM IN THE GAMBIA

DRAFT

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1.0 INTRODUCTION

The purpose of the Gambian Environmental Action Plan (GEAP) is to provide a structure for national environmental policy and decision making on a long-term basis. Environmental planning is currently undertaken by many of the public institutions, and to a lesser extent by Non-Governmental Organizations (NGOs). Typically, these institutions suffer from a lack of human, financial, and material resources which hinder their capacity to provide effective planning. In addition, there is a lack of coordination of efforts between institutions to collect, analyze and use information for resource management and development.

The planners of the GEAP have therefore documented "the strengthening of the institutional framework for environmental coordination and management at the national, regional and global levels" as a major policy objective. A prerequisite for this framework strengthening is the delivery of useful and timely information to decision makers.

The GEAP includes in its implementation strategies the establishment of an Environmental Information System (EIS) along the lines proposed in "Information Systems for Environmental Management" produced by UN Sudano-Sahel Office (UNSO) in October, 1991. The strategy also states that the distribution and sharing of environmental information will be carried out through the Documentation Centre of the Environmental Unit (EU) of the Ministry of Natural Resources and the Environment (MNRE).

With these directives in view, UNSO offered to provide assistance to the Government of The Gambia (GOTG) to begin the process leading to the implementation of an EIS. This assistance consisted of technical support from the UNSO EIS Technical Advisor as Team Leader, and an Environmental Data Expert from the Centre de Suivi Ecologique (CSE) Dakar for a duration of 3 weeks and 9 days respectively. The mission objectives were to:

i) perform an inventory of data sources and types available for environmental management,
ii) evaluate their adequacy for environmental planning and monitoring, and
iii) identify key parameters for eventual input to an EIS.

In addition, suggestions are offered for the establishment of an EIS.

An understanding of both the nature and flow of information in existing institutions involved in environmental management is a prerequisite in establishing an effective EIS. This information was obtained during the mission through a series of interviews with senior administrative and technical personnel in several government and non-governmental institutions involved in both the supply and use of environmental information. Given the short duration of the mission, the accent was placed on identifying information supply and needs at the national (nation-wide) scale.

The flow of information between data suppliers and data users within an environmental system will be influenced by the individual mandates, technical capacities or other constraints of these organizations. It is for this reason that profiles of the current activities as well as some of their projected data

LIST OF ACRONYMS

CSE	Centre de Suivi Ecologique
DCS	Department of Central Statistics
DPPH	Department of Physical Planning and Housing
DWC	Department of Wildlife Conservation
DWR	Department of Water Resources
EIS	Environmental Information Systems
EU	Environmental Unit of the MNRE
GEAP	Gambia Environmental Action Plan
GGFP	Gambian-German Forestry Project.
GIS	Geographic Information System
GUC	Gambia Utilities Corporation
GTZ	German Technical Assistance
MINAG	Ministry of Agriculture
MHSW	Ministry of Health and Social Welfare
MLGL	Ministry of Local Government and Lands
MNRE	Ministry of Natural Resources and Environment
MTIE	Ministry of Trade, Industry, and Employment
NGO	Non-Governmental Organization
PU	Planning Unit of the MNRE
TANGO	The Association of Non-Governmental Organizations
UNCED	UN Conference on Environment and Development
UNDP	UN Development Programme
UNSO	UN Sudano-Sahel Office
USAID	US Agency for International Development

needs of the major data suppliers and users are included in this report. It is recognized that some organizations are both data suppliers and data users to a different extent. In The Gambia, the institutions which perform predominantly data supply functions are the Departments of Forestry, Agriculture, Water Resources, Statistics, Lands and Surveys, Health, Fisheries and Livestock. The major data users, both actual and planned, include the Planning departments of the Ministry of Agriculture, Physical Planning and Housing, Policy and Planning Unit of the Department of Fisheries, the Planning Unit (PU) of the MNRE, and the EU of MNRE.

2.0 DATA SOURCES

2.1 Department of Forestry

2.1.1 Profile of Activities

The Forestry Department, first established in 1976, is located within the MNRE. The mandate of the Department is to carry out various planning, management and regulatory activities related to forest conservation, wind and water erosion control, promotion of small scale timber industries, protection of national parks and protection of specific tree species found outside of park boundaries.

The current emphasis of the Department is placed on field conservation efforts. Field officers typically report on production of wood lots and on court cases related to illegal forestry activities. Minor activities are related to public education on the use of wind breaks, and the promotion of tree planting. The Department is also responsible for issuing a small number of permits each year for timber exploitation, however these are limited to the use of small scale manual pit-saw operations.

Currently there are about 5 graduate level trained personnel who are responsible for the overall management of the Department. Lack of adequately trained personnel in sufficient numbers has been highlighted as a major reason why the Department is unable to effectively fulfil its mandate, particularly with respect to technical planning.

The Forestry Department has no computer facilities.

2.1.2 Available Information

The Department does not produce any periodic reports which are accessible to the public. An annual report of production figures is to be prepared for the first time this year. Some limited information is available for forestry plantations since these are required to have an approved plan every 5 years. A number of publications prepared under the GGFP (German Gambia Forestry Project) program are available. These include a land-use study of the whole country and the production of a photo-mosaic map at a scale of 1:10,000, published in 1985 and based on airphotos obtained in 1980. Reports on the results of other forestry studies (e.g. observation trials) for various small sites are also available.

The Department has the following maps in storage: 1:50,000 and 1:125,000 planimetric base maps (stable paper) published in 1986 based on 1:50,000 scale black and white airphotos collected in 1982/1983 under the USAID project # 635-0203-01. Other maps that are available and which are based on the same series of airphotos are 1:125,000 'landscape and soils' and 1:50,000 'rangelands' maps. Both maps are on stable plastic base and thus represent a good source of information for digitized input into a geographic information system. An early series of country wide planimetric base maps at a scale of 1:50,000 is also available. These paper maps were published by the Directorate of Colonial Surveys based on airphotos taken in 1946.

2.1.3 Adequacy of data sources for planning and monitoring.

2.1.3.1 Forest cover maps

Given the current rate of change and increase in shifting cultivation, conversion of primary to secondary forests and the persistence of bush fires, existing maps need to be updated. Thus, there is an immediate need to design and execute a combined aerial and ground survey for the purpose of monitoring the area and nature of deforestation, land-use change and possibly such baseline data as soil maps. Photography collected at a 1:50,000 contact scale should be adequate to monitor changes in the forest environment.

2.1.3.2 Bush burning studies

Throughout the forestry, soil science, range and livestock sectors, bush-burning is perceived as a major hazard for which little information has been collected. There is an immediate need to measure the extent of the seasonal burning, the consequent damage to the natural resource base, and the socio-economic impact of this loss.

2.1.3.3 Forest utilization and fuelwood consumption

Fuelwood consumption and timber harvesting constitute the main reasons for removal of woody biomass. At present, only a few surveys have attempted to assess the level of use, yet forest utilization information is one of the foundations for developing management plans.

2.2 Department of Water Resources

2.2.1 Profile of Activities

The Department of Water Resources (DWR) of the Ministry of the Environment and Natural Resources is responsible for gathering and disseminating information pertaining to surface water, groundwater, and meteorology for The Gambia.

DWR has a policy of distributing the information it collects free of cost to government organizations. Private users are, however, expected to pay a small 'cost recovery' fee for information. Lack of logistical support and an inadequate number of computer literate staff were cited as serious limiting factors in attaining departmental objectives.

The Department monitors a network of 38 rain gauges and 11 synoptic stations. The agro-meteorological activities within the Ministry are supported by the regional AGRHYMET centre located at Niamey. The principal task of this unit is to produce a dekadal (ten-day) AGRHYMET bulletin which contains an analysis of information pertaining to rainfall, pest conditions and agricultural reports on crop conditions.

The department has a total of 6 PCs which are dedicated to its various activities as follows: 1 PC each to Agrometeorology, climatology, hydrology, communications and training, and 2 PCs (one currently not working) to groundwater monitoring.

A United Nations sponsored project operates within the Water Resources Department. This project, called the Groundwater Research Planning and Development Project was set up with the twin objectives of institution building and direct support. Currently, the principal activities of the project are the construction of drilled wells and the periodic monitoring of a network of 128 wells for water quality and water table level. The water quality parameters measured are restricted to acidity and conductivity. The reason cited for the lack of monitoring of a wider range of parameters is the non-functioning of the present Water Quality Monitoring Unit (WQMU).

The WQMU has the role of analyzing samples of surface and groundwater to satisfy demand from government and non-government users. WQMU tests for bacteriological parameters, pH, salinity, conductivity, and dissolved oxygen in its standard analyses, but due to lack of chemical reagents, it has not been able to perform all of its functions. The personnel state that a charge has recently been attached to their analyses, but that users such as the Gambia Utilities Corporation, responsible for water, power, and sewerage services, are reluctant to pay. They have 10 staff members, of which 3 have had university education. There are no computers in the Unit.

2.2.2 Available Information and Data Users

A number of publications are regularly produced by the Department, namely, dekadal and monthly bulletins on meteorology and hydrology. The information is produced on a dekadal basis during the rainy season which lasts from 1st May to 31 October, and on a monthly basis for the rest of the year. A Hydrological Yearbook which is currently in draft form is to be published later this year. This yearbook will contain information on rainfall, temperature, relative humidity, river salinity and water levels, both groundwater and for the Gambia river. Paper hydrological charts showing the Gambia River level over a period dating back more than 10 years are stored in file cabinets. Also available are monthly and quarterly reports on groundwater levels.

Adequate hydrological modelling of the Gambia River flow is not possible at present because currently available models in The Gambia do not account for the tidal nature of the river. Local planners could use these models to help advise farmers how much irrigation water could be drawn from streams without accelerating the rate of salt intrusion.

The groundwater project maintains a groundwater database using Paradox 3 software and 2 PCs. The database contains information on approximately 1400 lined water wells. The information is therefore restricted to wells constructed after 1976, the date when lined wells were first introduced. In addition, this information relates to the uppermost of the three aquifers which underlie the country. This upper phreatic aquifer is important since most of the water wells, both drilled and traditional hand-dug wells which number over 10,000, extract water at a depth varying between 10 to 50 meters. The database also contains information on the characteristics of the pipe systems used in the villages and towns, and population density extracted from the last national census carried out in 1983.

Various studies have been carried out by the Department, however, the reports are not generally available in a centralized location which is readily accessible. It is said that many reports are missing or that only single copies exist.

2.3 Ministry of Agriculture, Department of Planning

2.3.1 Profile of Activities

The Department of Planning of the Ministry of Agriculture is responsible for the planning, monitoring and evaluation of agricultural projects, and for policy analysis. Its core activity is the annual survey which details agricultural information (eg. production estimates of livestock and major crops, crop areas, yields, farming practices, landuse, tenure system of farmland, planting dates, cereal stocks and prices). Annual reports are available dating from 1977. The Department carries out a few limited socio-economic surveys, however, the data collected are insufficient for planning and monitoring needs. A specific example is the evaluation of the impacts of recent droughts on the seed storage habits of farmers and the implications for government assistance in the provision of seeds.

The information provided by the Department is aimed primarily at formulating plans. However, owing to the current structural adjustment climate, it has been stated that there is little point to planning since implementation will inevitably require increased levels of government expenditures.

2.3.2 Available Information and Data Users

The Planning Department publishes annually a statistical yearbook of Gambian agriculture (National Agricultural Sample Survey - NASS). This publication contains tabular summaries of various statistics, including: (i) crop areas, yields and production, (ii) agricultural practices, - draft animal numbers, small ruminants, (iv) use of recommended agricultural practices, (v) tenure status of farmland, (vii) planting dates, and (viii) cereal stocks and cereal market prices. All of this information is regularly placed in a computerized database using Paradox software by the National Agricultural Data Centre. The data are subsequently archived on diskettes. The Department also keeps copies of its reports in their well maintained Documentation Centre which

houses local as well as international reports and publications related to the agricultural sector.

In addition to its annual survey, the Department carries out an early indication assessment of agricultural production in October each year. For this assessment, information on rainfall, the state of crop development and the quality of agricultural inputs are required.

Some effort is also being made at compiling information on the activities of NGOs which have intervened in the agricultural sector over the last 6 years. This information will be used to guide the activities of future donors in the agricultural sector.

The computerized resources consist of 6 PCs with 2 line conditioners and dot matrix printers. Personnel have claimed that this level is inadequate for the volume and assortment of tasks currently undertaken by the Department. It should be noted that, of the various institutions visited, this department boasts the best employment of computer technology in its regular technical activities.

The main users of the information gathered are other government departments (eg. Department of Livestock), non-governmental organizations, researchers and diverse international institutions.

2.4 Department of Fisheries

2.4.1 Profile of Activities

The main activities of the Department of Fisheries are to monitor the quantity and quality of fish species caught each year and the corresponding harvesting methods. Other activities which fall within the Department's mandate, but which owing to the lack of staff and logistical support cannot be carried out, include analysis of technologies used to process catch and the collection of basic biological data on fish species.

The total staff consist of approximately 102 persons of which 12 are trained to the university level. It is estimated that for appropriate monitoring, the staff complement should be at around 300 persons. Most of the present staff, approximately 70, are used as monitors on board industrial ships which fish within the 200 nautical mile offshore limits of the Gambia to ensure that fish stocks are protected. However, the practice of having monitors remunerated for their work by the ship owners puts into question the effectiveness of such policing activities.

On the Atlantic Coast, staff members sample all landing sites at a rate of 6 observations per month. Of the inland landing sites, only 3 out of 40 are covered. Data on quantities of fish caught and revenue derived are still hard to collect because some fishermen in the inland areas are reluctant to report this information for fear of being taxed.

Department officials are concerned about the rate of disappearance of the mangrove forest and would request information from the Forestry Department

concerning this problem. The mangrove forest is the spawning ground for certain high market value species. Thus, any cutting of mangrove should be severely regulated and carefully monitored. A 7 nautical mile zone north of the Gambia River mouth is reported to be a critical zone for spawning and should receive first priority.

2.4.2 Available Information and Data Users

Every two years, the Department carries out a Frame Survey during which assorted information on the fishing industry (eg. number of fishermen, fishing habits, fishing techniques, etc.) are collected. This information is recorded at the village level, however summarized statistics regrouping the data according to other administrative units are also produced. The Fisheries Department supplies data to the Policy and Planning Unit of the Directorate which defines policy to be implemented later by the Fisheries Department. Most of the data on fisheries exist somewhere in the offices of various staff members. The department is not computerized.

2.5 Ministry of Industry, Trade and Employment

2.5.1 Profile of Activities

The Ministry of Industry, Trade and Employment carries out a number of activities which can have an impact on the environment. It is responsible for the processing of applications for establishing all industries in The Gambia. It monitors some of these industries, however, such monitoring is confined to matters related to revenue collection. The Ministry uses the Development Act of 1988 as its principal guide in deciding whether applications for establishing industries should be granted. It also incorporates to a limited extent, the views of other Ministries in its decisions, although a formalized procedure does not exist.

The Ministry has recently prepared a position paper on the subject of industrial location and the environment which is being circulated to other government departments, including the Environmental Unit. It is hoped that this paper, when accepted, would set out procedures for including environmental factors when assessing industrial site selection. The staff is not aware of any guidelines on the treatment of industrial wastes. Questions on this issue are presently treated by the Environmental Unit of MNRE. At present, decisions on future industrial sites appear to be based mainly on land availability and the presence of similar industries in an area.

The Human Resources Section of the Ministry analyses information on the human resources of The Gambia. This section analyses census data to establish population statistics (eg. population growth rate) and develop policies on population (eg. family planning and migration). The section foresees use of an EIS in monitoring the implementation of a given population policy. Specifically, it would like to see whether there are links between environmental degradation and specific policies for given administrative units. With the assistance of a UN Population Fund project which is currently executed by ILO and due to become government executed in 1993, the Human Resources section hopes to establish a

computerized data bank on population and human resources in the last quarter of 1992. This would be a PC based system and as presently envisaged would contain selected data extracted from the Ministries of Health, Education and Statistics, all of which have information in a computerized format. Funding for the current phase of the project ends in 1994.

2.5.2 Available Information and Data Users

Data available at this ministry include a list of factories and their locations and publications on human resources, for example, population statistics.

2.6 Department of Lands and Surveys

2.6.1 Profile of Activities

The Department of Lands and Surveys consists of three units, namely, the Lands and Valuation Unit, the Map Production Unit, and the Surveying Unit. The major tasks of the surveying unit, which has a complement of 5 trained surveyors, is the carrying out of third-order cadastral surveys. There are no field offices and thus all requested work in The Gambia is organized through the Banjul office. In order to preserve a high quality of surveying work in the country, the Department has been active in promoting a Surveying Bill which will regulate the licensing of land surveyors in the near future.

The Department is beset by a general lack of modern equipment for all aspects of its work. There is an urgent need to computerize the Department. Not a single computer is currently used for carrying out its activities. Valuable original surveying data exist only in the form of tables on fading paper. A staff member is currently receiving training abroad at the ITC in The Netherlands in Land Information Systems (LIS).

2.6.2 Information Available

The Department has a complete set of all maps it has ever produced including supporting airphotos and their corresponding film negatives. Some local coverage maps produced by various projects are not stored at the Department.

A complete list of departmental holdings is given in Table 1. Special maps, which are not generally distributed but which are available for consultation, include a series of topographic spot elevation maps at a scale of 1:10,000 and an average interval spacing of approximately 500 meters, and height overlay maps published in 1976 which detail vertical and horizontal control of a levelling network alongside major routes. The Department also prepares cadastral plans of urban areas at a scale of 1:1250 (earlier series are at a scale of 1:2500). The users of these cadastral plans are mainly the Department of Physical Planning and Housing, Utility Corporations (telephone and water), local survey companies and private institutions. The Department also prepares individual cadastral lease plans necessary for real estate transactions. The

most popular map produced by the Department is the 1:250,000 guide map of the Gambia published in 1980.

2.7 Ministry of Health and Social Welfare

2.7.1 Profile of Activities

The main information gathering activities of this Ministry are related to the preparation of statistics on mobility and morbidity, vital statistics (births and deaths), and nutrition. These information are all reported to be available in computerized databases.. There is an ongoing project financed through the African Development Bank which aims at creating a database on health conditions and related socioeconomic indicators. Full details of the database were not released to the mission, however, it was stated that the database contains information on some 20,000 persons from various locations throughout The Gambia.

2.7.2 Information Available and Data Users

According to the Principal Health Planner, the Department produces an annual report, however the last one appeared in 1989. The results of analyses of the database currently being constructed will be distributed freely. However, it is not presently envisaged to make the database accessible to external users. Approximately 4 working PCs are used at the Computer Centre. The principal software in use is WordStar for data entry, files are then transferred to Lotus 1,2,3 which has proved to be tedious. Data collection on disease incidence has been hindered by a lack of data entry forms. Personnel stated that additional funding was being sought for the production of more forms.

2.8 Department of Livestock

2.8.1 Profile of Activities

A principal objective of the Department is integrated rangelands management. Given the limited forage resources in The Gambia and in order to avoid over-grazing and eventual degradation, planners would like to restrict the livestock population to a certain level. Emphasis is placed on achieving a zero growth rate for the cattle population, currently estimated to be in the range of 315,000 to 340,000.

Cattle counts were formerly obtained during the mass vaccination campaigns, the last one of which was held in 1987/1988. Since that time, the Department obtains its figures from the NASS reports which are produced by the Department of Planning of the Ministry of Agriculture. However, the logistical problems which often confront this latter Department often call into question the validity of some aspects of the data pertaining to livestock. Estimates of the ruminant population are obtained from slaughter house records. These figures are inaccurate since they reflect the counts from urban centres only. Statistics on sheep and goat populations are even less accurate as slaughtering takes place at home.

In order to achieve its integrated management objectives, the Department has identified a number of important data needs. In particular, it requires information on: (i) the carrying capacity of rangelands, (ii) the impact of bush fires on the quality of grazing resources, (iii) optimal siting of water wells, and (iv) socio-economic studies on herding practices and corresponding herd productivity. The Department personnel did express the opinion that the CSE in Dakar, owing to its long experience in pastoral studies, may be of technical assistance.

Some factors which currently limit rangelands resources are the presence of zones of high tsetse fly population, a lack of adequate water resources in areas where grazing is possible, and the conversion of rangelands into crop production, forestry, or other land-use.

2.8.2 Available Information and Data Users

The major users of the animal population and distribution data produced by the Department of Livestock are the Ministry of Trade, Industry and Employment for determining the impact of livestock on the gross domestic product(GDP) and for formulating development strategies. The Department also produces reports on livestock prices and on animal health statistic on a regular basis, especially those related to human health. It communicates these to the Ministry of Health and Social Welfare, the Livestock Marketing Board, livestock dealers and the Department of Statistics. Since 1991, the Department produces periodically a review report on the livestock sector.

The Livestock Department has instituted a program aimed at the utilization of animal byproducts in an effort to reduce the impact of these wastes on the environment. The emphasis of this program is at the village level only.

The department is not computerized and records are archived in paper files.

2.9 Department of Wildlife

2.9.1 Profile of Activities

The Department has operated with a trained staff complement of one, its Director, since 1981. Nine additional, full-time technical staff have been promised in the near future. The main problem from the perspective of wildlife conservation is the destruction of habitat during land clearing related to rising human population. The Department lacks essential baseline information to effectively carry out its mandate of wildlife conservation and management. Specific information include data on species distribution, species abundance and habitat types. The Department plays a minor regulatory role in the issuing of licenses for bird hunting. However, given the limited personnel resources of the Department, this role is ineffective in rural areas of the country. Recommendations for the establishment of wildlife parks are initiated by the Department.

The Department has no computer facilities.

2.9.2 Information available and Data Users

The Department has some qualitative information on species distribution to offer. The main requests for information come from overseas organizations such as the World Wildlife Fund and the International Union for the Conservation of Nature.

2.10 Soil and Water Management Unit

2.10.1 Profile of Activities

The Unit was established in 1978 with the objective of introducing soil conservation practices in The Gambia. It has a technical staff complement of 8 persons with support staff numbering 34. It is comprised of 5 different sections: agroforestry, engineering, soil survey, cartography, and training, monitoring and evaluation. Although the unit has a mandate to intervene nationwide, its zone of intervention is currently dictated by the availability of donor funding and the specific interests of the donor. Most of the current activities of the Unit are funded by GTZ which has targeted western Gambia for intervention. The Unit carries out a survey of farmer needs and adheres to a policy of having the farmers initiate requests for assistance in order to enhance the sustainability of the conservation practices which will result. According to the Department, the major regional environmental problems are erosion and salt intrusion.

The Unit has been lobbying unsuccessfully to prepare nationwide soil maps at scales of 1:10,000 for the lowlands and 1:25,000 for the upland areas. Some of the advantages which such detailed maps would offer when compared to the existing 1:125,00 soil associations map are: (i) better fertilizer recommendations to farmers at the field level, (ii) better landuse planning, (iii) better analysis of erosion problems, and (iv) applications in engineering studies.

The farmers surveys have been entered into a database using DBase software. The Unit has a total of 4 PCs, including 2 laptops.

2.10.2 Information Available and Data Users

The Unit has produced one regional soil survey at a scale of 1:10,000 of areas within the Gambia River Valley, specifically within the Upper River Division. The original maps are archived at the Unit's offices, however copies can be obtained from the OMVS head office in Dakar.

2.11 Department of Physical Planning and Housing

2.11.1 Profile of Activities

The Department of Physical Planning and Housing has the important mandate

of 'regulating and guiding the rational utilization of the country's land resources' (GEAP, p.24). However, due to a lack of appropriate regulations and means of enforcement, the Department appears to be ineffective. In addition, due to inter-departmental rivalry, its level of cooperation with other institutions appears to be minimal. The department carries out some limited urban planning activities, but is hampered by a lack of updated base maps, which it claims should be the responsibility of the Lands and Surveys Department. An urban plan for the region around Banjul was in 1986 and updated in 1989 during a GTZ supported project, however, this plan has never been respected. Owing to this experience, the Department questions the wisdom of preparing updated land use plans.

The technical staff complement is 3 graduate level planners and 9 planning technicians and draughtsmen. The Department is not computerized although it is reported that during the GTZ project, an attempt at computerized map making was made. Unfortunately, the computerized records of the study have not been maintained.

2.11.2 Information Available and Data Users

The Department has available a few publications which include large scale land use maps of some the major urban and rural growth centres, namely the Greater Banjul Area, Basse, Brikama and Farafenni. These maps were first published in 1985/1986 and need to be updated.

2.12 Ministry of Finance and Economic Planning, Documentation Centre

2.12.1 Profile of Activities

The Documentation Centre, established in 1983, has the role of supporting the Ministry through storing and supplying national and international documents on development planning. It serves as the archive for yearly reports from other institutions such as the Ministry of Industry, Trade and Employment.

The Documentalist is in the process of linking his centre with the Pan African Documentation and Information System (PADIS) based in Addis Ababa. Toward this effort, he has already established the unit as the regional centre for the West African Documentation and Information System (WADIS). Further progress will require funding in order to set up communication with the above information systems. A proposal is being developed by the Ministry of Finance, The President's Office, and the Central Bank, entitled "Economic Management Building Capacity Programme" which would secure funding for these activities. Once established, the linkages would allow remote access to databases with extensive cross-sectoral listings of documents, including the environment sector.

2.12.2 Information Available and Data Users

The Documentation Centre has the best available resources in The Gambia in the area of macroeconomic studies in international development. In addition to reference materials and yearly ministerial reports, it has a filing system based

on title, subject, and author. There is one PC in the unit, but no computerized bibliographic reference system. The main users are civil servants.

2.13 Parastatals

2.13.1 Profile of Activities

The only parastatal organization visited during the mission was the Gambia Utilities Corporation (GUC). The GUC has the mandate to supply electricity for the entire country, water supply in the GBA and other major urban centres, and sewerage service for Banjul and the major tourist hotels along the coast.

The GUC Sewerage Division has monitored water quality within effluent zones in the past. The sewerage outfall pipe terminates about 1 km offshore and transports untreated sewerage to the ocean. Five locations along the Banjul beaches and close to the pipe outfall point were chosen as sample points for bacteriological analysis. The Sewerage Department had contracted with the WQMU to perform the necessary analyses, but due either to the lack of chemicals within the WQMU or the GUC's unwillingness to pay the new WQMU fees, no samples have been analyzed for over one year. There seems to be little concern at this time because there have been no reports of community health problems.

Computer facilities exist within the GUC Sewerage Division, but are devoted entirely to processing financial data.

2.14 Non-governmental Organizations

2.14.1 Profile of Activities

There are now reported to be some 108 NGOs in the Gambia, up from about 15 in 1987. However, a significant number of these are 1-man organizations and religious schools. Of the four NGOs visited during the course of the mission, The Association of Non-Governmental Organizations (TANGO) has the role of coordinating NGO activities, whereas the Catholic Relief Services (CRS) and Action Aid are considered to be the largest in the Gambia. Worldview International Organization works in the area of village nursery and woodlot establishment.

The leadership in TANGO do not consider themselves a true NGO in that they do not execute activities in the field, but rather they are an umbrella organization whose first mandate is to service their members. About one-half of the NGOs in country belong to TANGO, and others are seeking membership. Because of its coordinating role, TANGO is ideally placed to be a conduit of environmental information to and from its members. An annual report is produced which is submitted to the GOTG.

Action Aid provides material support to rural projects in the areas of food production, primary health care, water and education. It maintains a database in DBase format created using results from periodic surveys conducted in approximately 500 villages. These data are used internally by Action Aid to

evaluate applications for its intervention in the various communities. The database includes information on ethnic groups, economic activities, transportation, energy sources and usage, human resources, self-employed entrepreneurs, physical resources, environmental sanitation and local market facilities. Participation by the rural population is one of the main requirements for support by Action Aid. Plans are underway to establish a documentation centre for storing in-house documents as well as those published by other NGOs.

As a data user, Action Aid requires limited information from the relevant government ministries on nutritional reports, school attendances, vaccination coverage and the locations of health centres for planning purposes. However, the present tendency is to reduce the level of planning carried out by Action Aid and to transfer this aspect to the communities themselves.

CRS also support projects in the areas of agricultural production, nutrition and health care for community participation is assured. CRS has a stated policy of not funding projects which the institution considers will be harmful to the environment. Thus, for example, projects which use pesticides or require land clearing by burning are not supported. In so far as its needs as a data user are concerned, the management feels that having ready access to information on natural resources (soils, vegetation and agriculture) would be useful in the evaluation of proposals it receives for support (usually in the form of funding or technical assistance).

The primary mandate of Worldview International Foundation (WIF) is to strengthen Forestry Department extension work. Their focus is on village-level participation in environmental management, using a self-help approach developed in Asia in the 1970's. They are currently active in 11 villages located on the North Bank. Their approach to information collection is to train villagers and collect socio-economic data simultaneously. They use some information from government ministries, but get most of the information they need for planning from their own surveys.

2.15 Summary of Data Sources

For convenience, the sources and institutional locations of the various types of national environmental data which have been inventoried are summarized below:

Data Type	Institution and Data Description
Soil	DLS -- Soil association maps, 1:125,000, 1976 DF, DLS, USAID -- Landscape and soils, 1:50,000 and 1:125,000 maps, 1986 (based on 1982 airphotos) SWMU -- Soil survey, Gambia river valley, 1:10,000; soil conservation practices
Geology	not available

Land Use	DF, DLS, USAID -- Agricultural Lands, 1:50,000 and 1:125,000 maps, 1986 (based on 1982 airphotos); DLS -- Land use photomaps of the Gambia, 1:10,000 DPPH -- Land use plans for the GBA (1:30,000), Basse, Farafenni and Brikama (1:5,000), 1985/1986.
Vegetation forests rangelands parks	DF, DLS, USAID -- Forested Lands, Rangelands, 1:50,000 and 1:125,000 maps, 1986 (based on 1982 airphotos)
Water Resources surface water ground water	DWR -- dekadal and monthly bulletins on and hydrology; Monthly and quarterly reports on groundwater levels (computerized); hydrological yearbook
Agriculture crop production soil fertility use of chemicals	MADA -- statistical yearbook (computerized)
Livestock	DL -- annual reports on animal population and distribution; livestock prices; animal health statistics
Fisheries	DF -- Frame Survey Report every 2 years
Wildlife	DWC -- qualitative information on wildlife species
Energy use of firewood	not available
Meteorology rainfall temperature humidity wind	DWR -- dekadal and monthly bulletins on and meteorology
Health	MHSW -- reports on mobility, morbidity and vital statistics (soon to be computerized)
Population	MTIE -- reports on population statistics, human resources and population policy (soon to be computerized)

Topographic Maps and base maps	DLS -- Photomaps of the Gambia, 1:50,000, 1976; Contoured Orthophotomaps of the Gambia, 1:25,000, 1983; Kombo Peninsula, 1:25,000, 1977; Coastal Strip, 1:10,000, 1976; Kaur to Georgetown, contoured orthophotomaps, 1:10,000; Cadastral Plans of Kombo, Soma Bansang and Pakalinding, 1:1250, 1985; Cadastral plans of Banjul, Farafenni, Bansang, Soma, Albreda and Juffereh, 1:1250, 1983; Cadastral plans of major towns and villages, 1:2500, 1983; Vertical and Horizontal control maps; topographic spot elevations, 1:10,000, 1976 DF -- planimetric map of the Gambia, 1:50,000, 1946
Aerial Photography	DLS -- 1:25,000 color infrared, MFRM project, 1980; 1:25,000 DOS undated; 1:10,000, for urban centres Banjul, Gunjur, Bansang, Basse Santa Su, 1983; 1:50,000 OMVG, B&W and coloured for the Gambian River Basin, 1983; 1:25,000 and 1:12000 OMVG from Kaur to Georgetown; 1:10,000 DOS from Kerewan to Sare Sofi, 1972; 1:25,000 DOS for areas south of Banjul, Camaloo, and Sukuta, 1972; assorted airphotos at various scales (1:5000 to 1: 40,000) of the coastal strip and major towns between 1960 and 1968
industries	MTIE -- list of industries and their location
national economy	CSD -- Reports on national accounts, statistical abstracts and consumer price index

Note: See list of acronyms and abbreviations for full names of institutional sites.

3.0 ENVIRONMENTAL CONCERNS AND DATA NEEDS

The major environmental problems in The Gambia have been listed in the GEAP document. These problems have not, however, been prioritized since it was felt that there was insufficient data available to support such an evaluation. Instead, establishing a list of priorities will be one of the activities to be accomplished at some future date as part of the implementation of the GEAP. Notwithstanding, an examination of the major problems and issues detailed in the GEAP document allows one to infer what some of the greatest data needs are at the national level.

The following ranking of the gravity of environmental concerns is at best very approximate and are based on the subjective commentaries offered by personnel interviewed in the various institutions visited during the course of

the mission and by discussions held with the staff of the Environmental Unit.

1. degradation of soils: due to salinization, erosion, over-cultivation, improper use of fertilizers and prolonged drought conditions

2. degradation of forests: related to the frequent occurrence of bush fires, exploitation of firewood, land clearing for cultivation and prolonged drought conditions.

3. degradation of rangelands: due to overgrazing.

4. salt water intrusion: due to increased rates of groundwater extraction in coastal areas and decreased river flow related to long term drought conditions and deforestation.

5. threat to fish stocks: due to over-fishing, destruction of spawning grounds and coastal pollution (in particular, wastes from fish processing, oil spills, litter and toxic wastes).

6. threat to population health: due to poor water quality, poor access to sanitation, improper waste management and misuse of fertilizers and pesticides.

7. coastal erosion: due to coastal submergence.

8. siltation: due to increased water erosion resulting from the clearing of vegetation.

9. loss of wildlife due to destruction of habitat

10. uncontrolled urbanization

The basic data needed to evaluate and monitor these environmental concerns are summarized in the following table. The number code for the environmental issues corresponds to the order noted above.

	Environmental Issues									
Information Needed for evaluation and monitoring	1	2	3	4	5	6	7	8	9	10
landcover (forests, rangelands, wetlands, parks)	Ro	Ro	Ro		Ro			Ro	Ro	
bush fires	Ru	Ru	Ru							
land use	Ro		Ro	Ro	Do			Ro	Ro	Ro

population distribution	Ra	Ra	Ra		Ra	Ra		Ra	Ra	Ra
socio-economic data	Ru	Ru	Ru	Ru	Ru	Ru		Ru	Ru	Ru
human settlements (urban and rural)	Ra	Ra	Ra	Ra	Ra	Ra		Ra	Ra	Ra
agriculture practice	Ra			Ra				Ra		
land tenure and property rights	Da		Du							Ri
property value										Ro
urbanization process										Ru
infrastructures						Ra				Ra
industrial sites and characteristics						Ri				
soils	Ri	Ri	Ri	Ri			Ri	Ri		
topography				Ri			Ri	Ri		
geology/hydrogeology	Du				Ri	Ri	Ri	Ri		
hydrology				Ri	Ri		Ru			
meteorology and climate	Ra	Ra	Ra	Ra			Ri	Ra		
air quality										
wind	Ri									
wildlife habitat and species distribution									Ru	
satellite imagery/ air photography		Du	Du							
wastes disposal						Ru				

Note: R - required
D - desirable
a - available
i - inadequate
o - outdated
u - unavailable

It is clear from the above table that in order to support the analytical activities associated with the major environmental issues there is need to obtain adequate information in the subject areas of landuse/ landcover, soils, hydrogeology, hydrology and socio-economy. Here, adequacy of data refers specifically to the appropriateness of scale, level of detail and accuracy, and date of acquisition. Since it seems unlikely that these sets of information can all be made available in the near future, a phased program for their acquisition which takes into consideration national priorities may be appropriate. At the time of data collection, every effort should be made to have the data recorded in digital format which will facilitate their eventual incorporation into computerized graphic and relational databases.

Given the general inadequacy of data for environmental management, the design of an EIS should include parameters which offer the maximum utility to monitor the wide variety of environmental problems hindering development.

4.0 KEY PARAMETERS FOR ENVIRONMENTAL MONITORING AND EVENTUAL INPUT TO AN EIS.

The following list of environmental parameters are offered as a guideline for information essential for monitoring at a national scale. It is not necessary that the EIS which Gambians will choose to design should include each of the parameters, rather the list is meant to serve as a point of departure for discussions leading to the selection of those most appropriate for The Gambia. The national databases are intended to serve as a base for integrated land use management planning at a local scale, although more detailed information should be collected to meet specific objectives.

When allocating resources to obtain the necessary data types, project planners should take into account which variables can be derived from others, thereby concentrating effort and reducing expenditure.

The parameters are grouped by sector for convenience, although the interrelationships between parameters are numerous. The relative priority of each parameter is categorized as being of primary or secondary importance. This judgement was based on the mission members' previous experience in environmental monitoring in Sub-Saharan Africa.

4.1 Forestry sector

4.1.1 Forest cover: density of canopy cover.

Data format: digital maps and hardcopy on paper and stable base for reproduction and digitizing.

Data units: % cover.

Level of accuracy: locational: 50 meters at 1:50,000 scale, % cover at +/- 5%. (Note: locational accuracy refers here to the relative position of map units with respect to one another. 50 meters at 1:50,000 scale corresponds to a map distance on 1 millimetre. This is distinguished from true geographic location which refers to a map element's position on the earth's surface.)

Acquisition method: Combined aerial and ground survey on a ten year interval, with sampling by other means (satellite or ground survey) of representative areas at 5 year intervals.

Relative importance: primary.

4.1.2 Forest structure: number of strata.

Data format: digital maps and hardcopy on paper and stable base for reproduction and digitizing.

Data units: # strata: herbaceous, 2 or 3 forest strata.

Level of accuracy: locational: 50 meters at 1:50,000 scale.

Acquisition method: as in #1.

Relative importance: primary.

4.1.3 Forest production in woody biomass by vegetation association.

Data format: tabular (spreadsheet) with eventual transfer to GIS.

Data Units: cubic meters per hectares,

Level of accuracy: total +/- %10.

Acquisition method: stratified sampling relating ground survey data to area estimates from forest cover/structure photomaps.

Relative importance: secondary.

4.1.4 Site index which integrates growth and yield.

Data format: tabular with eventual transfer to GIS.

Data units: height of representative tree species at base year.

Level of accuracy: + or - 2 meters.

Acquisition methods: derived map from soil and forest cover maps.

Relative importance: secondary.

4.1.5 Deforestation, with: i) conversion of forest to savanna grassland or

agriculture, ii) conversion of primary to secondary forests, and iii) disappearance of mangrove forest

Data format: digital map and hardcopy.

Data units: hectares by category.

Level of accuracy: determined by accuracy of previous forest cover maps (1982) and those to be produced in 1993 and registration to map base.

Acquisition method: Derived map resulting from GIS analysis of parameters 1) and 2).

Relative importance: primary.

4.1.6 Zones under high anthropogenic pressure

Data format: map.

Data units: hectares.

Level of accuracy: determined by accuracy of forest cover map.

Acquisition method: Derived map resulting from GIS analysis of the forest cover map, a recent map of towns and roads for distance measuring, and survey results on forest utilization patterns and fuelwood consumption. (note: a similar GIS analysis could be applied to identify similar zones for range management)

Relative importance: secondary.

4.1.7 Vegetation species composition maps

Data format: tabular listings (spreadsheet) and spatial display in GIS.

Data units: frequency, occurrence, other measures of biodiversity.

Level of accuracy: to be determined.

Acquisition method: Ground survey with eventual input to GIS.

Relative importance: primary.

4.1.8 Wildlife habitat and species distribution

Data format: tabular by wildlife reserve, forest park or other.

Data units: frequency, occurrence or other wildlife census measures.

Level of accuracy: total + or - 10%.

Method of acquisition: Ground survey with eventual input to EIS.

Relative importance: secondary.

4.1.9 Bush burning parameters

Total surface area and seasonal progression.

Data format: digital maps and tabular statistics.

Data units: hectares and hectares per day or month.

Level of accuracy: Total + or - 10%.

Acquisition method: analysis of historical satellite data, future studies should include ground survey combined with analysis of satellite data.

Relative importance: primary.

Cause by location

Data format: digital maps and tabular statistics.

Data units: hectares

Level of accuracy: to be determined.

Acquisition method: Ground survey in conjunction with above measures.

Relative importance: primary

Woody biomass or forage loss.

Data format: digital maps and tabular statistics.

Data units: cubic meters or tonnes per hectare by species.

Level of accuracy: Total + or - 20%

Acquisition method: Ground survey on sample sites before and after burn, as much as possible in conjunction with acquisition of current satellite data.

Relative importance: primary.

4.1.10 Fuelwood utilization

Data format: tabular by village and district.

Data units: cubic meters per hectare.

Level of accuracy: total + or - 10%.

Method of acquisition: socio-economic survey based on stratified sampling.

Relative importance: primary.

4.2 Water resources

4.2.1 Rainfall

Data format: tabular in spreadsheet and digital map.

Data units: total: millimetres
intensity: millimetres per hour

Level of accuracy: spatial accuracy determined by density of sampling stations (total of 38 in country).

Method of acquisition: Data presently collected at regular intervals (3 hourly for synoptic stations, yearly for others) and transmitted to AGRHYMET/Niamey headquarters. Convert tabular data to digital map using interpolation software packages.

Relative importance: primary

4.2.2 Evapotranspiration

Data format: tabular in spreadsheet, convert to digital map.

Data units: millimetres per hour.

Level of accuracy: spatial accuracy determined by density of synoptic meteorological stations (11 in country).

Method of acquisition: Data collected at 3 hour intervals at synoptic stations, as in 4.2.1.

Relative importance: secondary.

4.2.3 Temperature

Data format: tabular in spreadsheet, convert to digital map.

Data units: Degrees Celsius.

Level of accuracy: + or - 0.5 degree.

Method of acquisition: as in 4.2.1.

Relative importance: secondary.

4.2.4 Salinity (both ground and surface water)

Data format: tabular in spreadsheet, convert to digital map.

Data units: units of conductivity.

Level of accuracy: to be determined.

Method of acquisition: Sampling from boreholes and surface water. Frequency determined by: i) nature of use by local population, ii) seasonal flux, iii) past records of high levels.

Relative importance: primary.

4.2.5 Bacteriological content

Data format: tabular in spreadsheet, if desired, can convert these data to digital map.

Data units: # counts/millilitre.

Level of accuracy: total + or - 10%.

Method of acquisition: Sampling from boreholes and surface water. Frequency determined by season: i) nature of use by local population, ii) seasonal flux, iii) past records of contamination levels and potential hazards.

Relative importance: primary.

4.2.6 pH

Data format: tabular in spreadsheet, by location.

Data units: pH scale (1 -10) for hydrogen potential.

Level of accuracy: + or - one half level.

Method of acquisition: Sampling from boreholes.

Relative importance: secondary.

4.2.7 Stream discharge

Data format: tabular,

Data units: cubic meters per second

Level of accuracy: dependent on flow season (rainy or dry).

Method of acquisition: Correlate water level with discharge estimates.

Relative importance: secondary.

4.2.8 Groundwater level

Data format: tabular, reported for various water points.

Data units: # meters above sea level

Level of accuracy: + or - 0.5 meters.

Method of acquisition: Sampling on a seasonal basis.

Relative importance: primary.

4.2.9 Turbidity/sedimentation

Data format: tabular for spreadsheet

Data units: visibility in centimetres, convert to parts per later.

Level of accuracy: Total + or - 10%.

Method of acquisition: field sampling with frequency determined by seasonal needs

Relative importance: secondary.

4.3 Fisheries sector

4.3.1 Demographics of fish stock, including:

Estimate of total fish population.

Data units: # counts

Data format: tabular by species

Level of accuracy: total + or - 10%

Method of acquisition: currently limited to FAO funded fish population studies, but Fisheries Department intends to carry out these studies annually when funds are available.

Size-frequency by species (to estimate size composition of fish stocks).

Data format: tabular by species and length.

Data units: # counts by length class by species

Level of accuracy: total + or - 10%

Method of acquisition: currently limited to FAO funded fish population studies.

Relative importance: primary

Fecundity to estimate the rate of reproduction and recruitment.

Data format: tabular, egg counts by weight class of species.

Data units: egg counts.

Method of acquisition: currently none, but the Department plans to carry out this study when funds are available.

Relative importance: secondary

4.3.2 Incidence and location of contamination:

Data format: tabular by pollutant by location.

Data units: to be determined

Level of accuracy: to be determined

Method of acquisition: Fisheries Department would conduct sampling when estimating catch at landing sites.

Relative importance: secondary

4.4 Agricultural parameters

4.4.1 Soils map

Data type: thematic map on paper and in digital format.

Data units: Soil taxonomic divisions as described in the Dunsmore (1976) report, with additional detail on the functional use to which the soil unit is best suited.

Level of accuracy: 1:25,000 for upland soils and 1:10,000 for lowland soils which are characterized by high local variability.

Method of acquisition: Classic soil survey, such as the one currently in the North River Division (GTZ funded), using existing 1:50,000 aerial photography or that planned for 1993 for stratification of sample design.

Relative importance: primary

4.4.2 Erosion or erosion hazard map

Data format: thematic map on paper and in digital format.

Data units: erosion hazard index, with 5 ratings, based upon: i) slope, ii) soil type, iii) vegetation type and percent canopy cover, and iv) land use.

Level of accuracy: Locational accuracy at 25 meters, attribute or index accuracy within one index level.

Method of acquisition: derived map from i) aerial photo interpretation and/or field survey, ii) existing topographic data, iii) map of vegetation, iv) soils maps, and v) land use maps showing cattle throughways.

Relative importance: primary.

4.4.3 Rangelands carrying capacity

Data format: tabular by site, can be converted to thematic map on paper and in digital format.

Data units: kilograms of usable herbaceous forage per hectare.

Level of accuracy: Total + or - 10%. Map scale should be determined by aerial photography to be collected in 1993. If map is produced at 1:50,000, the locational accuracy should be of the order of 50 meters.

Method of acquisition: field survey stratified by range type. Data collected should reflect whether cattle, small ruminants, or a combination do or should graze the site.

Relative importance: primary.

4.4.4 Land Use/Suitability Map: including description of farming practice within each unit.

Data format: hardcopy and digital.

Data units: land use classes determined by predominant cultural activity.

Level of accuracy: Map scale should be determined by aerial photography to be collected in 1993. If map is produced at 1:50,000, the locational accuracy should be of the order of 50 meters.

Method of acquisition: Aerial photo interpretation supported by field survey.

Relative importance: primary.

4.4.5 Agricultural production map: maps for groundnut, millet, other major staples, and possibly horticultural production.

Data format: hardcopy and digital. Statistics aggregated at the District level.

Data units: tonnes per hectare.

Level of accuracy: to be determined (total + or - 20%?).

Method of acquisition: derived from tabular data compiled be field officers. Tabular data converted to digital map using GIS software.

Relative importance: secondary.

4.4.7 Soil fertility

Data format: tabular by site surveyed.

Data units: standard soil fertility measures for N,P,K and micronutrients, to be converted into prescription for fertilizer application.

Level of accuracy: to be determined.

Method of acquisition: soils sampled during soil mapping survey described above.

Relative importance: primary.

4.5 Population parameters

4.5.1 Population maps

Data format: tabular census data converted to a digital map using GIS software.

Data units: i) total individuals by district, with separate map for urban centre population.
ii) age classes in years
iii) population growth rate based on 1983 and 1993 (planned) censuses.

Level of accuracy: within legal limits for accuracy of census defined by Gambian law.

Method of acquisition: census results entered in spreadsheet and converted to digital maps.

Relative importance: primary.

4.5.2 Immigration and Emigration.

Data format: tabular by district.

Data units: # individuals by year of arrival and domicile.

Level of accuracy: as specified by census results.

Method of acquisition: census results entered and pie charts designed with spreadsheet software, then superimposed on district boundary map.

Relative importance: secondary.

4.5.3 Health status maps: morbidity, mortality, disease incidence.

Data format: tabular data in spreadsheet converted to digital map.

Data units: i) morbidity: # of cases reported by village.
ii) mortality: # deaths/100,000
iii) disease (ex. measles) incidence: # cases by village

Level of accuracy: determined by national health standards.

Method of acquisition: relevant information extracted from census reports, Ministry of Health statistics, input to spreadsheet and converted to digital maps.

Relative importance: primary

4.6 Other parameters

4.6.1 Infrastructure: towns, roads, airstrips.

Data format: paper and digital maps.

Data units: primary, secondary roads, village size, etc.

Level of accuracy: various map scales depending on application. 50 meters locational accuracy at 1:50,000 scale.

Method of acquisition: Digitized from existing planimetric maps and updated following 1993 aerial survey.

Relative importance: primary

4.6.2 Industry type and location: (note: given the mixing of residential and industrial sites in the GBA, this parameter applies only to the Kombos St. Mary District.

Data format: digital and paper maps.

Data units: industry type coded as map attribute.

Level of accuracy: Locational accuracy of the order of 10 to 25 meters.

Method of acquisition: Data collected from permit issued to industry.

Relative importance: primary.

4.6.3 Coastal beach loss

Data format: tabular, by location.

Data units: meters (of beach lost) or cubic meters (volume of soil/sand loss).

Level of accuracy: linear: + or - 0.5 meter, or volume: + or - 20% of total.

Method of acquisition: establish baseline conditions using a benchmark and measure amount lost (linear distance measure). Attempt to relate linear measure to volume measure. Density of measurements determined by threat to local infrastructure or cultural features.

Relative importance: primary

4.6.4 Land tenure

Data format: tabular data by location

Data units: not applicable for nominal data

Level of accuracy: locational accuracy determined by current land ownership policy.

Method of acquisition: information recorded during census or extracted from divisional land tenure records.

Relative importance: primary

4.6.5 Administrative boundaries

Data format: paper and digital map.

Data units: nominal data.

Level of accuracy: locational accuracy at 50 meters for 1:50,000 scale map.

Method of acquisition: digitize existing administrative boundary maps.

Relative importance: primary

5.0 ESTABLISHMENT OF AN EIS

5.1 Organization of Information Flow

The key objective of an information system is to make readily available to planners and decision makers the appropriate type of information which will enable environmentally sound decisions to be made. One of the primary challenges is therefore to ensure that the right type of information can be supplied when needed. The type of information required will include biological, physical as well as socio-economic data, since these are regarded as essential indicators of the status of the environment.

As is the case in most countries, information gathering and management on different aspects of the environment at the national scale falls within the mandates of several independent government institutions. So a major task in establishing an EIS is to coordinate the supply and exchange of this information and to assure its access by decision makers. More often than not this task can prove to be difficult owing to mistrust among rival government institutions. Sufficient attention should be given to sensitizing the various institutions who would be involved in establishing the EIS.

The institutions which have mandates relating to the collection and management of environmentally related information in The Gambia are: (i) Department of Forestry, (ii) Department of Lands and Surveys, (iii) Department of Livestock, (iv) Department of Water Resources, (v) Department of Fisheries, (vii) Ministry of Agriculture, (viii) Ministry of Industry, Trade and Employment, and (ix) Ministry of Health.

For the purposes of the EIS, each institution would therefore be required to supply information in a form(s) which is acceptable to users who eventually wish to incorporate the institution's information in their decisions in accordance with prevailing environmental policies. Institutions are thus likely to maintain a range of products and activities to meet various users' needs. These products may, for example, be simple database files of tabular data or maps in a particular standardized format which is 'compatible' to the data user.