



## **GEF-IWCAM Project Experience Note # 8**

### **TITLE:**

**Monitoring using Geographic Information Systems (GIS) – Providing information for decision making**

### **PROJECT TITLE**

**Land Use Planning and Watershed Restoration in the Courland Watershed, Tobago**

### **PROJECT DESCRIPTION**

The GEF-IWCAM Demonstration Project on the island of Tobago, in the twin republic of Trinidad and Tobago, was intended to alleviate the causes of environmental degradation in the Courland Watershed and Buccoo Reef area. It was specifically designed to mitigate acute land and marine based sources of pollution. To this end the project proposed addressing both the direct and root causes of the problems by developing cost-effective and appropriate reception, storage and treatment strategies for domestic wastewater; developing treatment and discharge requirements and practices for industrial wastes; and orchestrating an integrated watershed management approach targeted at improving land-use practices.

The project included nine interventions which could be divided into three broad categories. The first category focused upon specific on-the-ground activities to mitigate or remove actual threats to the problem of siltation and erosion; the second category

included two broad objectives to address the issue of coastal eutrophication and nutrient pollution; and the third category examined long-term root causes of the problems by focusing on actual shortcomings in information and data capture to support decision-making, and improving coordination and integration within management and administrative mechanisms. This third category also included an intensive public awareness strategy as a mechanism to influence both policy decision making and community perceptions and behaviour.

## **DESCRIPTION OF ISSUES**

The Republic of Trinidad and Tobago is a twin island nation at the south eastern end of the Caribbean archipelago. Tobago, with an area of 300 km<sup>2</sup>, is characterised by two dominant natural resources, a metamorphic and volcanic mountain range, the Main Ridge, and a flat coral limestone platform which extends seaward. The Main Ridge runs parallel to the coastline for about two thirds of island's length peaking at 550 metres above mean sea level. The Buccoo Reef is found on the more densely populated, south western side of the island. The reef is the largest of those from the flat coral limestone platform. It is also the largest fringing coral reef in Trinidad and Tobago, encompassing an area of 7 km<sup>2</sup>. The complexity of the reef with its contiguous mangrove wetland, seagrass beds and coral reefs has increased the need to protect this sensitive marine ecosystem.

Within the last two decades, there has been widespread deterioration of the reef stemming from a decline in coastal water quality. This has resulted from the more dominant issue facing Caribbean reefs - eutrophication and sedimentation of coastal areas. These have a direct correlation to the sewage system on the island which allows sewage flowing into soakaway septic tanks built into the porous coral limestone rock to eventually seep onto the nearby reefs. Another contributing factor has been the dramatic loss of vegetation over the last fifteen years as a result of expanding coastal developments, unsuitable farming practices and increasing forest fires. This has led to a substantial increase in topsoil erosion in adjacent inland and coastal areas, thus causing sedimentation in inshore reefs.

While there is consensus on the contributors to the general degradation of the reef, these issues persist because of a seemingly narrow sectoral approach to natural resource management and insufficiently informed decision making within the Tobago House of Assembly (THA). The THA is the local government authority on the island of Tobago and enjoys some level of autonomy in the administration of the island's affairs. The central government has however expressed a commitment to address such issues and adopt a more collaborative approach to decision making. In view of the Trinidad & Tobago government's obligation under Agenda 21 (1992), the Barbados Programme of Action (1994) and the WSSD Johannesburg Plan of Implementation to implement Integrated Coastal Zone Management (ICZM), the impetus to drive this agenda becomes more pressing. The fundamental issues arising are those that pertain to 1. Eutrophication and siltation; 2. Narrow sectoral approach to natural resource management; and 3. Inadequate levels of awareness and public participation.

## **RESULTS AND LEARNING FROM EXPERIENCE**

### **Project results**

One of the main expected project outcomes was to enhance the ability of policy and decision makers to address natural resource management. To this end, the GEF-IWCAM Tobago Demonstration Project Management Unit (PMU) sought to encourage the integration of agencies by using shared information as a tool for management and planning. In this regard, a Geographic Information System (GIS) Seminar was organized where fifty-one persons, representing twenty-seven stakeholder organizations, attended. The purpose of the workshop was to promote GIS to government and statutory bodies as a tool to manage data within their respective organizations. Presentations were made by stakeholders who were already using GIS. These included the Town and Country Planning Division and the Tobago Emergency Management Authority (TEMA). The Institute of Marine Affairs (IMA) was the main facilitator<sup>1</sup>.

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<sup>1</sup> The IMA is a state agency mandated to collect, analyse and disseminate data relating to the economic, technological, environmental, social and legal development in marine affairs generally, and to formulate and

The presentations included Introduction to GIS; Data Integration; Regional Coastal Marine Mapping Programme; Use of GIS in (TEMA) and use of GIS in Town and Country Planning in Trinidad. At the end of the workshop, a working group comprising nine stakeholders was formed. This working group, headed by the GEF-IWCAM Tobago Demonstration PMU, was given the mandate to further assess the need for GIS in government organizations and to present a case to the THA for the use of, and for the provision of, a central point for GIS in Government Departments in Tobago.

Three working group meetings were held, up to the time of project closure, and a follow up, in-depth, one month training of four government officers was done by the GEF-IWCAM Tobago Demonstration PMU-GIS Unit. A decision was taken to use the Division of Infrastructure and Public Utilities (DIPU) as the model government Division to demonstrate to policy makers how GIS can contribute to the management of the data. The GIS Unit also assisted the Forestry Department by showing some officers how to use Global Positioning System (GPS) and by creating a mapping tree using GPS. The GEF-IWCAM Tobago Demonstration Project provided input into ensuring that data on forests are up-to-date and can be accessed by decision makers. Through the establishment of this institutional framework as well as the capacity building that was fostered through knowledge sharing, the GIS technology can become an effective tool for decision making for water quality monitoring.

## **Learning from experience**

The value of applying simple technologies such as GIS and GPS to help make critical decisions is an invaluable experience. Terrestrial mapping using hand-held GPS and GIS technology was done in the Courland and surrounding watersheds. The GPS is a US space-based radio-navigational system that provides reliable positioning, navigation,

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implement specific programmes and projects to achieve the overall objectives. The IMA responds to technical enquiries from Government Ministries/Agencies, and from the private sector and makes recommendations on matters falling within its purview.

and timing services to civilians on a continuous worldwide basis. This service is provided free.

GIS was used by the Project to present the findings of the marine data (surveys) taken over the period 2007- 2009 on maps, making the results more visual and easily understandable for both policy makers and the general public.

Using this technology, a survey of livestock farming was done to ascertain areas of water pollution and livestock waste disposal within the watershed. The results of this survey were mapped and data was distributed to be used in the planning and development process. Livestock farms in the area, including chickens, ducks, goats, sheep and pigs, were mapped. The survey identified size of farms, how waste products are disposed of, location of farms in relation to rivers and storm drains and the geography of their access roads. Other profiles mapped included agricultural and industrial activities, solid waste disposal, storm drains, hotels and restaurants. This information was useful in determining point and non-point sources of pollution and will assist in planning mitigation activities in keeping with not only IWCAM, but with other international protocols such as the Land-based Sources of Pollution (LBS).

At the institutional level, the working group meetings held with relevant government ministries and agencies succeeded in making significant headway in getting buy-in to tackling the serious problem of degrading coastal water quality. The decision to use the Division responsible for Public Utilities, including water, as the model government agency to demonstrate to policy makers how GIS can contribute to the management of the watershed data, is instructive, and recommended as the most appropriate Government agency to focus this attention in other similar SIDS.

## **REPLICATION**

The conditions for replication of good practice or lessons learnt are often dependent on the local conditions that facilitate this. These conditions include availability of the technical and financial resources to replicate what may appear to be an excellent approach to addressing an issue. In the case of Tobago, the existence of the Buccoo Reef Trust (BRT) with its significant technical capacity, both human and technological,

is more than in other Caribbean SIDS. However, the GIS technology is simple and available to most Departments of Forestry and other Government departments in the islands. Data on either water quality or terrestrial conditions is easy and simple to collect. What is required is the mechanism or system to collate, distribute and discuss the findings amongst technocrats and decision makers. The GEF-IWCAM Tobago Demonstration PMU-GIS Unit organised a seminar of key stakeholders, as a deliberate strategy, where the data collected was presented and allowed for those experts to comment from their respective disciplines.

Unfortunately, technology-centric projects have a poor track record of success, and most organizations are still struggling to deliver an integrated content management environment. Many agencies have tried unsuccessfully to solve this challenge. More often than not, Information Management is not a technology problem; it is about the organizational, cultural and strategic factors that must be considered to improve management of information. The ability to replicate the use of GIS technology in decision making requires not being too technology-centric, but the use of a multiplicity of teaching aids including participatory, hands-on experiences, such as the PMU-GIS Unit did.

## **SIGNIFICANCE TO GEF-IWCAM**

The IWCAM approach is a strategy that incorporates watershed and coastal areas management in achieving improved overall watershed management objectives. The strategy covers coastal area management and biological diversity conservation; tourism development policy and planning; protection of water supplies; and land and marine-based sources of pollution. Perhaps using GPS is the most universal form of technology that can be used in all the aforementioned IWCAM approaches. Using GIS to assist in policy decision making in support of the aforementioned areas is simply about using appropriate technologies optimally.

GPS use has become widespread and is the mainstay of transportation systems including ground, marine and aviation. Disaster relief and emergency services use GPS for location and timing capabilities as a fundamental component of their life saving

exercises. GIS has become the most efficient, economical and accurate technology for farmers, surveyors, geologists, and can no doubt provide critical information for decisions makers in the areas of land-use planning, coastal area mapping, biological diversity protection, water resource management, and civil and infrastructure development planning.