JANUARYNEWS

The last meeting was held Tuesday 11 January at NLTB, Victoria Parade, Suva.

- · Tevita Wara, NLTB, gave a briefing of the history since a GIS was introduced in 1988 when NLTB was the first organisation in Fiji to use GIS. The monitoring of native land needs more modern systems and the organisation will buy MapInfo or ERDAS, which was mentioned in later discussion.
- . The software link from NLTB to FLIS will be postponed until April. The river system and road network information will be released in DXF format after evaluation by Lands Department. This may take another month of time. Forestry Department which needs the data soon may have to look for other sources.
- . NLTB advised that the organization is expecting the forest cover from Forestry Department, MSD who is responsible for forest cover and who will provide digital data and maps. For the time being, the maps will be related to the old map. series.
- · Asesela Wata, MSD, explained the reason for using the map sheet coverage for the new forest mapping by MSD: the road network and the river system have to be shown on the forest maps for orientation reasons. The easiest way is a graphic overlay using the printing machine where both information layers are only available for the old country wide series. Nevertheless, the river system has to be included digitally in the forest cover layer because big rivers in Fiji represent an area which has to be reduced from forest cover. The road nework is important for forestry because it links forest products to the users based outside forest areas. The roads within the

REMOTE SENSING NEWS FULUSER GROUP Number 4, February 1994

forests are even more important, they allow for an estimate of impact to the forest, such as fire danger, illegal logging or shifting cultivation. Forestry needs the "road network" spatial data set in digital form to carry out buffer analysis.

* Josua Wakolo, MSD, gave a briefing of the status of forest cover mapping and delineating of potential forest functions. Important information came out during the discussion, there some areas covered by clouds in the digital image data from satellite. These areas MSD will

be replace by forest cover digitized from the new Lands Department map series. This map series is based on old photographs, however, Lands Department carried out very detailed field checks and the forest cover information seems to be the best available for clouded areas within satellite images.

. There was no progress in combining the GIS documentation of the different organisations in Fiji to a complete national documentation at FLIS due to lack of time and personal.

especially on natural resources. infrastructure, communications and statistics. It must be noted that the use of different data types from sources outside the Ministry of Fijian Affairs and related organisations and Statutory Bodies, the consent of data owners were first obtained and are very much aware of the activities during the capture of the data concerned. Owners of these data are clearly identified in the NLTB-LIS Schema. Updating of these data will be controlled by data source owners.

NLTB - LIS SCHEMA

Data input into the data base is controlled by a schema or directory index. The schema is capable of controlling 256 data layers both graphic and attribute data. Informap III Systems Software is capable of controlling multiple schema or data bases which allows a wide parameters by users to access variety of data stored in different data bases within the same systems environment.

FLIS

We look forward to working dosely with FLIS (Fiii Land Information System centre) in the very near future in the development of the transformation of data between the two organisations to enable us to commence data sharing and also benefit from development of the LIS/GIS technology by FLIS in future.@

Tevita Wara, NLTB, Tel: 312733, Fax: 303164

■ by Tevita Wara

NATIVE LAND TRUST BOARD-Land Information System

The introduction in the use of Land Information System by the Native Land Trust Board was the result of several recommendations made in a report by consultants commissioned by the Ministry of Fijian Affairs to carry out a strategic review on information processing requirements and management of the Native Land Trust Board. Ministry of Fijian Affairs, related organisations and Statutory Bodies in July 1986.

One of the main recommendations in the report was the introduction of the LIS technology to assist in the achievement of a central approach to land information collation and management which will avoid duplication and costly development of individual system for the Fijian Affairs, its related organisations and Statutory **Bodies**

SYNERCOM INFORMAP III . REGIONAL LEVEL - (Small SYSTEM SOFTWARE

Based on several criteria on system development, the • MICRO FACILITY LEVEL consultants recommended Synercom Informap III Software because it was one of the industry leader in Mapping Information System and its "open architecture" capabilities at that

NLTB LIS DATA BASE

The NLTB LIS data base was developed by a Data Base consultant in August 1987 with

the assistance by local staff. Data identified for data input are categorised into three main

- scale mapping)
- (Large scale level)
- STATISTICAL DATA (Statistic and statistical analysis)

Since it was the first introduction of the LIS/GIS technology in the Republic of Fiji, it was decided to extend the scope of the data base to include all areas of interests to the Ministry of Fijian Affairs and related organisations

elcome to the fourth issue of this newsletter. This month there are contributions from the Native Lands Trust Board levels Of data capture pro- (NLTB), Forestry Division, SOPAC, grammes as follows:

SPOT Imaging Services and PWD who SPOT Imaging Services and PWD who fill the regular urban users section. NLTB fully outline their existing system and indicate that they will be working closely with FLIS when upgrading to a new system. Forestry Division report on the successful development of potential forest function maps which will assist in the formulation of a planning and management policy document and provide a comprehensive report on the translation of existing data to the accepted Fiji map grid as well as clearly describing projection transformation methods and limitations. A further article details an undocumented method for

transferring raster data in ERDAS to

common relational databases while a new and hopefully regular feature on computer tips is included. SPOT Imaging Services in Australia provides an overview of available services. As this issue went to press, SOPAC received an evaluation copy of the South Pacific in MapInfo format on CD-ROM and will provide a report in next month's newsletter. Meanwhile, we look forward to your continuing support through any articles, tips or hints.

SATELLITENEWS

- MSD received news from the data selling agency that there are no aerial photographs of Fiji available from the Russian space complex MIR The last newsletter mentioned that there is a permanent space station called MIR (Freedom) which has several camera systems on board, such as KFA-1000, MKF-6MA.
- There are possibly space born photographs available from the Russian KOMOS satellites, the editorial staff will get the answer soon.
- Landsat 5 is still healthy and transmits image data to 17 ground stations worldwide, however this does not help Fiji because the South Pacific is not covered by aground station.
- Landsat 4 is still non operational for TM data. The MSS sensor, however, is still functional.
- EOSAT is developing a portable ground station.
 This would allow the receipt of TM data from Pacific countries without using the relay satellite TIDRIS.
 SPOT data or radar data from ERS-1 may be received as well, this is not known by the editorial staff, at the moment.
- SPOT records data from the South Pacific. Because of its on board tape facility, there is no need to use a relay satellite. MSD will buy new SPOT data for Fiji.@

COMPUTER SYSTEMS TIPS

This is a new section which is aimed at providing tips on the common hardware and software used at GIŞ sites in the region. We welcome contributions which should be sent to Leslie Allinson, SOPAC, Fax: 370040.

Securing the Windows Desktop

System administrators have the unenviable task of being requested to repair damaged Windows interfaces and are often confronted with a Windows desktop with missing groups or icons, icons misplaced and icons which no longer launch the expected process. This situation can range from serious where a complete re-installation of Windows and all applications is necessary to trivial where an icon has been inadvertently moved to the incorrect group.

Installation from network servers has greatly assisted in cases where the damage is severe but a complete re-installation from floppy disks can take many hours. Where damage is minimal it still may require a specialist to recover a user's environment.

The most common cause of complaint is when a user carefully designs his or her desktop and another user alters the setup. The simplest solution is to setup the desktop as required and set Save Settinas on Exit as off under the Options menu on Program Manager

URBAN USER'S SECTION

SUVA AUTHORITIES MEET

The Suva Urban User's Group held its second meeting on January 18th at FLIS offices in Suva and it was decided to continue meeting with the intention of forming a formal structure under the Lands Department. The Ministry of Town and Country Planning was present at this meeting.

In particular Item 15 of the Land Information Strategy which has the objective to **Provide a Central Storage Facility for Utility Mapping.**

The general rule is for the Department of Lands to hold any new utility mapping within its CCMS system using a simple initial feature classification.

Principles

- · Data should be readily available,
- A standard feature classification is essential for new utility mapping initiatives,
- FLIS should be the base on which utility mapping is used,
- · Once only data capture.

Challenge

The challenge is for the technical users of information to make their senior people aware of the importance of such a system so that talks can proceed at a level that would enable a format to be developed and decisions to be made.

MEANWHILE, the authorities taking part have made a list of their present status with respect to computer drawing and mapping.

Public Works Department Hydraulics

- had WordPerfect, Excel, DbaselV for many years,
- recently purchased Fastcadd, Geocomp and GHD Asset Management software and are waiting on delivery of new computers,
- have purchased FLIS cadastral information for Suva.

Fiji Post & Telecommunications

working with FLIS to purchase high resolution computers, 8 pen Al plotter, A0 digitising tablet, Database (Oracle Version 7).

Fiji Electricity Authority

have Autocad to draw line diagrams of network and are interested in working towards capture of services in road reserves.

Housing Authority

 have total stations, digitisers and computers, they are considering purchasing Geocomp complete with sewer and road design.

Suva City Council

have no immediate plans, but would like to access FLIS title information for building and cadastral plans for road, stormwater and other engineering activities.

Public Works Department Roads

have their computers for data collection, word processing, Lotus and Excel, are intending to purchase a road design package which is most likely **Geocomp.** *For further information contact Phil Wright, PWD, Tel: 315244, Fax:303023.*

and then use the Alt-Shift-F4 $\,$ key combination to save subsequent changes.

A more robust solution is to add the following lines in the PROGMAN.INI file.

[Restrictions]

NoSaveSeftings=I

where NoSaveSettings=I prevents the user enabling the <u>Save Settings On Exit</u> switch in <u>Program Manager</u>.

Other items which may be added to the [Restrictions] section in PROGMAN.INI are:

NoC/ose=1Prevents exit from Windows

NoFi/eMenu=l File menu item not displayed in menu bar

NoRun=1 Run disabled in File pull down menu

EditLevel=4 User cannot add, copy, move or delete icons

The last item makes the desktop fully secure and is recommended on computers where there is little or no control over unauthorised users and the desktop must be preserved. The default setting for all the above is **0.**

■ by Wolf Forstreuter and Leslie Allinson

REQUIREMENTS FOR DIGITAL IMAGE ANALYSIS

Introduction

A component of Fiji's natural forest inventory was the analysis of digital satellite data to provide the forest cover stratified into dense, medium dense and scattered forest. The satellite analysis was the most important input to the forestry GIS and this satellite data is now available for other investigations outside the forest area, such as general land use mapping.

The forest cover analysis was initially carried out in Germany, but MSD is equipped with an image analysis system which will be updated at the end of February 1994. This article will give an overview of the minimum requirements for digital satellite image analysis and may be helpful to other organisations in Fiji and elsewhere who are considering undertaking this activity.

Getting Satellite Data into the Computer

Most digital satellite data (scanner data and radar) is provided on computer compatible tape (CCT), cartridge tape or more recently CD-ROM. Therefore, the system must include an appropriate tape or CD-ROM drive.. Most historical data is delivered on CCT so it may be necessary to have this type of drive in addition to other types. It should be noted that **a** CCT drive is very expensive. A simple floppy drive is not sufficient for satellite data analysis as image data are stored in large files of several hundred megabytes and it is impractical to import these files via floppy disks. (Data can be transferred from CCT to media with more cost effective drives using SOPAC facilities)

Computer Hardware

Most image analysis software can be run on high and medium performance personal computers and minicomputers such as Vax or Micro-Vax are not longer necessary. The PC used should be a 486 because image analysis is a time consuming operation. The recently released Plentium based computers should be considered if maximum performance is essential but current costs may prove prohibitive until prices drop later this year.

To load a complete Landsat TM scene, a hard disk with 300 MB of free space is required. While it is possible to work with sub-scenes or to load only parts of a satellite image, in the long term this may prove impractical. The falling cost of hard drives has resulted in reputable brand 2 GB SCSI units

being readily available with costs in the order of USD 1 per MB. It is possible to analyse the data from a CD-ROM but this may result in unacceptable performance.

Software

During the last few years, most image analysis software packages have been re-written to run on PCs. The user should clarify, that the software he wants to buy is able to manage following jobs:

- 1. Read all available world standard satellite data formats. It should not be limited to a particular satellite receiving station. Most ground stations transfer the satellite data to tape with different blocking factors or physical formats. The software must be able to recognise the format used and to operate the tape drive.
- 2. <u>Carry out the most common image enhancement procedures</u> such as different image stretches, level slicing, spectral ratioing, principal component analysis and simple spatial filtering.

The operator must <u>stretch</u> the grey level difference of the original data set (normally much smaller than 256) or interesting features of the image to the grey level difference of monitor (mostly 256). By this means the human eye can differentiate objects formerly not visible.

<u>Level slicing</u> is a special technique which cuts the grey values of the whole image into "slices". The image analyst has to define the levels, eg. closed forest 40 · 52, open forest 53 · 63, regeneration 64 · 72; then assign colours to the grey ranges or "slices".

Ratio images are created if pixel values of one channel are divided by the corresponding pixel values of another channel. The software normally stores the results in a new synthetic channel. This process can minimize relief-related grey value differences. At the same time, it can enhance the grey value difference related to chlorophyll content, water content or cell structure.

The different channels of a multispectral data set often correlate closely. Forest areas appearing dark on one channel do the same on other channels. The <u>Principal Comoonent Transformation</u> can combine the information of highly correlated channels in a new synthetic channel which differentiates the desired information.

Filter procedures enhance the image sharpness, which is important for visual interpretation. There are two main techniques a) the low pass b) the high pass.

Sometimes displayed images are blurred, mostly due to atmospheric problems during data transfer. Such images show a roughness called the salt and pepper effect. The digital data set can be "cleaned" through a low pass filter which replaces the value of every pixel with the mean value of the surrounding pixels. This homogenises the image, because the procedure reduces the differences between the single pixel and the neighbouring pixels. The high pass filter procedure deletes mixed pixels at the boundary of two spectral classes and enhances the visibility of image details, especially lines and small elements.

- 3. <u>Geometric correction</u> is necessary to adjust an image to the map projection used.
- 4. <u>Supervised classification</u> with maximum likelihood classifier. Digital image classification categorises all pixels into land cover or forest types. The forester uses his knowledge in preparing the classification process. Later, the software classifies every pixel without any interaction. The maximum likelihood

classifier is a procedure mostly used for images showing different land use or vegetation.

5. <u>Radiometric adiustment</u> for digital image mosaicing.

Often, the area of investigation is not totally covered by only one image. A mosaic of different digital images has to be matched together. This is easy once they are geometrically corrected. However, they mostly have different receiving date and every day the illumination and atmospheric conditions change. The software must be able to adjust the radiometric content of image data using overlapping parts of the images.

6. <u>Output aenerating</u> such as filtering and map annotation.

Majority filters of different sizes must be able to reduce the salt and pepper effect of the image classification results relating to the mapping scale used. If there is no GIS linked to the image analysis system the software must be able to edit the classification results in order to create a map legend and an overlay grid.

Output facilities

If there is a GIS available which can be linked to the image analysis system, all map output will be generated by the GIS. However, even with a GIS there should be the ability to output enhanced images. There are two ways to do this; either a colour inkjet or electrostatic plotter connected to the system or the image is displayed in RGB on photographic film from which images

can be produced by any photo laboratory.

Systems Available

There are some systems already installed in the South Pacific. SOPAC, SPREP and MSD use VGA ERDAS and MSD will get two more ERDAS systems in February 1994 where one will be the new version running under Windows. At SOPAC there is a French system inamed OSIRIS installed on a Sparcstation. In Australia microBRIAN is very popular while there is a low cost system available from ITC (International Institute for Aerospace Survey & Earth Science, Netherlands) called ILWIS, which has all the required features.

Beside the functions which a system has to perform, software packages can provide facilities for 3D images, vector data overlay, IHS transformation etc. which can be useful for special applications. However, a user should give the highest priority to the compatibility of the selected system within the organisation and with other organisations in the South Pacific. It should be able to read all satellite data formats (most ground stations provide different file format) and should be able to provide the digital output in a format which can be read by the most common GIS. The software should include an interface with on-line help as well as documentation in understandable English.

W. Forstreutec GOPA Consultant, MSD, Tel: 322635 Fax: 320311 L. Allinson, SOPAC, Tel: 381377 Fax: 370040

■ by Mike Poidevin

BACKGROUND INFOFT MATIONONMAP PROJECTIONS AS THEYAPPLYIN FIJI

A significant component of the Fiji Forest Resource Tactical Planning Project is the mapping at 1: 10,000 scale of forest logging coupes. All mapping will be completed on the Fiji Map Grid, which is based on the WGS-72 spheroid or ellipsoid.

A requirement in the compilation of these maps will be the gathering of non-photogrammetric data from other sources. Much of this data is stored as information on various maps or charts, which depending on their age and who produced them were based on different map grids.

It is intended to digitise any required data from these old plans or charts. Prior to starting the digitising it is necessary to correctly transform a minimum of four (4) boundary

coordinates to the Fiji Map Grid. This has lead to the development of a suite of programs to do this work. This suite of programs will also provide a sub-routine calling sequence for inclusion in other programs.

An existing program, FIJI, written by A.J. Broadhurst, Department of Survey and Land Information, New Zealand forms the basis of the conversions between different map grids in Fiji. This program is general and covers all conversions required, but may need the user to transform a number of times to get the required result.

It is the intention of the author to provide a fully rigorous (where possible) set of programs and their source code to the Government of Fiji. Most routines are written in Fottran, some in Pascal. They can be readily converted to other languages.

Why different map grids?

Since the time of Ptolemy, man has been concerned with how to represent the Earth's physical surface on a plane. This has lead to the development of complex formulae, approximate formulae, and a host of mapping projection techniques.

Essentially, a projection is chosen by a cartographer based on the following reasons:

- The shape and extent of the area to be mapped
- A specific property of the reference surface which is to be retained on the projection.
 eg. equal areas, retain shape, retain azimuth etc.
- The scale of the map. It is now common practice that mapping on scales of 1:100,000 and larger are done on the Transverse Mercator Projection. This is probably more of a reflection of the development of the Universal Transverse Mercator (UTM) projection and its application by the US military and their allies, to have a uniform consistent projection for their map series.

There are numerous map projections, but generally they fall under one of the following types:

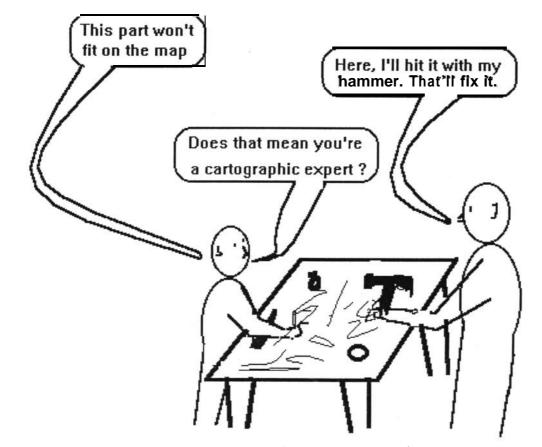
- Perspective projections. These are geometrical projections of a spherical reference onto a plane from a centre of projection. Eg. Stereographic projection which is used for mapping polar regions and star charts, Orthographic which is used for star charts, Gnomonic is used for navigation.
- Quasi Perspective projection. These do not have a common centre of projection, but adopt a curve on the sphere, such as a a parallel of latitude, from which the surface is projected. Eg. Lambert, Mercator, Transverse Mercator, Cassini-Soldner etc. The major land based map projections fall in this category.
- Pseudo projections are similar to the Quasi perspective, but without a simple relationship to an enveloping surface.
- Non perspective projections. Primarily used for atlas and world maps.

How do we define our position on the Earth ?

Our position on the surface of the Earth can be related to one of the following reference frames

- Three dimensional rectangular Cartesian co-ordinate system. (These are not the grid coordinates so often seen on a map.). They are expressed as (x_1, x_2, x_3)
- The set of curvilinear coordinates, phi, lambda, height above the spheroid (Latitude, Longitude, Height), which can then be converted to grid coordinates. These coordinates are those depicted on maps.
- Two dimensional system of surface parameters (u_1, u_2)

The problem of defining a position on the Earth's surface is also compounded by the definition of the spheroid or ellipsoid of revo-



lution. The earth is not a true sphere, but rather an oblate spheroid, and its definition is defined by an equatorial radius (semi-major axis) a, and flattening f. Knowing the semi-major axis and the degree of flattening, one can determine the semi-minor axis b. Note: The semi-minor axis is about 20 km less than the semi-major axis, which represents a flattening of approximately 1 in 300.

Unfortunately, many values (ie. hundreds) for the semi-major axis and flattening have been defined over the last couple of centuries. With the advent of computers and satellites, better information is derived all the time for the definition of the "perfect" spheroid definition of the earth.

Why all this worry with defining a "perfect" spheroid? It has to do with the fact that the earth as actually a geoid. At various points on the surface of the earth there is a difference between the geoid and the spheroid, which can be quite large, but is generally less than about 60 metres. Geodesists try and minimise this difference, so that survey observations require minimum reduction to the spheroid.

Likewise with the development of the Global Positioning System (GPS) there has been a push to adopt a spheroid that is geocentric (ie. the centre of the earth is based on the centre of mass), while at the same time satisfying the "fit" between the geoid and the spheroid.

Some common ellipsoids of revolution used in Fiji are :

	semi-major	f
World Geodetic System 1972 (WGS-72)	6376135.000	298.26
Clarke 1880 Spheroid	6378306.437	293.465
International	6378388.000	297.0

Another projection problem!

The Fiji Map Grid is based on the WGS-72 spheroid definition. Since the time of its definition in 1986, another spheroid has been defined WGS-84

WGS-84 is the current spheroid used by GPS receivers to compute position on the earth's surface. Unfortunately, there is no rigorous conversion from WGS-84 to WGS-72 |

The method of converting from WGS-84 to WGS-72, (if you are using GPS receivers) will be by means of a 7-parameter similarity transformation. The parameters are currently being determined by Department of Lands and Survey, Fiji. These parameters should be available in the near future. Key trig sites around the Fiji Islands

need to be observed and the baseline vectors derived will be analysed to provide a "local" datum shift between the two spheroids.

Who caused this confusion ?

The current state of confusion between different map projections can be blamed on 18-19th century French and German mathematicians and geodesists (Gauss, Kruger, Albers, de L'Isle, Plate Carre, Werner, Molleweide, Bonne, Lambert, Gerhard Kramer (Mercator Projection), Schreiber, Cauchy Riemann. More recently, we can blame the US military for the development of their Global Positioning System (GPS), however its benefits for civilian use far outweigh any ot our problems with projection transformations

here in the Pacific.

Key points to remember in doing projection transformations. The following are key points to remember:

- Not all geographical coordinates are the same. Geographical coordinates only have significance when you know which projection was used. Eg. WGS-72, International, Clarke 1830 etc.
- All maps should show what coordinate system or projection was used.
- Ensure that you use proven software or correct techniques when transforming coordinates. If it is the first time you are doing a particular conversion, have someone independently check your calculations. This can save you a lot of heartache later on.
- Remember that some transformations may only be approximate.

Conclusion

In summary, the geoid is the natural surface of the earth, with the height following the general mean tide level. This surface is normal to gravity and therefore changes constantly because the earth's mass changes. Because this surface varies, it cannot be defined accurately by mathematics. Subsequently, the earth is defined by the definition of an ellipsoid, which closely approximates the geoid for a particular area. Eg. Australian National Spheroid, North American Datum, New Zealand Datum, etc.

Depending on the size and shape of the country or area to be mapped, a projection technique is selected for which mapping will be undertaken. Most mapping these days is on the Transverse Mercator projection.@

Mike Poidevin, MSD, Tel: 322635 Fax: 320311

SPOTVIEW NEW SPOT PRODUCTS FOR GIS APPLICATIONS

Extract from press release dated 6 October, 1993. Received by far 12 January, 1994 from SPOT Imaging Services. Australia.

Since it was first set up in 1982, Spot image has handled worldwide distribution of Spot products returned by Spot satellites and associated services. Spot-3, the third in the series, has been successfully launched on September 26,1993. In a few short years, Spot Image has risen to the position of leader on the global market for geographic

information thanks to its constant effort to adapt and diversify its products and services to its clientele.

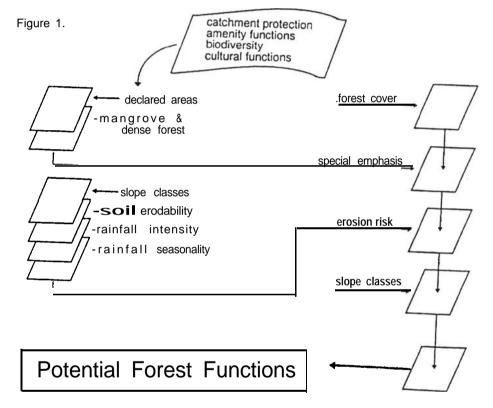
In the world of geographic information, the demand for digital products spawned by the development of geographic information systems (GISs) has led Spot Image to expand its range of Geospot products by creating

POTENTIAL FOREST FUNCTIONS FOR FIJI'S FORESTS

One of the objectives of the FGIP/MSD was to develop potential forest function maps of mainly natural forests resources to supplement the 36 forest type maps (20 years old) currently being used by the Forestry Department. Primarily, these maps are to be used for a Planning and management policy document by the Forestry Department with respect to the forest resources. Although lacking any legal status, it could be considered at the next stage.

The two phase consultancy of Dr D. Watling (Environmental Consultant (Fiji) Ltd.) was designed to establish an appropriate methodology and also consider the views and interests from other institutions/departments/etc. For example, Lands Department NLTB USP Hydrology Department, etc. Together with the MSD Team, the final presentation was made on 20 January, 1994 at the Forestry HQ.

The methodology represents the classifications/analysis and the combination of these Spatial and non-spatial data or information, see Figure 1. The classification which is a



SPOTView and to define a new data format.

The definition of the new GIS Geospot 4.0 format took into account all GIS players from system manufacturers to users and companies providing added-value services. The aim is to move towards full compatibility with the software packages marketed by leading GIS suppliers. The format is already recognised by ESRI, Intergraph, Cap Sesa, and others. It enables users to access process and combine raster-type image data gathered by satellites with vector-type data from conventional sources. Compatibility means the easy integration of various elements (administrative boundaries, networks, contourlines, digital elevation models etc.,) with Spot imagery

A SPOTView looks **like an ordinary mapsheet** on a Spot image underlay, Thanks to the GIS Geospot format, the SPOTView product line is open to continuing improvement to accommodate future developments in the GIS marketplace. The SPOTView line currently comprises:-

- SPOTView Basic
- SPOTView Plus
- SPOTMap

The Spot Image commercial network: Spot Image has subsidiaries in the United States, Australia and Singapore and a worldwide network of 80 distributors.@

For further information contact Keiko Crowley, SPOT Imaging Services, Suite 502 156 Pacific Highway, PO Box 197, St Leonards NSW 2065, Australia. Tel: (61) 2 9061733 Fax (61) 2 9065109.

three-stage hierarchical system defines the various forest uses with its potential uses and applications.

Stage 1:

- 1. Natural Forest Use
- 2. Plantation Forest Use

Stage 2:

- 1.1. Multiple Use Natural Forest
- 1.2. Protection Forest
- 1.3. Preserved Natural Forest
- 2.1. Amenity Plantation
- 2.2. Timber Plantation

Stage 3

- 1. General Forest Use
- 2. Amenity
 - Recreation
 - Education
 - Landscape
 - Research
- 3. Catchment Protection
 - Watersupply
 - Hydro-electricity
 - Irrigation
- 4. Biodiversity
 - Fauna
 - Flora
 - Communities
 - Habitat
- 5. Culture
 - Historic
- Traditional

Factors which determine the locations are influenced by the extent of slopes, rainfall intensity and seasonality and soil types with respect to soil erosivity. These factors are given GIS values which numerically indicate its rating from low - high or extreme.

An important layer which was determined in Germany and formed the base was the Forest Cover information These were produced from the Landsat TM Images which include forest type information ranging from dense, medium and scattered natural forests plus mangrove as well as digitised plantation areas.

The production of the potential forest functions is determined by overlaying at least 10 GIS layers with different (place) values using a GIS Program. However the production of the interpreted forest function maps covering all sheets of the old Directorate of Overseas Survey map series for the presentation was possible with the technical assistance from SOPAC. The final forest function information will be soon finalised before the production of the final maps in Germany.

May I take this opportunity to express my sincere thanks to SOPAC, Lands Department, Hydrology Division of PWD Land Use section of Agriculture and NLTB to name a few, for your assistance towards the final result.

A more detail article will issued by Dr D Watling in a later newsletter. Likewise the production of the final maps will be made after a final review by Forestry HQ. © Osea Tuinivanua, MSD, Tel: 322635 Fax: 320311

■ by Wolf Forstreuter

AREA CALCULATION WITH RASTER DATA BASED ERDAS SOFTWARE

Introduction

The Management Services Division (MSD) of the Forestry Department in Fiji uses a raster data based GIS because an overlay analysis of more than ten different information layers is difficult to carry out with a vector based system. However, raster data based system have limits to link spatial data to relational databases. This article describes a possible "work arround" to transfer spatial data produced with ERDAS to a relational database such as dBASE-IV.

Transfer of Print Output to ASCII File

Knowing that ERDAS software is written in FORTRAN it was easy to find out how the program can be told to write to a file instead of sending the analysis directly to the printer. When the program asks to which printer the output should be sent, the operator should answer with number "7", e.g.

Enter which text printer to use (by number) ? [0]:7

The ERDAS software then creates an ASCII file with the name FORT6. This file can be seen with the editor of MS-DOS or other text editors. It also can be imported into other word processing packages as ASCII text.

Import to dBASE-IV

Firstly, the operator has to create a so called "receiving file" (in our example we call it ERDASDBF.DBF) containing one characterfield (in our example called "FIELD_A") of 79 digits width, Then he imports the ASCII file produced by ERDAS with the command:

APPEND FROM FORT6 TYPE SDF

For every line of the ASCII file, dBASE creates a record in the ERDASDBF.DBF file. All information is stored in character format and can be viewed with the BROWSE instruction. An example of a dBASE table imported from ERDAS is shown in Listing 1

```
Header listing for GIS file: A4VITIOB.GIS
Date statistics printed: 07-JAN-1994
Date statistics created: 07-JAN-1994
This file has 1103 rows, and 1064 columns
This image is gee-referenced to a Other Map coordinate system
The upper left corner has coordinate: 1911126. 3939097
The cell size is (X, Y): 25, 25
The number of hectares per cell is: 0.0625
upper left corner data file coordinate (X,Y) is: 1, 1

Number of classes in this variable is: 101
This file contains El-bit data
The VARIABLE name is forest cover in district boundaries

VALUE

POINTS

BECCRIPTION

BECCRIPTION

BECCRIPTION

COUNTY WALUE

O. 0.000 0.00 % water
```

VALUE	=====	======= ==============================
î	0.	0.000 0.00 % water NODISTRICT
1		NODISTRICT
2	0. 0.	0.000 0.000 0.00 0.00 % % scattered dense forest forest NODISTRICT
3	0.	0.000 0.00 % non forest NODISTRICT
-	•	0.000 0.00 % NODISTRICT
5 6	Q.	0 000 NODISTRICT
	6	0.000 0.00 % NODISTRICT
8 9	0.	0.000 0.00 % NODISTRICT
8	•	0.000 0.00 % NODISTRICT
	0.	0.000 0.00 % NODISTRICT
10	0.	0.000 0.00 % WAINIMALA
11	103744.	6484.000 4.46 % dense forest WAINIMALA
12	4209.	263.062 8.84 % scattered WAINIMALA
13		0.36 % non forest WAINIMALA
	0.	0.000 0.00 % WAINIMALA
15	0.	0.000 0.00 % WAINIMALA
16	0.	0.000 0.00 % WAINIMALA
17	0.	0.000 0.00 % WAINIMALA
18	0.	0.000 0.00 % WAINIMALA
19	0.	0.000 0.00 % WAINIMALA
20 21	3419::	0.000 0.00 % NAVOSA
21	99330.	2137.125 2.91 % dense forest NAVOSA
22	5963.	6208.125 6.46 % scattered forest NAVOSA
24	0.	NAVOSA 372.687 0.51 % non forest NAVOSA
	٠.	
26		0.000 0.00 to:00 - NAVOSA
26	٥.	0.000 0.00 % NAVOSA
27 28	o.	0 000 0.00 % NAVOSA 0.000 0.00 % NAVOSA
29	0.	
30		0.000 0.00 % NAVOSA 0.000 0.00 % TAWA
30	0.	0.000 0.00 % TAWA

Listing 1: Printout of an example ERDAS statistik file imported into dBASE. For demonstration the file was simplified. Normally the area for three different types of natural forest is given beside the area for hardwood, pine and coconut plantation, mangrove, waterbodies and area covered by clouds. The VALUE (first column) derived from adding the value of the layer "forest cover" (1 = dense forest, 2 = scattered

forest, 3 = non forest) to the value of the layer "district" (IO = Wainimala, 20 = Navosa \dots)

Creating a Real Database File

Using the SUBSTRING command **a** further program selects the information needed from the original printout file now stored in ERDASDBF.DBF. (In reality, all different steps of transformation are included into one program, however, it is easier to copy the procedure if it is explained in several steps). Important information starts with record 30, so that the first instruction has to be a SKIP 29. The program then has to determine if the substring at position 5 is **l,2** or 3 in order to store the area (Hectares) into the corresponding variable. Because the variable and the corresponding field are of type "number" dBASE has to convert the character substring into numeric expression by VAL function.

STORE VAL(SUBSTR(FIELD_A,4,1)) TO distrind

```
IF VAL(SUBSTR(FIELD_A,5,1)) = 1
STORE VAL(SUBSTR(FIELD_A,27,9) TO densefo
ELSE
IF VAL(SUBSTR(FIELD_A,5,1)) = 2
STORE VAL(SUBSTR(FIELD_A,27,9) TO scatteredfo
ELSE
IF VAL(SUBSTR(FIELD_A,5,1)) = 3
STORE VAL(SUBSTR(FIELD_A,27,9) TO nonfo
ENDIF
ENDIF
ENDIF
```

SKIP && move to next record

variables:
densefo = dense forest
scateeredfo = scattered forest
nonfo = non forest
distrind = district indicator

Then the program moves to the next record and checks if the information is given for the same district by investigating if the first digit of the GIS VALUE is the same. If the program moves to a record in which areas of the next district are stored, the variables have to be stored into a new database (in our example called AF2.DBF). See Listing 2.

IF VAL(SUBSTR(FIELD_A,4,1)) <> distrind

STORE VAL(SUBSTR(FIELD_A,4,1)) TO distrind REPLACE AF2->DFOREST WITH desefo REPLACE AF2->SFOREST WITH scattered REPLACE AF2->NFOREST WITH nonfo

ENDIF

All these instructions have to be included into a DO LOOP analyzing all records until end of file.... DO WHILE .NOT. EOF(). Beside the area in hectares for every forest type; information such as filename, date of file creation or district names are stored in a similar way into the new database AF2.DBF.

MAPNAME	DISTRICT	DFOREST	SPOREST	NPOREST	DATEOFTR
A4VITIO6	WAINIMALA	3272	6484		07/01/94
A4VITIO6	NAVOSA	2137	6208		07/01/94

Listing 2: The newly created database file AF2.DBF contains the information of the ERDAS printout in a condensed form, usable for futher data bank investigation.

The area information of other map sheets can always be added to the same data bank. Easy dBASE commands such as:

CALCULATE SUM(DFOREST) TO xx FOR DISTRICT = "NAVOSA

will calculate the total area of dense forest, stored in several mapsheets for the district of Namosa.●

Worf Forstreuter GOPA Consultant, MSD. Tel: 322635 Fax: 320311

CONTACTS

The following list details the organisations who receive and orovide contributions to this newsletter in Fiji

ORGANISTATION, FAX

Delegation of the Commission of the European Community, 300370
Department of Energy, 370039
Department of Environment, 303515
Department of Town and Country Planning, 303515

Embassy of the Republic of Marshall Islands

Environmental Consultings Fiji Ltd, 370012 Fiji Forest Industries Ltd, 813088

Fiji Pine, 661784

Fiji Posts and Telecommunications, 313362 Forestry Department, Management Services Division. 320311

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Ministry of Environment and Natural Resource Development. Kiribati

Ministry of Foreign Affairs & International Trade, Kiribati

Ministry of Home Affairs and Rural Development, Lands and Survey Division, Kirihati

Marshall Islands Marine Resources Association, Marshall Islands

Ministry of Foreign Affairs, Marshall Islands Centre ORSTOM de Noumea, New Caledonia Service des Mines et de l'energie, New Caledonia

South Pacific Commission (SPC), New Caledonia

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New Zealand University of Otago, Spatial Information research Centre, New Zealand

Department of Mining and Petroleum, Papua

Department of Mining and Petroleum, Corporate Services Division, Papua New Guinea

Department of Mining and Petroleum, Minerals Division, Papua New Guinea

University of Papua New Guinea, Department of Geography, Papua New Guinea

Forum Fisheries Agency (FFA), Solomon Islands

Fiji Land Information System

Geographic Information

Federated States of Micronesia

Organisation

System

FLIS

FSM

GIS

Ministry of Foreign Affairs & Trade Relations, Solomon Islands

Ministry of Natural Resources, Forestry Division, Solomon Islands

Ministry of Natural Resources, Geological Survey Division, Solomon Islands

Department of Agriculture, Tonga Ministry of Fisheries, Tonga Ministry of Foreign Affairs, Tonga

Ministry of Lands, Survey and Natural Resources, Tonga

Department of Lands & Survey, Tuvalu Meteorological Office, Tuvalu Ministry of Natural Resources, Tuvalu Office of the Prime Minister, Tuvalu

Public Works Department, Tuvalu EOSAT, USA

United States Forestry Service, USA Department of Geology, Mines and Water

Resources, Vanuatu
Department of Forestry, Vanuatu
Lands and Survey Department, Vanuatu
Ministry of Foreign Affairs, External Trade &

Immigration, Vanuatu

Apia Observatory, Western Samoa Department of Agriculture Forests and Fisheries, Western Samoa

Department of Lands, Surveys and Environment, Western Samoa

Ministry of Foreign Affairs, Western Samoa South Pacific Regional Environment Programme (SPREP), Western Samoa

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

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or

MANAGEMENT SERVICES DIVISION FORESTRY DEPARTMENT PO BOX 3890, SAMABULA SUVA, FIJI

Attention: Wolf Forstreuter Tel: 322635 Fax: 3203 11

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. @

ACRONYMS

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

AIDAB Australian International
Development Assistance

Bureau
CSIRO Commonwealth Scientific and

Industrial Research

Organisation
ESCAP Economic and Social

Commission for Asia and the

Pacific
Food and Agriculture

GOPA Gesellschaft fuer Organisation Planung und Ausbildung (Agency for Organisation Planningand Education) Global Positioning System GPS MAFF Ministry of Agriculture Forests and Fisheries MIF MapInfo Interchange Format Mineral Resources Department MRD MSD Management Services Division NI TB Native Land Trust Board

ORSTOM Institut Francais de Recherche Scientifique pour le Developpement en Cooperation

PWD Public Works Department
SOPAC South Pacific Applied
Geoscience Commission
SPC South Pacific Commission

SPC South Pacific Commission
SPOT Satellite pour l'observation de la Terre

SPREP South Pacific Regional
Environment Programme
TM Thematic Mapping
UNDP United Nations Development

USP

Program
University of the South Pacific

FA0