

The Malawi National Environmental Information System

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Introduction

The multi-sectoral nature of most environment and natural resource problems requires the coordinated development of digital data sets that can be subjected to integrated analysis through the use of Geographic Information Systems (GIS) and related environmental information technologies. It is thus proposed that to support continued research and monitoring of environmental phenomena, a National Environmental Information System (EIS) be established. Such a system is consistent with the needs expressed in the Malawi National Environmental Action Plan (NEAP) and the current development of the Malawi Environmental Monitoring Programme (MEMP) within the Department of Research and Environmental Affairs (DREA).

The Environmental Information System is intended to provide timely information to support the inventory, investigation, and monitoring of the environment. It is proposed that this be designed to consist of five subactivities:

1. EIS Coordinating Committee (ECC)
2. National Environmental Mapping Program (NEMP)
3. EIS Distribution Center (EDC)
4. National Environmental Information Center (NEIC)
5. National Programme for the Development of Environmental Information Technologies (NPDEIT)

These subactivities will provide the mechanism for the development, dissemination and use of a National Environmental Information Database. The database will consist of an off-line archive of coordinated datasets, developed through a distributed group of independent agency mapping activities, but accessed through a centralized body within the Department of Research and Environmental Affairs (DREA). At some future date, when the need becomes obvious, an on-line networked system can be considered. In the meantime, emphasis will be placed on the display and analysis of such data through the use of independent software and hardware systems in a variety of contexts.

Organizational Structure

Figure 1 illustrates the proposed organizational structure of such a system. The EIS itself is enclosed in a red box, and can clearly be seen to be an inter-agency project, coordinated by the EIS Coordinating Committee (ECC). This committee is in turn responsible to the National Committee on the Environment (NCE) for overall policy guidance.

As can be seen in Figure 1, the EIS consists of environmental data (the boxes in the cyan color), and a support system consisting of a National Environmental Information Centre (NEIC), an EIS Distribution Center (EDC) and a National Program for the Development of Environmental Information Technologies (NPDEIT). The first of these support systems provides information on what is available in the database and how to order it; the second distributes the data, and the third provides an educational framework for the procedures required to use these data in a cost-effective manner.

The data themselves come from two sources. The first, and most important, is a National Environmental Mapping Program. This consists of a set of independent, but coordinated, digital mapping activities by each of the main agencies producing spatially-referenced environmental data. The second is a more ad-hoc collection of reports and data sets produced by a range of government, non-government, academic and parastatal groups.

Components of the EIS

EIS Coordinating Committee

The EIS Coordinating Committee (ECC) will have responsibility for the overall design, implementation and management of the EIS. It should consist of a full-time secretary, and representatives from each of the key agencies involved. Responsibilities will include:

- v data model development for each element of the National Environmental Mapping Programme
- v development of accuracy, coding and documentation standards
- v development of digital data exchange formats
- v long-range planning for data acquisition
- v coordination of long-range education and research in environmental information technologies
- v coordination of long-range political and financial support

Development of the first three of these elements will be strongly coordinated with the various mapping agencies involved. Indeed, the function of the ECC is largely to support and coordinate the activities of National Environmental Mapping Program Coordinating Committees within each of the affected agencies.

Although the ECC will be an interdepartmental committee, it is suggested that the secretary, administrative support and space be provided by DREA. It is also suggested that the position of chair rotate on an annual basis. To achieve continuity, a three-year sequence of responsibility is envisioned. Each year, the committee will elect an Assistant Chairperson position. That person will then succeed to the position of Chairperson the year after, and subsequently to the position of Past Chairperson the year after. Governance will thus be shared between three persons, with distinct responsibilities for each. It is suggested that agencies be required to provide for full time involvement of personnel during any year in which they serve as Chair, and half-time for the positions of Assistant Chair and Past Chair.

For policy guidance, the ECC will be directly responsible to the National Committee on the Environment (NCE).

The National Environmental Mapping Programme

The National Environmental Mapping Programme (NEMP) will be a decentralized programme of coordinated mapping activities, designed to provide consistent and timely data in a format suitable for integrated analysis using Geographic Information System (GIS) technology. Conversion of data into digital format will proceed independently within each of the responsible agencies (Surveys, Lands, Forests, etc.). However, to be designated as a NEMP node, certification will be required by the ECC. Certification requires the provision of a permanent member to the ECC, and the development of a digital mapping programme that is consistent with the aims of the EIS. Such consistency will include the development of data models, standards and exchange formats that meet with the approval of the ECC as a whole.

EIS Distribution Center

Although each agency in the NEMP will develop digital data sets independently, distribution of those data sets will be through a coordinated network of EIS Distribution Centres (EDC). Initially, it is proposed that a single EDC be established within DREA. This will consist of a centralized set of data holdings and the equipment necessary to copy and distribute those data in a timely fashion.

For reasons of cost, speed and efficiency of distribution, it is suggested that serious consideration be given to the use of CD-ROMs as the medium of storage and distribution. In addition, procedures will need to be implemented to maintain the archival nature of these data sets. Current CD-ROM technology does not meet national archival standards. Thus a backup system of Exabyte tapes (30-year life) should be considered (or a regular program of remastering). At present, there is little reason to believe that such a system cannot be implemented using microcomputer technology. A single system with a gigabyte hard drive, two CD-ROMS and an Exabyte tape should provide adequate facilities in the initial stages of development. At a later stage, more systems can be added as necessary.

National Environmental Information Centre

The National Environmental Information Centre (NEIC) will act as a centralized one-stop source for information on the availability of data sets, how to acquire them, and advice on suitable technologies for their display and analysis, and educational programmes about them.

Although in the initial stages, NEIC's information will pertain predominantly to data encompassed by the National Environmental Mapping Programme, it is envisioned that a broader domain should be considered. For example, this centre might provide information on air photo holdings, procedures for access to satellite imagery (Landsat, SPOT, AVHRR), holdings of imagery within various departments, documents, reports, and so on. The basic seeds for such a system are already in place at DREA and can be built upon to develop this centre.

National Programme for the Development of Environmental Information Technologies

To support the development and maintenance of the EIS, a National Programme for the Development of Environmental Information Technologies will be required. In its initial stages, this should be developed through external donor assistance. However, it should progressively move towards the development of a national program run as a consortium activity of government and university programs. Ultimately, envisioned activities of this programme might include:

- v university and certificate programs in environmental information technologies
- v inter- and intra-agency professional training programs
- v secondary school educational programmes
- v coordinated research opportunities for academic and government professionals to investigate critical issues in the use of environmental information technologies in the Malawian context

Technologies encompassed by this program include (as examples) :

- v Geographic Information Systems (GIS)
- v Digital Image Processing (DIP) of remotely sensed data
- v Global Positioning Systems (GPS)
- v Area Frame Sampling
- v Aerial Video Survey
- v Environmental Impact Assessment (EIA)
- v Multi-Criteria / Multi-Objective Environmental Decision Making

To put structure to this set of technologies, it is proposed that one of the first tasks of the interim NPDEIS be to develop a Compendium of Environmental Information Technologies. This can then be used to structure educational programs and curricula in this area.

It is proposed that this program ultimately be managed as a University programme, with a steering committee composed of representatives from a consortium of University and Polytechnical programmes, DREA, and the ECC.

Procedures for the Development of the EIS

The initial requirement in the development of the EIS will be to gain government and donor support. Given the interest in consolidating the National Environmental Action Plan (NEAP), and current donor activity in the area of environmental monitoring, this should be possible to develop a multi-donor assistance programme without too much difficulty. The next stage will then be one of Structural Organization in which the main organizing elements are put into place. Following this comes perhaps the most pains-taking part of the entire process -- System Design. There are a great number of details that need to be considered by each of the agencies involved in the National Environmental Mapping Programme (NEMP). It is therefore proposed that the NEMP proceed with an provisional design, with re-evaluation after the EIS is in an operational mode. Finally, with provisional designs in place, all elements of the EIS can begin.

The following is a rough outline of this sequence of activities:

1. Gaining Government and Donor Support

Professional Level Technology Awareness / Applications Workshops

Management Level Technology Awareness Seminars

Formal Programme Proposal and Acceptance

2. Structural Organization

Development of the interim ECC

Development of an interim NPDEIT

Development of the NEMP Coordinating Committees within Agencies

NPDEIT: Continued Professional Level Trainings

NPDEIT: Final Organizational Design

EDC : Organizational Design

NEIS : Organizational Design

3. System Design

NPDEIT: Development of the Compendium of Environmental Information Technologies

NEMP: Data Model Development

NEMP: Standards Development

NEMP: Digital Exchange Format Development

ECC: Formal Organization

EDC : Procedural Design

NEIS : Procedural Design

NPDEIT: Formal Program Design

4. System Implementation

NPDEIT: Implementation

NEMP: Physical Database Development

NEIS and EDC Implementation