

**RPIU Technical Report  
TR 98001**

**REVIEW OF GIS CAPABILITY AND  
NEEDS IN CPACC PARTNER  
INSTITUTIONS**

**Ian C King  
Information Systems Coordinator/GIS Specialist**

**November 1998**

**A Publication of the  
Caribbean Planning for Adaptation to Global Climate Change  
Regional Project Implementation Unit**

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# **REVIEW OF GIS CAPABILITY AND NEEDS IN CPACC PARTNER INSTITUTIONS**

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## 1. INTRODUCTION

This report is based on discussions held between February and September 1998 in the participating countries by the Information Systems Coordinator/Geographic Information Systems Specialist (ISC); results of an email survey of GIS capability; and country presentations at a Caribbean Planning for Adaptation to Global Climate Change (CPACC) regional workshop on Methodologies for Coastal Inventories and Information Management (Barbados, 18 – 20 May 1998). Additionally, much of the information for the Organisation of Eastern Caribbean States (OECS) countries was drawn from a survey of Geographic Information Systems (GIS) in those countries with particular reference to fisheries. Elizabeth Charles-Soomer of St. Lucia and Colin Campbell of St. Vincent undertook the study during 1997 for the OECS Natural Resources Management Unit (NRMU). The purpose of the OECS NRMU study was to inform a project to be funded by the Oceans Institute in Canada for support of fisheries management in the sub-region.

Under Component 3, Inventory of Coastal Resources and Uses, of the CPACC Project, is the requirement to **consolidate, evaluate, and computerize (GIS) existing information in each participating country**; and to **provide necessary GIS training**. This training should allow the relevant agencies to utilize the tools adopted in the project, such as the GIS based coastal inventory and assessments of vulnerability and valuation of coastal resources. Other aspects of capacity building will be addressed.

The implementation of Component 3: Inventory of Coastal Resources and Uses, is foreseen to be closely coupled with training. The Technical Implementation Guide for Component 3<sup>1</sup> specifies training in the areas of Metadata Development, Database Design and Management, Data Collection Techniques and Data Automation/Conversion. Additionally, CPACC has supported a one year GIS Certificate Course which is coordinated by the Centre for Geospatial Studies, Faculty of Engineering, University of the West Indies (UWI), St. Augustine Campus. This one-year course began at the St. Augustine Campus in the 1997 academic year and was started in October 1998 at the UWI Cave Hill Campus in Barbados. It may also be extended to Jamaica in the near future.

## 2. OBJECTIVES AND STRUCTURE

The purpose of this report is to characterize the level of GIS capacity in the participating countries in order to better inform the execution of the training activities; to identify additional areas of capacity building necessary; and to identify possible agencies in each country to function as the repositories of the spatial databases generated by the project. Final decisions on additional support would be based on the activities and responsibilities of the agency in question and a clear demonstration of how the support would be applied.

The report reviews the GIS capacity or ambitions of selected agencies. These agencies may play a part in the CPACC activities in each country. The review also describes the origins of the

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<sup>1</sup> Developed by Dr. Jacob Opadeyi of UWI St. Augustine and Dr. Leonard Nurse of the Coastal Zone Management Unit in Barbados – September/October 1998

technology's introduction, the existing personnel and infrastructure as well as the constraints and needs. Finally, country recommendations are made regarding possible additional areas of support and identifies the local agencies which may function as database repositories.

### 3. SUMMARY OF GIS IN CPACC COUNTRIES

#### ANTIGUA & BARBUDA

Antigua represents a relatively immature level of GIS development, with only one agency having limited GIS capacity.

##### **Development Control Authority**

###### *Origins*

The only government institution with a basic GIS capability is the Development Control Authority. This department acquired its GIS software and hardware through the UNDP and UNCHS program that provided GIS capability to Physical Planning Departments in the Eastern Caribbean.

###### *Personnel*

The GIS personnel consist of three draughtsmen with GIS training including supervised hands-on data conversion and automation training during the UNCHS project, short workshops and a six-week course at the College of Applied Science and Technology (CAST) in Jamaica.

###### *Infrastructure*

The department's complement of GIS hardware included a large format digitizer, a plotter, three stand alone PCs, a scanner and a printer. The software used was ArcView and ArcInfo.

Up to the end of 1997, two UN consultants were based in the department developing a national database focussing mainly on health and educational facilities, police and postal services, public utilities and some environmental parameters. The environmental parameters were to include topography, hydrology, roads and the coastline. Further, a priority specified during the ISC's mission was for the development of a cadastral map.

###### *Constraints and Needs*

The OECS Study identified that there appears to be poor data management protocols in place at the DCA. This seemed to be supported by the inability to locate a MapInfo database of Landsat Thematic Mapper (TM) imagery interpreted to characterize the nearshore area, which was supplied by the Fisheries Division. Another major problem identified by the OECS Report was

inadequate security resulting in disappearance of equipment and data. Some pertinent recommendations included additional GIS and basic computing training; computer hardware; and security for equipment and data.

## **Fisheries Division**

### *Origins*

The Fisheries Division is the CPACC National Focal Point (NFP) and specifically, the focal point for Component 3. This department is the most active in relation to management and monitoring of the coastal zone including such activities as the Coastal Marine Systems of Latin America and the Caribbean<sup>2</sup> (COSALC) beach monitoring exercises and the Caribbean Fisheries Resource Assessment and Management Project (CFRAMP). It was under the CFRAMP Project that the initiative for acquiring and interpreting the Landsat TM imagery and presenting it in MapInfo format was realised.

### *Personnel and Infrastructure*

Some of the personnel in the Fisheries Division have had limited GIS training in the form of short workshops, but there is no GIS software or dedicated hardware. This department does however wish to develop GIS capability. This desire appears to be based on the recognition of the potential for data management and analysis as well as in decision support. There may also be a possibility for some collaboration with the DCA for some initial hands-on training particularly for data conversion and automation.

### *Constraints and Needs*

A major need that had been specified during the mission was for GIS software to support the capacity building already initiated. Training requirements include general GIS training and ultimately software specific training.

One of the limitations of the development of GIS capability appears to be the inadequate space the division enjoys. During the ISC's mission in April 1998, it was sited in a former conference room in very cramped conditions. Whereas the situation was expected to change in the short term, but no specific target appeared to be set.

## **Recommendations**

In ideal conditions, the DCA would be recommended as the agency to function as the repository for GIS databases and metadata generated out of the project given its role as the primary and currently only institution with GIS capacity. However, until the problems identified by the OECS NRMU report are rectified, the DCA does not appear a suitable option. Given the experience of the Fisheries Division in managing coastal data and their role as the CPACC NFP, it is proposed that this agency may also be considered for the national repository of CPACC derived databases.

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<sup>2</sup> COSALC is coordinated in the Lesser Antilles by Dr. Gillian Cambers at the University of Puerto Rico

To facilitate the Fisheries Division as the repository, it may be necessary to provide the department with a desktop GIS software as well as considering one of its officers for the GIS Certificate Course. Further support for equipment acquisitions could be reviewed under the general systems maintenance and upgrading program at a later stage. Both the Fisheries Division and DCA should also benefit from the training specified under the Technical Implementation Guide. This would assist in addressing some of the limitations at the DCA and ensure that the main agencies involved in the management and application of coastal and spatial data are capable of utilising the tools developed from the project.

Discussions between the DCA and Fisheries Division for collaboration in areas such as joint database development using the facilities and support of the DCA and data of the Fisheries Division may prove mutually beneficial in terms of development of expertise and sharing of resources.

## **THE BAHAMAS**

In the Bahamas, several agencies have GIS capability, including the Bahamas Environment, Scientific and Technological (BEST) Commission and the GIS Unit in the Office of the Prime Minister. The former, through one of the Commission members, Mr. Philip Weech of the Water and Sewage Authority, serves as CPACC's NFP. Several other agencies appear to have access to GIS as well, but it appears that the two already mentioned are the main ones from CPACC's perspective.

### **GIS Unit in the Office of the Prime Minister**

#### *Origin*

The GIS Unit had its origins in a recommendation from a Ministry of Public Works Committee in 1989 to review the applicability of the technology for the coordination of public utilities' activities<sup>3</sup>. Phase I consisted of a project in 1990 in which three of the utility companies provided Bah \$40,000 each to facilitate the development of GIS capacity focussing on the acquisition and digitization of maps and photos of New Providence Island. By 1992, the GIS database of New Providence had been completed and a coordinating unit established under the Ministry of Public Works.

Following the continued development of the GIS facility, a second phase involved a user needs analysis and proposals for further development. A Cabinet Paper proposing this and other recommendations resulted in the Bahamas National GIS Project, which received support from the Inter-American Development Bank and the Japanese Government. The project seeks to address the development and application of GIS throughout government agencies and nationally. The concept calls for a corporate GIS and the strengthening of the GIS Unit. Components include:

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<sup>3</sup>Discussion with Carolann Albury, Head, GIS Unit, October 1998

- Geographic Information Policy Development including a National Data Management Strategy for all participating agencies
- Information Systems (technology)
- Technical Assistance consisting of training and database development
- Pilot Projects (environmental)

The project was at the stage in October of final selection of the consulting team from submitted proposals.

### *Personnel*

The GIS Unit comprises three officers with varying levels of experience and training. The head of the Unit is a graduate who has been involved with the development of GIS from the beginning and has been exposed to a number of training and conference activities. The two other officers consist of a technician and a data entry operator.

### *Infrastructure*

The GIS Unit is equipped with a network of three computers, two large format digitizers, a plotter, an engineering size copier as well as printers, a scanner and other peripherals. The principle software is Arcinfo and ArcView. Its databases appear to be focussed on infrastructural and economic themes as a result of its focus and those of the agencies that it assists with training, database development and hard copy outputs.

Through the Bahamas National GIS Project, the GIS Unit should acquire additional hardware and software although it is not clear that there may be any additional personnel. The Unit through the pending project should address issues such as training and data management increasing the efficacy of CPACC activities in these areas.

### *Constraints and Needs*

Up to October 1998, the GIS Unit was waiting to move into more suitable accommodation in order to undertake the National GIS Project. The Project should also address training and equipment needs for the department and other agencies. Under Component 3, CPACC should assist in addressing the deficiencies in coastal databases, which have had little attention to date. Additionally, CPACC's emphasis on metadata development is timely given the current attention to data management.

### **BEST Commission**

The CPACC NFP in the Bahamas is the BEST Commission, which is mainly a policy development and coordinating agency. The Commission consists of representation from many agencies and has a relatively small core staff. A representative from one of the member agencies serves as the lead for CPACC activities.

### *Origins*

The BEST Commission developed a GIS using the MapInfo software in mid 1997 and funded by the Commonwealth Fund for Technical Cooperation (CFTC). The purpose of the initiative was described in the Final Report of the CFTC Funded Project as to allow speedy preliminary assessment of the environmental impacts of development proposals.

### *Personnel*

The BEST Commission has one staff member who appears to have responsibility for the GIS and other information systems. This person has a wide range of other responsibilities and also, limited training in GIS. Generally speaking, GIS is not the individual's main responsibility.

### *Infrastructure*

The GIS was described as primarily an inventory of islands and cays based on 1:250,000 data. Additional data for the main islands were incorporated from 1:100,000 maps. The initiative also reviewed GIS data and training needs of other institutions in the country and tasks to be completed. As noted earlier, MapInfo is the software used and a desktop PC stores the software and data. However, the PC is not dedicated for GIS activities.

### *Constraints and Needs*

This GIS facility appeared static with little activity following the report and lack of full cooperation from local agencies in the proposed follow-up. Even in some of the activities undertaken by BEST for which the development or application of the GIS would have been relevant, the GIS was not utilised. Compounding the situation is the limited staff resources of the agency. The development of a National GIS project also appeared to have taken little notice of the BEST MapInfo facility. The limited databases and the coarseness of the data sources have probably limited the usefulness of this resource.

If GIS is to be applied within the Commission, there will need to be an investment in personnel, training and equipment.

### **Fisheries Division**

The Fisheries Division currently no GIS capacity, but will be a key operational contact for Component 3 and Component 5 matters. GIS is an area of some interest, particularly given the resource management mandate of that department.

### **Recommendations**

Although the BEST Commission is the CPACC NFP and the focal point for Component 3, the expertise, mandate and activities of the GIS Unit appear to recommend it as the best choice for a repository of the GIS data. Further, CPACC should work closely with that department in delivery of training and implementing the GIS components of the project.

Beyond working with the GIS Unit in the implementation of Component 3, it may be beneficial for the Fisheries Division and the BEST Commission to also benefit from some aspects of the scheduled training.

## **BARBADOS**

In Barbados, several agencies have varying levels of GIS capacity, however many of these agencies are not expected to play a role in the short to medium term of the CPACC project. The review will therefore focus on the Environment Division of the Ministry of Health and the Environment, which is the NFP, and the Coastal Zone Management Unit (CZMU) of the same Ministry, which has a lead role in Components 1, 3 and 6.

### **Coastal Zone Management Unit**

#### *Origins*

The CZMU originally focused on the South and West Coast of the island. It had first acquired GIS capability in the early half of the 1990's when it was the Coastal Zone Management Project with loan funding from the Inter-American Development Bank (IADB). The facility has been utilised for monitoring and modelling. GIS capacity has been supported by a new project to address the East Coast of the island which commenced in November 1996 and is expected to be completed by the end of 1998 or February 1999 at the latest. This project includes training and recommendations for the application of the GIS in the department's work programme.

#### *Personnel*

Several members of staff have had varying degrees of exposure to GIS, and capacity building in this area appears to be through working with the relevant consultants and short courses. The East Coast project has also included short training activities, with a more substantial 4-week activity planned for mid-November 1998.

CPACC has assisted the CZMU in this regard by supporting one of the department's officers in the 1998-99 CERMES/Engineering Institute Certificate in GIS Course. Beyond this, the CZMU also has a trained Hydrographic Surveyor on staff who has been involved in Component 1 activities, including establishing the Sea Level and Climate Monitoring Station and Global Positioning System (GPS) Base Station.

#### *Infrastructure*

The East Coast project office is equipped with AutoCad and ArcView GIS software. In addition, that office has two stand alone PCs, a large digitiser, a plotter and an A2 sized laser printer. In collaboration with CPACC, a GPS base station has been established at the main offices of the CZMU and is managed by the department.

### *Constraints and Needs*

Whereas no staff member has been officially assigned as GIS Manager or Specialist, however, one individual has been working closely with the project consultants. Further training of the individual and other officers is expected to facilitate the efficient application of the technology after the project. CPACC is assisting by supporting the training of one officer in the GIS Certificate Course.

## **Environment Division of the Ministry of Health and the Environment**

### *Origins*

In 1992, the Environment Division received GIS software, hardware and some training through an Australian technical assistance program. That program also facilitated the development of a digital elevation model of Barbados. However, the technology was not applied to the activities of the department and became redundant. More recently, the Environment Division had largely concluded the Environmental Management and Land Use Planning (EMLUP) project by October 1998. This latter initiative included the development of GIS capability in the Division.

### *Personnel*

Some members of the Environment Division have had exposure to GIS. One officer has postgraduate training, but has subsequently been seconded to the CPACC RPIU. Others have been exposed to short courses and also may have worked to some extent with the GIS consultants for the EMLUP project.

### *Infrastructure*

At the end of the EMLUP project, computers, digitizers, a plotter and other hardware will be transferred to the Environment Division. The software used during the project includes AutoCad and ArcView. Also the Division will be in possession of a base map derived using aerial photography, 1:10,000 and larger scale topographic maps, as well as databases from other agencies.

### *Constraints and Needs*

Notwithstanding the EMLUP project, there appeared to be little GIS expertise in the Environment Division particularly as there was little counterpart activity for the GIS component. As a result, CPACC sponsored one of the officers of the department for the Certificate in GIS course. Other than the data developed in the EMLUP Project, the department has little or no other databases and no primary data collection activities. The recommendations of the EMLUP project should be instrumental/determining the application of GS in that department.

## **Recommendations**

The CZMU is quite advanced in terms of management of coastal resources, including the use of GIS. This department is already the repository for coastal zone GIS data. Therefore, any additional data collected should be sent to this Unit. Furthermore, the Unit provides a good example of the data collection, management and analysis for other less developed agencies in other countries.

Beyond the GPS Base Station and the training support, no additional GIS capacity building is proposed, apart from any new database development activities and the training under Component 3.

## **BELIZE**

There were two main agencies with GIS capacity in Belize, these being the Coastal Zone Management Project (CZMP) and the Land Information Centre (LIC) of the Lands and Surveys Department. Several other governmental and non-governmental organisations reportedly had GIS capacity, but were not directly relevant to CPACC activities. Included among these was the University College of Belize (UCB).

### **Coastal Zone Management Project**

#### *Origins*

The CZMP began in the early 1990's and was funded for the last 5 years through UNDP from GEF. The funding period originally ended in March 1998, but was extended to the end of 1998. A further extension of 3 to 5 years will be associated with greater institutionalization. Legislation has already been drafted for the establishment of a Coastal Zone Management Board and an Institute which will be the technical arm to the Board. The Institute will be based at the University College of Belize (UCB).

#### *Personnel*

The current Data Manager and GIS specialist is a trained computer programmer. His training in GIS came through attachment with the Land Information Center (LIC); attachment with a research institution in the UK; on the job training; and specialised short courses. During the stint in the UK he created a spatial database of benthic cover and other biophysical parameters for the coastal area through supervised classification of satellite imagery.

#### *Infrastructure*

The CZMP has undertaken resource inventories in its earlier years and maintained these with ongoing monitoring. Much of the spatial data is stored in the Project's GIS. The software and hardware were obtained in 1994, but are likely to be upgraded with the extended project.

Geospatial capabilities consist of the PC ArcInfo and ArcView software, 100MHz, 2Gb standalone Compaq, Small digitizing tablet and Trimble GPS base station with roving units

The limitations of the PC versions of Arcinfo in manipulating the large dataset derived from satellite imagery have been resolved by using the resources of the Land Information Centre (LIC) when necessary.

The CZMP have made a list of their datasets available to CPACC. It should also be noted that the LIC is the repository for GIS data (and expertise) in Belize, the CZMP have an arrangement whereby they provide the LIC with a copy of all datasets and in return have access to all relevant data.

### *Constraints and Needs*

At the time of the ISC mission to Belize, a genuine constraint appeared to be the limitations of the GIS equipment to manipulate the rich datasets that they have developed, in particular those generated from remote sensing imagery. This will be addressed with the reinvestment in software and hardware and the development of the Windows NT version of the software in question.

## **Land Information Centre**

### *Origins and Infrastructure*

The LIC is described as having three major and somewhat associated activities, these being GIS, Land Information Systems (LIS) and the Central American initiative, Conservation and Environmental Data System (CEDS). The GIS and LIS in particular are closely related.

The LIC is the main GIS resource unit in Belize and in its function as Secretariat to CEDS. The agreement document for CEDS specifies the institutional framework for its operation. This framework includes standardised documentation for spatial data, influenced by international metadata standards. This development is due to an initiative termed CCAD, which is a Central American Information and Environmental Management Network. CCAD will be focussing on developing distributed networks of information management using metadata and interoperable network servers as outlined in the CIESIN model.

The LIC also serves as a resource to Ministries and NGOs mainly in undertaking spatial analyses and also in limited training through job attachments. In the latter case, individuals have worked under the supervision of LIC personnel, developing databases, copies of which would be kept by the LIC in a mutually beneficial arrangement.

### *Personnel*

In terms of personnel, the Principal Lands Information Officer appears to be the only member of staff with postgraduate training and possibly graduate training. However, staff members have

undergone several short to medium training activities and more are planned. Further, the staff have extensive hands-on experience and considerable expertise.

### *Constraints and Needs*

The physical facilities of the LIC were very cramped, limiting the number of personnel that could be accommodated for hands on training. This however did not appear to dampen the enthusiasm or effectiveness of the staff and the organisation generally.

### **Fisheries Division**

The CZMP started in the Fisheries Division, which remains the executive government agency for the project. Whereas the institutionalisation project may result in a change in this relationship, the agencies do work closely in several areas. Included in this collaboration is spatial analysis, where the Fisheries Division has no GIS capability of its own, but at least one officer has worked along with the GIS Specialist for experience and to participate in analyses. The Fisheries Department has also been involved in all the CPACC activities to date.

### **University College of Belize**

The UCB was eager to be involved in any training and capacity building that CPACC had to offer. Unfortunately, their resources consisted mainly of a limited number of computers, 10 site licences for ArcInfo and ArcView software and very limited expertise.

### **Recommendations**

The CZMP appears to be the main partner in this context and should serve as the repository for any database derived through the project. The institution already has a good relationship with the LIC and promotes the sharing of data and expertise.

Possible CPACC support should be assessed after the CZMP institutionalisation process has concluded, as equipment and training should be addressed. Training associated with Component 3 is likely to involve the CZMP and the Fisheries Department.

## **DOMINICA**

### **Physical Planning Division**

#### *Origins*

The Physical Planning Division (PPD) is the lead government agency with GIS capability. This was achieved through assistance from UNCHS (equipment) and CIDA (training), as was the case with St Lucia's and St Vincent and the Grenadines' Planning Departments.

### *Personnel*

In developing the capability, two of the planners had 24 weeks of training in-house between June 1995 and June 1997 on the software by a consultant. This training was implemented around the development of databases. Apart from the two planners, there is a technician with less exposure and training.

### *Infrastructure*

The equipment includes 3 computers, 2 of which are networked; a plotter, large tablet digitizer; and printer. Additionally, Dominica also uses SPANS GIS software like the other countries. The Ordinance Survey maps were the main source of data. Other government departments were requested to submit data for incorporation into a national database. Unfortunately, there appeared to be no data from the Fisheries Division. The limited data for coastal and marine areas include the coastline and socio-economic features. The limits of the marine reserve at Soufriere/Scots Head in the south of the island were to be determined in consultation with the Fisheries Division.

Several other agencies are at different stages of GIS development, including government agencies and at least one NGO. However, the department appears to serve as a resource for the database development and also assist other departments in spatial analysis.

### *Constraints and Needs*

The training needs identified included GIS analysis, concepts and techniques. Additionally, training for technician in hardware and software troubleshooting and maintenance was proposed. Expansion of the database to include coastal components was viewed as a positive contribution of the CPACC project.

### **Recommendations**

As the primary GIS agency in the country, the PPD is considered the most suitable option for the repository of GIS data. The department practically serves this function already. This department should be the main participant in the training to be undertaken in the implementation of Component 3.

## **GRENADA**

### **Physical Planning Unit**

#### *Origins*

Whereas several agencies were reported to have acquired GIS, application of the facility was very limited. The Physical Planning Unit had acquired the services of a UN Volunteer to help develop capability. Additionally, the Unit had recently been given GIS hardware and software

through a UN project. The UN Volunteer is a lecturer in GIS and Remote Sensing from an Australian University. He has a one-year assignment in the first instance to train personnel in the Physical Planning and other departments in GIS and Remote Sensing. He identified data capture as well as training as the main priorities.

### *Personnel and Infrastructure*

There appeared to be no staff members who had any substantive training or experience in GIS. This issue should be rectified by the UN Volunteer. The department had already received GIS related equipment at the time of the ISC country mission in March 1998. This equipment, including ArcInfo and ArcView, had remained in the box up to the time of the ISC mission even though it had been received several months prior.

### *Constraints and Needs*

The constraints included the lack of experience, a limited database and the delay of the incorporation of the technology. These problems were common to other agencies, principally the Inland Revenue Department. This issue should be addressed with the UN technical assistance. The UN Volunteer also noted that whereas the department had the hardware and GIS software, there was a need for remote sensing software for training and data analysis.

## **Land Use Division of the Ministry of Agriculture**

### *Origins, Personnel and Infrastructure*

The Land Use Division of the Ministry of Agriculture had the most experience of using GIS in Grenada. The officers interviewed were principally responsible for the development of the Geographic Land Information System (GLIS) which included of the following:

- Landuse data
- Coastal features (incl. Roads, rivers, lakes)
- Topographic data from the 1:25,000 basemaps (100m contours digitized)

The development of the database was completed over the period of a year from 1994 to 1995. The equipment and software being used were acquired in 1994. Apart from the early versions of PC ArcInfo and ArcView, the equipment being used included a 486/66MHz/540 Mb HD/16 Mb RAM machine (another is not functioning); a Calcomp 36"x48" digitizer, a pen plotter and a stereoscope.

An upgrade of equipment was expected in the second half of 1998. Notwithstanding the age of the technology, this department was the only one that was utilizing the GIS, and seemed to have the clearest vision of where they wanted to go with the technology. . The Division has also produced a leaflet describing their resources and databases, as well as the activities being undertaken.

### *Constraints and Needs*

In terms of needs, programming in the GIS language was identified by the officers as the most important training necessary. This partly reflected the age of the technology being employed but was more indicative of the level reached, which was beyond the basics

### **Recommendations**

The Land Use Division of the Ministry of Agriculture appeared to be best placed to function as the data repository at the time of the CPACC mission. However, it was not clear that there was an adequate sharing of information and resources between this and other departments, and therefore whether this agency could properly function in the capacity of GIS repository. Given the attachment of a UN Volunteer to the Physical Planning Department, this department may be another option by the start of 1999. The critical issue appears to be the available expertise and data management procedures in the organisation. Even the Land Use Division may need further assistance in this area, and therefore it may be suitable to support a candidate from Grenada for the certificate in GIS program.

### **GUYANA**

In Guyana, there are several agencies with GIS capability, and others are moving in that direction, some of which may have a role in the CPACC project.

### **Natural Resources Management Project**

#### *Origins*

The Natural Resources Management Project (NRMP) under the Guyana Natural Resources Agency (GNRA) is the main agent for the development and implementation of GIS in the country. The following activities have been identified in this initiative:

- Introduction of several government ministries and agencies to GIS issues
- Supply of computer equipment to a number of institutions
- Digitization of the 1:1,000,000 map of Guyana as a reference map (awaiting final approval of Lands and Surveys Department)
- A medium term goal is to digitize the 300+ 1:50000 (as these are used to specify the granting of concessions)
- Following the development of a landuse plan for the hinterland, the remainder of the country, including the coast will be addressed. (The coastal resources were not considered priority for digitising under the NRMP.)

#### *Personnel and Infrastructure*

The NRMP is also attempting to facilitate the development of a national database using the 1:1000000 map as a base layer, promoting collaboration in data collection and enabling training.

Up to August 1998, there was no specific agreement or protocol regarding the composition of a national database or on data exchange and updating. Beyond an introductory workshop, the NRMP have been developing the expertise of a core of GIS Specialists from NRMP, the Iwokrama Project and the Centre for Studies in Biological Diversity (CSBD). The GIS Specialists have then assisted other departments by offering introductory and hands-on training.

The GIS Specialists have also formed a de-facto technical committee to address problems and to advise their Heads of Departments on developmental matters. This is further facilitated as the NRMP, the Iwokrama Project and the CSBD use Arcinfo and Arcview software and are fully equipped in terms of computer equipment and peripherals.

### *Constraints and Needs*

All of the NRMP's focus to date has been in the interior of Guyana, with little attention on the coastline. This has been the case with most of the agencies in the country. Another constraint from a CPACC perspective is the finite nature of the NRMP as it is a project unit and thus may not be ideal as a repository or future development activities.

### **Iwokrama Project and Centre for Studies in Biological Diversity**

The CSBD GIS coverage was described as patchy and focussing on the interior as opposed to a coastal area. The Iwokrama Project is also focussed on the interior, in an even more narrowly defined area. However, there are possible areas of collaboration with these two agencies, namely in facilitating training, developing national data management procedures and extending their focus to include mangroves. As noted earlier, both agencies have GIS Specialists.

### **Lands and Surveys Commission**

The Lands and Survey Commission was in the process of implementing a British information system for data management. That Commission's priority is the development of a land tenure GIS using cadastral surveys, with a focus on settlement areas and public leased lands.

### **Sea and River Defences Division (SRDD)**

The Sea and River Defences Division has a responsibility for managing and protecting the shoreline. Under this agency, a Shorezone Management Project is to be started that will include developing baseline inventories, monitoring and modelling among other things. Whereas this agency does not possess GIS as yet, it is quite likely that this will occur in the near future.

### **Hydrometeorological Service**

#### *Origins, Personnel and Infrastructure*

The Hydrometeorological Service is the NFP in Guyana. This department has recently obtained some GIS equipment and appears keen to develop GIS capacity. In addition, the department has negotiated with the NRMP for introductory and hands-on training as there is little or no expertise

in that department. This collaboration should be reciprocal as the NRMP and/or Iwokrama would gain access to the metadata materials acquired through the CPACC training activities.

### *Constraints and Needs*

There is a lack of basic equipment and expertise to facilitate the functioning of a GIS system at the Hydrometeorological Service. Whereas no specific GIS requests have been made of CPACC from the Hydrometeorological Service, assistance that could be considered beyond the training associated with Component 3 is the provision of a desktop GIS software such as ArcView.

### **Recommendations**

The technical group of GIS Specialists appears to be an excellent means of facilitating capacity building in Guyana, through the administering of basic and hands-on training and to address other aspects including data management. Whereas the Hydrometeorological Service is determined to develop in-house GIS capacity which CPACC may support, the NRMP appears to be the best candidate as the repository of the GIS databases and metadata to be derived under CPACC. Even though the NRMP may not offer a medium to long term solution, it may be the most suitable for the present time.

## **JAMAICA**

Jamaica is another country that is relatively advanced in terms of the application of GIS. There are several departments and institutions with which CPACC could collaborate in terms of meeting the project's goals.

### **National GIS Coordinator in the Office of the Prime Minister**

#### *Origins and Personnel*

The National GIS Coordinator (NGC) is based in the Office of the Prime Minister (OPM) and has responsibility for coordinating and directing GIS related developments rather than being directly involved in GIS applications. The main priorities of the NGC included getting agencies to talk to each other, networking, share data and establish operating standards. The other priority was to keep abreast of developments in the field of GIS.

#### *Infrastructure*

The NGC serves a National Land Information Council comprising of several agencies is the mechanism for coordination of national activities and primarily focuses on projects that have GIS components. The Council was supported by eleven sub-committees which address such issues as, training, standards, topographical mapping, cadastral mapping, copyrights, legal and land adjudication, and the national grid reference.

GIS training is conducted in the laboratory facilities in the Governments Management Institute for National Development, where the equipment includes six computers, six digitizing boards of varying sizes, a scanner and a plotter and a networked printer. The system is supported by ArcInfo and ArcView, as these are the most widely used software in the Jamaica GIS and CAD community.

The OPM has developed seven GIS courses with supporting manuals. There were similarities between the courses developed by the OPM and those developed by Dr. Jacob Opadeyi for the Certificate in GIS Programme. The courses were run and the manuals written by Masters graduates working at the various agencies, and released for this purpose. These generally ran for five days

### *Constraints and Needs*

The current constraint to participation in the various courses was the absence of funds for training in the various Ministries. Participation was therefore lower than expected and in some cases courses had to be cancelled because agencies could not find the JA\$6500 course fee.

It was noted that the OPMs training facilities were currently under utilized and could therefore be considered for use for regional GIS training programs. The National Coordinator suggested that any courses that are developed should be accredited to the UWI Certificate in GIS program, so that students could eventually become certified. The next stage appears to be pursuing arrangements for formal links to be developed between the UWI, St. Augustine GIS Center, UWICED and Jamaica.

## **Natural Resource Conservation Authority**

### *Origins*

The Natural Resource Conservation Authority (NRCA) is a leading agency involved in the application of GIS. Much of its funding has come from the USAID, including the development of GIS capacity. The NRCA had also been involved in a Swedish International Development Agency (SIDA) initiative to map coastal ecology and landuse using remote sensing technology. This activity created a spatial database that the local agency could update through detailed ground truthing. The database coupled with ArcView GIS is available on CD.

### *Infrastructure*

The department currently has over 60 computers at its headquarters, which were expected to be networked before the end of 1998. This will provide institution wide desktop access to GIS. The software includes ArcInfo NT, ArcView, AutoCAD and IDRISI.

The NRCA is the focal point for CEPNET project and therefore has been involved in the implementation of metadata standards and use of WebGIS. The Senior Director, Technical Studies and Environmental Information Systems noted that his department would most likely be

committing to Metalite from EROS as a tool for the development of metadata. He however identified several concerns with the current version of Metalite including:

- Lack of capacity to include biological data
- Limitations in inventorising reports
- Only one type of vector coverage (points, lines and polygons) can be recorded for vector GIS databases
- Data not easily viewed
- Limited applicability across a network because programmed in Visual Basic as opposed to Access
- Current search engine expensive, but there are cheaper alternatives

The introduction of WebGIS was being considered to facilitate the internal access to GIS data and also to allow access from the field and field offices. This is due to the concept of GIS as a tool that should be applied throughout the organization with a technical support department rather than one GIS department.

### *Constraints and Needs*

In the area of national training needs and strategies, the following were identified:

- Mapping techniques to facilitate appropriate data collection methodology so data can be incorporated into a GIS
- Locally based training
- Training based on own data and database development to include issues such as data conversion
- Departmental based training rather than in disparate agencies and groups
- Use of State of the Environment Reporting and other such requirements as a stimulus and structure for training and GIS development
- Identification of indicators of measurement, including those that are realistic based on available resources

A major limitation identified in Jamaica is the lack of comprehensive base maps (e.g. there are over 300 1:12500 maps covering Jamaica, which costs Jam \$3000 and there is no complete set).

## **Fisheries Division**

### *Origins and Personnel*

The Fisheries Division was keen to develop GIS, but appeared to suffer from limited expertise and limited finances. Some officers have undertaken preliminary GIS training under the LIC program of the OPM, but further development has been restricted by the cessation of the training programs specified earlier. It is possible that some training may be acquired through attachments at the Rural and Physical Planning Department, but this does not appear to be definite.

## *Infrastructure*

The NRCA has advised the Fisheries Division on GIS hardware and software. As a start, the NRCA has provided the department with a copy of AutoCAD. The equipment acquired through CFRAMP has included a computer and digitizer. However, a year and a half after the acquisition of the equipment, no work has been possible on the database development. Future equipment needs are likely to include another computer as well as a printer, a plotter and a desktop GIS such as ArcView.

The department, like some others in the region, wishes to link the data from the CFRAMP developed Trip Interview Program (TIP) and the Licence and Registration System (LRS) into a spatial database. Generally, these linkages would have to be at the landing sites as the TIP data does not define the fishing areas other than very generally and the LRS data will be fixed to specific beaches. The department's GIS plans expect to define the fishery facilities, possibly using a base map from the NRCA. Future training is expected to be associated to database development.

## *Constraints and Needs*

The Fisheries Department has extensive needs in terms of training, equipment, database development and incorporation of the GIS into current procedures. Notwithstanding their limited financial resources, there appears to be some possibility for development through the assistance of the NRCA and the training programme of the LIC. CPACC may ultimately contribute with the creation of relevant databases and possibly through some support of the local training activity.

## **Recommendations**

The relative maturity of GIS application in Jamaica and establishment of a training program offer scope for collaboration. The extension of the Certificate in GIS Program to incorporate the existing program at the LIC might be an effective way of facilitating training. This might imply assisting in equipment purchase and also supporting the cost of some local and possibly overseas participants. The NRCA may be the best agency to serve as a repository given its experience and expertise, its involvement with the CEPNET project, particularly regarding metadata development.

## **ST. KITTS AND NEVIS**

### *Origins*

GIS in St. Kitts and Nevis is very immature with no functional system in place. The physical planning units of St. Kitts and Nevis received computer hardware the French Mission for Cooperation (FMC) and software from the UNDP/UNCHS in 1997. After a considerable delay, training activities have been organised during the latter half of 1998. These have included an

OECS sponsored workshop, delivered by IDAS, the ESRI representatives in the region and a (FMC) activity in Martinique planned for November 1998.

### *Personnel*

In St Kitts, the Physical Planning Officer, who had responsibility for GIS, and the Senior Physical Planning Officer both had exposure to GIS in their Masters programs and subsequent short introductory training activities, including the OECS workshop. However, the Physical Planning Officer left the Unit in September/October to undertake further studies for an extended period. In Nevis, there was even less experience with GIS as the St. Kitts Physical Planning department had provided introductory sessions their counterparts in Nevis. Additionally, the Nevis office would have sent at least one representative to the OECS GIS Workshop.

### *Infrastructure*

As noted, both Physical Planning departments in the two islands received equipment. In both cases, this consisted of a pentium computer, injet printer, large format digitiser and plotter as well as the ESRI software ArcInfo and ArcView. The St. Kitts Planning Department appeared to be developing their capability through upgrading departmental resources and individual determination and commitment. At the time of the ISC mission, the limitations in the human resources and expertise restricted the development of GIS in the Nevis Physical Planning Department.

Some of the recent initiatives undertaken in the St. Kitts office have included:

- ◆ Hosting an awareness seminar in late 1997 to generate interest in the technology and spur the various departments and organizations to consider how it could be used in their operations;
- ◆ Producing a newsletter on GIS issues;
- ◆ Developing a draft proposal for establishing a national GIS ;
- ◆ Introductory GIS training in Nevis by the Physical Planning Officer from St. Kitts.

### *Constraints and Needs*

The major constraint appears to be the lack of trained personnel to develop capacity. Whereas there is an increase in the number of training opportunities available, the relevant departments have a limited number of personnel who could be assigned the task of building GIS capability. The geographic location and administrative system of the two planning offices limit the opportunities for closer collaboration on a joint approach to GIS development.

### **Recommendations**

The OECS study has recommended a comprehensive staged technical assistance programme for Nevis and on building capacity from the base in the key user agencies in St. Kitts. The very limited expertise and experience in St. Kitts and Nevis therefore present a challenge in the CPACC context. One option may be to allow one or two participants from the country to participate in the Certificate in GIS programme, which along with the activities under

Component 3 may allow the necessary impetus in the key agencies. The Physical Planning Department in St Kitts appears the best option for the GIS repository with appropriate training in spatial database management.

## **ST. LUCIA**

Several departments and private agencies have been developing GIS capability, and there have also been collaborative efforts to address common issues. The leading agency on the island however is the Physical Planning Division.

### **Physical Planning Division**

#### *Origins*

St. Lucia has benefitted like Dominica and St. Vincent with the introduction of GIS equipment and significant on-site support for training and database and applications development in the physical planning departments through CIDA and the UNDP/UNCHS.

#### *Personnel*

This department has the greatest capability nationally with two trained planners in GIS at Masters degree level and four technicians. The GIS manager and the four technicians have also benefitted from a two-year on-site technical assistance programme.

#### *Infrastructure*

The original software acquired through the project was SPANS GIS. The agency has a networked PC based system with a digitiser, scanner, two printers and a plotter.

The GIS project has assembled baseline data for the coast, topography and drainage (scanned from topographic map). A data inventory was conducted in 1995 and another began in 1997 (but not completed). The department also developed databases and applications during the technical assistance period. The applications have focussed on land capability assessments, land use assessments and site evaluations. Services have been provided to other departments in training, spatial analysis and preparation of hard copy maps.

#### *Constraints and Needs*

In terms of training needs, the GIS Manager noted that IDAS, the ESRI (ArcInfo & ArcView as well as ERDAS and Trimble) representative for most of the Caribbean islands, has captured the attention of much of the market. As a result, many users specify training from IDAS in the ESRI software as a need. Beyond software specific training however, she noted that training in data capture and recording was important to permit the data to be incorporated into a GIS database. This was reflected in the discussion with the Climate Change Committee.

## **Coastal Zone Management Project**

The project has three defined phases, a pre-feasibility, feasibility and implementation. The ultimate objective of the project is to use integrated planning and management for the long term restoration, protection, maintenance and sustainability of the coastal resources.

The pre-feasibility stage began in 1992 and concentrated on assessing the problem and determining the need for further development of the action. The Feasibility Stage will quantify, describe and map information on the coastal parameters so that the coastal processes may be better understood and characterized. The stage is expected to last 18 months and formally begins on May 1<sup>st</sup> 1998. The elements of stage two are:

1. Coastal Processes Characterisation Programme
2. Environmental Quality Characterisation Programme
3. Marine Habitat Characterisation Programme
4. Socio-Economic Assessment and Public Awareness/Public Participation Programme

A prototype system GeoLucia has been developed as a customized GIS software interface for management planning. GeoLucia is a Geographic Land Use and Coastal Information Assessor for database display and simplified access query. More analytical capability will be developed for the system. The focus of the project is the northwest of the country given the economic and tourism concentration in that area.

## **Fisheries Department**

This department does not have any GIS capability as yet, although its officers have been getting increasing exposure. Like other fisheries departments in the region, it is eager to link the data collected under the TIP and LRS programs to a GIS. The department has been seeking the assistance of the Physical Planning Department in this regard. An area of particular attention has been the georeferencing of data collected.

## **OECS/NRMU**

The OECS/NRMU has been providing training programs for the OECS states in GIS, using the Cable and Wireless facilities in St. Lucia for this purpose. As noted earlier, the organisation commissioned a study on GIS in the sub-region.

## **Recommendations**

The Physical Planning Division appears the best option to manage the CPACC derived GIS databases and metadata. Support beyond the training under Component 3 is not envisaged at this time. However, it may be possible to conduct some aspects of training in that country given the infrastructure at Cable and Wireless and the experienced gained over the last 5 years in the Physical Planning Department.

## **ST. VINCENT AND THE GRENADINES**

### **GIS Unit, Physical Planning Unit**

#### *Origin*

As noted, GIS was introduced to the Physical Planning Division through the CIDA and the UNDP/UNCHS initiatives. There is no other department in the country with GIS capability to date although several are interested.

#### *Personnel*

The GIS Unit has staff trained through workshops and at the University of Science and Technology in Jamaica formerly the College for Applied Science and Technology (CAST). Two Planners were trained at CAST in a programme sponsored and supported by the Dutch government and which included GIS. The programme was a 3-year diploma with the option of gaining a degree in the 4<sup>th</sup> year.

#### *Infrastructure*

The department has an NT Server based network with two servers and Pentium computers of 200MHz to 300Mhz. There is also a HP 650 Plotter (20Mb RAM) and a HP 1200 Deskjet printer (12 Mb RAM). Other equipment includes a large format digitizer, a CD writer, scanner, digital camera and UPS protection for the equipment. It was noted that whereas the unit originally has SPANS GIS and now has ArcView and ArcInfo, it was expected that the latter two products would displace the former.

The database developed under the CIDA and the UNDP/UNCHS project used the 1:25,000 topographic maps and this phase was completed in 18 months. The database was updated using the 1:2500 series focussing on the south of St. Vincent where the capital and major tourist facilities are located. Additionally, the 1993 set of aerial photographs has been interpreted for settlements, roads and vegetation. This is due to the focus on physical planning issues rather than environmental ones.

The GIS Unit had not been able to initiate metadata development, but expected to improve the situation by mid 1999. It was agreed that the documentation that CPACC provided to regional participants in this area would be relevant.

Regarding inventorying activities, it was noted that the Fisheries Division was attempting to map and photograph coastal ecological resources. The Physical Planning Unit also conducted a survey of various departments to determine existing data 2 to 3 years ago. This effort had little success. Subsequently, the GIS Unit has been organising meetings of GIS users and potentials users on a quarterly basis. As a result, it is reported that there is more cooperation and greater sharing of data and information.

It was also noted that the GIS Unit was assisting the Valuation Department in training and database development by having four officers from that department spend a day a week at the GIS Unit, and it was expected that similar assistance would be offered to the Forestry Division. The limited number of personnel and equipment has restricted the department's capacity to assist more agencies in this regard. The benefit to the Physical Planning Department from the assistance offered appeared to include access to reliable databases and also recognition from Central Government of its role in terms of resource allocation.

### *Constraints and Needs*

A major constraint appeared to be the limitation in personnel and equipment to assist other agencies as desired. Two distinct areas that CPACC is expected to assist is in the development of metadata and coastal databases as these elements have not been addressed as yet.

### **Recommendations**

Clearly the GIS Unit of the Physical Planning Division represents the best option for managing GIS databases and metadata. It should participate in the training exercises associated with Component 3 implementation.

## **TRINIDAD AND TOBAGO**

Trinidad and Tobago has probably the most advanced GIS infrastructure and the greatest experience in application of the technology amongst the countries involved in the CPACC project. Of the many agencies involved with or interested in GIS, those of greatest relevance include the Institute of Marine Affairs, the Environmental Management Authority, the University of the West Indies and the Ministry of Energy.

### **Institute of Marine Affairs**

#### *Personnel and Infrastructure*

The Institute of Marine Affairs (IMA) has been serving as a resource for specialised research, including the use and application of GIS (ArcInfo 3.5 and ArcView 3.0) and Remote Sensing (RS) (EASI/PACE Versions 5.0 and 6.0). The Institute has capability in terms of hardware, software, databases and personnel.

Much of the data that the IMA possess has been developed under projects and consultancies for which the organization has been contracted. This is the case with the Oil Spill Sensitivity Index for the Ministry of Energy and the Caroni WASA (Water and Sewage Authority) Basin Project, the latter using 1984 aerial photography. Additionally, the IMA has over 20 years of data that serves as a valuable reference and there are a number of technical reports and studies.

### *Constraints*

A constraint that may be faced in attempting to use the IMA data is that in many cases, these were developed for specific clients, and may not be available to a third user such as CPACC.

### **Environmental Management Authority**

#### *Origins and Infrastructure*

The Environmental Management Authority (EMA) has no GIS capability at present but intends to develop this in the future. The department appears to have decided on a product by Intergraph called Geomedia. They sought the assistance of Dr. Jacob Opadeyi of the Lands and Survey Department of the Faculty of Engineering at the UWI in assessing the software. The agency has also used Dr Opadeyi's resources for the development of maps for the 1997 State of the Environment Report that it produced.

The EMA will be participating in the CEPNET/IDB project, particularly in relation to metadata standards, approaches and development. It was noted that some agencies already had well-developed information centres, but clearly many did not.

The EMA is developing its own Internet based information system for a National Environmental Information System (NEIS). This system will eventually link government agencies via the Internet for the purpose of data and information management and access.

### *Constraints*

The main constraint faced at the EMA would be the relative inexperience in the management and use of GIS and consequently the limited spatial databases.

### **Centre for Geospatial Studies, Engineering Institute, Faculty of Engineering, UWI**

The Centre for Geospatial Studies and associated University department provides GIS training for undergraduates, postgraduates and industry based personnel. There is a GIS training laboratory with requisite data capture and output facilities as well as cartographic, remote sensing and photogrammetric equipment.

The Centre also undertakes consultancies in database and applications development. The head of the Centre, has been involved in a number of CPACC related activities including advising on the GIS and data issues for the implementation of Component 3. Additionally, CPACC is supporting the Certificate in GIS program at the Barbados Campus of the UWI in collaboration with the Centre.

### **Ministry of Energy**

The Ministry of Energy (MoE) has contracted the IMA to develop a series of Oil Spill Sensitivity Maps for the Gulf of Paria area within a GIS. The Scope of works were made available and

indicated that the data should be drawn from existing maps (both hard copy and digital), aerial photographs, bathymetric maps, satellite images and field surveys. A series of data requirements were specified most of which appeared to be relevant to the coastal inventorying process. The conclusion of this GIS system was slowed by personnel departures within the IMA, but was expected to be finalised by March 1998.

It was promised that this information would be available to the CPACC Project. A similar facility was to be produced for the remainder of the country's coastline, but the timing of this activity could not be specified. The emphasis on the Gulf of Paria was naturally as a function of its importance for oil exploration.

The GIS system used at the MoE was Intergraph MGE. Currently, two persons were being trained in GIS on the 1997 to 1998 Certificate in GIS course being run by the Centre for Geospatial Studies at the UWI.

### **Recommendations**

The IMA is one of the regional agencies involved with the CPACC project, and given its role and expertise in the Trinidad and Tobago situation, may be the best option as the repository of spatial data. The EMA may be an alternative given its data management expertise, intention to develop GIS capacity and role in the CPACC project. Further, CPACC may wish to consider supporting an EMA officer in attending the Certificate in GIS program.

## **4. CONCLUSIONS**

The experiences amongst the CPACC countries with GIS have several commonalities in terms of origins, equipment and strategies of development. The major difference appears to be level of advancement. From the review undertaken, there appears to be three identifiable groups as follows:

- Countries with relatively advanced GIS capacity and coastal databases:
  - Barbados
  - Belize
  - Jamaica
  - Trinidad and Tobago
- Countries with functioning GIS in terms of applications and expertise, but little coastal GIS databases
  - Bahamas
  - Dominica
  - Guyana
  - St. Lucia
  - St. Vincent and the Grenadines
- Countries with GIS equipment but limited GIS databases or expertise
  - Antigua and Barbuda

- Grenada
- St. Kitts and Nevis

There are opportunities for collaboration in GIS training and development in the OECS countries through the OECS/NRMU, UWI GIS Certificate Course and CPACC. Therefore any training programme should seek to build on past activities and work with the relevant agencies which facilitate current GIS training.