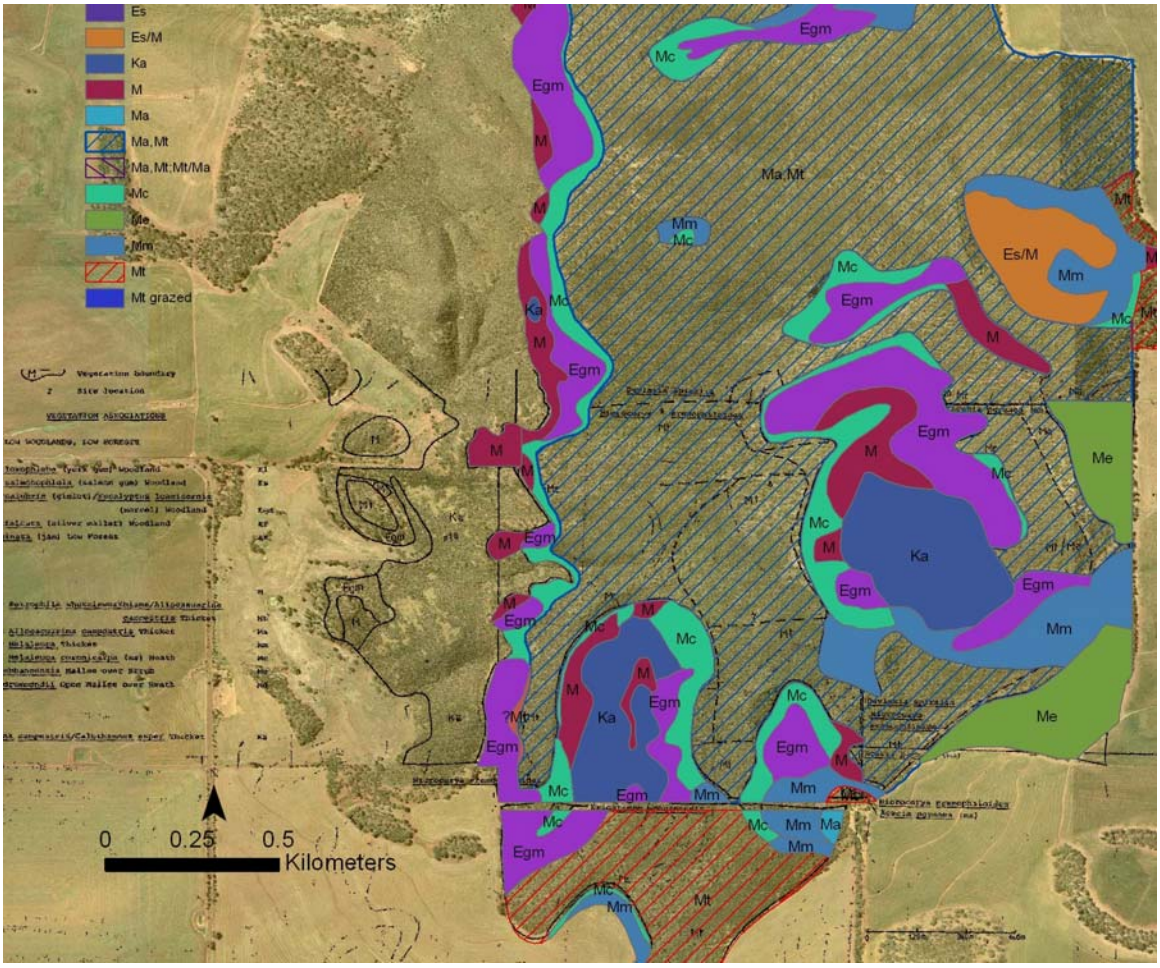
The Vegetation Mapping of the ANRMR Project: Progress, Status and Future Directions.



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AVON CATCHMENT COUNCIL

Government of Western Australia

Australian Government

Summary

This document is a summary of the seminar and workshop convened to inform on the progress of and to develop the future directions of the *Vegetation Mapping of the ANRMR Project*. It was held on the 20th May 2008 at DEC's Kensington offices.

The project was developed to address a priority knowledge gap within the Avon Natural Resource Management Region (ANRMR): the lack of knowledge of the location and extent of vegetation communities across the region.

Essentially, the project aimed at:
(i) Collating the existing vegetation maps of the region;
(ii) Digitising these maps into a GIS format;
(iii) Attributing the resultant polygons in a standardised format that allows for database query.

The existing vegetation maps from the region cover an area of over 8% of the remnant vegetation of the agricultural district of the Avon NRM Region. This constitutes an area of over 185,000 hectares. Predominately, these maps are on the conservation estate. These maps have been digitised into a GIS format and the resultant vegetation based polygons are being attributed to NVIS standards. The attribution data is retained in relational database to which a number of queries have been developed into forms.

The seminar gave examples of the types of query presently being performed and asked the participants how else they would like to be able to query the data as well as what other data would they like to see.

Presently the resultant GIS layer can be queried on any plant taxa in any of the NVIS strata. These results are currently being used in a collaborative project in defining the vegetation communities of the region and to define management and restoration objectives.

Many participants expressed support for the project and its present output. The current applications were discussed. There was some discussion about the possibility of being able to add to this database after the Vegetation Mapping Project was completed; it was determined that the output from the project would be a snap-shot in time and not readily updateable without an understanding of the complexity of the data and data entry requirements. Other questions and their responses are captured at the end of this report.

As a consequence of the seminar and workshop the query fields have been altered to allow for multiple species query.

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Acronyms

ACC	Avon Catchment Council
ANRMR	Avon Natural Resource Management Region
DEC	Department of Environment and Conservation
NVIS	National Vegetation Information System
WWF	WWF-Australia (formerly World Wide Fund for Nature)

Cover picture: Digitised vegetation overlay for part of Wongan Hills NR with orthophotography and example of scanned source map-work.

1. Introduction

As part of the Avon Natural Resources Management Strategy the Avon Catchment Council (ACC), through the support of the State and Australian Governments Natural Heritage Trust and the National Action Plan for Salinity and Water Quality programs, has made a substantial investment into biodiversity conservation through the establishment of a Natural Diversity (ND) program. This program has the stated goal to "retain, restore and enhance the Avon Region's natural biodiversity in ways that are consistent with the core values and sustainability goals of the region". One of the ways in which the ND program is to achieve this goal is by delivering funding projects within the program. One of these projects is the Terrestrial Baselining Project which, amongst other things, is responsible for biodiversity relevant data collation, processing, interpretation and dissemination. Included in this brief is the identification of priority gaps in existing knowledge and projects in regards to nature conservation.

One of the key knowledge gaps identified was the location of vegetation communities across the Avon NRM Region (ANRMR). While we have a good knowledge of where remnant vegetation is (due to the availability of remnant vegetation GIS coverage) we have little knowledge of what is in these patches.

There is some existing vegetation mapping such as Beard's 1:250,000 Vegetation Associations and Beards and Hopkins 1:100,000 System Association mapping. These scales, though, are too coarse for the some of the ND projects. There are numerous existing finer-scaled vegetation maps from across the region that have not been collated in a meaningful way. In February 2007 a Project Officer was appointed to:

(i) Collate the existing maps.
(ii) Coordinate their digitisation.
(iii) Develop a database to attribute the resultant vegetation polygons.
(iv) Attribute the digitised polygons.

The collation, digitisation and development of the database has been completed and the attribution of the polygons is continuing.

At present these data have been used in a number of ways:

(i) To identify which patches of vegetation have already been mapped.
(ii) To help inform vegetation management and re-vegetation projects of project objectives.
(iii) To help in defining vegetation communities across the ANRMR.

We perceive that there will be numerous other applications of these data and a presentation and workshop was convened to achieve a number of outputs:

(i) To review rationale for project initiation.
(ii) To present project status.
(iii) To propose a number of future directions.
(iv) To workshop other (besides those identified above) potential applications of the data.

(v) To identify any other issues that end-users will have of the database.

To inform end-users of these data a presentation and workshop was convened at DEC's Kensington Training Room on Tuesday the 20th May 2008.

Attendees

Name, Title	Organisation
Ben Bayliss, Project Officer	Science Applications, DEC
Brett Beecham, Regional Ecologist	Narrogin, DEC
Brett Glossop, Data Administrator/Web Developer	Science Applications, DEC
Bronwen Keighery, Environmental Officer	Terrestrial Ecosystems, DEC
Chris Curnow, Senior Project Manager	WWF, Australia
Dave Robertson, Project Leader	GIS Apps, DEC
Dhanendra Prabhu, GIS Officer	GIS Apps, DEC
Greg Keighery, Principal Research Scientist	DEC
Helena Mills,	WWF, Australia
Ian Steward, GIS Officer	Northam, DEC
Jeff Richardson, Coordinating Ecologist	Science Applications, DEC
Kathy Murray, GIS Officer	Remote Sensing, DEC
Ken Atkins, Manager & Prinicpal Botanist	Species & Community, DEC
Margaret Wheeler, Ecologist	Northam, DEC
Mia Podesta, Ecologist	Species & Communities Branch, DEC
Milan Vicentic, Environmental GIS Coordinator	GIS Apps, DEC
Neil Riches, Australian Government NRM Facilitator - Bushcare	Department of Environment, Water, Heritage and the Arts.
Paul Davis, Monitoring and Evaluation Coordinator	Swan Catchment Council
Paul Gioia, Program Leader, Sci Apps	Science Applications, DEC
Shane French, Acting GIS Applications Manager	GIS Apps, DEC
Tim Gamblin, Technical Officer	Science Applications, DEC
Val English, Principal Ecologist	Species & Communities Branch, DEC
Wendy Chow, Ecologist	Species & Communities Branch, DEC

2. Project Summary

2.1 Map Digitisation and Attribution Details and Progress by Ben Bayliss

The compilation of relevant vegetation mapping and documentation for the Avon NRM built on a substantial reference collection held by Greg Keighery. To be useful for the project, the source material had to include some form of geographically referenced vegetation map. Most of these maps existed as annotated hand drawn or printed hard copy, largely associated with "grey literature", such as unpublished Departmental documents, consultants reports, and surveys by non government special interest groups such as the WA Wildflower Society. More recently some vegetation mapping had been captured digitally in a GIS compatible format.

All hard copy maps have been scanned, georeferenced and digitised into a GIS. These GIS files are currently being attributed with the source vegetation data.
About 400 references have been compiled so far, from which 139 digital maps have been generated so far.

Most of the area mapped and digitised occurs on DEC estate. Some non-DEC crown land, such as water reserves and Unallocated Crown Land (UCL) as well as a few native vegetation remnants on private land have also been captured.

Map 1 shows the extent of vegetation mapping digitised and incorporated into a GIS as well as the proportion currently attributed with vegetation data. The total area mapped and digitised is ~ 186,000 ha. This represents 8.3% of the remnant vegetation extent within the Avon NRM agricultural land use zone.

Currency of mapping ranges from the early 1970's to the most recent in 2006.
Scale varies from 1:6000 to 1:80,000 in terms of air photography used in conjunction with ground survey activities. These values are a guide only, as it should be noted scale is also dependent on other factors such as the type, distribution, density and interpolation of ground survey data.

Survey methods and protocols used to map and describe vegetation varied considerably; some maps tended to be more schematic with vegetation boundaries implied with few definable polygons; others were more explicit in showing vegetation delineated by discrete boundaries defining many polygons. However most of the surveys based their vegetation association descriptions on the Muir classification system.

Such variability in mapping parameters raised the issue of comparability of vegetation units derived from the heterogeneous data sources available for the Avon NRM.
To address this, the National Vegetation Information System (NVIS) was considered a useful tool in helping to consistently reinterpret all vegetation descriptions and allow some level of comparability.

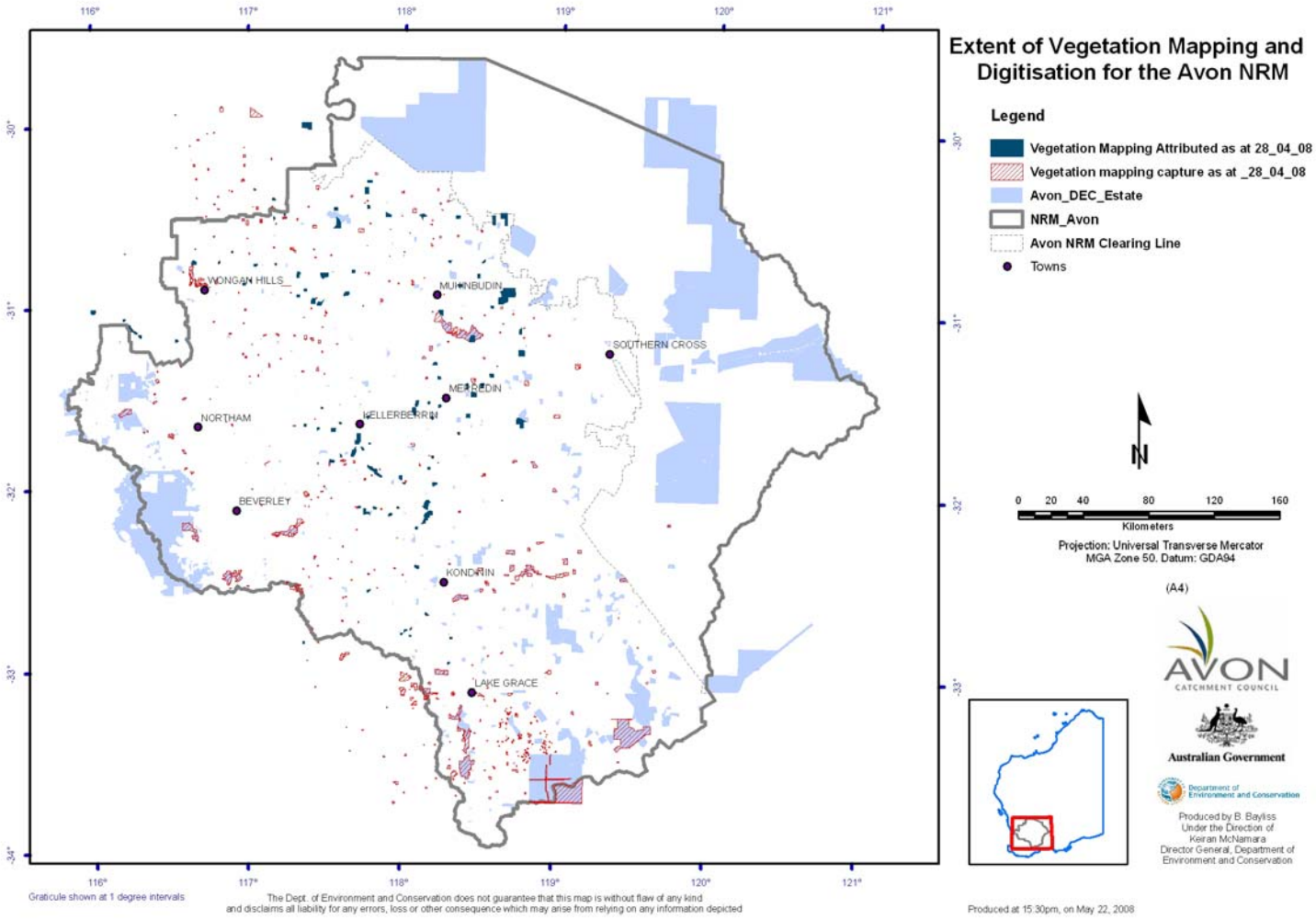
NVIS provided:

- A nationally agreed hierarchical framework for describing and representing vegetation information according to a consistent set of criteria.

- A basis for developing a standard set of data fields in a Relational Database Management System for vegetation mapping data linked to a GIS. (ie The Avon Vegetation Mapping Database)
- A standard template from which to build such a database for the systematic entry, management and querying of vegetation data and metadata as well as establishment of the required links with the GIS holding the digitised maps and their feature polygons.

An example of the NVIS hierarchy is given in Appendix 1.

Currently work is progressing with the translation of all original vegetation descriptions into the NVIS framework. This involves reattributing each of the map polygons with these translated descriptions and associated data through the Avon Vegetation Mapping Database.



Map 1: The Vegetation Mapping of the Avon NRM Region. The legend explains the meaning of the colours and polygons.

2.2 The Database and Data Query Capabilities by Brett Glossop

Currently the software can search for species by name. The user enters a six letter code (the first three letters of the genus and the first three letters of the species name of the taxa of interest) and from a drop-down menu (shown in Figure 1) the user selects the taxa. The user also identifies whether they are interested in this taxa anywhere in the NVIS hierarchy, as a dominant or co-dominant in any strata or as a dominant in the dominant strata. The software searches the many hundreds of polygons in the database to find the species. The picture below shows a search for York Gum in any of the strata.

The search result is then loaded into a GIS viewer (such as ESRI ArcMap, MapWindow or similar) and the polygon locations displayed. Figure 2 shows polygons where York Gum can be found near Wyalkatchem – the polygons highlighted in light blue.

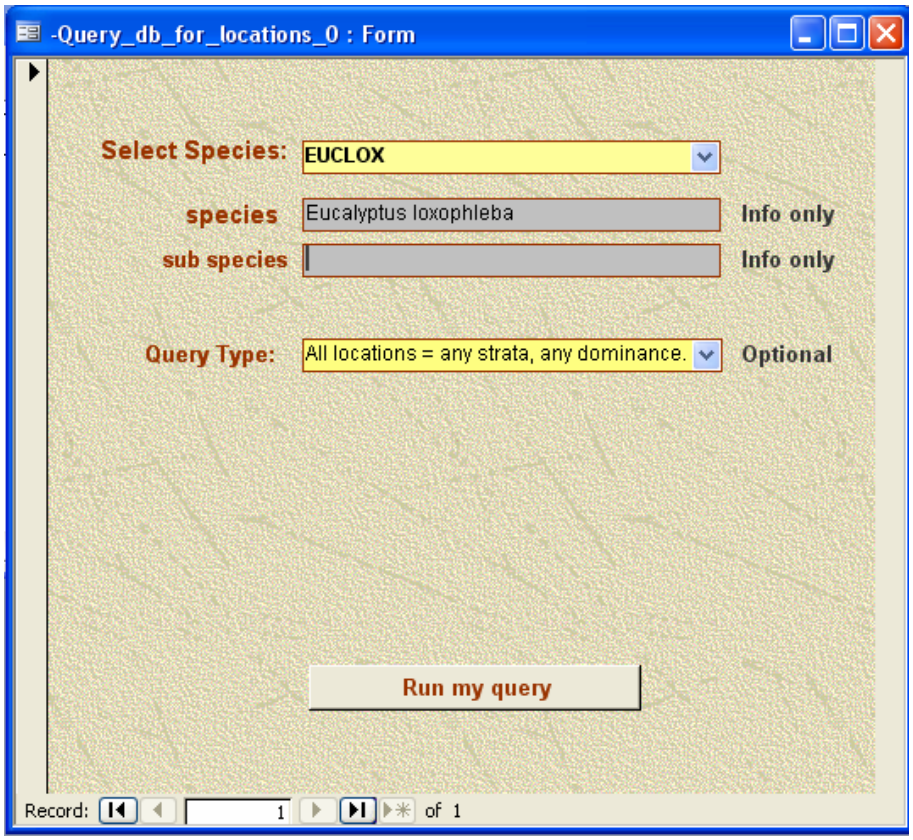


Figure 1: The database query form showing a query for York Gum (*Eucalyptus loxophleba*) in any strata.

Zooming in and clicking on relevant locations can reveal much more vegetation detail. For example Figure 3 shows the vegetation descriptions of one York gum polygon. This example is only a portion of the attribution data fields.

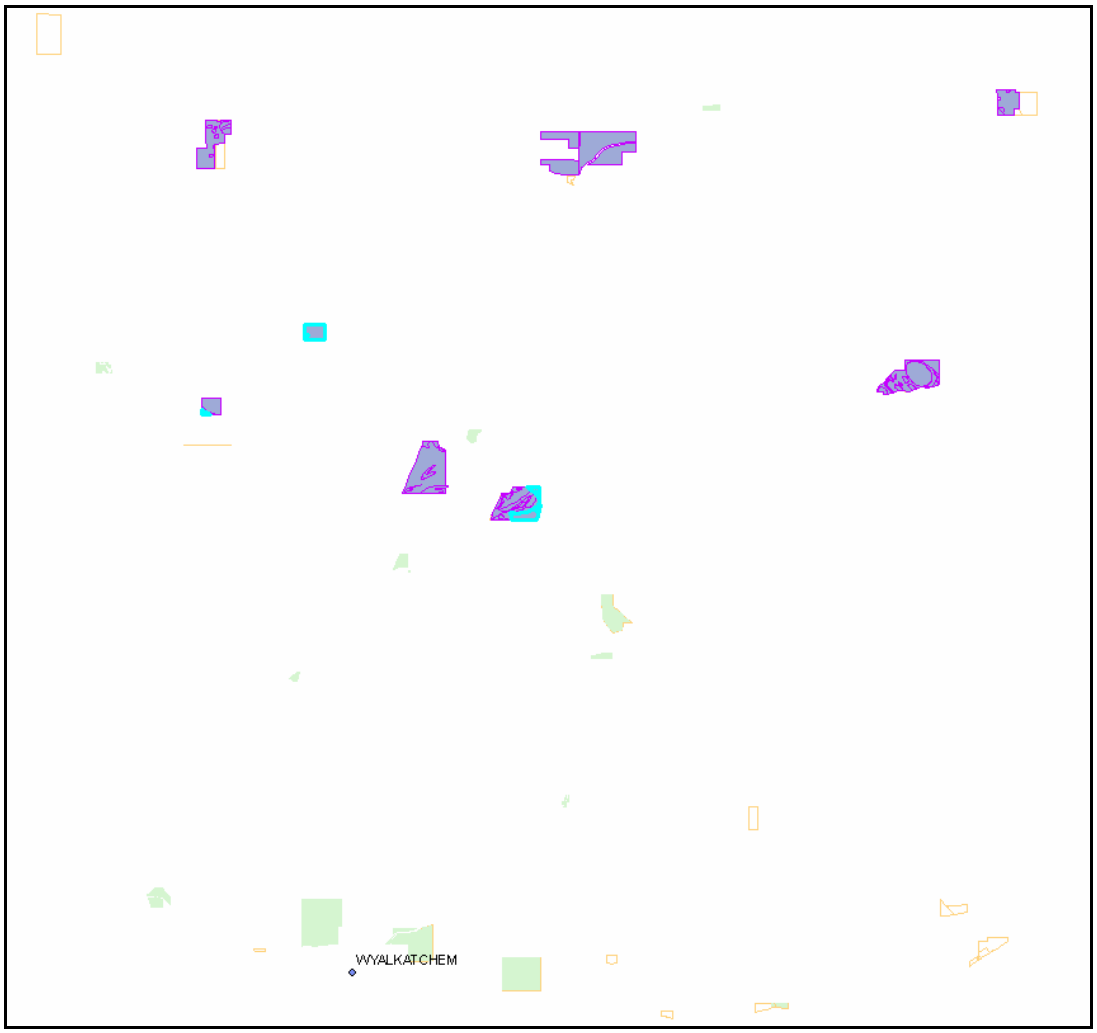


Figure 2: A sample output from the database query. The filled green polygons are areas that have been mapped but as yet there is no vegetation description attribution for these polygons. The purple shapes are areas that have been mapped and attributed; the dark purple lines within these polygons are separation between vegetation communities. The blue polygons are those areas that have conformed to the query in Figure 1, namely they contain York Gum in any strata.

Field	Value
VEG_ID	292
SOURCE_CODE	243059_1
LEVEL_OF_DETAIL	Level 6 - Sub-Association
NUMBER_OF_STRATA	<null>
L1_CLASS	Tree Mallee
L2_STRUCTURAL_FORMATION	Open Mallee Woodland
L3_BROAD_FLORISTIC_FORMATION	Eucalyptus Open Mallee Woodland
L4_SUB_FORMATION	+Eucalyptus Open Mallee Woodland\Acacia Woodland
L5_ASSOCIATION	U+^Eucalyptus loxophleba\Eucalyptus\^tree mallee\r\6;M^Acacia acuminata\Acacia\^tree\r\6
L6_SUB_ASSOCIATION	U1+^Eucalyptus loxophleba\Eucalyptus\^tree mallee\r\6;M1^Acacia acuminata\Acacia\^tree\r\6
SOURCE_DESCRIPTION	[Original Map Veg Unit:York Gum Mallee][Original Veg description:York Gum mallee] Eucalyptus loxophleba (York Gum)
ENVIRONMENTAL_DESCRIPTION	Soil light grey, fine sandy clay loam. Poorly drained.

Figure 3: An example of the vegetation attribution of one of the York Gum polygons above.

Information can be discovered on neighbouring polygons and even the original paper maps can be displayed.

Several layers are available to assist users to locate and interpret the findings. They are:

(i) Attributed map units
(ii) Major towns
(iii) All Avon maps (including those attributed and those not yet attributed)
(iv) Remnant vegetation
(v) DEC estate
(vi) Avon NRM boundary.

Six people took away a disk of the draft software and database. They will investigate the potential and give feedback and suggestions to Brett Glossop or Ben Bayliss.

3. Discussion and Questions

Following the presentations the group was asked for any feedback on the project, the database, or applications of the database. What follows is a summary of the main points raised and a response.

Can point data (eg WA Herbarium vouchers) also be added to the vegetation map database?

Yes, it can as a point shape file. However, as the vegetation mapping database will be a snapshot we recommend that NatureMap is used for access to plant point data. We are reluctant to add the WA Herbarium voucher data to the database as the herbarium data is regularly updated as new vouchers are lodged in the herbarium and taxonomy is kept current. In contrast the vegetation mapping product will be a snapshot in time and any herbarium data retained with this will lose currency.

Can you overlay WA Herb/DRF data over the top of the vegetation mapping to help identify which areas may be searched for DRF?

Yes you can but, as discussed above, we'd recommend that these data come straight from the herbarium.

Is there a bibliography with the database?

At present the data sources are included within the information from each vegetation polygon. We will ensure that the final product has a stand alone bibliography.

Many of the vegetation maps are old, how have you dealt with changes of taxonomy?

A given species name listed in the Avon Vegetation Mapping Database,(upon which a search of the database may be based) represents the status of that particular taxon as quoted in the original survey/mapping source. As it is not feasible to link most of these species thus quoted to specific herbarium collection records, any attempt to update their names according to current taxonomic knowledge could be fraught with misinterpretation. Therefore it was decided not to update or correct the species names but rather leave them unambiguously as they appear in the original vegetation source descriptions.

The only exception was for species of Casuarina entered in the Avon vegetation mapping database which have since been reclassified under Allocasuarina. These species were correspondingly updated in our database as they have no WA Herbarium taxon code associated with their old names.

(All species have been identified in the Avon vegetation mapping database with an Herbarium Taxon ID code. Where a taxon quoted in the original mapping source description has been listed by the WA Herbarium as no longer current, but is still retained with its original code in the WAHerb database, then the old name is kept in the Avon vegmapping database)

Did you make use of the turn-of-the-century forestry maps as they may be suitable for a NVIS Level 3 description?

We will look into this.

Will the database and related shapefiles be updatable by other users particularly after the Baselining Project finishes?

We are looking into options here but believe we will end up with a database and related shapefile that will be a snapshot in time of the vegetation mapping of the Avon NRM Region. The database we have developed, however, can be used by other users in other locations for existing or their own maps.

For those plant taxa that have subspecies can I query the database for the species and get all records for all subspecies returned?

No, the queries in prototype are limited to one particular taxon. We are investigating the feasibility of querying on multiple taxa and returning locations for sub species as well. In the immediate term, however, the pull down menu for the database query will allow you to select the subspecies for any species.

Appendix 1: NVIS

The National Vegetation Information System (NVIS) is an information hierarchy for vegetation structure and floristic information. Table 1 below shows the hierarchy

Hierarchical Level	Description	NVIS structural/floristic components required
I	**Class***	Dominant growth form for the ecologically or structurally dominant stratum
II	**Structural Formation***	Dominant growth form, cover and height for the ecologically or structurally dominant stratum.
III	**Broad Floristic Formation****	Dominant growth form, cover, height and dominant land cover genus for the upper most or the ecologically or structurally dominant stratum.
IV	**Sub-Formation****	Dominant growth form, cover, height and dominant genus for each of the three traditional strata. (i.e. Upper, Mid and Ground)
V	**Association****	Dominant growth form, height, cover and species (3 species) for the three traditional strata. (i.e. Upper, Mid and Ground)
VI	**Sub-Association****	Dominant growth form, height, cover and species (5 species) for all layers/sub-strata.

Table 1: The NVIS information hierarchy.

Below is an example from the vegetation mapping database for the Avon. What follows immediately is the data from the relevant report with Table 2 showing this data attributed into the NVIS hierarchy.

NVIS example[1]

Woodland Formation
Location 1.1
[Original Description
Woodland over Low Woodland A over Open Scrub over Open Low Scrub B over Open Dwarf Scrub C over Dwarf Scrub D over Very Open Low Grass on Clay – loam.]
Muir Code: e1Mi.e1+e2Lai.a1Sr.xSBr.xSCr.xSXi.GLr/CL

Stratum 1: *Eucalytpus salmonophloia* (e1), stratum height 16m tall, 15% canopy cover.
Stratum 2: *Eucalyptus salmonophloia* (e1) and *Eucalyptus loxophleba* (e2), stratum height 6-10m tall, 18% canopy cover.
Stratum 3: *Acacia acuminata* (a1), *Acacia microbotrya*, *Eremophila drummondii* and *Daviesia hakeoides*, stratum height 2-6m tall, 9% canopy cover.

[1] This example is taken from a series of vegetation maps of Water Reserves by Libby Mattiske in 1992.

Stratum 4: *Acacia erinacea*, *Olearia muelleri*, *Eremophila drummondii*, *Acacia merrallii* and *Rhagodia preissii* ssp*. Preissii*, stratum height 1-1.5m tall, 9% canopy cover.
Stratum 5: *Eremophila drummondii, Daviesia hakeoides* and *Maireana brevifolia*, stratum height 0.5-1.0m tall, 7% canopy cover.
Stratum 6: *Maireana brevifolia and Rhagodia preissii* ssp. *Preissii*, stratum height 0.1-0.5m tall, 13% canopy cover.
Stratum 7 *Stipa elegantissima*, stratum height <0.5m tall, 3% canopy cover.

Comments: Lichen and moss species in the understorey, 5% canopy cover on soil surface.
Litter: 0-2cm deep, 15% ground cover, composed mainly of leaves, some small twigs and some large logs.

(note in this example author has already defined substrata – although refers to them as stratum.
Although growth form is not stated in Stratum descriptions, it is implied in the associated muir diagnosis and code.)

Level	Description	NVIS Translation
I	**Class** • Growth form (dominant Stratum only)	**Tree**
II	**Structural Formation** • Structure (dominant Stratum only)	**Woodland**
III	**Broad Floristic Formation** • Dominant Stratum only • Genus (dominant only) • Structure (as structural class term for dominant Stratum only)	**Eucalyptus Woodland**
IV	**Sub-Formation** • Stratum (all strata) • Dominant (& co-dominant) Genus only • Structure (as structural class term for all strata)	+*Eucalyptus* **Woodlan***d*\ *Acacia* Mixed Sparse Shrubland\ *Eremophila Mixed* Sparse Shrubland
V	**Association** • Stratum (All Dominant Substrata only) • Species (all) • Genus (Dominant for each substratum) • Structural parameters (for ea. stratum: dominant growth form\Substratum cover class\Substratum height class)	**U+^***Eucalyptus salmonophloia***\Eucalyptus\^tree\i\7**; M^^*Acacia acuminata, Acacia microbotrya, Eremophila drummondii**Acacia*\^shrub\r\4; G^^*Eremophila drummondii, Daviesia hakeoides, Maireana brevifolia**Eremophila*\^shrub,chenopod shrub\r\2;
VI	**Sub-Association** • Substratum (All Dominant & Nondominant Substrata.) • Species (all) • Genus (Dominant for each substratum) • Structural parameters (for ea. substratum: dominant growth form\Substratum cover class\Substratum height class,)	**U1+^***Eucalyptus salmonophloia******Eucalyptus***\^tree\i\7**; U2 ^*Eucalyptus salmonophloia, Eucalyptus loxophleba**Eucalyptus*\^tree\i\6; **M1**^^*Acacia acuminata, Acacia microbotrya, Eremophila drummondii, Daviesia hakeoides**Acacia*\^shrub\r\4; M2^^*Acacia erinacea, Olearia muelleri, Eremophila drummondii, Acacia merrallii, Rhagodia preissii ssp. Preissii**Acacia*\^shrub\r\3; **G1**^^*Eremophila drummondii, Daviesia hakeoides,Maireana brevifolia**Eremophila*\^shrub, chenopod shrub\r\2; G2^*Maireana brevifolia^Rhagodia preissii ssp. preissii**Maireana*\^chenopod shrub\i\1; G3^*Stipa elegantissima**Stipa*\^other grass\r\1

Table 2: The above vegetation description described in the NVIS terminology.