

# Information tool for environmental conservation and sustainable development

*Tagaloa Bismarck Crawley\**

## Introduction

Samoa as a member of the United Nations joined the rest of the world to endorse Agenda 21 that came out during the United Nations Conference on Environment and Development (UNCED) 1992, Rio. The Agenda provides resolutions that countries agreed on to support environmental conservation and sustainable development. One chapter that receives collective attention and global recognition was Chapter 40, which calls for the need to have accurate and presentable information to support and catalyse decision-making for strategy and action plan development as well as policy formulation and review. One vehicle of this information declaration encourages the use of information tools like Geographical Information System (GIS), remote sensing (RS) and databases.

In Samoa, the high population growth competing for a limited natural resource base to support it has slowly become evident. The limits in the capacity of these resources together with excessive pressures on its use develops a much greater need on how we approach a balance between environmental conservation and sustainable development. Natural disasters, which hinder and affect development and enhance environmental degradation, are becoming more frequent as supported by a global recognition of climate change. There exist land degradation and deforestation. In response good decision-making and customised programs are essential to ensure the sustainability of all efforts for future generations. These efforts require good, accurate, transparent and available information for assessing current situations as well as forecasting and planning future efforts.

GIS is a computer-generated tool that caters for the management of biophysical and socio-economic data in particular their association. Given that Environment encompasses a broad area and responsibility, this data and information needs to be analysed collectively as to develop an integrated approach towards action plan development, environmental assessment and reporting and policy formulation. In this paper, GIS will be discussed in its role for environmental conservation and sustainable development. Other applications of GIS will also be visited. A framework for environmental assessment and reporting (EAR) that is of relevance to Samoa will be discussed.

## Sustainable development

Sustainable Development means development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs, and implies using resources to improve the quality of human life while living within carrying capacity of a supporting ecological system<sup>1</sup>. Sustainable development in its broad sense is discussed in the 3 main areas; social, traditional and cultural aspects. The approach had come to cribs when it was argued through policy formulation and other efforts, that it had been mainly catered on a more strategic reasoning, which concentrates on economics as the main attribute or indicator of development.

---

\*T.B.Crawley is Project Manager for the World Bank Infrastructure Asset Management Project

Despite the many attempts to address sustainable development through international agendas and other regional efforts, one common constraint that is continually addressed is the deficiency in the required information and relevant tools to simplify, quantify and be able to integrate the many comprehensive actions and mechanisms required to manage and sustain those resources and interests of concern. Effort had been placed in the development of policies and legislations, which are geared to assemble an integrated approach through the various sectors, involvement. Strategies and Action plans are continually being produced to develop procedures and mechanisms to drive its interests. Assessment and Reporting have been vehicles for identification of trends and appropriate analysis on the status of the various resources under consideration. However, countries are continually threatened by the issues of appropriateness and affordability in their role in implementing the various conventions that dictate some or if not all these activities.

In the past four decades, 'development was focused on merely economic terms which was seen by scientists and environmentalists, etc. as overwhelmingly emphasising on economic growth to the exclusion of other considerations. The refocus on human development was an effort as seen by experts as a response to a debate on the real purpose of development and that is to bring about an improvement in peoples life styles. Lately with increased focus on environmental protection, the concept of sustainability achieved greater attention underlying the inter-dependence of environmental, economic, social cultural and political issues'<sup>2</sup>.

In small island countries in the Pacific where resources are scarce and limited, information is a critical issue. In addition response and measure are hindered by the smallness of their land areas, their remoteness from the metropolitan places for trade investment; their capacity to develop cleaner and appropriate energy resources; lack of skilled personnel to institutionalised and respond to sustainability measures and responses; appropriate and customised measures are much required.

One of the big questions is where 'information' really plays a role in the many frameworks. In many attempts actions and response are developed upon the identification of an issue or a problem rather than taking another step further where efforts are placed in the collection of relevant data and information to assess the extent of the problem before developing appropriate measures to mitigate the problem. At times thematic issues can be solved through a quasi approach where these problems can be directly catered for.

The question is, do we develop policies and legislation based on the current information or is it appropriate to look at the trend of or a forecast. On the other side of the process, there lies the question on how can we promote and translate the relevant information not only to enhance awareness and understanding but also to facilitate decision-making on relevant options and measures to take. What level of presentation is there that will welcome and promote a level of responsibility to the relevant audience on the particular issue at stake.

The focus of this paper is on information and its significant role in the framework of developing relevant strategies and action plans to achieve sustainable development. Particular emphasis is on information tools like the GIS/database that had been tested, deployed and promoted to facilitate the use, management and presentation of data to develop appropriate information for planning, assessment and reporting obligations.

### **Basis for action**

Agenda 21, Chapter 40 - The UNCED 1992, generated Agenda 21, which recognises the need to promote the integration between environmental issues and development, highlighting the need for accurate and reliable information to materialize this integration for sound decision-making. In addition, the same chapter also emphasises the need for tools that will present and analyse the relevant data to generate appropriate information in such a format that will catalyse decision-making.

United Nations Environment Program (UNEP) EAR - At the regional level, UNEP-EAR for Asia and the Pacific through the South Pacific Regional Environment Programme (SPREP) are assisting SPREP member countries to develop State of the Environment databases as well as assisting in developing tools like GIS for managing the display, analysis and presentation of these databases. The core of the project is to (1) build the capacity of countries through training, seminars and meetings so to exchange on common issues of information and resources it requires; (2) Support the management of these databases and information and (3) support how the data is used to meet environmental assessment and reporting.

Statement of Economic Strategy<sup>3</sup> - At the national level, the Government of Samoa had in place a 'Statement of Economic Strategy 2000–2001'. The statement emphasises the need to broaden the partnership between Government and all stakeholders as the key towards economic development. The broadening nature of the strategy simplifies an integrated approach towards development, which is the keynote in addressing sustainable development. The role of information in establishing this partnership is well recognized and discussed.

Department of Lands Survey and Environment (DLSE), Corporate Plan and Infrastructure Asset Management Project – At the sectoral level, the DLSE is implementing its Corporate Plan that was approved by the Government of Samoa for 2000–2002. The corporate plan had discussed the setup of a GIS to be known as Lands Information System for the Department under an International Development Association credit. The loan is earmarked by the Department for the development of a Coastal Infrastructure Management Strategy supported by an extensive schedule of coastal and aerial surveys and hazard mapping. The GIS will be used as a tool to manage these data and information for the implementation and monitoring of this Strategy.

### **GIS**

GIS provides a means of integrating information in a way that helps us understand and address some of the most pressing problems we face today-tropical deforestation, acid rain, rapid urbanization, overpopulation, hunger, spread of disease and impacts from changes in our global climate, to name a few. GIS helps to organise data about these problems and to understand their spatial relationships, providing a basis for making more sensitive and intelligent decisions.

GIS was developed mainly as means of collecting information after being geo-referenced from accurate surveys and GPS work, that can be linked to non spatial descriptive data to enhance and consider the make up of that particular interest. This makes GIS different from other mapping software like CAD because of its capability of linking database information to the spatial features.

Over the past decades, this growing technology has come to be known as Geographic Information Systems. Paralleling advancement in the technology has been the growth of GIS

applications. From high-quality cartography to land use planning, natural resource management, environmental assessment and planning, tax mapping, ecological research, emergency vehicle dispatch, demographic research, utilities, business applications and more, GIS promises to be one of the largest computer applications ever to emerge.

From a statistical or a probability (mathematical) point of view, if we consider a situation where you have two sets of data for the same area, such as yearly income by villages and average cost of housing, each data set might be analysed and mapped individually. Alternatively, they can be combined to produce one valid combination. If however, you have 20 data sets for the county, you have one million possible combinations. Although not all combinations are meaningful (e.g. unemployment and soil type), you can answer many more questions than if the data sets are kept separate. Combining them adds value to the database thus the role of a GIS setup.

### **Institutional issues**

GIS technology is only a tool for information management, not a solution in itself. Without good quality data, and organisation and routines with a capacity to maintain the data sets, the information systems will fail, irrespective of the technology used. The first series of steps to improve information management include defining the information needs, setting priorities and then comparing these with the state of existing information and the capabilities of data producers and users. The major costs of improvement are in data acquisition, institutional improvement, and education and training. Equipment represents less than 20% of the costs. In fact, the greatest cost involved in developing and managing a GIS is usually the effort it takes to build and maintain the computerized database.

The main obstacles to successful GIS implementation are connected with organizational structure and management, rather than technical issues. The biggest problems are coordination and communication difficulties within and between the organisations involved, followed by lack of management commitment and high-level support.

High-level support, policies and commitment from management are essential since the real benefits of GIS technology lie in the integration of resources within and between organisations. This also calls for involvement and support from the users when a GIS system is being developed. User committees and regular progress reports sent to all those involved in development of the system are one way to gather and maintain support.

A successful institutional model is to set up a network of information sharing agencies. Agencies retain responsibility for their own information but agree to share parts that are of interest to others. A separate municipal information agency can handle inquiries for data and act as a coordinator via the development of meta-database.

### **Framework for environmental assessment**

The framework in Figure 1 provides, a mechanism that links information to the development of action plan, policies and strategies. Biophysical and socioeconomic data are collectively analysed through tools like GIS to generate and develop indexes and indicators. These indicators and indexes through specific applications and issues are manipulated using expert systems that will quantify the State of the Environment which is subject to a decision making level for the development of legislation and action plans. The process is an ongoing one in the sense that new data are continued to be collected to test the appropriateness of legislation and any revision on development and action plans.

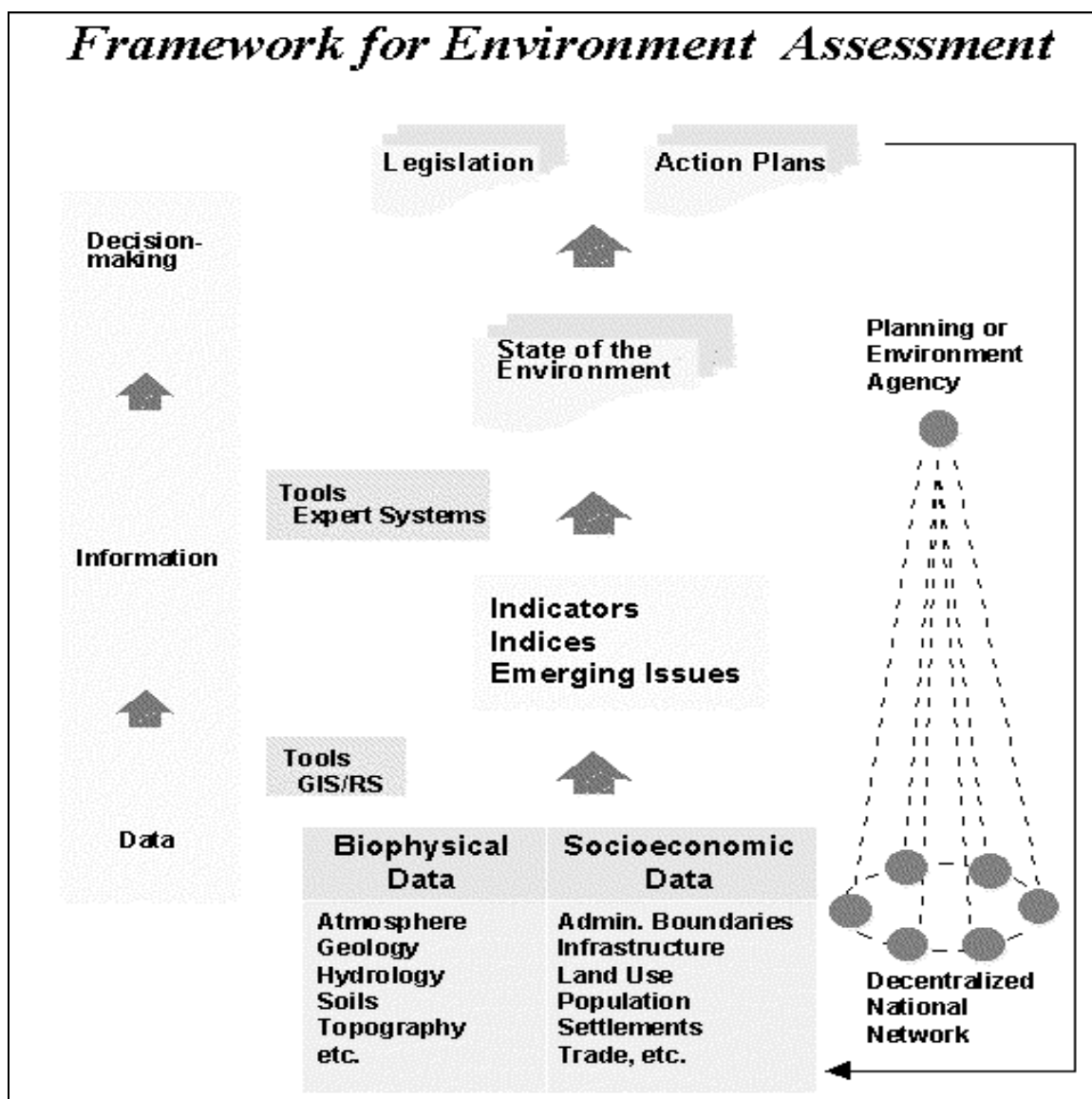


Figure 1: Framework for environment assessment, Source: UNEP-EAP Bangkok

### Constraints

GIS is still in its infant stage in the region including Samoa. This has resulted firstly in a lack of appreciation for the technology, which filters down to the lack of resources to promote it and the insufficient manpower or available skill to develop it. Other problems are highlighted in the institutional issues where there is lack of collaboration between department on the data to be produced, the applicability of the data on particular issues that are priorities to the organization; agreement on a common information base and more importantly the issue of “ownership”.

GIS technology is becoming very popular. This growth has had an adverse effect on sustaining systems in terms of supporting costs given the growth the overwhelming growth in technology and capacity. Data formats are becoming less an issue for compatibility as software and applications are slowly talking to each other regarding data exchangeable

formats; hardware specifications are continually changing as computer file managements and platforms are becoming sophisticated.

Overall, constraints to the many approaches includes the lack of appropriate administrative and institutional framework and apparatus to guide efforts; lack of integration of development and environmental policies; predominance of economic and social goals in national decision making, without regard to any environmental context; highly sectoralised legislative process; inadequate resources and expertise in environmental economics; lack of political will to confront issues; little public response to environmental degradation because of an inability to articulate concerns and an unwillingness and/or inability to act on them and finally the perception of many government officials and private sector that the environment is a minor development issue.

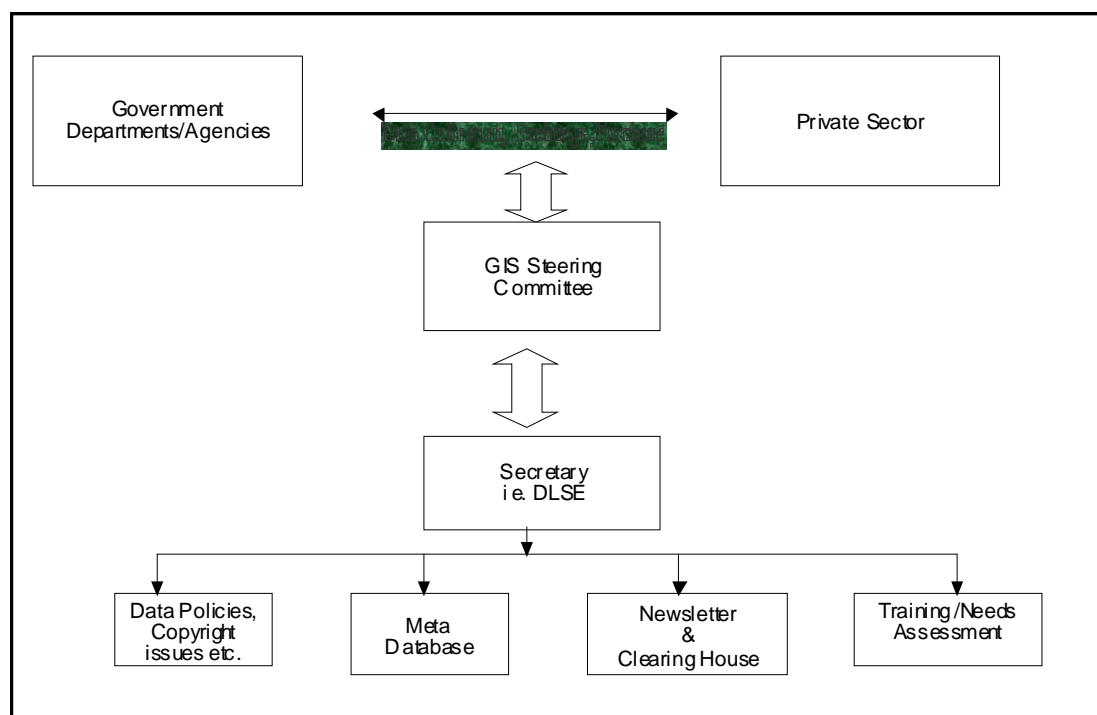


Figure 2: Proposed GIS user group and network

### Applications

The use of GIS is widely recognised ranging from planning at the community level to global issues like deforestation and climatic change. Despite the nature of the problems, sensitivity and priorities vary from country to country, the development in technology had build the capacity to ensure appropriate expert systems are in place to drive identified measures and procedures to manage the problems<sup>4</sup>.

Geographical locations of the countries determine the level data capture and use through satellite imagery and Global Positioning System (GPS) technology. For example most areas between 5 to 15 degrees, west of Australia in the Pacific ocean, would have problems getting cloud free images because of the high convection activity. Most reliable source of remote sensing data is through aerial photography but very expensive. Use of GPS depends on the type of application, which of course based on the accuracy it requires.

### GIS strategy and network for Samoa

Networking is an integral and a very important process in the sustainability of national efforts to promote and utilize GIS/RS. The network approach is required for information exchange, dissemination and collection in general. The proposed network process recognizes the following:

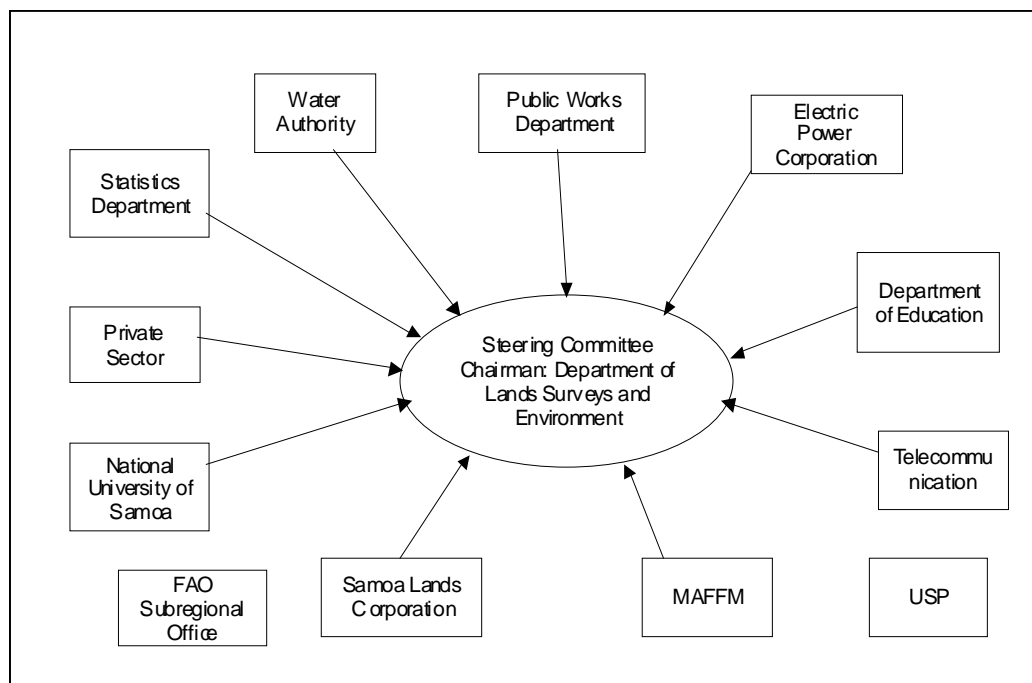


Figure 3: IS Steering Committee- members.

Note: DLSE is put as chairman of steering committee given the existing knowledge on GIS and also in recognition of the setup of a Lands information System to be procured and setup for the department under the World Bank/AusAID-IIInfrastructure Asset Management Project, 1999-2006

- Foster partnerships between government departments/agencies and private sectors for information collection and exchange. Private Sector includes Non-governmental Organizations, Regional Organization and International Organizations like Food Agriculture Organization, Training institutions like University of the South Pacific and National University of Samoa who have interest in promoting the technology.
- The Steering Committee co-ordinate all national GIS activities. Memberships to the committee are potential data providers or users.
- The Steering Committee is led by a secretary, which DLSE will be the most appropriate, given their status on GIS in terms of personnel and data holdings.
- The functions of the secretary are; 1) identify and develop appropriate policies for data exchange, collection, purchase, selling; 2) conduct needs assessment to assist new set up, training needs etc; 3) act as clearing house on GIS/RS issues and publications. Develop newsletter on GIS activities, trainings, research at the national level; and 4) develop and maintain a Meta-Database i.e. Information on Information, available within government agencies/department and the private sector

### GIS Assessment for Samoa

In November 2000, a GIS Inventory was conducted for Samoa by FAO and the findings are as follows:

- The most used GIS package is ARCVIEW and MapInfo
- There is good aerial photography and orthomaps information available with DLSE for agricultural and forestry work. Orthophotos are available at 1: 5000 Scale for areas around the coast. National coverage is available at 1: 50000.
- There is no capability in place regarding satellite image processing and analysis
- Training is very much required on aspects of GIS and RS. Training should be developed to cover all levels of planning and implementation. I.e. Ministers, Directors, Professional Staff & managers, Technical personnel
- There is a good working knowledge on the use of database packages like ACCESS and Excel
- There is lack of documentation on data and information generated from pilot projects and research
- Information divisions of the various departments consulted are confined to information dissemination with little to no knowledge of projects happening within departments.
- In some departments, there are no information divisions who have full records of what had been done
- Reporting is fragmented and not all the work carried out is published
- Lack of collaboration between government to standardise planning and data collection
- Old data not available in electronic form. This information is mainly available in maps and reports.
- No government policy regarding data collection, dissemination and exchange
- Absence of a framework to foster a partnership between government agencies and private sector for data exchange.

### **Conclusion**

The role of information in developing appropriate strategies, legislation and action plans, is well recognised and thus requires strengthening. This is in recognition of the need to move away from a more qualitative approach in the identification and analysis of development and environmental issues to a more quantitative means so to accurately allocate resources, which its availability often limits the response it requires. Finally, information presentation can catalyse awareness and participation and thus is an integral part of the process in addressing sustainable development. This can be achieved through the use of information management tools like GIS.

### **References**

- <sup>1</sup> IUCN, 1994 “Strategies for National Sustainable development”
- <sup>2</sup> UNESCO 1991, “Environmentally Sustainable Economic Development: Building on Brundtland” (SPREP Library)
- <sup>3</sup> Treasury Department, Government of Samoa, January 2000 “Statement of Economic Strategy”
- <sup>4</sup> Crawley B, “GIS Inventory for Samoa”, FAO 2000