Pacific Islands
GIS&RS news

The Newsletter of the GIS&Remote Sensing Users in the Pacific
Issue 2/2007
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# Remote Sensing Expands in the Pacific

***Ever wondered what Remote Sensing really is?*** Despite being familiar with the term Remote Sensing, we tend to limit our idea of how useful it can be to our work. Remote sensing is often associated with satellite image interpretation of data in the optical range only but it's more than just that. Many know explain it as a tool that allows you to gather information and data which the need to touch an object or to be physically present. This newsletter explains bathymetry or swath mapping of the seabed and the establishment of digital terrain models (DTM) through RTK GPS survey. Both are remote sensing applications, which are not usually associated with the term itself. This newsletter also introduces TerraSAT-X, which is a new radar satellite in space for producing pictures. It is where the sensor sends a beam to the object and records the intensity, response time and polarisation of the reflection. However, this doesn't relate with a recorded image in the optical range such as the well-known image data from Landsat, IKONOS or QuickBird satellites in the Pacific. Similarly LiDAR, which stands for Light Detecting And Ranging, works in the same way. A beam is sent to the object and the sensor records the reflection. The only difference is that the beam is a laser pulse and not a radar wave. In Pacific Island Countries, there is no application so far because the sensor needs a special plane to operate which would be expensive. However, discussions to mount the sensor on a car and scan small atoll islands from fixed points a few 100m apart and mosaic the data to one DTM are ongoing. But it does not end there, the term remote sensing also includes the classical aerial photo analysis, where pairs of stereo images are utilised to create a three-dimensional model allowing drawing the image features in map projection if instruments like stereo plotters are applied. Here new developments concentrate on digital cameras together with in flight GPS position and motion recording. This will reduce the amount of ground control points necessary to establish the three-dimensional model in map projection. Digital cameras cut the process of film development, which has been an ongoing problem when colour or infrared film was used under island conditions. So far, there is no photo flight utilising such equipment in the Pacific, but it is expected that the development will reach the region soon.

The last issue of this newsletter reflects the discussion at the end of the Pacific Regional GIS&RS User Conference, which highlighted demand for different remote sensing applications and the need to adapt methods to Pacific Island conditions although applications run well in Europe and North America. Through the SOPAC-EU Project remote sensing data and analysis, techniques are introduced in 14 Pacific Island Countries, which gave an enormous boost to GIS and remote sensing development. Nearly all GIS establishments in countries covered by the SOPAC-EU Project utilising GIS backdrops; the GIS of the Samoan power utility is shown as example in the current newsletter and a further article explains the potential and limitations of image pre-processing required for GIS backdrops. Now, method development will follow to optimise the utilisation of remote sensing data and to widen the use of different data. Welcome to the newsletter that opens a wide spectrum of new applications for your purpose.

Wolf

*Elizabeth Whippy and Litea Buikoto testing RTK GPS in the Suva reef*


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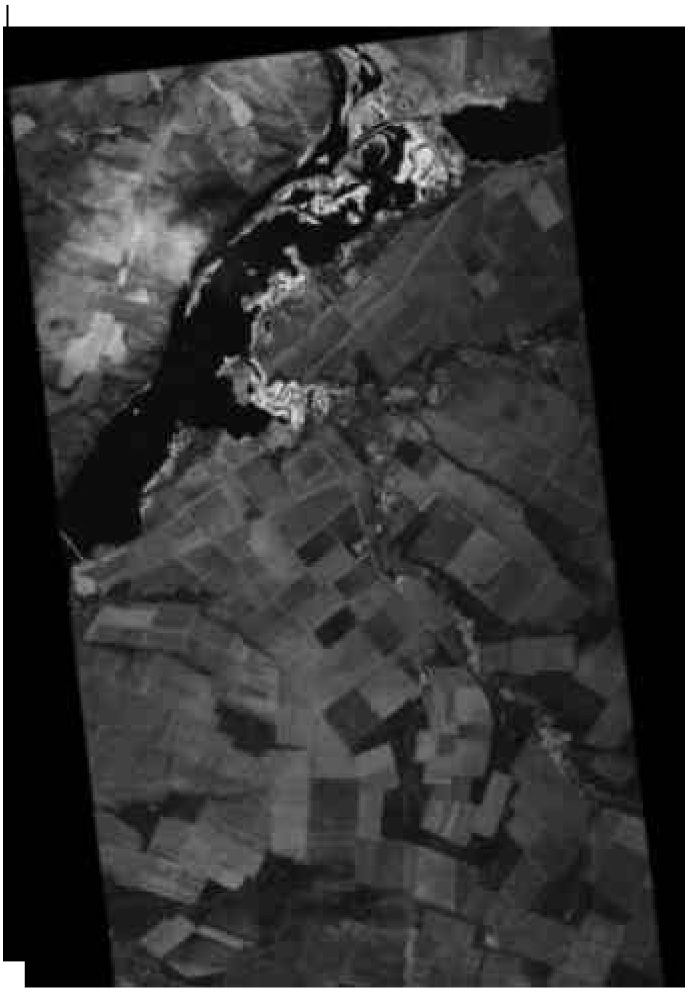
## Content



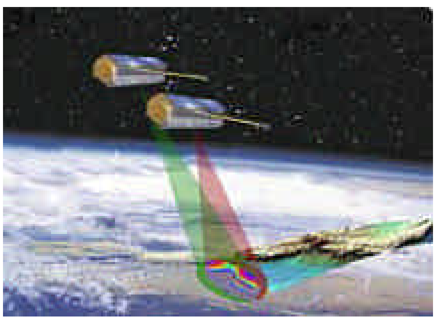
# TerraSAR-X

TerraSAR-X is not only another new satellite in space. The equipment on board of the spacecraft allows mapping through cloud cover and first timing with high-resolution. The satellite was launched in June this year a provided the first images already four days after being in space. The first TerraSAR-X image captures a region in Southern Russia; about 500km northeast of the Black Sea and 50km west of Wolgograd see Figure 01 (Image sources: DLR, Infoterra GmbH). The upper part of the image displays the Tsimlyanskoye reservoir. A railway bridge across the river Don can be made out in the middle/left of the image, with the railway tracks clearly visible running in a north-eastern direction. The lower part of the image is dominated by large agricultural areas. The variations in grey tones of the different fields reflects the different crops and growth stages. Acquisition date: 19 June 2007, Spatial resolution: degraded to approx. 15 m. The satellite provides three different image products:



1. Spotlight (up to 1 m resolution)
2. StripMap (up to 3 m resolution)
3. ScanSAR (up to 16 m resolution)

Mapping of coastal change will be possible at 1:10,000 scale. Next year another satellite of this type will be launched, TanDEM-X. The establishment of digital terrain models will be possible through synthetic aperture radar interferometry. More details in next newsletter.



# RTK GPS for Beach Profile DTMs

Wolf Forstreuter, SOPAC

## Introduction

Sand or beach movements on atoll islands have the potential to cause significant problems for housing and infrastructure. It is important to monitor where the sand drifts away and where beach is building up. The reasons for these shoreline movements are still not fully known. More understanding would allow a forecast to reduce negative impact. Contour lines of sub-metre accuracy are required to map the shape of the beach. The technique could also be used to create detailed DTM's for wind farms allowing the optimisation of windmill locations. Another application would be the ortho-correction of high-resolution image data, which so far does not work in Pacific Island Countries due to the missing DTMs.

***Figure 01:*** *Base station in the centre of the sandbank of the Suva reef. From there it can transmit the position data for more than 1 km. (The transmission antenna pointing downwards on the left side of the instrumnent). The tripod position is marked with a peg for follow up surveys.*

Martin Hewitt director of GeoSystems New Zealand as Trimble main dealer for the region promised during the last Regional GIS&RS Users Conference to bring equipment to Suva for a trial survey, as the beach profile simulation carried out by SOPAC in Kiribati in August 2005 did not show a complete DTM. In May 2007 the sandbank in the Suva reef was surveyed representing a part of a beach in an atoll island.

## Equipment and Setup

The survey used a Trimble R8 Global Navigation Satellite System (GNSS), which has a multi-channel, multi-frequency receiver capturing American and Russian navigation satellite signals. The unit combines the GPS antenna, the receiver, the battery and the radio transmitter to send the base station signal to the rover unit. The rover unit is also a multi-channel, multi-frequency unit, which combines antenna, GPS receiver, battery and radio receiver (see figure 02).

The base station was setup on a tripod in the middle of the sandbank (see figure 01) and position was temporally marked. It will be permanently marked with a stainless steel pin to be available for re-surveys.

***Figure 02:*** *This base station unit contains the GPS antenna, the GPS receiving unit, the VHS transmitter and the battery.*

The base station immediately averaged its position and transmitted the position data to the rover visible by a control light. Both base station and rover initialised within seconds after being switched on. This is a big improvement when comparing to the Trimble 4600 LS units of SOPAC, which take about 20 minutes.

## Survey

The survey team followed first the visible contour lines, which are the high water mark, the water line and the vegetation line (see figure 03). Then position data were captured along lines within the water and within the vegetation (see figure 04). Every 1 to 1 ½ metres the operator stopped, hold the survey pole in vertical position, which was indicated by a little bubble (see figure 04) and pressed the button and waited one or two seconds for the confirmation signal of correct data receiving before walking another 1 ½ metres. The confirmation signal ensures the receiving of correct

***Figure 03:*** *The sandbank in the Suva reef. Clearly visible contour lines are: a) the vegetation boundary, the high water mark and the water line. The survey team followed these lines additional position data were collected within the water and vegetation area.*

***Figure 05:*** *Some lines were surveyed in the water, where the operator tried to walk in the same water depth to best capture a contour line.*

***Figure 04:*** *The spirit level mounted at the side of the survey pole indicates if the pole is in correct vertical position.*

satellite signals with the defined precision and base station signal. Re-survey due to week signals or due to problems of differential correction can be avoided through this setup. The survey of the 4.4 hectares required about two hours including the setup of the base station.

## Producing the DTM

The data download from the GPS rover unit does not require special software, as it can be exported as CSV

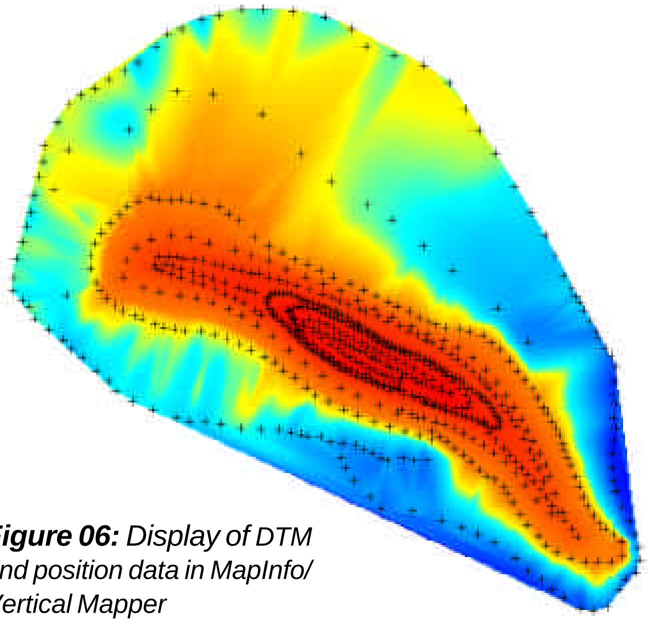


***Figure 06:*** *Display of DTM and position data in MapInfo/ Vertical Mapper*

files containing position data X, Y, Z, point ID and annotation. The CSV files (ASCII) can be imported into MapInfo, Access or ERDAS. MapInfo and Vertical Mapper were used as first display for checking the data integrity (see figure 06).

The main data analysis was performed within ERDAS Imagine as this software environment provides more potential for data analysis and is distributed in most Pacific Island Countries. The import to ERDAS is most easy, if the ASCII file just contains X, Y and Z value separated by a comma (,). Therefore the CSV file was first imported to Access, reformatted and exported as ASCII TXT file. The ERDAS module Create Surface produces a DTM from this ASCII file, where the user can define the cell size, the background value and the data type. The cell size of 1 x 1m was chosen

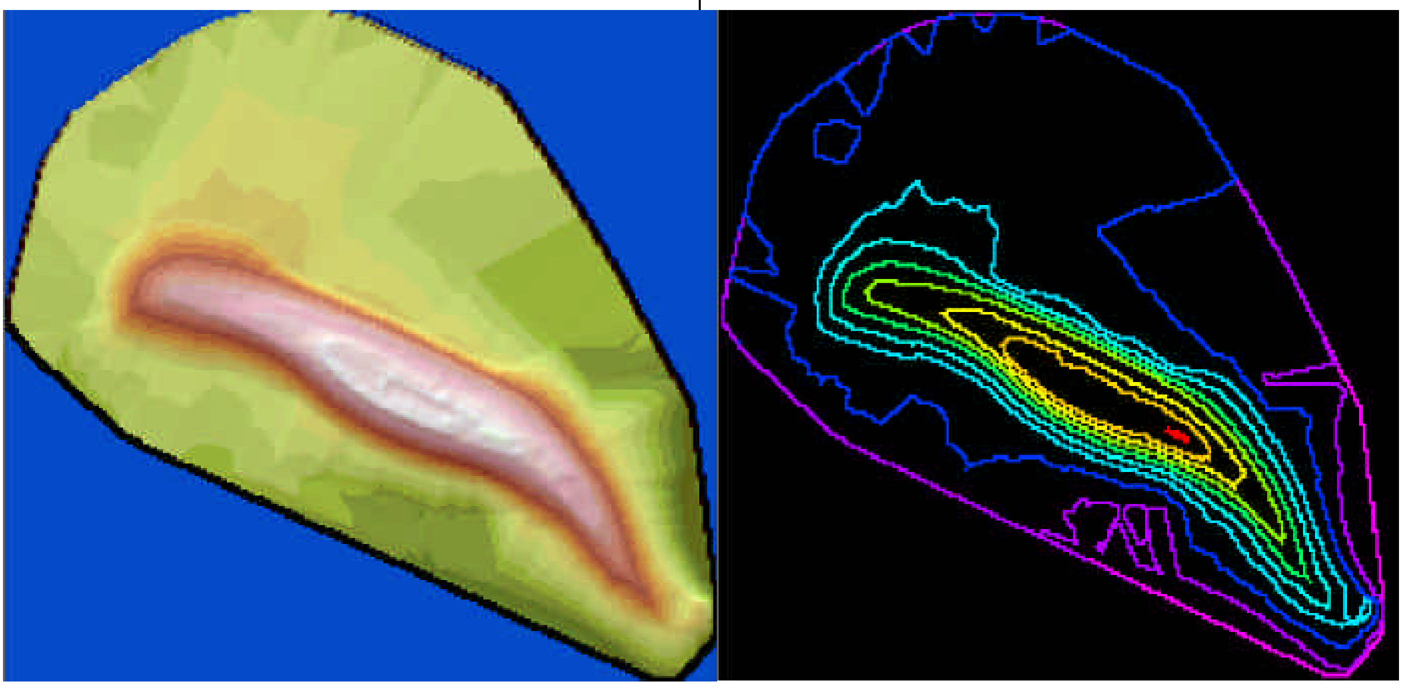


***Figure 07:*** *Display of DTM in ERDAS, left as painted relief and calculated contour lines on the right.*

correspond with high-resolution satellite image data purchased nowadays for Pacific Island Countries. Having the DTM the user can produce:

- Shaded relief,
- Painted relief,
- Contour lines,

to better visualise the DTM (see figures 07 and 08)

**Calculating the Volume**

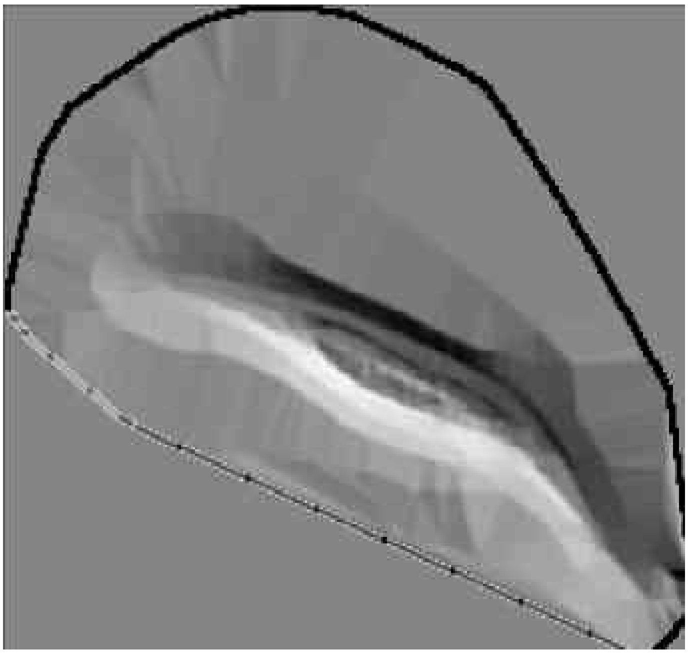


*Figure 08: Display of DTM in ERDAS as shaded relief.*

For Pacific Island Countries it is important to know, how much sand is drifting away or built on the beach. Therefore the best way to quantify this is by calculating the volume using the DTM.

So far, the elevation values represented height above ellipsoid (HAE), something the user is not interested in. In the case of the sandbank survey 55 metres HAE was the lowest point measured when surveying in the water. This height value was used as a reference plane from which the DTM was re-calculated. This was performed with the ERDAS module *Spatial Modeler,* which reduced all height values to elevation above 55 metres HAE.

Knowing that the pixel size is 1 x 1m (1 x 1 = 1) the volume of represented by each pixel can be determined by the height value (volume = height). Therefore the total volume of the DTM is the sum of the height values of all pixels representing the survey area. There is no module in ERDAS, which sums pixel values, however, the pixel values can be exported from ERDAS to Access where a table can be created to enable the full use of analysis in Access environment

**Simulation of Erosion Monitoring**

The target of the survey and mapping exercise is to estimate the potential of quantitative change detection

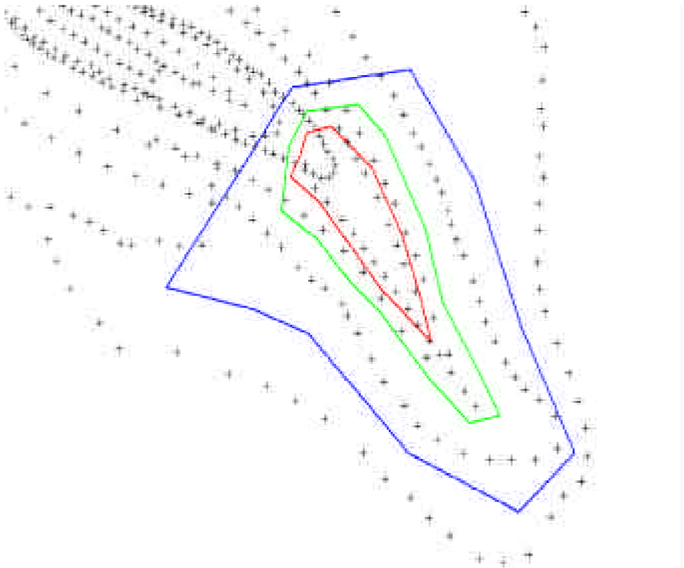


***Figure 09:*** *Within these polygons the Z value of the GPS input data were reduced in Access environment: a) red polygon by 75cm, b) green polygon by 50 cm and c) blue polygon by 25cm before the DTM was created again utilising this manipulated data set.*

as mentioned above. Therefore a change of surface had to be simulated before the volume change can be calculated.

In MapInfo polygons were drawn representing areas where the sand would be eroded of 25, 50 and 75 cm (see figure 09). The GPS points within these areas were reduced accordingly. This was performed in Access to which the points were exported from MapInfo. In ERDAS a new DTM was established with the manipulated GPS input data

Afterwards the volume was calculated again within Access environment allowing a comparison of both figures. Both displays beside each other (see figure 10) allow a comparison of both shapes. In addition, ERDAS provides a routine to subtract one DTM from the other one, which visualises the area of change in more detail (see figure 11).

**Results**

The DTM covered an area of 212 x 209 metres (= 4.4 hectares) with the UTM position of 7989900, 655714 of the upper left corner. The instrument was set to record with 2cm precision in the Z axis and recorded 55.71m above ellipsoid as lowest and 58.02 as highest height value. The volume above 55.0m was calculated with 38,672m$^3$ before the simulated erosion and 36,934m$^3$ after the simulated change. The 55.0 metre is a layer lower than all positions and most parts of the 4.4 hectares are one metre above this layer; therefore the calculated volume is big. A volume change above a layer at 56.0m above ellipsoid shows 4,020m$^3$ and 3462m$^3$.

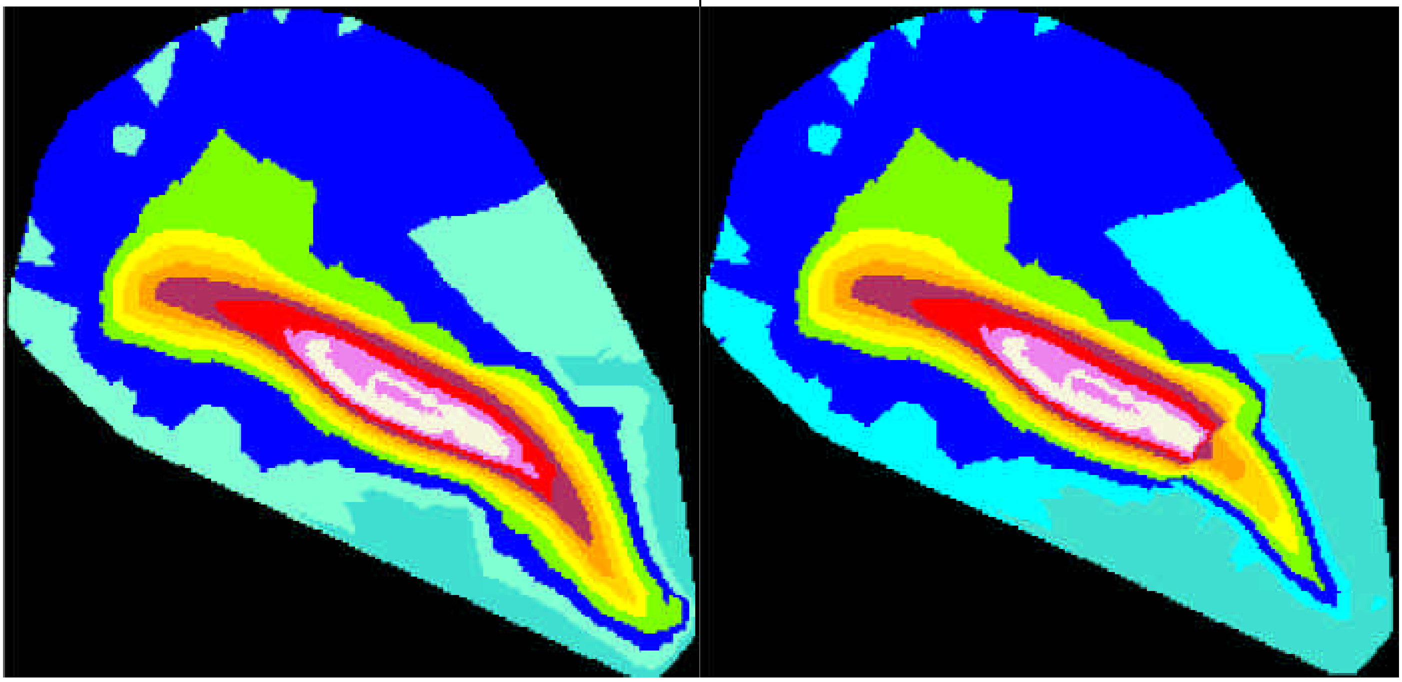


***Figure 10:*** *Display of DTM as density slice of 20cm height difference. Left the original DTM and right the simulated erosion by manipulating the GPS input data.*

### Conclusion and Recommendation

The traditionally SOPAC recommended beach profiling can be replaced by RTK GPS survey and explained analysis in employing MapInfo, ERDAS and Access software. Creating a DTM there is no need to get compass bearing and the DTM represents the complete target area and not a linear representation, which might not be statistically sound.

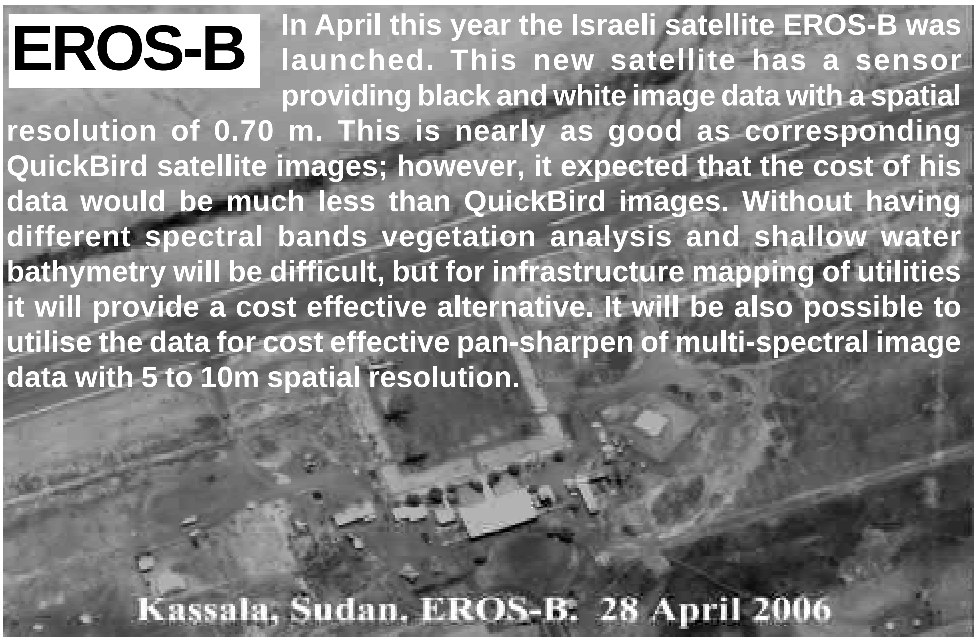
The analysis can be provided directly after the survey in quantitative change of volume directly after the survey.

The change can be visualised with software available in all EDF8/EDF9 linked countries.

SOPAC should purchase one RTK GPS unit and train staff in Pacific Island Countries to utilise instruments and software for carrying out beach profiles starting in parts where erosion is expected.

## EROS-B

In April this year the Israeli satellite EROS-B was launched. This new satellite has a sensor providing black and white image data with a spatial resolution of 0.70 m. This is nearly as good as corresponding QuickBird satellite images; however, it expected that the cost of his data would be much less than QuickBird images. Without having different spectral bands vegetation analysis and shallow water bathymetry will be difficult, but for infrastructure mapping of utilities it will provide a cost effective alternative. It will be also possible to utilise the data for cost effective pan-sharpen of multi-spectral image data with 5 to 10m spatial resolution.




# Bio-Regional Mapping of Viti Levu

Leba Gaunavinaka

### Bioregional Mapping for Viti Levu:

Our natural environment is the main life supporting body and precious of human beings. Over the last century however, human societies have become increasingly industrial and technologically driven; increasingly contributing to pollution, soil erosions, and the loss of diversity of all kinds. Protecting the environment's quality is crucial as human society progresses. In light of this understanding, conservation strategies of all sorts are being implemented, are currently proposed or in the process of endorsement. New strategies thought to be more effective are being explored. Along this argument is one, such that in the past, the planning of environmental conservation were mostly carried out under administrative geo-political boundaries (like via provinces etc) but that in more recent years, it had become increasingly apparent that that was no longer a satisfactory basis for conservation assessments and planning (Morgan and Terry: 1992). There appeared a need for a conservation resource system so if to be a representative of the natural environment, to contain viable areas of the major ecosystems of each natural region. From this, came the concept of bioregionalism (identifying and mapping bioregions) as a possible solution and comparatively more appropriate approach.

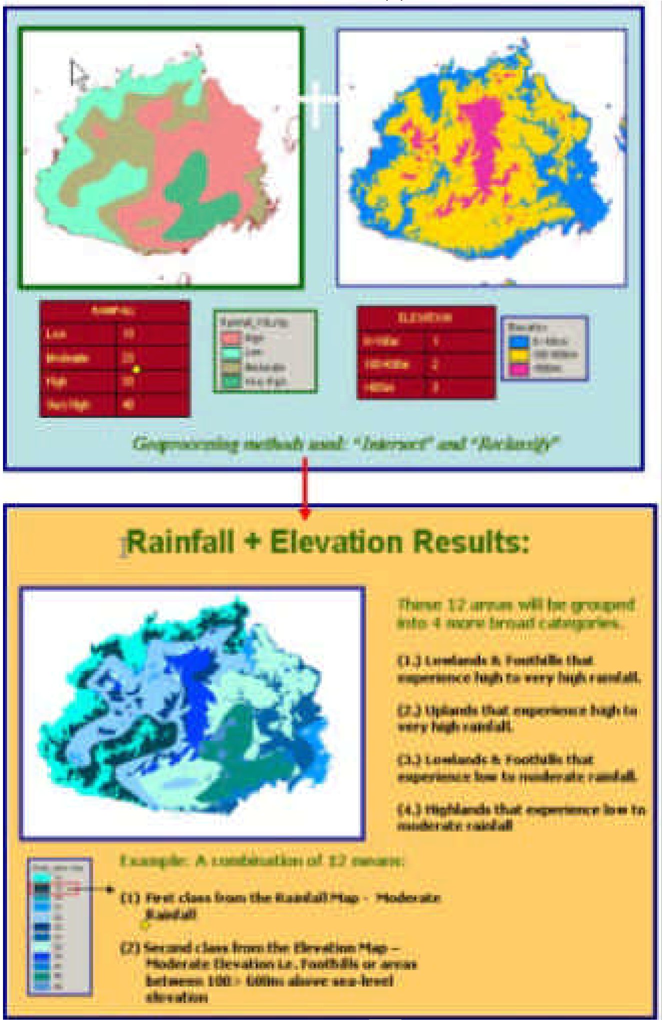



***Figure 01:*** *phase 1 is Identifying the areas to classify as bio regions.*

In bioregional mapping, the main influencing factors on an environment are integrated. From their combinations, we group areas that share uniformal characteristics into units that we then call bioregions. In elementary projects, this can be done via the manual overlay of paper maps. In bigger projects, computer systems are used for this task. The application of Geographical Information Systems (GIS) for bioregional mapping is what this project chose. The selected site was Viti Levu terrestrial due to the availability of relevant data. Most information on the main biophysical influences on Fiji's environment exists mostly if not only for this mainland.

### Two Phases:

Bioregion Map Creation

Integration with other Maps of Ecological or Biological Significance.

The second phase develops to illustrate how the bioregion map is potentially useful for conservation resource assessments or planning purposes.

### Phase One: Bioregion Map Creation:

Identify the main biophysical influences on Viti Levu terrestrial environment to use;

These were namely Rainfall, Temperature, Relief (Elevation, Aspect), Geology and Soils.

Combinations of these were carried out to identify similarities and group areas accordingly.

Some maps were already in digital form like Soils and Geology, others had to be scanned, rectified and digitized into the working of the project, like Rainfall and those maps used in phase two.

Overlay of themes – two layers at a time, where a number was allocated for each combination derived from a set of two layers. That number is further combined with another that represents a combination also from another two layers and then so on and so fourth. Using numeric allocations for combinations for further grouping helped identify more defined areas.

We applied these combinations integrating the necessary elements from the selected themes (of most influential environmental parameters) to finally arrive at the distinguished combinations that entail areas of similarities that ultimately make up the bioregions.

Through discussions with field experts on the above parameters, their relative classes to use were noted and studied prior to the analysis.

Four classes of rainfall, three classes of elevation, six classes of geology, 2 elements that considers soil and temperature were all integrated to end up with a map of 21 bioregions.

**Phase Two: Integration with other Maps of Ecological or Biological Significance:**

In this phase, maps of Ecological or Biological Significance are overlaid with the Bioregion Map to see how they relate. Maps overlaid with the Bioregion Map during Phase Two include;

Map of Major Wetlands

- Candidate Important Bird Areas (IBAs)
- Sites of Biological Significance
- High Priority Areas

Heavily Forested Areas (indicative of areas of high biodiversity)

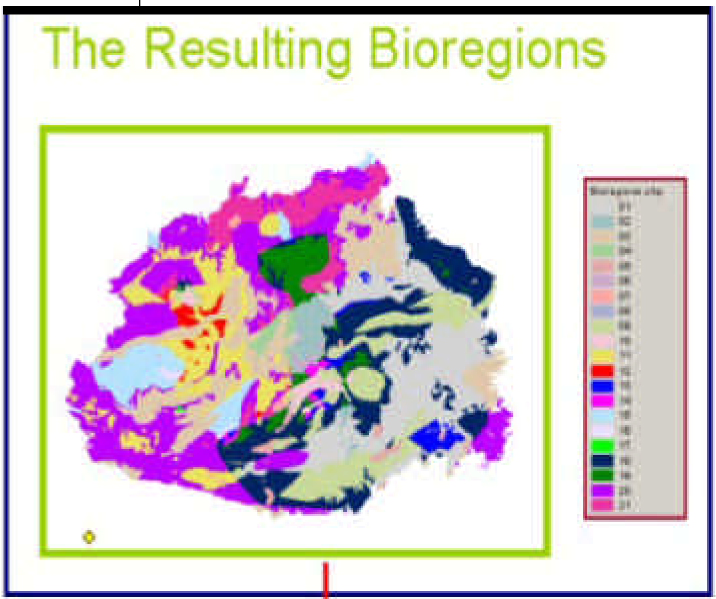
Sources: *"A Sub-regional Profile of Fiji"* by David Olsen of the Wildlife Conservation Society (WCS, Fiji), served as a very good source for most maps on ecologically significant elements on Viti Levu terrestrial. The rest of the maps used were obtained from other NGOs and government departments that work closely with projects that deal with Fiji's natural resource conservation.

**What is the significance of this?**

The overlay of the above maps with the Bioregion Map points out what conditions (which define a certain bioregion) are supportive of which ecologically or biologically important areas [e.g. which major wetland or which Important Bird Area (IBA)]. This ultimately offers users an ecological and/or empirically scientific approach that can provide knowledge and insights into the conservation of important areas and/or what can be done to preserve a certain type of environment, by merely an understanding of the conditions (via the interaction of the parameters) that work to support that unit of place.

**Conclusion:**

We can say that the degree to which bioregional mapping can be useful depends largely on bringing these biophysical parameters together with the ecologically and biologically significant as well as environmentally social and in part economic considerations. The concept of bioregionalism offers light into a potentially effective approach that could help in the direction of effective conservation. The measure of its applicability in the real world however may be a rather complex matter to comprehend given our land tenure and resource use situation and such. In the larger scope of things though, Bioregionalism can collectively communicate a holistic image of place that would allow decision makers to make out what actions could be adopted relatively to achieve sustainable prosperity and better resource management. It can make our citizens better resource managers in partnership with the community.




| Bioregion | Definition |
|---|---|
| 01 | Sediment clastic sedimentary rocks on lowlands or foothills. Experience high to very high annual average rainfall. |
| 02 | Sediment clastic sedimentary rocks on Uplands (>600m) Experience high to very high annual average rainfall. |
| 03 | Sediment-clastic sedimentary rocks of lowlands and fotthills Experience low to moderate annual average rainfall. |
| 04 | Sediment clastic sedimnetary rocks of Uplands. Experience low to moderate annual average rainfall. |

***Figure 02:*** *The end result gave 21 areas of similar characteristics, then classified as the bioregions*

# Utilising GIS to Determine the Value of Navovo Agriculture Subdivision

Buliruarua Lesuma
George Tami

The main purpose of the project is to use GIS to extract the Unimproved Capital Value per lot identified for agriculture leases.

- Demonstrate the ability to use the existing Land Use Class information to determine the UCV through MAPINFO.
- Improve the speed of issuing agriculture leases at the same time provide the lessee with information regarding the land use class for them to make informed decision about there land.
- Simplify the method used to determining the UCV for Agricultural Leases.
- Calculate the Land Rents from the LUC Schedule of Fees.

Information on land use at Navovo Agricultural S/D was produced by the Land Resource Planning and Development Department.

- LUC data was transferred to MapInfo formats and used as layers to overlay with the original Scheme Plan of the Agricultural Subdivision.
- LUC area for each lot was extracted after overlaying the layer to determine the UCV for each Lot.

<u>Benefits</u>

- The Project is to engineer ways for NLTB to move forward using modern technology.
- This process is to ensure quick assessment of UCV using Land use Data, Satellite Imagery and GIS through MapInfo.
- This approach will have the following impact on NLTB Operational Cost will include the following:
- Reduction in fuel cost as one is able to visualize the area of inspection (Location, Feature, etc) saves time and money in trying to locate the area.
- The turnover time in creating a contract which is currently (6 months) can be reduced to half the time (3 months) if such desktop Assessment are completed prior to field inspection, which will be for confirmation purposes only.
- Since all estate Officers will be accessible to Laptops next year, all such information can be downloaded to their laptops and will be available on hand for confirmation on field inspection
- NLTB staff will be on par technologically and will ensure upgrading of their skills
- Overall improvement of Customer Services to the Stakeholders
- Convenient and Justifiable when doing reassessment for all agricultural Leases.

<u>Cost</u>

- The time spent in training staff and upgrading there skills to familiarize them with the Proposed GIS project.
- Digitizing the LUC Maps to represent the area earmarked for Agriculture Lease.
- Cost of sending Technical officers to train staff in the region

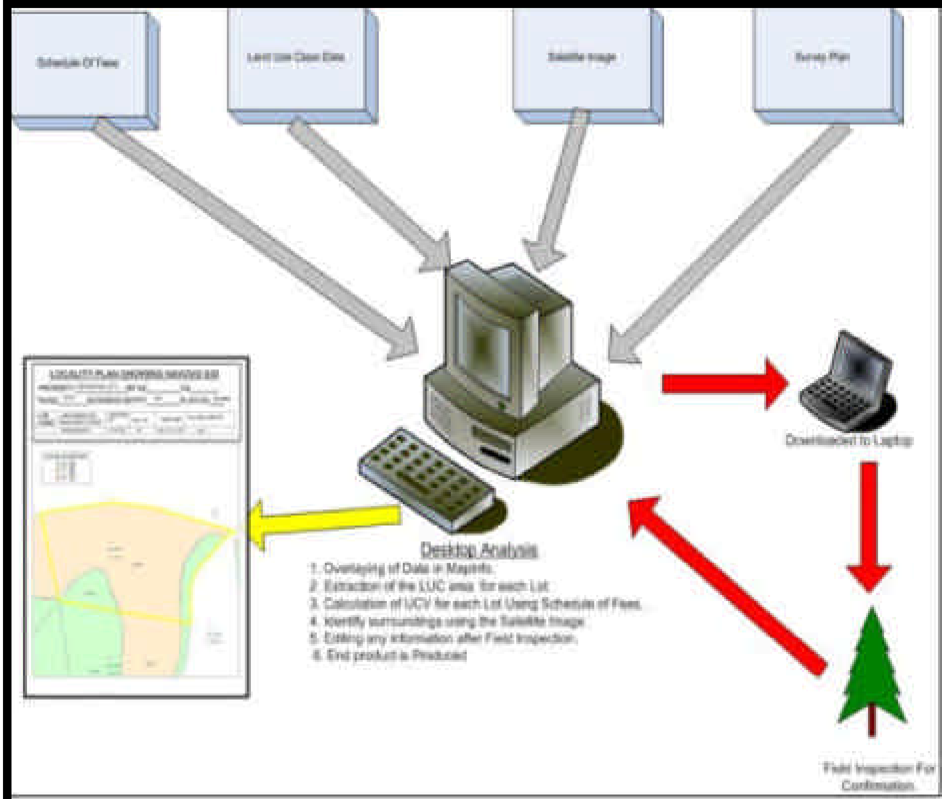



***Figure 1:*** *Shows the summary of the steps taken to determine the unimproved capital value of Navovo subdivision*

# Mapping Important Bird Areas (IBA) in Fiji and the Region

Amit Sukal

BirdLife INTERNATIONAL
Pacific Partnership Secretariat

IBAs are internationally recognized sites which are vital for the conservation of birds. They are identified using a standard set of four global selection criteria: 1. Globally threatened species; 2. Restricted-range species; 3. Biome-restricted assemblages; and 4. Congregation. To qualify as an IBA the site must meet or exceed one or more of the criteria and thresholds indicated. The sites are large enough to support viable populations of the species for which they have been identified but small enough that site-based conservation is practicable. IBA designation is not a legal one, nor does it oblige the land-owner or other users to conserve the site or change their behaviour. IBA designation only identifies the area as globally important for its birds (and other biodiversity), and provides information upon which government, NGOs and other people can, and are encouraged to act.

The IBA identification process for Fiji has been completed and the boundaries have been mapped. Altogether 14 sites have been identified as IBAs.

***Figure 1:*** *Location of Important Bird Areas* (IBAs) in Fiji.

## Location of Important Bird Areas (IBAs) in Fiji

The IBA process has commenced in other countries around the region. Palau, New Caledonia, French Polynesia and other Pacific countries have adopted the IBA process and this data will be mapped very soon.

Another project that has just started in the region is identifying Seabird IBAs. This project is funded by the David & Lucile Packard Foundation. This project will lead to a major improvement in understanding of seabird breeding colonies in two of the most significant island groups for seabirds in the Pacific, French Polynesia and Fiji. The project will analyse historical information, gather new ethno-biological information from local people – fisherfolk in particular – and investigate the use of remote imagery to identify existing and historically important islands for breeding seabirds in both countries. The up-to-date information will be made available mapped showing distributions and numbers of breeding seabirds. An action plan will be produced identifying islands to be restored for breeding seabirds. The culmination of this work, alongside the ongoing advocacy, education and provision of information to national and local governments and people, will be a significant first step for the development of a coherent regional seabird conservation initiative.Conservation prioritization becomes a hassle if data is not ready available. With limited resources we have to make every cent count. The IBA process helps identify sites of national significance and thus allowing stake holders to put their resources to best use. Having mapped data readily available will help government, NGOs, people and other organization adopt conservation on these sites.

## MIS/GIS Established at Samoa Electric Power Corporation

Edwin Liava'a, GIS Specialist Avon Solutions

Leslie Allinson, ICT Specialist Avon Solutions

### Introduction

"The power of a GIS is limited only by the imagination of the users" stated Joseph Walter, General Manager, Electric Power Corporation (EPC) at the successful Commissioning and Demonstration of the MIS/GIS to EPC staff and stakeholders at EPC Headquarters, Apia in March 2007

The Commissioning and Demonstration was the conclusion of fourth phase where the previous three phases were Inception, Training and Development while the fifth was Final Reports and Manuals. The five phases where completed under a project titled Establishment of MIS/GIS at the Electric Power Corporation of Samoa.

This project that had taken some eight years to bring to implementation was made possible by the recognition of the value of a MIS/GIS by the General Manager EPC and the Manager of the Pacific Islands Energy Policy and Strategic Action Planning (PIEPSAP) Project as well as the generous support by the Danish Government and the European Union who supported the funding of the satellite imagery that was selected and processed by the GIS Specialist from the Pacific Islands Applied Geoscience Commission. In addition, the United Nations Development Project Samoa was a key player in the success of the project that was implemented by two technical specialists from Avon Solutions, a Pacific based and staffed company that focuses on MIS/GIS solutions.

This article outlines the objectives and the activities to achieve same as well as an overview of the challenges and how these were addressed.

### Objectives

The key objectives of the joint EPC PIEPSAP project were:

1. Develop and establish a MIS/GIS at EPC in close collaboration with EPC professional staff
2. Train EPC staff to build, maintain and develop a comprehensive asset database and a Geographical Information System, which both can be linked to transfer annotation information to the GIS and spatial information to the asset database
3. Provide inputs for long term system expansion planning in the electricity sector
4. Exchange information and experiences with other GIS using utilities in the Pacific Region.

### Activities

The equipment that was purchased by EPC included two Trimble GeoXM GPS Rover Units, one Trimble 5700 Reference Station, two Cannon Coolpix digital cameras, one Underground Cable Locator, one high performance, a high capacity Dell Desktop computer with 19" TFT display, an Epson A1 printer and Mustek A3 Scanner. The software purchased included MapInfo Professional 8.5 and MapBasic 8.5 together with Microsoft Office 2003.

The data included a QuickBird Image with 60cm resolution of Apia Town that covered the target EPC feeders named Hospital and Beach Road. This invaluable image purchased through EU funds served as the foundation backdrop data for the project and was at the specified datum of WGS84 and obviated the need to convert any historical imagery or historical vector data from Samoa Grid datum. It should be noted that at the Commissioning and Demonstration stakeholders meeting the representative from the Government Lands and Survey sector advised that all key vector data had been converted to WGS84 and would be available to relevant stakeholders.

All equipment was tested and found to be fully functional and operational and a survey was carried out on the Hospital Feeder as specified in the Project Documents. In spite of the survey being carried out during the wet season in Apia it was completed within the estimated 30 working days (5 weeks where a week was 6 working days) where the target was attained though the enthusiasm and dedication of the survey that were experienced survey and line specialist EPC staff.

The asset items captured on the Hospital Feeder included some 630 Meters, 480 Poles and 34 Transformers. A survey of the Beach Road Feeder was commenced and both the main Tanugamano diesel generation plant and the Samasoni Hydro plant were fully surveyed to provide a comprehensive data set for fully testing the overall MIS/GIS and particularly the High and Low Voltage Line drawing and display algorithms over multiple feeders and generators. The total asset items captured and created (Lines) are shown in the following table.

There are two separate Corporate Information Systems (CIS) at EPC with one being a fully featured Asset Management System named DAFFRON that uses the IBM DB2 relational database engine and requires an IBM AS400 server. The other is a PREPAID system using SUPRIMA that uses Sybase and is currently running on a Dell server with Microsoft Server 2003.

| ASSET | CODE | TYPE | NUMBER |
|---|---|---|---|
| BREAKER | BR | POINT | 24 |
| BUILDING | BL | REGION | 2 |
| BUILDING SECTIONS | BS | REGION | 7 |
| BUSBAR | BU | LINE | 5 |
| FEEDER | FD | COLLECTION | 2 |
| GENERATOR | GN | POINT | 9 |
| LINE HIGH VOLTAGE | LN_HV | LINE | 223 |
| LINE LOW VOLTAGE | LN_LV | LINE | 1031 |
| METER | MT | POINT | 636 |
| NODE | ND | POINT | 29 |
| POLE | PL | POINT | 483 |
| POWER STATION | PS | REGION | 2 |
| SWITCH | SW | POINT | 8 |
| TRANSFOMER | TX | POINT | 37 |

***Table 01:*** *Asset items captured and created lines.*

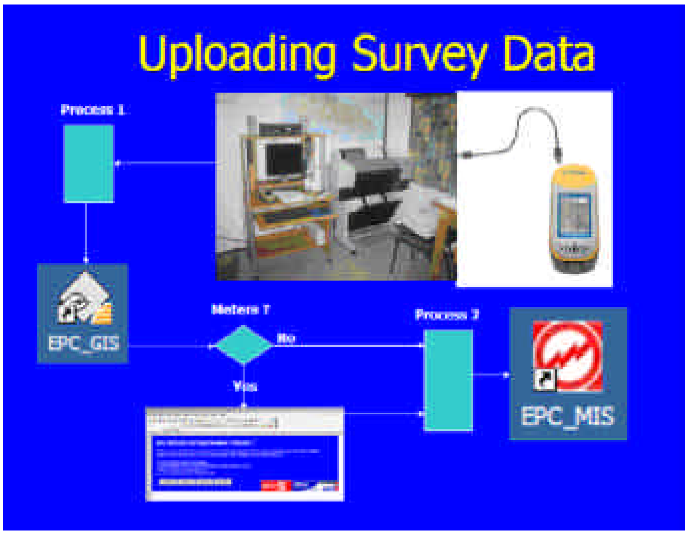



***Figure 01:*** *Uploading survey data*

It was necessary to link the MIS/GIS with the two CIS and this was achieved through ODBC drivers and live links to both systems.

Both systems stored data on conventional and prepaid meters respectively while the former (DAFFRON) has the capacity to store data on other assets such as poles, transformers, switches, generators and buildings. All meters have serial numbers but as there a possibility

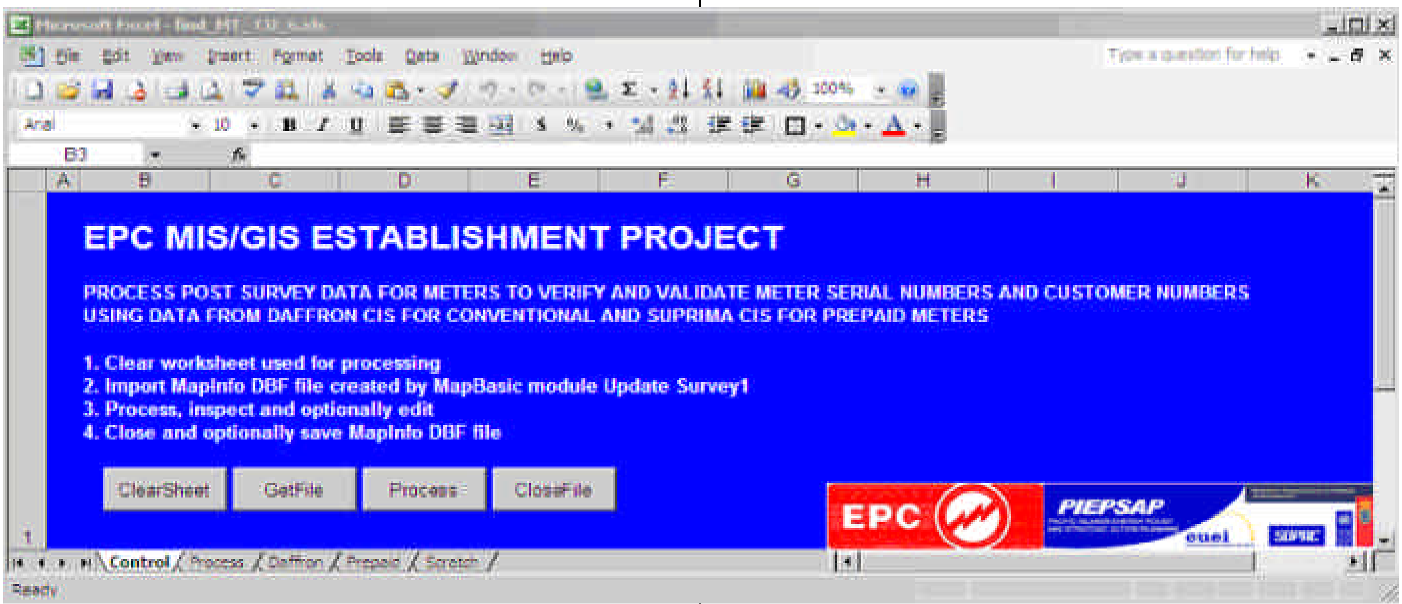



***Figure 02:*** *EPC MIS/GIS entry form*

that a serial number of a conventional meter can be the same as that of a prepaid meter a unique key was created for meters such as MT000001, MT000002 etc. Both types of meters use a mix of alpha and numeric characters for the serial number and the DAFFRON system had been established to only accept numerical data for the serial numbers and data entry operators had over the past five years used arbitrary methods to convert alpha to numeric such as entering a S as a 5, omitting training alpha or using the numeric position in the alphabet as the numeric.

In addition most meters had a customer ID that again was a mix of alpha and numeric.

The objective of matching data captured in the field with data stored in the two CIS was carried out by a semi automated process where field data was loaded into the MIS through a set of MapBasic modules where a verification and validation step was needed using VB modules controlled by a user front end. The overall process is shown in the following two diagrams.

During the process of developing the subsystems to ensure that data was verified and validated and duplicate data could not be loaded into the MIS from multiple survey teams an analysis of the process flow to install new meters, replace existing meters and remove meters was undertaken and areas were identified where efficiencies could be significantly improved. These improvements would not only increase customer satisfaction through more rapid response times but would also increase revenue flows.

## MIS/GIS Established at Samoa Electric Power Corporation

The majority of assets had an associated picture and the following diagram shows clockwise from upper right: buildings, breakers, generators, transformers, poles, meters prepaid and meters conventional.

Finally the following Queries were created where several followed requests from demonstrations to the Section Heads, the General Manager and finally to the full stakeholders.

- Find EPC Asset
- Simulate Cutting a Line


***Figure 03:*** *Assets captured in the target area.*

- HV Lines by Feeder
- HV Lines Underground
- LV Lines by Feeder
- Lines by Phase
- Meters Prepaid and Conventional
- Poles by Owner
- Poles with Telco Assets
- Transformers by Feeder
- Transformers by Total Consumption

Three examples follow and show the power of the EPC MIS/GIS for Management Decision making.

As displayed in figure 04, the majority of EPC Power Poles on this Feeder have various types of Telco assets affixed that include such items as a Connection Terminal (CT) with Heavy Cable (8), CT with Light Cable (42), Heavy Cable only (18), Light Cable only (235) and None (179).

As displayed in figure 05 the Red phase (261) is over utilised, Yellow (176) and Blue (103) under utilised.

As expected, the majority of customers are still connected with Conventional (520) meters against Prepaid (126).

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***Figure 04:*** *Poles with Telco Assets*

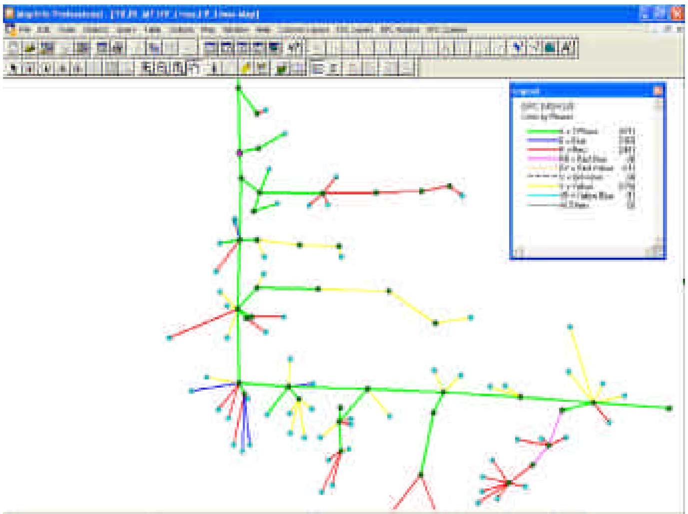

***Figure 05:*** *Lines by Phase*

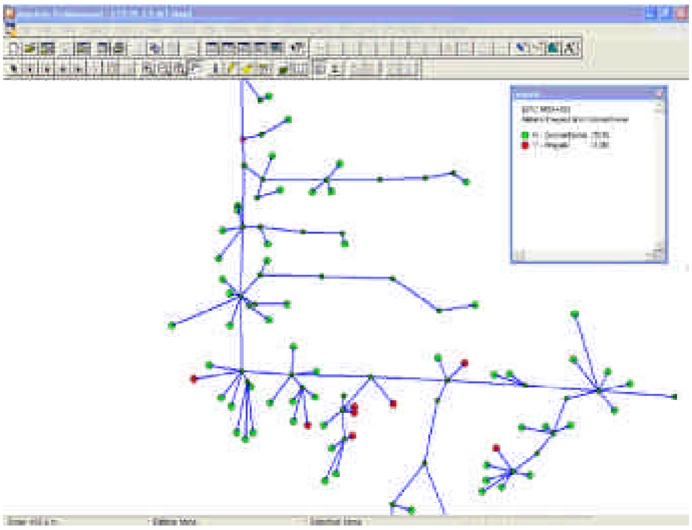

***Figure 06:*** *Meters Prepaid and Conventional*

**"Charting the Yasawa Platform"**

# Mapping complex Morphology and Marine Habitats from a Classic Hydrographic Survey

Robert Smith SOPAC

The Yasawa Islands and platform and its plate tectonic significance has long been the subject of study in the region by many to unravel its geological evolution. However, until now, much of this shelf platform marking the western boundary of the Fiji platform has never been mapped this evident in many of the map published. This is illustrated Figure 1 is but one example from the Fiji 1:250, 000 bathymetric series published by the Mineral Resources Department of Fiji

***Figure 1** " VIWA" Sheet 4 from the 1:250, 000 Fiji Bathymetric series*

Previous resource surveys were limited to geophysical hydrocarbon surveys in the early 70s with great difficulty experienced in navigating the shelf waters due to the inadequate coverage of existent charts of the area. Kilometre-long streamers would find uncharted shoals. The odd reconnaissance survey by organizations interested in the fisheries potential of the shelf were also not very exhaustive. Today a large portion of the vessel traffic in the Yasawa and Mamanuca Islands are operated by the tourism

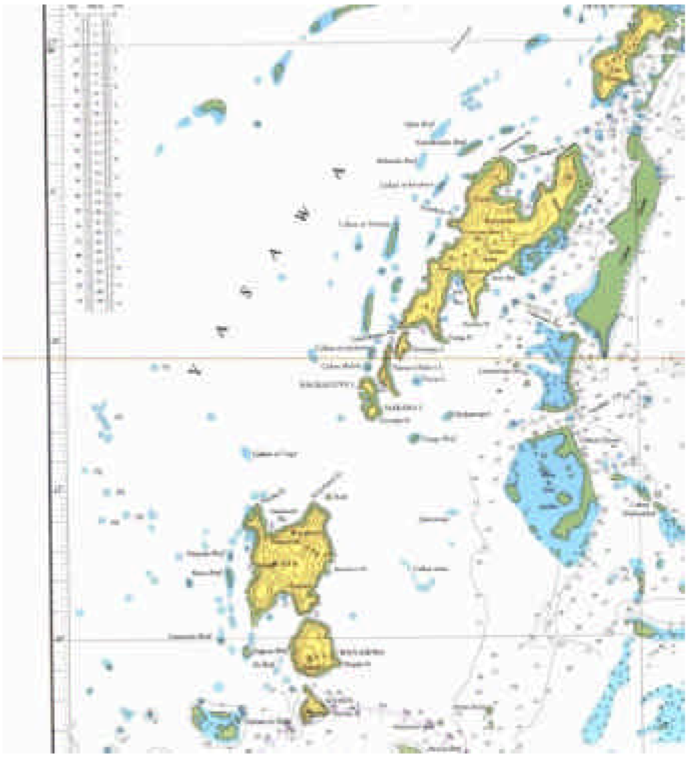

***Figure 2:** A portion of the "F-5" chart illustrating the lack of charting and bathyntric detail of the Yasawa Platform west of Waya. Note Viwa is not on the chart* of the platform and outside the western boundary of the chart.

industry using modern GPS navigation systems against backdrops based on practically non-existent chart data that has datum incompatibilities and certainly not to modern-day standards. The *"F – 5", Figure 2 a chart released by the Fiji* Hydrographic Department in 1986, is the only available chart for the Yasawa Islands and clearly indicated how much of

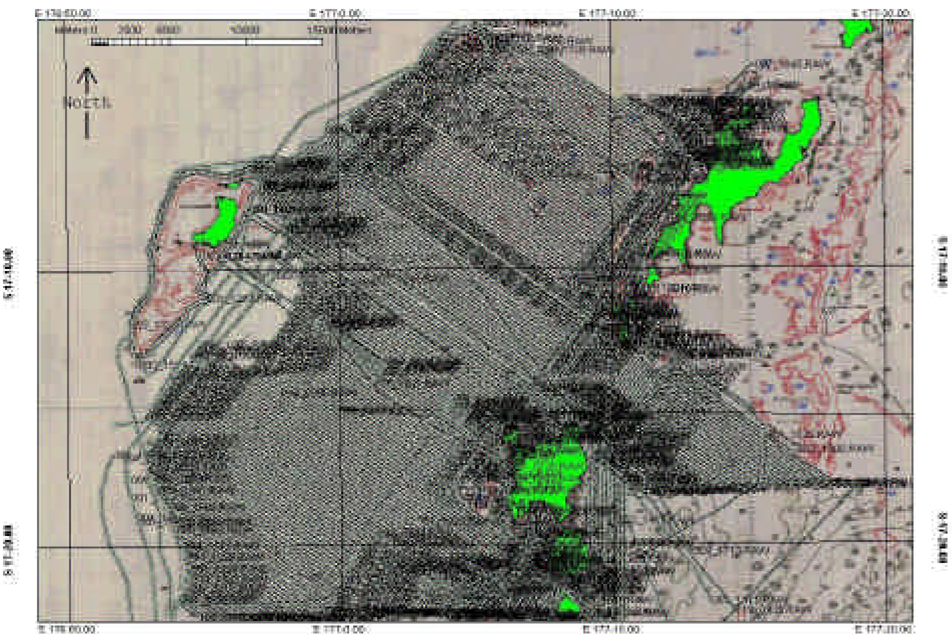

***Figure 3:** Track plot illustrating line coverage in subject area. Line spacing variable ranging between 200 and 250 metres determined by water depth*

the area remained uncharted. Viwa Island the most western island in the group lies on the western edge

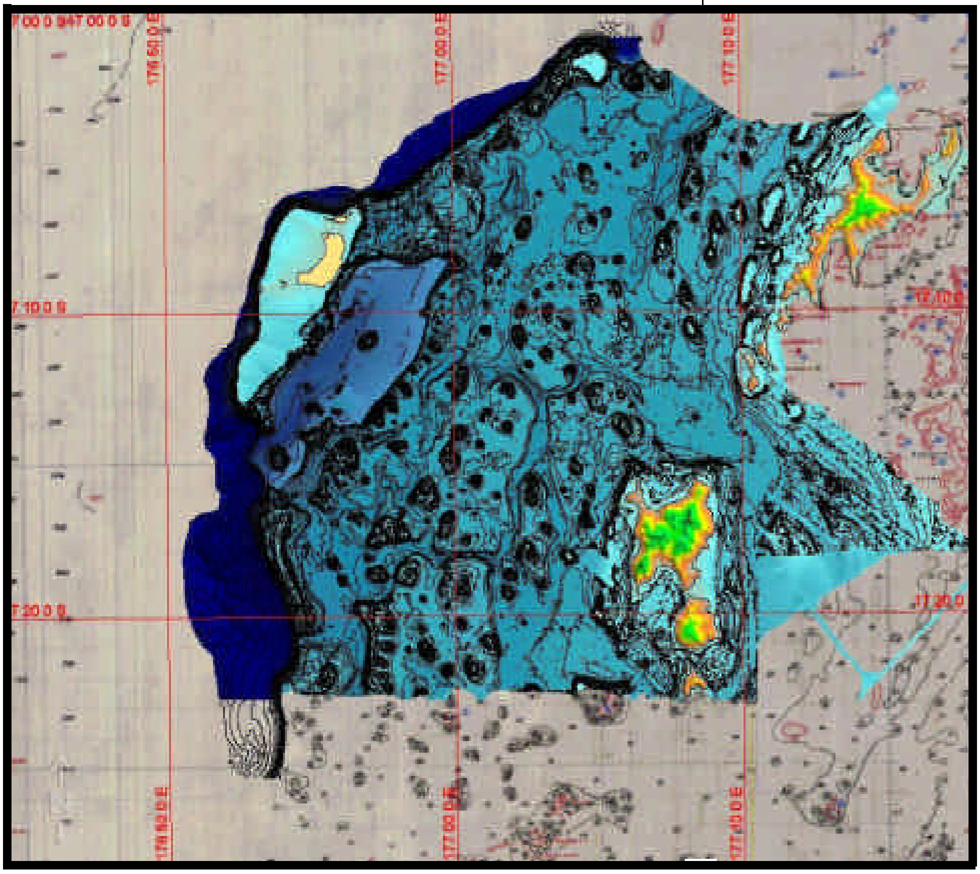

*Figure 4: Contour map of the bathymetry of the Yasawa Shelf illustrating a complex.*

With limited resources to survey an area of 4,000 $km^2$ to modern-day standards the Fiji Hydrographic Department sought the assistance of SOPAC for the use of their multibeam mapping system, a RESON 8101, to jump start their Yasawa mapping programme. The principal objective of the programme was to produce a new chart for the Yasawa and Mamanuca group of islands. In 2005 four months of survey work was completed; and in 2006 another month. This collaborative effort resulted in the acquisition of 5500 line kilometres of multibeam, sidescan and backscatter data covering an area of approximately 2000 $km^2$ illustrated in figure 3 .

Based on the results of the mapping a new contour map for the platform was generated. This is shown in figure 4. As such is the detail in the data set contour interval on the platform is 5 m from 0-200m water depth and 200m from 200m to 2000 m.

**Seabed morphology**

The benefits of this combined mapping exercise are just beginning to unfold along with the almost magical landscape of the Yasawa platform heretofore hidden even from prying remote imaging satellite sensors. The very complex seafloor morphology with numerous patch reefs, drowned barrier reef systems, a network of structurally controlled valleys and channels, fault scarps, fault-controlled basins dramatic fore reef slopes with 500 m scarps have now yielded their secrets. Offshore submarine canyon development is surprisingly limited. With such a complex morphology a complex hydrodynamic flow regime is likely to exist across the platform, hence a considerable diversity in the marine biodiversity can y of these features are shown in figure

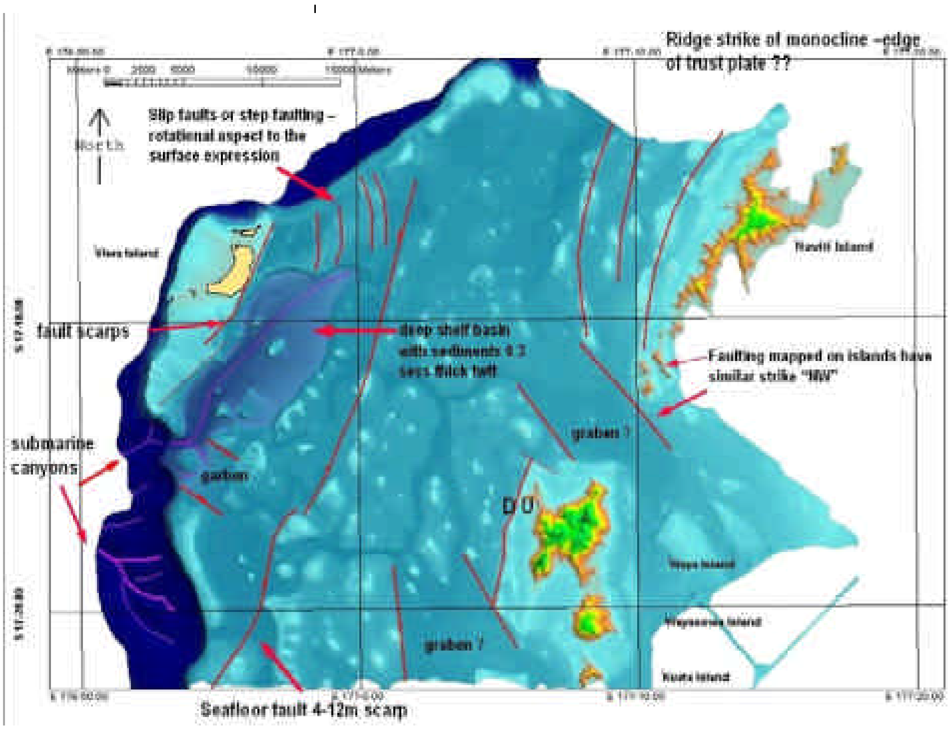


*Figure 5 : Interpreted structural features of the Yasawa Shelf from the multibeam data set*

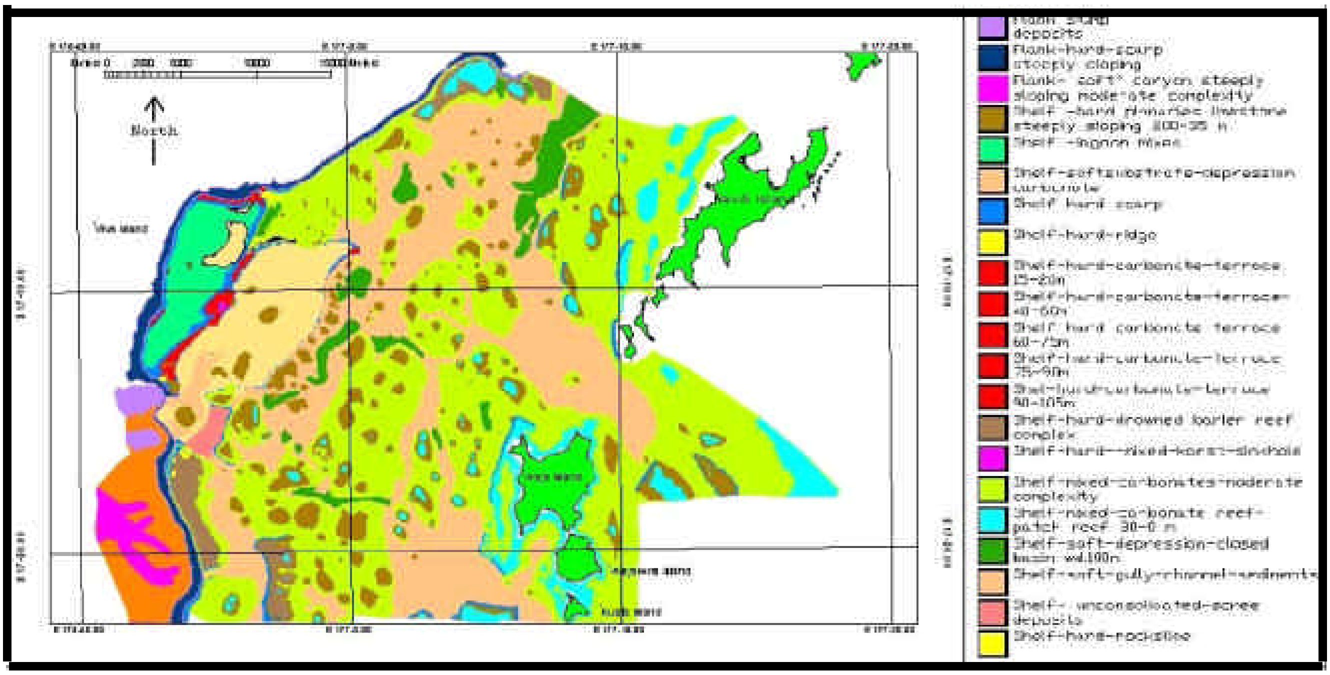


***Figure 6**: Habitat map of the Yasawa shelf.*

5. The interpretation of key habitat areas is based on a habitat scheme from (Greene et Al 1999). In this scheme habitat areas or zones are defined by a combination of parameters all of which are a product of the original data set. These include and are not limited to depth, structural interpretation of contours, 3D visualisation, sidescan data and mosaic backscatter data providing information on the nature of the sediments of the seafloor, seismic data providing data on sediment thickness and internal structure. Some seventeen different habitats were defined based on the Green classification scheme and this compilation is shown in figure 6.

As an example of the benefits of developing such habitat maps one such habitat explored in this dataset is home to a diverse group of fishes commonly referred to as bottom fish that are found on the fore-reef slopes, pinnacles and seamounts at depths between 100 – 500 m and is highly prised for the quality of its flesh. Typical habitats sought by fisherman for these species are shown in figure 7.

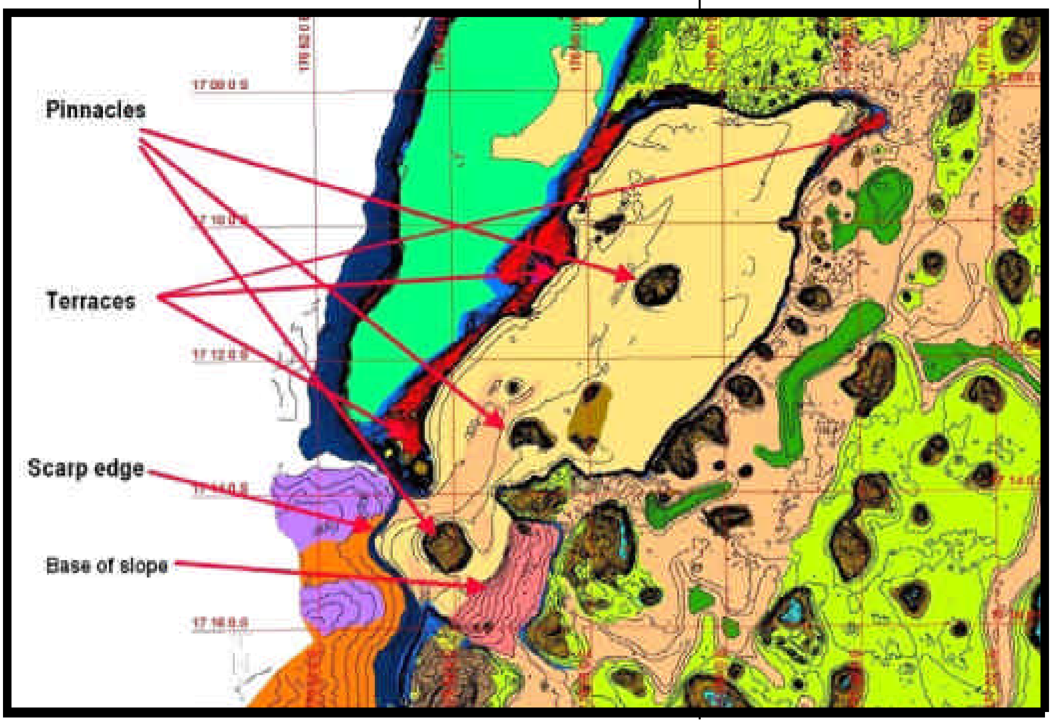


***Figure 7:** Habitats of the deep water demersal snapper species .*

In conclusion apart from producing a new chart for the Yasawa waters, the same dataset can further exploration into the natural resource potential of the area in fisheries, habitats, coral research, exploring climate change and sea-level rise value adding to what maybe considered a conventional data to many.