

OCTOBER NEWS

The last meeting was held Tuesday 12 October at SOPAC, Mead Road.

- FLIS has now compiled a "Fiji GIS documentation" and is available at FLIS Support Centre in digital form and can be printed any time. This documentation contains GIS directories provided

by MRD, MSD and FLIS. Other Departments in Fiji should also send a digital directory of information available, data origin, physical file format, scale, data accuracy.

- SOPAC will compile a catalogue of regional GIS data.

Satellite News

- SPOT was launched at 2 October 1993. The satellite has the same sensors on-board as the previous SPOT satellites. The satellite is working already

- Landsat 6 was launched at 5 October 1993. The satellite has a new system on-board the "Enhanced Thematic Mapper". The satellite did not reach the right orbit and is missing up to now. Landsat 5, however, is still operational.

- The Heads of Forestry Meeting, 20 - 24 October 1993, Nadi, learned that there will be a German funded regional forestry project from mid 1994. One component will be GIS and Remote Sensing. The Heads of Forestry will decide in 1996 which regional organisation will be the counterpart for the project. Representatives from SPC and SPREP explained their interests.

- As from mid-November, the Forestry Department will be finalising the GIS application: Definitions of Potential Forest Functions. A report defining the

interrelation of ten different GIS layers was distributed to 14 agencies related to the definitions. Responses from these agencies are expected by end of October. Finally, from mid-November to mid-December the delineation of these areas will take place.

- A regional meeting about GIS and Remote Sensing took place on 1 and 12 October using PEACESAT (communication satellite) at SPC. The available hard and software of different GIS stations in the region were described as well as upcoming projects, available staff, possible funding etc. The next meeting will discuss the issue of satellite data sharing in the region.

- A regional GIS-documentation will be compiled by SPREP. This will contain available data, format descriptions, medium of data storage, hardware output etc. The directories of relevant data should be send to SPREP, Western Samoa in digital file format (MS-Word or WordPerfect). Communication with SPREP can be enhanced by the use of PEACESAT. The first release of this GIS-documentation will be handed out on a regional GIS workshop, in June 1994, in Fiji.

- The next meeting will be at 2:30 PM on Thursday 4 November at SOPAC, Mead Rd. @

This is the first newsletter of the GIS and Remote Sensing User Group in Fiji and follows the suggestion by participants at the October user group meeting. It is anticipated that this will be an ongoing publication aimed at informing the diverse interest groups in Fiji and the South Pacific as well as providing a forum for exchange of ideas.

This first issue contains a summary of news reported at the October meeting and several articles. Information on the transfer of large digital terrain model files is covered as well as the GIS needs of PWD. Developments in GIS at USP is outlined and FLIS provides news on an aerial photography project which will cover Fiji. MSD provides a report on mangrove mapping using Landsat TM data which highlights the limitations of SPOT while MapInfo Notes from SOPAC provides a method for creating grids of cell objects for thematic mapping.

We would appreciate your feedback and welcome articles on this subject which is one of the fastest growth areas in the resource and environment fields. The final section lists the contacts and includes the address, telephone and fax number where you can request to be included in the mailing list for future copies and where you can submit articles. @

GIS FACILITIES AT USP

In response to the rapidly growing GIS field, the University of the South Pacific recently established a USP GIS Unit. It is to function as a regional training centre for GIS, remote sensing, and related technologies, as well as to help provide co-ordination within the

USP region. Housed within the School of Social and Economic Development, the Unit is meant to be broadly interdisciplinary and integrative, reaching both the academic and professional worlds. Its primary charter is education and training, with a principal

objective of serving all of the GIS community. Commitments have been made to develop a new GIS teaching lab, composed of twenty 486-PCs with digitiser tablets and an array of associated equipment. Also, other facilities are being modernised to support research and services. Operations are to begin semester 1, 1994, in time for the introductory GIS course (GE204). This course is open to students and professionals who want a hands-on introduction to

GIS. Also planned for the semester are a workshop or two, a SPREP technical and co-ordination meeting, possible development of a diploma or certificate in GIS, and other activities. Assistance in ideas, suggestions, planning, and support is encouraged from the GIS user community. For further information or requests, please contact Dr Bruce Davis, USP Geography Department: Telephone 212654, Fax 300487, or e-mail DAVIS_B@USP.AC.FJ.☎

FLIS NEWS

ESCAP paper

UNDP/ESCAP will be conducting a ministerial level meeting on space applications in September 1994. The Ministry of Foreign Affairs is in receipt of a concept paper which will shortly be distributed to ministries and organisations that use space-borne activities. This will enable the Ministry of Lands to prepare a country paper to be presented by our Minister at the ESCAP meeting in China in 1994. Application areas include GPS, remote sensing/GIS, satellite based communications and space borne meteorology.

National Topographical Mapping

A study was commissioned to establish the production of the Fiji 1:50,000 topographical maps to meet the increasing demands for topographic based mapping for a number of overseas and local programmes addressing land management issues. The report on the study was endorsed by the FLIC in its June 1993 meeting. One of the recommendations mentioned was to have a new coverage of aerial photography to cover the whole of Fiji. Two overseas aerial mapping companies tendered for the task and Australian Aerial Mapping Ltd of Brisbane was chosen by the major tender board. The team arrived in the country on Saturday 23 October 1993 and have commenced flying on Sunday 24 October. The priority area is Vanua Levu but given suitable weather conditions, flying will also be done over the Lau group and Kadavu. The FLIS Support Centre is well advanced in consultations with the NZ government to monetarily assist this Fiji funded project to secure total Fiji coverage.

For further information contact Kemueli Masikerei, Tel 211435, Fax 305029.☎

the database which will be an integral part of the GIS. Private users could then strike up a contract with FLIS.

For Further information contact Phil Wright, PWD, Fiji, Tel 3 15244, Fax 303023.☎

URBAN USERS SECTION

INFORMATION REQUIREMENTS OF PWD HYDRAULIC SECTIONS

Background

The Hydraulics Section of the Public Works Department (PWD) is responsible for Sewerage and Water Design in all urban areas of Fiji. Over the years, there has been a huge collection of drawings at various scales of all areas where there have been works.

Traditionally, jobs have been drawn by hand after surveyors used theodolite and level. A change to the Total Station method began in 1992 when consultants were given sections of Suva to locate and define existing sewer mains. The consultants used infra red equipment, reflecting off a mirror with the survey information stored in a mini computer on site. This is then down loaded into a survey software package which produces a site plan.

The information as collected was then handed onto FLIS. In August 1993, FLIS completed the cadastral (title) mapping of Suva and all other major urban areas. PWD has since obtained copies of the information in DXF format for all of Suva.

Software

This is seen as a major achievement. DXF format is a common language that all computer software can use.

To utilise this information the following software has been chosen: Geocomp for 3-dimensional modelling and sewerage design and Easycad drawing. The choice for Easycad was made on the basis of cost and the sample system that can be easily learnt by many people instead of specialist training in Autocad.

Demand

In 1986, all of Suva was flown over and photographed. From this was created 1:25,000 contour plans without title information. What is needed now is for the contour information to be added to the FLIS title information.

There are three possibilities of doing this:

1. Do a spot survey of the whole of Suva.
2. Fly again and produce the information in DXF format.
3. Digitise the data from the contour plans to title plans.

Users

Likely users of this information would be PWD, Housing Authority, Suva City Council, FEA, P&T, consultants and developers. Therefore, the PWD believe it is necessary to have a combined approach, controlled centrally by FLIS with departments being asked to contribute annually to building

TRANSFER OF LARGE FILES WITH OTHER GIS USERS

Raster files of the Forestry GIS showing information such as soil, district boundaries or boundaries of a watershed can be transferred and displayed on the PCs of other users.

In the past, two problems made such a display difficult:

1. Few departments in Fiji have a GIS.
2. Raster tiles are often very large files and difficult to store on 1.44 MB disks.

Nowadays, it is not necessary to have a GIS for display of data files as programs such as Windows Corel Draw allow the import of TIFF format files. The layers of the forestry GIS can be transferred easily to TIFF format.

The problem of the file size is solved by using desktop to notebook file transfer using applications such as LapLink, FastLynx and Interlink. The program Interlink is included with MS-DOS 6 and is being used by Forestry to transfer files from ERDAS, the raster GIS, to the hard disk of a laptop and from the laptop to the computer of the recipient. Very large files can be also be compressed and decompressed using the common utilities PKZIP and PKUNZIP

The Drainage and Irrigation section of MAFF can now display the areas of watershed catchment of Ba, digitised in MSD, Forestry Department.

Using the above tools, it was possible to transfer a digital terrain model from magnetic tape, read at SOPAC, where one file for Viti Levu was in excess of 60 MB to the hard disk of the forestry GIS.

For further information contact Wolf Forsteuter, MSD, Tel 322635, Fax 320311.

The overall size of the grid rectangle should be no larger and the size of cell no smaller than necessary to minimise processing time when performing the analysis as well as creating and importing the grid data. For example, a 15 x 15 degree grid with 0.1 degree cell size will take a several minutes to create, a total storage of 1.5 MB and take several minutes to import as well as several minutes for an analysis against a 5,000 record database.

Detailed Instructions

To produce MapInfo Interchange Files

1. Run FoxPro. (FoxPro for DOS or Windows)
2. DO GRIDMAKE
3. Input your selections
4. The files will be created
5. Exit FoxPro
6. Optionally move the files to MapInfo working directory

To import MapInfo Interchange Files.

1. Run MapInfo
2. Select Table menu
3. Select Import
4. Save as same name
5. This will create files with extensions DAT, ID, MAP, TAB in addition to the original MID and MIF files
6. Analysis can now be performed using shading or colour in the cells to represent activities.

MAPINFO NOTES

MapInfo provides for spatial analysis of tabular data using dot density, symbol size or shading of objects. The last method is ideal for representing data by areas such as population by state but there are times when data must be represented by unit areas where a typical application would be fishing activity by degree square.

Where it is necessary to aggregate data by unit areas the most effective method is to create a rectangular grid of square cells and use these for thematic mapping. It should be noted that MapInfo is provided with several grids to represent lines of latitude or longitude but these are made up of lines and not closed polygons which are necessary for performing analysis.

A simple FoxPro program named GRIDMAKE was created which produces a pair of MapInfo

Interchange Format (MIF) files which can be imported into MapInfo and subsequently used as a grid for analysis. The user can specify any cell size in decimal degrees, the X and Y origins and limits in decimal degrees, and the name of the output files.

The Data

The sample data for the analysis was provided by the Ministry of Environment and Natural Resources Development, Bairiki, Kiribati, to

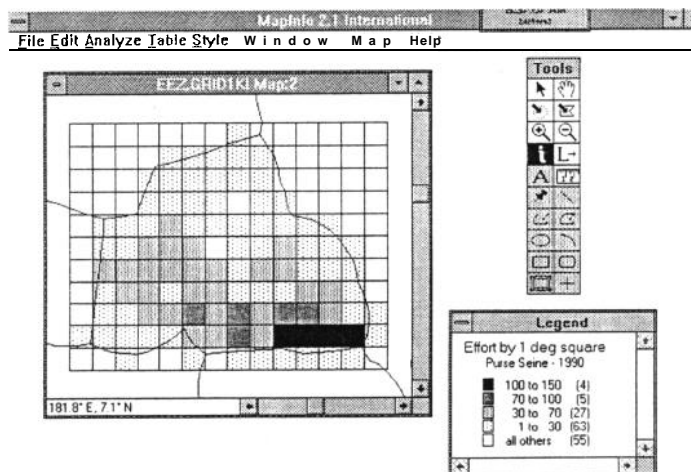


Figure 1 - Effort by 1 degree square.

demonstrate the feasibility of using MapInfo for analysis of fishing activity. The data was purse seine activity for 1990 and was in the form of an XBase table. It was necessary to add two fields, XCOORD and YCOORD and update these with decimal degrees calculated from the LAT and LON fields in each record. MapInfo needs decimal degrees where positive is North of equator and East of 0 degrees (0 - 360 degrees). Another field, TOTAL, was added to store the sum the weight of all species. Unused fields were then deleted. This enabled the data to be geocoded using the XCOORD and YCOORD with multipliers of 1. Figure 1 and 2 show MapInfo output for 1 degree and 0.25 degree respectively.

Summary

Essentially, the ability to create a grid of cells of any size cell and area of grid allows fisheries applications to use MapInfo more effectively. However, the grids can be used in other applications such as forestry where traditional raster systems are

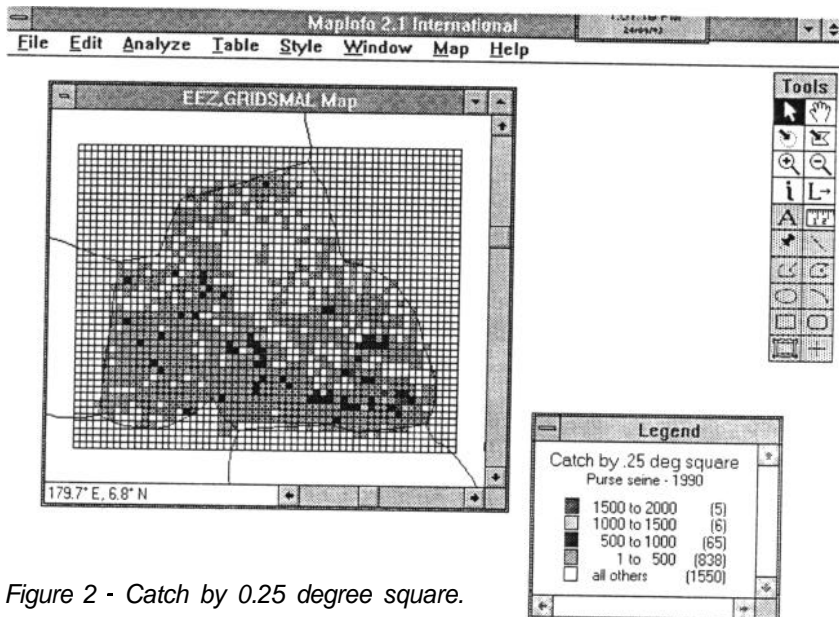


Figure 2 - Catch by 0.25 degree square.

employed thus allowing MapInfo to provide more flexibility to users.

When using small cells, such as 0.25 degree over a 15 x 15 degree grid it is more effective to use colour than shading.

The creation of a grid of cells using GRIDMAKE and subsequent importation of MIF files could have also been achieved through a

MapBasic program. However, as the sample data was in XBase and required preprocessing in an XBase application it was more appropriate to use FoxPro.

For further information or copy of the FoxPro source code, contact Les Allinson, SOPAC, tel 381377, fax 370040.ⓧ

POSSIBILITIES OF MANGROVE MAPPING WITH LANDSAT TM DATA

Introduction

Mapping of mangrove areas has been traditionally carried out using aerial photographs. Visual interpretation by aerial photographs has certain advantages because the operator can use three types of information:

1. Tone
2. Texture
3. Shape or outline

However, aerial photographs have two disadvantages:

1. As normal photo mosaicing has no correct map projection area, calculation is not possible and mapping in correct map projection needs expensive instruments.
2. Aerial photographs are expensive and will not be available regularly

Satellite data will be available regularly in the near future. They

are very cheap on a hectare based calculation and mapping in orthogonal projection is easy

However, digital analysis is limited to one information type tone or colour. Texture analysis and recognition of shape is not possible with normal image analysis software. On the other hand, digital TM (Thematic Mapping) data provides more "colour information" any photograph can do.

Case Study in the Rewa Delta

The case study was used to investigate and analyse the radiometric content of Landsat TM data and its suitability for mapping. A mangrove mapping was carried out by Watling¹ in 1985 with photographs taken in 1978. Now, a comparison was made using digital satellite TM data of 1992.

Watling separated six different

mangrove related land cover classes:

1. **Seaward Alliance** In the seaward alliance *R. Stylosa* is dominant mixed with Selala, Dogo and *R. Samoensis*.
2. **Tiri Alliance** *R. samoensis* is dominant in Tiri Alliance mixed with *R. stylosa* Dogo and Dabi.
3. **Dogo Forest Alliance** In the dogo alliance Dogo is dominant, mixed with selala, Dabi and Saqali. Canopy pure Dogo 9-15 m.
4. **Mixed Alliance** The mixed alliance is described as heterogeneous forest of variable mixed composition with uneven canopy height 5-15 m. Dogo and Selala are the dominant species. *R. samoensis* forms limited pure stands within this type.
5. **Landward Alliance** The landward alliance is a heterogeneous closed forest of mixed

composition **Dogo** and other mangroves are mixed with common trees and palms.

6. Boreti Alliance The boreti alliance is described as poorly drained flats dominated by Leather Fern Boreti (*Acrostichum aureum*).

Image Enhancement

Digital Landsat TM data have a great potential of image contrast enhancement, enabling the users to choose between six² different digital bands (see Figure 1). The best contrast was provided by the band combination 4,5,7. Best contrast is related to the best contrast between the mangrove type. Features such as, roads, village and other non mangrove vegetation are not taken into account.

Beside the band selection, a linear contrast stretch was done for every band separately. Knowing the location of the different mangroves types it was possible to estimate the lowest and highest grey level of light reflection from mangrove cover. Other features in the image were set to white if they have a brighter reflection than mangrove and they were set to black if they have a lower reflection.

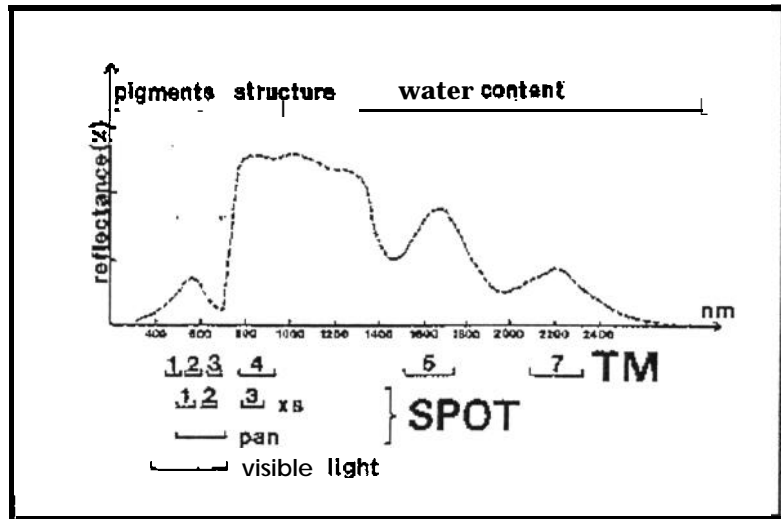


Figure 1: spectral bands covered by different remote sensing data.

First Classification Stage

For every mangrove type, a training area was chosen within the enhanced image. A training area is a small part of the image containing pixels of the investigated mangrove type. For the other land cover types training areas were chosen out of the normal stretched image. The classification result distinguished mangroves from other land cover. Overlap was noted for Boreti and grassland. The class Seaward Alliance could not be separated.

Field Work

The field visit was concentrated on the mouth of the Nasoata river and Nukui Point. The indicated Seaward Alliance could not be distinguished any more on area mapped with satellite data. The Boreti Alliance is associated with other shrubs and cannot be included as a mangrove class. Although the leaves themselves do not differ very much in shape and behaviour, colour difference was notable between *Dogo*, *R. samoensis* and *R. stylosa*.

Second Classification Stage

For the second classification, pixels were analyzed and classified into one of the mentioned classes during the first classification stage. Other pixels definitely not showing mangroves were masked out. This masking process also allows an optional contrast stretching.

The training areas were defined again for the classes:

- Dogo Alliance
- Tiri Alliance
- Mixed Alliance
- Landward Alliance

Other land cover was summarised as non mangrove.

Conclusion

TM – data provides multi spectral information which allows a separation of different mangrove types. The infrared bands seem to be important for the mangrove

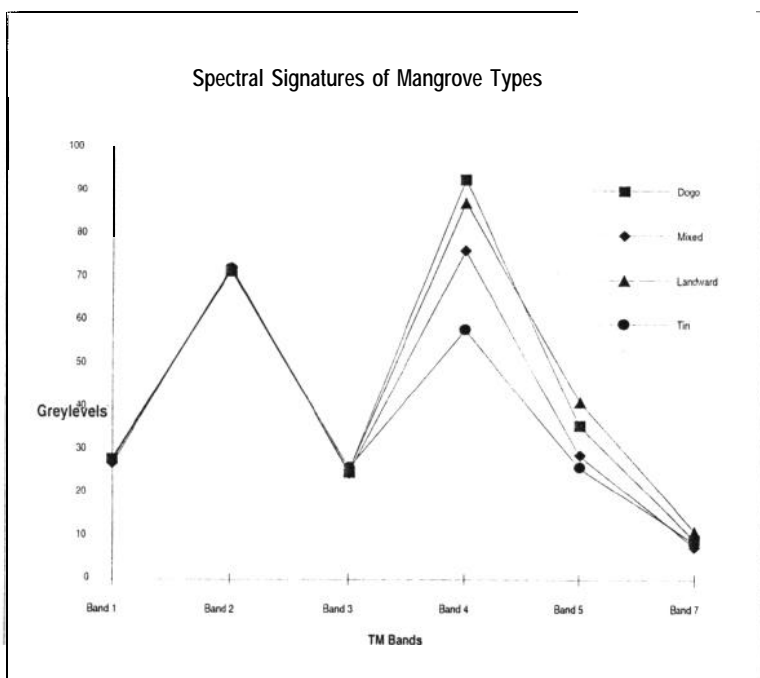


Figure 2: spectral reflection of different mangrove types.

types found in the Rewa Delta, whereas the visual bands do not show significant radiometric difference, This can be related to the different cell structure and water content from the leaves of the dominant species or the canopy.

The graph and the table show, that the infrared bands are important for mangrove classification, because they show more difference than the visible bands. SPOT data contain only one infrared band, so Landsat data is far more suitable for the Rewa Delta mangrove vegetation mapping.

Table 1: Training areas of mangrove types. The first line shows the mean of reflection grey level of all pixels within the training areas, the second line shows the corresponding standard deviation.

Training Areas	Band 1	Band 2	Band 3	Band 4	Band 5	Band 7
Dogo Alliance	27.87 0.97	71.52 1.14	25.13 0.91	92.67 5.75	35.57 2.74	9.09 1.16
Mixed Alliance	26.85 1.06	72.41 1.13	24.69 0.85	76.11 2.06	28.77 1.45	7.55 0.94
Landward Alliance	28.33 0.84	71.75 0.99	25.09 0.78	87.32 1.25	41.24 1.45	11.07 0.92
Tiri Alliance	27.66 0.77	71.88 1.24	25.86 0.85	57.69 2.19	25.88 1.46	8.44 0.96

GIS - Integration and Analysis of Classification Output

Isolated mangrove areas displayed on the screen would require visual orientation. Therefore other image classes such as water types were integrated back into the display

In order to compare the mangrove mapping of the aerial photographs from 1978 with the analysis of TM data captured 1992, the mapping was geometrically corrected and overlaid over the classification.

For further information contact: Osea Tuinivanua, MSD, Fax 320311; Dr Wolf Forstreuter MSD, Fax 321106.

¹ see Watling, D. 1985 "Mangrove Management Plan for Fiji", 1. Zonation requirements and a plan for the mangroves of the Ba, Labasa and Rewa Deltas pages 47 to 50.

² band No. 6 contains the received active thermal radiation and is not suitable for this kind of forest stratification.@

CONTACTS

The following list details the organisations who will receive and provide contributions to this newsletter.

ORGANISATION/FAX

Department of Lands & Survey/
304037

Department for Town and Country
Planning/130351 5

Drainage & Irrigation Section, MAFF/
305546

Fiji Land Information System Support
Centre, Lands Department/305029

Harrison and Grierson Consultants/
301986

Hydraulics Section, Public Works
Department/303023

Land Use Section, Koroniva, MAFF/
400262

Management Services Division,
Forestry Department/32031 1

Mineral Resources Department/
370039

Native Land Trust Board/303164

Queensland Insurance/300285

ACRONYMS

Acronyms, love them or hate them, are here to stay and we will attempt to expand every one used in the newsletter.

ESCAP	Economic and Social Commission for Asia and the Pacific
FAO	Food and Agriculture Organisation
FLIS	Fiji Land Information System
GIS	Geographic Information System
GPS	Global Positioning System
MAFF	Ministry of Agriculture Forests and Fisheries
MIF	MapInfo Interchange Format
MRD	Mineral Resources Department
MSD	Management Services Division
NLTB	Native Land Trust Board
PWD	Public Works Department
SOPAC	South Pacific Applied Geoscience Commission
SPC	South Pacific Commission
SPREP	South Pacific Regional Environment Programme
TM	Thematic Mapping
USP	University of the South Pacific

South Pacific Applied Geoscience Commission/370040

South Pacific Forestry Development Programme, FAO/305212, 301718

University of the South Pacific/301 487

Water and Sewerage Section, Public Works department/303023

Wood & Jepson Consultants/1304942

Requests for inclusion in the mailing list for this newsletter as well as the submission of articles for publication should be sent to:

GIS AND REMOTE SENSING NEWS
SOPAC
PRIVATE MAIL BAG, GPO
SUVA, FIJI
Attention: Les Allinson

It would be appreciated if contributions could be sent on floppy disk in Word for Windows (preferred), Wordperfect for Windows or Wordperfect for DOS format.Ⓜ