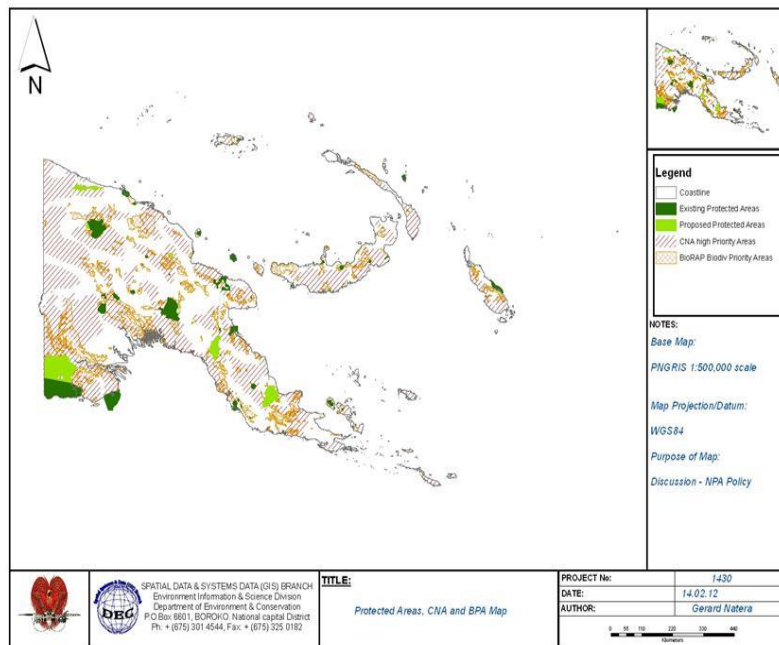# CONSERVATION TARGETS – BIORAP TOOLBOX

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10/20/2016	Summary

The BioRAP Toolbox constitutes a complex series of computer programs (ANUDEM, ANUSPLIN, ANUCLIM, PATN and TARGET). This was first assembled in 1994 – 1995 by the Environment Resources Information Network (ERIN), Great Barrier Reef Management Park Authority (GBRMPA), Centre for Resource and Environmental Studies (CRES) of Australian National University and CSIRO (Division of Wildlife &

Ecology). In 1997, the Australian Consortium of Australian National Herbarium (ANH), CRES of the Australian National University and CSIRO (Division of Wildlife & Ecology) successfully completed the pilot phase of the project. The PNG partners, were the PNG Forest Research Institute (PNGFRI), National Weather Service (NWS), Land Use Section of Department of Agriculture & Livestock and the Department of Environment & Conservation. Although most of the work done by CRES was in ArcInfo, the standard display program used during the project, was IDRISI

Hence, much of the emphasis in this report is on the use and application of BioRap tools such as ANUDEM, LAPGRD, BIOCLIM and PATN. BioRAP (or Biological Rapid Appraisal Project) tools were developed by the Australian Consortium (ERIN, GBRMPA, CRES and CSIRO) to produce a 16.8 % biodiversity priority area (bpa) map (see Figure 1) for PNG within a 14-month period (Nix, 2000). The application of each of the programs, is astounding and can cover features e.g. terrain and climate, other than biodiversity.

According to Nix et .al (2000), these tools support high spatial resolution biodiversity assessments e.g. 1 km grids that are readily integrated with existing spatial distributed planning information, such as PNGRIS. BioRAP outputs such as the biodiversity priority area (bpa) map can also be incorporated into PNGRIS.

CONSERVATION TARGETS – BioRAP Toolbox

HISTORY & LESSON LEARNT

HISTORY / LESSON LEARNT

The fight to preserve and conserve rare, critically endangered species and endemic areas, has been an ongoing struggle over the last decade or so. Tools like CNA using CSig Program, PNGRIS and FIMS using FoxPro and MapInfo Program, followed by BioRAP using ANU Software and Idrisi program and recently POWPA using MARXAN were used as a decision-making tool. Its success is yet to be determined. Where have we gone wrong? Or what have we achieved so far? BioRAP Analysis showed 16.8% which is 3.8% lesser than the optimistic figure of 20% (as per NEC Decision (No??)

This report describes the journey or process of transforming raw data into meaningful map output, the lesson learnt and challenges it faced in trying to achieve 20% target and the next step forward

Records show that 70% TRF is available (PNGFA Base-map) but in reality 50% or less is available or is of commercial value. This staggering data could mean the end of the Timber Industry unless reforestation or reafforestation efforts are done now. That would mean either PNGFA inject heavy funding or use reforestation or environment levy (under CEPA) to kick-start nurseries and eventual goal of establishing Forest Plantations. The natural TRF can never be fully recovered but at least Forest Plantation will provide some relief for wildlife refuge, habit, fuel-wood, employment and sustenance of the Timber Industry.

Over the years, monitoring and enforcement went on a downward spiral due to government new directive as a policy oriented organization. This has brought to light the need to use policy, Environment Act 2000 and review EP condition for proponents to provide spatial data to CEPA and set aside area within projects to cater for biodiversity offsets.

Giving weight to MARXAN is the National Protected Area (NPA) Policy and the Protected Area (PA) Bill and in part certain section of the Environment Act (2000), that provides for data and information gathering.

> **Quote : The fight to conserve the last reaming Tropical Rainforest (TRF) is still being fought. Are we loosing or staying the cause?**

The purpose of my talk is to give a history of BioRAP Toolbox and focus on TARGET which is similar to MARXAN (various scenarios, iterations and percentage targets)

SUITE OF TOOLS

There are 5 software program that are part of the BioRAP Toolbox. These are ANUDEM, ANUSPLIN, ANUCLIM, PATN and TARGET. The Displaying software program used was Idrisi

ANUDEM

ANUDEM is a digital elevation model (DEM) program, developed by the Australian National University (ANU). The program, like ANUSPLIN and ANUCLIM are currently written in standard FORTRAN 90 and normally distributed in binary format for standard grid display in IDRISI (Hutchinson (1997).

This program as described by Hutchinson (1997) " calculates values on a regular grid of a discretised smooth surface fitted to large numbers of <u>irregularly spaced elevation data points, contour line data (if any) and streamline data</u>. The program imposes a global drainage condition which automatically removes sinks where possible."

ANUDEM program has the following advantages. These are:

1. The availability of a good quality, fine scale
2. The compatibility of the ANUDEM program with DOS, Windows 95 and 98 environment.
3. The compatibility of IDRISI (a digitizing and map displaying software) program with Windows 95 / 98 environment running on a Pentium 1 Computer.
4. The generation of DEM as a useful bridge to generate climate and other terrain images where previously seen difficult to do
5. The displaying of a three dimensional or ortho-perspective view of DEM image in IDRISI.

The complementary ability of ANUDEM and IDRISI, is that they are interactive, not only in terms of displaying various diagnostic outputs (normally produced in graphical form) but with data quality control through the error correction phase or procedure. The main data flow for ANUDEM is provided in Figure 1.
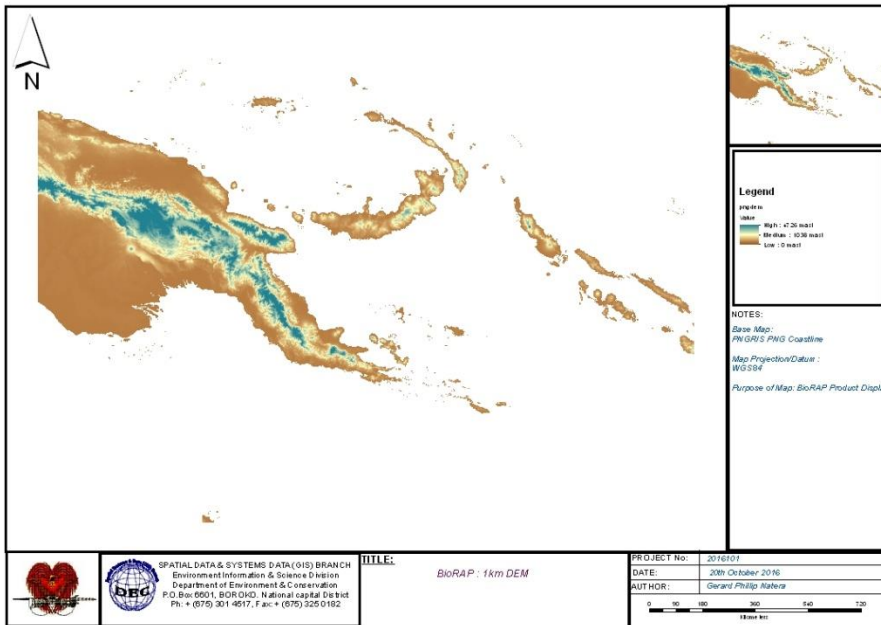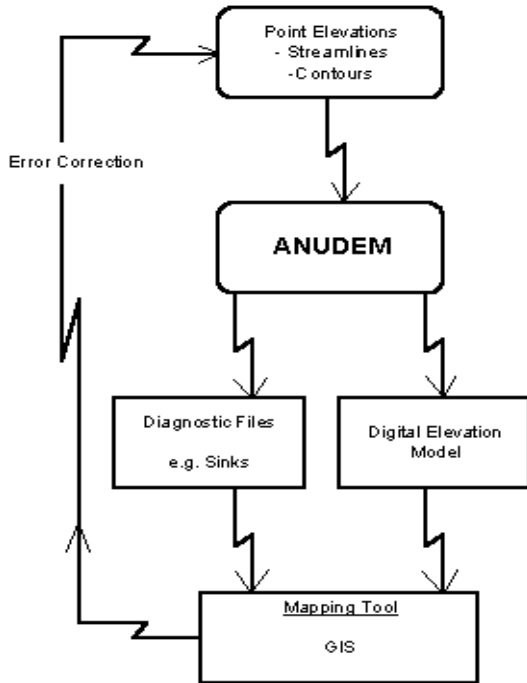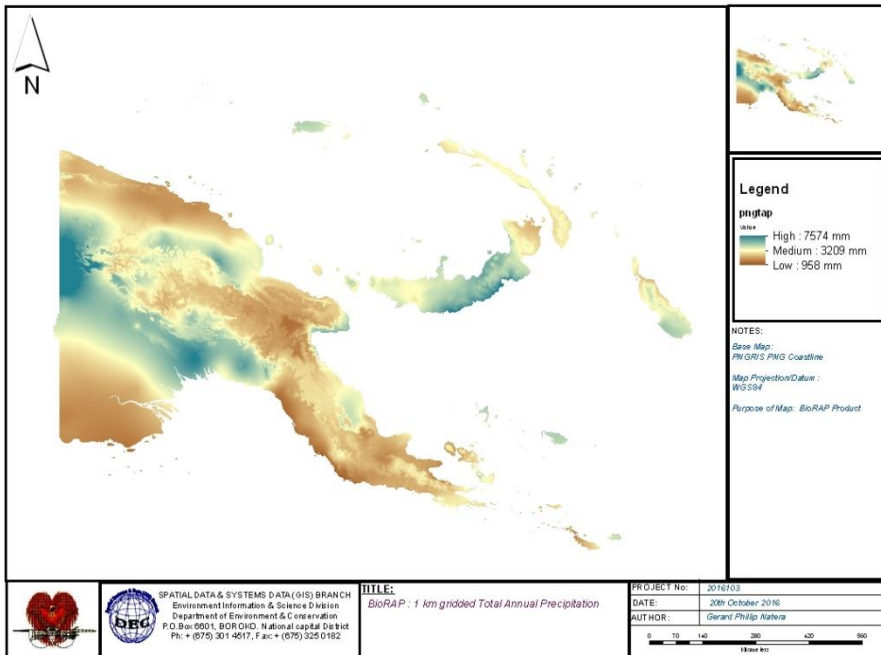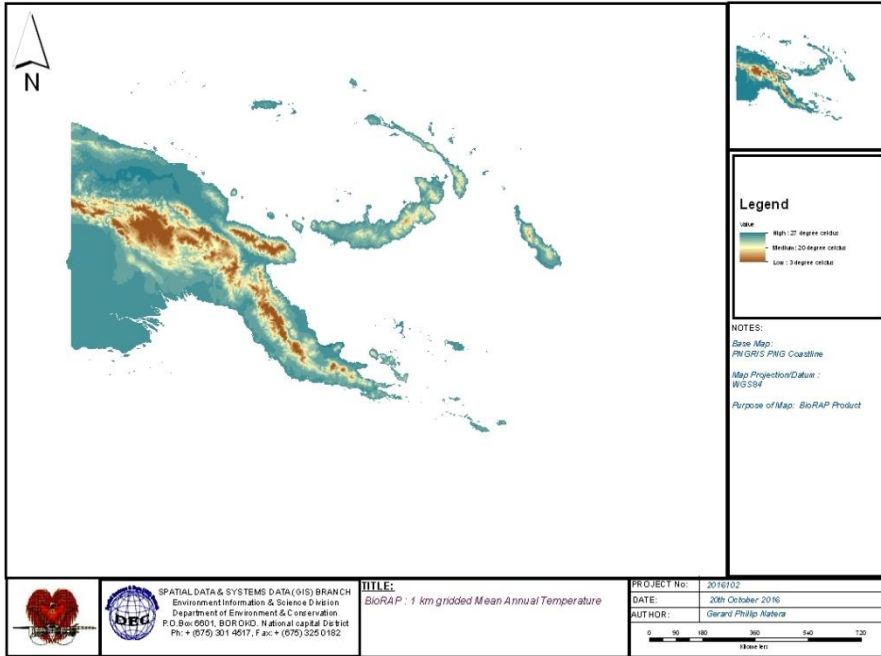
ANUSPLIN

ANUSPLIN is a climate model (version 3.2) program also developed by the Australian National University (ANU). It generates climate surfaces through the spline function, using the derived digital elevation program as a base image. It was developed to <u>fit surfaces to noisy data as functions of one or more independent variables</u>. Programs for interrogating the fitted surfaces in both point and grid form are also contained in the package

Hence, LAPGRD is an executable program in ANUSPLIN that allows for the production of temperature, rainfall and solar radiation maps with ease. The method employed here is simply the generation of command and batch file to be able to generate images mentioned above.

As PNG climate surfaces data files were already produced, LAPGRD (See command and batch files below) was used for my MPhil Thesis (unpub) to "calculate values of partial thin plate smoothing spline surfaces at points supplied in the file" (Hutchinson, M.F (15 Sept 1997)).

The relevant files used for this exercise were surflist (Listing of Surfaces), watut.img (DEM for Slate-creek Catchment), pngmin5b.sur (minimum temperature), pngmax5b.sur (maximum temperature), pngrad.sur (solar radiation) and pngrf5d.sur (precipitation).

Mint1.cmd	Explanation of Parameters and Values for Mint1.cmd
pngmin5b.sur	Spline coefficient file name
1	Surface number (0-12). 1= January
watn01.img	Output grid file name
3	Mode of output grid: 3 = Idrisi Image
5	Grid value units: 5 = Degrees
5	Grid position units: 5 = Degrees
1	Centring option: 1 = at centres
1	Index of first grid variable: 1 = normal
146.510 146.533 .0001	Lower limit, upper limit and spacing of first grid variable
2	Index of second grid variable: 2= normal
7.241 -7.223 .0001	Lower limit, upper limit and spacing of second grid variable
	Output Idrisi image format: Blank for binary
3	Mode of 3rd independent variable (0,1,2 or 3)
Watut.img	Input grid file name
-99	Special value of output grid

Mint.bat
lapgrd <mint1.cmd> mint1.log
lapgrd <mint2.cmd> mint2.log
lapgrd <mint3.cmd> mint3.log
lapgrd <mint4.cmd> mint4.log
lapgrd <mint5.cmd> mint5.log
lapgrd <mint6.cmd> mint6.log
lapgrd <mint7.cmd> mint7.log
lapgrd <mint8.cmd> mint8.log
lapgrd <mint9.cmd> mint9.log
lapgrd <mint10.cmd> mint10.log
lapgrd <mint11.cmd> mint11.log
lapgrd <mint12.cmd> mint12.log

BioRAP : 1 km gridded Mean Annual Temperature

BioRAP : 1 km gridded Total Annual Precipitation

ANUCLIM

ANUCLIM program was developed by the Australian National University (ANU), to systematically accessing the climate surfaces created by ANUSPLIN and to <u>predict the spatial distribution of species by linking species occurrence to climate</u>.

ANUCLIM acts as a user-friendly front end to BIOCLIM (which is the climate interrogation program) and creates command files to be submitted to BIOCLIM and makes direct use of SURFLIST (Hutchinson (1997)).

BIOCLIM operation is defined in terms of a set of bioclimatic parameters. These parameters are listed in Table 1. The text file used here is for *Themeda australus* species. The first bioclimatic parameters in this list are based on monthly mean temperature and precipitation. These parameters constitute the basic environmental data for proxy or surrogate measurement of vegetation.

The BIOMAP program is used in conjunction with BIOCLIM program to complete spatial predictions of species. It matches the 'bioclimatic envelopes' calculated by BIOCLIM to regular grids of bioclimatic parameters.

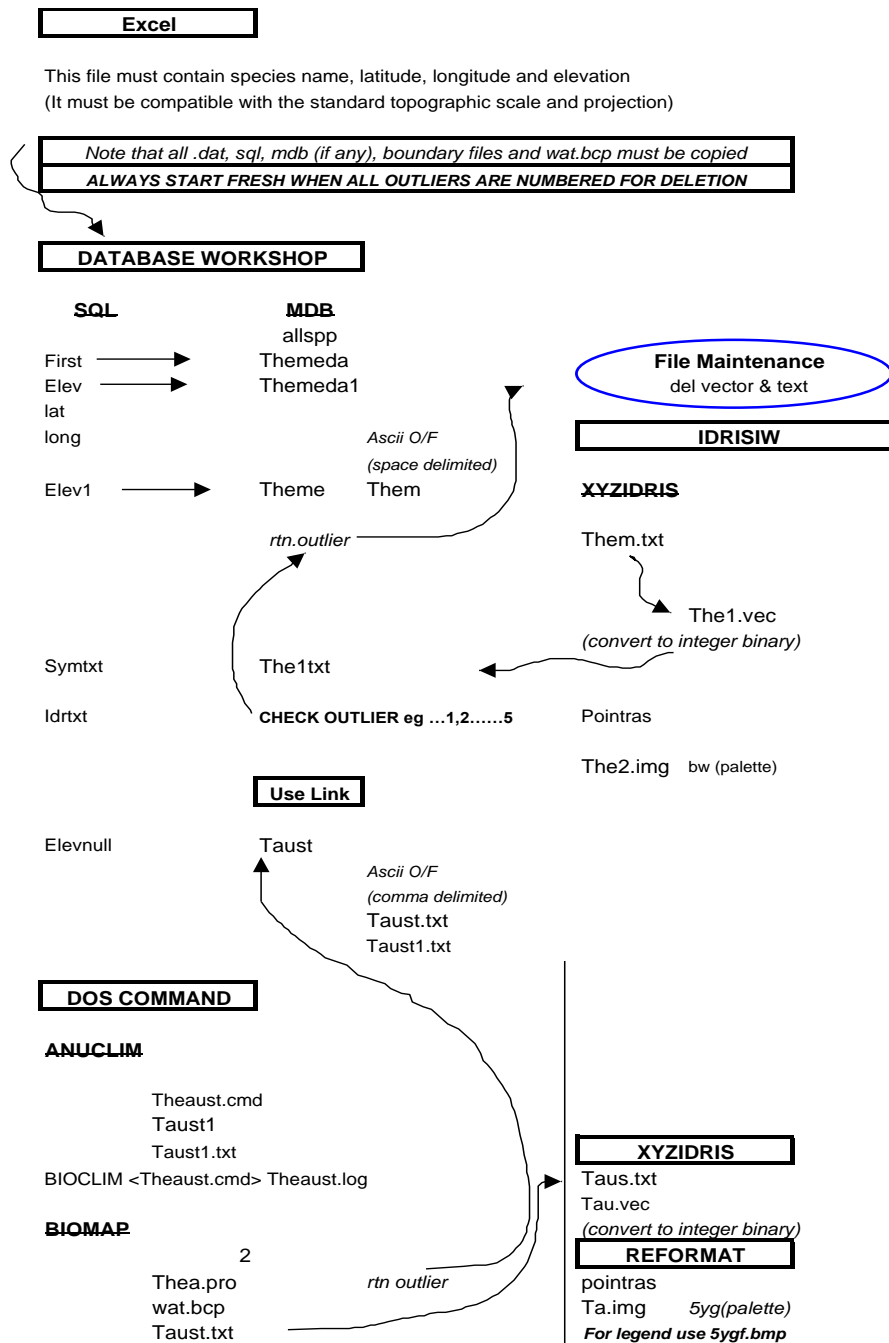
Nothofagus grandis bioclimatic distribution.
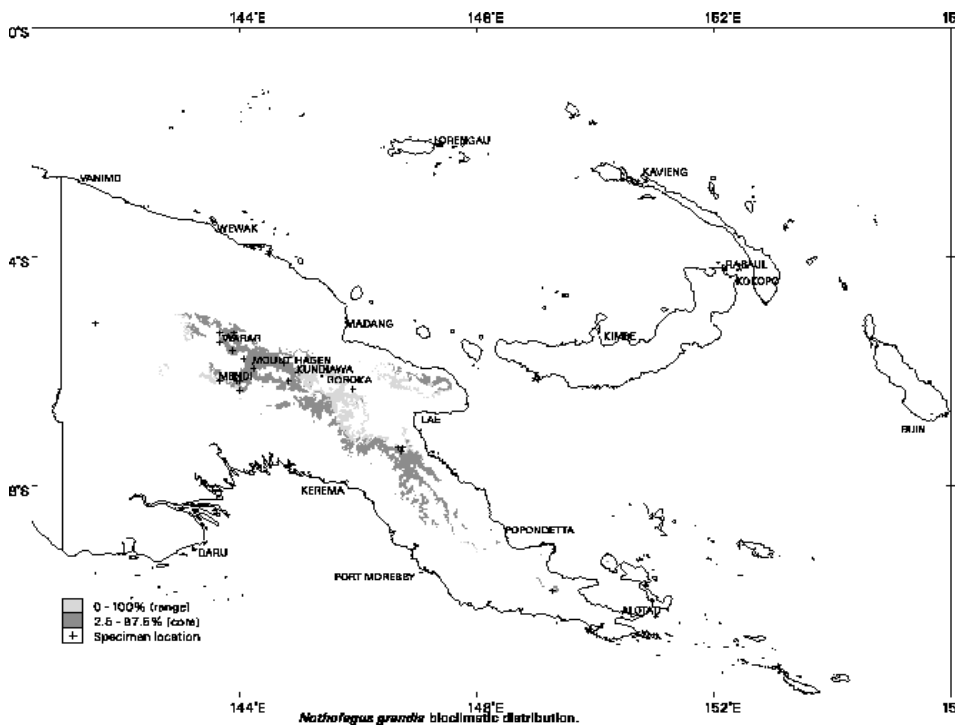
Nothofagus Grandis

The output of the program is an indicator for each grid point denoting the predicted occurrence of absence of the species, based on the bioclimate of each grid point. The output is in a form suitable for storing and mapping by the mapping tool.

The grids of bioclimatic parameters can be provided directly to the ALOB classification procedure of PATN. Details will be discussed in the Environmental Domains Section of this Chapter.

Bioclim flow-chart

Excel	

This file must contain species name, latitude, longitude and elevation
(It must be compatible with the standard topographic scale and projection)

Note that all .dat, sql, mdb (if any), boundary files and wat.bcp must be copied
ALWAYS START FRESH WHEN ALL OUTLIERS ARE NUMBERED FOR DELETION

DATABASE WORKSHOP

SQL   **MDB**
                 allspp
First → Themeda
Elev → Themeda1

lat
long   *Ascii O/F*
                             (space delimited)

Elev1 → Theme   Them

                 rtn.outlier

Symtxt   The1txt

Idrtxt   **CHECK OUTLIER eg …1,2……5**

File Maintenance
del vector & text

IDRISIW

XYZIDRIS

Them.txt

The1.vec
(convert to integer binary)

Pointras

The2.img   bw (palette)

Use Link

Elevnull   Taust

Ascii O/F
(comma delimited)
Taust.txt
Taust1.txt

DOS COMMAND

ANUCLIM

Theaust.cmd
Taust1
Taust1.txt
BIOCLIM <Theaust.cmd> Theaust.log

BIOMAP
                 2
Thea.pro   *rtn outlier*
wat.bcp
Taust.txt

XYZIDRIS
Taus.txt
Tau.vec
(convert to integer binary)

REFORMAT
pointras
Ta.img   *5yg(palette)*
***For legend use 5ygf.bmp***

PATN

PATN runs from DOS and is purposely used to create environment domains

The procedure to derive environment domains is as follows;

1. In the DOS window, start PATN

2. PRAM – restore parameter file created above. Type in new title eg. Environmental Domains. Leave rows and columns alone. Rows are grid cells while columns are attributes (image values). Change logging level from 0 to 2 to allow full logging. Save w3patn.prm file and exit.

3. HIST – generates histograms of columns (attributes. The use of the histograms and summary statistics (eg. mean, minimum and maximum values) to check that PATN has received all the data correctly from IDRISI.

4. ALOB – produces classification of grid cells (environmental domains) Choose Gower as the association measure and default all prompts, up to the required radius or number of groups. In this case, we used 4 groups with 204 iterations. The group numbers are stored in the group affinity vector format in file w3patn.gav. Inter-group dissimilarity matrix is stored in w3patng.aso.

5. GSTA – generates group statistics for each column (attribute) (w3patn.gst). Select option 1 (quantitative data) and Group Affinity Vector form (w3patn.gav) for the form of group definition. Use the default format for the input file format. Quit PATN

6. In the DOS Window, run PATN2IDR to convert w3patn.gav file to IDRISI image. Use mask image (w3patn.img) created with program IDR2PATN. This new image (w3patng.img) may be displayed in IDRISI using the existing palette file however the colours assigned to each group will not reflect their similarity. See Section D below for a technique to generate meaningful colours for each environmental domain (classification group)
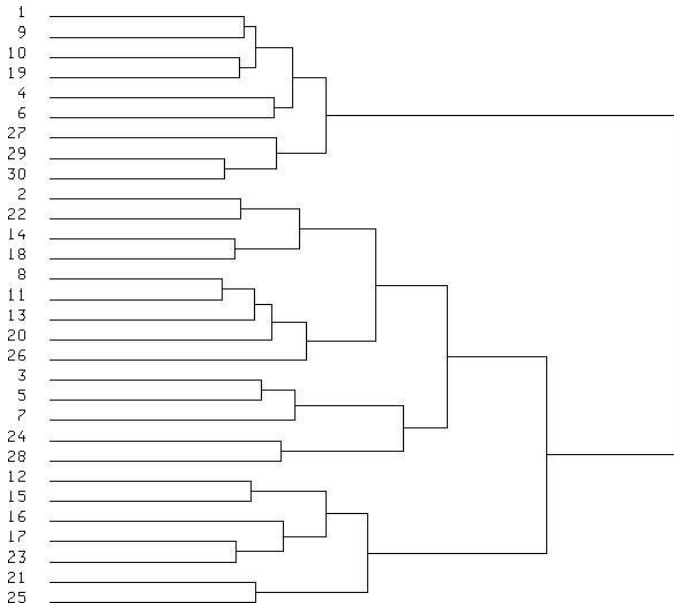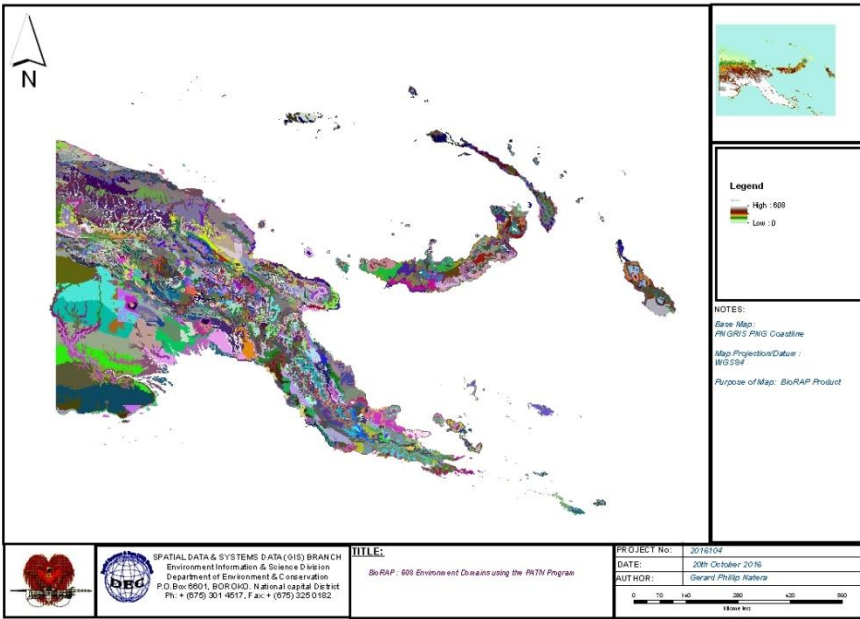
TARGET

These notes describe the derivation of environmental domains, forest type/ domain combinations and species bioclimatic profile group distributions and their preparation for use as biodiversity surrogates for the TARGET program priority area analysis of D.Faith and C.Margules, CSIRO Division of Wildlife and Ecology. The locations to be considered are the Resource Mapping Units (RMU's) from the PNGRIS database. TARGET requires these units be described in terms of their composition of each of the biodiversity surrogate attributes.

The final step in preparing the files for TARGET analysis involved combining the .loc files created independently for the three sets of attributes. This was done by incrementing the attribute numbers for the second and third sets of attributes by the maximum attribute value of the first and second sets respectively (table 4).

TABLE 4. ATTRIBUTE RENUMBERING FOR COMBINED .LOC FILE, RMUALL3.LOC

Original attribute range	Combined attribute range	Description
1 - 608	1 - 608	Environmental domains
1 - 634	609 - 1242	Forest type/ domain combination
1 - 10	1243 - 1342	Species group predicted distributions
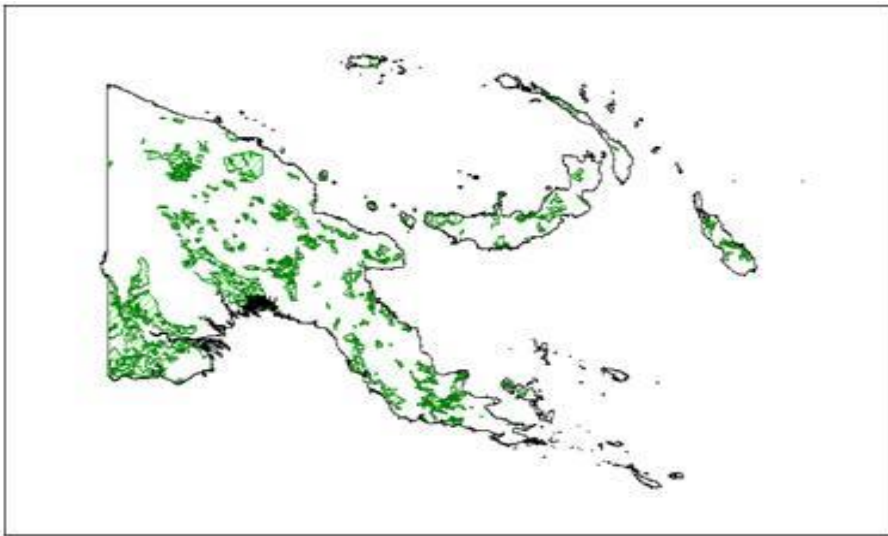
The current set (bpa) includes all gazetted protected areas, endemic, rare and endangered species, low conflicting land uses, population, agricultural and forest potential areas

We are, in my opinion, at cross-roads where conservationist etc., have to be aggressive in their efforts. The usage of Tools such as MARXAN helps as long data and information is readily available. CEPA has recognized this and has included the provision of data (S77 S41 EA 2000) in all recent EP Conditions.