Fungis

Far North Queensland GIS User's Group, Inc

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FUNGIS Newsletter JULY - September 1997

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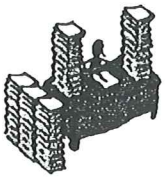


It seems only yesterday that I sat down and compiled the last FUNGIS, a lot has happened, we have survived NARGIS 97, well done Les. It was really gratifying to have our distant visitors and the spread of papers was most commendable, I am really sorry I missed the function dinner, it certainly beats not remembering what happened at Georges Greek Taverna, oh by the way, I with she who will be obeyed dined in fine style at Sirocco restaurant at the Radisson Plaza a wee while ago. Unreal food, the wine list was built for people not Bankers and Politicians the staff gratifyingly servile; go there.

This newsletter is being built by Sharlene Blakeney from Do No Research, Mareeba, she has entirely free hand so I just know it will be much more visually appealing than the monotonous regimented format I have put out since 1988 with a brief Guy Carpenter interlude, thank you Shazza, the Froth and Bubbles brigade to the fore once again.

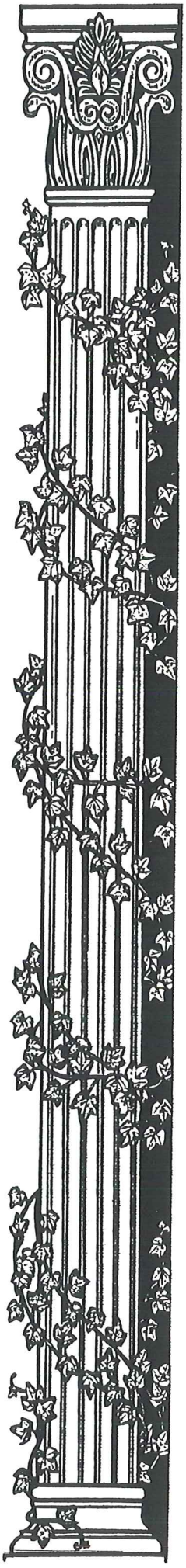
Now to the major item in this Editorial. It is with regret, I have to advise you of the resignation of our Secretariat Judith Searle. For health reasons Judith cannot continue to cosset, bully, poke, prod and generally steer your Management Committee. For over two years Judith has been the most professional secretary I have had the pleasure to be associated with, she kept the Committee well informed at all times, meeting draft agendas were faxed in good time and reminder phone calls kept the ship in good trim at all times The majority of our membership would not really appreciate the work the Management group actually do, we are all really busy pople, have high demands placed upon us by our employers and are dedicated to our profession, Judith appreciated this and despite many very odd quirks and bouts of forgetfulness she gently herded us along. Thank you Judith.

For me the highlight of NARGIS 97 was EarthWatch and the pending launch of their first Satellite with 3 metre resolution, a close second was Terry Webb's presentation, METADATA it won't go away and I loved the sound bites in his Powerpoint presentation.

Ok members it is Annual General Meeting time again, all financial members will already have notice of meeting date and time. It is also a quarterly workshop, at this time the program has 3 presenters, Tony Dawson:-Schools, Brazier and Motti:- Survey/GPS and Geoff Mustard :- Natural Resource Assessment P/L.

Please come along to the meeting with and open mind, the Management Committee can always do with some new blood, certainly the position of Newsletter Editor is free, it is long overdue for a sharp new quill to push this tired old Irishman onto the back bench.

Alan Stafford.



A PRAYER
For Those Growing Old

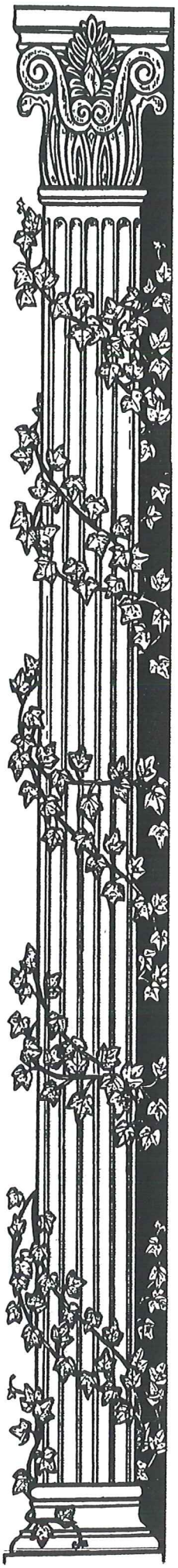
Lord, Thou knowest I am
Growing older. Keep me from
Becoming talkative and possessed
With the idea that I must express
myself on every subject.

Release me from the craving to
Straighten out everyone's affairs.

Keep me from the recital of
Endless detail. Give me wings
To get to the point.

Seal my lips when I am inclined
To tell of my aches and pains.
They are increasing with the years
And my love to speak of them
Grows sweeter as time goes by.

Teach me the glorious lesson
That occasionally I may be wrong.
Make me thoughtful but not nosy,
Helpful but not bossy.
With my vast store of wisdom and
Experience it does seem a pity
Not to use it all.
But thou knowest, Lord,
That I want a few friends at the end.
Amen



Powerful Tools for Creating, Analyzing, and Visualizing Data in 3D on the Desktop
Introducing ArcView 3D Analyst

The ArcView 3D Analyst is an optional extension for ArcView GIS that brings 3D surface modeling and interactive 3D perspective viewing to the desktop for an affordable price. The ArcView 3D Analyst extension provides a suite of easy-to-use tools used for the creation, display, and analysis of 3D data within ArcView GIS.

To support sophisticated 3D surface analysis, the 3D Analyst enables support for the creation and use of triangulated irregular networks (TINs) within ArcView. TINs are vector-based topologically structured data models that are well suited for terrain and surface data modeling. The 3D Analyst provides tools for creating TINs from existing ArcView feature themes and editing the resulting TIN, if necessary. The 3D Analyst also provides fully integrated support for grid data analysis and will provide the tools to create 3D shapes by interpolating a Z coordinate from surface data.
There are many areas that produce and/or use 3D data. The ArcView 3D Analyst is particularly suited for areas requiring 3D visualization and analysis across many data sets, such as

* Photogrammetry (stereoplotters) * Remote sensing (satellite imagery)
* Petroleum (boreholes) * Environmental (well logs) * Utilities (pipes, sewers)
* Transportation (road networks) * Engineering/Surveying (CAD, GPS)

Perspective Viewing

ArcView 3D Analyst adds a new type of document (3D World document) to ArcView GIS, which allows interactive perspective viewing and 3D manipulation of the display. 3D Worlds are similar to View documents in ArcView GIS and contain much of the same interfaces and tools that make the View documents so usable. Using the tools in 3D World, users can rotate the scenes and "fly-through" them giving a whole new meaning to exploring the data. You can even point and identify features in 3D. ArcView 3D Analyst provides a seamless link between 3D visualization and your GIS data.

Analysis

Much more than a 3D viewer, ArcView 3D Analyst gives users the power to manipulate and analyze data from a three-dimensional perspective, including 3D specific tools such as line-of-sight, volumetric calculations, grid and TIN creation, and much more. Upon loading ArcView 3D Analyst, additional tools and choices are added to the View document and the 3D World document is enabled.

These menus and tool buttons are fully customizable using Avenue. Additionally, Avenue requests are also provided for more sophisticated functionality that can be used to satisfy more demanding application requirements.

Some of the available functionality includes

* Creation of TIN and grid based surface models * Draping images over a surface
* Creation of 3D shapes * Drawing 2-D geographic data in 3D
* Interactive query of 3D features * Planimetric display of surfaces and 3D shapes
* Simple editing of TINs * Perspective display of surfaces, shapefiles, and images
* Spot height interpolation and profiling * Contouring
* Slope and aspect calculation * Line-of-sight intervisibility and viewshed analysis
* Surface area and volumetric calculation * Steepest path determination
* Export of perspective scenes to virtual reality modeling language (VRML)
* Grid operators (resample, merge) * Additional analysis functions (cut/fill, Thiessen)
* Low-level access to the TIN data model (triangle selection and navigation)

TINs

TINs used and created in ArcView GIS are not static and can be edited by adding additional features to them. In addition, existing nodes within a TIN can have their elevation (z) values modified. This incremental refinement will help users create high-quality surfaces.

ArcView 3D Analyst goes well beyond common forms of surface analysis, such as contouring and slope/aspect derivation, by providing attribute support and low-level TIN navigation tools and iterators. Values representing attributes can be assigned to triangle facets (real features) in a TIN. This means that, for any location on a TIN, the user can access not only the surface geometry but other thematic characteristics such as land cover. The navigation tools and iterators are useful to application developers who need to walk through the triangulation or process a collection of triangles that satisfy some criterion. These capabilities will be of significant benefit to application developers.

3D Shapes

ArcView 3D Analyst adds support for simple 3D vector geometry through new shape types. These include 3D points, 3D lines, and 3D polygons. For each shape the x, y, and z values will be stored for every point within the feature.

Availability

ArcView 3D Analyst is scheduled for release by the time you read this. It will be available on Windows 95/NT and selected UNIX platforms.

TRINITY ENVIRONMENTAL DATA MANAGEMENT SYSTEM

Robert Crossley has been toiling away for quite a while on a system that he is calling Trinity Environmental Data Management System. Why Trinity we asked? Because I live in Trinity St and just about everything else in Cairns is named Trinity something - so why not a Trinity Environmental Data Management System?

Anyway he supplied us with some pretty biased marketing material for the newsletter, and we are so short of good articles we have decided to print it. He also told us that his new offices are pretty well completed, so watch this space for news about the office warming.

What is it?

Trinity EDMS (Environmental Data Management System) is a modular computer system that can store virtually any type of monitoring data collected over time, and then provides tools to visualise that data and recognise when problems arise.

Trinity EDMS is composed of three integrated modules.

1. The first module uses an innovative data structure design to store data from virtually any type of monitoring program and compare the results of that monitoring program with user definable performance indicators. The performance indicators can be set specifically for particular management units or for discrete components of the environment (eg. groundwater, process water). The data can be accessed and summarised using reports or on-screen forms using Microsoft Access's standard functions.

2. The second module allows users to access and visualise the data through a "manager-friendly" mapping interface. This mapping interface allows the user to produce graphs from data stored for locations by simply pointing to them on the screen. The mapping interface also provides a spatial context to the data so that data from one location can be compared to that from other locations close-by, or be located to features on maps or aerial photographs.

3. The third module is still currently under development. This module uses a simple form of fuzzy logic to identify those activities that possibly contribute to a problem identified by the performance indicators, and provide a reporting system to notify staff who should be aware of those problems. The data structures for this module have been implemented, but its development has given a lower priority at this point in time.

Features:

Trinity EDMS has a number of features that make it an ideal solution for environmental data management for any organisation.

1. The data used by the system resides in the world's most popular database (Microsoft Access) and Desktop Mapping System (MapInfo), ensuring that its development will be compatible with current trends in computing and can quickly incorporate the new features released by these large software companies.

2. The core functionality of the mapping/ graphing interface is being implemented in C++ to provide the speed for rapid inquiries, as well as control to the large number of tools available (eg. graph controls).

3. The "manager-friendly" map interface provides access to historical data by simply pointing to a location(s) on a map on the screen and choosing the analysis and type of graph needed. Even the most basic windows user can be calling up maps/ images of sites and monitoring locations, and producing graphs within minutes.

4. This mapping interface also allows you to thematically map the level of any element on a base map, so that you can see which locations exceed or are approaching the defined performance indicators. This feature helps recognise patterns in the data or problem areas in a way that textural databases cannot.

5. User-definable performance indicators can be used to screen results and identify potential problems. These may be as simple as compliance criteria or be subtle site specific indicators used to indicate that a problem could be present. These performance indicators are set up specifically for each site, although a generic library of regulatory requirements is being developed.

6. Built-in sample tracking from when you decide to take a sample until when you get the results, meets the most stringent quality assurance requirements.

7. The ability to manage data comprehensively and to meet ISO14000 requirements.

8. (Under development) Activities that may be contributing to any environmental problems can be identified using a form of fuzzy logic, and the system can report those problems to the staff who need to know. While still under development, the system uses an approach that has already been used effectively to recognise problems and suggest management options for catchment management.

Where is it at?

The product is in its Beta phase of testing, but the mapping module is being completely re-written in C++.

The only site where Trinity is implemented in its current form is the Red Dome Gold Mine at Chillagoe, Australia. The staff there are heavily involved in the product development.

There has been considerable interest in the project recently from some very large mining corporations. We shall see.

Lotus Glen Rotary Field Days
13th - 14th June 1997

The Mareeba DNR and DPI along with the Tableland Beef Group had an exhibit including the following groups:

GIS and Cartography Unit (Froth and Bubble)
WaterWatch DNR Soils Info Choices
Land and Water Management Plans State Water Projects
Mitchell River Watershed Papaya Fruit Fly
Future Profit (PMP) Tableland Beef Co-op

The theme or aim of the group was to promote the working together of the Community, DNR and DPI for a better future. The Tableland Beef Groups beef tasting was a big hit and the live Papaya Fruit Flies drew the people in. There was a steady flow through the display on both days at times it was quite crowded. The Tableland Beef group were really impressed and happy with the support they received from the DNR and DPI. The good news is that we won the best display overall.

The GIS unit found that most people were not aware of what GIS could do for them. Once they were given an idea of what information was available to them they were quite impressed. The training of our extension officers in the use of GIS will hopefully start to open the door to GIS for many of the property owners and other business clients. Overall comments from the two days where positive and people were interested in finding out more about what we could do for them. Hopefully in the not to distant future our Info Centre here will have a customised farm mapping system which will enable the farmer/property owner to access information eg. soils, crop suitability of his property at his request.

Predicting the Spatial Distribution of Forest Types in a Complex Tropical Landscape

David W. Hilbert, Jeroen van den Muyzenberg, Mike Hopkins,
Brett Buckley and Warwick Sayers

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Far North Queensland contains a large number of vegetation types. In a 2 hour drive west of Cairns eleven vegetation types can be seen. This mosaic is not static. It changes over hundreds of years as rainfall patterns shift and temperature and fire regimes change. If we are to protect and rehabilitate parts of this mosaic, or try to manage it for the enjoyment of future generations, we must understand its current spatial pattern and predict how it will change in the future. The Spatial Modelling and Data Exchange Project has developed a model which has the potential to do this.

The model is an Artificial Neural Network (ANN). It is a feed-forward network consisting of many simple computing elements (nodes) arranged in three layers - input, hidden and output. Each node in a layer is joined to each node in the next by a weighted connection. When an input pattern is presented to the network, each node receives the weighted sum of the outputs of the previous layer. The output of each node is it's input transformed by a simple non-linear function. It is the value of all the connection weights that determine the mapping between input and output.

To establish the appropriate weights for a particular classification problem, a supervised training algorithm termed back-propagation is used. A training set of points with known vegetation is presented to the model, and the error between the actual and predicted vegetation type is computed. This error is used to modify the connection weights until an optimal model is identified.

Once the model is trained, the climate, soil parent material and terrain data for the entire wet tropics are presented to it. This information is currently stored in Arc/Info as grids. Because the ANN is unable to directly access these layers a text file was created by sampling the grids in a regular lattice at an interval of 100 metres. This created approximately 2 million spatial records, each containing descriptive information for over 50 attributes.

The input lattice of values is used by the ANN to predict which vegetation type is most likely to be found at each place. The resulting lattice is imported back into the GIS as a raster grid for display and further analysis.

The accuracy of the model is 65% in predicting the forest type over the entire wet tropics region. Much of the error is due to a misclassification of the successional forest types (33% accuracy for vine forests with Acacia sp. and/or Eucalyptus sp.) This error is not surprising since these types are expected to have a high overlap in environmental requirements with other forest types.

In the future the model will be enhanced by increasing the quality and kinds of input data. Spatial context will be investigated. This will give the ANN knowledge about the surrounding terrain for each location. Principal Components Analysis might be used to reduce the number of layers used as inputs.

Analysis of the model will lead to a better understanding of the environmental controls on forest types. It is hoped to map past, present and future distributions. In particular, we will predict the pre-clearing vegetation mosaic of the region, forest distributions of the recent geological past, and the likely changes and stresses due to future climate change. These predictions are essential for the effective management of our region and the conservation of biodiversity at large scales. Scientifically, this research will further the general understanding of vegetation-environment relationships in landscapes.