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Fiji and South Pacific GIS/RS news

The Newsletter of the Fiji GIS/Remote Sensing User Forum
Issue 98/01
April, 1998

Newsletter Re-activated!

After a year and a half break, the User Forum newsletter is back in print

The last newsletter for the Fiji GIS-Remote Sensing User Forum came out in June of 1996. Since that time, the only record of what has been happening at the meetings was the minutes, which are not that widely circulated. While GIS activity in the Government sector has been covered by FLISnews, other projects, events, and developments were no longer brought to the attention of the South Pacific Island GIS community. With the re-establishment of a newsletter for the User Forum, it is hoped that a wider sharing of different types of information can occur. However, starting a newsletter and keeping it going, are two different things, as we shall see.

On new beginnings...

by James Britton, GIS Unit, USP

After some discussion at the user Forum meetings, further work by myself and Dr. Wolf Forstreuter, and the contributions of our helpful writers, the GIS/RS User Forum newsletter is finally up and running again. The revitalisation of the newsletter comes at a time when we have seen a change in the makeup of the User Forum itself. The inclusion of the utilities members back into the larger group reflects a number of changes in the activities of the User Forum and a maturing of the whole GIS community in the South Pacific. You will see how this edition of the newsletter reflects these developments.

New beginnings are exciting, especially with a journal like this one. There is usually plenty of vision for what is wanted and where things might go, and enthusiasm is generally high. People know what it was like when there was no newsletter, so there is a real desire to make the new publication work. However, the real key to the long-term success of this newsletter is continued contributions by all members of the GIS community. The newsletter seeks to meet the needs of as many members of the GIS community as possible, and to this end we have structured the newsletter to accomodate a wide range of items. From larger, more theoretical articles to short technical pieces, to two-line social notices...if it affects the people working with GIS in Fiji and the Region, we want it in here somewhere. *Please, please, please* contribute to future editions of this newsletter. If you do not, it will die.

We anticipate receiving contributions from as wide a possible range of GIS users and interested parties in Fiji, the Pacific Region, and overseas. The end result will be, we hope, an informative journal that will allow the reader to learn more about GIS activity in the Region, and about some of the more important world-wide trends and events in GIS, Remote Sensing and related disciplines. Of course, our main goal will be to keep you up to date on what is happening at the monthly meetings.

In this new issue we have presented our articles so readers can get a sense of the different types of content in the newsletter: user meeting news, featured articles, opinions, local news updates, world-wide GIS events, social and personal news, and how to contact the editors. From this, readers can quickly select the parts of the newsletter they wish to read and get a sense of how their contributions might fit in.

What we have tried to do in this new format is to bring some structure to the newsletter, yet keep the informal style of the original newsletter. After all, one of the strengths of the User Forum is its informality. Time will tell if this is how the readers want to keep it. This issue is a starting point based on what the newsletter was before, plus experiences I have in publishing newsletters and journals overseas. I would appreciate any comments you have on the format and content of the newsletter.

Above all, read, digest, and, hopefully, enjoy! If you like what you see, tell your friends, if you don't, tell me, or any one else in the editing team!

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Publishing

Fiji and South Pacific GIS/RS News is published through the facilities of SOPAC and The University of the South Pacific in Suva, Fiji. Besides acting as the newsletter of the Fiji GIS and Remote Sensing User Forum, this publication serves as an information and news link between individuals and organisations across the South Pacific Region who are interested in GIS, Remote Sensing and related disciplines. The primary focus is on advances in these areas and how GIS is developing within the Region. Articles focus on individual projects and organisations, new trends, technological problems, human resource issues, successes and failures. We encourage all types of contributions on a variety of topics from both new and established members of the GIS community both regionally and internationally. If you have an idea for an articles, please contact any member of the editing team listed below for advice and development help. We can offer friendly assistance with article development.

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Instructions for submission

If at all possible, please provide unformatted digital content. Graphics should be in separate files in their native formats. You can send these via email, or by floppy disk (IBM or Mac format) to any address above. We can work with most text and image formats. If you have any questions about submitting articles, please contact the editorial team listed above.

First Meeting of the New Year.

Fiji GIS/Remote Sensing User Forum
Minutes of February 1998 Meeting
Library Conference Room, USP
Tuesday, 10 February, 1998

Welcome

James Britton, Acting Director of the USP GIS Unit, opened the meeting at 14:15.

All 19 attendees introduced themselves, and special welcome was made to members attending for the first time.

Representatives from: USP, Lukemine, NLTB, FLIS, Bureau of Statistics, Telecom, SOPAC, Forestry Department.

Updates

Lukemine:

New MapInfo License in Forestry, and ongoing upgrades to MI4.5

Forestry:

River system for forest cover mapping at 1:50,000 scale is now being processed and output at various sizes using new DesignJet 450C plotter. Local prints at high quality are now available.

Arc/Info plantation 10:000 forest plantation mapping project ongoing; however, MapInfo software is now supporting project for various database queries and output. Work continues on the plantation and inventory database linkage.

A major future project is the Mataqali data integration project with the NLTB. The project, which is currently in the formative stages and should commence soon, will see the integration of Mataqali land ownership and resource data.

Logging plan mapping continues, with 7,000 of 9,000 ha. currently completed.

Fiji Land Information System:

FLIC — new council members: Permanent Secretary National Planning (Robin Yarrow), Managing Director Telecom Fiji.

CCMS and Topo sections are now being relocated to the 2nd floor of the Government Buildings. For data supply their new telephone numbers are CCMS 211-453 and Fiji Topo 211-722.

Projects:

Fiji Topo: Vanua Levu, Viti Levu, Kadavu and North Lau, have been captured. Kadavu, North Lau, and part of Vanua Levu awaits field checks. South Lau is currently being captured. We hope to capture the whole of Fiji by June this year.

NLC Mapping: Fifty-four NLC sheets out of a total of 410 sheets have been captured.

Election Mapping: Work has started on the Election mapping using data from the BOS.

Systems Integration: Systems migration from Arev to Oracle.

Pilot Projects in Progress: Fiji Police/GIS/MapInfo. Crime Analysis and Accidents.

Training:

Silika Tuivanuavou University of Queensland (M.Sc. GIS), Rt Jone Seniloli and Ben Ralogaivau attachment training for 6 weeks next month.

NZ Consultants:

Feasibility studies on the state land sales in Fiji.

NLTB:

Mahogany stand definition project almost completed.

USP:

Lab upgrade to Idrisi for windows version 2.

Successful semester last year with several students graduating with GIS Diplomas and Degrees with GIS specialisation.

Completed lab refurbishments during break.

Bureau of Statistics

Inia has moved over to FLIS, however new hire is expected soon.

Telecom:

Base data completion projected for June 1998. Sixty percent of land coverage is now live.

Training is ongoing with workshop and completion by August 1998.

SOPAC:

Conducting workshop March 10-12 in the Cook Islands on GIS for marine resources and disaster relief managers.

FEA have begun project similar to work already underway in Solomon Islands.

Working on cadastral mapping project in Nuie.

Distributing MapInfo 4.5.

Working on Lagoon Modelling project.

Presentations

Two presentations were made.

Using Landsat data to monitor land degradation in Malawi.
Dr. John Soulsby, Geography Department, USP

Developing GIS network in Surinam
Dr. Wolf Forstreuter, GOPA-Consultant, SOPAC

Instead of a third presentation, the agenda called for round-table discussion on the year ahead and what it held for the current user group, GIS and Remote Sensing in general in Fiji, and any other issues the members wanted to discuss.

Kevin McConell indicated he was concerned over the lack of input from the survey community and the current state of affairs in surveying at USP.

James Britton of USP responded that the survey equipment currently fell under the control of the Land Management Program and that there had been a retirement from the faculty at USP. He expected the current survey equipment including GPS capability would be used as soon as the person was replaced, or failing that, the GIS Unit would be more than happy to help with this equipment.

On the second issue, Mr. Britton responded that if Mr. McConell felt the surveyors should be included in the discussion on GIS, there was nothing stopping him from asking them to join in. Mr. McConnel suggested he might approach them over this.

The re-activation of the newsletter was discussed at length. James Britton and Wolf Forstreuter agreed to meet and work to get a new issue out. Both warned that without continual member support, the Newsletter would not survive long.

James Britton outlined the potential of a two-day meeting for GIS-related users at the end of the year. Mr. Britton had raised this issue briefly at the previous User Forum meeting and at that time had asked the members to consider the idea. The response was that such a meeting was a good idea and that USP should proceed with the organisation of such a meeting. Formatted as a mini-conference, the meeting would allow the main GIS organisations to outline the challenges and advances they have made during the year and what they see happening in the coming year. The meetings could also include sessions outlining interesting projects, new techniques, or student work. The conference could conclude with a panel discussion that summarised the important and common themes from the previous sessions, plus offered opinions on what the way ahead might include. This session could include an open discussion of interested parties.

In terms of discussion for the overall direction of the User Group for 1998, it was noted that many members of the utility sub-group and others were not in attendance. It was suggested that the acceptance by FLIC of the decision to merge the two user groups had not been circulated widely enough. There was strong support for a wider and earlier notification of the next meetings and indication of the importance of this "directions" discussion. It is requested of the next meeting host to bring this to the attention of as many people as possible.

Other Business

None

Next Meeting

Telecom suggested that they might be able to host the next meeting.

Close

James Britton thanked everyone for attending.

Utility Members Join Forum.

Fiji GIS/Remote Sensing User Forum
Minutes for the March 1998 Meeting
Fiji Land Information System Support Centre
Tuesday, 24 March, 1998

Welcome

Laisa Raratabu, Senior Technical Officer, FLIS, Opened the meeting at 14:15.

All 22 attendees introduced themselves, and special welcome was made to members attending for the first time.

Representatives from: FLIS, USP, MRD, NLTB, SOPAC, FEA, Bureau of Statistics, Telecom, and Forestry.

New members: Fiji Police Force, Lautoka City Council, Wood & Jepson Consultants.

Updates

Fiji Land Information System

Projects

Fiji Topo: Part of Vanua Levu, North Lau, and Kadavu, awaiting field checks. We hope to capture the whole of Fiji by June this year.

NLC Mapping: 62 NLC sheets captured out of a total of 410 sheets.

Election Mapping: Work on the Election Mapping is continuing using data from BOS. Cartographic work has just begun.

System Integration: FLIS systems integration, this includes the Lands Rental System (Oracle). Lease Admin and the Valuation system (in A-Rev migrating to Oracle).

Vanuaview: A system to be developed by Terralink NZ. "Vanuaview" is to replace the Cadastral sheets on our Public Service Counter and to generate prints we need Vanuaview's rapid, easy-to-use spatial viewer. Our focus is on the access to the computerised land information. Another feature is that Vanuaview is seamless.

Year 2000 Compliance: FLIS is working on this and it is now a project that must be completed by the end of this year. FLIS is working closely with ITC (Min of Finance) on this issue.

Police Pilot Project: Database design on Microsoft Access has been completed. Mapping of Police Beats and Stations to be completed next week.

Training

Jone Seniloli and Ben Ralogaivau (Registrar of Titles Office) are currently on a Short Term Training Attachment in Terralink NZ (focus on DBA).

Josefa Uluibua and Paula Muayara have just recently completed one week TCP/IP training at PacSoft.

Graduate Trainees

Just appointed GIS/Specialist and a Programmer.

Property Addressing System for the Republic of Fiji.

An action group was formed to be chaired by the PS/H&UD with reps from PWD, Lands, Local Govt (SCC), National Fire Authority, Ministry of Regional Development.

Lukemine Enterprises

Mapinfo:

SOPAC continues to order upgrades to version 4.5 for member countries. Enquiry from the Fiji Police Force.

Trimble GPS Equipment:

Conducted 3 days' training on real-time DGPS equipment for USP Marine Studies Program personnel using their new equipment. This comprises a base station and antenna/screen combination placed on a boat, as well as Radio Links at base plus a repeater. Positional accuracy of around 5 metres will be available to 60 km from Base, which is fixed or portable. This equipment is a small part of project funded by the Japanese, and will be handed over, along with building and scientific equipment, in April.

SOPAC has taken delivery of 4600LS bundle and 6 GeoExplorer handhelds. The pair of 4600LS will be used to survey control points up to 20 km apart with sub centimetre accuracy. They are also capable of real-time DGPS. One of them has been upgraded to 12 channel and is intended for use as base station for the GeoExplorers. Positional accuracy of 2 to 5 metres up to 200km from the base.

Telecom

Shandil is touring Australia, Hong Kong and India for research on Block Wiring into Building and on GPS.

63% of all exchange converted to digital format with current GIS Project targeted to finish by May.

NLTB

Lease input and data editing of NLC boundaries for central and eastern division. This editing had been done before but because of transfer from InfoMap to InfoCad, it has be to redone.

USP

Courses continuing. More later in the meeting.

Lautoka City Council

Microsoft Access database ready to be attached to maps. Waiting for approval for purchase of Mapinfo Software.

Bureau of Statistics

Ms Turenaga Christopher has replaced Inia.

Polygonising EA boundaries of Ba, Naitasiri and Rewa.

Registering of new EA numbers.

SOPAC

Les Allinson and Franc Martin is in Cook Islands for GIS workshop and assistance to Ministry of Marine Resources and National Disaster Management.

Power Utility Project with FEA ongoing.

Hazard assessment mapping using GPS ongoing.

MRD

Metadata System was produced using MS Access. Available through MRD's Local Area Network since December 1997.

Automating and customising GIS application using MapInfo and MapBasic. Available through LAN since February 1998.

MapInfo 4.5 operational at MRD.

Forestry

Data transfer from ArcInfo to Mapinfo.

NLC and Forestry Pilot Project: Using GPS to confirm mataqali boundaries on 1:10000. Completed Nukurua Forestation.

2100 hectares of native forest logging plan maps done on Microstation last month.

Presentations

Two presentations were made

GIS for FEA Power Utility
Rupeti Levaci

Forest Monitoring System in Yunnan, China
Wolf Forstreuter, GOPA-Consultants

Round Table Discussion

New Name:

Members agreed to keep the existing name.

Newsletter:

James Britton and Wolf Forestreuter are working on a new issue of the newsletter which should be ready by first week of April. They need continual member support. James Britton said that the articles from members need not necessarily be on what is happening, it can also be opinions. Both requested the articles to be in digital format so that they do not have to be retyped.

Osea Tuinivanua suggested funding from FLIC for publication of the newsletter. Wolf Forestreuter said that as long as the newletter is published in monochrome (B&W), SOPAC is willing to publish, all they need is support from the members.

Mini Conference:

In the last meeting, the idea of a two-day mini conference had received a positive response and James Britton was asked to proceed with the organisation. James has a booking for N111 lecture hall for 2 and 3 December. James is to present to the June FLIC meeting.

Next Meeting

MRD will host the next meeting.

Close

Laisa thanked everyone for attending.

ERDAS Imagine 8.3.1 for MSD-Forestry

By Osea Tuinivanua
Management Officer MSD

As part of an on-going commitment to increasing the quality of work completed within the Management Services Division, Forestry Department (MSD), the Division has recently installed the latest upgrade of the Erdas remote sensing and image processing system. Erdas finally released Imagine 8.3.1, the PC version for Win NT/95 and Win 3.5 on January, 1998. The new system will work in conjunction with or independent of the existing Imagine 8.2 installation at MSD.

The new version offers a number of improvements, particularly a system-wide graphic user interface, automated processing and advanced data access and management methods. The entire structure of the system is broken down into three major groups, as opposed to two in Imagine 8.2. These are

- *ERDAS Essentials*: image enhancement, geocorrection, visualisation and mapping;
- *ERDAS Advantage*: orthocorrection, image processing and GIS Analysis; and
- *ERDAS Professional*: radar analysis, advanced classification and graphic spatial modeling.

Version 8.3.1 includes a number of useful add-on modules such as

- *Imagine Vector Module*: import and export vector data and clean and build topology etc.;
- *Imagine Orthomax*: photogrammetric toolkit for generating DEM and orthophotos from satellite and aerial photos etc.;
- *Imagine Virtual GIS*: 3D flythrough, visualisation and data query; and
- *Expert Classifier*: advanced classification.

Also available is the module *ERDAS Mapsheet* for map presentation in MS Office 97 and Win NT/95.

Both applications will be used in the processing/mapping of satellite imagery, aerial photos, captured digital data overlaying and thematic mapping of forest and forest-related information.

For further information contact: Osea Tuinivanua, Management Services Division, Forestry Department, P.O. Box 3890 Samabula, Suva, Fiji Islands, Fax: Fax: +679-320311, e-mail: `msd@sopacsun.sopac.org.fj`

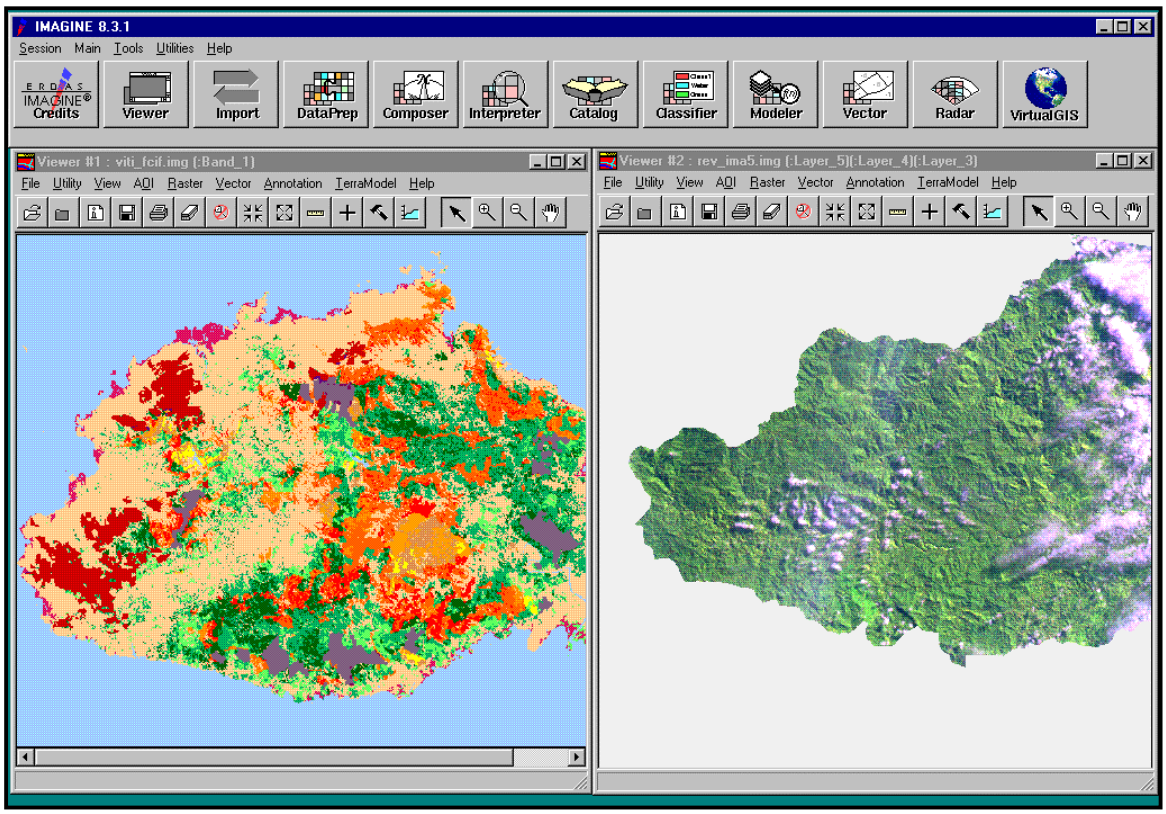


Figure 1: The screen display shows the new ERDAS Imagine. The left window displays the Forest Type / Forest Function map available at MSD, and the right window shows an image display of Landsat Thematic Mapper Data covering a water-shed.

Forest Type/Forest Function Maps as an Example Application of the 1:50,000 Infrastructure Layer for Thematic Mapping in Fiji

by Asesela Wata
MSD-Forestry

Background

In 1994, the Management Services Division, Forestry Department (MSD) had to produce Forest Type/Forest Function (FT/FF) maps, which would show Fiji's forest cover stratified into different forest types and different forest functions. For orientation purposes and as background for the thematic data, it was necessary to include infrastructure elements such as the river system, road network and location of villages. At that time, the Lands Department provided the infrastructure layers on transparent film, free of charge. A company in Germany scanned these films and the resulting digital files are available from the Lands Department and MSD-Forestry.

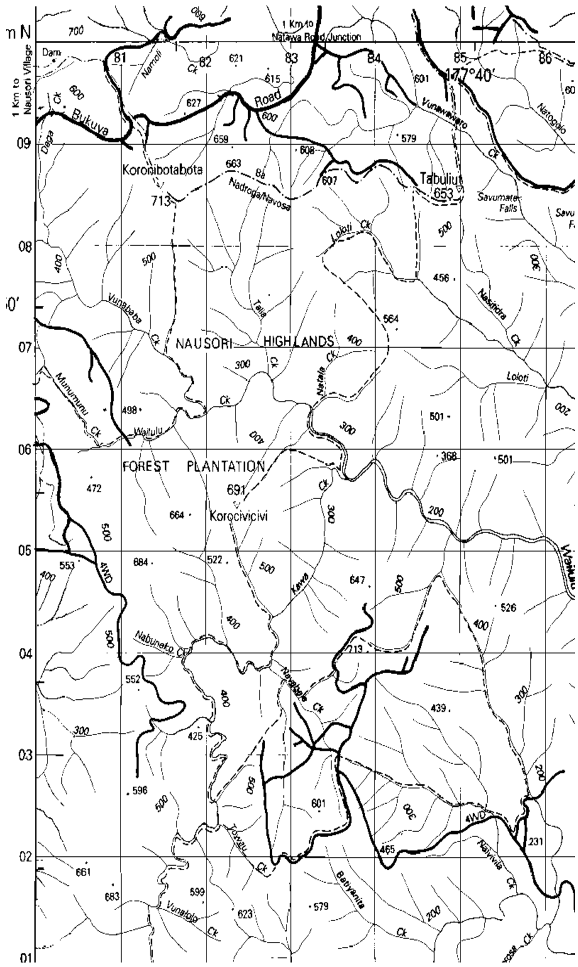


Figure 1: Digital Infrastructure Layer

The resulting infrastructure map files cover Viti Levu and Vanua Levu as well as some small islands. This data was obtained from all available new Lands Department map series and, where these were not available, from stitched-together maps from the old series.

Despite the ready availability of this excellent data set for physical data in Fiji, these files have only been used for one major project. In an EU funded project, the infrastructure data layer was used as the base for updated FT/FF maps. This article outlines how to use the infrastructure layer.

Utilisation of the Infrastructure Layer

With the maps from the EU project out of date and faced with the need to further develop these FT/FF maps by including logged areas, MSD again turned to the infrastructure layer as a base map. The key technique in this process is overlaying the thematic data (forest cover) with the available infrastructure layer. This means getting both layers to a compatible resolution. The infrastructure layer received from Germany on CD ROM was not geographically referenced and effectively very large in size. Therefore, MSD reduced the file size and executed geometric correction. The thematic layer was increased in resolution to match it to high detail linear features in the infrastructure layer.

Steps in File Transformation

The infrastructure films were scanned with a high-resolution scanner which produced, for each map sheet and layer, a file of about 500 MB. The first step is the reduction of resolution and file size of the infrastructure layer to meet the resolution needs of the thematic forest cover layer. This layer is derived from satellite images with a (resampled) pixel size of 25 x 25m (1/4 mm^2 on the map). This determines the layer size for a map sheet to be 1600 x 1200 pixels. If the infrastructure data is displayed at this resolution, linear elements such as roads would appear jagged. To appear smooth, the infrastructure layer has to have a pixel size of 1/16 mm^2. ERDAS provides necessary software for resolution reduction.

The scanning of the transparencies always produces a slight distortion in x and y directions. This is an internal hardware problem occurring with every photocopy ma-

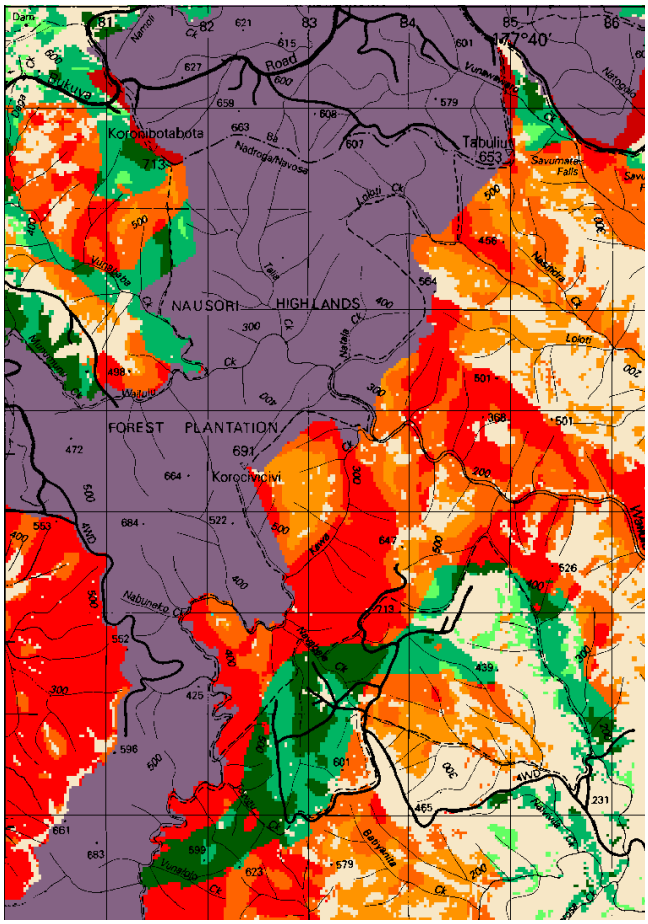


Figure 2: Infrastructure layer combined with Forest Function data.

chine. To overcome this, MSD carries out a geometric correction on the infrastructure layer using a linear transformation using the four map corners as ground control points.

To combine the 1/16 mm^2 resolution (infrastructure layer) with the thematic forest cover information both layers must have the same pixel size. This requires a resolution increase of the thematic layer, which can be performed by ERDAS software. The following overlay is a semi-automatic process.

Conclusion

Once reduced in file size and geometrically corrected, the infrastructure layer can be easily imported to MapInfo. Given this relative ease of use, many departments throughout Fiji could utilise this information as 1:50,000 backdrop in a variety of projects. Furthermore, GPS technology makes it very easy to update and add to the infrastructure layer.

For further information contact Asesela Wata at Management Services Division, Forestry in Colo-i-Suva, Fiji. Fax: +679-320311, e-mail: msd@sopacsun.sopac.org.fj

Regional Update

VANRIS in Vanuatu

by Erberhard Kobler

The Land Use Planning Office (LUPO) in Vanuatu will release a new version of VANRIS (Vanuatu Resources Inventory System) late in May 1998. In addition to the existing data in the previous versions of VANRIS, the new version will provide information about seismic activities, locations of bore holes, and the roads and boundaries of conservation areas in Vanuatu. This latest version of VANRIS, as in earlier versions, is built using Visual FoxPro and MapInfo.

The new version of VANRIS will introduce a new system of Land Classifications. The new classifications are not only more user friendly (for example, describing land use capabilities in plain English), but data has also been updated using satellite images that were purchased by the project.

The new version of VANRIS will include a new tool called *VANRIS Companion*. It is a stand-alone application that can be consulted while MapInfo Maps are displayed on the screen. The companion assists in the interpretation of the maps, and should make VANRIS easier to use and understand. The VANRIS Companion also contains additional sets of data about, for example, anchorages, moorings and polling stations. Look for more details in later editions when the new VANRIS is released.

Eberhard Kobler described VANRIS in a past Newsletter and will, hopefully, provide an updated description in our next issue. For any questions you can reach him via e-mail at either
kobler@vanuatu.com.vu *or*
ekobler@compuserve.com

Miscellany

Some Regional WWW URL's for GIS-related work.

SOPAC:
http://www.sopac.org.fj/

AURISA:
http://www.w3c2.com.au/aurisa/

Terralink, New Zealand
http://www.terralink.co.nz/

Bamboo, a plant for all reasons

by Linda Miller,
Bamboo Association of Fiji

The development of bamboo as a natural resource presents real opportunity for the people of Pacific Islands to participate in safeguarding the integrity of their coastal zones while developing commercial ventures. The marine and land ecosystems of Pacific Islands, which are inherently bound to the cultures of the people, now face complex demands for utilisation. Today, many coastal zones are threatened as a consequence of deforestation, and bamboo can be a mitigating factor in this degradation. In a series of articles, I would like to highlight the potential of bamboo in Fiji and the possibilities for integrated resource management.

One key to successful island living is to recognise the importance of maintaining the coastal zone integrity as the area of interface between the people and their environment. The health of this environment determines the ability of a local population to sustain their normal activities of daily village use in coastal areas. As populations increase and those daily activities escalate to include commercial endeavours, demands on the resources intensify and the health of the coastal zone becomes a prime concern.

In the quest for a better livelihood, it is the forest areas which often become the focus for utilisation and economic ventures; timber is cut for home use or for sale, land is cleared and converted to pasture or agriculture use. The land is then left vulnerable to degrading factors and the end result is damage to the coastal zone. All activities that lead to a degradation of forests upstream can lead to runoff, flooding, erosion and damage to the coastal estuaries and coral reefs. It would be ideal to investigate ways bamboo could be utilised in village activities to supplement or replace current materials and to develop income-generating enterprise.

Bamboo is a hearty, tall, perennial grass with tree-like habits that can thrive in a variety of environmental conditions from tropical rain forests to cool temperate climates. In a balanced tropical habitat its shallow roots share the terrain with other deep-rooted native timbers. Although bamboo is a natural habitant of a tropical forest, large stands often indicate previously logged or over harvested and abandoned areas, a situation which has occurred in Fiji. When areas become degraded, bamboo is a pioneer species that can rapidly reforest even marginal lands, stabilising soil erosion and with its ample leaf litter quickly help to rebuild soil health and watershed capabilities. Bamboo is habitually found along waterways where its dense growth and vigorous root matrix helps to prevent erosion and flood damage, yet does not clog waterways.

Fiji is in the unique position in that it possesses large stands of bamboo that are under-valued and under-utilised. Although bamboo is used wherever available in the rural sector (largely for rafts, house construction, and in agriculture), there are a great many ways to further utilise bamboo. This would increase the living standards of people as well as create self-employment and, potentially, other jobs. There is a tremendous amount of new research available that could improve the methods used in these current applications.

There has been no traditional commercial use of bamboo in the Pacific, yet it is an integral aspect of many Asian economies. It has no current application, either as an industrial resource on a commercial scale or from the harvest of natural stands to support village-based enterprise. This creates enormous potential for the use of bamboo in every application from rural domestic needs to the development of industry-based usage for value-added commercial enterprise.

Long regarded as the plant with a thousand uses, bamboo provides food, fuel, housing, handicrafts, transport, medicines, and millions of jobs for people in other parts of the world. In recent years, bamboo has achieved acclaim as a high yield, multi-purpose renewable resource. As one of the fastest growing plants (a recorded growth of forty inches in one day!) it can contribute to rapid reforestation to stabilise degraded areas and to create and protect valuable watersheds. This in turn creates a large biomass for generating oxygen. As a non-wood forest product, bamboo can yield extensive benefits in a wide range of applications from rural use in developing countries to high-end market design in first world countries.

Bamboo can be successfully integrated into natural forest regeneration and with timber plantations. Studies show mixed stands of trees and bamboo can improve the growth performance of both. As a fast growing crop, bamboo can be harvested as timber after 3 to 5 years and reduce pressure on wood timbers by providing an interim income while other trees continue to grow. It can offer an early windbreak for seedlings and a large leaf litter to amend and improve the soil.

Intercropping with edible crops is another common practice throughout bamboo cultures. The edible crops can be utilised while the bamboo matures to harvestable age, or the bamboo can be grown to offer support to the edible crops. Bamboo can thrive on marginal lands and can be grown for hedges, shade, and wind breaks and harvested for use as bridges, fences, plant supports, trellises, animal feed, water troughs and guttering, ladders and scaffolding, carts and wheel barrows, kindling and charcoal, simple tools and household wares.

The physical properties of bamboo allow many practical uses for its strong hollow stems. In areas of Fiji, bamboo is used as a vessel for carrying water, storage containers and cooking prawns and other steamed foods. These uses can be greatly expanded for home and commercial use. Many items can be made easily to create versatile and inexpensive domestic utensils to ease or enhance daily chores that may not otherwise be affordable. Bamboo products are environmentally friendly in a fragile island ecosystem where the choice of plastic and other artificial alternatives creates an ever-increasing pollution problem.

Traditional technology and use of bamboo can be broadened to create a variety of marketable products such as bamboo baskets, brooms, containers, vases, trays, blinds, lamps, picture frames, flower pots, fishing poles, toys, flutes, hats, etc. It is a versatile complementary material of wood, coconut, rattan and other natural textiles for small items as well as furniture, fittings and fixtures. These items would also have commercial and tourist value added possibilities when developed as a cottage industry.

Bamboo is a multipurpose species and is currently harvested in Fiji with no concern for conservation measures or its land management value. I would suggest that bamboo research be introduced in the new Forestry Management School. In selecting it for expansion, bamboo could play a more significant role in rural development through promoting the harvest of existing natural stands.

In the National Forest Resource Inventory using digital satellite images of Fiji, bamboo was included as a category for differentiation. In a recent report, Osea Tuinivanua (MSD--Forestry) reports having good success at being able to recognise and separate bamboo stands in their data. This data could be analysed to establish the location and size of bamboo stands within the coastal zones. With further evaluation, this information could be used to identify the availability for potential use by determining the proximity to village areas, roads and waterways, and if quantities suggest sufficient resources to support a level of development. This data could be used to direct areas of priority for ground surveys for a complete resource assessment.

The Bamboo Association of Fiji has been formed to encourage the wise development of bamboo in the Pacific. It recognises the need for a complete resource assessment of bamboo before any development is considered. With this base information of the existing resource, it is then possible to determine areas of market potential and to support sustainable economic development.

In conclusion, the connection between the role of tropical forests, bamboo, and health of the Pacific coastal zone needs to be well documented. The well being of the coastal zone marine and land ecosystems will be a defining factor in the ability of island community cultures to survive and perpetuate their customs. There is an abundance of bamboo growing within existing forests and in wild stands around cultivated areas, and there is considerable potential to further cultivate new stands of bamboo. The number of ways bamboo can be utilised in rural applications as well as for economic ventures warrants further investigation in the Pacific. The development of bamboo as a natural resource presents a real opportunity for the people of Pacific Islands to create sustainable economic ventures while simultaneously contributing to the preservation of precious coastal zones.

Regional Update

GIS/RS User Group formed in Solomon Islands

from information supplied by
Martin Rasu, SIEA

On the last Wednesday of each month, representatives from six organisations in the Solomon Islands meet to promote GIS applications for Utilities. The "Utility Planning Committee" is made up of The Solomon Islands Water Authority (SIWA), Telecom, the Ministry of Works, the Honiara Town Council, the Lands Department and the Solomon Islands Electric Authority (SIEA). They have common requirements and questions from geographical information, such as

- where are the routes of lines, cables, pipes, etc.?;
- where are critical points at which disturbances could take place?;
- how can new settlements be planned in an economical way; and
- how can consumers be serviced in more efficient ways.

GIS is established already at Telecom, the Lands Department and at SIWA. SIEA is currently building its GIS under guidance and support of the Pacific Regional Energy Program (PREP), which is funded by the European Union.

The Need for Homogenized and Structured Databases Containing Information on the Availability, Structure and Characteristics of Existing Spatial Data

By, Prakash Narayan,
Mineral Resources Department

Introduction

Large quantities of digital data are generated from various sources and by various organisations for the land and ocean area for different regions or the country as a whole. Knowing the availability of land and ocean coverage is very important as this can help to reduce, or even eliminate, the creation of duplicate coverages of any one area. Given that the creation of the required spatial data is a large component of any GIS project, the possibility of using existing data rather than creating redundant datasets becomes a very attractive option.

Metadata is the term used for the description of a dataset. Besides just describing the data, metadata provides the means for users to understand data content and format so that the data may be correctly converted, integrated, and interpreted. Metadata also indicates the characteristics and appropriate uses of data. However, the term Metadata and the mechanics of implementing metadata directories are poorly understood and not generally well followed.

The Mineral Resources Department (MRD) did embark on a task to produce metadata directories for the datasets the Department holds. Metadata directories bring together the metadata from various datasets into a single repository where they are available for various interested parties. The MRD metadata directory is implemented through a very elementary database application developed using the current version ('97) of Microsoft Access. This software is currently available to MRD staff through the existing MRD computer network.

This article serves to increase the awareness and understanding of metadata, to underscore the importance of establishing metadata directories, and to outline the experiences of implementing such a metadata directory at MRD. The article also outlines what MRD is doing to promote metadata standards. It is hoped that increased awareness of the issues surrounding metadata and GIS will lead to wider cooperation among GIS users in the region and, possibly, the establishment of larger, shared metadata directories.

Metadata: what is it and why is it so important

Metadata is "data about data" or, more specifically, it is descriptive information about data and the availability of that data. The broad term "description" encompasses a wide range of database characteristics, from descriptive summaries to detailed discussions of attribute coding schemes. Metadata often includes data processing histories, file format specification, as well as instructions for obtaining data. The whole purpose of metadata is to facilitate access and to guarantee appropriate application of data.

Without metadata, GIS data is useless. Imagine someone giving you a CD with two words, "World Countries" on the CD cover. How could you use the data? Perhaps this CD is physically in a format you machine can read. Let's assume for a second it is, and you find one file, "WRDCNT" on the CD. There are no file extensions and no other clues as to the format of the data. Which software package is the data designed for? Which datasets are included in the data? What is the useful scale of the data? What attributes might be included? All of these questions, and many more, could be answered if the CD was supplied with understandable metadata. Metadata is like a card catalogue for the GIS data library. Without it, potential users of the library will take a long time, and possibly never succeed, in locating the information they need.

Unfortunately, most digital data users have had to decipher data for which there is no documentation as to format, source, or basic characteristics. In many instances, simply extracting information from delivery media can be a challenge. The tendency to avoid defining the metadata for a coverage is tremendous, just as it is for programmers to avoid creating documentation for programs after completion. However, well-defined metadata in widely readable formats reduces or eliminates these difficulties.

There are other reasons for defining quality metadata beyond allowing the new user to access the data through a particular GIS. Good metadata protects the developer's investment. For complex data sets, quality and up-to-date metadata must be available so users can correctly interpret analysis results. Metadata directories allow for easier searching of the availability of data, which is especially important as GIS becomes more popular and widespread. The availability of accessible metadata directories means that there is less likelihood of existing data being duplicated, which leads to redundancy and potential error.

How to identify essential metadata components

A little common sense goes a long way in this exercise. First, determine what you need to collect based on the purpose to which the GIS data will be put. Clearly the topic of what to collect is an enormous one. Cherie Barton, Software specialist at ESRI, puts it this way:

Metadata is information about a database, or a portion of it, such as a layer, an attribute, or specific features. Metadata tells what the database contains, how accurate the data is and even how you use it. Anytime you write down where data came from, who worked on it and what was done to it, you are recording metadata.

A slightly broader view, metadata is anything that anyone could conceivably want to know about data before they decided to use it.

Metadata can be broken down into two parts:

Basic identification information includes data set identification, currency, data description and theme, location, data set structure, source, resolution, data owner and custodian contact information and metadata custodian contact information.

Detailed information includes availability of the data set, acquisition information, operating system software and data processing, summary table of types of attributes stored, measure of positional and thematic accuracy, specification about the source, history, comments from users of the data set and listing of further resources.

The problem is deciding what to include and what to exclude. Standards are a good place to start. And it helps to keep the problem in perspective. Examine what is the intent of the coverage? Are your intended users specialised in their work? Is the data general purpose? Who will be using it the most ?

An excellent guideline is to ask the people who will use the data what else they would like to know about the coverage. If you have not stored the most important things about that coverage, your data loses value. It gathers no interest and it does not appreciate over time.

Let's be honest about it: collecting metadata is a somewhat boring task. This is especially true if you are not that familiar with the data from direct experience. Information about the data's usage and accuracy is critical information that must be correct. If this inforamtion is neglected or ignored, the quality of a dataset may be called into question. At this stage, the issue is one of data integrity, and this may contribute to errors of judgement on the part of the user of the data.

Towards the increased use and quality of Metadata

There are two main reasons why metadata is more rare than data itself. First, the creation of a metadata listing requires a time commitment that many people are not prepared to make. Second, even when properly developed, metadata sometimes becomes separated from the data itself. Providing guidelines and tools to facilitate metadata development and exchange can alleviate the first circumstance. Unfortunately, the second circumstance will remain a problem until GIS software vendors begin embedding metadata into their data structures.

New technologies in GIS and network communications provide many opportunities for the development and application of metadata resources. One can easily imagine being able to browse an organisation's on-line data catalogue, or to use an interactive map display on the Internet to determine data availability for a particular area, or to identify variations in data quality over a database. The establishment and adoption of a national metadata standard will help facilitate the development of standard systems for data exchange.

Metadata use will not expand until more users become aware of the issue and start to include metadata with all their data holdings and bring these together into centralised metadata directories. To this end, MRD believe that if an easy-to-use standard is developed with supporting tools, users will be more likely to document their data set effectively. Data exchange among users would also be greatly facilitated by the inclusion of standard metadata reports with data deliveries.

A draft metadata standard was proposed to MRD and is open for comments. MRD would also like to initiate discussions with other organisations that are working in this area and have created software tools that could be adapted to MRD requirements. Prototype metadata have also been developed under the draft standard. Interested parties are encouraged to contact the Author for more discussion and development on this issue.

Supporting Documents available at MRD:

Prakash Narayan, December 1997, *Geographical Information Systems(GIS) Metadata (December 1997 version)*, MRD reference MRD75/01 Mineral Resources Department(MRD), Suva, FIJI ISLANDS.

Prakash Narayan, February 1998, *Customising and Automating GIS applications*, MRD reference BP75/03, Mineral Resources Department(MRD) Suva, FIJI ISLANDS.

For further information contact: Prakash Narayan, Mineral Resources Department, Suva, FIJI ISLANDS. Fax: 370 039 (679) Email: prakash@mrd.gov.fj

NLTB/MSD-FORESTRY PILOT PROJECT

By Velemani Latilevu
MSD-Forestry

In 1995/1996, the European Union financed the mapping of Fiji's hardwood plantations. The purpose of this project was to identify the exact area covered by these plantations. This data would form the basis of a spatial database for monitoring further conversion from natural forest to plantations.

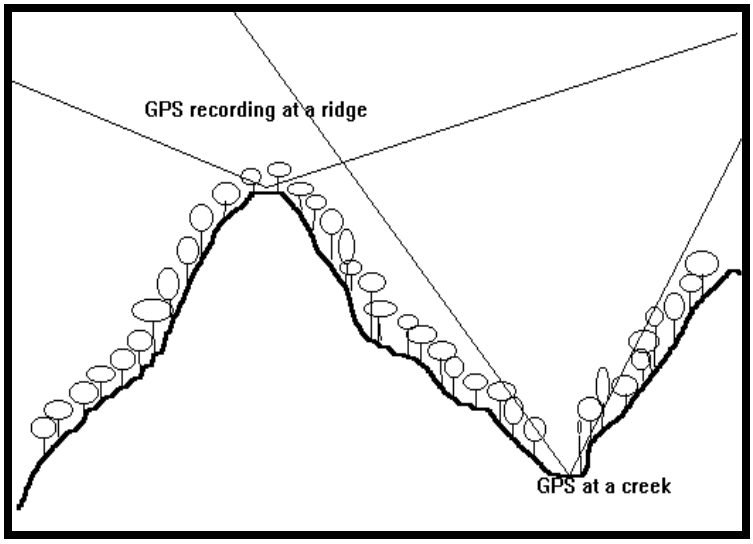


Figure 1: GPS receiving on a ridge and in a valley. In the valley the angle of view is smaller and is further reduced by the forest canopy

Plantations are mainly established on native leases and normally the lease boundaries follow the mataqali boundaries. However, there is no map series available in Fiji showing the geographically correct mataqali boundaries, because the official map was produced at a time when professional survey equipment was not yet available. Therefore, the plantation mapping project had to re-survey all plantation boundaries. This was completed employing a ZEISS Visopret analytical stereoplotter and differential GPS.

The use of GPS technology was not without problems. GPS receiving faced problems in valley situations wherever boundaries followed creeks or small rivers. However, these linear elements were mapped easily by stereoplotting. Where the boundaries followed ridges and other features which were difficult to identify in the stereomodel, a team, assisted by villagers, marked the boundaries, which were later surveyed by a second team using a GPS rover.

The spatial data from the GPS survey and stereoplotting were then combined using ArcInfo software. In addition, a tabular database (dBASE IV) containing the hardwood plantation inventory information was linked to the spatial database.

In 1997, the mapping was updated with an additional GPS survey. The update included unplanted portions in plantations, logged-out areas (mostly covered with *Pinus caribaea*), unconfirmed management boundaries, new roads, new stand boundaries and mataqali boundaries. Most work carried out during this year was the final editing of spatial information and map plotting. The availability of the more user-friendly MicroStation software (as opposed to ArcInfo) helped in this process.

All digital plantation information from ArcInfo were exported to MicroStation through DXF (the agreed exchange format for vector data in Fiji) for final map editing and production. MicroStation was connected to a high resolution plotter that produced excellent quality maps.

At the end of 1997, NLTB expressed interest to utilise the spatial database to update their information of native land use. The idea was developed into a pilot project

Figure 2: GPS survey of hardwood plantations boundaries in Vanua Levu

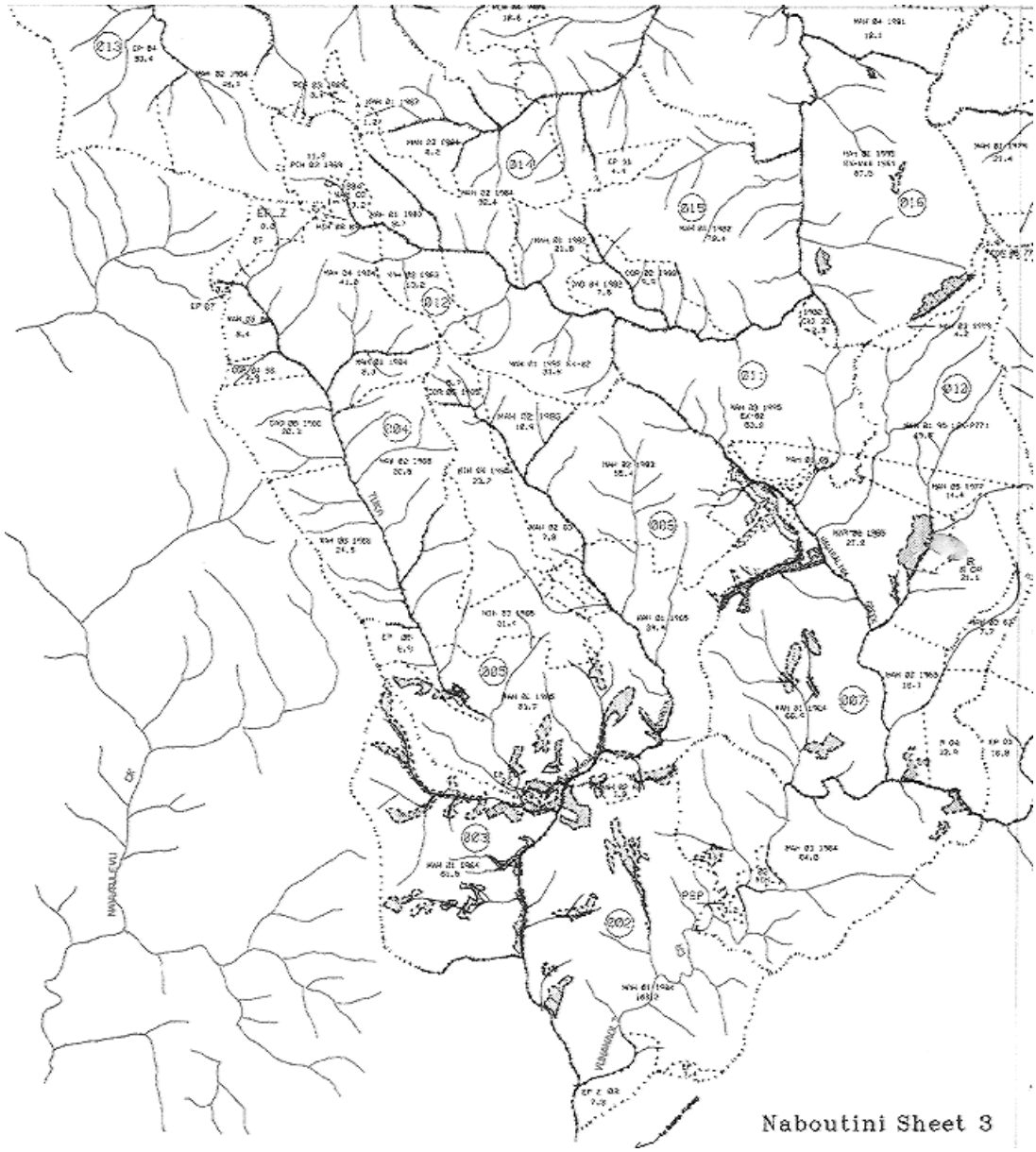


Figure 3: Hardword plantation map, drawn using ArcInfo at MSD-Forestry and then transferred to NLTB

to examine the problems and solutions associated with sharing data between agencies using different systems and with different mandates. The results of such a project would, hopefully, assist other agencies in data sharing.

NLTB uses the INFOCAD software while ArcInfo is used by MSD-Forestry. NLTB exports NLC data through DXF, which is accessible by Arc/Info. MSD exports all plantation data to DXF. Thus, DXF becomes the common link between different systems used by NLTB and MSD.

The combined spatial database linking forest plantations and land ownership units has many advantages. From the MSD end, the management team has a better decision support tool since the forest plantation boundaries are based on mataqalis. Interested land owners can get a better picture of the appearance of their land extent to the resources they have and possible indications for financial expectations.

The importance of this project increases as the Forestry Department approaches the corporatisation stage of the hardwood component. At the moment, only one Forest Plantation Station (Nukurua in Tailevu Provice) has completed data link to NLTB, while the others are in progress. MSD will prioritise the future stages of the project based on plantation maturity.

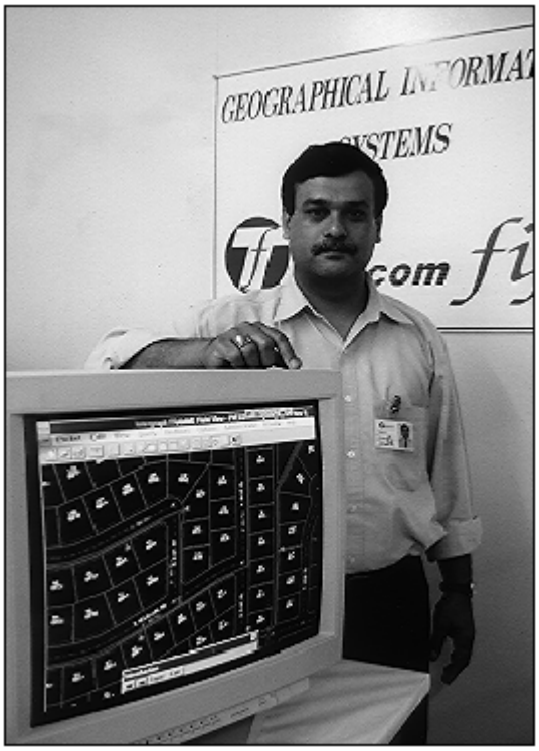
For further information contact Velemani Latilevu at Management Services Division, Forestry Department in Fiji, Colo-i-Suva, Fax: Fax: +679-320311, e-mail: msd@sopacsun.sopac.org.fj

Organisation Update

AM/FM GIS for Telecom Fiji, Ltd.

by Sukhendra P. Shandil
GIS Project Manager

Telecom Fiji Ltd. activated a new GIS at the beginning of 1997, and the implementation is now almost complete. The system presents data such as cabling works and infrastructure on-line via computer terminals. This is a marked improvement over having to produce the same information on manually drawn maps.



For instance, Telecom Fiji can attend promptly to customer queries about new telephone connections. With the press of a button, the front-line staff can tell a customer wanting a new telephone connection whether a telephone connection is available. Employees can also print paper copies of maps to use when they are dealing with customer queries.

The Telecom Fiji system is now in the data conversion phase. Telecom Fiji has opened the system to more categories of employees, and allows them to view database information from their own computer terminals. Employees can select particular areas on the screen for more detailed viewing. Certain viewers may need to see features like cable terminals, manholes, roads, or exchanges. But with view-only privileges the data is protected; viewers cannot change or remove data.

GIS data is available on the Telecom Fiji's Wide area and Local area net work. The employees in the operational, maintenance, development and sales area are now beginning to use GIS as daily assets and facility management tool. It is expected that by the end of the year 40 users in the remote sites in the three divisions will be able to get information in the fraction of the time that it used to take.

The data conversion for TFL is done off shore by Rolta International, a company based in Bombay, India. It is expected that by end of July '98 all data will be captured. As this article goes to the press, 60% of the data is in the digital format.

Currently, Telecom Fiji is enhancing the GIS by incorporating GPS data. The GPS will allow and help TFL's other utilities to locate their assets precisely.

For further information contact Sukhendra Shandil via e-mail:
shandils@is.com.fj

Systems Update

MapInfo 4.1 & 4.5 for MSD-Forestry

By Osea Tuinivanua
Management Services Division,
Forestry Department

The Management Services Division (MSD) of the Forestry Department located in Colo-i-Suva has recently expanded its range of GIS packages with the addition of MapInfo 4.1 and 4.5. This new system joins a variety of other systems already in use at MSD. The range of systems reflects the variety of functions and capabilities demanded by the different tasks completed by MSD.

Satellite image data supplements aerial photography for the countrywide overview of forest cover. The basic format of this data and past experience in developing countries pointed to the need for raster-based image processing software for this sort of work. Here, MSD uses the popular ERDAS software package, which provides fast overlay analysis necessary for any change detection, monitoring and planning.

Logging maps are another important forest management tool required from the MSD GIS. These maps indicate the areas above 30° slope-areas that are not supposed to be logged even within a logging concession. These maps also

show contour lines at 1:10,000 scale. Together, this data supports the environmentally sound planning of logging roads and tracks. Aerial photographs are used to build a DTM at 1:10,000 scale with a ZEISS Visopret stereoplotter. Production of these maps is facilitated through the use of MicroStation software, part of the Intergraph range of products. Microstation is used given the vector-based nature of this data and the need to connect with the Visopret stereoplotter.

The mapping of all Fiji hardwood plantation areas is also processed at 1:10,000 scale and requires a vector data based system. However, this project requires a strong link to the tabular plantation data stored in dBASE IV and extensive overlay operations on the plantation data. Because of these requirements, ArcInfo is used instead of Microstation.

While ArcInfo offers a robust data structure and good polygon overlay capability, data output and rapid visualisation is not so easy using ArcInfo. To support this sort of work, MSD has recently acquired MapInfo 4.1 and 4.5 for Win NT/95 and Win 3.11. MapInfo 4.1 has been widely used for the hardwood plantation mapping. The recently released MapInfo 4.5 offers a number of improvements over the older package, especially in data conversion from ArcInfo, which given the use of ArcInfo in the earlier stages of the mapping, has been most beneficial.

In conclusion, MSD has embraced the idea of flexibility and growth in its approach to software utilisation for GIS work. By choosing the right tool for each task, high quality and efficiency are always maintained. Such flexibility is not without cost, however. MSD staff have to remain eager to learn new software and new ways of doing things.

For further information contact: Osea Tuinivanua, Management Services Division, Forestry Department, P.O. Box 3890 Samabula, Suva, Fiji Islands, Fax: Fax: +679-320311, e-mail: msd@sopacsun.sopac.org.fj

Making it work!

The editing team: a flexible resource for new writers

As indicated on the front page, one of the main challenges facing this publication will be finding and developing material for publication. However, we do have a good resource to help readers and other interested parties get their ideas published: our editing team.

Our editorial team is here to help anyone who is interested in writing something for the newsletter. Experience shows that many people have the basic idea for a good article but do not proceed from this point. Why? Numerous reasons. Some people feel that what they have to say isn't that interesting. Others feel they do not have the depth of experience in GIS, Remote Sensing, or Computing to be able to write something that others would not criticise or correct. Yet others feel that they do not have enough writing experience to write something of high enough quality for the newsletter. And others are just plain shy.

For any of these reasons, and others, we have the support you need. Our team has a diverse range of experience and skills in both the applied disciplines we are interested in (like GIS and Remote Sensing), and in publishing. So if your problem is that you feel you do not know quite enough about a particular subject in GIS, you are not sure how to structure an article, or you are just not sure if a subject is interesting enough, we can help.

Wolf Forstreuter, Les Allinson, and Lala Bukarau have worked on the GIS & Remote Sensing News for a long time. They have a good sense of the background of the newsletter: what sort of articles have worked in the past and how articles can best meet the needs of the readers. They also have a range of technical and professional skills, which can help make your article better. James Britton has extensive experience in Cartography and GIS and edited a national-level Cartographic newsletter in Canada for a number of years. No matter what you are looking for, from a little encouragement or some specific technical help, you are likely to find the help you need in one of the editorial team.

We want to stress that the interests, views and opinions of all members of our readership are important, from the most experienced user to the person who just was assigned to do GIS work last week. Indeed, the views of someone fresh to our user community are often the most revealing in illustrating how entrenched we might have become. Please do not feel you have to be an expert to contribute. All views are important.

So, if you have an idea for an article, no matter how big or small, contact one of us. We will gladly help you get your ideas out to our readers. Our contact information is on the inside front cover. As the well-known advertising slogan goes, "just do it!"

Forgotten how? Check out the bottom of page 2, or call

James Britton: 212 620

Wolf, Les, or Lala: 381 377

GIS Activities at the Tonga Electric Power Board

By Edwin Liava'a
Senior Technical Statistician, TEPB

Prior to 1995, staff at the Tonga Electric Power Board (TEPB) recognised the need to combine their simple database system with existing power grid maps of the distribution network. The TEPB was selected as the pilot site for Regional Power Utility GIS after a successful submission to the Pacific Regional Energy Programme (PREP), a development support program funded by the European Union. The objective of the pilot study was to design, develop and implement a GIS to assist in asset management, maintenance and for planning purposes.

In May 1997, technical staff of TEPB attended training sessions in Fiji provided by SOPAC. To implement the GIS, the group chose MapInfo, MapBasic and Microsoft Access software, as they are cost effective and meet regional standards. By the end of May, the GIS was installed in Tonga and the system has been developing ever since. In August of 1997, a Regional Power Utility GIS workshop highlighted the work and development in the system to interested parties from various utilities around the region.

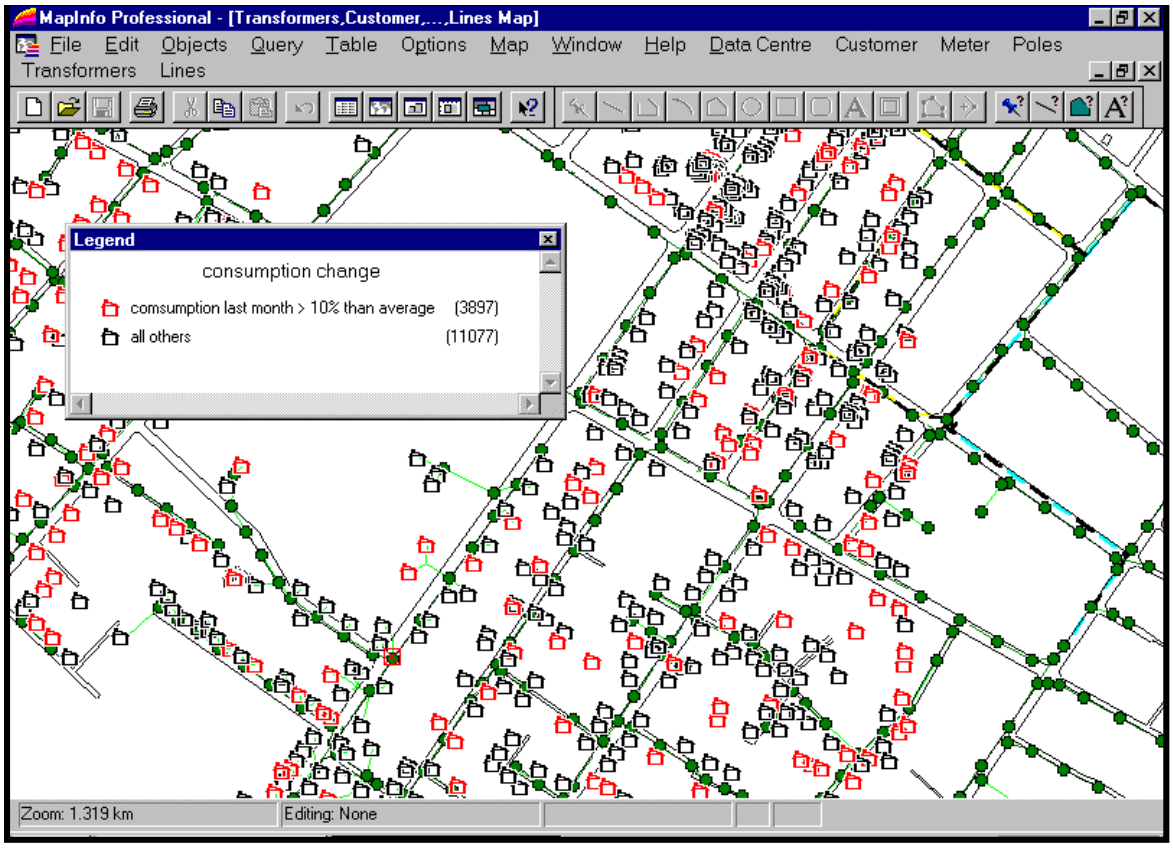
In August of 1997, the spatial GIS database only covered parts of Nuku'alofa. This database was created by connecting the relational database, i.e., Poles, Lines, Transformers, Customers, by digitisation onto the digital maps. Other layers like roads, coastline and a background image were also included to provide orientation within the spatial database. Since then, TEPB has completed the whole Nuku'atofa area, although there were some minor problems. Existing data had to be resurveyed when cyclone Hina demolished most of our power poles and lines. The only available digital information TEPB was able to obtain was cadastral data that only covered Nuku'alofa. Cleaning and updating the data took the usual extended period of time. Although spatial data is not yet available for the other parts of Tongatapu, the Nuku'alofa area accounts for the majority (75-80%) of TEPB's Power consumption. Most of our potential customers are found in this area.

At present, with only Nuku'alofa completed, the operation of GIS here at TEPB has been proved to be of great help in managing electricity distribution, managing our existing assets and planning where the objectives are cost efficiency and improved customer service. As an example application, TEPB can import consumption data from the accounts billing system to the customer database that indicates which phase the customer is hooked on to, i.e. red, yellow, or blue. By linking consumption and phase for each customer geographically, TEPB staff see areas where high consumers are all hooked on the same phase, thus pinpointing potential overloads and assisting in the planning of balanced phase connections.

An ongoing project by TEPB and the Tonga Water Board (TWB) attempts to combine the reading of each utility's consumption meters. The meter readers will read both electricity and water meters, rather than each utility running separate meter reading systems. There were problems with this idea: each utility had different routes and different systems for dividing areas into blocks for meter readings. Besides these logistical difficulties, the project had no way to get a geographical overview of the area in order to make the right adjustments and decisions. This was when our GIS came in. The Tonga Water Board distribution network only covers Nuku'alofa whereas the outer villages run their own water committees independent from TWB. With the help of our GIS, we were able to compare account numbers to the corresponding correct customer and highlight areas providing a geographical overview. Once the new system was set up, we could also print exact maps for the meter readers to carry with them until they get familiar with the new system.

TEPB is also embarked on making plans of approaching PREP/SOPAC with the intention of seeking support on how to get the rest of the digital information, e.g., the cadastral background for the rest of Tonga. PREP supports regional power utilities and SOPAC has the regional mandate for Remote Sensing and GIS activities.

For further information, you can reach Edwin via fax at TEPB +676-23632 or via e-mail by using the address of his supervisor Paula Helu (Deputy General Manager TEPB),
`pssc@candw.to`



The screen display above shows an example of the TEPB GIS. All consumers with consumption than average of last six month are displayed in red.)

GIS for FEA Power Utility

By Rupeti Levaci, Vilisi Kalou
FEA

The Pacific Regional Energy Programme (PREP) is funded with 4.5 million ECU by the European Union and assists the countries of the South Pacific to manage their energy in a sustainable way. PREP gives advisory and training assistance to eight ACP countries. One of the topics is the promotion of the state-of-the art planning and management tools[1]. Geographical Information Systems can help to provide a spatial overview of all power utility items necessary to distribute energy in an efficient way.

The Fiji Electric Authority (FEA) was founded in 1966. In 1979, the Monasavu dam was constructed. It was commissioned 1983 and now provides 90% of the electric power for consumers in Viti Levu. Before this, the different load centres in Viti Levu, such as Sigatoka, Lautoka, and Suva, were independent and not linked by an island-wide power grid. To implement this link, FEA had to make extensive additions to the transmission/subtransmission and distributing system.

In 1991, FEA recognised the advantage of managing important items of Fiji's power supply with the help of digital databases. At that time, the company selected dBASE III+ software to store all transformer data. In 1997, the regional PREP workshop on GIS for power utilities demonstrated the application of modern databases such as Microsoft Access. The workshop also showed the advantages of linking tabular data stored in relational databases with spatial data (digital maps). The workshop initiated a discussion within FEA management, which lead into a formal request to PREP. The European Union, as donor agency, agreed to set up a new project to help FEA and SIEA[2] in establishing relational and spatial databases.

While some data, such as consumer or transformer data, is already stored in digital files, most of the needed data was stored in non-digital formats, such as cards and printed reports. The project included conversion of the existing dBASE III+ data to MS-Access, and manual entry of the non-digital data to form an integrated FEA utility database. After importing all information, the integrity had to be checked and the various tables have to be linked together. The project created two different types of database tables:

"Basic Tables", containing descriptive information, e.g. the table "LineVolt", which keeps all voltage types existing in Fiji's power lines;

"Main Tables", containing all information necessary to manage all transformers, lines, consumers, meters, and power poles of Fiji's electric power utility, e.g. the table "Line" contains information about the voltage, conductor, length, etc. of the lines.

Some information is stored in graphical form, such as line dressing or possible stays of a power pole. The project scanned these drawings and linked them to the database. In addition, in some cases, photos are necessary to explain certain types of complicated asset items. These were also scanned and linked to the database.

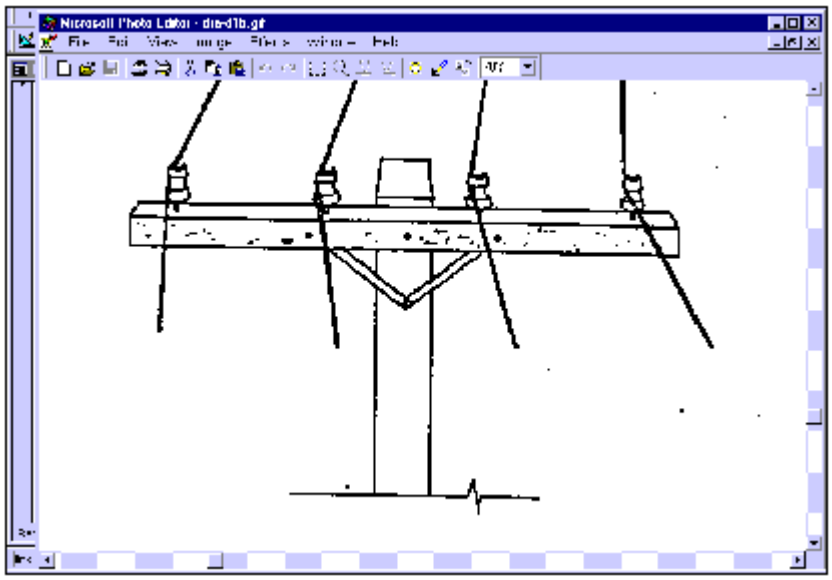


Figure 1: When the system user needs to examine the details of a complicated object, raster image handling software such as MS Photo Editor or Corel Photo Paint can be called up automatically and allows an enlargement of the part. The operator can then study the exact construction and the stock numbers of all necessary spare parts.

The established spatial database has two different scales:

1:50,000, completely covering the islands, for overview purposes, and
1:1000 detail maps, which shows the exact location of utility items.

For the overview scale all high voltage lines were digitised, such as the 132 kV line from Monasavu to Vuda and to Suva, the 33 kV lines and the 11kV lines. For all lines the positions of power poles were digitised and the system drew the line between the digitised poles. An image backdrop allows the user to see power utility items in relation to the terrain of the area. This provides better orientation for field teams and management. In addition, the field teams can better prepare for repair work, for example, the crew can locate a landing spot for helicopters when repairs are made on the 132kV line. The image backdrop is derived from Landsat images supplied by the Management Services Division (MSD), Forestry. MSD geometrically rectified the images and cut them into 1:50,000 "image maps", which are images that match exactly the map sheets of the new Lands Department Topographic map series. These "image maps" were converted to TIF files and then imported to MapInfo.

The scale 1:1000 requires digitising the position of all of the following: consumers, meters, transformers, poles of low voltage lines and with the poles the route of the lines, route of underground cables.

For the 1:1000 scale background the project scanned aerial photographs, rectified them with image analysis software (Erdas) and imported them to MapInfo environment. This image backdrop allows the spatial technical information to be placed into the natural environment. There are a number of benefits of having this backdrop. For example, field teams will have a better orientation than when working with only cadastral maps due to the additional information in the raster images. The backdrop provides an improved view of most construction sites, as trees that grow in path of a power line are visible on the image. Customers can be connected in the most effective way as the image shows all buildings, car parking areas, minor roads and other necessary items not shown in the cadastral map.

In addition to the GIS and Remote Sensing components of the project, in 1996, FEA purchased advanced GPS equipment. However, due to computer hardware problems, FEA never used this equipment. The project will try to install the necessary software on new available computer and perform the necessary training to operate the system.

[1] *For further information see: "PREP, A Regional Energy Programme for all Pacific ACP Countries"*

[2] *The Solomon Island Electric Authority (SIEA) is also installing a GIS under funding and guidance of the current project.*

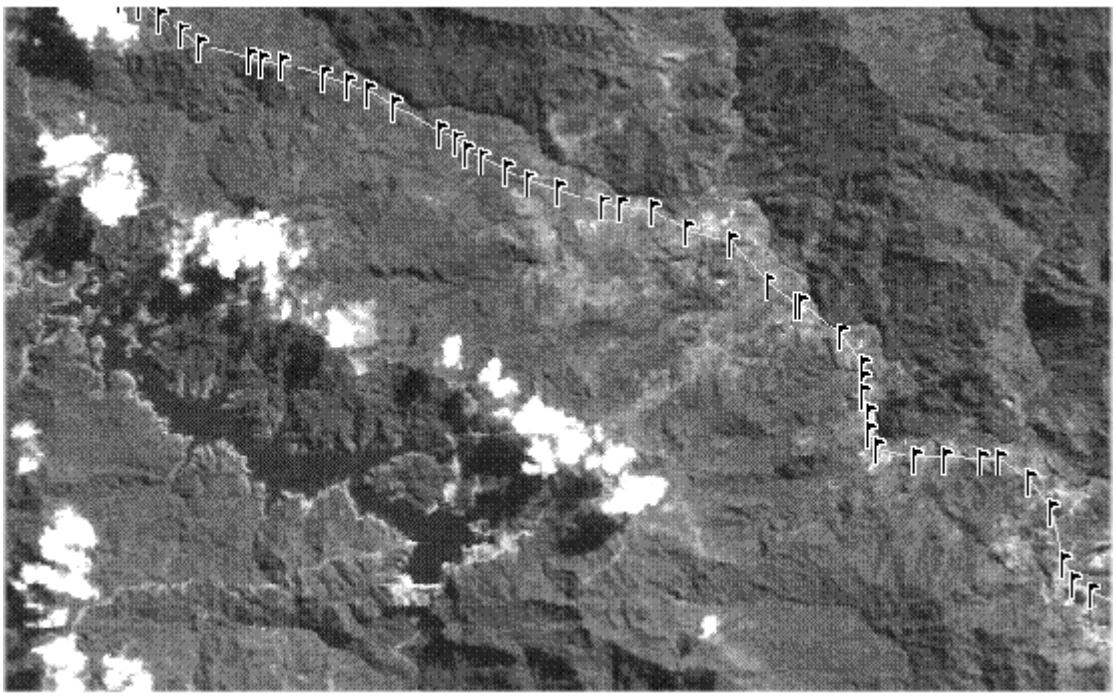


Figure 2: The MapInfo screen display shows the route of the 132kV line from Monasavu to Vuda and Suva on top of the Landsat satellite image backdrop, which was received from MSD-Forestry.

Aerial Photographs as GIS Background

By Wolf Forstreuter
GOPA-Consultants

Introduction

The use of raster image data as a Geographic Information System (GIS) background layer is increasing worldwide. GIS applications enable non-cartographers to add spatial referencing to their data, which creates a greater need to update their maps and requires increased detail of information. A way of shortening the production time of these detailed maps is through the employment of aerial photographs.

The process of creating a background image from an aerial photograph normally follows these steps: scanning of the image, geometric correction, contrast adjustment and stitching of the scanned images and finally, the actual import to the GIS.

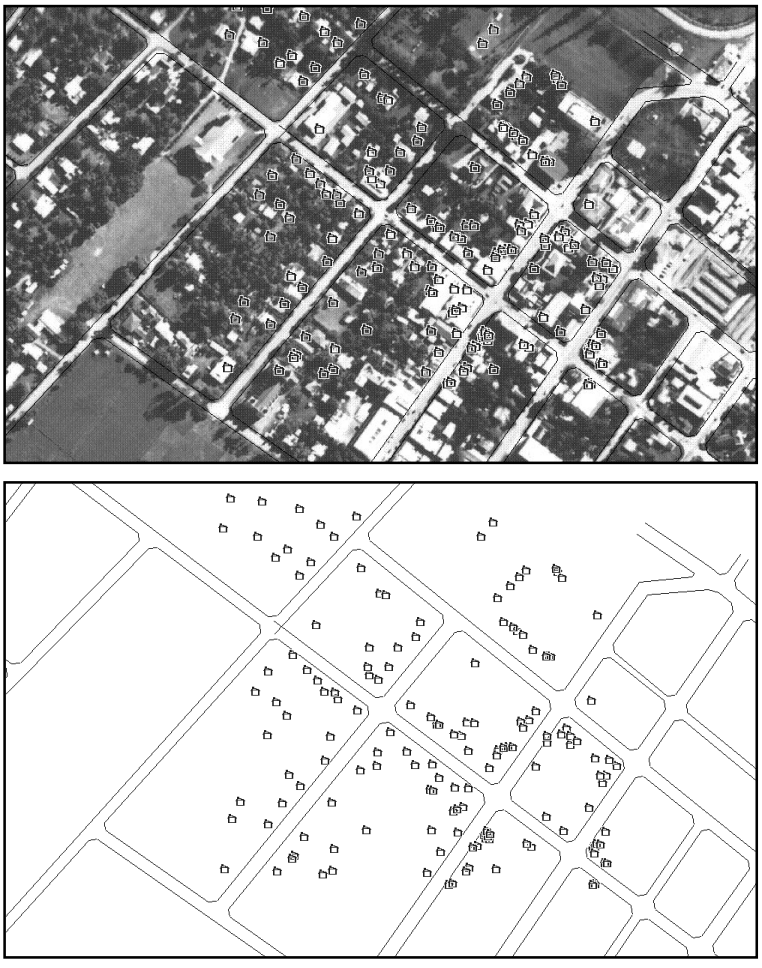


Figure 1: Customer location displayed in the TEPB GIS with a background of aerial photograph (above) and on a simple cadastral map (below).

Scanning of Image

The most important factors are the illumination during scanning and the resolution of the scanning process. For the GIS background used in the Power Utility GIS Project in Tonga (see article of Edwin Liava'a, page 18) the optimal resolution was 600 dots per inch (dpi). At this resolution, power poles, which were hard to distinguish at 300 dpi, could be identified in sunny areas on the photographs

Geometric Correction

The geometric correction was completed using the image analysis software ERDAS Imagine through three independent steps:

- Transformation from central projection of every aerial photograph to orthogonal map projection.
- Stitching of all corrected photographs to one background layer
- Contrast adjustment of the images

Transformation of Projection

An aerial photograph is often treated like a map and joined together to form an image mosaic. However, every image has a variety of possible distortions that must be corrected before the image can be used. Pitch, roll and yaw of the aircraft during the flight cause some distortion. Furthermore, different parts of the aerial photograph have different scale and displacement due to the central projection of the image. Slight variations in ground elevation cause differences in scale and displacement throughout the image. Since these variations in ground elevation are not constant across the image, transformations based on linear equations are not sufficient to correct the image and second or even higher degree corrections are used. Second degree correction requires a minimum of six ground control points (GCPs). These GCPs are used to relate the location of the point in the input image and the position in the output image. The software executing the transformation calculates an equation, which is employed for all other picture elements (pixels) of the image during the image transformation. Users considering this sort of transformation using MapInfo should be warned that MapInfo only provides linear rectification, not higher level corrections. Because of this, the image transformation must be performed

outside of MapInfo environment using software such as Erdas.

Image Stitching

After correcting the single aerial photographs they have to be stitched together to provide a homogeneous layer. Overlapping parts have to be cut and the cut images have to be correctly placed in one output matrix. The software homogenises slight geometric aberrations on the joints of the images.

Contrast Adjustment

Due to a variety of factors, different parts of individual photos will have different amounts of illumination, sometimes referred to as radiometric difference. This creates problems when the images are stitched together. Due to its central projection, an aerial photograph has different radiometric characteristics based on location within the image. Every photo has more light in its centre than at its edges, which is called exposure falloff. In tropical countries such as Tonga, the sun is high enough in the sky that there is an area where the beams from the sun are reflected from the smooth surface directly into the camera lens. This phenomena creates and area on the photo called the "Hot Spot". Objects in the photo can be illuminated on one side of the image and the same type of object can be in the shadow at the other side of the image. The differential shading is the most obvious radiometric difference when images are stitched together. While stitching the images the ERDAS program adjusts the radiometric differences.

Import of Images into MapInfo

MapInfo allows the import of raster data but does not provide a direct link to the image analysis software. Therefore, the image has to be reconverted to TIFF file format and loses its direct georeferencing. However, it does not lose its orthogonal projection. Once imported into MapInfo, four GCPs are sufficient to register the and the program stores all projection parameter in a TAB file related to the image.

Conclusion

To create a background layer produced by aerial photographs is a time consuming process. It requires hardware such as a high-speed computer with sufficient free capacity hard drive and a scanner of A3 size and 600 dpi resolution. In addition, image analysis software is essential.

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Techniques

The Conversion of Fiji Cassini Soldner coordinates to Fiji Map Grid: A case study

By Robert Smith
SOPAC

With the wider implementation of GIS and increasing use of GPS navigation systems, accurate conversion of Fiji Cassini Soldner coordinates to Fiji Map Grid has now become something of problem. While there is sufficient control available in FMG for DGPS work supporting coastal bathymetry surveys around Fiji, projects in the interior of Viti Levu lack FMG control.

Back in 1993 a bathymetric study of the Monasavu Lake was completed using a Delnorte Trisponder for positioning control. Since the shore-based control used the Cassini Soldner system, position on the water was calculated for the same system. In 1998 a resurvey of the lake is planned with real-time DGPS for positioning control. For the real-time DGPS to work, the survey needs to establish a reference station based on WGS84. While this is not a problem in itself, problems do arise when this data has to be compared to the earlier 1993 data which has different projection parameters. Since one of the main objectives is a comparison of the two sets of data, it was clear that the older data set, based on one datum would have to be transcribed to the new datum.

A number of options were considered including repeating the survey using range range based on the same (older) control or converting all existing data to Fiji Map grid, but this is like taking a horse rather than an air-conditioned 4WD up to Monasavu.

We know of at least two programs currently available that convert from Cassini Soldner to FMG. The first program, called Fijitrans, is available from MSD-Forestry and was written by Mike Poidovin. A second is commercially available software from Bluemarble called Geographic Calculator. The version used for conversion was Ver 3.01. Within the Geographic Calculator library of systems and datums available there is a "Viti Levu 1916". This datum is based on Clarke 1880 spheriod. In setting up a custom system for conversion such as the Cassini Soldner for Viti Levu to FMG the values are as follows:

False Northing: 141621.0010 m
False Easting: 109434.4700
Central Meridian: 178 0 0 East
Latitude of True Scale: 18 0 0 South

The Geographic Calculator program coverts the Cassini Soldner coordinates to Fiji Map Grid in a single step. However when using Fijitrans, it was necessary to convert the (in my case study) grid coordinates to Clarke 1880 geographicals. This was done independent of the Geographic Calculator using hydrographic software to remove any potential bias or introduce additional error in the calculation. Results of computations from the Geographic Calculator and the Fijitrans are shown in Table below.

Conclusion:

Both systems will calculate FMG coordinates from Cassini grid coordinates. Which is the more accurate cannot be answered here as it is beyond the scope of this particular article. However needless to say it appears that cartographers now have an alternative method in which to do these calculations.

From Geographic Calculator			From Fijitrans		Difference in Coordinate values	
station	Easting	Northing	Easting	Northing	Delta-East'gs	Delta Northing
mom7	1925462.35	3916120.97	1925463	3916120	-0.87	1.32
mom8	1926012.21	3916153.00	1926013	3916152	-0.86	1.47
L1	1925985.88	3917227.51	1925987	3917226	-1.11	1.62
R1	1925644.00	3916736.21	1925645	3916735	-1.09	1.66
RS 35	1924382.37	3918160.44	1924383	3918159	-1.04	1.65
RS15	1924069.94	3917346.62	1924071	3917345	-0.97	1.63
L2	1924742.20	3917968.49	1924743	3917967	-0.97	1.65

Techniques

Spaceborne Image Data Update

Introduction

Spaceborne image data has become, or is becoming, a cost effective alternative to aerial photography. This is especially true in the South Pacific, as aircraft for aerial photography have to fly in from Australia or New Zealand and while they are here stand-by costs are high. More GIS applications are using remotely sensed data as an integral part of the project. Most GIS applications require an update of the land cover surface, especially in sectors such as forestry, agriculture or land use planning. Two articles in this edition of the newsletter and recent presentations to the Fiji User Forum have illustrated the effective use of remotely sensed images as backdrop for utility data and mapping.

To meet this trend, this section of the newsletter will provide users and interested parties in South Pacific Island Countries with information about spaceborne remote sensing image data: how the data is different, what data is available, what can be expected, where to buy the data and the costs involved. There are plenty sensors in space, either aboard satellites or installed on the permanent space station MIR. However, the key issue for users in the Region is data availability, since the South Pacific is still outside any ground receiving station for satellite data and this limits the amount of data collected over the South Pacific. This is a result of the way satellites store and download data. To store data, satellites must be equipped with either an on-board tape storage facility or a link to a ground station. When using a link to a ground station the satellite does not have to pause to download and can spend more time collecting data. When using tape unit, the satellite has to pause occasionally to download the full tapes.

The Landsat Series

The satellites of the Landsat (Land Use Satellite) started the area of spaceborne digital remote sensing. The first three satellites of this series were equipped with video cameras and had a sensor on board called the *Multi Spectral Scanner* (MSS). MSS data were the most widely used space images for a long time. The spatial resolution with about 70m allowed mapping up to 1:100.000 scale. *Landsat 4* was equipped with a sensor called *Thematic Mapper* (TM) which delivered data of 30m spatial resolution and a spectral resolution up to the thermal infrared band. Landsat 4 was able to download data via relay satellite to the ground antenna in the USA. Landsat 4 data was used for mapping Fiji's tropical rain forest. *Landsat 5*, which has the same sensors as Landsat 4 on board, does not have the link to the relay satellite. It was impossible to purchase data for the South Pacific. *Landsat 6* did not reach its orbit after the launch, crashing somewhere in the ocean. NASA had planned the launch of *Landsat 7* for July; however, two of the four thematic mapping instrument's power modules failed in recent testing. The launch probably will be delayed to December 1998. Like the earlier TM sensors, the Landsat7 *Enhanced Thematic Mapper Plus* (ETM+) will provide data in six visible, near infrared (NIR) and short wave infrared (SWIR) bands. In addition, ETM+ will provide improved resolution for the thermal infrared (TIR) band (60 m vs. 120 m), a panchromatic band with 15m resolution, and a new in-flight solar calibration which will improve the radiometric accuracy within 5 percent.

Continued in next Issue...