The Avon Native Vegetation Map Project

Department of Environment and Conservation
The Wheatbelt NRM
June, 2011

wheatbelt natural resource management

Department of Environment and Conservation
Our environment, our future

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June 2011

[*The map layer and vegetation attribute outputs from this project can be viewed in the DEC NatureMap website*.]

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Introduction

The Baselining Project is one of the natural diversity projects funded largely by the federal government through the Wheatbelt Natural Resource Management, NRM (formerly Avon Catchment Council, ACC). The Project's primary purpose is to collate the biodiversity data and interpret these data to support other projects in the Wheatbelt NRM biodiversity theme. A preliminary role of the Baselining project was to identify key knowledge and operational gaps in natural diversity conservation within the Wheatbelt NRM region.

One of these key knowledge gaps concerned the lack of appropriately scaled native vegetation mapping available for supporting natural diversity conservation across the Wheatbelt NRM region, (Richardson and Gamblin, 2009).
Beard's 1:250,000 Vegetation Associations and Beards and Hopkins 1:100,000 System Association mapping has been the main source of regional vegetation map coverage available for WA wheatbelt natural resource management. At such scales the vegetation associations mapped are too broad to account for the fine scale variations in vegetation (Harvey et al 2012). It was highlighted by Richardson and Gamblin (2009), that whilst invaluable as a synopsis of pre-European extent, Beard's coverage was too coarse for appropriately informing the kinds of issues encountered at the scale of existing vegetation remnants. This deficiency of appropriately scaled map information was also identified as a constraint to vegetation management in the Northern Agricultural NRM Region (DEC, 2008).
The existence of many separate and largely unpublished but potentially finer-scaled vegetation map documents related to the Avon NRM region raised the possibility of developing a combined resource that could help resolve this vegetation knowledge gap.

Project Scope

To be useful, any source maps needed to be integrated with a standardised set of vegetation attributes in a framework that allowed the data to be easily accessed, viewed, queried spatially as well as stored and managed as a coherent entity.
In other words what was required was:

- A single georeferenced spatial layer i.e. in a Geographic Information System (GIS)dataset
- A set of corresponding standardised vegetation attributes.
- A basis for querying data as a set of equivalent vegetation attributes.

The currency, methods and scale of source mapping available for the Avon region varied considerably. The earliest sources represented a series of extensive wheatbelt surveys carried out in 1978 by Muir and the most recent in 2010 by Rick covering the Lake Campion Nature Reserve. Sources also varied with respect to methods and protocols used to interpret and describe the vegetation surveyed , as well as presented some differences in the way this information was related to the delineated map units.

It was important then, to find some consistent way to take this heterogeneity into account when combining all the sources of mapping and attribute information into a common dataset. The National Vegetation Information System (NVIS) presented a useful framework to help achieve this. NVIS, by way of the Australian Vegetation Attribute Manual (ESCAVI 2003), provided a guide to managing vegetation information through establishing consistent rule sets and criteria. This approach enabled standardization of attributes, including a common descriptive terminology for vegetation that provided a basis for comparing vegetation types from a variety of data sources using different methods.
NVIS also provided a data structure template from which to build a database for the systematic entry, management and query of vegetation attribute data as an adjunct to the display and query of the spatial native vegetation layer.
Although many more native vegetation data sources exist for the Wheatbelt NRM region than are represented in the ANVMP, only those sources containing vegetation maps for which vegetation attribute data was interpreted in terms of polygonal mapped units could be used. Not all sources described vegetation attributes in a consistent way such that they could be standardised according to a common terminology or set of database criteria. In general the many sources of detailed site (point based) data and descriptions did not interpret vegetation

information as mapped units. For this reason such detailed site data could not be incorporated into the project data set.

Project Area

The Avon Native Vegetation Map Project (ANVMP) area follows that of the Avon River Basin (Geosciences Australia, 1997), (Fig.1), which is the catchment for the Avon-Mortlock, Yilgarn and Lockhart river systems. The Avon River basin also coincides with the area currently defined as the Wheatbelt NRM region.
Suitable map data sources identified for incorporation into the project spatial layer were selected from within the Avon River Basin area as well as a 50km buffer region around the river basin boundary.
The mapped areas occur almost entirely within the region of greatest habitat fragmentation west of the clearing line. Around 16% of the agricultural zone vegetation remains and this is distributed over 110,000 patches of which ~ 70,000 are 1 hectare or less in size (Richardson et al. 2007). It is not surprising then, that the areas represented by many of the source maps similarly reflect these dimensions.

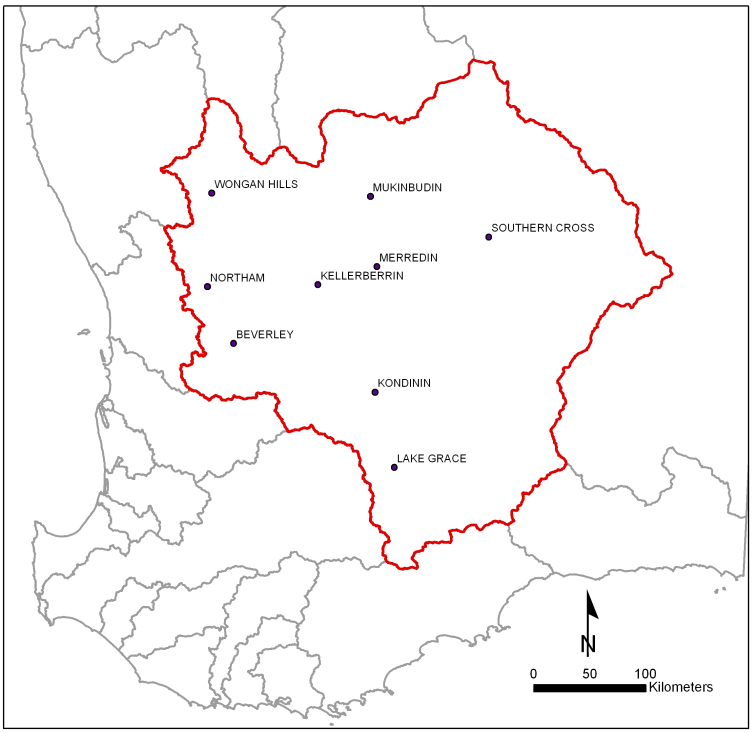


Figure 1. The ANVMP boundary (coincident with the Avon Catchment boundary, Geosciences Australia, 2004)

Project Outputs

- A GIS (digitally) based native vegetation map layer amalgamating the various sources of existing map data.
- A set of standardised vegetation attributes held in a database linked to the spatial (map) layer.
- A spatial data layer accessible on a web based spatial viewer (Naturemap) allowing basic vegetation attribute query.

Project Data Scoping

Data Sources

To be useable for the Avon Native Vegetation Map Project (ANVMP) the map data sources had to meet certain fundamental criteria.
They had to have:

- A vegetation map represented to scale with sufficient features to enable correlation with a known standard geographic frame of reference.
- Vegetation data that could be attributed to the map.
- Vegetation attributes interpreted in terms of polygonal map units delineated on the map.
- Vegetation attributes conforming to some kind of systematic structural and floristic classification system (or at least vegetation attribute values collected as part of a systematic survey protocol that could be correlated with established attribute classes such as those defined by the National Vegetation Information System (NVIS) (ESCAVI, 2003))

For the Avon region, there were also existing data sources containing comprehensive point based vegetation data such as from survey plots or quadrats. However, where this information had not been interpreted or was not interpretable as a set of mapped vegetation units, the information could not be used for the ANVMP other than as supporting or contextual reference material.

[See Appendix 1for further discussion about the vegetation mapping process and data types in relation to the project .

Specific information about the NVIS data field attributes and how they were interpreted and related to those used in the ANVMP database can be viewed in the NVIS Attribute List , given in Appendix 7. This list of NVIS Attributes, describes the property and function of each database field and any variations associated with their implementation through the ANVMP database. Where reference is made to a specific attribute field in this report there will be a reference to the relevant section in the Descriptions of NVIS Attributes list,]

Data Variability

Amongst the data sources there was some variation in methods and protocols used to interpret, map and describe vegetation.

Map delineation could be:

- Explicit - with discrete well delineated and coded vegetation units clearly correlated with described vegetation attributes: for example Fig 2a
- Schematic - with vegetation boundaries more implicitly defined and correlated with vegetation units through a more informal symbology and annotation scheme: for example Fig 2b

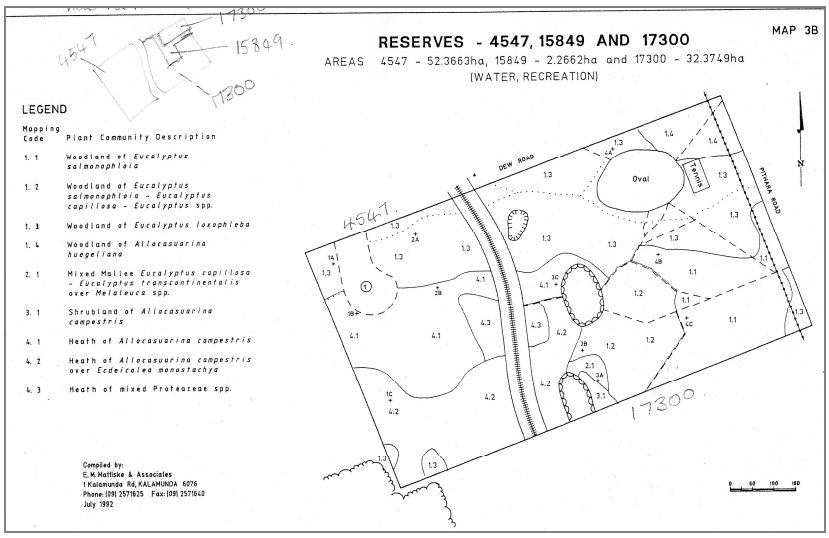


Fig 2a. Source map: 214_072. Map unit polygon labels are clearly correlated with the vegetation descriptions through a map unit code legend

[EM Mattiske & Associates (1992) 'Botanical survey of 43 reserves vested in the Water Authority of Western Australia. Parts A, B and C'. EM Mattiske & Associates, Perth.]

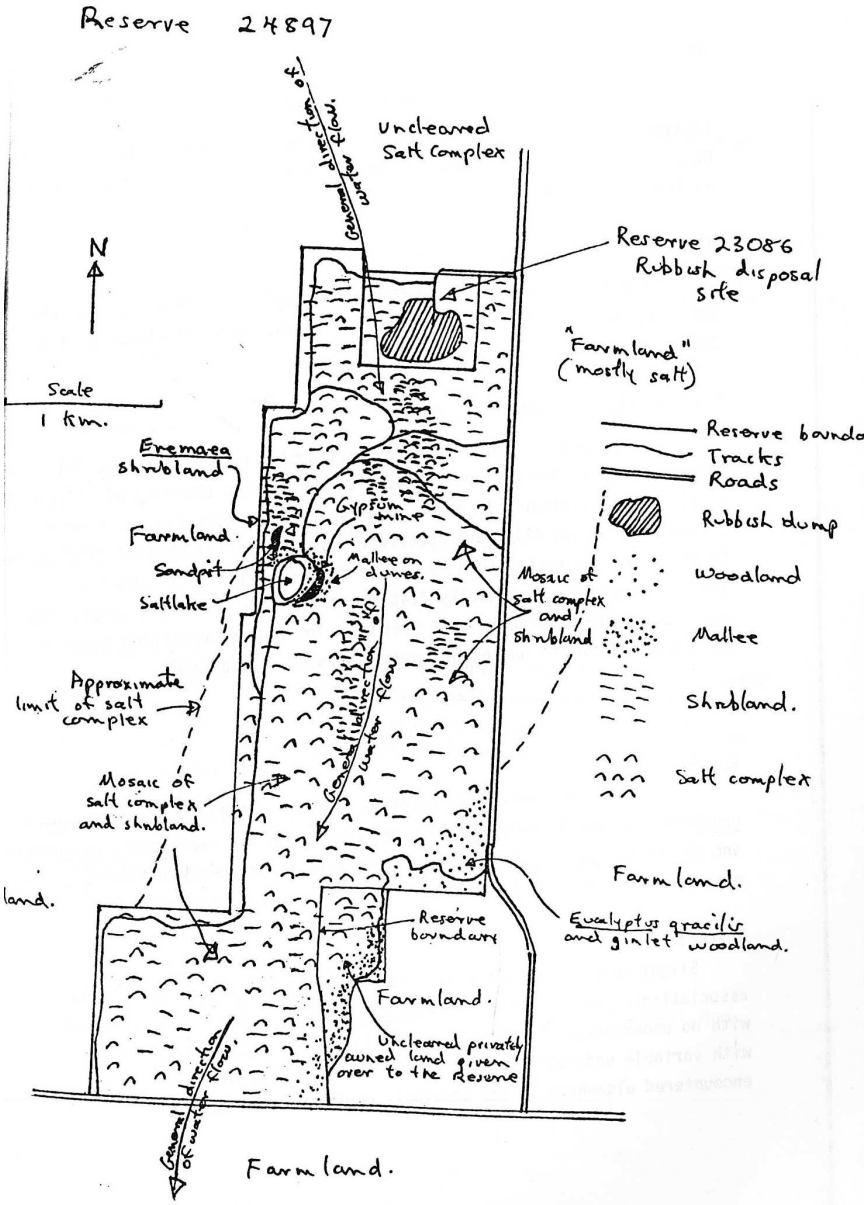


Fig 2b. Source map: 235_032. Map units are defined and related to vegetation descriptions through annotation and symbology rather than explicit delineation. The boundary however is to scale, taken from Department of Lands and Survey cadastral maps, current at the time of the maps creation.

[Muir BG (1978) 'Some nature reserves of the Western Australian Wheatbelt. Part 2 Kellerberrin Shire'. Department of Fisheries and Wildlife, Perth.]

For many of the sources consulted, Vegetation survey and mapping methods generally took the following basic approach:

1. Broad vegetation divisions were identified from some kind of remote sensing image e.g. air photo, as well as reference to other mapped environmental attributes such as soil landforms. These divisions were mostly structural as structure was usually the most clearly discerned vegetation parameter from remote sensing images.
2. These preliminary divisions were used to survey vegetation in the field and establish a set of observation or vegetation sample points. These points may have been simply reconnaissance survey stops or quantitative plot based sample sites. Floristic information was usually derived from these observations.
3. Survey observations and sample site data were used to revise and refine the preliminary vegetation divisions.

Steps 1 to 3 are usually iterative, building up a more comprehensive vegetation map in the process. Areas requiring more information are ideally examined through further site establishment or observations. However in many cases access, time and resource limitations determined the extent to which further physical survey could be pursued. Thus areas not covered by ground survey were often mapped by extrapolation or interpolation of known vegetation types by referring to remote sensing and other potentially correlated map data such as soil landforms.

In a number of source documents consulted, vegetation surveys included site data information. Where sites were chosen within homogenous areas and considered to be characteristic of the whole vegetation unit at the selected location, these site vegetation descriptions could be considered representative of the map unit and attributed to the polygon/s comprising it.
For other sources, although site data were used to help inform the vegetation descriptions and define the map units, they could not be directly attributable to them. For many sources, where site data was supplied, although it could be used for contextual help in interpreting the vegetation descriptions, it could not be directly attributed to delineated map unit polygons.
[See Appendix 1 for more information about site data in the mapping process]
An important consideration for many potential vegetation data sources was the purpose and aim behind the surveys, data, map work and documentation. Frequently many of the data sources were concerned with assimilating many other themes related to a suite of natural resource management issues.
In many cases, generating a vegetation map was a subsidiary component to the vegetation data description, analysis and assessment. For example, Muir`s extensive vegetation surveys of the Wheatbelt from 1978 to 1979 assessed within a two year period more than 130 reserves in the Avon Catchment Basin. The purpose of the surveys was to make an evaluation of these areas for inclusion in the conservation estate based on a suite of biophysical, natural resource and land use parameters of which vegetation was one. The vegetation associations were comprehensively described by Muir for the purpose intended and yielded much detailed structural and floristic information from largely plotless observation locations. These observations were related to, in some cases, highly schematic vegetation maps which addressed the basic requirements for the survey's objectives and reflected the resource limitations experienced at the time (Fig 2b). Thus, although these maps did not represent ideal material in relation to the unambiguous correlation of vegetation attributes and explicitly delineated map units, they represented an extensive and valuable set of observations for native vegetation in the Avon Wheatbelt region. In general Muir drafted his vegetation maps within the frame of a scaled reserve tenure boundary derived from the standard Department of Lands and Survey cadastral maps current at the time. This meant that Muir's map boundaries at least could be rectified and georeferenced (see section below on Spatial Data Incorporation). The small scale of the reserves meant that although vegetation units were schematic they could be placed within a reasonably precise location at a catchment scale.
Thus in reality for some of the source documents, a certain amount of ambiguity in correlating described and mapped vegetation units had to be accommodated in the ANVMP.
Appendix 2 gives an example of how this accommodation was approached.

Project Methods

The ANVMP data model was comprised of two fundamental parts:

1) The delineated spatial features or polygons constituting the map units and
2) The vegetation information linked or attributed to each of these polygons.

Generally, each vegetation description can be considered an attribute of a polygon or polygons. In terms of the database structure, each field and its value that is linked to a polygon can also be considered an attribute.
Appendix 6 describes further the project data structure and Appendix 7 lists database attribute fields defined by NVIS and adapted to the ANVMP.

Thus Incorporation of source vegetation map delineation and vegetation description data into the ANVMP involved the following elements:

1. Spatial – related to the delineated map unit polygons
2. Attribute – related to vegetation attribute data

These processes are summarised in Figure 3. and the steps involved are explained further in the following section, "Spatial Data Incorporation":

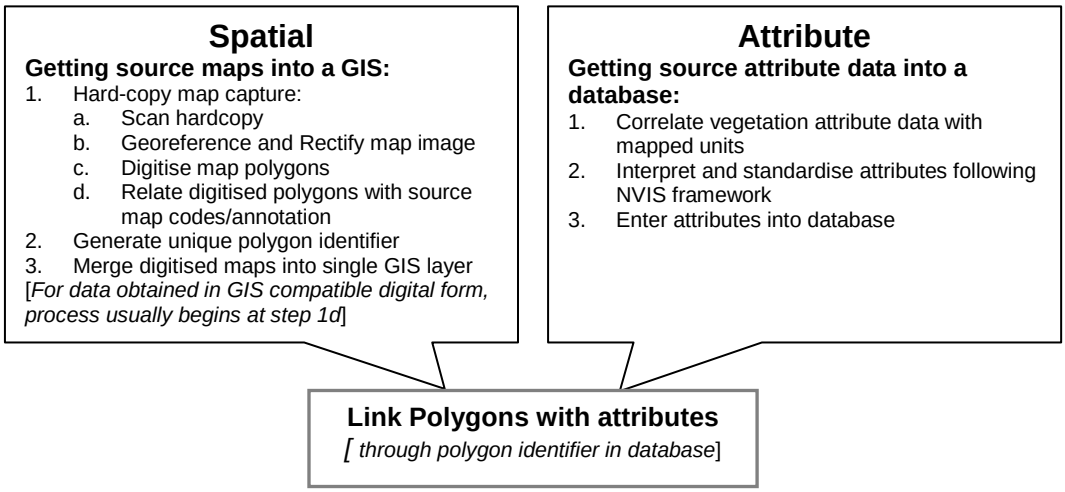


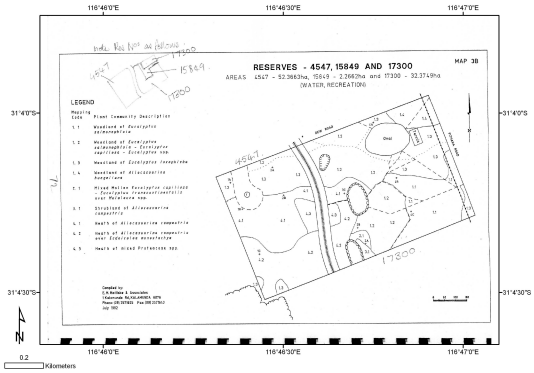
Figure 3. Processing and integrating spatial and attribute data for the ANVMP

Spatial Data Incorporation

Raw source map data had to be digitised and brought into the digital spatial realm of a Geographic Information System (GIS). The steps in the process followed in the ANVMP are illustrated and explained in Figure 4:

Figure 4: Steps involved in spatial data incorporation

1. Scan hard copy maps



The hardcopy maps represent the source spatial data set. When scanned, these raw raster images do not have any real world spatial reference in a GIS. The raw image has to be aligned or georeferenced to a known coordinate system in the GIS.

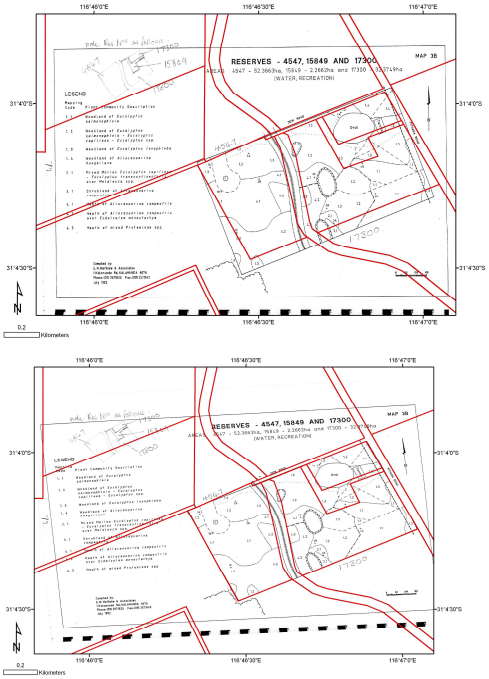
[Map source: EM Mattiske & Associates ;(1992);'Botanical survey of 43 reserves vested in the Water Authority of Western Australia. Parts A, B and C'. EM Mattiske & Associates, for the Department of Conservation of Land Management, Perth.]

2. The spatial reference – Tenure data set

Most maps have a reserve or tenure boundary of some jurisdiction drawn to scale that represents a common frame of reference. This provides the source “control points” in the raster image that can be correlated with corresponding target control points in the reference dataset layer. The DEC Corporate Tenure data* is usually used as the standard, spatial reference. This is the “target” data set”

[*the Dept of Land Administration State Cadastral Database (SCDB) (October 2005)]

3. Georeference and Rectify



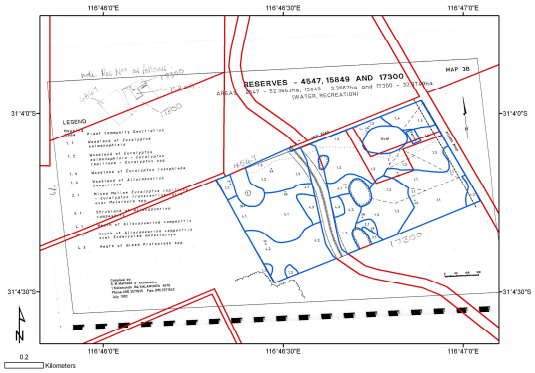
In this example, reserve boundary vertices shown in the source map are used as the “control points”. Congruent vertices in the source data layer are “pulled” into line (“warped”) to those of the target data set.

The process of warping “rectifies” the raster image so that it conforms to the target data set features. This also means the source image now has a geographic frame of reference.

For small areas it is assumed that the warping of the vegetation map unit line work within the reserve boundary follows proportionately across the extent of the mapped area when rectified. In larger areas – other internal control points may need to be added where possible – to allow for non linear distortions across the map extent. These displacements may contribute to positional error or deviations from true coordinates.

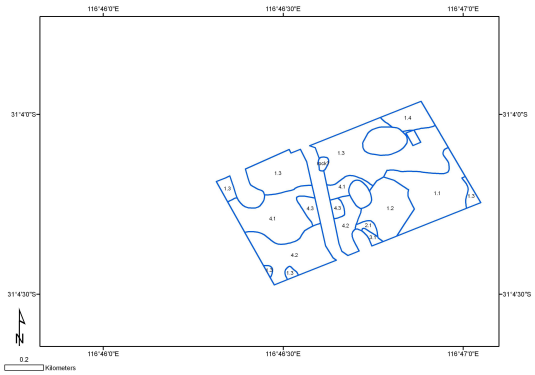
Note: In some cases where tenure control points were insufficient or not available (for example where mapped remnant vegetation does not conform to, or extends beyond tenure boundaries depicted on the source map), other forms of source to target alignment had to be used e.g. orthophoto image data showing distinct features such as road/track intersections, clearing interfaces, rock outcrops.

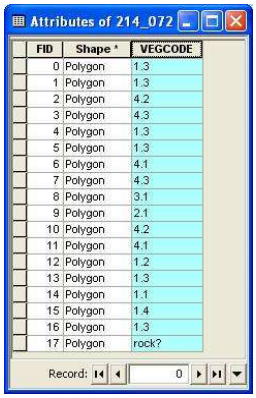
4. Digitise



The rectified scan is used as a background reference against which the vegetation line work (polygons) is digitised as a proprietary GIS file (i.e. ArcGIS shapefile).

5.Note Source Codes



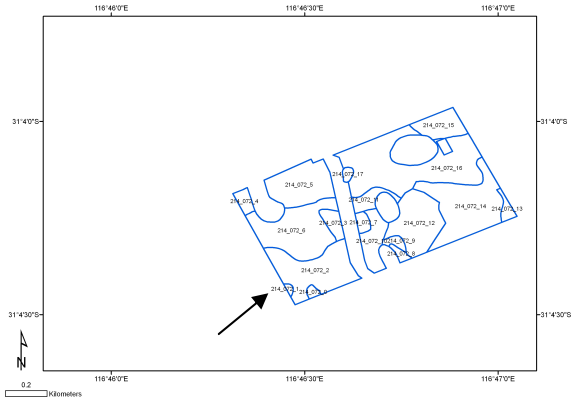

Attributes of 214_072

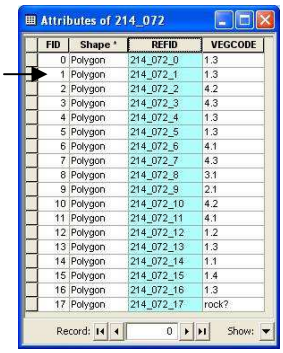
FID	Shape *	VEGCODE
0	Polygon	1.3
1	Polygon	1.3
2	Polygon	4.2
3	Polygon	4.3
4	Polygon	1.3
5	Polygon	1.3
6	Polygon	4.1
7	Polygon	4.3
8	Polygon	3.1
9	Polygon	2.1
10	Polygon	4.2
11	Polygon	4.1
12	Polygon	1.2
13	Polygon	1.3
14	Polygon	1.1
15	Polygon	1.4
16	Polygon	1.3
17	Polygon	rock?

Record: 0

Any codes, symbols, annotations, descriptive text or information shown in the background map scan is noted in relation to the digitised polygon for attribution reference. This information is entered for each polygon into a temporary reference field in the attribute table of the spatial file.

6. Allocate Polygon Identifier



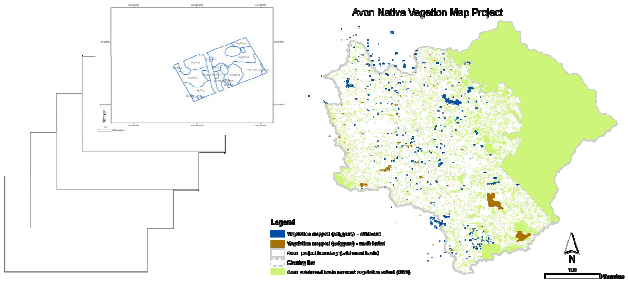


Each polygon is given a unique permanent identifier which links it with the corresponding vegetation attribute data in the ANVMP attribute database.
The identifier is comprised of three sets of numbers. For the example given here:

- the source reference number (**214)**
- the map number (**072)**
- the polygon feature number (**1)**

i.e. "**214_072_1**" is the unique polygon identifier
A permanent field is created in the GIS file attribute table for these values

7. Merge Maps



All digitised maps are combined into one GIS Avon vegetation map layer.
All polygons carry through and retain their identifier in the merged layer.
This identifier links the polygon feature with the respective attribute data in the ANVMP database.

Vegetation Data Attribution

To be useful as attribute data for the ANVMP, there were several requirements that vegetation data from the source material needed to fulfill:

- could be related to mapped units or polygons,
- conformed to a standard or consistent, known vegetation classification scheme,
- addressed essential structural and floristic parameters.

Meeting these requirements enabled source datasets to be interpreted and databased according to a common set of attribute fields in a database governed by a consistent set of rules and criteria as defined by the Australian Vegetation Attribute Manual. (ESCAVI 2003)

Correlating source vegetation descriptions with map units

For maps scanned, rectified and digitised from the hard copy source, any symbology, rendering or annotation displayed in the background reference source image was noted for each polygon in the digitised layer. This helped to identify each polygon with the corresponding vegetation descriptions and vegetation parameter data provided by the source documents.
The Source vegetation descriptions could then be correlated with the polygons comprising the delineated map units in the relevant source map.
In some cases the correlation process was straight forward where source vegetation descriptions were clearly linked to maps through a congruent set of codes, symbols or text.
In other cases the relationship between the vegetation descriptions and map units were less explicit or direct and required a greater level of interpretation. This ambiguity could occur for a number of reasons; for example:

- As a function of the schematic nature of source map delineation. (e.g.: fig 2b)
- Where several source codes were annotated to a given delineated source map unit polygon.
- Where the source description encompassed a range of structural and floristic variability that could be interpreted as more than one vegetation type attributable to a given delineated

map unit polygon. (These kinds of source data generally did not provide sufficient information to clearly differentiate these vegetation descriptions into discrete spatial elements).

- Where the source map annotation did not directly correlate with the vegetation descriptions requiring further information to help clarify attribution.

In each of these situations the resolution of either uncertainty in spatial delineation or attribute correlation created a situation where polygons were attributed with more than one source description (i.e. “multi-attributed” polygons) Such polygons were interpreted as “undefined mosaics” , that is, where the relative proportion and pattern of the mosaic components attributable to a polygon were unknown or unclear.
In some cases polygons such as those delineating geomorphic features (e.g. granite outcrops, salt lakes) were identified by an explicit code in the source map annotation and could be clearly attributed with a vegetation type described in the source documentation in relation to this code. However it could not be interpreted that the vegetation type necessarily represented the full extent of the attributed polygon feature. In some cases the vegetation attributes were associated with the geomorphically delineated polygon as a peripheral or niche element, too small to be resolved at the scale originally mapped.
[In the ANVMP database the render class for these types of polygons has been defined by their dominant environmental context or geomorphic feature. This was considered less misleading and more generally informative when rendered in the spatial viewer (NatureMap).]
[Appendix 2 gives examples of the attribute-polygon feature correlation process and ambiguities that were apparent and how they were resolved.]

Attribute translation

All source vegetation descriptions once correlated with delineated map unit polygons, were translated according to the Australian Vegetation Attribute Manual (AVAM) Version 6.0 (ESCAVI 2003). These translated descriptions provided the vegetation attributes that were entered into the ANVMP database. The database enabled these attributes to be linked with digitised map unit polygons in the GIS spatial layer. [See Appendix 3 for a summary of the NVIS hierarchy, description coding and Appendix 7 for NVIS attribute data fields]
For each substratum [NVIS Level 6] or Stratum [NVIS Level 5], source descriptions needed to provide information for the following vegetation parameters:

- Relative dominance (unless the most dominant stratum only was recorded).
- Height.
- Cover.
- Dominant growth form.
- Dominant Taxa (preferably by species [NVIS Level 5&6] or at least genus [NVIS Level 4]).

These parameters represent the essential elements required to generate an NVIS description at Levels 4, 5 and 6.

Structural parameters:

Where structural parameter values, from either the source text or interpreted site information were provided, these could be referenced directly to NVIS structural parameter value fields relating to height and cover for each stratum. In the absence of these values, translation had to be made by comparison of source and NVIS class intervals through the value ranges associated with the respective codes given for cover and height.
For example:

VegID 1137

[Original Map Veg Unit: 1.2 Woodland of *Eucalyptus salmonophloia – Eucalyptus capillosa*][Muir Diagnosis: Low woodland A over Open Low Scrub B over Open Dwarf Scrub C over Open Low Grass over Very Open Herbs on Clay-loam.][Muir Code: el+e4LAi.xSBr.xSDr.xGLi.xJr/CL]
Description:
Stratum I: *Eucalyptus salmonophloia* (e1) and *Eucalyptus capillosa* (e4), stratum height 7-12m tall, 10 -35% canopy cover.
Stratum 2: *Santalum acuminatum*, *Olearia muelleri* and *Acacia lasiocarpa*, stratum height 1-1.5m tall, 3-10% canopy cover.

Stratum 3: *Acacia erinacea*, *Sclerolaena sp.* and *Maireana sp.*, stratum height <0.5m tall, 3% canopy cover.
Stratum 4: *Stipa elegantissima* and occasional *Danthonia sp.* and *Neurachne alopecuroidea*, stratum height <0 5m tall, 8-20% canopy cover.
Stratum 5: *Borya nitida*, *Ursinia anthemoides* and *Hypochaeris glabra*, stratum height 0.01-0.03m tall, 5% canopy cover.
Source: Mattiske & Associates (1992)

In the above example, strata are clearly indicated. For each stratum, its height and cover are given as well as the dominant species comprising the stratum. The NVIS Classification class intervals corresponding to these source description height and cover values can then be determined

Where only descriptive source information was available (i.e. no height or cover class values provided), and the vegetation descriptions followed a consistent and documented classification system (e.g. Muir 1977), the structural parameters defined in the source classification terminology could be cross referenced to their equivalents in the NVIS classification.

For example:

VegID 1865
[Original Map Veg Unit: RLB039.02]*Eucalyptus salmonophloia* Woodland over *Acacia microbotrya* Open Scrub over *Eucalyptus phenax* scattered shrub mallee. [Formation overstorey species: *E. salmonophloia*]
Source: Ecoscape (Australia) Pty Ltd. (2004)

In the above example, only the Muir description is given, however the strata can be identified from the structural terminology and the order with which the strata are given in the description. The structural terms relate to specific Muir classification height and cover class intervals. These class intervals can be cross referenced with those of NVIS under the equivalent growth forms. Only the dominant species for each stratum are indicated in this example.

Sometimes there were incongruities between structural classes when comparing source and NVIS classification intervals. These incongruities had to be resolved using subjective judgment with reference to other contextual information provided in the source documentation or supplementary site data where possible.
[See Appendix 4 for more information on classification systems and their comparisons]

Floristic attributes

Floristic attributes were generally derived from the source description. Taxa were described in the source descriptions:

- As being dominant or occurring within a particular stratum, or
- in the context of a classification description where the terminology indicated stratum order.

In some cases source descriptions listed species without explicitly identifying them within a structural class or stratum, in which case accessory site data was sometimes used to help determine the most probable species representation. Otherwise In the absence of adequate information, additional species described for the vegetation type but not identified according to any stratum, had to be omitted from the database attributes.

Dominance

One of the definitions for stratum dominance given in the Australian Vegetation Attribute Manual indicates that:

> "*The dominant stratum is that which, because of its physiognomy and relative continuity, dominates the rest of the community in the sense that it conditions the habitats of the other strata*"

Most source vegetation descriptions, at least by implication, indicated the dominant stratum through the vegetation type name.

For example: “Salmon Gum – Morrel Woodland” (*Eucalyptus salmonophloia* and *Eucalyptus longicornis*)

> **Veg ID 1656**
> [Original Map Veg Unit: Salmon Gum - Morrel Woodland (VS2)] [Original association: Salmon Gum-Morrell Woodland (VS2)] Description: *Eucalyptus salmonophloia*, *Eucalyptus longicornis* and *Eucalyptus salubris* Woodland over *Acacia aestivalis*, *Santalum acuminatum* and *Acacia nyssophylla* Open Low Scrub A over *Atriplex stipitata, Rhagodia preissii, Olearia muelleri* and *Enchylaena tomentosa* Dwarf Scrub D over *Stipa elegantissima* Open Low Grass
> *Source: Safstrom, R., True, D. and Coates, A. (1996)*

The above vegetation association is identified as “Salmon Gum – Morrel Woodland”. *Eucalyptus salmonophloia* and *Eucalyptus longicornis* are interpreted as representing the dominant species of the dominant upper stratum.

In cases where the dominant stratum or the order of stratum dominance was not clear, an estimate was made by comparing the relative height and cover of each stratum through a rough “rule of thumb formula”.
[See Appendix 5 for an example]

Source descriptions usually indicated the dominant genus at least through the formation name for the map unit. Where strata were identified within the description, the dominant or indicative species were usually given in this context. [See appendix 3]

Taxon nomenclature and currency

Where possible, species nomenclature represented the status of that particular taxon as cited in the source vegetation data. As it was not feasible to easily link many of these cited taxa to specific herbarium collection records, any attempt to update or correct their names according to current taxonomic knowledge could be fraught with misinterpretation. Doing this could obscure the source record hindering subsequent attempts to follow through nomenclatural errors and revision.
All taxa have been identified in the ANVMP database by a Herbarium Taxon ID code. Where a taxon quoted in the source description has been listed by the WA Herbarium as no longer current, but is still retained and traceable with its original code in the WAHerb database, then the old name was retained in the Avon dataset, unambiguously reflecting that as it appeared in the source documents.
Plant names and corresponding codes were obtained from the "WACensus" – the repository of plant names in WA produced by the WA Herbarium. Names were imported in August of 2008 to the WA_PLANT_NAMES table in the ANVMP database. The names in this table represent a static set and do not reflect subsequent updates to the “WACensus” since August 2008.

Databasing

As well as providing a framework for the standardization and basis for comparing disparate data sources, the NVIS framework provided a relational data structure template. The data fields, tables and table relationships comprising the ANVMP database were based on those defined in the Australian Vegetation Attribute Manual Ver. 6 (ESCAVI 2003), where the data structure and attribute fields are explained in detail. However some of the attributes were interpreted differently from the Manual or were not relevant in the current context of the Avon Native Vegetation Map Project.
This is explained further in Appendix 6. A table of data attributes comparing NVIS definitions with those of the AVNVMP database is given noting those attributes for which the two differ.

References

1. Department of Environment and Conservation (2008) *Native Vegetation management Plan, Northern Agricultural Region*. DEC, Geraldton, WA.

2. Ecoscape (Australia) Pty Ltd. (2004) *'Lake Bryde Recovery Catchment Vegetation Survey'*. Dept. of Conservation and Land Management, Western Australia.

3. Executive Steering Committee for Australian Vegetation Information (ESCAVI) (2003) Australian Vegetation Attribute Manual: National Vegetation Information System, Version 6.0 Department of the Environment and Heritage, Canberra.

4. Geosciences Australia (2004) *Australia's River Basins 1997* National Mapping Division, Geoscience Australia, Canberra

5. Harvey, J.M. and Keighery G.J. (2012) Benchmarking Wheatbelt Vegetation Communities. Classification and Description of Eucalypt Woodlands. Wheatbelt Baselining Project, Wheatbelt Natural Resource Management Region and Department of Environment and Conservation. Perth

6. Mattiske EM & Associates (1992) '*Botanical survey of 43 reserves vested in the Water Authority of Western Australia. Part A and B'* Department of Conservation and Land Management', Western Australia, Water Authority of Western Australia.

7. Richardson, J. and Gamblin, T. (2009) *Project and knowledge gaps that restrict regional biodiversity conservation of the ANRMR*. Department of Environment and Conservation, Kensington, WA.

8. Safstrom, R., True, D. and Coates, A. (1996) *'Conservation and other values of selected agricultural area dams in the central wheatbelt of Western Australia. Volume 2'*. Dept. of Conservation and Land Management, Western Australia

Avon Native Vegetation Map Project Source Documents

The following reference list shows those sources from which map images have been digitised as GIS files. Those records marked * have been merged into the ANVMP map layer and linked to NVIS standardised vegetation attributes. The Ref Map ID is the map or remnant parcel identifier and is carried through as the first three digits identifying derived spatial features and file subdirectories.

Ref Map ID		Reference Citation
081		Napier A, Coates A (1986) 'Vegetation and Flora of Corrigin Reserves 16196 and 28131. Report prepared for the Pingelly Management District, CALM'. Department of Conservation and Land Management, Western Australia.
084	*	Coates A (1988) 'Vegetation survey of the Wongan Hills'. Department of Conservation and Land Management, Western Australia.
085	*	Coates A (1990) 'General reserve and vegetation survey of selected smaller nature reserves of the central wheatbelt, Pingelly management district. Part 1, Corrigin Shire'. Department of Conservation and Land Management, Western Australia.
087		Coates A (1990) 'Floristic and vegetation survey of Charles Gardner Reserve (A20041)'. Department of Conservation and Land Management, Western Australia.
088		Coates A (1990) 'General reserve and vegetation survey of selected smaller nature reserves of the Central Wheatbelt, Pingelly Management District. Part 5. Narrogin Shire'. Department of Conservation and Land Management, Western Australia.
089	*	Coates A (1990) 'General reserve and vegetation survey of selected smaller nature reserves of the central wheatbelt, Pingelly management district. Part 3. Kulin Shire (west)'. Department of Conservation and Land Management, Western Australia.
090		Coates A (1990) 'General reserve and vegetation survey of selected smaller nature reserves of the central wheatbelt, Pingelly Management District. Part 4. Wickepin Shire'. Department of Conservation and Land Management, Western Australia.
091		Coates A (1990) 'General reserve and vegetation survey of selected smaller nature reserves of the Central Wheatbelt, Pingelly Management District. Part 2. Quairading Shire'. Department of Conservation and Land Management, Perth.
093		Coates A (1990) 'Vegetation survey of Boolanelling Nature Reserve'. Department of Conservation and Land Management, Western Australia.
094	*	Coates A (1992) 'Vegetation survey of reserve no. 16418 and part reserve no. 18672, Wongan Hills area'. Department of Conservation and Land Management, Western Australia.
095		Coates A (1992) 'Flora and vegetation survey of Dragon Rocks Nature Reserve (No. A36128)'. Department of Conservation and Land Management, Western Australia.
107		Dames and Moore, Western Australia. Dept. of Conservation and Land Management (1985) 'The vegetation of the Boyagin Nature Reserve: a report'. Dames and Moore, Western Australia.
157		Gunness AG (2000) 'A survey of vegetation and flora of heritage bushland on the Taylor's Property, Woodford, at Tincurrin in the fence road catchment. Shire of Wickepin'. Wildflower Society of W.A. Nedlands, Western Australia.
173		Keating CDM, Keighery GJ, Bushland Plant Survey Project (W.A.) (2002) 'The vegetation and flora of Elashgin-Faulkner Road bushland and Hutchy's Block, Hadlaw Lakes, Cardiff Pastoral Co., Mortlock River East Catchment, Shire of Wyalkatchem'. Wildflower Society of W.A. Nedlands, Western Australia.
174		Keating CDM, Keighery GJ, Bushland Plant Survey Project (W.A.) 'The vegetation and flora of heritage bushland on David & Colleen Lawrence's property Mindah in the Benjaberring Catchment, Shire of Wyalkatchem'. Wildflower Society of W.A. Nedlands, Western Australia.
191		WG Martinick & Associates, Western Australia. Dept. of Fisheries and Wildlife (1984) 'Vegetation Survey of the Dunn Rock Nature Reserve'. W.G. Martinick & Associates, Perth, Western Australia.
214	*	EM Mattiske & Associates (1992) 'Botanical survey of 43 reserves vested in the Water Authority of Western Australia. Parts A, B and C'. EM Mattiske & Associates, Perth.

224		Moore SA, Williams AAE, Crook IG, Chatfield GR (1984) 'Nature Reserves of the Shire of Toodyay'. West. Aust. Nat. Reserve Manage. Plan No. 6 (DRAFT). Department of Fisheries and Wildlife, Western Australia
227		Moore S, Alford J, Raven R, Williams A; (1987); 'Nature Reserves of the Shires of York and Northam Management Plan 1987- 1997'. Management Plan No. 4. Department of Conservation and Land Management, Western Australia.
229		Moore SA, Williams AAE (1984) 'Reserves of the Shire of Wyalkatchem'. West. Aust. Nat. Reserve Management Plan No. 8 (draft).Department of Fisheries and Wildlife, Perth.
235	*	Muir BG (1978) 'Some nature reserves of the Western Australian Wheatbelt. Part 2 Kellerberrin Shire'. Department of Fisheries and Wildlife, Perth.
238	*	Muir BG (1978) 'Some nature reserves of the Western Australian Wheatbelt: Part 11 Mt. Marshall Shire'. Department of Fisheries and Wildlife, Perth.
239	*	Muir BG (1978) 'Some nature reserves of the Western Australian Wheatbelt: Part 27 Cuballing Shire'. Department of Fisheries and Wildlife, Perth.
240	*	Muir BG (1978) 'Some nature reserves of the Western Australian Wheatbelt: Part 6 Merredin Shire'. Department of Fisheries and Wildlife, Perth.
241	*	Muir BG (1978) 'Some nature reserves of the Western Australian Wheatbelt: Part 8, Dalwalinu Shire'. Department of Fisheries and Wildlife, Perth.
242	*	Muir BG (1978) 'Some nature reserves of the Western Australian wheatbelt: Part 1, Tammin Shire'. Department of Fisheries and Wildlife, Perth.
243	*	Muir BG (1978) 'Some nature reserves of the Western Australian wheatbelt: Part 5, Bruce Rock Shire'. Department of Fisheries and Wildlife, Perth.
244	*	Muir BG (1978) 'Some nature reserves of the Western Australian wheatbelt: Part 3, Wongan - Ballidu shire'. Department of Fisheries and Wildlife, Perth.
245	*	Muir BG (1978) 'Some nature reserves of the Western Australian wheatbelt: Part 7, Victoria Plains Shire'. Department of Fisheries and Wildlife, Perth.
246	*	Muir BG (1979) 'Some nature reserves of the Western Australian Wheatbelt: Part 12, Koorda Shire'. Department of Fisheries and Wildlife, Perth.
247	*	Muir BG (1978) 'Some nature reserves of the Western Australian Wheatbelt: Part 13, Muckinbudin Shire'. Department of Fisheries and Wildlife, Perth.
248	*	Muir BG (1979) 'Some nature reserves of the Western Australian Wheatbelt: Part 14, Westonia'. Department of Fisheries and Wildlife, Perth.
249	*	Muir BG (1979) 'Some nature reserves of the Western Australian Wheatbelt: Part 15, Nungarin Shire'. Department of Fisheries and Wildlife, Perth.
250	*	Muir BG (1979) 'Some nature reserves of the Western Australian Wheatbelt: Part 16, Trayning Shire'. Department of Fisheries and Wildlife, Perth.
251	*	Muir BG (1979) 'Some nature reserves of the Western Australian Wheatbelt: Part 17, Dowerin Shire'. Department of Fisheries and Wildlife, Perth.
252	*	Muir BG (1979) 'Some nature reserves of the Western Australian Wheatbelt: Part 18, Goomaling Shire'. Department of Fisheries and Wildlife, Perth.
253	*	Muir BG (1979) 'Some nature reserves of the Western Australian Wheatbelt: Part 19 Northam Shire'. Department of Fisheries and Wildlife, Perth.
254	*	Muir BG (1979) 'Some nature reserves of the Western Australian Wheatbelt: Part 20, Kondinin Shire'. Department of Fisheries and Wildlife, Perth.
255	*	Muir BG (1979) 'Some nature reserves of the Western Australian Wheatbelt: Part 21, Corrigin Shire'. Department of Fisheries and Wildlife, Perth.
256	*	Muir BG (1979) 'Some nature reserves of the Western Australian Wheatbelt: Part 22, Quairading Shire'. Department of Fisheries and Wildlife, Perth.
257	*	Muir BG (1979) 'Some nature reserves of the Western Australian wheatbelt: Part 23, York Shire'. Department of Fisheries and Wildlife, Perth.
258	*	Muir BG (1979) 'Some nature reserves of the Western Australian wheatbelt: Part 24, Beverley Shire'. Department of Fisheries and Wildlife, Perth.
259	*	Muir BG (1979) 'Some nature reserves of the Western Australian wheatbelt: Part 25, Pingelly Shire'. Department of Fisheries and Wildlife, Perth.

286	*	Safstrom R, True D, Coates A (1995) 'Conservation values of small reserves in the central wheatbelt of Western Australia'. Report on 38 Reserve Surveys, Volume 1. Prepared for the Western Australian Department of Conservation and Land Management. R. Safstrom Victoria Park, W.A.
287	*	Safstrom R, True D, Coates A.(1995) 'Conservation values of small reserves in the central wheatbelt of Western Australia'. Report on 38 Reserve Surveys, Volume 2. Prepared for the Western Australian Department of Conservation and Land Management. R. Safstrom Victoria Park, W.A.
288	*	Safstrom R, True D, Coates A (1996) 'Conservation and other values of selected agricultural area dams in the central wheatbelt of Western Australia. Volume 3'. Prepared for the Western Australian Department of Conservation and Land Management. R. Safstrom Victoria Park, W.A.
289	*	Safstrom R, True D, Coates A (1996); 'Conservation and other values of selected agricultural area dams in the central wheatbelt of Western Australia. Volume 1'. Prepared for the Western Australian Department of Conservation and Land Management. R. Safstrom Victoria Park, W.A.
290	*	Safstrom R, True D, Coates A (1996) 'Conservation and other values of selected agricultural area dams in the central wheatbelt of Western Australia. Volume 2'. Prepared for the Western Australian Department of Conservation and Land Management. R. Safstrom Victoria Park, W.A.
295	*	Weston AS (1985) 'The vegetation, flora and avifauna of Chiddarcooping Nature Reserve'. Department of Conservation and Land Management. Western Australia.
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319	*	Muir BG (1978) 'Some Nature Reserves of the Western Australian Wheatbelt. Part 4, Narembeen Shire'. Department of Fisheries and Wildlife, Western Australia.
322		Ecoscape (Australia) Pty Ltd (2007) 'Vegetation Mapping and Assessment at Yenyening Lakes Nature Reserve (RFQ 407 04/06)'. Department of Conservation and Land Management, Perth
323	*	Ecoscape (Australia) Pty Ltd (2005) 'Assessment of Conservation Values Of 24 Wheatbelt Reserves, Report to CALM'. Department of Conservation and Land Management, Perth. CALM
325	*	Ecoscape (Australia) Pty Ltd (2000) 'Assessing the Nature Conservation and Other Values of Crown Lands Within the Shire of Kent Report to CALM'; Department of Conservation and Land Management, Perth.
326		Ecoscape (Australia) Pty Ltd (2001) 'Assessing the Nature Conservation and Other Values of Crown Lands Within the Shire of Kent, Report to CALM'. Department of Conservation and Land Management, Perth.
328	*	Ecoscape (Australia) Pty Ltd; (2004) 'Lake Bryde Recovery Catchment Vegetation Survey, Report to CALM' Department of Conservation and Land Management, Perth.
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331	*	Woodman Environmental Consulting Pty Ltd (2002) 'Vegetation Survey of the Tarin Rock Target Landscape Area. Report to CALM (RFQ 418 5/02).' Department of Conservation and Land Management, Perth
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342	*	Rick A (2010) 'Lake Campion Nature Reserve (24789) and Reserve (21759) revisited'. Botanical consultants report to the Department of Environment and Conservation.

* Maps for which vegetation attributes have been databased.

Appendix 1: The Vegetation Mapping Process

To understand why only certain data sources were able to be used for the Avon Native Vegetation Map Project it helps to have some understanding of the general processes involved in vegetation mapping

A Vegetation map can be thought of as a synoptic view of the type, composition, spatial distribution and extent of a vegetation community, usually delineated as discrete polygonal map units, showing what is most likely to be the typical vegetation in an area. That is, the vegetation map is an expression of "probability" indicating what vegetation is *likely* to be in a particular place but not necessarily what will always *actually be* there.

Site data, whether an undelimited observation point or area defined plot such as a quadrat, in contrast, is a more precise indication of what is actually at that point and moment but cannot always be construed in terms of a mapped area.

On-ground survey activities usually involve collection of floristic as well structural data from strategically located sample sites. Other key environmental parameters such as soil type and landform may also be recorded at these sites. These types of vegetation survey show species composition at discrete points (e.g. by quadrat) that while helping inform the mapping process, do not necessarily *spatially* define vegetation communities in themselves.

Certain kinds of detailed floristic survey site data may also be analysed to identify or statistically classify vegetation into species assemblages. These assemblages may be related to some kind of environmental variable such as moisture, soil type, slope, and aspect or landscape position. Species assemblages tend to indicate or define the likelihood of certain species being found together but do not necessarily define them spatially as mappable units.

Fundamentally, unless vegetation site data or classified derivatives were able to be defined spatially as mappable units then they were difficult to incorporate into the ANVMP data model.

The Source documents consulted for the ANVMP (such as vegetation surveys, nature reserve resource assessments and inventories) varied considerably in the purpose, scope, extent, scale, methods, interpretation and description of vegetation and its mapping.
Some sources presented maps showing vegetation units as mainly structural formations with detailed vegetation association data and descriptions presented without direct interpretation as defined map units or polygons. Although the maps from such sources could be digitised as part of the Avon Vegetation Map Project, the detailed vegetation association descriptions could not be unambiguously attributed to specific map unit polygons and so where not directly applicable to the project data set.

Appendix 2: Vegetation Attributes and Map Unit Correlation

The following example illustrates the process of correlating vegetation attributes with map units and highlights several vegetation attribute/feature correlation issues encountered in the ANVMP:

- Where there is an indirect relationship between the source map annotation and the described vegetation.
- Where the source description has to be broken down into a number of separate descriptions (attributed components) in order to be databased as a mosaic.
- Where the source vegetation description is attributed to a polygon representing a geomorphic feature (e.g. granite outcrop); but where the described vegetation does not occupy the entire extent of the polygon.

Attribution example: map 286_089

Source:

Safstrom, R., True, D. and Coates, A. (1995) 'Conservation values of small reserves in the central wheatbelt of Western Australia'. Department of Conservation and Land Management, Western Australia. (Part 1).

Source Map

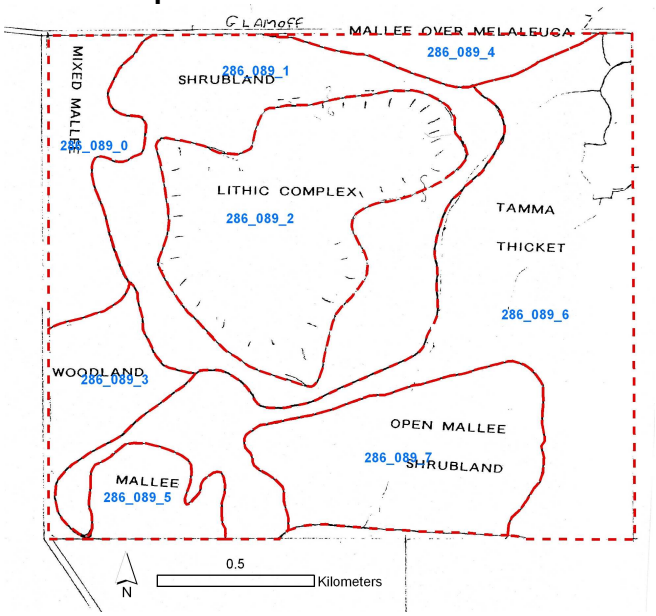


Fig 1. map 286_089 Source map background image showing map annotation with digitised spatial layer (red) and polygon identifiers (blue) superimposed.

The following are the source vegetation associations identified within the reserve and described in the source document (with NVIS L6 and L4 translations)

1 Mallee – Shrub Mallee of *Eucalyptus transcontinentalis, Eucalyptus pileata, Eucalyptus celastroides ssp. celastroides* over Low Scrub A.
NVIS L 6: U1+^*Eucalyptus transcontinentalis*,*Eucalyptus pileata*,*Eucalyptus celastroides ssp. celastroides*\Eucalyptus\^mallee shrub\6\c;M1^*Grevillea huegelii*^*Melaleuca uncinata**Grevillea*\^shrub\3\i
NVIS L 4: +*Eucalyptus* Mallee Shrubland*Grevillea/Melaleuca* Open Shrubland
[*note NVIS level 6 Mid stratum species were derived from relevant source site data records for 286_089*]

2 Tall Shrubland with emergent mallee – Very Open Shrub Mallee of *Eucalyptus leptopoda* over Thicket of *Allocasuarina campestris, Acacia neurophylla.*
NVIS L 6: U1^*Eucalyptus leptopoda**Eucalyptus*\^mallee shrub\5\r;M1+^*Allocasuarina campestris*^*Acacia neurophylla**Allocasuarina*\^shrub\4\c

NVIS L 4: *Eucalyptus* Low Sparse Mallee Shrubland\+*Allocasuarina/Acacia* Tall Shrubland

3 Outcrop Lithic Complex - Dense Herbs of *Borya sphaerocephala* on the rock surface, and *Allocasuarina campestris, Malleostemon tuberculatus* and *Acacia coolgardiensis* form a perimeter Thicket.

[3a] [Attributed component: Dense Herbs]
NVIS L 6: G1+^*Borya sphaerocephala**Borya*\^rush\1\d
NVIS L 4: +*Borya* Low Closed Rushland

[3b] [Attributed component: Perimeter Thicket]
NVIS L 6: M1+^^*Allocasuarina campestris*,*Malleostemon tuberculatus,Acacia coolgardiensis**Allocasuarina*\^shrub\4\c
NVIS L 4: +*Allocasuarina* Mixed Tall Shrubland

4 Woodland - of *Eucalyptus salmonophloia, Eucalyptus salubris, Eucalyptus loxophleba* over Open Low Scrub A of Acacia *acuminata, Melaleuca pauperiflora.*
NVIS L 6: U1+^*Eucalyptus salmonophloia,Eucalyptus salubris,Eucalyptus loxophleba**Eucalyptus*\^tree\7\i;M1^*Acacia acuminata^Melaleuca pauperiflora**Acacia*\^shrub\3\r
NVIS L 4: +*Eucalyptus* Woodland\Acacia/*Melaleuca* Sparse Shrubland

5 Shrubland - Thicket of *Allocasuarina campestris, Acacia neurophylla* over Open Low Sedges of *Ecdeiocolea monostachya.*
NVIS L 6: M1+^*Allocasuarina campestris^Acacia neurophylla**Allocasuarina*\^shrub\4\c;G1^*Ecdeiocolea monostachya**Ecdeiocolea*\^rush\1\i
NVIS L 4: +*Allocasuarina/Acacia* Tall Shrubland*Ecdeiocolea* Low Open Rushland

6 Mallee -Open Shrub Mallee of *Eucalyptus subangusta ssp. subangusta, Eucalyptus kochii ssp. kochii, Eucalyptus loxophleba* over Heath A of *Melaleuca acuminata, Melaleuca eleuterostachya.*
NVIS L 6: U1+^*Eucalyptus subangusta ssp. subangusta,Eucalyptus kochii ssp. kochii,Eucalyptus loxophleba* *Eucalyptus*\mallee shrub\6\i;M1^*Melaleuca acuminata,Melaleuca eleuterostachya**Melaleuca*\^shrub\3\c
NVIS L 4: +*Eucalyptus* Open Mallee Shrubland*Melaleuca* Shrubland

7 Mallee -*Melaleuca* sp. Open Shrub Mallee of *Eucalyptus erythronema, Eucalyptus transcontinentalis* over Low Scrub A of *Melaleuca acuminata ssp. acuminata, Acacia enervia ssp. explicata.*
NVIS L 6: U1+^*Eucalyptus erythronema,Eucalyptus transcontinentalis**Eucalyptus*\mallee shrub\6\i;M1^*Melaleuca acuminata ssp. acuminata^Acacia enervia ssp. explicata**Melaleuca*\^shrub\3\i
NVIS L 4: +*Eucalyptus* Open Mallee Shrubland*Melaleuca/Acacia* Open Shrubland

	Source Vegetation Description Name	ANVMP Veg ID
1	Mallee	1320
2	Tall Shrubland with emergent mallee	1321
3a	Outcrop Lithic Complex [Dense Herbs]	1322
3b	Outcrop Lithic Complex [Perimeter Thicket]	1323
4	Woodland	1324
5	Shrubland	1325
6	Mallee [Over *Melaleuca* Heath]	1326
7	Mallee -*Melaleuca sp*.	1327

The Matrix below *shows the interpreted correlation of source map polygons with the Source Vegetation descriptions. The VegID codes **are shown in the matrix cells indicating those vegetation associations attributed to a given polygon in the database.

**[The attribution matrix is based on the pre-merged GIS file attribute table showing polygon identifiers and source map annotation exported as a spreadsheet document. The columns representing the described vegetation types are inserted and then the cells representing the relationship between the described vegetation and the map polygons identified. Where a polygon row has more than one cell identified in relation to described vegetation types then that polygon represents a "multi attribution" or "unknown mosaic"]*

***[The VegID code is a field in the ANVMP database .The VegID is a unique identifier for each vegetation type described in the source]* .

Source Vegetation Description									
		1	2	3a	3b	4	5	6	7
Polygon ID	**Map Annotation**	**Mallee**	**Tall Shrubland with emergent mallee**	**Outcrop Lithic Complex [Dense Herbs]**	**Outcrop Lithic Complex [Perimeter Thicket]**	**Woodland**	**Shrubland**	**Mallee [Over Melaleuca Heath]**	**Mallee - Melaleuca sp.**
286_089_0	Mixed Mallee	1320						1326	1327
286_089_1	Shrubland						1325		
286_089_2	Lithic Complex			1322	1323				
286_089_3	Woodland					1324			
286_089_4	Mallee over Melaleuca	1320						1326	1327
286_089_5	Mallee	1320						1326	1327
286_089_6	Tamma Thicket		1321				1325		
286_089_7	Open Mallee Shrubland		1321					1326	1327

Attribute – Map Unit Correlation

Mallee

The relationship between Mallee units as labeled on the map and as described in the source document is not always direct.

All Mallee descriptions: 1, 6 and 7 appear to be comprised of mixed co-dominant Eucalypt Mallee species so have been correlated with "Mixed Mallee" as delineated and annotated on the source map (polygon ID 286_089_0)

The mapped unit "Mallee" does not indicate any particular dominant according to the map annotation – so given this ambiguity all Mallee descriptions (1, 6, and 7) have been attributed to polygon 286_089_5.

"Mallee" description (6) by direct annotation is attributed to 286_089_5. However "Mallee" (6) also has a shrubland understorey of *Melaleuca* species, so has been attributed to polygon 286_089_4 annotated "Mallee over *Melaleuca*" on the source map

"Mallee – *Melaleuca* sp" description (7) with an open shrubland understorey of *Melaleuca sp*. is also attributed to polygon 286_089_4 "Mallee over *Melaleuca*"

Tamma/Shrubland

Similarly there is ambiguity with the way areas mapped and annotated on the source map as "Shrubland" and "Tamma Thicket" relate to the vegetation descriptions.

The map annotation "Tamma Thicket" is not actually represented by any described vegetation association specifically under this name.
However:
"Tall Shrubland with Emergent Mallee" description (2) is comprised of a sparse mallee shrubland over a mixed dominant *Allocasuarina/Acacia* tall shrubland, so has been

attributed to polygon 286_089_7 labeled “Open Mallee Shrubland” and to 286_089_6 labeled “Tamma Thicket” as related to an Open Mallee Shrubland and *Allocasuarina campestris* Thicket component in description (2) respectively .
“Shrubland” (5) has been attributed to 286_089_1 annotated as “Shrubland”.
As “Shrubland” (5) is described as a mixed dominant *Allocasuarina campestris /Acacia* Tall Shrubland over Low Open Rushland, it has also been attributed to polygon 286_089_6 “Tamma Thicket” on the basis of the *Allocasuarina campestris* component.

In attempting to resolve the attribution of described vegetation to map units, where the relationship is not mutually denoted in the map and description coding, many of the polygons have been multi-attributed - that is they represent more than one attribute. (fig 2) By NVIS definition this means that they are considered to be “unknown mosaics” (in the sense that the relative proportion of each mosaic component within the polygon is unknown). However it might be more appropriate to view these more as mosaics of “attribution uncertainty”.

Attributed components

The following description:

> **3 Outcrop Lithic Complex -** Dense Herbs of *Borya sphaerocephala* on the rock surface, and *Allocasuarina campestris, Malleostemon tuberculatus* and *Acacia coolgardiensis* form a perimeter Thicket.

Consists of two components:

(3a) Dense Herbs
(3b) Perimeter Thicket

As the source description indicates, these components are separate vegetation types within the complex, rather than substrata within the same association. Because of this these components have to be interpreted and databased as separate attribute records, ie as “attributed components” of the original source description.
This reflects the relationship of the vegetation to:

- its location and geomorphic context
- Interpretation as a complex or mosaic.
- the criteria and rule sets required by the data structure whereby mosaic components have to be treated as separate vegetation records (VegID) attributed to a given feature (e.g. polygon 286_089_2)

In NVIS terminology the two records databased are:

[3a] **VegID:** 1322 NVIS L 6: G1+^*Borya sphaerocephala**Borya*\^rush\1\d
NVIS L 4: +*Borya* Low Closed Rushland

[3b] **VegID:** 1323 NVIS L 6: M1+^^*Allocasuarina campestris,Malleostemon tuberculatus,Acacia coolgardiensis**Allocasuarina*\^shrub\4\c
NVIS L 4: +*Allocasuarina* Mixed Tall Shrubland

Both **VegID:** 1322 and 1323 are attributed to the same polygon (originally as a Lithic Complex) by the source description and so are interpreted as a mosaic by NVIS criteria.

Neither vegetation component 1322 or 1323 however could be construed as occupying the full extent of the feature to which they have been attributed.
VegID 1323 is described as having a peripheral occurrence to the feature but could not be delineated separately at the scale mapped.
The occurrence of VegID 1323 is also likely to be strongly influence by environmental parameters associated with the geomorphic character of the lithic feature itself e.g. soil, runoff.

For these reasons the polygon 286_089_2 is rendered in the spatial viewer according to its geomorphic character, i.e. “Rock”, rather than by its vegetation attributes. [See section on “Multi attributed (formation rendered) polygons” . in Viewing and querying the Avon Native Vegetation Map with NatureMap at the Naturemap Website; The look up table explaining non vegetation render codes including geomorphic features can also be viewed here.]

The above example illustrates what could be regarded as a mosaic reflecting the heterogeneous nature of a vegetation community i.e. a “complex”. In this case it is clear to which feature the vegetation descriptions are attributed, however at the scale originally mapped or interpreted they cannot be resolved spatially within the delineated polygon. The mosaic is thus more a product of scale as much as “attribution uncertainty”.

Mosaics and Multiattribution

Figure 2. illustrates the many to many relationship that often exists between mapped polygons and the vegetation attributed to them. This relationship has implications for the way the data relationship is handled and interpreted.

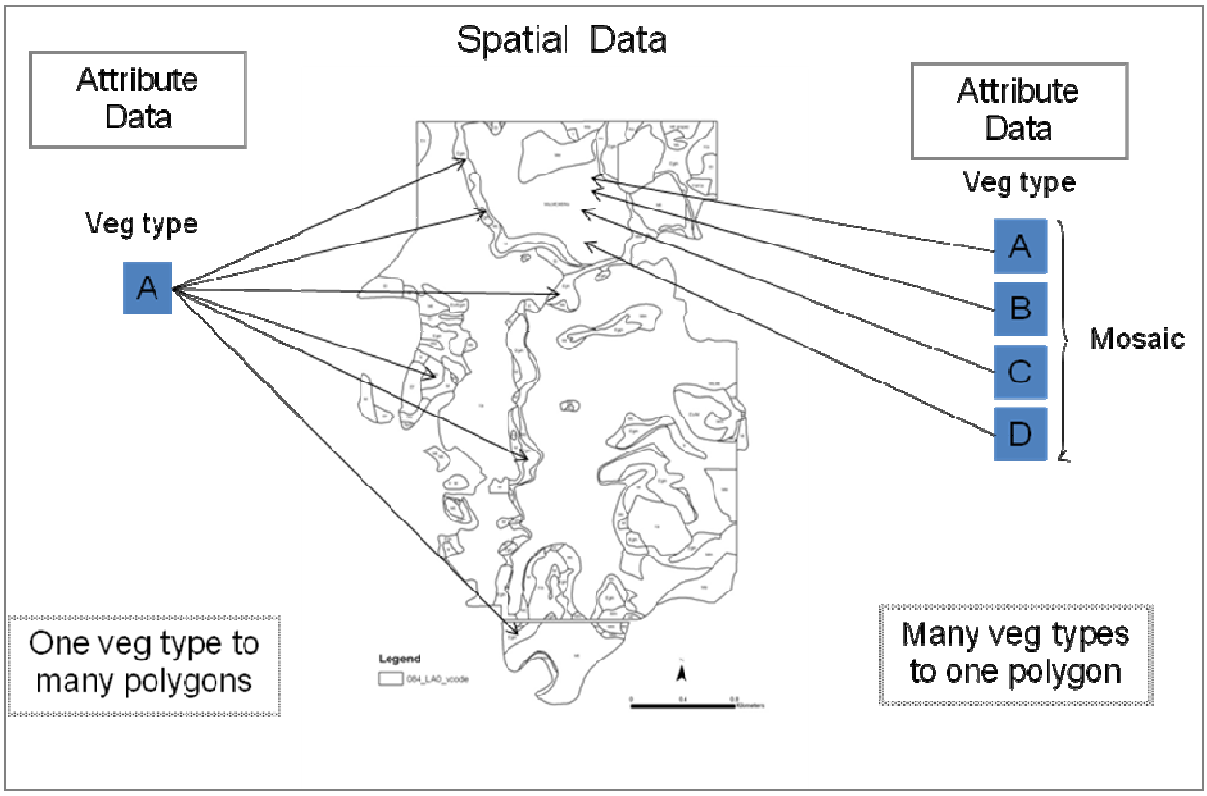


Fig 2. Illustration of a many to many relationship between map polygons and vegetation attributes.

Mosaics arise where:

- A map unit polygon is explicitly described as a mosaic and each mosaic element is described as a distinct vegetation type. Each vegetation type is attributed to the polygon but cannot be explicitly delineated at the scale mapped.
- Polygons are labeled with different symbols or codes which can be correlated with descriptions for different vegetation associations – but where these symbols or codes are not delineated according to the vegetation they represent at the scale mapped. In this case the mosaic is implied but the relationship, distribution or relative proportion of the multi-attributes symbolized in the source map are not explicitly described in the source documentation.
- Where the map annotation is ambiguous in relation to the delineation linework such that vegetation descriptions cannot be resolved beyond the most common boundary of delineation – in some cases this happens to be the reserve boundary polygon itself.

It is worth noting that all mosaics are scale dependent – ie mosaics may be too fine or complex to be resolved at the scale mapped. At a larger (i.e. finer) scale of mapping they may be resolvable into separate map unit polygons.

Appendix 3: NVIS, Summary of General Concepts and Description Coding

The NVIS Hierarchy:

The following is an example illustrating the basic concept behind the NVIS hierarchy. For a more comprehensive treatment of the information given in the topics outlined here, go to the Australian Vegetation Attribute Manual Version 6.0 which can be viewed and downloaded from the NVIS website: [http://www.environment.gov.au/erin/nvis/index.html]

Source Vegetation Map Unit:

Woodland Formation (Location 1.1)

Source Vegetation Description:

(Note: NVIS stratum codes to which the source strata have been correlated are shown in red)

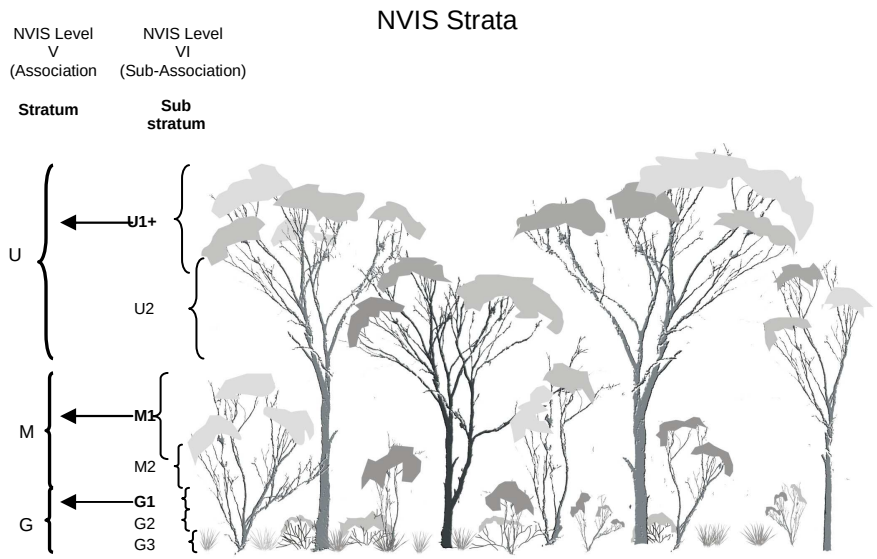
[Muir Description: Woodland over Low Woodland A over Open Scrub over Open Low Scrub B over Open Dwarf Scrub C over Dwarf Scrub D over Very Open Low Grass on Clay – loam.]
[Muir Code: e1Mi.e1+e2Lai.a1Sr.xSBr.xSCr.xSXi.GLr/CL]

Stratum 1 +(*U1*): *Eucalyptus salmonophloia* (e1), stratum height 16m tall, 15% canopy cover.
Stratum 2 (*U2*): *Eucalyptus salmonophloia* (e1) and *Eucalyptus loxophleba* (e2), stratum height 6- 10m tall, 18% canopy cover.
Stratum 3 (*M1*): *Acacia acuminata* (a1), *Acacia microbotrya*, *Eremophila drummondii* and *Daviesia hakeoides*, stratum height 2-6m tall, 9% canopy cover.
Stratum 4 (*M2*): *Acacia erinacea*, *Olearia muelleri*, *Eremophila drummondii*, *Acacia merrallii* and *Rhagodia preissii* ssp*. Preissii*, stratum height 1-1.5m tall, 9% canopy cover.
Stratum 5 (*G1*): *Eremophila drummondii, Daviesia hakeoides* and *Maireana brevifolia*, stratum height 0.5-1.0m tall, 7% canopy cover.
Stratum 6 (*G2*): *Maireana brevifolia and Rhagodia preissii* ssp. *Preissii*, stratum height 0.1- 0.5m tall, 13% canopy cover.
Stratum 7 (*G3*): *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.

Source: EM Mattiske & Associates; (1992);'Botanical survey of 43 reserves vested in the Water Authority of Western Australia. Parts A, B and C': prepared for Department of Conservation and Land Management'; Department of Conservation and Land Management, Perth.) REFID 214 p61, map 214_072

Diagram of typical Wheatbelt Woodland Association: e.g. Salmon Gum Woodland



Level V1 Sub Association: Floristic and Structural parameters for all substrata

U1 e.g. *Eucalyptus salmonophloia*. U2 e.g. *Eucalyptus loxophleba*
M1 e.g. *Acacia acuminata*, M2 *Acacia erinacea, Acacia merrallii*
G1 e.g. *Eremophila drummondii, Daviesia hakeoides,* G2*Maireana brevifolia*
(note NVIS defines dominance in terms of "biomass" or Ecological significance. The dominant substratum is therefore not always the tallest e.g. if M2 presents the greatest biomass in the strata M then it is carried through as the representative strata for M. Similarly if M2 had the greatest biomass of **All** substrata from U, M, G, then it would be designated "+" (dominant overall

Level 6 NVIS Translation (dominant elements in bold)

U1+^*Eucalyptus salmonophloiaEucalyptus*\^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

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,)

Level V Association: Floristic and Structural for dominant substrata only.
Dominant substrata representing each of U, M and G carried through to NVIS Level V from Level VI dominant substrata elements.
Coded terminology and species indicated

Level 5 NVIS Translation (dominant elements in bold)

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;

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)

	**Level IV: Sub-Formation – structural and Floristic (Genus)** Dominant Genus for each of the dominant substrata only - no species given. Essentially descriptive terminology with dominant genus only indicated.
Level 4 NVIS Translation *(dominant elements in bold)* ***+Eucalyptus* Woodland***\Acacia* Mixed tall Sparse Shrubland*Eremophila* Mixed Low Sparse Shrubland	**Sub-Formation** • Stratum (all strata) • Dominant (& co-dominant) Genus only • Structure (as structural class term for all strata)
	**Level III - Broad Floristic Formation**
Level 3 NVIS Translation *(dominant elements in bold)* ***+Eucalyptus* Woodland***	**Broad Floristic Formation** • Dominant Stratum only • Genus (dominant only) • Structure (as structural class term for dominant Stratum only)
	**Level II - Structural Formation**
Level 2 NVIS Translation *(dominant elements in bold)*	**Structural Formation**

+Woodland	• Structure (dominant Stratum only)

NVIS level I description **Stratum** **Tree** **U+** 	**Level 1 Class**
Level 1 NVIS Translation *(dominant elements in bold)* ***+Tree***	**Class:** Growth form (dominant Stratum only)

NVIS Description Codes

The following is a condensed guide to the coding used in NVIS Level 6 descriptions. These codes are applied to the example source description illustrated in The NVIS Hierarchy above.

NVIS L6 description (VegID 707):

U1+^*Eucalyptus salmonophloiaEucalyptus*\^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

The description components and coding are briefly outlined below. The Level 6 description has the general format:

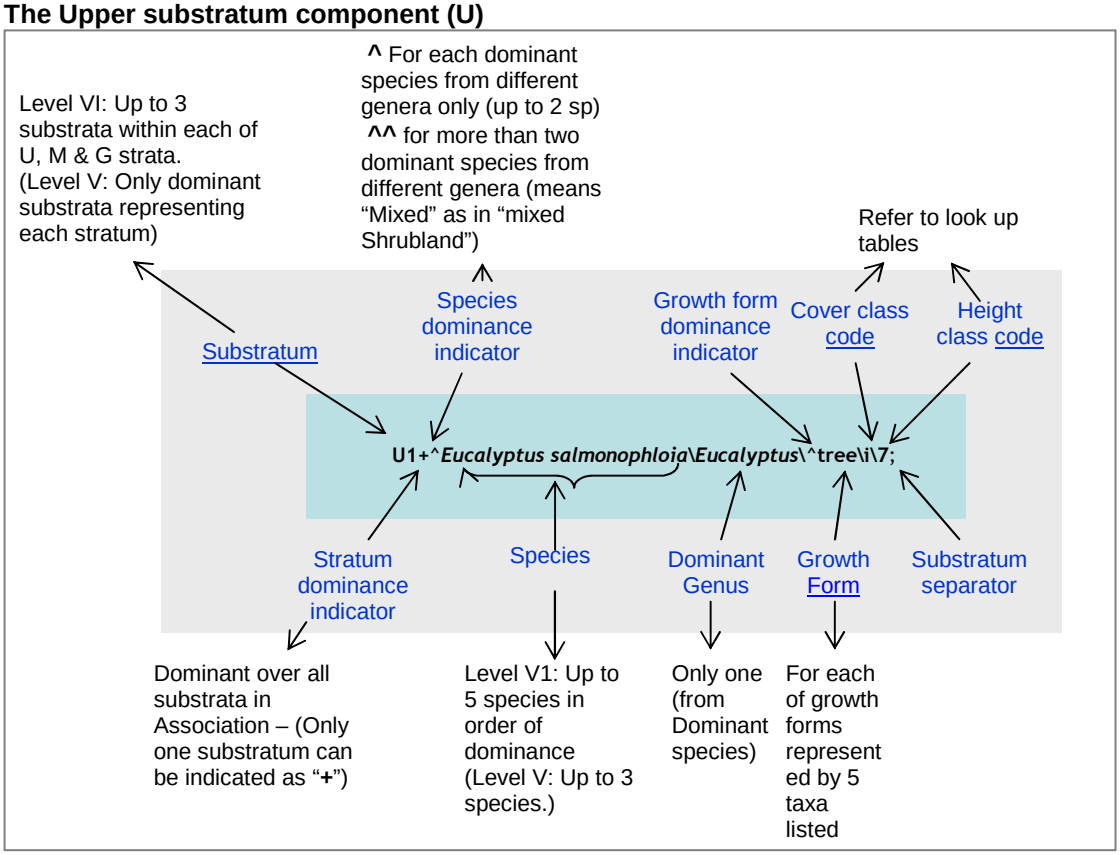
[substratum indicator] [stratum dominance flag] [dominance indicator] [dominant or indicator species]\[dominant or characterising genus]\[growth form dominance indicator][dominant growth form]\[substratum cover class code]\[substratum height class code];

Where:

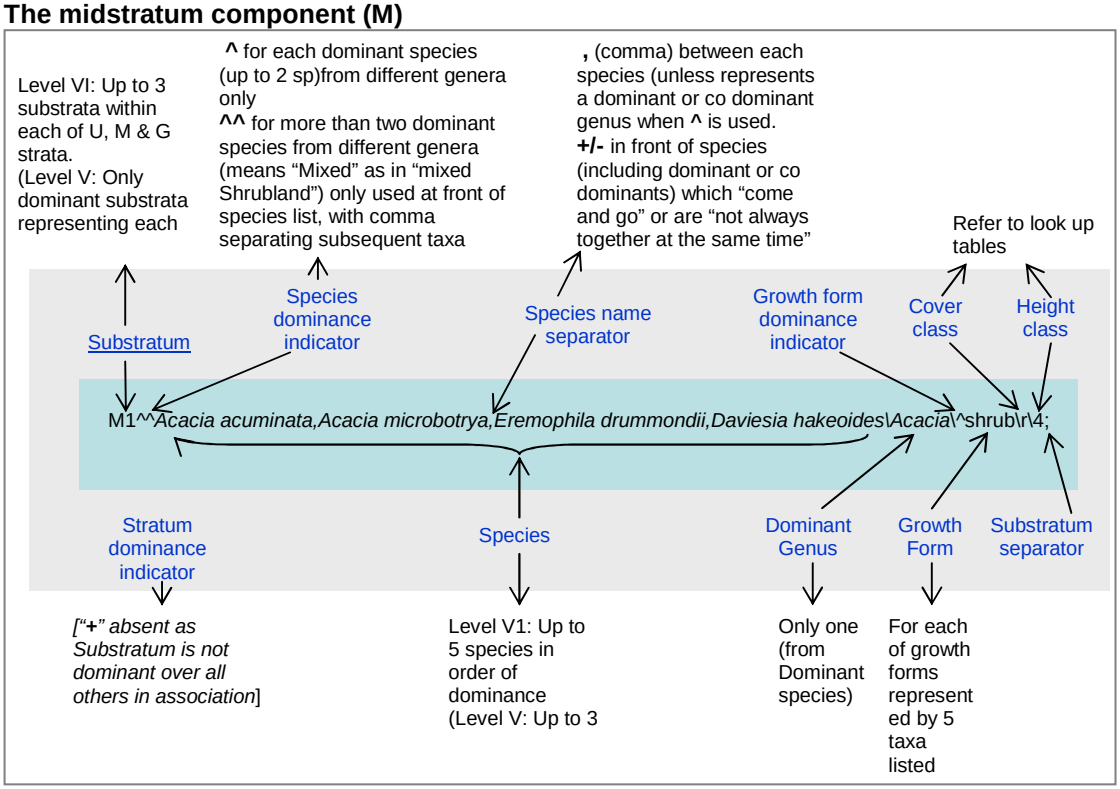
"**+**"	substratum (and stratum) dominance indicator
"**^**"	dominant or co dominant species indicator
"**^^**"	mixed (ie more than 2 co dominant species)
"****"	separator
"**;**"	substratum separator

These codes and the description format are illustrated and discussed further below:

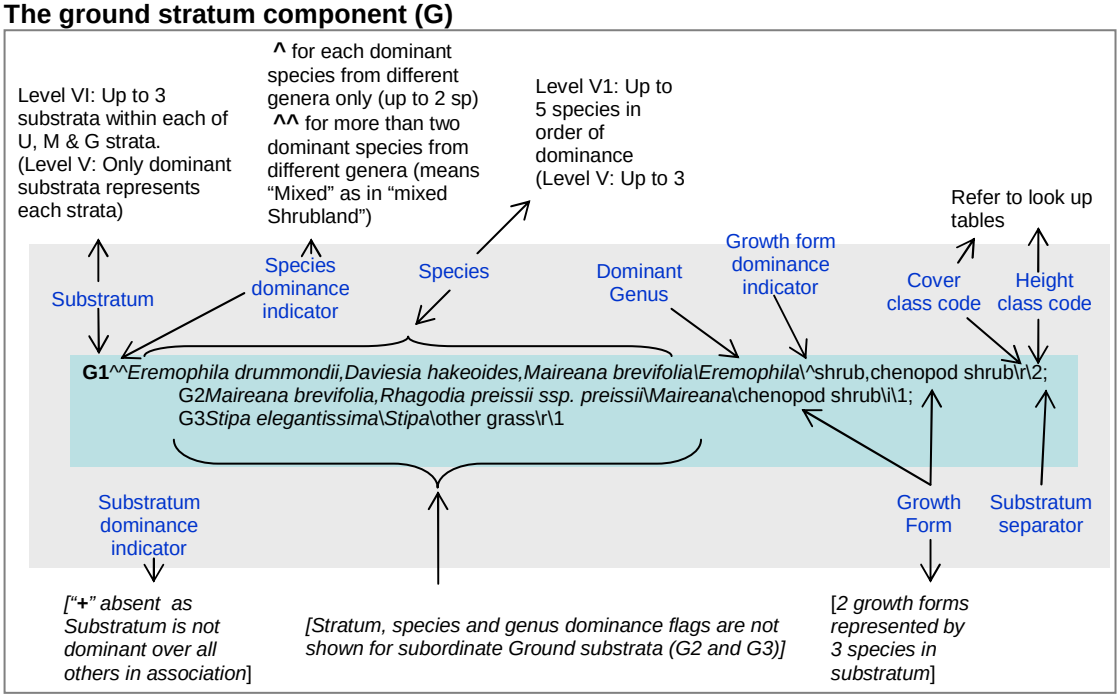
The Upper substratum component (U)



The midstratum component (M)



The ground stratum component (G)



NVIS Tables:

NVIS Structural Formation Terminology:

NVIS cover codes and structural terminology shown in relation to cover and height classes for respective growth forms

	Cover Characteristics							
	Foliage cover *	70-100	30-70	10-30	<10	≈0	0-5	unknown
	Crown cover **	>80	50-80	20-50	0.25-20	<0.25	0-5	unknown
	% Cover ***	>80	50-80	20-50	0.25-20	<0.25	0-5	unknown
	Cover code	**d**	**c**	**i**	**r**	**bi**	**bc**	**unknown**
Growth Form	**Height Ranges (m)**	**Structural Formation Classes**						
tree, palm	<10,10-30, >30	closed forest	open forest	woodland	open woodland	isolated trees	isolated clumps of trees	trees
tree mallee	<3, <10, 10-30	closed mallee forest	open mallee forest	mallee woodland	open mallee woodland	isolated mallee trees	isolated clumps of mallee trees	mallee trees
shrub, cycad, grass-tree, tree-fern	<1,1-2,>2	closed shrubland	shrubland	open shrubland	sparse shrubland	isolated shrubs	isolated clumps of shrubs	shrubs
mallee shrub	<3, <10, 10-30	closed mallee shrubland	mallee shrubland	open mallee shrubland	sparse mallee shrubland	isolated mallee shrubs	isolated clumps of mallee shrubs	mallee shrubs
heath shrub	<1,1-2,>2	closed heathland	heathland	open heathland	sparse heathland	isolated heath shrubs	isolated clumps of heath shrubs	heath shrubs
chenopod shrub	<1,1-2,>2	closed chenopod shrubland	chenopod shrubland	open chenopod shrubland	sparse chenopod shrubland	isolated chenopod shrubs	isolated clumps of chenopod shrubs	chenopod shrubs
samphire shrub	<0.5,>0.5	closed samphire shrubland	samphire shrubland	open samphire shrubland	sparse samphire shrubland	isolated samphire shrubs	isolated clumps of samphire shrubs	samphire shrubs
hummock grass	<2,>2	closed hummock grassland	hummock grassland	open hummock grassland	sparse hummock grassland	isolated hummock grasses	isolated clumps of hummock grasses	hummock grasses
tussock grass	<0.5,>0.5	closed tussock grassland	tussock grassland	open tussock grassland	sparse tussock grassland	isolated tussock grasses	isolated clumps of tussock grasses	tussock grasses
other grass	<0.5,>0.5	closed grassland	grassland	open grassland	sparse grassland	isolated grasses	isolated clumps of grasses	other grasses
sedge	<0.5,>0.5	closed sedgeland	sedgeland	open sedgeland	sparse sedgeland	isolated sedges	isolated clumps of sedges	sedges
rush	<0.5,>0.5	closed rushland	rushland	open rushland	sparse rushland	isolated rushes	isolated clumps of rushes	rushes
forb	<0.5,>0.5	closed forbland	forbland	open forbland	sparse forbland	isolated forbs	isolated clumps of forbs	forbs
fern	<1,1-2,>2	closed fernland	fernland	open fernland	sparse fernland	isolated ferns	isolated clumps of ferns	ferns
bryophyte	<0.5	closed bryophyteland	bryophyteland	open bryophyteland	sparse bryophyteland	isolated bryophytes	isolated clumps of bryophytes	bryophytes
lichen	<0.5	closed lichenland	lichenland	open lichenland	sparse lichenland	isolated lichens	isolated clumps of lichens	lichens
vine	<10,10-30, >30	closed vineland	vineland	open vineland	sparse vineland	isolated vines	isolated clumps of vines	vines
aquatic	0-0.5,<1	closed aquatic bed	aquatic bed	open aquatic bed	sparse aquatics	isolated aquatics	isolated clumps of aquatics	aquatics
seagrass	0-0.5,<1	closed seagrass bed	seagrassbed	open seagrassbed	sparse seagrassbed	isolated seagrasses	isolated clumps of seagrasses	seagrasses

Cover codes shown in the NVIS Level 5 and 6 descriptions relate to foliage cover, and are defined as:

> *The percentage of the sample site occupied by the vertical projection of foliage and branches (if woody)*
>
> Australian Vegetation Attribute Manual Ver. 6 (2003)

Cover type definitions are given in the Australian Vegetation Attribute Manual, List of NVIS Attributes, Attribute ST05 – Cover type (see Attribute ST05 – Cover type)

NVIS Height Class codes (and height range according to Growth form)

Height		Growth Form				
Height Class	**Height Range (m)**	**tree, vine (M & U),**	**shrub, heath shrub, chenopod shrub, ferns,samphire shrub, cycad, grass-tree,**	**tree mallee, mallee shrub**	**tussock grass, hummock grass, other grass, sedge, rush, forbs, vine (G)**	**bryophyte, lichen, aquatic**
8	**>30**	**tall**	NA	NA	NA	NA
7	**10-30**	**mid**	NA	**tall**	NA	NA
6	**<10**	**low**	NA	**mid**	NA	NA
5	**<3**	NA	NA	**low**	NA	NA
4	**>2**	NA	**tall**	NA	**tall**	NA
3	**1-2**	NA	**mid**	NA	**tall**	NA
2	**0.5-1**	NA	**low**	NA	**mid**	**tall**
1	**<0.5**	NA	**low**	NA	**low**	**low**

NVIS stratum codes

NVIS Stratum Code	**NVIS Sub-stratum Code**	**Description**	**Traditional Stratum Name**	**Growth Forms***	**Height Classes***	**Not allowed***
U	U1	Tallest tree sub-stratum. For forests and woodlands this will generally be the dominant stratum. For a continuum (eg. no distinct or discernible layering in the vegetation) the tallest stratum becomes the defining sub-stratum.	Upper, tree Overstorey/Canopy (If only one tree layer occurs it is coded U1)	Trees, tree mallees, palms, vines (mallee shrubs) Also: epiphytes, lichens	8,7,6 (5)	Grasses & shrubs, low mallee shrubs
	U2	Sub-canopy layer, second tree layer				
	U3	Sub-canopy layer, third tree layer				
M	M1	Tallest shrub layer.	Mid, shrub (if only one mid layer occurs it is coded M1)	Shrubs, low trees, mallee shrubs, vines, (low shrubs, tall grasses, tall forbs, tall sedges) grass-trees, tree-ferns, cycads, palms. Also: epiphytes, lichens	(6) 5,4,3	Mid and low grasses, sedges, rushes & forbs. Mid & tall trees/ palms.
	M2	Next shrub layer.				
	M3	Third shrub layer				
G	G1	Tallest ground species	Lower, ground (if only one ground layer occurs it is coded G1)	Grasses, forbs, sedges, rushes, vines, lichens, epiphytes, low shrubs, ferns, bryophytes, cycads, grass-trees, aquatics, seagrasses.	(4,3) 2,1	Trees, tree-mallees, palms.
	G2	Ground				

Stratum Dominance Flag "+"

Indicates whether the stratum is dominant, relative to all other strata, within the vegetation community being described. See Appendix 5 Dominance, for more information about how stratum dominance is defined and determined

Level 6 Description Separators
Subsequent Taxa names in the description are separated by a comma

- where the leading species in the list is the dominant species (prefixed by **^**)
- Where the two leading species are of a different genus are co dominant (and each is prefixed by **^**)
- Where all species listed are co dominant and so the leading taxa name is prefixed by **^^** (indicating “mixed”)

Each substratum description component is separated by a semicolon (;).

The “+/-“ Qualifier
This indicates that a species although dominant/co dominant/mixed or indicative, is not always present in the vegetation association or that the species so denoted are all part of an identifiable association but do not always occur together concurrently.
(See Attribute: TD12 - TAXON DATA ALWAYS THERE)
It may appear with ^ or ^^ indicators or as a separator instead of the comma in front of species names in a description.

Source Description
Veg ID: 453

> [Original Map Veg Unit:*Acacia shrubland*][Original Veg description:*Acacia shrubland*] *Acacia resinomarginea* and /or *Casuarina acutivalvis* shrubs, 2.5-4m tall, 30-70% canopy cover. Also present were *Amphipogon debilis*, *Astroloma serratifolium*, *Baeckea muricata*, *Dianella revoluta*, *Ecdeicocolea monostachya*, *Grevillea paradoxa*, *Hakea subsulcata*, *Melaleuca oldfieldii*. Some areas with dense understorey of *Eriostemon deserti*.

NVIS translation

> Level 6: M1++/-^*Acacia resinomarginea*+/-^*Allocasuarina acutivalvis*\Acacia\^shrub\4\c
> Level 4: +*Acacia*/*Allocasuarina* Tall Shrubland

The reference to "and/or" in the source description in relation to the dominant species: *Acacia resinomarginea* and *Casuarina acutivalvis* shrubs is interpreted as their "coming and going" within the vegetation unit. This is interpreted as a +/- qualifier "Taxon data not always there"
Note the qualifier can appear with the dominance indicator “+”
For more information see Appendix 5

Appendix 4: Vegetation Classification

Vegetation is classified on the basis of:

- Structure (the vertical and horizontal distribution of vegetation: its growth form, height, cover and strata) and
- Floristics (the dominant genera or species comprising various strata and the characteristic plant species) (Hnatuik et al 2009).

There are various approaches to classifying vegetation and the systems used to define them. The approach taken by the NVIS framework to classifying vegetation according to a structural and floristic hierarchy is illustrated in Appendix 3 and is discussed in detail in the Australian Vegetation Attribute Manual V 6 (ESCAVI 2003). The structural classification of Walker (1990) is also organised following a similar concept.

Many of the ANVMP Sources followed the method of Muir (1977), characterising vegetation units to the level of Association based upon the growth form, height, cover and floristics of the dominant species for all strata. Muir`s classification was modified from that of Beard and Webb (1974) and was developed to represent wheatbelt vegetation as a habitat for vertebrate fauna. A full discussion of the structural classes and their definition is given in Muir (1977). The Muir vegetation classification table is shown below, giving the structural (Height and Cover) classes associated with life form categories and the descriptive terminology that summarises these relationships.

The translation of source vegetation descriptions following the Muir Classification into those of the NVIS classification hierarchy involved cross referencing equivalent structural classes. Appendix 8 presents a table correlating Muir and NVIS classes Most classes defined in the two systems, although largely congruent, do show some differences in interpretation. These differences are outlined below, and are also noted in relation to the NVIS attribute fields definitions in Appendix 7: NVIS attribute list

The Muir Classification

		Dense (d)	Mid - Dense (c)	Sparse (i)	Very Sparse (r)
		70-100%	**30-70%**	**10-30%**	**2-10%**
T	**Trees >30m**	Dense Tall Forest	Tall Forest	Tall Woodland	Open Tall Woodland
M	**Trees 15-30m**	Dense Forest	Forest	Woodland	Open Woodland
LA	**Trees 5-15m**	Dense Low Forest A	Low Forest A	Low Woodland A	Open Low Woodland A
LB	**Trees <5m**	Dense Low Forest B	Low Forest B	Low Woodland B	Open Low Woodland B
KT	**Mallee Tree Form**	Dense Tree Mallee	Tree Mallee	Open Tree Mallee	Very Open Tree Mallee
KS	**Mallee Shrub Form**	Dense Shrub Mallee	Shrub Mallee	Open Shrub Mallee	Very Open Shrub Mallee
S	**Shrubs >2m**	Dense Thicket	Thicket	Scrub	Open Scrub
SA	**Shrubs 1.5-2.0m**	Dense Heath A	Heath A	Low Scrub A	Open Low Scrub A
SB	**Shrubs 1.0-1.5m**	Dense Heath B	Heath b	Low Scrub B	Open Low Scrub B
SC	**Shrubs 0.5-1.0m**	Dense Low Heath C	Low Heath C	Dwarf Scrub C	Open Dwarf Scrub C
SD	**Shrubs <0.5m**	Dense Low Heath D	Low Heath D	Dwarf Scrub D	Open Dwarf Scrub D
P	**Mat Plants**	Dense Mat Plants	Mat Plants	Open Mat Plants	Very Open Mat Plants
H	**Hummock Grass**	Dense Hummock Grass	Mid-Dense Hummock Grass	Hummock Grass	Open Hummock Grass
GT	**Bunch Grass >0.5m**	Dense Tall Grass	Tall Grass	Open Tall Grass	Very Open Tall Grass
GL	**Bunch Grass <0.5m**	Dense Low Grass	Low Grass	Open Low Grass	Very Open Low Grass
J	**Herbaceous spp.**	Dense Herbs	Herbs	Open Herbs	Very Open Herbs
VT	**Sedges >0.5m**	Dense Tall Sedges	Tall Sedges	Open Tall Sedges	Very Open Tall Sedges
VL	**Sedges <0.5m**	Dense Low Sedges	Low Sedges	Open Low Sedges	Very Open Low Sedges
X	**Ferns**	Dense Ferns	Ferns	Open Ferns	Very Open Ferns
	Mosses, Liverwort	Dense Mosses	Mosses	Open Mosses	Very Open Mosses

Structural Categories

Cover Type

NVIS recognises several types of cover measurement and definition. These are described for Attribute: ST05 - COVER TYPE in the NVIS attribute list, Appendix 7

For many of the ANVMP source documents vegetation descriptions are based on the Muir (1977) classification.
Under this classification Muir (1977) uses the term “Canopy Cover" defining it as:

The total area encompassed within the circumference of individual foliage clumps, and expressed as a percentage of a given area, e.g. quadrat or formation area.

Muir (1977) used “Canopy Cover” in preference to the term ”crown cover” because he considered the former to record the actual area of foliage more accurately, (fig 1). He argued that this is particularly so with mallees which have widely spaced foliage clumps.
Muir adopts the percentage canopy cover groupings of (10%, 10-30%, 30-70% and 70-100% as used by Specht, Beard-Webb and others. These appear to more or less correspond with cover classes associated with “Foliage Cover” in the NVIS cover class tables [see Attribute: ST05 - COVER TYPE]. Muir proposes that these are well established convenient groupings and probably represent fairly well the commonly used divisions of very sparse, sparse, medium and dense vegetation. As faunal habitat is a criterion upon which Muir developed his classification , he indicates that although it is not known to what level animals differentiate between various canopy covers, it is probably safe to assume that they utilise 0-30% (sparse), differently from 30-70%, and 70-100% (very dense) vegetation. A lower limit of 2% canopy cover has been set by Muir because he considered that experience in wheatbelt vegetation indicated that plants with less than 2% canopy cover are very widely spaced and do not appear as a stratum. In many of the ANVMP source document vegetation descriptions the term "scattered " appears to be used for cover < 2%. This has been interpreted as equivalent to NVIS cover code "bi". In many cases surveys using Muir`s classification do not specify or document the methods used to determine cover with the implication that the approach is largely a qualitative estimate. Therefore Attribute: ST05 - COVER TYPE for the ANVMP data fields is usually entered as "unknown".

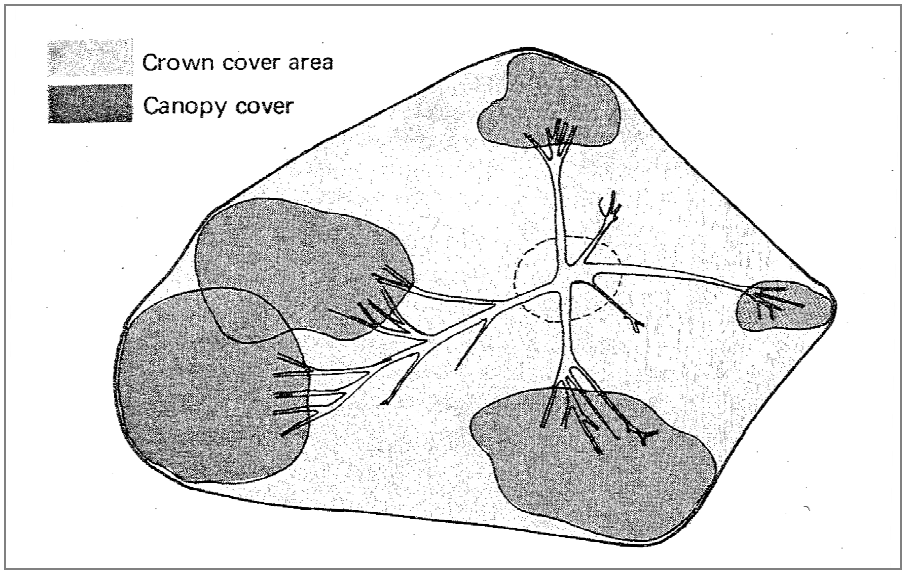


Fig. 1 Canopy cover as defined by Muir (1977)

The lack of of cover measurement methods documentation in the source literature generally means that this attribute is the most problematic for cross matching datasets. It has been argued that cover classes and cover measurements used in vegetation mapping and in classification schemes present confusion amongst users and that the various concepts appear

to be inconsistently interpreted or applied. For this reason, Hopkins (pers. com.) has suggested that all preclassified records of vegetation using (notionally) projective foliage cover, crown cover or canopy cover, to be considered canopy cover by default.
From a practical point of view, as the Muir Classification terminology expresses cover classes more or less congruently with NVIS "foliage cover" percentages, for the purposes of the ANVMP an assumption has been made that the two measures are equivalent.

Cover Code

Attribute: ST11 - COVER CODE
For the ANVMP database the NVIS cover code may be derived from the stated cover values in the source description or in turn interpreted from the cover class provided by the source description. The COVER_CODE recorded for the ANVMP database in many instances has been inferred from cover value class intervals implicit in the source description terminology, such as that of the Muir (1977) Classification, and correlated with the corresponding NVIS cover value class intervals. (See code "2C" explanation in look up table for attribute field ST05 - COVER TYPE)

Look-up Table for: COVER CODE

Code	Explanation	
d	**Foliage cover 70-100% - Crown cover 80-100%**	Equivalent to Muir Canopy Cover 70-100%
d	**Ground cover 70-100%**	
c	**Foliage cover 30-70% - Crown cover 50-80%**	Equivalent to Muir Canopy Cover 30-70%
c	**Ground cover 30-70%**	
i	**Foliage cover 10-30% - Crown cover 20-50%**	Equivalent to Muir Canopy Cover 10-30%
i	**Ground cover 10-30%**	
r	**Foliage cover less than 10% - Crown cover 0.25-20%**	Equivalent to Muir Canopy Cover 2-10% ("A lower limit of 2% canopy cover has been set because experience in wheatbelt vegetation has indicated that plants with less than 2% canopy cover are very widely spaced." Muir 1977)
r	**Ground cover less than 10%**	
bi	**Foliage cover ~0% (scattered) - Crown cover 0-0.25%**	No direct Muir cover class Equivalent but may be applied where stratum cover is described in terms of "scattered clumps" (e.g. ANVMP Veg id 217)
bi	**Ground cover ~0% (scattered)**	
bc	**Foliage cover ~0% (clumped) - Crown cover 0-0.25%**	
bc	**Ground cover ~0% (clumped)**	
unknown	**unknown**	

Height

Attribute: ST18 - HEIGHT CLASS

For the ANVMP database the NVIS height code may be derived from the stated cover values in the source description or in turn interpreted from the cover class provided by the source description.
The HEIGHT CLASS given in an NVIS Level 6 description in many instances has been inferred from Height value class intervals implicit in the source description terminology (i.e. the height and cover class intervals are read off from the structural term shown in the relevant classification table matrix, for example that of Muir [1977]) and correlated with the corresponding NVIS Height value class intervals. Exceptions to this include herb, cryptogam and hummock grass growth forms for which Muir does not define height class intervals.
Where Mallees are described according to the Muir Classification as “Mallee Shrub” with a height class range of <8m (and in the absence of any other measured height data) the default NVIS height class is generally taken to be 6 (3-10m) as the equivalent class for NVIS “mallee shrub”. Where Mallees are described as Mallee Tree according to their Muir classification, with a height class range of >8m, then the default NVIS height class is taken to be 7 (10-30m) as the equivalent class for NVIS “tree mallee”. There is some incongruence between the Muir and NVIS intervals for Mallee height classes so it is helpful when measured height ranges are supplied with the source description.
Other sources of information that were sometimes used to help estimate height class include site data provided with the source documentation or species profile descriptions from FloraBase.
In the case of low growth forms such as Muir defined "herb" (NVIS "forb"), and Muir defined "mat plants" (no direct NVIS equivalent) the default NVIS height class was 1.

Growth Form

Refer to NVIS Attribute: GF02 - GROWTH FORM CODE (see under this attribute heading for the look up table of NVIS growth form codes)

Some variation in interpretation of plant growth forms exist amongst Muir (1977), NVIS and ANVMP definitions. These variations are summarised below:

Mallee

Muir (1977) defines mallee as:
Woody, usually perennial plants of the genus Eucalyptus, generally erect, of variable outline but commonly with a spherical or vertically flattened canopy raised well above the ground. Leaves are commonly born only near the ends of the branches. The major part of the canopy from bottom to top may extend from the ground to the maximum height of the plant, or may occupy only the upper portion of the total height. Multi-stemmed, the individual trunks arising from a lignotuber or swelling at the base of the stem, at or below soil-level, and bearing dormant buds.

In the Bendering Reserve surveys for which Muir (1977) originally devised his classification, he defined the subcategories of Mallee as:

Shrub mallee - Commonly less than 6-7m tall, usually with 5 or more trunks, of which at least three do not exceed 10cm in diameter at breast height. When the mallee is dead the hollow limbs and trunks are rarely of sufficient size to provide habitats for vertebrates.
Tree mallee - Usually 8m or more tall, with fewer than 5 trunks, of which at least three exceed 10cm in diameter at breast height. When dead, hollow limbs and trunks provide habitats for large vertebrates

NVIS basically follows the same criteria:

Tree mallee (M) - Woody perennial plant usually of the genus Eucalyptus. Multi-stemmed with fewer than 5 trunks of which at least 3 exceed 100mm at breast height (1.3m). Usually 8m or more.

mallee shrub (Y)- Commonly less than 8m tall, usually with 5 or more trunks, of which at least three of the largest do not exceed 100mm at breast height (1.3m).

In some cases source documents indicated that the Muir (1977) system was being used to classify vegetation, however for the stated Tree Mallee stratum, the height, was sometimes given as less than 8m. NVIS appears to allow growth form height codes for Tree Mallee of 5, 6 and 7 where 5 is less than 3m.

Occasionally in the source literature the mallee growth form has been applied to non Eucalypt species that were considered to show the mallee form. For the ANVMP, mallee is by definition considered only to be of the genus Eucalyptus.

Shrubs:
Muir (1977) includes as shrubs: Woody perennials, non lignotuberous shrubby Eucalypts, woody Chenopods, and Woody Samphires.

> *Woody, usually perennial plants, generally erect but may be procumbent or of weeping habit. Commonly broadly conical in form with the foliage occupying all or only part of the total height of the plant. Multiple stems and branches arise from a rootstock or very short common trunk. Lignotubers of the mallee type absent.*
> *Shrubs may be of any height but are generally less than 5m tall. Dead hollow branches rarely reach sufficient size to provide habitats for vertebrates. Enlarged rootstocks may be present in some Hakea and Melaleuca species. Unlike mallee eucalypts, shrub-form eucalypts do not have a lignotuber. Height classes were selected in order to separate all strata in shrub dominated formations. This was thought to be particularly important with reference to bird utilization of these formations.*

NVIS defines Shrubs as woody plants multi-stemmed at the base (or within 200mm from ground level) or if single stemmed, less than 2m. Chenopods and Samphires, whether woody or non woody are defined according to these particular taxonomic groups

Heath Shrubs:
Muir (1977) appears to define heath as shrubs above a certain percentage cover (30%) and below a certain height (2m).

NVIS does not seem to specify any cover percentage criteria for defining "heath"

> *Heath shrub (z) - Shrub usually less than 2m, with sclerophyllous leaves having high fibre: protein ratios and with an area of nanophyll or smaller (less than 225 sq. m.). Often a member of one the following families: Epacridaceae, Myrtaceae, Fabaceae and Proteaceae. Commonly occur on nutrient-poor substrates.*

For the ANVMP any shrub meeting the NVIS heath shrub criteria with cover of < 30% is considered a "shrub" not a "heath shrub".
In the context of South West Australian heath vegetation - the notion of a "Sparse Heathland" would appear to be a contradiction in terms for most people working with WA vegetation. For this code value a “Heath Shrub” is interpreted in floristic and structural terms as a shrub less than 2m and cover >30% where any such shrub is generally co dominant with generally 3 or more different genera of the families: Epacridaceae, Myrtaceae, Fabaceae and Proteaceae. That is, for a given vegetation association, a sole shrub species (representing one of these families) constituting a dominant stratum cover of >30% and height of <2m is defined as a shrub not a heath shrub. The same shrub of same cover and height comprising a stratum with > 2 other co-dominant genera from the above mentioned families, would be defined along with the other co dominant species as a heath shrub. This tries to accommodate - somewhat awkwardly- both Muir`s and the NVIS concept of “heath shrub” with a “sense” that for West Australian wheatbelt vegetation, Heath "by definition" has a high floristic diversity.

Mat Plants:
These are defined by Muir as:

> *Herbaceous or woody plants, usually perennial, prostrate and cushion- like. With densely compacted foliage which may occupy the whole volume of the aerial portion of the plant, or may only occupy the outside surface of the cushion. Usually numerous, very short stems.*
> *Plants may vary from a few centimeters to several metres in diameter but rarely exceed 10cm in height. They provide no hollow limbs. Mat plants are separated from shrubs and herbs because they provide a different habitat for vertebrates. They provide perches on their outside surface, but generally are not penetrated into by vertebrates but may be burrowed under. Mat plants may be shrub-like woody species (e.g.*

Astroloma compactum) or herb-like species such as Wilsonia humilis. This growth form is not widespread in the wheatbelt.

Mat Plants are not an NVIS growth form class. Mat plants are classified according to the relevant NVIS growth form with a height class < 0.5m. That is woody mat plants are classed as shrubs, Samphire shrubs or chenopod shrubs <0.5m; non woody mat plants are classed as forbs (or Samphire shrubs or chenopod shrubs if the species is a non woody member of these taxa).

Herbs/Forbs:
Herbs as defined by Muir include non woody Chenopods and non woody Samphires.

> *Herbaceous or slightly woody, annual or sometimes perennial plants. Herbaceous, annual species are commonly erect and woody, perennial species commonly creepers or climbers. Some species are tufted, e.g. Borya nitida, Haemodorum spp. Foliage usually covers the majority of the branches in shrubby and creeping forms. May arise from stolons, tubers, bulbs, rhizomes or seeds, but usually not from lignotubers. Rarely exceed 0.5m in height, unless climbing species.*

The NVIS equivalent is "Forb" i.e.:

> *An Herbaceous or slightly woody annual or sometimes perennial plant - usually a dicot.*

Both woody and non woody Chenopods and Samphires are classified under their respective taxa.

Sedges/Rushes:
Muir treats both these NVIS growth form classes as one:

> *Herbaceous, usually perennial erect plants. Generally of tufted habit. Arise from stolons, tubers, bulbs, rhizomes or seeds. Term includes Cyperaceae, Juncaceae, and Restionaceae, Typhaceae and Xyridaceae and other plants of sedge-like form.*
> *The literature does not define the terms sedge, reed or rush adequately. Where the terms do appear, they tend to refer only to semi-aquatics. Restionaceae and Lepidosperma spp. (Cyperaceae) are common components of terrestrial wheatbelt habitats and are not shrubs, mat plants, bunch grasses or herbaceous in character. The term sedge has been adopted to include all these plants. It also includes such plants as Lomandra effusa which will not fit into any other life-form and are of sedge-like character. The height division appears to separate fairly effectively the swamp inhabiting sedges (usually >0.5m) from the dry land species (usually <0.5m tall).*

NVIS separates the above groups as:
Sedges -

> *Herbaceous, usually perennial erect plant generally with a tufted habit and of the families Cyperaceae (true sedges) or Restionaceae (node sedges).*

Rushes -

> *Herbaceous, usually perennial erect monocot that is neither a grass nor sedge. For the purposes of NVIS, rushes include the monocotyledon families Juncaceae, Typhaceae, Liliaceae, Iridaceae, Xyridaceae and the genus Lomandra. I.e. "graminoid" or grass-like genera.*

(note: for the ANVMP, Borya is included with NVIS defined "rush" forms (although not specified in the NVIS Attribute Manual) as it is a perennial, slightly woody, narrow leaved clumping monocot that is not a grass but does not fit well the NVIS forb criteria as an herbaceous dicotyledonous annual. Most vegetation descriptions using the Muir classification refer to Borya as an "herb".) This means that a formation dominated by Borya described in Muir terms as “Herbs” will translate as NVIS Level 4 “Low Rushland” according to ANVMP interpretation

References:

Hnatuik RJ, Thackway R and J Walker, (2009) *Vegetation*. In Australian Soil and Land Survey Field Handbook, 3rd edition, The National Committee on Soil and Terrain, CSIRO publishing, Victoria.

Walker J. and M.S. Hopkins (1990). *Vegetation*. In: McDonald, R.C., R.F., Isbell, J.G., Speight, J. Walker, and M.S. Hopkins. 1990. Australian soil and land survey. Field handbook. 2nd edn. Melbourne: Inkata Press

Muir B (1977), Survey *of the Western Australian wheatbelt. Part 2: Vegetation and habitat of Bendering Reserve.* Records of the Western Australian Museum, Supplement No. 3. Western Australian Museum, Perth.

Appendix 5: Dominance

Stratum

Source descriptions did not always explicitly define the dominant stratum of a vegetation type. Where this was the case, stratum dominance could usually be inferred from a descriptor such as a formation or association name

Sometimes the relationship between stratum dominance and the characterizing vegetation name could be ambiguous; for example, a source description may nominally define a vegetation type as a "Mallee formation". However, the height and cover values given in the description may suggest a dense lower shrub stratum is dominant by biomass with respect to a sparse upper Mallee stratum.

In such a situation, for NVIS description it may be considered that the dominance flag should be applied to the substratum based on the structural parameters indicating greater biomass. This however, may mean that the nominal emphasis expressed in the NVIS broad floristic formation will shift from that expressed by the source formation name. For example the vegetation type described as a "Mallee" formation in the source may be represented as a "Shrubland" according to the application of NVIS criteria for dominance based on relative biomass

Similarly where a vegetation description is identified by an annotation code rather than a vegetation type descriptor, stratum dominance may need to be inferred using height and cover parameters only (either primary values or class interval limits depending on available information).
For such situations in the ANVMP the decision making process was sometimes assisted by applying the following "rule of thumb" formula:
((Min Height * Min Cover) + (Max Height * Max Cover))/2.
This formula was applied to each of the substratum structural parameter values where the greater value suggested dominance. How this was applied and interpreted for each association depended on the nature of supporting source information available, knowledge of the vegetation type and its context.
[See Attribute: ST19 - DOMINANT STRATUM FLAG]

Below is an example of how the “rule of thumb” dominance formula was used to help make a decision on this attribute. The upper and lower values from each class interval defined by the Muir description terminology are used according to the formula for each substratum.

Dominance Calculator

In each stratum/substratum of a source vegetation description using:

1. measured height and cover values
   Or (*if only a description based on classification terminology is given e.g. Muir 1977*)
2. Height and cover class interval ranges in a classification category upon which the source description is based

where:

H1: minimum height value
H2: maximum height value
C1: minimum cover value
C2: maximum cover value
DI: “Dominance Index” for a stratum/substratum

Then:

DI = ((H1*C1) + (H2*C2))/2

Example
323_020
VegID 2295

Source Description [Classification system: Muir (1977)]:

*Eucalytpus leptopod*a Very Open Shrub Mallee over *Allocasuarina acutivalvis*, Allocasuarina corniculata, Acacia longispinea & Hakea sp. Scrub over *Philotheca thryptomenoides, Melaleuca cordata, Baeckea elderiana* & *Petrophile incurvata* Heath B over *Hibbertia aff. lineata* Dwarf Scrub D

NVIS Description:

U1^*Eucalyptus leptopoda**Eucalyptus*\^mallee shrub\6\r;*M1Allocasuarina acutivalvis,Allocasuarina corniculata*, *Acacia longispinea*,*Hakea sp.**Allocasuarina*\^shrub\4\i;M2+^^*Philotheca thryptomenoides,Melaleuca cordata, Baeckea elderiana,Petrophile incurvata**Philotheca*\^heath shrub\3\c;G1^*Hibbertia aff. lineata**Hibbertia*\^shrub\1\i

Where values are based on Muir classification intervals related to description terminology; Using the formula below, with a "DI" value of **67.5,** M2 is the dominant substratum within the M stratum and for all strata.

Values based on Muir classification intervals related to description terminology

Substratum (U1)					Substratum (M1)					Substratum (M2)					Substratum (G1)			
Height Range		Cover Range			Height Range		Cover Range			Height Range		Cover Range			Height Range		Cover Range	
H1	H2	C1	C2	DI 1	H1	H2	C1	C2	DI 2	H1	H2	C1	C2	DI 3	H1	H2	C1	C2
3	*10*	*2*	*10*	**53**	2	3	10	30	**55**	*1*	*1.5*	*30*	*70*	**67.5**	0.1	0.5	10	30

Species

Apart from the dominant species, Taxon rank in terms of relative importance of all species listed for a substratum is not always apparent from the source description. Sometimes species may appear in order of some importance to the source description authors. In some cases the species are listed alphabetically. Usually the Taxon_Data_Rank [see Attribute: TD01 - TAXON DATA RANK] is allocated according to the order listed in the source description unless some other accessory data can be used to help determine rank order such as site observations or quadrat data. Sources may only describe structural parameters for each stratum and then list all species observed in the vegetation association without differentiation into stratum. In some cases obvious differentiation of the listed species can be made into strata, or rank within strata, based on ordering of height and cover values as given in site data or from species profile descriptions from the "Florabase" website. [http://florabase.dec.wa.gov.au]. This provides a rough estimate only and depends on what other contextual information is available.

In general alien species are omitted from the NVIS description. In some cases where a substratum might be construed from the source description as dominant within the stratum but where the major contribution of biomass appears to be from alien species, then the choice has to made whether to:

a) Omit the whole substratum (including any native taxa) from the NVIS description and taxon data list
b) Maintain the substratum in the description, listing alien taxa in the description and taxon data list but at a taxon data rank below that of any native taxa. This approach gives an indication that a proportion of the stratum biomass is represented by non native taxa whilst not defining the substratum by alien species in the Level 4 description.

(Generally option "a" is exercised.)

Where more than 5 taxa (species) are listed for a given substratum in the source description - all are entered into the taxon data field of the Avon Native Vegetation Map Database (but only the first 5 are shown in the Level 6 description) [see Attribute: TD01 - TAXON DATA RANK]

The "+/-" qualifier [see Attribute: TD12 - TAXON DATA ALWAYS THERE]
Application of this attribute value in the ANVMP Database differs from that in NVIS in that the qualifier is not necessarily used as a function of quantitative frequency data, i.e. it is applied as a qualitative attribute. For example, when a source description indicates that in a particular vegetation type or association a species is one of several variable co-dominants that "come and go" across the extent of the map unit or are not always coincident within that vegetation association.
This approach was sometimes the only way to interpret and represent complex vegetation association descriptions that encompassed a highly variable set of dominant taxa. As such it could be considered an appropriate interpretation of the attribute and flag (Wilson pers com. 2008)

For example
VegID 2079
Source Description

> [Original Map Veg Unit: Wc]Open Low Woodland B over Scrub over Dwarf Scrub C
> Stratum 1: Open Low Woodland B to Scrub in some places of *Callitris glaucophylla*. This stratum is patchy and discontinuous with *Callitris glaucophylla* present only as scattered individuals in some areas. Occasional *Callitris preissii ssp. verrucosa*, *Allocasuarina acutivalvis* and *Eucalyptus salicola* may be present.
> Stratum 2: Very patchy stratum of Scrub to Low Scrub A present in some areas. Characteristic species include *Acacia rigens*, *Acacia prainii*, *Alyxia buxifolia*, *Grevillea juncifolia*,*Leptospermum roei*, *Persoonia ?angustiflora, Melaleuca halmaturorum ssp. cymbifolia*, *Melaleuca uncinata* and *Santalum acuminatum*.
> Stratum 3 A very patchy and discontinuous stratum of Dwarf Scrub C with only scattered shrubs present in some areas. Characteristic species include *Astroloma serratifolium*, *Darwinia drummondii*, *Conostephium preissii*, *Jacksonia aff. hakeoides*, *Grevillea apiciloba, Leucopogon cuneifolius*, *and Leucopogon ?nutans*.

Translates to:

342_L00_492 - Shrubland/Heathland
VegID: 2079

> NVIS L4:
>
> > *Callitris* Low Open Woodland\+*Leptospermum* Mixed Tall Open Shrubland*Darwinia* Mixed Low Open Shrubland
>
> NVIS L6:
>
> > U1^+/-*Callitris columellaris+/-Callitris preissi+/-Eucalyptus salicola**Callitris*\^tree\6\r;M1+^^*Leptospermum roei*,*Persoonia ?angustiflora*,*Acacia rigens*,*Melaleuca uncinata*,*Santalum acuminatum**Leptospermum*\^shrub\4\i;G1^^*Darwinia drummondii,Conostephium preissii,Leucopogon cuneifolius,Jacksonia hakeoides,Grevillea apiciloba**Darwinia*\^shrub\2\i

Source:

> Rick (2010) *Lake Campion Nature Reserve (24789) and Reserve (21759) revisited*. Consultants report to the Department of Environment and Conservation.

Infrequency is often implied in source descriptions by using "and/or" terms separating species; or where a source description involves a complex vegetation type in which there is a great deal of floristic heterogeneity and where certain taxa are identified as significant components across the extent of the map unit although none are described as explicitly co-dominant at any given point

Example
Source Description
Veg ID: 453
[Original Map Veg Unit: *Acacia* shrubland][Original Veg description: *Acacia shrubland*]
Acacia resinomarginea and /or *Casuarina acutivalvis* shrubs, 2.5-4m tall, 30-70% canopy cover. Also present were *Amphipogon debilis*, *Astroloma serratifolium*, *Baeckea muricata*, *Dianella revoluta*, *Ecdeicocolea monostachya*, *Grevillea paradoxa*, *Hakea subsulcata*, *Melaleuca oldfieldii*. Some areas with dense understorey of *Eriostemon deserti*.

NVIS translation

NVIS L6: M1++/-^*Acacia resinomarginea*+/-^*Allocasuarina acutivalvis**Acacia*\^shrub\4\c

NVIS L4: +*Acacia*/*Allocasuarina* Tall Shrubland

The reference to "and/or" in the source description in relation to the dominant species: *Acacia resinomarginea* and *Casuarina acutivalvis* shrubs is interpreted as their not always occurring together as co dominants within the vegetation unit. This is denoted in the description as a “+/-“qualifier and equates to the NVIS attribute: TD12 - TAXON DATA ALWAYS THERE although no quantitative frequency data was given in the source data.

Reference

Wilson, B (04/03/08), Vegetation Survey and Mapping, Biodiversity Sciences, Environmental Sciences Division, Queensland Herbarium, Brisbane Botanic Gardens.

Appendix 6: Data structure

The ANVMP Database is essentially based on the structure outlined in the Australian Vegetation Attribute Manual Ver. 6 (ESCAVI, 2003). A key rationale of NVIS is the standardization of regional vegetation datasets for National native vegetation resource assessments. This was not of immediate relevance for the ANVMP dataset and therefore many of the data fields related to submission of attribute data for inclusion in the national vegetation dataset were not populated. However the fields were retained in the ANVMP database structure should this ever be required.

Some of the ANVMP attribute fields were functional equivalents of their NVIS counterparts, addressing similar functions but in a context more appropriate to established protocols for Western Australian native vegetation data. In particular were fields in the NVIS data structure associated with species name (Taxon List Origin) Information. The systematic management and data basing of WA plant names is directed by the WA Herbarium which has an established protocol for nomenclature and coding through the "WA census". It was more appropriate then to follow these protocols to maintain consistency and standardization congruent with the WA herbarium rather than follow NVIS criteria. [see Supplementary Taxon Information for detailed notes about this matter relating to these data fields].

A key function of the ANVMP Database was to link spatial and attribute components.
All polygons in the spatial layer were attributed with a unique identifier linking tables storing vegetation attributes. This link involved a many to many relationship between polygons and vegetation attribute records (i.e. many polygons may be attributed with a given vegetation description and many vegetation descriptions may occur in a given polygon representing a "mosaic" or multi attribution" – see Fig 2 Appendix 2).

Each unique combination of polygon/s with corresponding vegetation description is also represented by an identifier. This value serves to identify the vegetation description relating to each spatial unit such that it can be linked to the spatial coverage. [MU01 – MAP UNIT IDENTIFIER]

Polygon multiattributes and web-based applications (Naturemap)

Where polygon multi attributes exist, these have been concatenated for each polygon through an accessory data table, into a single attribute string to facilitate query display in the web based spatial viewer (Naturemap). This table is not part of the NVIS field structure, does not affect the primary data values in the main data structure, and exists only for the purpose of the web based user interface.
In this accessory table, all polygons were also assigned a render code for display in the spatial viewer.
Vegetation render codes were autogenerated from "L1_CLASS" field values; the level 1 description for each vegetation description being its dominant growth form [see Attribute: GF02 - GROWTH FORM CODE look up table for the growth form code]. These growth forms have been classified into 5 formation render groups for visual display as follows:

Vegetation Category Codes

Code	NVIS Level 1 Growth Forms
Forest/Woodland	Tree
Mallee	Tree Mallee, Mallee Shrub
Shrubland/Heathland	Shrub, Heath shrub, Chenopod Shrub, Samphire Shrub.
Sedgeland/Rushland/Grassland/Forbland	Sedge, Rush, Tussock Grass, Other Grass, Forb
Mixed	Override category for polygons attributed with >1 Veg ID representing different category codes and with none predominant in the polygon

Non vegetation render codes have been manually allocated where the dominant polygon attribute does not conform to a defined vegetation category, such as a salt lake or granite outcrop, or is considered to override the existing vegetation attribute/s in relevance. Any render conflicts arising from within concatenated polygon multi-attributes are subject to a discretionary override function to enable resolution of render display in the spatial viewer. Nonvegetation render codes are defined in the lookup table: "NONVEG_LOOKUP". All vegetation attributes have been interpreted and databased following the NVIS framework.

Data entry was initially made into a Microsoft office 2003 database comprised of a "backend" data table component and "front end" with forms for facilitating data entry.
The tables from this access database have been migrated to the DEC corporate dataset as Oracle business tables with some field name changes as required by Oracle protocols.
With the adoption of Naturemap as a spatial viewer, an accessory set of data tables and fields to the existing tables were created specifically to facilitate Naturemap functions. These are associated with polygon rendering in the spatial viewer based on

- structural formations derived from NVIS level attributes associated with the vegetation descriptions
- Non vegetation code categories.

The codes and values are described in the look up table below

Non Vegetation Render Codes: "NONVEG_LOOKUP"

CATEGORY	DESCRIPTION	COMMENTS
Bare	Undefined bare areas with little or no native vegetation	Areas devoid of vegetation for reasons (not necessarily specified) other than the direct result of native vegetation clearing
Disturbed	Disturbed areas of native Vegetation. including degraded, modified and regrowth vegetation	Areas where the floristic composition or vegetation structure has been described in the source documentation as showing evidence of degradation or modification; i.e., where native vegetation has been impacted in some way through human influenced activity, e.g.: grazing, clearing, mining, altered hydrology (salinity, waterlogging,erosion) fire, traffic, invasive species. Nature of disturbance not always specified.
Rock	Rock exposures including granite outcrops and Lithic complexes	Natural surface expression of rock, usually granite but occasionally laterite. May appear as isolated outcrops or as a complex including bare pavements, boulders, periodically inundated depressions and vegetated pockets.
Waterbody	Periodically inundated areas - freshwater or type unknown	Permanently or periodically inundated; may be freshwater or with salinity unspecified; may be variously associated with patchy or fringing vegetation. Waterbody may be a lake, river channel or seasonal wet depression. Waterbodies mapped as geographically isolated entities may not be hydrologically isolated and therefore interpreted and delineated in other wetland spatial data sets as part of a broader set of wetland chains or suites.
Saline Waterbody	Periodically inundated saline areas including salt complexes, bare salt lakes, flats and channels	Components of a saline hydrological system of variable hydroperiod and connectivity. May include salt lakes as isolated waterbodies or as interconnected chains of salt marshes, flats and channels. May incorporate halophytic and non halophytic vegetation complexes, depending on local edaphic factors, topography and hydrology. Hydrology may be influenced by human activity and affect vegetation structure and composition; for example, through changes to hydroperiod and salinity.Saltlakes mapped as geographically isolated entities may not necessarily be hydrologically isolated and therefore interpreted and delineated in other wetland spatial data sets as part of broader wetland chains or suites.
Undefined	Vegetated areas	Area of uncleared vegetation delineated on a map but

CATEGORY	DESCRIPTION	COMMENTS
	mapped but not described	with no vegetation description attributed. May be an undefined intergrade zone of several identified vegetation types, an undefined and undescribed mosaic or where the vegetation is only vaguely defined in informal terms e.g. "shrubland", "trees", "heathy scrub"
Breakaway	Short scarp and debris slope	Usually associated with an upper slope break in lateritic duricrust

Appendix 7: NVIS Attribute List

The Avon Native Vegetation Map Project (ANVMP) database followed the NVIS attribute protocols as closely as possible. However not all NVIS attributes and associated fields were used or were applicable; such fields were not necessarily omitted from the Avon data structure but retained so as to allow for flexibility of future population if necessary or possible. Some additional fields, not present in the NVIS structure, have been included to address specific requirements for the Avon Vegetation Mapping project. The status of a listed NVIS attribute in the Avon database is indicated.

Some differences of interpretation and application may occur between NVIS attributes and the ANVMP Database equivalents. These differences are outlined under the respective NVIS attribute headings. Next to the NVIS attribute heading:" Database Field Name", the Avon Native Vegetation Map Database field name is shown with the name of the Access data table in which it occurs shown enclosed by i.e.: Access FIELD_NAME[TABLE_NAME]

Descriptions of NVIS Attributes (as described in the Australian Vegetation Attribute Manual Ver 6.2)		**Attribute descriptions applied to the ANVMP Database**
Attribute: DS01 - DATA SET NAME		
Heading	Details	
Purpose:	To identify each dataset in a user-friendly way.	
Requirement:	Mandatory	
Database Field Name:	DATA_SET_NAME	DATA_SET_NAME [DATA_SET]
Description:	This is the name given to the spatial data set by the custodial organisation. The information should be in plain language (that is, preferably not solely in acronym form).	
Value:	Character(2000)	
Example:	Gippsland Ecological Vegetation Classes - Extant	Native Vegetation Associations of Wongan Hills and Elphin Nature Reserve
Comments:	Sometimes duplicates ANZLIC_METADATA_NAME, but is necessary to cater for situation where the dataset supplied to NVIS is a subset or a superset of the dataset described on the Australian Spatial Data Directory.	The Data set name is the source reference for the vegetation data entered into the ANVMP Database. A description for the source reference dataset name has not been supplied to the Australian Spatial Data Directory as part of the current ANVMP Database Project activities. This may be done if the Avon Native Vegetation Map Project Dataset is submitted for inclusion in the National dataset.
Status:	Implemented in the NVIS Oracle database.	Implemented in the ANVMP Database (Access Version) but name not supplied to Australian Spatial Data Directory.

Attribute: DS02 - DATA SET NUMBER		
Heading	Details	
Purpose:	To identify each dataset in a concise and systematic way.	
Requirement:	Commonwealth	
Database Field Name:	DATA_SET_NUMBER	DATA SET NUMBER [DATA_SET]
Description:	This is a number given to the data set by the Commonwealth in compiling the NVIS (2000) dataset. The number must be retained by the data custodian for any subsequent transfers or updates to the vegetation description.	
Value:	Number (10). Format: SDD, where S = State Code (from lookup table); DD is the dataset number, which is assigned by the administrator.	
Example:	413	(see Comments)
Comments:	This first digit is a value set from a defined lookup table. The values in the lookup table are set by the administrator and cannot be added to. This field will probably be of little direct interest to the States and Territories.	The function of the DATA SET NUMBER is performed in the ANVMP database by the primary key field DATA_SET_ID which is an auto number generated in the table.
Status:	Implemented in the NVIS Oracle database.	Provision is made for this field in the ANVMP database but values have not been assigned as the dataset has not been submitted for inclusion in the National dataset. Not implemented in the ANVMP Database (Access Version).
Look-up Table for: DATA SET NUMBER		
Code	Explanation	

1	Australian Capital Territory	
2	New South Wales	
3	Northern Territory	
4	Queensland	
5	South Australia	
6	Tasmania	
7	Victoria	
8	Western Australia	

Attribute: DS03 - VEGETATION THEME CODE		
Heading	Details	
Purpose:	To identify whether the dataset represents pre-1750 and/or extant (present) vegetation.	
Requirement:	Mandatory	
Database Field Name:	VEGETATION_THEME_CODE (was: DATASET_COVERAGE_TYPE)	VEGETATION_THEME_CODE [DATA_SET]
Description:	This is a short code assigned to the data set according to whether the dataset represents pre-1750 and/or extant (present) vegetation.	
Value:	Character (20). This is a value set from a defined lookup table. The values in the lookup table are set by the administrator and cannot be added to.	
Example:	E	E

Comments:	This attribute was developed and applied by BRS (as B/E/P) in the compilation phase of NVIS (2000). It is a useful and important attribute for managing NVIS spatial coverages. This field and the next (VEGETATION_THEME_CONSTRAINTS) replace the former attribute VEGETATION_THEME COVERAGE, which combined two streams of information about the dataset.	The Dataset represents only extant (i.e. present, remnant) vegetation - as at the date of vegetation data capture cited by the source reference.
Status:	Implemented in the NVIS Oracle database.	Implemented in the ANVMP Database (Access Version)
Look-up Table for: **VEGETATION** **THEME CODE**		
Code	Explanation	
B	The dataset comprises both extant and pre-clearing	
E	Extant (i.e. present, remnant) vegetation	
P	Pre-clearing (i.e. pre-1750 or "natural") vegetation	
Attribute: DS04 - VEGETATION THEME CONSTRAINTS		
Heading	Details	
Purpose:	To describe any major limitations applying to the vegetation theme for the dataset.	
Requirement:	Recommended	
Database Field Name:	VEGETATION_THEME_CONSTRAINTS	VEGETATION_THEME_CONSTRAINTS [DATA_SET]
Description:	A free text description of any spatial or attribute limitations to the vegetation theme (pre-clearing or extant) that applies to the dataset.	
Value:	Character(2000).	

Example:	Woody vegetation only; endangered communities only; only recorded vegetation types conforming to the vegetation regulation act - see reference 456; mapped woody remnant vegetation within the wheatbelt study area, but did not attribute the cleared and semi-native vegetation types.	Vegetation data capture and mapping confined to area within reserve boundaries Many annual plant species excluded due to timing of the surveys
Comments:	In terms of spatial constraints, please specify the extent of coverage by the attributes and any exclusions. See also VEGETATION THEME CODE,	
Status:	Proposed field, not yet implemented in the NVIS Oracle database. Requires agreement and provision of content from NVIS stakeholders.	Implemented in the ANVMP Database (Access Version)
Attribute: DS05 - ANZLIC METADATA IDENTIFIER		
Heading	Details	
Purpose:	To provide a unique, machine-generated, human-readable link to the completed metadata and further information about the data set on the Australian Spatial Data Directory.	
Requirement:	Recommended	
Database Field Name:	ANZLIC_METADATA_IDENTIFIER	ANZLIC_METADATA_IDENTIFIER [DATA_SET]
Description:	Each metadata statement prepared by the custodian must have a unique, system-generated ANZLIC identifier. A data set should be internally consistent, for example the methods used for mapping and the taxon list used to name species records must be consistent. A data set derived with inconsistent methodologies should be recorded as a distinct data set where possible.	
Value:	Character(50)	

Example:	ANZCW0501000222	
Comments:	All data sets must have an ANZLIC compliant metadata entry before being accepted into the NVIS. The ANZLIC identifier is supplied by the ANZLIC contact in each jurisdiction. The Australian Spatial Data directory can be searched at URL: http://www.auslig.gov.au/asdd/ and has useful extra details including the data set: title, custodian, contact information, quality information and a list of attributes.	For data under DEC custodianship, the Australian Spatial Data Directory (ASDD) is accessed through Landgate SLIP Interragator for allocation of the ANZLIC Metadata Identifier. At this stage none of the Source Datasets have had metadata entries submitted to ANZLIC as the ANVMP dataset has not been submitted for inclusion in the National dataset. [*Some of these source datasets may have origins or links with other agencies (extant and non extant) There is a possibility the source datasets may already have ASDD metadata entries supplied by these agencies. Metadata statements have been made for each source data set in relation to the treatment this data has received as part of incorporation into the Avon Native Vegetation Map Project. For this reason it is probably not appropriate submit these metadata statements (and thus generate an ANZLIC metadata identifier) for each source dataset. Rather an ANZLIC metadata statement for the ANVMP Dataset as a whole will be generated and submitted if necessary.*]
Status:	Implemented in the NVIS Oracle database.	Provision made for attribute but not currently implemented in the ANVMP Database (Access Version)

Attribute: DS06 - ANZLIC METADATA NAME		
Heading	Details	
Purpose:	To provide name of dataset in ASDD	
Requirement:	Optional	
Database Field Name:	ANZLIC_METADATA_NAME	ANZLIC_METADATA_NAME [in DATA_SET]
Description:	This is the name given to the data set by the custodial organisation. The information should be in plain language (that is, preferably not solely in acronym form). Should preferably be the same as DS1, but typically, this isn't the case.	
Value:	Character(2000)	
Example:	Gippsland Ecological Vegetation Classes - Extant	
Comments:		For data under DEC custodianship, the Australian Spatial Data Directory (ASDD) is accessed through Landgate SLIP Interragator for allocation of the ANZLIC Metadata Identifier. At this stage none of the Source Datasets have had metadata entries submitted to ANZLIC as the ANVMP dataset has not been submitted for inclusion in the National dataset.

Status:	Implemented in the NVIS Oracle database.	Provision made for this attribute in the ANVMP Database (Access Version) but is not currently implemented as the Avon dataset has not been submitted for inclusion in the National Dataset.
Attribute: DS07 - ANZLIC METADATA URL		
Heading	Details	
Purpose:	To provide a direct, on-line link to the metadata statement.	
Requirement:	Optional	
Database Field Name:	ANZLIC_METADATA_URL	ANZLIC_METADATA_URL [DATA_SET]
Description:	The internet address of the metadata statement, (preferably as found on the Australian Spatial Data Directory (ASDD).	
Value:	Character(2000)	
Example:	http://www.auslig.gov.au/servlet/asdd_basic/retrieve?pn=17&el=F&db=current&rp=2&mr=1&ac=current&cid=177	
Comments:	The contents of this field will require maintenance from time to time.	For data under DEC custodianship, the Australian Spatial Data Directory (ASDD) is accessed through Landgate SLIP Interragator for allocation of the ANZLIC Metadata Identifier. At this stage none of the Source Datasets have had metadata entries submitted to ANZLIC as the ANVMP dataset has not been submitted for inclusion in the National dataset.
Status:	Implemented in the NVIS Oracle database.	Provision has been made for this attribute but is not currently implemented in the ANVMP Database (Access Version) as the dataset has not been submitted for inclusion in the National (NVIS) Dataset.
Vegetation Attribute Methods and Accuracy		

Attribute: DS08 - STRUCTURAL CLASSIFICATION SYSTEM		
Heading	Details	
Purpose:	To specify the classification system originally used in the field survey and mapping method.	
Requirement:	QAQC	
Database Field Name:	STRUCTURAL_CLASSFN_SYSTEM	STRUCTURAL_CLASSIFN_SYSTEM [DATA_SET]
Description:	The classification system and reference used for describing the vegetation structural formations in a data set. ¶ This is important where information entered has come in class ranges rather than discretely measured values (applicable to older mapping and land system/unit mapping).	
Value:	Character(50). This is a value set from an expandable look up table. Initial values are set by the administrator, new values can be added by the data loader.	
Example:	Walker1990	Muir 1977
Comments:	Where a data set has been pre-classified and the classification system is not listed in the lookup table, the user will be able to ask the administrator to add an entry to the lookup table.	Many of the Avon Vegetation mapping surveys followed the method of Muir (1977), characterising vegetation units to the level of Association based upon the growth form, height, cover and floristics of the dominant species for all strata. Muir (1977) is not included in the NVIS look up table (although an SA adaption is). Muir Classification is the system most widely used by many of the vegetation mapping surveys incorporated into the ANVMP Project "Muir 1977" has been created as a code in the ANVMP Database. With the addition of "Muir1977", the ANVMP Database uses the codes presented in the NVIS Structural Classification System look up table - however the table is not included in the database as a lookup feature.
Status:	Implemented in the NVIS Oracle database.	Implemented (With additions - see comments) in the ANVMP Database (Access Version)

Look-up Table for: STRUCTURAL CLASSIFICATION SYSTEM

Code	Explanation	
Specht1995	Specht, R. L., E. E. Hegarty, M. B. Whelan and A, Specht. 1995. Conservation atlas of plant communities in Australia. Southern Cross University. Centre for Coastal Management, Lismore	
Specht1974	Specht, R.L., E.M. Roe, and V.H. Boughton, 1974. Conservation of major plant communities in Australia and Papua New Guinea. Aust.J.Bot.Suppl.No.7.	
Walker1990	Walker J. and M.S. Hopkins 1990. Vegetation. In: McDonald, R.C., R.F., Isbell, J.G., Speight, J. Walker, and M.S. Hopkins. 1990. Australian soil and land survey. Field handbook. 2nd edn. Melbourne: Inkata Press	
Beadle1981	Beadle, N. C. W. 1981. The vegetation of Australia. Cambridge University Press, London	
Carnahan1976	Carnahan, J.A. 1976. Natural Vegetation. Atlas of Australian Resources. Second Series. Department of Natural Resources, Canberra	
Beard1976	Beard, JS (1976) Vegetation map of Western Australia: map and explanatory memoir. Applecross WA, Vegemap Publications, 1976: 27 vols, illus, maps.	
not applicable	not applicable	
unknown	unknown	
SA Structural Formation Table	Classification based on adaptation of Muir 1977 and Specht 1972	
Modified Carnahan/Specht	developed for Atlas of Australian Vegetation	
Muir 1977	Muir BG; (1977); Biological survey of the Western Australian wheatbelt. Part 2: Vegetation and habitat of Bendering Reserve.; Records of the Western Australian Museum, Supplement No. 3.	This code is an addition to the ANVMP Database only

Attribute: DS09 - FLORISTIC GROUP TYPE		
Heading	Details	
Purpose:	To describe how each vegetation type has been defined in terms of species composition.	
Requirement:	Recommended	
Database Field Name:	FLORISTIC_GROUP_TYPE	FLORISTIC_GROUP_TYPE [DATA_SET]
Description:	This field describes the method by which species are selected to define each floristic group in the dataset (i.e. the choice of up to 5 species in the level 6 description). This field should identify whether the vegetation descriptions contain: (i) species that contribute the most biomass (or cover/abundance), (ii) indicator species or (iii) a mixture of both types of species.	
Value:	Character (20). This is a value set from a defined lookup table. The values in the lookup table are set by the administrator and cannot be added to.	
Example:	indicator_biomass	
Comments:	Indicator species are those species that are characteristic or unique to a particular vegetation type but may not be the most abundant or dominant species.	Many of the ANVMP source surveys are not explicit in describing : i) the basis on which species are selected to define each floristic group and ii) the relative contribution of biomass or other characteristics used as species selection criteria to define the floristic group. Generally these selection criteria are implied or contextual in the source documentation.
Status:	Implemented in the NVIS Oracle database.	Attribute and NVIS code set implemented in the ANVMP Database (Access Version)
Look-up Table for: FLORISTIC GROUP TYPE		
Code	Explanation	

indicator_biomass	The species listed for the floristic group are both the indicator/diagnostic species and also those species with the greatest biomass (e.g. Allosyncarpia ternata forests)	
indicator	The species listed for the floristic group are indicator or diagnostic species, (i.e. not necessarily those species with the greatest biomass.)	
biomass	The species listed for the floristic group contribute the greatest biomass or cover abundance to the floristic group	
not applicable	not applicable	
unknown	unknown	
Attribute: DS10 - CLASSIFICATION METHOD		
Heading	Details	
Purpose:	To describe the analysis methods used to create the vegetation types.	
Requirement:	QAQC	
Database Field Name:	CLASSIFICATION_METHOD (was: CLASSIFICATION_SUPPORT)	CLASSIFICATION_METHOD [DATA_SET]
Description:	This attribute is used to describe the methods used to derive the vegetation types. It includes the package used e.g. PATN, the particular module used e.g. UPGMA, and the parameters selected and the rationale for their selection.	
Value:	Character(4000)	

Example:	Classification: The quadrats were classified into types on the basis of floristic/structural data (canopy cover of every species in each quadrat measured on a scale of 1 to 6 - modified Braun Blanquet scale). Both agglomerative and divisive hierarchical methods were used to classify the quadrats into major types to allow a comparison of the results of the two methods.¶ The agglomerative method used was Unpaired Analysis (UPGMA) using a Canberra metric (Kovach, 1993). The divisive method was a two way Indicator Species Analysis (TWINSPAN) (Hill, 1979) with 6 cut levels corresponding to the cover scores.¶ Minor types were distinguished within each major type using a combination of TWINSPAN analysis of each major group and the UPGMA analysis of the whole database. ¶Ordination: The floristic/cover data were also ordinated to investigate the relationships between the different vegetation types. The method used was Principle components Analysis of untransformed data with the species, but not the sites, standardised. All the species and samples were given equal weighting. The species data for the Banksia ericifolia Heath (H1) community was ordinated using Detrended Correspondence Analysis (DCA) to investigate for patterns and to correlate any patterns with time since last fire and fire frequency.	No analytical method to derive vegetation types is specified. Most likely to be the result of the surveyor's judgment informed by air photo interpretation and observations from ground reconnaissance field check sites.
Comments:	The text could often be cut and pasted from an existing project report. Any modifications to the original classification must be reported.	Provision for this attribute has been made in the ANVMP Database but Very few of the Wheatbelt vegetation mapping surveys have documented a quantitative method for defining vegetation types interpreted as mappable units. Mapped vegetation types have usually been the result of qualitative interpretation. Where there have been a set of quantitatively classified vegetation associations, they are generally the product of quadrat based surveys from which the classified vegetation types have not been interpreted, or are difficult to interpret, as mappable units.
Status:	Implemented in the NVIS Oracle database.	Implemented in the ANVMP Database (Access Version)

Attribute: DS11 - SAMPLING TYPE		
Heading	Details	
Purpose:	To describe the type of site plots used to derive and/or field check the map, survey or project. Used to determine the reliability of the resultant map.	
Requirement:	QAQC	
Database Field Name:	SAMPLING_TYPE	SAMPLING TYPE [DATA_SET]
Description:		
Value:	Character(50). This is a value set from a defined lookup table. The values in the lookup table are set by the administrator and cannot be added to.	
Example:	full vegetation sites	field check sites
Comments:	Further details on the sampling should be provided in the attribute MAPPING_METHOD for each method used in the creation of the dataset.	
Status:	Implemented in the NVIS Oracle database.	Attribute and NVIS code set implemented in the ANVMP Database (Access Version)

Look-up Table for: SAMPLING TYPE

Code	Explanation

full vegetation and field check sites	A 'full vegetation and field check site' vegetation survey is one, which includes most of the following elements and hence represents the highest class for data quality that can be entered into the NVIS Database. 1. Planning and field survey ¶ Where the site-based quadrats are located using a stratification system that includes reference to environmental attributes and aerial photos and/or satellite imagery that are available on a regional scale (i.e. at least 1:100,000). ¶ A sufficient density of site based quadrats to detect the majority of the vegetation types present within the region at a particular scale e.g. one site per unique map unit defined on aerial photos and/or satellite imagery. ¶ Recording general biophysical and environmental attributes of a landscape unit in which the site is located. ¶ Recording the full list of higher plants and various attributes of the species e.g. growth forms ¶ Recording the vegetation in strata ¶ Recording the structural attributes of the vegetation community e.g. height, cover, strata and growth forms ¶ Recording a geo-reference for the site-based quadrats so that they are relocatable and capable of being used in a GIS ¶ Recording of metadata for each site e.g. date, observer, etc ¶ Entering of the data from site-based quadrats into a relational database and checking of the data. 2. Classifying, interpreting and describing the quadrats the vegetation into definitive vegetation types ¶ This involves describing the vegetation types in terms of structural, floristic and environmental characteristics using multivariate analyses or classifying the vegetation types according to a pre-existing list of definitive vegetation types that has been developed to represent all vegetation types known to occur within a region or jurisdiction. 3. Mapping the definitive vegetation types across the landscape based on observed patterns between the original stratification system and aerial photos and/or satellite imagery.	
full vegetation sites	Plot area delimited. Full species lists (at time of survey) for each stratum including height and cover. These are generally used to ground truth mapping.	
characterisation sites	Plot area delimited. List of the dominant or conspicuous species only (at time of survey), for the over-storey and ground layer including average height of the over-storey and ground-storey cover	
field check sites	No plot area. With or without a GPS location. Dominant species in the predominant strata measured or checked. Rapid assessment sites. Possibly some structural information. Fly by sites.	[Note: applicable type for most vegetation mapping in ANVMP source data.]

basal area sites	No plot area. Aim to capture the woody species (trees and shrubs) above 1.3m by using the Bitterlich gauge. Basal area by species provides a measure of dominance of overstorey species.	
no sites	No field verification	
not applicable	not applicable	
unknown	unknown	
Attribute: DS12 - BOTANICAL EXPERTISE		
Heading	Details	
Purpose:	To describe, as a whole for the dataset, how reliably plants were identified.	
Requirement:	Recommended	
Database Field Name:	BOTANICAL_EXPERTISE	BOTANICAL_EXPERTISE [DATA_SET]
Description:	A description of how well the flora was assessed.	
Value:	Character(2000)	
Example:	High confidence in skill and reliability of the observers/interpreters. Project manager has practical experience of 15 years and team has an average of 5 years field experience. Voucher specimens were collected.	Species of doubtful identity were submitted to the WA herbarium for identification. It is not known whether any voucher specimens were lodged. Many species were not in flower at the time of survey, limiting identifications to vegetative material. The surveyor is a qualified botanist and recognized by peers as competent in the field with at least 10 years of wheatbelt vegetation survey experience.
Comments:	This information is not intended to describe individual sub-associations or map units.	
Status:	Implemented in the NVIS Oracle database.	Implemented in the ANVMP Database (Access Version)
Spatial Methods, Positional Accuracy and Usable Scales		
Attribute: DS13 - POSITIONAL ACCURACY		

Heading	Details	
Purpose:	To specify the locational accuracy of the dataset.	
Requirement:	QAQC	
Database Field Name:	POSITIONAL_ACCURACY	POSITIONAL_ACCURACY [DATA_SET]
Description:	The accuracy of mapped line or cell features in relation to their real world locations (eg. nearness to the real world geo-referenced location) across the data set.	
Value:	Number(5,1)	
Example:	10 [accurate to +/- 10]	
Comments:	The units of measure for this attribute must be in metres.	Information about Positional accuracy in relation to the ANVMP Database is covered in the Project Metadata Statement.
Status:	Implemented in the NVIS Oracle database.	Implemented in the ANVMP Database (Access Version)

Attribute: DS14 - POSITIONAL ACCURACY DETERMINATION		
Heading	Details	
Purpose:	To identify the method used for assessing POSITIONAL ACCURACY	
Requirement:	QAQC	
Database Field Name:	POSITIONAL_ACCURACY_DETERM	POSITIONAL_ACCURACY_DETERM [DATA_SET]
Description:	A code indicating the positional source or determination of points, polygons or cells across the data set. The information provided should relate to the type of data set i.e. point, polygon or raster (##where? field not set up to provide this info).	
Value:	Character(20). This is a value set from a defined lookup table. The values in the lookup table are set by the administrator and cannot be added to.	
Example:	satellite	

Comments:	Lookup Table sourced and simplified from draft Martin and Sinclair (1999). Where the entry is recorded as unknown or not applicable, the POSITIONAL ACCURACY attribute in the metadata should provide more information. Further details on positional controls etc should be provided in the attribute MAPPING_METHOD.	
Status:	Implemented in the NVIS Oracle database.	Attribute and NVIS code set Implemented in the ANVMP Database (Access Version)

Look-up Table for: POSITIONAL ACCURACY DETERMINATION

Code	Explanation
GPS	GPS - type unspecified
DGPS	Differential /RTCM corrected GPS
mapped	Mapped topographic features
satellite	rectified satellite image
rectphoto	rectified aerial photograph
orthoquad	orthophoto quad
estimate	estimate from known position
not applicable	not applicable
unknown	unknown

Attribute: DS15 - POSITIONAL ACCURACY MEASURE	
Heading	Details
Purpose:	To specify the type of measure and/or calculation used to determine DATASET POSITIONAL ACCURACY.

Requirement:	Recommended	
Database Field Name:	POSITIONAL_ACCURACY_MEASURE	POSITIONAL_ACCURACY_MEASURE [DATA_SET]
Description:		
Value:	Character(20); This is a value set from a defined lookup table. The values in the lookup table are set by the administrator and can not be added to.	
Example:	RMSE	
Comments:		Information about positional accuracy measures in relation to the ANVMP Database is given in the Project Metadata Statement.
Status:	Implemented in the NVIS Oracle database.	Attribute and NVIS code set implemented in the ANVMP Database (Access Version)

Look-up Table for: POSITIONAL ACCURACY MEASURE

Code	Explanation
RMSE	Root Mean Square of Error determined at time of transformation or registration.
CMAS	Circular map accuracy standard
percentage measure	Percentage value measured after the mapping is completed using an independent field sampling procedure
percentage estimate	Percentage value estimated from anecdotal information and/or experts
probability	Probability estimate
not applicable	not applicable
unknown	unknown

Attribute: DS16 - MAP PUBLICATION SCALE	
Heading	Details
Purpose:	To specify the scale at which the vegetation map/dataset was published.
Requirement:	Mandatory

Database Field Name:	MAP_PUBLICATION_SCALE (was: MAPPING_SCALE)	MAP_PUBLICATION_SCALE [DATA_SET]
Description:	The denominator of the ratio of a distance on a map to its corresponding distance on the ground.	
Value:	Number(10)	
Example:	50000; e.g. Kangaroo Island SA.	
Comments:	For unpublished maps or coverages, please specify a nominal scale that would be suited to routine use.	Information about scale in relation to the ANVMP Database is given in the Project Metadata Statement.
Status:	Implemented in the NVIS Oracle database.	Implemented in the ANVMP Database (Access Version)

Attribute: DS17 - FINEST SCALE		
Heading	Details	
Purpose:	To specify the finest scale at which the mapping would be most accurate for display without modifying the map/spatial units.	
Requirement:	Recommended	
Database Field Name:	FINEST_SCALE (was: FINE_SCALE)	FINEST_SCALE [DATA_SET]
Description:	This field is based on the stated scale/resolution of the data set, as recorded in the metadata. The field is expressed as the denominator only.¶ This attributes addresses the fact that It is quite a common occurrence that either out of ignorance or opportunism, maps are often used at a scale far finer than the intention of, and original purpose of, the mapping.¶ The term fine scale equates to large scale.	
Value:	Number(10); To be used in conjunction with DS 19. BROADEST SCALE	

Example:	40000 - A 1:50000 scale map could be used at 1:40000 scale without too much inaccuracy. However it could not be used at 1:20000. E.g. Kangaroo Island SA.	
Comments:	The data custodian will determine the value. These scale limit restrictions could be applied in a GIS or internet mapping facility to restrict zooming capacity.	
Status:	Implemented in the NVIS Oracle database.	Implemented in the ANVMP Database (Access Version)

Attribute: DS18 - BROADEST SCALE		
Heading	Details	
Purpose:	To specify the broadest scale at which the mapping would be most accurate for display without modifying the map/spatial units.	
Requirement:	Recommended	
Database Field Name:	BROADEST_SCALE (was: BROAD_SCALE)	BROADEST_SCALE [DATA_SET]

Description:	This is based on the stated scale/resolution of the data set, as recorded in the metadata. The field is expressed as the denominator only.¶ This attributes addresses the fact that it is quite a common occurrence that maps are sometimes used at a scale or resolution far broader than the intention of, and original purpose of, the mapping. Maps used at a broader scale than the publication scale may need spatial and/or attribute generalisation to be applied before viewing. I.e. simpler levels in the hierarchy would provide simpler analyses, faster viewing and coverages of comparable complexity to other themes at the broad scale.¶ The term broad scale equates with small scale.	
Value:	Number(10); To be used in Conjunction with DS 18. FINEST SCALE.	
Example:	200000 - A 1:50000 scale map could be used at 1:1200000 scale without too many problems; e.g. Kangaroo Island SA.	
Comments:	The data custodian will determine the value. These scale limit restrictions could be applied in a GIS or internet mapping facility to restrict zooming capacity.	Information about scale in relation to the ANVMP Database is given in the Project Metadata Statement.
Status:	Implemented in the NVIS Oracle database.	Implemented in the ANVMP Database (Access Version)
Summary of Survey and Mapping Methods and Accuracy		

Attribute: DS19 - SURVEY AND MAP RELIABILITY		
Heading	Details	
Purpose:	To describe the overall reliability in the survey and mapping methods (spatial/positional and attributes/ecological) used to derive the data set.	
Requirement:	Mandatory	
Database Field Name:	SURVEY_AND_MAP_RELIABILITY(was: RELIABILITY)	SURVEY_AND_MAP_RELIABILITY [DATA_SET]
Description:	This attribute should be completed even if little information is available and should be based on an expert assessment of all methods used and their limitations.¶ This attribute could also contain a reference to a document for further information.	
Value:	Character(2000)	
Example:	The reliability of this data set is very good. The delineation of map units was based on rectified colour aerial photography at 1:20000 scale using experienced interpreters. Data collected was calibrated in the field with a final accuracy of 85% in the delineation of vegetation mapping units. Further information can be found in Marther (1987) Vegetation mapping of Eastern River, Northern Territory.	General vegetation divisions were noted using colour aerial photography at a scale of 1:6,000. Areas of interest thus delineated were examined in the field and the vegetation and soils at selected sites described. Because of time limitations some areas were not covered in detail in the ground survey. Mapping was carried out by extrapolation of known vegetation associations using the aerial photographs. Data (i.e. mapped vegetation types) were not specifically field calibrated such that percentage accuracy in the delineation of vegetation mapping units could be determined. It is unlikely that a GPS was used to georeference field observations.
Comments:	The contents of this attribute should synthesise and summarise the values of other attributes from the DataSet, Mapping Methods and Map Source tables. Where there were more than one mapping method used in the dataset, the reliability of each method should be described in MAPPING_EXPERTISE.	

Status:	Implemented in the NVIS Oracle database.	Implemented in the ANVMP Database (Access Version)
Attribute: DS20 - START DATE_ATTRIBUTE		
Heading	Details	
Purpose:	To document the date of the earliest field collection of vegetation-related attributes used in the survey underpinning the maps.	
Requirement:	Mandatory	
Database Field Name:	START DATE_ATTRIBUTE	START_DATE_ATTRIBUTE [DATA_SET]
Description:	Day, Month, Year of earliest attributes used in the survey.	
Value:	Date. This is a year 2000 consistent date and time value set as dd/mm/yyyy.	
Example:	9/04/1978	
Comments:	This field is later attached to the NVIS GIS coverage and is fundamental to assessing the currency of the attribute data in each polygon.	Where only month and year are given the format is: 01\mm\yyyy; Where year only is specified the start date format is: 1/01/yyyy
Status:	Implemented in the NVIS Oracle database.	Implemented in the ANVMP Database (Access Version)
Attribute: DS21 - END DATE ATTRIBUTE		
Heading	Details	
Purpose:	To document the date of the latest field collection of vegetation-related attributes used in the survey underpinning the maps.	
Requirement:	Mandatory	
Database Field Name:	END_DATE_ATTRIBUTE	END_DATE_ATTRIBUTE [DATA_SET]
Description:	Day, Month, Year of latest attributes used in the survey.	

Value:	Date. This is a year 2000 consistent date and time value set as hh:mm:ss dd/mm/yyyy with hours set in 24hr time.	
Example:	6/06/1996	
Comments:	This field is later attached to the NVIS GIS coverage and is fundamental to assessing the currency of the attribute data in each polygon.	Where only month and year are given the format is: last day of given month\mm\yyyy
Status:	Implemented in the NVIS Oracle database.	Implemented in the ANVMP Database (Access Version)

Attribute: DS22 - START DATE_SPATIAL		
Heading	Details	
Purpose:	To document the date of the earliest image used in the mapping.	
Requirement:	Mandatory	
Database Field Name:	START_DATE_SPATIAL (was: START_DATE)	START_DATE_SPATIAL [DATA_SET]
Description:	Day, Month, Year of earliest image used in the mapping. The value for a dataset would normally come from earliest START_DATE_SOURCE in the Map_Source table.	
Value:	Date. This is a year 2000 consistent date and time value set as dd/mm/yyyy.	Where year only is specified the start date format is: 1/01/yyyy; Where only month and year are specified the start date uses 01 for the first day
Example:	9/04/1978	1/01/1989
Comments:	Any automated procedure used to generate the value of this field for a dataset should be checked by an expert to ensure that it correctly summarises the whole dataset. The contents of this attribute carry through to the spatial coverage and are fundamental to assessing the currency of the spatial data.	
Status:	Implemented in the NVIS Oracle database.	Implemented in the ANVMP Database (Access Version)

Attribute: DS23 - END DATE SPATIAL		
Heading	Details	
Purpose:	To document the date of the most recent image used in the mapping.	
Requirement:	Mandatory	
Database Field Name:	END_DATE_SPATIAL (was: END_DATE)	END_DATE_SPATIAL [DATA_SET]
Description:	Day, Month, Year of latest image used in the mapping.	
Value:	Date. This is a year 2000 consistent date and time value set as hh:mm:ss dd/mm/yyyy. The value would normally come from latest END_DATE_SOURCE in the Map_Source table.	Where year only is specified the end date format is: 31/12/yyyy; Where only month and year specified the day is taken to be the last day relevant to the month indicated.
Example:	6/06/1996	31/12/1989
Comments:	Any automated procedure used to generate the value of this field for a dataset should be checked by an expert to ensure that it correctly summarises the whole dataset. The contents of this attribute carry thru to the spatial coverage and are fundamental to assessing the currency of the spatial data.	
Status:	Implemented in the NVIS Oracle database.	Implemented in the ANVMP Database (Access Version)

Vegetation_Data_Set_Comment		
Heading	Details	
Purpose:	NA	This is to allow relevant supplementary contextual information relating to source data set attributes that cannot be accommodated or summarised by the standard NVIS(Ver 6.0) attribute field data constraints
Requirement:	NA	NA
Database Field Name:	NA	Vegetation_Data_Set_Comment [DATA_SET]

Description:	NA	This is a free text comment for source data set related information not accommodated in NVIS Data Set Level Attribute field constraints
Value:	NA	Character (Access memo field)
Example:	NA	"The principal aim of the survey was to provide baseline botanical data to be used in the development of a management plan for Chiddarcooping Reserve. As well as mapped vegetation, other spatial themes include: soil, geology, drainage and topography, fire, populations of rare and restricted species. Floristic Group Type: Although biomass was not quantitatively measured from sample plots. Vegetation associations were characterized by dominant species in terms of estimated height and cover. Biomass was therefore an implied factor in selecting species to define floristic groups. Positional Accuracy: As “Interpretational” accuracy (of vegetation boundaries) is hard to determine for qualitative surveys, Positional accuracy is thus interpreted in terms of “mapping” accuracy only. This is a function of: a) distance on the ground represented by a notional pen thickness of 1mm delineating vegetation boundaries on interpreted aerial photographs of a given scale; and b) “rule of thumb” that “minimum optimum” accuracy is achieved where the maximum scale of a vegetation map is no greater than half the scale of the aerial photographs upon which the map is based. I.e. for aerial photography at a scale of 1:80000, 1mm at an optimum map scale of 1:160000 = 160m on ground (Positional accuracy = +/-80m). Map Publication Scale: unpublished consultants report and maps"
Comments:	NA	Non NVIS field:
Status:	NA	Implemented in the ANVMP Database (Access Version) only
Map Origins (Methods and Sources)		
Attribute: MS01 - MAPPING SOURCE NUMBER		

Heading	Details	
Purpose:	To identify each unique combination of map source and mapping method used in each dataset.	
Requirement:	Optional	
Database Field Name:	MAPPING_SOURCE_NUMBER	MAPPING_SOURCE_NUMBER[MAPPING_SOURCE]
Description:	A number assigned to each defined map origin details used in the construction of a dataset. The number is assigned sequentially, beginning with 1, within each dataset. Typical numbers are 1, 2 or 3.	
Value:	Number(10)	
Example:	2	
Comments:	New field made necessary by the joining of unique combinations of the former MAPPING_METHOD and MAP_SOURCE tables.	*
Status:	New field; not yet implemented in the NVIS Oracle database. Will need to reconcile data in the version 5.0 MAP_SOURCE and MAPPING_METHODS tables.	Provision for this attribute field is made within the ANVMP Database but the intended function of this field value according to the NVIS database structure (version 6.00) can only be enabled through establishing a many to one relationship between the [MAPPING_SOURCE] and [DATA_SET] Access_tables. Currently the relationship between these tables is one to one (as at 03/02/10)

Attribute: MS02 - MAPPING METHOD		
Heading	Details	
Purpose:	To describe the interpretive tools used for delineating the map units within the data set.	
Requirement:	QAQC	
Database Field Name:	MAPPING_METHOD	MAPPING METHOD [MAPPING_SOURCE]

Description:	Detailed description of mapping methods. A data set must have one or more entries for this attribute. In particular, the attribute provides further background for the assessment of POSITIONAL_ACCURACY and SAMPLING_TYPE.	
Value:	Character(2000); multiple entries allowed.	Access memo field Char(2000)
Example:	Aerial photo interpretation; manual satellite image interpretation; combination of quantitative modelling and aerial photo interpretation	Mapping line work was based on l:80,000 scale, black and white aerial photography and then transferred, with modifications, to a five times enlargement of the photograph. Mapped units were interpreted according to homogeneity of texture, tone and topography of images using stereo pairs.
Comments:	The current list of attributes used to describe the MAPPING METHOD is primarily based on the use of some form of imagery. Where other methods have been used such as modelled surfaces, a full description should be provided. Additional attributes to describe other mapping methods may be subsequently defined.	
Status:	Implemented in the NVIS Oracle database.	Implemented in the ANVMP Database (Access Version)

Attribute: MS03 - MAPPING EXPERTISE		
Heading	Details	
Purpose:	To describe the overall level of skill and expertise of the map interpreters during the project or survey for a particular MAPPING METHOD.	
Requirement:	Recommended	
Database Field Name:	MAPPING_EXPERTISE	MAPPING EXPERTISE [MAPPING_SOURCE]
Description:	Custodians should specify the expertise in mapping or botanical survey or a combination of both used in the compilation of the dataset.	

Value:	Character(2000)	Access memo field Char(2000)
Example:	High confidence in the skill and expertise of the interpreter(s)	Recognized by peers as competent in the field with a high level of experience in interpreting, describing and mapping native vegetation in the WA wheatbelt region.
Comments:	This field should be completed by the project leader or from information documented about the project. It is a summary of the quality of both spatial and attribute aspects of the application of the particular MAPPING_METHOD. Where there is only one mapping method for the dataset, this attribute can be used for further details of the method, with the attribute SURVEY_AND_MAP_RELIABILITY used to describe the overall quality assessment for the dataset.	
Status:	Implemented in the NVIS Oracle database.	Implemented in the ANVMP Database (Access Version)

Attribute: MS04 - IMAGERY SOURCE		
Heading	Details	
Purpose:	To briefly describe the type of image used to derive/classify the mapping units.	
Requirement:	QAQC	
Database Field Name:	IMAGERY_SOURCE (was: INTERPRETIVE_BASE)	IMAGERY SOURCE [MAPPING_SOURCE]
Description:	These descriptions are commonly used terms. A MAPPING METHOD must have one or more entries for this attribute. Each type of image must have a separate entry.	
Value:	Character(2000)	Access Text field Char(100)

Example:	For a dataset mapped using API using 2 image types would have 2 records in the MAP_SOURCE table, viz::¶ 1. true colour photography' and 2. 'black and white photography'.	Black and white aerial photography
Comments:		
Status:	Implemented in the NVIS Oracle database.	Implemented in the ANVMP Database (Access Version). However, provision for multiple attribute entries for this field within the ANVMP Database can only be enabled through establishing a many to one relationship between the [MAPPING_SOURCE] and [DATA_SET] Access_tables. Currently the relationship between these tables is one to one (as at 03/02/10)

Look-up Table for:
IMAGERY SOURCE

Code	Explanation
black and white aerial photography	black and white aerial photography
colour aerial photography	Colour aerial photography
colour infrared aerial photography	Colour infrared aerial photography
satellite imagery: LANDSAT TM	Satellite imagery: LANDSAT Thematic Mapper
satellite imagery: LANDSAT MSS	satellite imagery: LANDSAT Multi-Spectral Scanner
satellite imagery: non-LANDSAT	satellite imagery: neither LANDSAT MSS nor TM. Please specify details in MAPPING_METHOD field.
maps	existing and/or historic maps
unknown	unknown

Attribute: MS05 - IMAGERY SCALE

Heading	Details	
Purpose:	To document the scale of each IMAGERY_SOURCE.	
Requirement:	QAQC	
Database Field Name:	IMAGERY_SCALE (was: SCALE_OR_RESOLUTION)	IMAGERY SCALE [MAPPING_SOURCE]
Description:	The denominator of the scale of each image listed in IMAGERY_SOURCE.	
Value:	Number(10)	
Example:	25000	
Comments:	Scale is usually applied to aerial photography.	
Status:	Implemented in the NVIS Oracle database; need to implement field changes.	Implemented in the ANVMP Database (Access Version)

Attribute: MS06 - IMAGERY RESOLUTION		
Heading	Details	
Purpose:	To document the resolution of each IMAGERY_SOURCE.	
Requirement:	Recommended	
Database Field Name:	IMAGERY_RESOLUTION (was: SCALE_OR_RESOLUTION)	IMAGERY RESOLUTION [MAPPING_SOURCE]
Description:	The resolution (cell or pixel size) of each image listed in IMAGERY_SOURCE.	
Value:	Number(10)	
Example:	25	
Comments:	The units are in metres. Resolution is usually applied to airborne or satellite scanned imagery.	
Status:	Implemented in the NVIS Oracle database; need to implement field changes.	Implemented in the ANVMP Database (Access Version)

Attribute: MS07 - MAPPING SOURCE EXTENT	

Heading	Details	
Purpose:	To describe the extent of the map source and/or mapping method within the dataset.	
Requirement:	Optional	
Database Field Name:	MAPPING_SOURCE_EXTENT	MAPPING_SOURCE_EXTENT [MAPPING_SOURCE]
Description:	A description of the area of coverage of the map source and/or mapping method within the dataset.	
Value:	Character(4000)	Access memo field Char(4000)
Example:	The interpretation of colour aerial photos was confined to public land in the coastal portion of the dataset.	Aerial photo interpretation and mapping is confined to Remnant native vegetation occurring: a) within and adjacent to Elphin Nature Reserve, b) on Wongan Hills as defined by the 320m contour line of best fit delineating outcropping lateritised hills from the surrounding sandplain. An intrusion of sandplain over laterite on the south eastern boundary of the area thus delineated is excluded.
Comments:	There are many cases where a mapping method and/or map source covers only part of the area of a dataset. This is a simple text field to describe such subsets of the dataset. In future, there may be a case for x,y strings to more-precisely define the internal (methodological and source) boundaries within a dataset.	
Status:	New field. Yet to be implemented in the NVIS Oracle database.	Implemented in the ANVMP Database (Access Version)

Attribute: MS08 - DELINEATION MEDIUM		
Heading	Details	
Purpose:	To describe the medium on which the map units were delineated.	
Requirement:	Recommended	
Database Field Name:	DELINEATION_MEDIUM (was: MEDIUM)	DELINEATION MEDIUM [MAPPING_SOURCE]

Description:	A description of the medium on which the image was captured, processed and interpreted or, if a combination of these, the medium on which map unit boundaries were delineated.	
Value:	Character(2000)	Access text field Char(255)
Example:	Options might include: hardcopy paper; hardcopy mylar film; digital	Unknown
Comments:	The use of particular mapping media may have implications for POSITIONAL _ACCURACY.	
Status:	Implemented in the NVIS Oracle database.	Attribute field and NVIS code set implemented in the ANVMP Database (Access Version)

Look-up Table for:
DELINEATION MEDIUM

Code	Explanation
digital	digital
hardcopy mylar film	hardcopy mylar film
hardcopy paper	hardcopy paper
hardcopy photographs	hardcopy photographs
unknown	unknown

Attribute: MS09 - START_DATE_SOURCE		
Heading	Details	
Purpose:	To document the date of the earliest image source used in the particular mapping.	
Requirement:	Recommended	
Database Field Name:	START DATE_SOURCE (was: START_DATE)	START_DATE_SOURCE [MAPPING_SOURCE]
Description:	Day, Month, Year of earliest image used in the particular mapping method.	

Value:	Date. This is a year 2000 consistent date and time value set as dd/mm/yyyy.	Where year only is specified the start date format is: 1/01/yyyy; Where only month and year are specified the start date uses 01 for the first day
Example:	9/04/1978	1/01/1989
Comments:	The earliest mapping source across all mapping methods for a dataset would normally be used in the attribute START_DATE_SPATIAL to summarise the whole dataset.	
Status:	Implemented in the NVIS Oracle database.	

Attribute: MS10 - END DATE SOURCE		
Heading	Details	
Purpose:	To document the date of the most recent (i.e. the latest) image used in the mapping.	
Requirement:	Recommended	
Database Field Name:	END_DATE_SOURCE (was: END_DATE)	END DATE SOURCE [MAPPING_SOURCE]
Description:	Day, Month, Year of latest image used in the mapping.	
Value:	Date. This is a year 2000 consistent date and time value set as hh:mm:ss dd/mm/yyyy with hours set in 24hr time.	Where year only is specified the end date format is: 31/12/yyyy; Where only month and year specified the day is taken to be the last day relevant to the month indicated.
Example:	6/06/1996	31/12/1989
Comments:	The latest mapping source across all mapping methods for a dataset would normally be used in the attribute END_DATE_SPATIAL to summarise the whole dataset.	
Status:	Implemented in the NVIS Oracle database.	Implemented in the ANVMP Database (Access Version)

Attribute: MS11 - MAP BASE		
Heading	Details	

Purpose:	To describe the source of the map base used for registering the final line-work in the data set.	
Requirement:	Recommended	
Database Field Name:	MAP_BASE	MAP BASE [MAPPING_SOURCE]
Description:	An attribute describing the final map base used to collate the line work and provide ground control. This field is at a "higher" level than DELINEATION_MEDIUM and is normally later in the mapping process. Multiple sources can be listed.	
Value:	Character(2000); Semi-colon delimited	Access memo field Char(2000)
Example:	AUSLIG (1990) 1:100,000 series; GPS Ground Control Points	Aerial photography enlargements to a scale of 1:6 000
Comments:	Information should include the owner/custodian of the source, the year the information was collected, the scale or resolution of the mapping base, data set title or description in this order.	
Status:	Implemented in the NVIS Oracle database.	Implemented in the ANVMP Database (Access Version)

Mapping_Source_Comment		
Heading	Details	
Purpose:		This is to allow relevant supplementary contextual information relating to source data set attributes that cannot be accommodated or summarised by the NVIS (ver 6.0) Map Origin Attribute fields data constraints
Requirement:		NA
Database Field Name:		Mapping_Source_Comment [MAPPING_SOURCE]
Description:		This is a free text comment for source data set related information not accommodated in NVIS Map Origin Attribute field constraints
Value:		Character (Access memo field)

Example:		Imagery Scale: Two scales of aerial photography were used in this survey, 1:40000 and 1:80000. As it was not specified where each scale of image was used, The smallest scale is quoted for the Imagery Scale field. Start and End Date Source: no date for source imagery stated.
Comments:		Non NVIS field:
Status:		Implemented in the ANVMP Database (Access Version) only
References		

Attribute: RF01 - CITATION	
Heading	Details
Purpose:	To cite the reference.
Requirement:	QAQC
Database Field Name:	CITATION
Description:	A full reference to a publication, including reports, technical manuals, journal articles that describe the data set and/or the methods used in its compilation.
Value:	Character(2000); The entry must include all authors names, date, title, publication name and publisher.
Example:	1. AUSLIG. 1990, Vegetation - Atlas of Australian Resources, Third Series, vol. 6, Australian Surveying and Land Information Group, Canberra.¶ 2. Barlow, B.A. & Hyland, B.P.M. 1988, 'The Origin of the Flora of Australia's Wet Tropics', Proc.Ecol.Soc.Aust, vol. 15, pp. 1-17.

CITATION [REFERENCE]
Coates A ; (1988);Vegetation survey of the Wongan Hills, Department of Conservation and Land Management, Narrogin.

Comments:	A very useful attribute when consistently and comprehensively filled out.	Citation format follows guidelines set out in "Conservation Science Western Australia" published by The Department of Environment and Conservation, Western Australia
Status:	Implemented in the NVIS Oracle database.	
Attribute: Citation		
Heading		
Purpose:	NA	Allows Citation information held as a character string in an access memo field to be displayed in an ArcGIS attribute table text field (Char 255 limit).
Requirement:	NA	
Database Field Name:	NA	TRUNCATED_CITATION [REFERENCE]
Description:	NA	Character text string that can be accommodated as a value in an ArcGIS™ shapefile attribute table text field.
Value:	NA	Access text field Char(255)
Example:	NA	
Comments:	NA	CITATION in the Access data table [REFERENCE] is a memo field that can accommodate the NVIS 2000 character value. In order for CITATION values to be displayed in an ArcGIS attribute table, the citation attribute has to be changed from an Access memo field type to a 255 char limited text field type. The full citation text string in the memo field may be truncated where greater than 255 char. For Oracle business tables the full character length can be accommodated.
Status:	NA	Implemented in the ANVMP Database (Access ver) only
Attribute: RF02 - FORMAT		
Heading	Details	
Purpose:	To describe the format(s) in which the reference is available.	
Requirement:	Optional	
Database Field Name:	FORMAT	FORMAT [REFERENCE]
Description:		

Value:	Character(2000); Semi-colon delimited	Access text field Char(255); Semi-colon delimited
Example:	Hardcopy and digital; Hardcopy; Digital; URL	Hardcopy
Comments:		
Status:	Implemented in the NVIS Oracle database.	Implemented in the ANVMP Database (Access ver)
Attribute: RF03 - STORAGE LOCATION		
Heading	Details	
Purpose:	To specify where the reference can be found.	
Requirement:	Optional	
Database Field Name:	STORAGE_LOCATION	STORAGE LOCATION [REFERENCE]
Description:	The storage location(s) indicating where the reference can be found, including its URL where available.	
Value:	Character(2000); Semi-colon delimited	Access Text field Char(50)
Example:	1. Queensland Herbarium Library¶ 2. National Library¶ 3. http://www.environment.gov.au/states/cyp_on_l/reports/lup/cons_con.html	DEC Science Division Library, WA
Comments:		
Status:	Implemented in the NVIS Oracle database.	Implemented in the ANVMP Database (Access)
Attribute: Reference identifier		
Heading		
Purpose:	NA	Serves as an additional source reference identifier to the primary key field auto number and can help interpret the spatial coverage feature identifier.
Requirement:	NA	
Database Field Name:	NA	Ref_ID [REFERENCE]
Description:	NA	*This is a unique three digit code originally assigned to each source reference from an external Access reference database: "Avon Mapping Source Ref."

Value:	NA	Access text field Char(10)
Example:	NA	235
Comments:	NA	Code is carried through as a component of the unique polygon identifier in the [Map_Unit] table field: Ref_Map_Feat_ID and its equivalent in the spatial coverage attributes .
Status:	NA	Implemented in the ANVMP Database (Access Version) only

Attribute: Reference identifier (parent key)		
Heading		
Purpose:	NA	Serves as parent key field in ANVMP Database (Access ver) table [REFERENCE]. Serves as foreign key in related table [DATA_SET]
Requirement:	NA	
Database Field Name:	NA	REFERENCE_ID [REFERENCE]
Description:	NA	This is an autonumber generated in the REFERENCE table in the ANVMP Database (Access)
Value:	NA	Number
Example:	NA	1
Comments:	NA	
Status:	NA	Implemented in the ANVMP Database (Access Version)

Map Unit Level Attributes

	Note: all attributes at the Map Unit level according to NVIS appear to be organised under the premise that the spatial unit is the Map Unit. In NVIS terms, a Map Unit can be thought of as "an item in the legend of a vegetation map" (see MU01 - MAPUNIT_IDENTIFIER comments in the NVIS attribute reference information). This means that where more than one polygon is attributed with the same vegetation type then the Map Unit, in terms of the spatial coverage, may then represent a multipart feature in that coverage. (i.e. a map unit representing a particular vegetation type may be comprised of several polygons) Organising data by attributing vegetation types to multipart features has implications for: 1. The way the vegetation description data relating to each spatial unit is linked to the spatial coverage and managed 2.The way the spatial mix (mosaic) parameters are defined in terms of the NVIS attribute fields. 3. The checking of spatial geometry and transfer of data to SDE. Also given the ambiguity of some source mapping, the possibility of reviewing and reattribution of spatial features is much more difficult when dealing with map units represented as multipart features compared to single polygon features. For these reasons, for the ANVMP Database, vegetation types have been attributed to single part features, ie single polygons. Mosaics therefore relate to the number and relative proportion of vegetation types attributed to a particular polygon not necessarily the group of polygons that might comprise what NVIS would define as a map unit.
Reference Information	

Attribute: MU01 - MAP UNIT IDENTIFIER	
Heading	Details

Purpose:	The purpose of this attribute is to identify the vegetation description data relating to each spatial unit, so that it can be linked to the spatial coverage.	Many vegetation associations may occur in one map polygon and a given vegetation association may also occur in many polygons. The Map Unit Identifier serves to represent each of the unique combinations of Vegetation Association and Map unit polygon. This handles the many to many relationships and enables vegetation attributes to be linked to the spatial coverage.
Requirement:	Mandatory	
Database Field Name:	MAPUNT_IDENTIFIER	MAPUNT_IDENTIFIER [map_unit]
Description:	A unique map (spatial) unit identifier, which links map units to the data set identifier (DATA_SET_NUMBER) and the vegetation descriptions within them. Up to 6 vegetation descriptions are allowed per map unit. (Map units with more than one vegetation type within them are called mosaics).	(Note: For the ANVMP Database > 6 vegetation descriptions have been allowed per map unit)
Value:	Number(10); in the format SDDNNNNN, where S=State code, DD=dataset number within the state and NNNNN = the mapunit ID supplied by the States and Territories. S and NN are assigned by the administrator.	
Example:	76017501	
Comments:	The MAP_UNIT table is essentially the table used to resolve the many to many relationship between the SPATIAL_ATRIBUTE_FORMAT and VEG_DESCRIPTION tables. The map unit can be thought of as an item in the legend of a vegetation map.	The function of the MAPUNT_IDENTIFIER is performed in the ANVMP Database by the primary key field MAP_UNIT_ID which is an auto number generated in the table.
Status:	Implemented in the NVIS Oracle database.	provision has been made for this attribute field in the ANVMP Database but values have not been assigned as the dataset has not been submitted for inclusion in the National dataset

Attribute: MAP UNIT IDENTIFIER	

Heading		
Purpose:		The purpose of this attribute is to identify the vegetation description data relating to each spatial unit, so that it can be linked to the appropriate corresponding element in the spatial coverage. Many vegetation associations may occur in one map polygon and a given vegetation association may also occur in many polygons. The Map Unit Identifier serves to represent each of the unique combinations of Vegetation Association and Map unit polygon. This handles the many to many relationships and enables vegetation attributes to be linked to the spatial coverage.
Requirement:		
Database Field Name:		MAP_UNIT_ID [map_unit] (see NVIS attribute MU01)
Description:		A unique map (spatial) unit identifier, which links map units to the data set identifier (DATA_SET_ID) and the vegetation descriptions associated with the map units. No limit is placed on the number of descriptions allowed per map unit. (NVIS refers to Map units with more than one attributed vegetation type as a mosaic).
Value:		Auto number
Example:		
Comments:		In the ANVMP Database, the MAP_UNIT_ID perfoms the function of the MAPUNT_IDENTIFIER in the NVIS data structure (see NVIS attribute MU01)
Status:		
		Implemented in the ANVMP Database (Access Version)only
Descriptive Information		

Attribute: MU02 - SPATIAL MIX		
Heading	Details	
Purpose:	To specify the spatial mix of a map unit.	
Requirement:	Mandatory	
Database Field Name:	SPATIAL_MIX	SPATIAL_MIX [Map_Unit]

Description:	This attribute provides general information on both the spatial extent and makeup of the discrete sub-associations or floristic groups within the one map-unit. Map units may be homogeneous (pure) or mixed (mosaics). ¶ Spatially mixed map units are defined as those that have a number of discrete vegetation types within a map unit boundary.	
Value:	Character(50); This is a value set from a defined lookup table. The values in the lookup table are set by the administrator and cannot be added to.	Access text field (Char 30)

Example:	Examples of spatially mixed map units (mosaics):¶ 1. Structurally similar but floristically different vegetation types within one map unit. For example some alpine eucalyptus forests of similar structure but different species mixes may not readily be separable by either API or image classification (without resort to secondary information such as elevation or aspect).¶ 2. Structurally and floristically different vegetation types within one map unit that are not uniquely tied together ecologically (eg. are part of the patterning of the landscape). Most mapped units (depending on scale, interpretation materials, operator efficiency etc.) will be variations on this theme. Vegetation types smaller than the minimum-mapping unit will also occur here.¶ 3. Structurally and floristically different vegetation types within one map unit that are uniquely tied together ecologically. These Community Complexes are defined as vegetation types that occur with other vegetation types that are uniquely tied together ecologically, but are quite different structurally and floristically, but are mapped within map unit (eg. dune and swale complexes).	*
Comments:		
Status:	Implemented in the NVIS Oracle database. Action required by NVIS collaborators to resolve mosaics.	Attribute field and NVIS value code set (with additions) Implemented in the ANVMP Database (Access Version)
Look-up Table for: SPATIAL MIX		
Code	Explanation	
pure	The map unit has only one sub-association or discrete floristic group, and this can be adequately described.	Where a polygon has only one vegetation description attritbuted to it

dominant mosaic	The map unit has 2 or 3 main sub-associations or floristic groups, one of which occupies or is estimated to occupy greater than 70% of the spatial area of the polygon.	
mosaic	The map unit definitely has 2 or 3 main sub-associations, which can be described in detail, the spatial extent of each within the polygon is known, and one of the sub-associations is clearly spatially dominant.	
equal mosaic	The map unit has two or three main sub-associations, which can be described in detail, and the spatial extent of each within the map unit, is more or less equal.	
incomplete	The map unit definitely has more than one sub-association, although only one can be adequately described.	
mosaic unknown	The map unit definitely has two or three main sub-associations, which can be described in detail, although the spatial extent of each is unknown.	Where a polygon has more than one vegetation association attributed to it but where the proportions of each component are not specified by the source reference or cannot be determined.
unknown	unknown	
not applicable		This value is exclusive to the ANVMP Database and is not part of the NVIS code set. This is the value applied where the source code serves to identify map units representing non vegetation features such as salt lakes and granite outcrops for which no vegetation association is defined by the source reference. These features can often be naturally bare areas that significantly influence adjacent vegetation type (e.g. runoff from a granite outcrop) or are indicative of particular adjacent vegetation type. The value may also applied to map units linked to attributes of an undefined, or disturbed vegetation category

Attribute: MU03 - MOSAIC TYPE		
Heading	Details	
Purpose:	To specify the data model or format used in describing a mosaic spatial unit. This assists with the matching of source codes to NVIS descriptions.	
Requirement:	Commonwealth	
Database Field Name:	MOSAIC_TYPE	MOSAIC_TYPE [map_unit]

Description:	Mosaics are defined as heterogenous spatial units, containing more than one vegetation association within the unit of mapping. The field can have one of three values, as per the lookup table, below. 'Unknown' is not a valid option.	
Value:	Character(1)	Access Text field (Char 1)
Example:	M	
Comments:	This is a new data management field which arose as part of the restructure (2001-02) process.	
Status:	Implemented in the NVIS Oracle database.	Provision is made for this field in the ANVMP Database structure but values have not been assigned as the dataset has not been submitted for inclusion in the National dataset.

Look-up Table for:
MOSAIC TYPE

Code	Explanation
S	SPLIT - The components of the mosaic are clearly identified within the map unit by the source codes of its constituent elements.
C	COMPOUND - The source code for the mosaic as a whole is identical to the codes for all of its constituent associations (as specified within NVIS).
M	MIXED - The source code for the mosaic as a whole is not identical to the codes, for some or all of its constituent associations (in NVIS). I.e. this is a mixture of the two above options.

Attribute: MU04 - NUMBER OF VEGETATION DESCRIPTIONS		
Heading	Details	
Purpose:	To count the number of discrete vegetation descriptions occurring within the map unit.	
Requirement:	Essential	
Database Field Name:	NUMBER_OF_VEG_DESCRIPTIONS	NUMBER_OF_VEG_DESCRIPTIONS [map unit]

Description:	This attribute provides a quick summary of the number of discrete vegetation descriptions occurring within the one map unit. It is a simple sum of the number of discrete vegetation descriptions occurring within the map unit.¶ Map Unit has one discrete sub-association = 1¶ Map Unit has two discrete sub-association = 2	
Value:	Number(10)	Access Number field (long integer)
Example:	3	
Comments:	This field checks the integrity of the relevant records in the VEGETATION_DESCRIPTION table through relevant rules (see Section 4).	
Status:	Implemented in the NVIS Oracle database.	Note: provision is made for this field in the ANVMP Database but values have not been entered.

Attribute: MU05 - VEG DESCRIPTION POSITION		
Heading	Details	
Purpose:	To document the relative areas or proportions of each vegetation description within the map unit.	
Requirement:	Essential	
Database Field Name:	VEG_DESC_POSITION	VEG_DESC_POSITION [Map Unit]
Description:	Each discrete vegetation description (ideally sub-associations) within the map unit is assigned a unique number. The vegetation description with the greatest area must be assigned a value of '1'.¶ The number assigned to the remaining sub-associations (if they exist in the unit) should be allocated according to decreasing spatial area. Where there is no clear pattern of spatial dominance for subsequent sub-associations, the numbering can be arbitrary.	

Value:	Number(10)	Access Number field (long integer)
Example:	3	
Comments:	This is a new field which arose as part of the restructure (2001-02) process. It is similar in intended function to the obsolete field VEGETATION DESCRIPTION NUMBER in the VEG_DESCRIPTION table.	
Status:	Implemented in the NVIS Oracle database.	Provision has been made for this field in the ANVMP Database but values have not been assigned as the dataset has not been submitted for inclusion in the National dataset.

Attribute: MU06 - VEG DESCRIPTION PROPORTION		
Heading	Details	
Purpose:	To document the estimated percentage area of each vegetation description within the map unit.	
Requirement:	Optional	
Database Field Name:	VEG_DESC_PROPORTION	
Description:	Percentage of each vegetation description.	
Value:	Number(10)	Access Number field (long integer)
Example:	40	
Comments:	This is a new field which arose as part of the restructure (2001-02) process.	
Status:	Implemented in the NVIS Oracle database.	Provision has been made for this field in the ANVMP Database but values have not been assigned as the dataset has not been submitted for inclusion in the National dataset.

Attribute: WAVIS_ID		
Heading		
Purpose:		
Requirement:		

Database Field Name:		WAVIS_ID
Description:		
Value:		Access Text field (Char 50)
Example:		
Comments:		This field is a Vegetation Identifier in the WA_VIS 2003 database. WAVIS_ID is equivalent to Veg_ID in the NVIS and ANVMP Database. WAVIS is the Pre European (Beard) vegetation dataset - Implementation of the National Vegetation Information System (NVIS) Model by the Department of Agriculture WA.
Status:		Provision was made for WAVIS_ID during the initial development of the ANVMP Database but probably can be deleted if there is not likely to be any requirement for a functional link with WAVIS.

Vegetation Description Level Attributes

Reference Information

Attribute: VG01 - VEGETATION IDENTIFICATION		
Heading	Details	
Purpose:	To definitively identify each unique vegetation description at the jurisdictional level.	
Requirement:	Mandatory	
Database Field Name:	VEG_ID	VEG_ID [Veg Description]

Description:	This is a unique number assigned by each jurisdiction to each unique vegetation description. It is suggested that the numbers are assigned sequentially within a State or Territory. Ideally each VEG_ID can be matched to a single NVIS_ID on a 1:1 basis.	This is an auto number generated in the VEG_ID field of the ANVMP Database Access table: [veg_description]. VEG_ID is a unique identifier for each Vegetation description entered into the ANVMP Database.
Value:	Number(10)	auto number, Access number field (long integer)
Example:	3078	
Comments:	Once assigned, the number cannot be changed.	
Status:	New field: not yet implemented in the NVIS Oracle database.	Implemented in the ANVMP Database (Access Version)

Attribute: VG02 - NVIS IDENTIFICATION		
Heading	Details	
Purpose:	To definitively identify each unique vegetation description at the national level.	
Requirement:	Commonwealth	
Database Field Name:	NVIS_ID	
Description:	This is a number assigned by the Commonwealth to each unique vegetation description supplied by the States and Territories. The numbers are assigned sequentially on initial receipt of the data. Ideally each SOURCE_CODE (and/or VEG_ID) can be matched to a single NVIS_ID on a 1:1 basis.	
Value:	Number(10)	
Example:	3078	
Comments:	Once assigned, the number cannot be changed. Maintenance of this field is highly desirable and would be essential in a fully distributed system.	No provision has been made for this field in the Avon Vegetation Map database as vegetation descriptions are not currently being supplied to the Commonwealth. Also, for the purposes of the Avon Vegetation Map Database, VEG_ID is a functional equivalent of NVIS_ID.

Status:	Implemented in the NVIS Oracle database.	Not Implemented in the Avon Vegetation Map Database (Access Version)
Attribute: VG03 - SOURCE CODE		
Heading	Details	
Purpose:	To enable labelling of each mapping unit with the original mapping code used by the data supplier (usually a State or Territory).	To enable labeling and identification of each source vegetation description. To provide a key link between the vegetation attributes in the Avon Vegetation Map Database [veg_description] and the spatial data layer.
Requirement:	Mandatory	
Database Field Name:	SOURCE_CODE	SOURCE_CODE [veg_description]
Description:	The original mapping code used by the data custodian for labeling and displaying the map unit. The original code used by the data supplier for uniquely describing or identifying the vegetation description.¶ If there is a hierarchy in the coding, the lowest level (i.e. the most detailed or descriptive level) should be provided.	A code assigned manually to the Avon Vegetation Map Database and used for labeling and uniquely identifying the source vegetation description. This code is comprised of 6 undelimited characters derived from the source reference code and the map/remnant parcel code followed by a description number.
Value:	Character(50).	Access Text field (char 50)
Example:	1023 [F3]; 130 [411]; 2005300; 28c_MV; A1; AH0035; KI023A; Land unit 6b1; a8,10Sr k2Ci [803]	085010_0

Comments:	These codes will generally not be comparable between data sets or jurisdictions. This attribute allows the NVIS coding to be matched to the original coding for the sub-association. This field is critical to communicating with collaborators and identifying additional (e.g. printed) information on the vegetation description.	The SOURCE_CODE [veg_description] field attribute in the Avon Vegetation Map Database is defined differently to that of NVIS (2003) database. For some of the source data relevant to the ANVMP Database, the original source map units and the corresponding vegetation described in the source documents are not always correlated using explicit labels or codes. A surrogate source code is thus created manually to serve this function for the Avon database. Any original source map annotation or code interpreted as identifying the spatial context of a vegetation description in the source map is quoted with the vegetation source description itself in the database SOURCE_DESCRIPTION field (see entry for SOURCE_DESCRIPTION [veg_description]. This is done using the format: [Original Map Veg Unit: xxxxx] followed by the source vegetation description text.*
Status:	Implemented in the NVIS Oracle database.	Implemented in the Avon Vegetation Map Database (Access Version)
Descriptive Information		

Attribute: VG04 - LEVEL OF DETAIL		
Heading	Details	
Purpose:	To describe the level of detail in the NVIS Information Hierarchy at which the vegetation description has been supplied by the data custodian.	
Requirement:	QAQC	
Database Field Name:	LEVEL_OF_DETAIL (was: ENTRY_LEVEL)	LEVEL_OF_DETAIL [veg_description]

Description:	This is used to readily identify the most complex level of data description supplied for each vegetation type.¶ The vegetation description entry level (association or sub-association) determines the expected detail of stratum information supplied for the vegetation description.	
Value:	Character(50). This is a value set from a defined lookup table. The values in the lookup table are set by the administrator and cannot be added to.	Access Text field (Char 50)
Example:	sub-association	Level 6 - Sub-Association
Comments:	For future data supply, the minimum expected level of entry would be Association/Level 5.	For the Avon Vegetation Map Database, provision has been made for identifying entry at all NVIS levels (1 to 6.) The value for each level is selected from a look up table. *
Status:	Implemented in the NVIS Oracle database. Issue of legacy content.	Implemented in the Avon Vegetation Map Database (Access Version)

Look-up Table for:
LEVEL OF DETAIL

Code	Explanation	
Level1_Class	For the ecologically dominant stratum only: growth form. Level 1	Avon Vegetation Map database Lookup table only
Level2_Structural Formation	For the ecologically dominant stratum only: structural formation class term only (Growth form, cover and height are implied as per Table 4 in Section 2). Level 2	Avon Vegetation Map database Lookup table only
Level3_Broad Floristic Formation	For the ecologically dominant stratum only: 1 dominant genus name plus structural formation class term only ((Growth form, cover and height are implied as per Table 4 in Section 2). Level 3	Avon Vegetation Map database Lookup table only

Level4_Sub-Formation	For each stratum (maximum of 3 strata): 1 dominant genus name plus structural formation class term only (Growth form, cover and height are implied as per Table 4 in Section 2). The ecologically predominant stratum is indicated (with a plus symbol: "+"); level 4	Avon Vegetation Map database Lookup table only
level5_association	For each stratum (maximum of 3 strata): floristic information (up to 3 dominant and/or diagnostic species) plus structural formation (Growth form, cover and height are implied as per Table 4 in Section 2). The ecologically predominant stratum is indicated (with a plus symbol: "+"); level 5	NVIS & Avon Vegetation Map database Lookup table
level6_sub-association	For each layer/sub-stratum (maximum of 8 sub-strata): floristic information (up to 5 dominant and/or diagnostic species) plus structural formation (Growth form, cover and height are implied as per Table 4 in Section 2). The ecologically predominant stratum is indicated (with a plus symbol: "+"); level 6	NVIS & Avon Vegetation Map database Lookup table

Attribute: VG05 - NUMBER OF STRATA		
Heading	Details	
Purpose:	To identify the number of (sub-)strata described within a vegetation description.	
Requirement:	QAQC	
Database Field Name:	NUMBER_OF_STRATA	NUMBER_OF_STRATA [veg_description]
Description:	This attribute provides a quick summary of the number of discrete sub-strata occurring within the one vegetation description. A maximum number of eight sub-strata per sub-association can be reported. The value is provided by the data supplier.	

Value:	Number(10); Valid range 1-8; There is no particular importance placed on the order of the sub-strata, although previous versions of NVIS specified listing the sub-strata in order of decreasing dominance. Whatever order is chosen should be documented in the Data_Set table.	Access Number field (long integer)
Example:	3	
Comments:	This field checks the integrity of the relevant records in the Stratum table through relevant rules (see Section 4).	
Status:	Implemented in the NVIS Oracle database.	Provision has been made for this field in the Avon Vegetation Map Database but no values have been entered
Attribute: VG06 - LEVEL 1 (CLASS)		
Heading	Details	
Purpose:	To describe level 1 (i.e. the class defining the vegetation type) within the NVIS Information Hierarchy (refer to Table 1).	
Requirement:	Automated	Entered manually
Database Field Name:	L1_CLASS	L1_CLASS [veg_description]
Description:	The description of class should include the growth form for the ecologically dominant stratum of the vegetation type/description (refer to Tables 2 and 3).	
Value:	Character(50).	Access text field (Char 100)
Example:	Tree	Shrub
Comments:	This attribute should be derived from level 5 or 6 using a rule set.	
Status:	Implemented in the NVIS Oracle database. Need to change field name in the NVIS database.	Implemented in the Avon Vegetation Map Database (Access Version)

Attribute: VG07 - LEVEL 2 (STRUCTURAL FORMATION)		
Heading	Details	
Purpose:	To describe level 2 (i.e. the structural formation defining the vegetation type) within the NVIS Information Hierarchy (refer to Table 1).	
Requirement:	Automated	Entered manually
Database Field Name:	L2_STRUCTURAL_FORMATION	L2_STRUCTURAL_FORMATION [veg_description]
Description:	The description of structural formation should include dominant growth form, height and cover (using the terminology of Tables 2, 3 and 4) for the ecologically dominant stratum of the vegetation type/description.	
Value:	Character(2000).	Access Text field (Char 200)
Example:	Tall open forest	Tall Shrubland
Comments:	This attribute should be derived from level 5 or 6 using a rule set.	
Status:	Implemented in the NVIS Oracle database. Need to change field name in the NVIS database.	Implemented in the Avon Vegetation Map Database (Access Version)

Attribute: VG08 - LEVEL 3 (BROAD FLORISTIC FORMATION)		
Heading	Details	
Purpose:	To describe level 3 (i.e. the broad floristic formation defining the vegetation type) within the NVIS Information Hierarchy.	
Requirement:	Automated	Entered manually
Database Field Name:	L3_BROAD_FLORISTIC_FORMATION	L3_BROAD_FLORISTIC_FORMATION [veg_description]

Description:	This attribute describes the vegetation type/description with floristic information at the level of genus, plus the structural formation of the dominant stratum reported at the sub-formation level (Level 4) of the NVIS Information Hierarchy (see Table 1). Refer to tables 2, 3 and 4.	
Value:	Character(2000).	Access Text field (Char 200)
Example:	Eucalyptus tall open forest.	Acacia Tall Shrubland
Comments:	This attribute should be derived from level 5 or 6 using a rule set.	
Status:	Implemented in the NVIS Oracle database. Need to change field name in the NVIS database.	Implemented in the Avon Vegetation Map Database (Access Version)

Attribute: VG09 - LEVEL 4 (SUB-FORMATION)		
Heading	Details	
Purpose:	To describe level 4 (i.e. the sub-formation defining the vegetation type) within the NVIS Information Hierarchy.	
Requirement:	Automated	Entered manually
Database Field Name:	L4_SUB_FORMATION	L4_SUB_FORMATION [veg_description]
Description:	For each stratum, the sub-formation description of the vegetation type should include floristic information (genus) plus the structural formation (dominant growth form, cover, height are implied). A maximum of three strata is allowed and the dominant stratum is indicated by a plus symbol "+". Refer to tables 1, 2, 3 and 4.	
Value:	Character(2000).	Access Text field (Char 255)
Example:	Eucalyptus tall open forest\Banksia open shrubland\Themeda open tussock grassland	Eucalyptus Low Open Woodland\+Acacia Tall Shrubland\Stipa Mixed Low Open Tussock Grassland

Comments:	This attribute should be derived from level 5 or 6 using a rule set. As at the time of writing, June 2003, the user must input "(mixed)" at this level, if there is no clear dominant genus in a stratum.	
Status:	Implemented in the NVIS Oracle database. Need to change field name in the NVIS database.	Implemented in the Avon Vegetation Map Database (Access Version)
Attribute: VG10 - LEVEL 5 (ASSOCIATION)		
Heading	Details	
Purpose:	This attribute describes level 5 (i.e. an association level description of the vegetation type) within the NVIS Information Hierarchy (refer to Table 1).	
Requirement:	Essential	Entered manually
Database Field Name:	L5_ASSOCIATION	L5_ASSOCIATION [veg_description]
Description:	For each stratum, the association description of the vegetation type should include floristic information for the dominant and/or diagnostic species (maximum of 3 species per stratum) plus the structural formation (dominant growth form, cover, height are implied). A maximum of three strata (upper, mid and ground) are allowed and the dominant stratum is indicated by a plus symbol "+". Refer to tables 1, 2, 3 and 4. For documentation of the dominance and the hats ^, please see Section 2.	
Value:	Character(2000).	Access memo field
Example:	Refer to the Example for Association in Table 6.	U^*Eucalyptus loxophleba**Eucalyptus*\^tree\6\r;M+^*Acacia acuminata**Acacia*\^shrub\4\c;G^^*Stipa trichophylla*,*Neurachne alopecuroidea,Borya nitida**Stipa*\^tussock grass,rush\1\i

Comments:	This attribute should be entered directly at this level if the source vegetation data will only support an association-level and not a sub-association-level description. Alternatively, the data can be derived from level 6 using a rule set and/or the use of expert knowledge. As at the time of writing, Feb 2003, the user must interpret this level from level 6 data.	
Status:	Implemented in the NVIS Oracle database. Need to change field name in the NVIS database.	Implemented in the Avon Vegetation Map Database (Access Version)

Attribute: VG11 - LEVEL 6 (SUB-ASSOCIATION)		
Heading	Details	
Purpose:	This attribute describes the sub-association level description of the vegetation description as defined within the NVIS Information Hierarchy (refer to Table 1).	
Requirement:	Essential	Entered manually
Database Field Name:	L6_SUB_ASSOCIATION	L6_SUB_ASSOCIATION [veg_description]
Description:	For each layer/sub-stratum, the sub-association description of the vegetation type should include floristic information for the dominant and/or diagnostic species (maximum of 5 species per sub-stratum) plus the structural formation (dominant growth form, cover, height are implied). A maximum of eight sub-strata (as per Table 2) are allowed and the dominant sub-stratum is indicated by a plus symbol "+". Refer to tables 1, 2, 3 and 4. For documentation of dominance and the hats ^, please see Section 2.	Maximum of 5 species per substratum - see comment note for this field
Value:	Character(2000).	Access memo field

Example:	Refer to the example for Sub-Association in Table 6.	U1^*Eucalyptus loxophleba**Eucalyptus*\^tree\6\r;*U2Allocasuarina huegeliana**Allocasuarin*a\tree\6\i;M1+^*Acacia acuminata**Acacia*\^shrub\4\c;G1^^*Stipa trichophylla,Neurachne alopecuroidea*,*Borya nitida,Ptilotus polystachyus,Dampiera candicans**Stipa*\^tussock grass,rush,forb,\1\i
Comments:	This attribute should be entered directly at this level if the source vegetation data will support a sub-association-level description.	Only 5 species are referred to in the L6_SUB_ASSOCIATION coded description, but these may be the first 5 of more than 5 listed in the [taxon_data] table for a given substratum. For the ANVMP no limit was put on the number of species entered into the taxon data list if these species were supplied in the source description and attributable to a given substratum.
Status:	Implemented in the NVIS Oracle database. Need to change field name in the NVIS database.	Implemented in the ANVMP Database (Access Version)

Attribute: VG12 - SOURCE DESCRIPTION		
Heading	Details	
Purpose:	To describe the mapping unit as used by the data supplier.	
Requirement:	Essential	
Database Field Name:	SOURCE_DESCRIPTION	SOURCE_DESCRIPTION [veg_description]
Description:	A written description of the original vegetation description used by the data custodian. The written description will be the same as that name held in the original data set, sourced from the custodian of the data.	For the ANVMP database, the source description also includes information relating to the original mapping codes and annotation used by the source data authors for labeling and displaying the map unit (see SOURCE_CODE).
Value:	Character(2000).	Access memo field
Example:	Montane grassy woodland¶ Coastal vine-rich forest	[Original Map Veg Unit:Type 9]Acacia Dense Thicket over *Phebalium tuberculosum* Open Dwarf Scrub C. ¶*Acacia affin. resinomarginea* shrubs, mature, 4-7m tall, 2-10% canopy cover over *Phebalium tuberculosum* shrubs, mature, 1m tall, 2-10% canopy cover. Also recorded were: *Amhipogon debilis, Glischrocaryon flavescens, Melaleuca uncinata* and *Santalum acuminatum.*

Comments:	These descriptions will generally not be comparable between data sets or jurisdictions.¶ This attribute allows the NVIS sub-association description to be matched to the original description for the sub-association.	In some cases the written description in the SOURCE_DESCRIPTION field is not exactly the same as that presented in the source documentation. For example some original source descriptions attributed to a mapped unit may reflect a high degree of structural and floristic heterogeneity. These descriptions may need to be disaggregated into attributable subunits comprising an unknown mosaic. Other sources may define a salt complex as one vegetation type but within this may describe several different components associated with low rises, flats or channels. This disaggregation is necessary in order for the floristic and structural information in the description to be correlated with the discrete structural class intervals defined by NVIS database field criteria. These subunits or "attributed components" are entered as separate Source Descriptions and are treated as "unknown mosaic".
Status:	Implemented in the NVIS Oracle database.	Implemented in the Avon Vegetation Map Database (Access Version)

Attribute: VG13 - ENVIRONMENTAL DESCRIPTION		
Heading	Details	
Purpose:	To describe the environmental characteristics that consistently occur within the vegetation type.	
Requirement:	Recommended	
Database Field Name:	ENVIRONMENTAL_DESCRIPTION	ENVIRONMENTAL_DESCRIPTION [veg_description]

Description:	A description of environmental parameters that consistently occur within the vegetation description and thereby help to define it.¶ Descriptions should be categorical and concentrate on the main physical drivers that influence the type and extent of vegetation. Attributes should include where available geographical location (e.g. Hunter Valley or an IBRA region), soil type/s (e.g. soil depth, texture, structure), geology (e.g. basalt), landform patterns/units (e.g. upper slopes and ridge lines), terrain (elevation range, slope, solar radiation and aspect), climatic types (e.g. long hot dry summer, mild wet winter). Where possible use key words and look up tables linked to published source material.	
Value:	Character(2000).	Access memo field
Example:	This type of vegetation occurs on old sand dunes. The distribution appears to correlate with sheltered moist areas on the landward side of the Rainforests on the deep sands along the east coast of the Range. The recorded fire history varies but cool ground fires are likely to be common and patchy.	[breakaway slope] Mallee over Melaleuca coronicarpa Heath is found on scarp slopes immediately below the breakaway and on flat terrain. The association favours duplex soils or shallow red soils overlying the residual laterite debris associated with breakaways. The upper stratum of Mallee may be absent on scree slopes.
Comments:		In some cases the Source document may not provide an explicit environmental description but from the source map rendering is apparent that the vegetation relates to features representing a particular soil/landform e.g. Salt Flat or Granite Outcrop. Or the environmental context is embodied in the vegetation description itself. In such cases a non source comment is entered using the format: [.....] e.g.: [breakaway slope]; [Granite]
Status:	Implemented in the NVIS Oracle database.	

Attribute: AMALGAMATED_TAXA_DESC*		
Heading	Details	
Purpose:		To enable operation of Access Query tool
Requirement:		
Database Field Name:		AMALGAMATED_TAXA_DESC[veg_description]
Description:		A delimited text string amalgamating Species and their respective dominance qualifiers within all substrata. Each text string is generated from the relevant database field values related to a given source code.
Value:		Access memo field (values generated via SQL code)
Example:		U1.N-Dominant.Eucalyptus.loxophleba..;M1.Y-Co-dominant.Santalum.acuminatum..;M1.Y-Co-dominant.Melaleuca.uncinata..;M1.Y-Co-dominant.Alyxia.buxifolia..;M1.Y-Co-dominant.Acacia.tratmaniana..;M1.Y-Co-dominant.Acacia.saligna..;G3.N-Co-dominant.Mesomelaena.stygia..;G3.N-Co-dominant.Lepidosperma.gracile..;G3.N-Co-dominant.Lepidobolus.chaetocephalus..;G2.N-Co-dominant.Stipa.elegantissima..;G2.N-Co-dominant.Neurachne.alopecuroidea..;G1.N-Co-dominant.Rhagodia.ulicina..;G1.N-Co-dominant.Olearia.axillaris..;G1.N-Co-dominant.Melaleuca.pentagona..;G1.N-Co-dominant.Gastrolobium.spinosum..;G1.N-Co-dominant.Daviesia.cardiophylla..;
Comments:		This field was established to facilitate the operation of a prototype query tool to find the location of species/taxa selected according to various dominance and stratum criteria. Running the query generates a text file with the relevant location codes (i.e. polygon identifiers) that can be interpreted by the spatial data viewer.(e.g. ArcGIS™)*
Status:	Not Applicable to the NVIS database	Implemented in the Avon Vegetation Map Database (Access Version) only

Attribute: (Truncated) LEVEL 5 (ASSOCIATION)*		
Heading	Details	
Purpose:		Text field copy of memo field such that the field value (or part thereof) can be viewed as a shapefile attribute in ArcGIS
Requirement:		
Database Field Name:		TRUNCATED_L5_ASSOCIATION [veg_description]
Description:		255 character text field copy of Access database memo field. The Text field copy is compatible with ArcGIS shape file attribute table field properties
Value:		Access Text field (Char 255)
Example:		
Comments:		In Access, a memo field can hold a character text string greater than 255 characters necessary to accommodate some of the longer source and environmental descriptions. ArcGIS can accept a 255 character text field but not a memo field. In some cases where the memo field value is greater than 255 characters, the text field copy will be truncated to 255 characters and some of the original text will be missing.
Status:	Not Applicable to the NVIS database	Implemented in the Avon Vegetation Map Database (Access Version) only

Attribute: (Truncated) LEVEL 6 (SUB_ASSOCIATION)*		
Heading	Details	
Purpose:		Text field copy of memo field such that the field value (or part thereof) can be viewed as a shapefile attribute in ArcGIS
Requirement:		
Database Field Name:		TRUNCATED_L6_SUB_ASSOCIATION [veg_description]
Description:		255 character text field copy of Access database memo field. The Text field copy is compatible with ArcGIS shape file attribute table field properties
Value:		Access Text field (Char 255)
Example:		

Comments:		In Access, a memo field can hold a character text string greater than 255 characters necessary to accommodate some of the longer source and environmental descriptions. ArcGIS can accept a 255 character text field but not a memo field. In some cases where the memo field value is greater than 255 characters, the text field copy will be truncated to 255 characters and some of the original text will be missing.
Status:	Not Applicable to the NVIS database	Implemented in the Avon Vegetation Map Database (Access Version) only

Attribute: (truncated) SOURCE DESCRIPTION*		
Heading	Details	
Purpose:		Text field copy of memo field such that the field value (or part thereof) can be viewed as a shapefile attribute in ArcGIS
Requirement:		
Database Field Name:		TRUNCATED_SOURCE_DESCRIPTION [veg_description]
Description:		255 character text field copy of Access database memo field. The Text field copy is compatible with ArcGIS shape file attribute table field properties
Value:		Access Text field (Char 255)
Example:		
Comments:		In Access, a memo field can hold a character text string greater than 255 characters necessary to accommodate some of the longer source and environmental descriptions. ArcGIS can accept a 255 character text field but not a memo field. In some cases where the memo field value is greater than 255 characters, the text field copy will be truncated to 255 characters and some of the original text will be missing.
Status:	Not Applicable to the NVIS database	Implemented in the Avon Vegetation Map Database (Access Version) only

Attribute:(truncated) ENVIRONMENTAL_DESCRIPTION*		
Heading	Details	
Purpose:		Text field copy of memo field such that the field value (or part thereof) can be viewed as a shapefile attribute in ArcGIS
Requirement:		

Database Field Name:		TRUNCATED_ENVIRONMENTAL_DESCRIPTION [veg_description]
Description:		255 character text field copy of Access database memo field. The Text field copy is compatible with ArcGIS shape file attribute table field properties
Value:		Access Text field (Char 255)
Example:		
Comments:		In Access, a memo field can hold a character text string greater than 255 characters necessary to accommodate some of the longer source and environmental descriptions. ArcGIS can accept a 255 character text field but not a memo field. In some cases where the memo field value is greater than 255 characters, the text field copy will be truncated to 255 characters and some of the original text will be missing.
Status:	Not Applicable to the NVIS database	Implemented in the Avon Vegetation Map Database (Access Version) only

XML_LOADDATE

Heading	Details	
Purpose:		
Requirement:		
Database Field Name:	XML_LOADDATE	
Description:		WAVIS database field
Value:		
Example:		
Comments:		WAVIS is the Pre European (Beard) vegetation dataset - Implementation of the National Vegetation Information System (NVIS) Model by the Departement of Agriculture WA.
Status:	Not Applicable to the NVIS database	Provision was made for certain WAVIS database fields during the initial development of the Avon Vegetation Map database. No values have been entered into these fields. These fields can probably be deleted as there is not likely to be any requirement for a functional link with WAVIS.

XML_STATUS

Heading	Details	
Purpose:		

Requirement:		
Database Field Name:	XML_STATUS	
Description:		WAVIS database field
Value:		
Example:		
Comments:		WAVIS is the Pre European (Beard) vegetation dataset - Implementation of the National Vegetation Information System (NVIS) Model by the Departement of Agriculture WA.
Status:	Not Applicable to the NVIS database	Provision was made for certain WAVIS database fields during the initial development of the Avon Vegetation Map database. No values have been entered into these fields. These fields can probably be deleted as there is not likely to be any requirement for a functional link with WAVIS.

Community_ID

Heading	Details	
Purpose:		
Requirement:		
Database Field Name:	Community_ID	
Description:		WAVIS database field
Value:		
Example:		
Comments:		WAVIS is the Pre European (Beard) vegetation dataset - Implementation of the National Vegetation Information System (NVIS) Model by the Departement of Agriculture WA.
Status:	Not Applicable to the NVIS database	Provision was made for certain WAVIS database fields during the initial development of the Avon Vegetation Map database. No values have been entered into these fields. These fields can probably be deleted as there is not likely to be any requirement for a functional link with WAVIS.

Detailed Vegetation Attributes

Structural Information

Attribute: ST01 - STRATUM CODE		
Heading	Details	
Purpose:	To briefly describe the sub-stratum.	These fields relate to structural information about each substratum as a whole identified in the source vegetation description i.e. Cover, Height and Dominance contribution.
Requirement:	Essential	
Database Field Name:	STRATUM_CODE	STRATUM_CODE [Stratum]
Description:	The stratum code defines each sub-stratum with a letter that corresponds with the stratum, and a number that describes the position within the stratum of a particular sub-stratum, in order of decreasing relative height, e.g. U1 > U2 > U3. I.e. U1 is always the tallest tree layer. The stratum code does not imply dominance.	
Value:	Character(20); This is a value set from a defined lookup table. The values in the lookup table are set by the administrator and cannot be added to.	Access text field (Char 10)
Example:	U1	
Comments:	Note that E, for emergent, is no longer a valid value. In the validation of the NVIS (2000) dataset in the Commonwealth, most E sub-strata have been converted to U1 sub-stratum, as appropriate. Several E sub-strata have been converted to M sub-strata.	*

Status:	Implemented in the NVIS Oracle database.	Implemented in the Avon Vegetation Map Database (Access Version)
Look-up Table for: STRATUM CODE		
Code	Explanation	
U1	Upper - Tallest sub-stratum. For forests and woodlands this will often, but not always, be the dominant sub-stratum. For a continuum, the tallest stratum becomes the defining stratum.	
U	Upper - Tree layer; for data supplied at NVIS Level 5.	
U2	Upper - Sub canopy layer, second tree layer	
U3	Upper - Sub canopy layer, third tree layer	
M1	Mid - Tall shrub layer	
M	Mid - Mid (shrub) layer; for data supplied at NVIS Level 5.	
M2	Mid - Mid shrub layer	
M3	Mid - Low shrub layer.	
G1	Lower - Tall ground layer.	
G	Ground - Ground layer; for data supplied at NVIS Level 5.	
G2	Lower - Low ground layer	
Attribute: ST02 - SUB-STRATUM RANK		
Heading	Details	
Purpose:	To assign a number to each sub-stratum in a stratum in order of decreasing dominance.	
Requirement:	Recommended	
Database Field Name:	SUB_STRATUM_RANK (was: STR_NUMBER)	SUB-STRATUM_RANK [stratum]

Description:	A number assigned to each sub-stratum within a stratum in order of decreasing dominance. Rather than number sub-strata in order of decreasing dominance across the whole vegetation profile, comparing similar entities will be easier for the assignment of dominance to sub-strata within each stratum. Dominance would be based on an estimate of biomass (cover x height) for each sub-stratum.	*
Value:	Number(10); Valid range for NVIS: 1-3.	Access number field (long integer)
Example:	2	
Comments:	Applies to data supplied at NVIS Level 6 only. This attribute does not necessarily work on decreasing height of the sub-stratum, as does STRATUM_CODE. This attribute is subject to further review with respect to improving the transparency of generating Level V descriptions from Level VI.	Sometime determining relative order of dominance was assisted by application of a "rule of thumb" formulae incorporating stratum or substratum height and cover values to give a quotient for each stratum/substratum Where: H1: minimum height value H2: maximum height value C1: minimum cover value C2: maximum cover value DI: “Dominance Index” for a stratum/substratum Then: DI = ((H1*C1) + (H2*C2))/2
Status:	Similar (v. 5.0) field implemented in the NVIS Oracle database.	Implemented in the Avon Vegetation Map Database (Access Version)

Attribute: ST03 - NUMBER OF GROWTH FORMS		
Heading	Details	
Purpose:	To document the number of growth forms recorded for the (sub-)stratum.	
Requirement:	QAQC	
Database Field Name:	NUMBER_OF_GROWTH_FORMS	NUMBER_OF_GROWTH_FORMS [stratum]

Description:	This attribute provides a quick summary of the number of discrete growth forms occurring within one sub-stratum within the vegetation description. It is provided by the data supplier. A maximum number of five growth forms per sub-stratum can be reported.	
Value:	Number(10)	Access Number field (long integer)
Example:	3	
Comments:	This field checks the integrity of the relevant records in the Growth Form table through relevant rules (see Section 4).	
Status:	Implemented in the NVIS Oracle database.	*Provision is made for this field in the Avon Vegetation Map database structure but values have not been assigned as the dataset has not been submitted for inclusion in the National dataset.

Attribute: ST04 - NUMBER OF TAXA		
Heading	Details	
Purpose:	To document the number of taxa recorded for the (sub-)stratum.	
Requirement:	QAQC	
Database Field Name:	NUMBER_OF_TAXA	NUMBER_OF_TAXA [stratum]
Description:	This attribute provides a quick summary of the number of discrete taxa occurring within the one sub-stratum in the vegetation description. It is provided by the data supplier. A maximum number of five taxa per sub-stratum can be reported.	
Value:	Number (10)	Access Number field (long integer)
Example:	3	

Comments:	This field checks the integrity of the relevant records in the Taxon table through relevant rules (see Section 4).	*For the Avon Vegetation Map database no restriction is placed on the number of species that can be entered into the [TAXON_DATA] if these are listed by the source description for a given substratum. However only the first 5 ranked species in any substratum are included in the NVIS level 6 Description.
Status:	Implemented in the NVIS Oracle database.	Provision is made for this field in the Avon Vegetation Map database structure but values have not been assigned as the dataset has not been submitted for inclusion in the National dataset.
Attribute: ST05 - COVER TYPE		
Heading	Details	
Purpose:	To briefly specify the type of measure used in the COVER VALUE in the Stratum table.	
Requirement:	Essential	
Database Field Name:	COVER TYPE	COVER_TYPE [stratum]
Description:	This attribute must be completed if any of the COVER VALUE fields (MINIMUM, MAXIMUM, MEDIAN and/or MEAN) are recorded in the STRATUM table.¶ The codes are prefixed by:¶ N - Numeric Real Value¶ C - Numeric Classed Value (the values provided are the upper and lower ranges of a cover class category)¶ Q - Qualitative Value	
Value:	Character(20). This is a value set from a defined lookup table. The values in the lookup table are set by the administrator and cannot be added to.	Access text field (char 20)
Example:	1N	

Comments:	The numbers for the "C" options have been simplified, so that the number refers to the type of cover measure. (The letter refers to how it is reported.) Options 10Q (frequency) and 11Q (Dominance), from version 5.0 of the Aust. Veg. Attributes, have been removed, since these values would not be valid options in the STRATUM table. Also, FREQUENCY and DOMINANCE are separate fields in the GROWTH_FORM and TAXON tables.	*
Status:	Implemented in the NVIS Oracle database. The options 5C to 9C will need to be changed to 1C to 5C, respectively. Also, decisions made about 10Q and 11Q, where these exist.	Implemented in the Avon Vegetation Map Database (Access Version)

Look-up Table for:
COVER TYPE

Code	Explanation	
1N	Crown or Canopy Cover:§ Crown Cover is defined as the percentage of the sample site within the vertical projection of the periphery of the crowns. In this case crowns are treated as opaque (Walker and Hopkins 1990). § Crown cover is estimated using the mean gap between crowns divided by mean crown width (the crown separation ratio) (Walker and Hopkins 1990).§ The cover values provided for the NVIS are the summed and averaged values for each sub-association, generally determined from the synthesis of site data.§ Values may include the minimum, maximum, mean and median.	

2N	Foliage Cover:§ Foliage cover is defined as the percentage of the sample site occupied by the vertical projection of foliage and branches (if woody) (Walker and Hopkins 1990). § For ground vegetation, it is measured using line intercept methods. It will, to some degree take into account the thickness of a clump of grass.§ % crown cover x crown type (Walker and Hopkins 1990) § The cover values provided for the NVIS are the summed and averaged values for each sub-association, generally determined from the synthesis of site data.§ Values may include the minimum, maximum, mean and median.	This cover type appears to have the most equivalence to Muir`s "Canopy Cover" i.e.: "the total area encompassed within the circumference of individual foliage clumps, and expressed as a percentage of a given area, e.g. quadrat or formation area." According to Muir (1977) The term is used in preference to the commonly used term ‘crown cover’ because it records the actual area of foliage more accurately. This is particularly so with mallees which have widely spaced foliage clumps. Muir adopts the percentage canopy cover groupings of (10%, 10-30%, 30-70% and 70-100% as used by Specht, Beard-Webb and others. These correspond with Cover classes associated with Foliage Cover in the NVIS Cover class tables. Muir argues that these are well established convenient groupings and probably represent fairly well the commonly used divisions of very sparse, sparse, medium and dense vegetation. It is not known to what level animals differentiate between various canopy covers, but it is probably safe to assume that they utilise 0-30% (sparse), differently from 30-70%, and 70-100% (very dense) vegetation. A lower limit of 2% canopy cover has been set by Muir because experience in wheatbelt vegetation has indicated that plants with less than 2% canopy cover are very widely spaced and do not appear as a stratum. In many source descriptions the term "scattered” appears to be used for cover < 2%. This has been interpreted as equivalent to NVIS cover code "bi", Canopy cover was estimated subjectively according to the four canopy cover groups. The accuracy of these estimates was occasionally checked using line transects. In many cases surveys using Muir`s classification do not specify or document the methods used to determine cover with the implication that the approach is largely a qualitative estimate. Therefore field "Cover Type" in database is usually entered as "unknown"
3N	Percentage Cover:§ The percentage of a strictly defined plot area, covered by vegetation, generally applicable for the ground vegetation that has been estimated rather than measured using line intercept methods. It does not necessarily take into account thickness of a clump of grass.§ The cover values provided for the NVIS are the summed and averaged values for each sub-association, generally determined from the synthesis of site data.§ Values may include the minimum, maximum, mean and median.	

4N	Projective Foliage Cover:§ The percentage of the sample site occupied by the vertical projection of foliage only (Walker and Hopkins 1990). § The cover values provided for the NVIS are the summed and averaged values for each sub-association, generally determined from the synthesis of site data.§ Values may include the minimum, maximum, mean and median.	
1C	Crown or Canopy Cover: As for 1N above but for data derived from or containing class intervals. § Crown Cover is defined as the percentage of the sample site within the vertical projection of the periphery of the crowns. In this case crowns are treated as opaque. § The cover values provided for the NVIS are the summed and averaged values for each sub-association, generally determined from the synthesis of site data.§ Values may include the minimum, maximum, mean and median. (Formerly 5C).	
2C	Foliage Cover: As for 2N above but for data derived from or containing class intervals. § Foliage cover is defined as the percentage of the sample site occupied by the vertical projection of foliage and branches (Walker and Hopkins 1990). § For ground vegetation, it is measured using line intercept methods. It will, to some degree take into account the thickness of a clump of grass.§ The cover values provided for the NVIS are the summed and averaged values for each sub-association, generally determined from the synthesis of site data.§ Values may include the minimum, maximum, mean and median. (Formerly 6C)	

3C	Percentage Cover: As for 3N above but for data derived from or containing class intervals. § The percentage of a strictly defined plot area, covered by vegetation, generally applicable for the ground vegetation that has been estimated rather than measured using line intercept methods. It does not necessarily take into account thickness of a clump of grass.§ The cover values provided for the NVIS are the summed and averaged values for each sub-association, generally determined from the synthesis of site data. Values may include the minimum, maximum, mean and median. (Formerly 7C)	
4C	Projective Foliage Cover: As for 2N above but for data derived from or containing class intervals. § The percentage of the sample site occupied by the vertical projection of foliage only (not branches) (Walker and Hopkins 1990). § The cover values provided for the NVIS are the summed and averaged values for each sub-association, generally determined from the synthesis of site data.§ Values may include the minimum, maximum, mean and median. (Formerly 8C)	
5C	Cover Abundance Rating: § Abundance class system eg. Braun-Blanquet.§ Percentage values may include the minimum and maximum. (Formerly 9C)	
not applicable	not applicable	
unknown	unknown	

Attribute: ST06 - COVER TYPE DERIVATION METHOD		
Heading	Details	
Purpose:	To provide further details on the type of measure used in the COVER VALUE in the Stratum table.	
Requirement:	Optional	
Database Field Name:	COVER_TYPE_DERIV_METHOD	COVER_TYPE_DERIV_METHOD [stratum]

Description:	A more detailed description of the COVER TYPE recorded, including the derivation method.¶ Where a cover abundance rating is recorded, specify the system applied and a reference where available.	
Value:	Character(2000).	Access text field (Char 255)
Example:	Braun-Blanquet	
Comments:		Although many wheatbelt survey references follow the Muir classification, In most cases explicit documentation of cover derivation methods are not given and it is assumed that cover is by and large the product of subjective or qualitative estimate. Where a cover class, but no specific stratum cover values, is given then this field is left blank, if specific cover values are given and the Muir Classification is used to describe vegetation then "Muir" is entered in this field
Status:	Implemented in the NVIS Oracle database. Recommend upgrade to contents of this field.	Implemented in the Avon Vegetation Map Database (Access Version)

Attribute: ST07 - COVER MINIMUM VALUE		
Heading	Details	
Purpose:	To record the minimum value of cover for the (sub-)stratum.	
Requirement:	Optional	
Database Field Name:	COVER_MINIMUM_VALUE	COVER_MINIMUM_VALUE [stratum]
Description:	A percentage value related to the COVER TYPE, expressed as the minimum value for the (sub-)stratum.¶ Actual values (TYPES 1N-4N), a class value (TYPES 5C-8C) or a qualitative value (TYPE 9Q) may be provided for this attribute. This record relates to the lowest value of the range. This value is provided by the data supplier when only classified cover data is available for the vegetation description.	

Value:	Number(5,1); Valid entries 0.0-100.0; Missing/unknown values = -9999	Access number field
Example:	10	
Comments:		Entered only if source description states that cover value as a minimum cover value. Where a source description provides a cover class only (i.e. in the case of a Muir description the cover class is implicit in the terminology which relates to a minimum and maximum value defining the cover class e.g. Muir "Heath B" represents a cover range of 30 to 70%). In the absence of any other explicit cover values. The lower and higher cover class values are not interpreted as valid minimum and Maximum values for the cover value fields - instead, the value -9999 is entered (with cover recoded only as an NVIS Cover Code - see entry under "cover code" field). Where a source description provides only one explicit cover value (rather than an unambiguous maximum and/or minimum value) then this value is entered in both minimum and maximum value fields - it is not interpreted as a valid "Mean" field value field unless it has been explicitly stated in the source description as a calculated statistic. In some cases the term "at least" is used with a single stated value - this is interpreted as the "minimum value" and entered in the corresponding field, with -9999 being entered into the maximum value field indicating a null value (as distinct from "0").
Status:	Implemented in the NVIS Oracle database.	Implemented in the Avon Vegetation Map Database (Access Version)

Attribute: ST08 - COVER MAXIMUM VALUE		
Heading	Details	
Purpose:	To record the maximum value of cover for the (sub-)stratum.	
Requirement:	Optional	
Database Field Name:	COVER_MAXIMUM_VALUE	COVER_MAXIMUM_VALUE [stratum]

Description:	A percentage value related to the COVER TYPE, expressed as the maximum value for the (sub-)stratum.¶ Actual values (TYPES 1N-4N), a class value (TYPES 5C-8C) or a qualitative value (TYPE 9Q) may be provided for this attribute. This record relates to the highest value of the range. This value is provided by the data supplier when only classified cover data is available for the vegetation description.	*
Value:	Number(5,1); Valid entries 0.0-100.0; Missing/unknown values = -9999	
Example:	70	
Comments:		Entered only if source description states that cover value as a maximum cover value. Where a source description provides a cover class only (i.e. in the case of a Muir description the cover class is implicit in the terminology which relates to a minimum and maximum value defining the cover class e.g. Muir "Heath B" represents a cover range of 30 to 70%). In the absence of any other explicit cover values. The lower and higher cover class values are not interpreted as valid minimum and Maximum values for the cover value fields - instead, the value -9999 is entered (with cover recoded only as an NVIS Cover Code - see entry under "cover code" field). Where a source description provides only one explicit cover value (rather than an unambiguous maximum and/or minimum value) then this value is entered in both minimum and maximum value fields - it is not interpreted as a valid "Mean" field value field unless it has been explicitly stated in the source description as a calculated statistic. In some cases the term "up to" is used with a single stated value - this is interpreted as the "Maximum value" and entered in the corresponding field, with -9999 being entered into the minimum value field indicating a null value (as distinct from "0").
Status:	Implemented in the NVIS Oracle database.	Implemented in the Avon Vegetation Map Database (Access Version)
Attribute: ST09 - COVER MEDIAN VALUE		

Heading	Details	
Purpose:	To record the median value of cover for the (sub-)stratum.	
Requirement:	Optional	
Database Field Name:	COVER_MEDIAN_VALUE	COVER_MEDIAN_VALUE [
Description:	A percentage value related to the COVER TYPE, expressed as the median value for the (sub-)stratum.¶ Actual values (TYPES 1N-4N) or a class value (TYPES 5C-8C) may be provided for this attribute.	
Value:	Number(5,1); Valid entries 0.0-100.0; Missing/unknown values = -9999	Access Number field
Example:	60	
Comments:		Interpreted as a valid "Median" field value field only if it has been explicitly expressed in the source data/description as a calculated statistic from a set of cover values
Status:	Implemented in the NVIS Oracle database.	Implemented in the Avon Vegetation Map Database (Access Version)

Attribute: ST10 - COVER MEAN VALUE		
Heading	Details	
Purpose:	To record the mean value of cover for the (sub-)stratum.	
Requirement:	Essential	
Database Field Name:	COVER_MEAN_VALUE	COVER_MEAN_VALUE [stratum]
Description:	A percentage value related to the SUB-ASSOCIATION STRATUM COVER TYPE, expressed as the mean value for the (sub-)stratum.¶ Actual values (TYPES 1N-4N) or a class value (TYPES 5C-8C) may be provided for this attribute.	

Value:	Number(5,1); Valid entries 0.0-100.0; Missing/unknown values = -9999	Access Number field
Example:	60	
Comments:		Interpreted as a valid "Mean" field value field only if it has been explicitly expressed in the source data/description as a calculated statistic from a set of cover values
Status:	Implemented in the NVIS Oracle database.	Implemented in the Avon Vegetation Map Database (Access Version)

Attribute: ST11 - COVER CODE		
Heading	Details	
Purpose:	To categorise the cover measurement for the stratum or sub-stratum.	
Requirement:	Essential	
Database Field Name:	COVER_CODE	COVER_CODE [stratum]
Description:	A code which is interpreted by the data custodian from primary measure(s) of cover for the (sub-)stratum. It summarises the cover measure in a form which is comparable across different methods of measurement.	
Value:	Character(20); This is a value set from a defined lookup table. The values in the lookup table are set by the administrator and cannot be added to.	Access text field (Char 100
Example:	d	

Comments:	The methods used to translate the associated TYPE and VALUE into the appropriate COVER CODE must be documented.	For the Avon Vegetation Map database the NVIS cover code may be derived from the stated cover values in the source description or in turn interpreted from the cover class provided by the source description. The NVIS COVER_CODE in many instances has been inferred from cover value class intervals implicit in the source description terminology (e.g. as from the Muir (1977) Classification.) and correlated with the corresponding NVIS cover value class intervals. The Muir Classification terminology expresses cover classes more or less congruently with NVIS "foliage cover" percentages. (see code "2C" explanation in look up table for attribute field "ST05 - COVER TYPE")
Status:	Implemented in the NVIS Oracle database.	Implemented in the Avon Vegetation Map Database (Access Version)
Look-up Table for: COVER CODE		

Code	Explanation	
d	Foliage cover 70-100% - Crown cover 80-100%	Equivalent to Muir Canopy Cover 70-100%
d	Ground cover 70-100%	
c	Foliage cover 30-70% - Crown cover 50-80%	Equivalent to Muir Canopy Cover 30-70%
c	Ground cover 30-70%	
i	Foliage cover 10-30% - Crown cover 20-50%	Equivalent to Muir Canopy Cover 10-30%
i	Ground cover 10-30%	
r	Foliage cover less than 10% - Crown cover 0.25-20%	Equivalent to Muir Canopy Cover 2-10% ("A lower limit of 2% canopy cover has been set because experience in wheatbelt vegetation has indicated that plants with less than 2% canopy cover are very widely spaced." Muir 1977)
r	Ground cover less than 10%	
bi	Foliage cover ~0% (scattered) - Crown cover 0-0.25%	No direct Muir cover class equivalent but may applied where stratum cover is described in terms of "scattered clumps" (e.g. Veg id 217)
bi	Ground cover ~0% (scattered)	
bc	Foliage cover ~0% (clumped) - Crown cover 0-0.25%	
bc	Ground cover ~0% (clumped)	

unknown	unknown	
Attribute: ST12 - HEIGHT TYPE		
Heading	Details	
Purpose:	To describe the method used to provide the HEIGHT VALUE.	
Requirement:	QAQC	
Database Field Name:	HEIGHT_TYPE	HEIGHT_TYPE [stratum]
Description:	The measurement point for the heights of each (sub-)stratum. This can vary depending on observer and will probably always be somewhat imprecise, as there is no unequivocal method for defining the height measurement point of particular sub canopy layers or stratum. The delineation of these layers or strata is generally subjective, relying on the recorders perception of heights and can be complicated by the vegetation itself.	
Value:	Character(20); This is a value set from a defined lookup table. The values in the lookup table are set by the administrator and cannot be added to. In the lookup code, the first letter is as per COVER_TYPE in the STRATUM table, viz: N = Numeric Real Value; C = Numeric Classified Value	Access text field (Char 30)
Example:	NT	
Comments:	This attribute is an attempt to standardise the precision and the source of the height measurement.	For most of the source mapping no specific method for height calculation was given - in most cases height measurements were most likely made as a visual estimate which is recorded in the Height type field as "unknown"
Status:	Implemented in the NVIS Oracle database.	Implemented in the Avon Vegetation Map Database (Access Version)

Look-up Table for:
HEIGHT TYPE

Code	Height Type
NV	Layer Height (general vegetation mapping)
NA	Average Height (general vegetation mapping)
NT	Top Height
CV	Layer Height
CP	Top Height
CT	Dominant Height
CA	Average Height
not applicable	-
unknown	-

Attribute: ST13 - HEIGHT TYPE DERIVATION METHOD		
Heading	Details	
Purpose:	To provide further descriptive information on the HEIGHT TYPE recorded, including the derivation method.	
Requirement:	Optional	
Database Field Name:	HEIGHT_TYPE_DERIV_METHOD	HEIGHT_TYPE_DERIV_METHOD [stratum]
Description:	A more detailed description of the HEIGHT_TYPE recorded, including the derivation method.	
Value:	Character(2000).	Access text field (Char 255)
Example:	Average height measured by a clinometer in the field.	
Comments:	The unit of this field is metres or fractions, thereof.	For most of the source mapping as no specific method for height calculation was documented the value entered into "Height Type Derivation Method" field is "unknown"
Status:	Implemented in the NVIS Oracle database.	Implemented in the Avon Vegetation Map Database (Access Version)

Attribute: ST14 - HEIGHT MINIMUM VALUE		
Heading	Details	
Purpose:	To record the minimum value of height for the (sub-)stratum.	
Requirement:	Optional	
Database Field Name:	HEIGHT_MINIMUM_VALUE	HEIGHT_MINIMUM_VALUE [stratum]
Description:	A height value for the HEIGHT TYPE, expressed as the minimum value for the (sub-)stratum. This value is provided by the data supplier when only classified height data is available for the vegetation description.	For the Avon Vegetation Map Database the source description may provide an explicit minimum height value but may not necessarily be stated as the product of classified height data.
Value:	Number(5,1)	Access Number field
Example:	10	
Comments:	The unit of this field is metres or fractions, thereof.	Entered only if source description states height as a minimum height value. Where a source description provides a height class only (i.e. in the case of a Muir description the height class is implicit in the terminology which relates to a minimum and maximum value defining the height class e.g. Muir "Heath B" represents a Height range of 1 to 1.5m). In the absence of any other explicit cover values the lower and upper height values are not interpreted as valid minimum and Maximum values for the Height value fields - instead, the value -9999 is entered (with height recoded only as an NVIS Cover Code - see entry under "height class" field). Where a source description provides only one explicit height value (rather than an unambiguous maximum and/or minimum value) then this value is entered in both minimum and maximum value fields - it is not interpreted as a valid "Mean" field value field unless it has been explicitly stated in the source description as a calculated statistic. In some cases the term "at least" is used with a single stated value - this is interpreted as the "minimum value" and entered in the corresponding field, with -9999 being entered into the maximum value field indicating a null value (as distinct from "0").
Status:	Implemented in the NVIS Oracle database.	Implemented in the Avon Vegetation Map Database (Access Version)

Attribute: ST15 - HEIGHT MAXIMUM VALUE		
Heading	Details	
Purpose:	To record the maximum value of height for the (sub-)stratum.	
Requirement:	Optional	
Database Field Name:	HEIGHT_MAXIMUM_VALUE	HEIGHT_MAXIMUM_VALUE [stratum]
Description:	A height value for the HEIGHT TYPE, expressed as the maximum value for the (sub-)stratum. This value is provided by the data supplier when only classified height data is available for the vegetation description.	For the Avon Vegetation Map Database the source description may provide an explicit maximum height value but may not necessarily be stated as the product of classified height data.
Value:	Number(5,1)	Access Number field
Example:	40	
Comments:	The unit of this field is metres or fractions, thereof.	Entered only if source description states that height value as a maximum height value. Where a source description provides a height class only (ie in the case of a Muir description the height class is implicit in the terminology which relates to a minimum and maximum value defining the height class e.g. Muir "Heath B" represents a Height range of 1 to 1.5m). In the absence of any other explicit cover values the lower and upper height values are not interpreted as valid minimum and Maximum values for the Height value fields - instead, the value -9999 is entered (with height recoded only as an NVIS Cover Code - see entry under "height class" field). Where a source description provides only one explicit height value (rather than an unambiguous maximum and/or minimum value) then this value is entered in both minimum and maximum value fields - it is not interpreted as a valid "Mean" field value field unless it has been explicitly stated in the source description as a calculated statistic. In some cases the term "up to" is used with a single stated value - this is interpreted as the "Maximum value" and entered in the corresponding field, with -9999 being entered into the maximum value field indicating a null value (as distinct from "0").

Status:	Implemented in the NVIS Oracle database.	Implemented in the Avon Vegetation Map Database (Access Version)

Attribute: ST16 - HEIGHT MEAN VALUE		
Heading	Details	
Purpose:	To record the mean height for the (sub-)stratum	
Requirement:	Essential	
Database Field Name:	HEIGHT_MEAN_VALUE	HEIGHT_MEAN_VALUE [stratum]
Description:	A height value for the HEIGHT TYPE, expressed as the mean value for the (sub-)stratum.	
Value:	Number(5,1)	Access Number field
Example:	25.6	
Comments:	The unit of this field is metres or fractions, thereof.	Interpreted as a valid "Mean" field value field only if it has been explicitly expressed in the source data/description as a calculated statistic from a set of height values
Status:	Implemented in the NVIS Oracle database.	Implemented in the Avon Vegetation Map Database (Access Version)

Attribute: ST17 - HEIGHT MEDIAN VALUE		
Heading	Details	
Purpose:	To record the mean height for the (sub-)stratum.	
Requirement:	Optional	
Database Field Name:	HEIGHT_MEDIAN_VALUE (was: MEDIAN VALUE)	HEIGHT_MEDIAN_VALUE [stratum]
Description:	A height value for the HEIGHT TYPE, expressed as the median value for the (sub-)stratum.	
Value:	Number(5,1)	Access Number field
Example:	30	
Comments:		Interpreted as a valid "Median" field value field only if it has been explicitly expressed in the source data/description as a calculated statistic from a set of height values
Status:	Implemented in the NVIS Oracle database.	Implemented in the Avon Vegetation Map Database (Access Version)

Attribute: ST18 - HEIGHT CLASS		
Heading	Details	
Purpose:	To categorise the height for each sub-stratum.	
Requirement:	Essential	
Database Field Name:	HEIGHT_CLASS	HEIGHT_CLASS [stratum]
Description:	The height class is interpreted by the data custodian from the sub-stratum height value(s) and growth form(s) for the sub-stratum. It summarises the height measure in a form which is comparable across different methods of measurement. It contributes to the definition of the structural formation of the sub-stratum.	
Value:	Number(10); This is a value set from a defined lookup table. The values in the lookup table are set by the administrator and cannot be added to.	Access text field (char 10) Note: the value "unknown" cannot be accommodated in a number field
Example:	8	

Comments:	Note that previously, this field was a character data type. The classes were proposed to avoid confusion with the Walker & Hopkins (1990) height classes, and to enable simplified coding for map legends.¶ The class intervals were derived from an appraisal of Australian vegetation mapping height classes used by the various jurisdictions. The existing Walker & Hopkins (1990) height classes, although applicable for the taller classes, did not correspond well in the lower classes. An epiphyte takes on the height class code of the (sub-)stratum in which it occurs.	*For the purposes of defining the HEIGHT CLASS field attribute for the ANVMP, the data custodian is considered to be the source reference authorship under which primary height measures may have been estimated as a height class interval but without necessarily presenting the primary measures. For the ANVMP the NVIS height code may be derived from the stated cover values in the source description or in turn interpreted from the cover class provided by the source description. The NVIS HEIGHT CLASS in many instances has been inferred from Height value class intervals implicit in the source description terminology [e.g. as from the Muir (1977) Classification.] and correlated with the corresponding NVIS Height value class intervals. Exceptions to this concern Mallee, herb, cryptogam and hummock grass growth forms for which Muir does not define height class intervals. Where Mallee are described according to the Muir Classification and in the absence of any other height data, the default NVIS height class is generally 6 unless a species for which Florabase summary description indicates a predominantly lower height class (i.e. 5). In the absence of any other height data, Muir "herb" (NVIS "forb"), "mat plants" (no NVIS equivalent) the default NVIS height class is 1.
Status:	Implemented in the NVIS Oracle database. Check implications of change from Character to Numeric field.	Implemented in the Avon Vegetation Map Database (Access Version)

Look-up Table for:
HEIGHT CLASS

Code	Explanation	See NVIS - Muir comparative classification Table to see how these classes compare
8	Height Range greater than 30 m - Trees, Vines (in M and U), Palms (single-stemmed), Epiphytes	
7	Height Range 10 - 30 m - Trees, Vines (in M and U), Palms (single-stemmed), Mallee, Mallee shrub, Epiphytes	
6	Height Range less than 10 m - Trees, Vines (in M and U), Palms (single-stemmed), Epiphyte; Height Range 3 - 10 m - Mallee, Mallee shrub, Epiphytes	
5	Height Range less than 3 m - Mallee, Mallee shrub, Epiphytes	

4	Height Range above 2 m - Cycads, Grass-trees, Tree-ferns, Shrubs, Heath shrub, Chenopod shrub, Ferns, Samphire, Palms (multi-stemmed), Tussock and Hummock grasses, Sedges, Rushes, Forbs, Epiphytes (in G), Vines (in G)	
3	Height Range 1 - 2 m - Cycads, Grass-trees, Tree-ferns, Shrubs, Heath shrub, Chenopod shrub, Ferns, Samphire, Palms (multi-stemmed), Tussock and Hummock grasses, Sedges, Rushes, Forbs, Epiphytes (in G), Vines (in G)	
2	Height Range 0.5 - 1 m - Cycads, Grass-trees, Tree-ferns, Shrubs, Heath shrub, Chenopod shrub, Ferns, Samphire, Palms (multi-stemmed), Tussock and Hummock grasses, Sedges, Rushes, Forbs, Lichen, Bryophyte, Seagrasses, Epiphytes (in G), Vines (in G)	
1	Height Range less than 0.5 m - Cycads, Grass-trees, Tree-ferns, Shrubs, Heath shrub, Chenopod shrub, Ferns, Samphire, Palms (multi-stemmed), tussock and Hummock grasses, Sedges, Rushes, Forbs, Lichen, Bryophyte, Seagrasses, Epiphytes (in G)	
unknown	unknown	

Attribute: ST19 - DOMINANT STRATUM FLAG		
Heading	Details	
Purpose:	To give a simple indication as to whether the stratum is dominant, relative to all other strata, within the vegetation community being described.	
Requirement:	Essential	
Database Field Name:	DOMINANT_STRATUM_FLAG (was: IS_DOMINANT)	DOMINANT_STRATUM_FLAG [stratum]
Description:	This is a Boolean field added to the dominant sub-stratum in level 6 or stratum in level 5. It is carried through at the stratum level in upper levels of the NVIS Hierarchy.	
Value:	Character(1); Valid entries: "Y" (Yes) or "N" (No); "T" (True) or "F" (False).	Access text field (Char 50)
Example:	Y	

Comments:	See glossary for further discussion of dominance. Where the value of this field is T or Y, the corresponding (sub-)stratum is marked with a "+" in the appropriate fields describing levels 6 to 4 in the NVIS Information Hierarchy. As part of the restructure and review of NVIS (2000), rules were developed to check the content and automatically generate levels 1 to 4 (and 5) thru XML applications.	Source descriptions rarely flag the dominant stratum explicitly. Usually the vegetation type is described under some kind of formation or association name indicating the characterising structure and taxa (Genus/species). These names may be an informal identifier correlating the description with map unit, rather than a systematic taxa nomenclatural classification, but can be used as a guide to the likely dominant stratum. In some cases the relationship is ambiguous, for example where the height and cover values given in the source description for a dense shrub stratum suggest it is dominant over a sparse Mallee stratum but where the vegetation type is presented in the source description as a "Mallee formation". In this situation the dominance flag may be applied to the substratum based on the structural parameters suggesting greater biomass such that the association translates in NVIS terms to a "Shrubland" rather than a "Mallee" formation. Similarly where a vegetation description is identified by a code rather than a descriptive name, stratum dominance is identified using height and cover parameters (either primary values or class interval limits).Sometimes the decision making process is assisted with the following "rule of thumb" formula: ((Min Height * Min Cover)+(Max Height * Max Cover))/2. Applied to each of the substratum structural parameter values where the greater value suggests dominance. How this is applied and interpreted for each association depends on the nature of supporting source information available, knowledge of the vegetation type and its biophysical context.
Status:	New field. Implemented in the NVIS Oracle database.	Implemented in the Avon Vegetation Map Database (Access Version)

Taxon Data

Attribute: TD01 - TAXON DATA RANK	
Heading	Details
Purpose:	To number to each taxon (species) in order of decreasing importance within each sub-stratum.
Requirement:	Essential

Database Field Name:	TAXON_DATA_RANK	TAXON_DATA_RANK [taxon_data]
Description:	The most important taxon in describing the (sub-)stratum must be assigned a value of '1'.¶ The number assigned to the remaining taxa should allocated according to decreasing importance.¶ A maximum of 5 taxa are required for NVIS at each sub-stratum, but more for each sub-stratum, but more can be supplied , if needed.	
Value:	Number(10); Valid range for NVIS: 1-5, with no ties. Numbers greater than 5 are optional.	Access text field (Char 50)
Example:	3	

Comments:	Importance is usually the dominance of the taxon in the (sub-)stratum, as estimated by biomass. However, once the co-dominant and sub-dominant taxa have been listed, indicator taxa (but not otherwise dominant) can be used to characterise the vegetation description.	*Generally in the absence of any other dominance information the taxon rank is assigned according to the order taxa are listed in the source description. - Alien species: in general alien species are omitted from the NVIS description. In some cases where a substratum might be construed as Dominant within the stratum from the source description but the major contribution of biomass appears to be from alien species, then the choice has to made whether to: a) Omit the whole substratum (including any native taxa) from the NVIS description and taxon data list b) Maintain the substratum in the description, listing alien taxa in the description and taxon data list but at a taxon data rank below that of any native taxa. This gives an indication that most of the biomass is derived from non native taxa while not defining the substratum by alien species in the Level 4 description. Generally option a) is exercised. - where more than 5 taxa (species) are listed for a given substratum in the source description - all are entered into the taxon data field (but only first 5 are shown in the Level 6 description) Apart from the dominant species, Taxon rank in terms of relative importance of all species listed for a substratum is not always apparent from the source description. Sometimes species may appear in order of some importance to the source description authors. In some cases the species are listed alphabetically. Usually the Taxon_Data_Rank is allocated according to the order listed in the source description unless some other accessory data can be used to help determine rank order such as site observations or quadrat data. Sources may only describe structural parameters for each stratum and then list all species observed in the vegetation association. In some cases obvious differentiation of the listed species can be made into strata or rank within strata by ordering on Height and cover values as given in site data or from Florabase taxa descriptions. This is highly qualitative and depends on what other contextual information is available.
Status:	Implemented in the NVIS Oracle database.	Implemented in the ANVMP database (Access Version)
Attribute: TD02 - TAXON DATA DESCRIPTION		

Heading	Details	
Purpose:	To describe the taxon against which ecological data is entered in the TAXON_DATA table.	
Requirement:	Essential	
Database Field Name:	TAXON_DATA_DESCRIPTION	TAXON_DESCRIPTION [taxon_data]
Description:	This field contains the full taxonomic names of the taxon.	
Value:	Character (2000). Genus+species+infraspecies rank+infraspecies in the format: [A-Z][a-z]+ [a-z-]+.?((subsp.|var.|sp. aff.|cv.|f.|s. lat.|s. str.|x|nothossp.) [a-z]+)?, where A-Z means the genus name is capitalised and remaining fields are lower-case. Species and infraspecies names are all lower-case.	Access text field (Char 50)
Example:	Eucalyptus obliqua	*Eucalyptus sapthulata* subsp. Spathulata
Comments:		*In the Avon Vegetation Database the field, TAXON_DESCRIPTION is the functional equivalent of TAXON_DATA_DESCRIPTION in the NVIS structure. Species names are not normally entered directly into TAXON_DESCRIPTION but by selecting the relevant species from a drop down list of WAHERB codes through the Access data entry form "-MAIN-Veg-Desc-and-Below". Non standard names (such as manuscript names) without an equivalent WAHERB code can be entered directly into the TAXON_DESCRIPTION field if necessary.
Status:	Implemented in the NVIS Oracle database and XML transfer system.	Implemented in the Avon Vegetation Map Database (Access Version)

Attribute: TD03 - TAXON DATA SOURCE CODE		
Heading	Details	
Purpose:	To supply a code for the taxon against which ecological data is entered in the TAXON_DATA table.	

Requirement:	Recommended	
Database Field Name:	TAXON_DATA_SOURCE_CODE	TAXON_DATA_SOURCE_CODE [taxon_data]
Description:	The data supplier's unique source code for the taxon. This attribute is based on the authority's coding system.	
Value:	Character(50).	Access text field (Char 50)
Example:	'eucatetr' represents Eucalyptus tetrodonta in a particular dataset or jurisdiction.	
Comments:	These codes will not be comparable between data sets or jurisdictions and are only used to provide a link to the TAXON SOURCE and TAXON SOURCE IDENTIFIER.	The taxon code is represented by a numerical WAHERB species code which provides a link to the table [WA_PLANT_NAMES] and the WAHERB taxon alpha codes as well as species names
Status:	New field in this table. Implemented in the NVIS Oracle database and the XML transfer system.	*Provision is made for this field in the Avon Vegetation Map database structure but values have not been assigned directly as the TAXON_LISTS_ID [taxon_data] values provide a key link to the WAHERB species codes [WA_PLANT_NAMES]

Attribute: TD04 - COVER TYPE		
Heading	Details	
Purpose:	To briefly specify the type of measure used in the COVER VALUE in the Taxon table.	
Requirement:	QAQC	
Database Field Name:	COVER_TYPE	COVER_TYPE [taxon_data]

Description:	The type of measure used for defining the COVER VALUE fields (MINIMUM, MAXIMUM, MEDIAN and/or MEAN). This attribute must be completed if the COVER VALUE is recorded in the TAXON table.¶ The codes are prefixed by:¶ N - Numeric Real Value¶ C - Numeric Classed Value (the values provided are the upper and lower ranges of a cover class category)¶ Q - Qualitative Value	
Value:	Character(20). This is a value set from a defined lookup table. The values in the lookup table are set by the administrator and cannot be added to.	Access text field (Char 30)
Example:	10Q	
Comments:	**N.B. See ST05 COVER TYPE for the lookup table.	look up table does not appear to be complete e.g. 10Q as given in the example is not listed.
Status:	Implemented in the NVIS Oracle database.	Implemented in the Avon Vegetation Map Database (Access Version)
Attribute: TD05 - COVER TYPE DERIVATION METHOD		
Heading	Details	
Purpose:	To provide further details on the type of measure used in the COVER VALUE in the Taxon table.	
Requirement:	Optional	
Database Field Name:	COVER_TYPE_DERIV_METHOD	COVER_TYPE_DERIV_METHOD [taxon_data]

Description:	A more detailed description of the COVER TYPE recorded in the fields (MINIMUM, MAXIMUM, MEDIAN and/or MEAN), including the derivation method, as per COVER TYPE DERIVATION METHOD in the Stratum table.¶ Where a cover abundance rating is recorded, specify the system applied and a reference where available.	
Value:	Character(2000).	Access text field (Char 255)
Example:	Braun-Blanquet	
Comments:		
Status:	Implemented in the NVIS Oracle database.	Implemented in the Avon Vegetation Map Database (Access Version)

Attribute: TD06 - COVER MINIMUM VALUE		
Heading	Details	
Purpose:	To record the minimum value of cover for the taxon in the sub-stratum.	
Requirement:	Optional	
Database Field Name:	COVER_MINIMUM_VALUE	COVER_MINIMUM_VALUE [taxon_data]
Description:	A percentage value related to the TAXON COVER TYPE, expressed as the minimum value for the (sub-)stratum.¶ Actual values (TYPES 1N-4N), a class value (TYPES 5C-8C) or a qualitative value (TYPE 9Q) may be provided for this attribute. This record relates to the lower value of the range.	
Value:	Number(5,1); Valid entries 0.0-100.0; Missing/unknown values = -9999	Access number field
Example:	10	

Comments:		Where minimum and maximum values for a taxon represent the values given for the substratum in which a particular taxon is the sole constituent of that substratum, the values for the substratum are considered to also be those of the sole constituent taxon.
Status:	Implemented in the NVIS Oracle database.	Implemented in the Avon Vegetation Map Database (Access Version)
Attribute: TD07 - COVER MAXIMUM VALUE		
Heading	Details	
Purpose:	To record the maximum value of cover for the taxon in the sub-stratum.	
Requirement:	Optional	
Database Field Name:	COVER_MAXIMUM_VALUE	COVER_MAXIMUM_VALUE [taxon_data]
Description:	A percentage value related to the COVER TYPE, expressed as the maximum value for the (sub-)stratum.¶ Actual values (TYPES 1N-4N), a class value (TYPES 5C-8C) or a qualitative value (TYPE 9Q) may be provided for this attribute. This record relates to the highest value of the range.	
Value:	Number(5,1); Valid entries 0.0-100.0; Missing/unknown values = -9999	Access number field
Example:	70	
Comments:		Where minimum and maximum values for a taxon represent the values given for the substratum in which a particular taxon is the sole constituent of that substratum, the values for the substratum are considered to be those of the sole constituent taxon.
Status:	Implemented in the NVIS Oracle database.	Implemented in the Avon Vegetation Map Database (Access Version)
Attribute: TD08 - COVER MEDIAN VALUE		
Heading	Details	

Purpose:	To record the median value of cover for the taxon in the sub-stratum.	
Requirement:	Optional	
Database Field Name:	COVER_MEDIAN_VALUE	COVER_MEDIAN_VALUE [taxon_data]
Description:	A percentage value related to the COVER TYPE, expressed as the median value for the (sub-)stratum.¶ Actual values (TYPES 1N-4N) or a class value (TYPES 5C-8C) may be provided for this attribute.	
Value:	Number(5,1); Valid entries 0.0-100.0; Missing/unknown values = -9999	Access number field
Example:	60	
Comments:		Where the median value for a taxon represents the values given for the substratum in which a particular taxon is the sole constituent of that substratum, the values for the substratum are considered to be those of the sole constituent taxon.
Status:	Implemented in the NVIS Oracle database.	Implemented in the Avon Vegetation Map Database (Access Version)

Attribute: TD09 - COVER MEAN VALUE		
Heading	Details	
Purpose:	To record the mean value of cover for the taxon in the sub-stratum.	
Requirement:	Recommended	
Database Field Name:	COVER_MEAN_VALUE	COVER_MEAN_VALUE [taxon_data]
Description:	A percentage value related to the COVER TYPE, expressed as the mean value for the (sub-)stratum.¶ Actual values (TYPES 1N-4N) or a class value (TYPES 5C-8C) may be provided for this attribute.	
Value:	Number(5,1); Valid entries 0.0-100.0; Missing/unknown values = -9999	Access number field

Example:	60	
Comments:		Where the mean value for a taxon represents the values given for the substratum in which a particular taxon is the sole constituent of that substratum, the values for the substratum are considered to be those of the sole constituent taxon.
Status:	Implemented in the NVIS Oracle database.	Implemented in the Avon Vegetation Map Database (Access Version)

Attribute: TD10 - TAXON DATA DOMINANCE QUALIFIER		
Heading	Details	
Purpose:	To indicate the type of dominance of the species in the sub-stratum.	
Requirement:	Recommended	
Database Field Name:	TAXON_DATA_DOMINANCE_QUALIFIER (was: COVER DOMINANCE)	TAXON_DATA_DOMINANCE_QUALIFIER [taxon_data]
Description:	A value of dominance for the species in the (sub-)stratum. Dominance is the relative contribution the species makes to the biomass of the (sub-)stratum. Dominance can relate to the spatial extent of a species in a vegetation type as well as its dominance at sites. Please see Glossary (Appendix A) for further definitions.	
Value:	Character(20); This is a value set from a defined lookup table. The values in the lookup table are set by the administrator and cannot be added to.	Access text field (Char 30)
Example:	dominant	
Comments:	The procedures used to generate the contents of this field need to be comprehensively documented in the Data Set table, for each data set.	

Status:	Implemented in the NVIS Oracle database. The information content needs to be reconciled with the obsolete field TX 2 DOMINANCE_SEPARATOR. Where this cannot be done automatically, the data custodians will need to supply the correct interpretation. Also, codes from Version 5.0 need to be converted to words.	Implemented in the ANVMP Database (Access Version)

Look-up Table for:
TAXON DATA
DOMINANCE
QUALIFIER

Code	Explanation
dominant	Dominant species.
co-dominant	A co-dominant species is one which is equally-dominant to one or more other species.
sub-dominant	A sub-dominant species is one which occurs frequently in the vegetation type but has a lesser relative biomass than the dominant species.
indicator	A characteristic or indicator species that is not otherwise dominant in the vegetation type.
other	A species that is not a dominant, co-dominant, sub-dominant or characteristic/indicator species.
unknown	unknown

Attribute: TD11 - TAXON DATA FREQUENCY		
Heading	Details	
Purpose:	To specify the frequency of a particular taxon across the (sub-)stratum.	
Requirement:	Recommended	
Database Field Name:	TAXON_DATA_FREQUENCY (was: COVER FREQUENCY)	TAXON_DATA_FREQUENCY [taxon_data]

Description:	A frequency code for the taxon.	
Value:	Character(20); This is a value set from a defined lookup table. The values in the lookup table are set by the administrator and cannot be added to.	Access text field (Char 20)
Example:	A	
Comments:		
Status:	Implemented in the NVIS Oracle database. Need to change name in database.	Implemented in the ANVMP Database (Access Version)

Look-up Table for:
TAXON DATA FREQUENCY

Code	Explanation
A	High frequency (abundant) >80%
C	Moderate frequency (common) 50-80%
O	Low frequency (occasional) 10-50%
R	Infrequent (rare) less than 10%
not applicable	not applicable
unknown	unknown

Attribute: TD12 - TAXON DATA ALWAYS THERE	
Heading	Details
Purpose:	To indicate whether the species is always present throughout the extent of the vegetation type.
Requirement:	Essential
Database Field Name:	TAXON_DATA_ALWAYS_THERE
Description:	This attribute is used to specify whether a +/- symbol is generated in the vegetation description at levels 5 and 6.

TAXON_DATA_ALWAYS_THERE [taxon_data]

Value:	Character(20); a value of N generates a +/- separator symbol in the level 5 and 6 attributes in the Vegetation Description Table.	Access text field (Char 10)
Example:	N	
Comments:	This field appears to duplicate FREQUENCY, but is meant to be a simple interpretation of frequency in the context of generating vegetation descriptions with +/- symbols between relevant species. There is considerable scope to create and apply a rule, here, when FREQUENCY data are available in the record.	* Application of this attribute value in the ANVMP Database differs from that in NVIS in that the qualifier is not necessarily used as a function of frequency data. I.e. it is applied as a qualitative attribute. For example when a source description indicates that a species is one of several variable co-dominants in an association in the context that they "come and go" across the extent of the map unit. This situation is often implied in source descriptions by using "and/or" terms separating species; or where a source description involves a complex vegetation type in which there is a great deal of floristic heterogeneity and where certain taxa are identified as significant components across the extent of the map unit although none are described as explicitly co-dominant at any given point. [This attribute issue was discussed with Bruce Wilson, Vegetation Survey and Mapping, Biodiversity Sciences (Queensland Herbarium) Environmental Sciences Division, Queensland Herbarium, Brisbane Botanic Gardens 04/03/08. Bruce indicated that he considered this was probably an appropriate application of the attribute in the circumstances.]
Status:	New field. Yet to be implemented in the NVIS Oracle database. Some information content can be retrieved from DOMINANCE_SEPARATOR in version 5.0 and from SOURCE_CODE. Where this cannot be done automatically, the data custodians will need to supply the correct interpretation.	Implemented in the ANVMP Database (Access Version)
Look-up Table for: **TAXON DATA** **ALWAYS THERE**		
Code	Explanation	

Y	Yes. The species is always found in the vegetation type. Where quantitative frequency data are available, frequencies greater than 80% (FREQUENCY = 'A'; i.e. high frequency/abundant) generate a Yes value. This generates a "," separator for the species in the level 5 and 6 attributes in the Vegetation Description Table. Where FREQUENCY = 'C' and ALWAYS_THERE = 'Y' a rule could be developed to generate a warning.	
N	No. The species may or may not be present. Where quantitative frequency data are available, frequencies less than 80% (FREQUENCY = 'C', 'O', 'R', 'not applicable' and 'unknown'; i.e. lower frequency values) generate a No value This generates a +/- separator symbol for the species in the level 5 and 6 attributes in the Vegetation Description Table.	
unknown	unknown. This option generates a "," separator for the species in the level 5 and 6 attributes in the Vegetation Description Table.	

Attribute: TD13 - TAXON DATA SUMMARY FLAG		
Heading	Details	
Purpose:	To give a simple indication as to whether a particular genus is required as a descriptor of the stratum at simpler levels in the NVIS Information Hierarchy and whether the word "mixed" should be appended to a stratum description.	
Requirement:	Essential	
Database Field Name:	TAXON_DATA_SUMMARY_FLAG	TAXON_DATA_SUMMARY_FLAG [taxon_data]

Description:	This is a data value added by the interpreter to a genus characteristic of (and usually dominant in) each level 5 stratum. A value of “Y” is carried through the description in levels 4 (and 3) descriptions in the VEG_DESCRIPTION table as a hat symbol, viz: "^", in front of the genus name. A value of “M” is carried through as a double hat "^^" for situations where the interpreter requires the word "mixed" to be appended to the level 4 (and 3) descriptions.	
Value:	Character(1); Valid entries: "Y", "M" or "N". A maximum of 2 genera per stratum can be marked ("Y") as descriptive of the stratum at simpler levels in the NVIS Information Hierarchy. If two genera are marked “Y” for a stratum (i.e. at Level 5), these can be in the same or different sub-strata in the corresponding Level 6 description. A maximum of 1 genus per stratum can be marked ("M") as descriptive of the stratum at simpler levels in the NVIS Information Hierarchy.	Access text field (Char 50)
Example:	Y	

Comments:	Note that this is an interpreted field relating to the suitability of the genus (not the species) for description of the stratum at simpler levels in the NVIS Information Hierarchy. "Unknown" is not an allowable option; "N" is the default. See Section 2 for further discussion of the up-arrow or hat nomenclature; Table 5 gives a summary of allowable uses. Where there are two ("Y") values are assigned in a vegetation description, the level 3 and 4 descriptions will have genus names written in the rank order specified in TAXON_DATA_RANK.	Refer to the: Australian Vegetation Attribute Manual Version 6, table 5
Status:	New field. Implemented in the NVIS Oracle database. The second hat per stratum and the "M" option has not yet been implemented in application programming.	Implemented in the ANVMP Database (Access Version)

Look-up Table for:
TAXON DATA
SUMMARY FLAG

Code	Explanation
Y	The genus is descriptive of the stratum at simpler levels in the NVIS Information Hierarchy
M	When combined with the word "mixed" in a vegetation description, the genus is more or less descriptive of the stratum at simpler levels in the NVIS Information Hierarchy
N	The genus is not descriptive of the stratum at simpler levels in the NVIS Information Hierarchy. This is the default value.

Growth Form Information

Attribute: GF01 - GROWTH FORM RANK		
Heading	Details	
Purpose:	To rank each growth form within the (sub-)stratum in order of decreasing importance in describing the sub-stratum or stratum.	
Requirement:	Essential	
Database Field Name:	GROWTH_ FORM_RANK (was: GROFRM_NUMBER)	GROWTH_FORM_RANK [growth_form]
Description:	A number assigned to the growth form indicating the relative importance of the growth form in describing the sub-stratum.	
Value:	Number(10); Valid range for NVIS: 1-5, with no ties. Numbers greater than 5 are optional.	Access number field (long integer)
Example:	1	
Comments:	Importance is usually the dominance of the growth form in the (sub-)stratum, as estimated by biomass. However, once the co-dominant and sub-dominant growth forms have been listed, indicator growth forms (but not otherwise dominant) can be used to characterise the vegetation description.	*note: link to dominance estimate methods and examples
Status:	Implemented in the NVIS Oracle database.	Implemented in the ANVMP Database (Access Version)

Attribute: GF02 - GROWTH FORM CODE		
Heading	Details	
Purpose:	To provide a symbol and name for identifying growth forms in a (sub-)stratum.	
Requirement:	Essential	
Database Field Name:	GROWTH_FORM_CODE	GROWTH_FORM_CODE[growth_form]

Description:	The growth form code describes the habit of a plant, identified most precisely by the position of its perennating buds (Beadle & Costin, 1952).¶ Identification of the dominant growth form for each sub-stratum will contribute to the definition of the structural formation (see Table 4 and levels 1 to 6 in the table: VEG_DESCRIPTION).	
Value:	Character(20); This is a value set from a defined lookup table. The values in the lookup table are set by the administrator and cannot be added to.	Access text field (Char 20)
Example:	T	
Comments:		
Status:	Implemented in the NVIS Oracle database.	Implemented in the ANVMP Database (Access Version)
Look-up Table for: GROWTH FORM CODE		
Code	Explanation	
T	tree - Woody plants, more than 2m tall with a single stem or branches well above the base.	
M	tree mallee - Woody perennial plant usually of the genus Eucalyptus. Multi-stemmed with fewer than 5 trunks of which at least 3 exceed 100mm at breast height (1.3m). Usually 8m or more.	Qualifier to NVIS definition: must belong to genus Eucalyptus
S	shrub - Woody plants multi-stemmed at the base (or within 200mm from ground level) or if single stemmed, less than 2m.	See also comment relating to "heath shrub" below

Y	mallee shrub - Commonly less than 8m tall, usually with 5 or more trunks, of which at least three of the largest do not exceed 100mm at breast height (1.3m).	Qualifier to NVIS definition: Must belong to genus Eucalyptus
Z	Heath shrub - Shrub usually less than 2m, with sclerophyllous leaves having high fibre: protein ratios and with an area of nanophyll or smaller (less than 225 sq. m.). Often a member of one the following families: Epacridaceae, Myrtaceae, Fabaceae and Proteaceae. Commonly occur on nutrient-poor substrates.	Note: NVIS does not seem to specify any Cover % criteria to defining "heath" - However for the Avon Vegetation Map dataset any shrub meeting the NVIS heath shrub criteria but with cover of < 30% is considered a "shrub" not a "heath shrub. In the context of South West Australian heath vegetation - the notion of a "Sparse Heathland" would appear to be a contradiction in terms for most people working with WA vegetation. For this code value a Heath shrub is interpreted in floristic and structural terms as a shrub less than 2m and cover >30% where any such shrub is generally co dominant with 2 or more different genera of the families: Epacridaceae, Myrtaceae, Fabaceae and Proteaceae. That is for a given vegetation association, a sole shrub species (representing one of these families) constituting a dominant stratum cover of >30% and height of <2m is defined as a shrub not a heath shrub. The same shrub of same cover and height comprising a stratum with > 2 other co-dominant genera from the above mentioned families, would be defined along with the other co dominant species as a heath shrub. This tries to accommodate - somewhat awkwardly- both Muir`s and NVIS concept of heath shrub with the fundamental sense that for West Australian wheatbelt vegetation, Heath "by definition" has a high floristic diversity.
C	chenopod shrub -Single or multi-stemmed, semi-succulent shrub of the family Chenopodiaceae exhibiting drought and salt tolerance.	
U	samphire shrub - Genera (of Tribe Salicornioideae, viz: Halosarcia, Pachycornia, Sarcocornia, Sclerostegia, Tecticornia and Tegicornia) with articulate branches, fleshy stems and reduced flowers within the Chenopodiaceae family, succulent chenopods (Wilson 1980). Also the genus Sueda.	
G	tussock grass - Forms discrete but open tussocks usually with distinct individual shoots, or if not, then forming a hummock. These are the common agricultural grasses.	
H	hummock grass - Coarse xeromorphic grass with a mound-like form often dead in the middle; genera are Triodia and Plectrachne.	

W	other grass - Member of the family Poaceae, but having neither a distinctive tussock nor hummock appearance.	
V	sedge - Herbaceous, usually perennial erect plant generally with a tufted habit and of the families Cyperaceae (true sedges) or Restionaceae (node sedges).	
R	rush - Herbaceous, usually perennial erect monocot that is neither a grass nor a sedge. For the purposes of NVIS, rushes include the monocotyledon families Juncaceae, Typhaceae, Liliaceae, Iridaceae, Xyridaceae and the genus Lomandra. I.e. "graminoid" or grass-like genera.	
F	forb - Herbaceous or slightly woody, annual or sometimes perennial plant. (Usually a dicotyledon.).	
D	tree-fern - Characterised by large and usually branched leaves (fronds), arborescent and terrestrial; spores in sporangia on the leaves.	
E	fern - Ferns and fern allies. Characterised by large and usually branched leaves (fronds), herbaceous and terrestrial to aquatic; spores in sporangia on the leaves.	
B	bryophyte - Mosses and Liverworts. Mosses are small plants usually with a slender leaf-bearing stem with no true vascular tissue. Liverworts are often moss-like in appearance or consisting of a flat, ribbon-like green thallus.	
N	lichen - Composite plant consisting of a fungus living symbiotically with algae: without true roots, stems or leaves.	
K	epiphyte - Epiphytes, mistletoes and parasites. Plant with roots attached to the aerial portions of other plants. Often could also be another growth form, such as fern or forb.	
L	vine - Climbing, twining, winding or sprawling plants usually with a woody stem.	
P	palm - Palms and other arborescent monocotyledons. Members of the Arecaceae or the genus Pandanus. (Pandanus is often multi-stemmed).	
X	grass-tree - Australian grass trees. Members of the Xanthorroeaceae.	
A	cycad - Members of the families Cycadaceae and Zamiaceae	
J	seagrass - Flowering angiosperms forming sparse to dense mats of material at the subtidal and down to 30m below MSL. Occasionally exposed.	

Q	aquatic - Plant growing in an inland waterway or wetland with the majority of its biomass under water for most of the year. Fresh, saline or brackish water.	
O	lower plant - Alga, fungus.	
unknown	unknown	
Attribute: GF03 - COVER TYPE		
Heading	Details	
Purpose:	To briefly specify the type of measure used in the COVER VALUE fields (MINIMUM, MAXIMUM, MEDIAN and/or MEAN) in the Growth Form table.	
Requirement:	Recommended	
Database Field Name:	COVER_TYPE	COVER_TYPE[growth_form]
Description:	The type of measure used for defining the GROWTH FORM COVER VALUES. The valid types are specified in COVER TYPE. This attribute must be completed if any of the COVER VALUE fields (MINIMUM, MAXIMUM, MEDIAN and/or MEAN) are recorded in the GROWTH_FORM table.	
Value:	Character(20); This is a value set from a defined lookup table:- Cover Type. The values in the lookup table are set by the administrator and cannot be added to.	Access text field (Char 30)
Example:	3N	
Comments:	**N.B. See ST05 COVER_TYPE for the lookup table.	ST05 COVER_TYPE
Status:	Implemented in the NVIS Oracle database.	Provision made for this field in the Avon Vegetation Map Database (Access Version)
Attribute: GF04 - COVER TYPE DERIVATION METHOD		

Heading	Details	
Purpose:	To provide further details on the type of measure used in the COVER VALUE in the Growth Form table.	
Requirement:	Optional	
Database Field Name:	COVER_TYPE_DERIV_METHOD	COVER_TYPE_DERIV_METHOD[growth_from]
Description:	A more detailed description of the GROWTH FORM COVER TYPE recorded. Where a cover abundance rating is recorded, specify the system applied and a reference where applicable	Access text field (Char 255)
Value:	Character(2000).	
Example:	Braun-Blanquet	
Comments:		
Status:	Implemented in the NVIS Oracle database.	Provision made for this field in the Avon Vegetation Map Database (Access Version)

Attribute: GF05 - COVER MINIMUM VALUE		
Heading	Details	
Purpose:	To record the minimum value of cover for the growth form in the sub-stratum.	
Requirement:	Optional	
Database Field Name:	COVER_MINIMUM_VALUE	COVER_MINIMUM_VALUE[growth_form]
Description:	A percentage value related to the GROWTH FORM COVER TYPE, expressed as the minimum value for the growth form in the (sub-)stratum.¶ Actual values (TYPES 1N-4N), a class value (TYPES 5C-8C) or a qualitative value (TYPE 9Q) may be provided for this attribute. This record relates to the lowest value of the range.	

Value:	Number(5,1); Valid entries 0.0-100.0; Missing/unknown values = -9999	Access number field
Example:	10	
Comments:		
Status:	Implemented in the NVIS Oracle database.	Provision made for this field in the Avon Vegetation Map Database (Access Version)

Attribute: GF06 - COVER MAXIMUM VALUE		
Heading	Details	
Purpose:	To record the maximum value of cover for the growth form in the sub-stratum.	
Requirement:	Optional	
Database Field Name:	COVER_MAXIMUM_VALUE	COVER_MAXIMUM_VALUE[growth_form]
Description:	A percentage value related to the GROWTH FORM COVER TYPE, expressed as the maximum value for the (sub-)stratum. ¶ Actual values (TYPES 1N-4N), a class value (TYPES 5C-8C) or a qualitative value (TYPE 9Q) may be provided for this attribute. This record relates to the highest value of the class.	
Value:	Number(5,1); Valid entries 0.0-100.0; Missing/unknown values = -9999	Access number field
Example:	40	
Comments:		
Status:	Implemented in the NVIS Oracle database.	Provision made for this field in the Avon Vegetation Map Database (Access Version)

Attribute: GF07 - COVER MEDIAN VALUE		
Heading	Details	
Purpose:	To record the median value of cover for the growth form in the sub-stratum.	

Requirement:	Optional	
Database Field Name:	COVER_MEDIAN_VALUE	COVER_MEDIAN_VALUE[growth_form]
Description:	A percentage value related to the GROWTH FORM COVER TYPE, expressed as the median value for the growth form for the (sub-) stratum.¶ Actual values (TYPES 1N-4N) or a class value (TYPES 5C-8C) may be provided for this attribute.	
Value:	Number(5,1); Valid entries 0.0-100.0; Missing/unknown values = -9999	Access number field
Example:	26	
Comments:		
Status:	Implemented in the NVIS Oracle database.	Provision made for this field in the Avon Vegetation Map Database (Access Version)

Attribute: GF08 - COVER MEAN VALUE		
Heading	Details	
Purpose:	To record the mean value of cover for the growth form in the sub-stratum.	
Requirement:	Recommended	
Database Field Name:	COVER_MEAN_VALUE	COVER_MEAN_VALUE[growth_form]
Description:	A percentage value related to the attribute GR4 GROWTH FORM: COVER TYPE, expressed as the mean value for growth for the (sub-)stratum.¶ Actual values (TYPES 1N-4N) or a class value (TYPES 5C-8C) may be provided for this attribute.	
Value:	Number(5,1); Valid entries 0.0-100.0; Missing/unknown values = -9999	Access number field
Example:	40	
Comments:		

Status:	Implemented in the NVIS Oracle database.	Provision made for this field in the Avon Vegetation Map Database (Access Version)
Attribute: GF09 - GROWTH FORM DOMINANCE QUALIFIER		
Heading	Details	
Purpose:	To indicate the type of dominance of the growth form in the sub-stratum.	
Requirement:	Recommended	
Database Field Name:	GR_FORM_DOMINANCE_QUALIFIER	GR_FORM_DOMINANCE_QUALIFIER[growth_form]
Description:	A value of dominance for the growth form in the sub-stratum. Dominance is the relative contribution the growth form makes to the biomass of the (sub-)stratum. Dominance can relate to the spatial extent of a growth form in a vegetation type as well as its dominance at sites. Please see Glossary (Appendix A) for further definitions.	
Value:	Character(20); This is a value set from a defined lookup table. The values in the lookup table are set by the administrator and cannot be added to.	Access text field (Char 20)
Example:	indicator	
Comments:	The procedures used to generate the contents of this field need to be comprehensively documented in the Data Set table, for each data set.	

Status:	Implemented in the NVIS Oracle database. The information content needs to be reconciled with the obsolete field GR 2 DOMINANCE_SEPARATOR. Where this cannot be done automatically, the data custodians will need to supply the correct interpretation. Also, codes from Version 5.0 need to be converted to words.	Implemented in the ANVMP Database (Access Version)

Look-up Table for:
GROWTH FORM
DOMINANCE
QUALIFIER

Code	Explanation
dominant	Dominant growth form.
co-dominant	A co-dominant growth form is one which has equal dominance to one or more other growth forms.
sub-dominant	A sub-dominant growth form is one which occurs frequently in the vegetation type but has a lesser relative biomass than the dominant growth form.
indicator	A characteristic or indicator growth form that is not otherwise dominant in the vegetation type.
other	A growth form that is not a dominant, co-dominant, sub-dominant or characteristic/indicator species.
unknown	unknown

Attribute: GF10 - GROWTH FORM FREQUENCY		
Heading	Details	
Purpose:	To specify the frequency of a particular growth form across the sub-stratum.	
Requirement:	Optional	
Database Field Name:	GROWTH_FORM_FREQUENCY	GROWTH_FORM_FREQUENCY[growth_form]

Description:	This code is a summary of the number of sites with a particular growth form divided by the total number of sites.	
Value:	Character(20); This is a value set from a defined lookup table. The values in the lookup table are set by the administrator and cannot be added to.	Access text field (Char 20)
Example:	A	
Comments:	The derivation of this field needs to be comprehensively documented in the Data Set table, for each data set.	For the Avon Vegetation Map database source data set frequency values are not usually supplied in the source data set or in a format that can be attributed to map unit descriptions. The value entered in these cases is "unknown"
Status:	Implemented in the NVIS Oracle database.	Provision made for this field in the Avon Vegetation Map Database (Access Version)

Look-up Table for:
GROWTH FORM
FREQUENCY

Code	Explanation
A	High frequency (abundant) >80%
C	Moderate frequency (common) 50-80%
O	Low frequency (occasional) 10-50%
R	Infrequent (rare) less than 10%
not applicable	not applicable
unknown	unknown

Attribute: GF12 - GROWTH FORM ALWAYS THERE	
Heading	Details
Purpose:	To indicate whether the growth form is always present throughout the extent of the vegetation type.
Requirement:	Optional
Database Field Name:	GROWTH_FORM_ALWAYS_THERE

Description:	This attribute is used to specify whether a +/- symbol is generated in the vegetation description at levels 5 and 6.	
Value:	Character(20); a value of N generates a +/- separator symbol in the level 5 and 6 attributes in the Vegetation Description Table.	Access text field (Char 10)
Example:	N	
Comments:	This field appears to duplicate FREQUENCY, but is meant to be a simple interpretation of frequency in the context of generating vegetation descriptions with +/- symbols between relevant growth forms. There is considerable scope to create and apply a rule, here, when FREQUENCY data are available in the record.	
Status:	New field. Yet to be implemented in the NVIS Oracle database. Some information content can be retrieved from DOMINANCE_SEPARATOR in version 5.0 and from SOURCE_CODE. Where this cannot be done automatically, the data custodians will need to supply the correct interpretation.	Provision made for this field in the Avon Vegetation Map Database (Access Version)
Look-up Table for: **GROWTH FORM** **ALWAYS THERE**		
Code	Explanation	

Y	Yes. The growth form is always found in the vegetation type. Where quantitative frequency data are available, frequencies greater than 80% (FREQUENCY = 'A'; i.e. high frequency/abundant) generate a Yes value. This generates a "," separator for the growth form in the level 5 and 6 attributes in the Vegetation Description Table. Where FREQUENCY = 'C' and ALWAYS_THERE = 'Y' a rule could be developed to generate a warning.	
N	No. The growth form may or may not be present. Where quantitative frequency data are available, frequencies less than 80% (FREQUENCY = 'C', 'O', 'R', 'not applicable' and 'unknown'; i.e. lower frequency values) generate a No value This generates a +/- separator symbol for the growth form in the level 5 and 6 attributes in the Vegetation Description Table.	
unknown	unknown. This option generates a "," separator for the growth form in the level 5 and 6 attributes in the Vegetation Description Table.	

Attribute: GF13 - GROWTH FORM SUMMARY FLAG		
Heading	Details	
Purpose:	To give a simple indication as to whether the particular growth form is required as a descriptor of the stratum at simpler levels in the NVIS Information Hierarchy.	
Requirement:	Essential	
Database Field Name:	GROWTH_FORM_SUMMARY_FLAG	GROWTH_FORM_SUMMARY_FLAG[growth_form]

Description:	This is a Boolean field added to a characteristic (and usually dominant) growth form for the stratum in level 5. The same growth form can be marked in Level 6, but in only one sub-stratum per stratum. It is carried through the description in upper levels of the NVIS Information Hierarchy as a hat symbol, viz: "^", in front of the growth form.	
Value:	Character(1); Valid entries: "Y" or "N"; "T" or "F". Only one hat per stratum is permitted.	Access Text field (Char 1)
Example:	Y	
Comments:	Note that this is an interpreted field relating to the suitability of the growth form for description of the stratum at simpler levels in the NVIS Information Hierarchy. See Section 2 for further discussion of the up-arrow or hat nomenclature. "Unknown" is not an allowable option; suggest "N" as the default.	
Status:	New field. Implemented in the NVIS Oracle database.	Implemented in the Avon Vegetation Map Database (Access Version)

Supplementary
Taxon Information

Taxon List Origin Information		Fields contained within the Avon Vegetation Map access database table: [WA_Plant_Names] are a functional replacement for those listed under the NVIS Supplementary Taxon Information set of attributes. The WA Plant Name fields are consistent with WA herbarium standards and protocols. Some of the NVIS Taxon Information fields relating to State Origin descriptors may need to be created and addressed if the Avon Vegetation Database is to be submitted to NVIS at a National Level. Whilst it was considered desirable to follow the NVIS framework as closely as possible it was not the primary objective for the data to be fully compliant at the National Level where this was not practical for the project objectives. See Avon Vegetation Map Access database table: "WA_PLANT_NAMES" for full list of WAHerb codes and taxa represented. This TABLE is a functional replacement for NVIS Taxon List Origin attributes. WA_PLANT NAMES TABLE is Derived from MAX (Imported August 2008), name source: WACensus (WA Herbarium)
Attribute: TO01 - TAXON LIST ORIGIN CUSTODIAN		
Heading	Details	
Purpose:	To name the custodian of each taxon list used to supply species data to NVIS.	
Requirement:	QAQC	
Database Field Name:	TAXON_LIST_ORIGIN_CUSTODIAN (was: TAXON_LIST_SOURCE)	
Description:	A short description of the originating institution or custodian of the taxon list.¶ The custodian should be an authority within the jurisdiction for supplying current species names.	
Value:	Character(2000).	
Example:	Queensland Herbarium	Western Australian Herbarium (WAHerb)
Comments:		
Status:	Implemented in the NVIS Oracle database.	Not currently implemented in the ANVMP Database, Provision will need to be made for this field if the database is to be submitted for inclusion in the National (NVIS) dataset

Attribute: TO02 - TAXON LIST ORIGIN STATE		
Heading	Details	
Purpose:	To name the state of origin of each taxon list used to supply species data to NVIS.	
Requirement:	QAQC	
Database Field Name:	TAXON_LIST_ORIGIN_STATE	
Description:	The state of the source, from which the taxon list has been derived.	
Value:	Character(20)	8 (Western Australia)
Example:	4	
Comments:	May need two attributes.	
Status:	Implemented in the NVIS Oracle database.	Not currently implemented in the ANVMP Database, Provision will need to be made for this field if the database is to be submitted for inclusion in the National (NVIS) dataset

Look-up Table for:
TAXON LIST
ORIGIN STATE

Code	Explanation
1	Australian Capital Territory
2	New South Wales
3	Northern Territory
4	Queensland
5	South Australia
6	Tasmania
7	Victoria
8	Western Australia

Attribute: TO03 - TAXON LIST ORIGIN DETAILS	
Heading	Details

Purpose:	To name the name and date of each taxon list used to supply species data to NVIS.	
Requirement:	QAQC	
Database Field Name:	TAXON_LIST_ORIGIN_DETAILS	
Description:	The name and date of the source list from which the taxon list has been derived.	
Value:	Character(2000)	
Example:	Victorian Herbarium list, July 1999	Western Australian Herbarium (WACensus) list (MAX) August 2008
Comments:	Any known limitations, errors, caveats or user instructions should be added in this' attribute.	
Status:	Implemented in the NVIS Oracle database.	Not currently implemented in the ANVMP Database, Provision will need to be made for this field if the database is to be submitted for inclusion in the National (NVIS) dataset

Taxon Source Information

Attribute: TL01 - TAXON LISTS SOURCE CODE		
Heading	Details	
Purpose:		
Requirement:	Optional	
Database Field Name:	TAXON_LISTS_SOURCE_CODE	Functional equivalents: SPECIES_CODE [WA_PLANT NAMES] and NAME_ID[WA_PLANT NAMES]
Description:	The authority's (TAXON SOURCE) code for each taxon used for data entry. This attribute is based on the authority's coding system.	
Value:	Character(50).	
Example:	'eucatetr' represents Eucalyptus tetrodonta in a particular dataset or jurisdiction.	

Comments:	These codes will not be comparable between data sets or jurisdictions and are only used to provide a link to the TAXON SOURCE and TAXON SOURCE IDENTIFIER.	See Access table "WA_PLANT_NAMES" table for full list of WAHerb codes and taxa represented. This TABLE is a functional replacement for NVIS "Taxon_List". The [WA_PLANT NAMES] Table is Derived from MAX (Imported August 2008), name source: WACensus (WA Herbarium)
Status:	Implemented in the NVIS Oracle database.	Implementation of this field in the Avon Vegetation Map database is through the functional equivalent field "SPECIES_CODE" [WA_PLANT NAMES]. Note however the value of this code is not always unique to a given species. The field "NAME_ID"[WA_PLANT NAMES] represents values unique to each species and all their infraspecies. NAME_ID is the primary key link in the table [WA_PLANT NAMES] to its foreign key equivalent "TAXON_LISTS_ID" in the [taxon_data] table. As NVIS TAXON_LISTS_SOURCE_CODE is an optional attribute, provision for this field in the ANVMP Database is not necessary if ANVMP data is to be submitted for inclusion into the National Dataset.

Attribute: TL02 - TAXON LISTS FAMILY		
Heading	Details	
Purpose:	To describe a family of a taxon in the master list of a jurisdiction.	
Requirement:	Recommended	
Database Field Name:	TAXON_LISTS_FAMILY	functional equivalent: FAMILY_CODE [WA_PLANT NAMES]
Description:	Recognised Family name as of time of entry into the database. The data custodian must use the latest taxonomic name for each species.	
Value:	Character(50).	
Example:	Myrtaceae	
Comments:		see "WA_PLANT NAMES" TABLE field: "FAMILY_CODE"
Status:	Implemented in the NVIS Oracle database.	Implementation of this field in the ANVMP database is through the functional equivalent field: FAMILY_CODE [WA_PLANT NAMES]

Attribute: TL03 - TAXON LISTS GENUS		
Heading	Details	

Purpose:	To describe a genus of a taxon in the master list of a jurisdiction.	
Requirement:	Essential	
Database Field Name:	TAXON_LISTS_GENUS	functional equivalent: GENUS [WA_PLANT NAMES]
Description:	Recognised Genus name as of time of entry into the database. The data custodian must use the currently-accepted taxonomic name for each species.	
Value:	Character(50).	
Example:	Eucalyptus	
Comments:		see GENUS [WA_PLANT NAMES]
Status:	Implemented in the NVIS Oracle database.	Implementation of this field in the ANVMP database is through the functional equivalent field: GENUS [WA_PLANT NAMES]

Attribute: TL04 - TAXON LISTS SPECIES		
Heading	Details	
Purpose:	To describe the species epithet of a taxon in the master list of a jurisdiction.	
Requirement:	Essential	
Database Field Name:	TAXON_LISTS_SPECIES	functional equivalent: SPECIES [WA_PLANT NAMES]
Description:	Recognised Species name as of time of entry into the database. The data custodian must use the currently-accepted taxonomic name for each species.	
Value:	Character(50).	see SPECIES [WA_PLANT NAMES]
Example:	tetrodonta	
Comments:		
Status:	Implemented in the NVIS Oracle database.	Implementation of this field in the ANVMP database is through the functional equivalent field: SPECIES [WA_PLANT NAMES]

Attribute: TL05 - TAXON LISTS AUTHOR		
Heading	Details	
Purpose:	To describe an author of a species binomial in the master list of a jurisdiction.	
Requirement:	Recommended	
Database Field Name:	TAXON_LISTS_AUTHOR	functional equivalent: AUTHOR [WA_PLANT NAMES]
Description:	The author citation of the species in standard abbreviated form.¶ A valid author abbreviation for a species as described in HISPID (1993).	
Value:	Character(2000).	
Example:	Mueller, F.J.H. von	
Comments:		see: AUTHOR [WA_PLANT NAMES]
Status:	Implemented in the NVIS Oracle database.	Implementation of this field in the ANVMP database is through the functional equivalent field: AUTHOR [WA_PLANT NAMES]

Attribute: TL06 - TAXON LISTS INFRASPECIES RANK		
Heading	Details	
Purpose:	To describe the infraspecies rank of a taxon in the master list of a jurisdiction.	
Requirement:	Recommended	
Database Field Name:	TAXON_LISTS_INFRA_SPECIES_RANK	functional equivalents: INFRA_RANK [WA_PLANT NAMES]; INFRA_RANK2[WA_PLANT NAMES]
Description:	A field to indicate the lowest infraspecific rank for the species. This can be left blank if a species has no infraspecies.	
Value:	Character(50); This is a value set from an expandable lookup table. Initial values are set by the administrator, new values will be added as required, according to the guidelines in Appendix B.	
Example:	subsp.	

Comments:	The options: s. lat., s. str. and sp. aff. are conveniently stored in this attribute, but actually refer to the specific epithet (i.e. looking upwards in the taxonomic hierarchy) rather than to the infraspecies.	See: INFRA_RANK [WA_PLANT NAMES]; INFRA_RANK2 [WA_PLANT NAMES]. Note: the WACensus does not follow the codes displayed in the NVIS Look-up table for the TAXON LISTS INFRASPECIES RANK. The Avon Vegetation Map Database records the NAME_ID value (which is unique for all species and their infraspecies) through a drop down list in the database entry form linked to the relevant fields in the WA_PLANT_NAMES table. A look up table of infraspecies codes is not required in this process, and the codes used are those adopted by the WA Herbarium.
Status:	Implemented in the NVIS Oracle database.	Implementation of this field in the Avon Vegetation Map database is through the functional equivalents INFRA_RANK [WA_PLANT NAMES]; INFRA_RANK2 [WA_PLANT NAMES]. Provision may need to be made in the Avon Vegetation Map Database for the NVIS field TAXON_LISTS_INFRA_SPECIES_RANK to accommodate infraspecies rank coding in accordance with the NVIS schema if Avon data is submitted for inclusion in the National (NVIS) dataset.
Look-up Table for: TAXON LISTS INFRASPECIES RANK		Wa Census code equivalent
Code	Explanation	
subsp.	subspecies - Taxon description is at the subspecies level.	subsp.
var.	variety - Taxon description is at the variety level.	var.
cv.	cultivar - Taxon description is at the cultivar level.	cv.
f.	form - Taxon description is at the form level.	forma
s. lat.	sensu lato - The taxon description is at the species level refers to a wide interpretation of the species.	The WACensus does not appear to recognise these categories as infraspecies rank where a source taxon name incorporates these descriptors then the name is entered directly into the "TAXON_DATA" table TAXON_DESCRIPTION field - for these types of entry there is no corresponding species code or Taxon_Lists_ID to link with the WA_PLANT_NAMES table derived from the Herbarium WA census.
sp. aff.	species with affinity to- The taxon description at the species level refers to an undescribed taxonomic entity that is similar to the described species.	
subf.	subform - Taxon description is at the subform level.	
Attribute: TL07 - TAXON LISTS INFRASPECIES		

Heading	Details	
Purpose:	To describe an infraspecies (subspecies, variety, etc.) name of a taxon in the master list of a jurisdiction.	
Requirement:	Recommended	
Database Field Name:	TAXON_LISTS_INFRA_SPECIES	functional equivalents: INFRA_NAME [WA_PLANT NAMES]; INFRA_NAME2 [WA_PLANT NAMES]
Description:	The name of lowest infraspecific rank for the species.¶ Do no enter this field if the INFRASPECIES RANK is not recorded.	
Value:	Character(50).	
Example:	leptophylla (in Boronia inornata subspecies leptophylla)	
Comments:		
Status:	Implemented in the NVIS Oracle database.	Implementation of this field in the Avon Vegetation Map database is through the functional equivalent field: INFRA_NAME [WA_PLANT NAMES]; INFRA_NAME2 [WA_PLANT NAMES] Provision may need to be made in the Avon Vegetation Map Database for the NVIS field TAXON_LISTS_INFRA_SPECIES to accommodate infraspecies nomenclature in accordance with the NVIS schema if Avon data is to be submitted for inclusion in the National (NVIS) dataset.

Attribute: TL08 - TAXON LISTS INFRASPECIES AUTHOR		
Heading	Details	
Purpose:		
Requirement:	Recommended	
Database Field Name:	TAXON_LISTS_INFRA_SP_AUTHOR	functional equivalent: AUTHOR[WA_PLANT_NAMES]
Description:	The author citation of the recorded INFRASPECIES in standard abbreviated form.¶ A valid author abbreviation for an infraspecies as described in HISPID (1993).	

Value:	Character(2000).	
Example:	Bisby (1994)	
Comments:		In the [WA_PLANT_NAMES] species and infraspecies authorship are not listed in separate fields- each species and its infraspecies have a separate unique NAME_ID code and this is also linked to the relevant nomenclatural author citation.
Status:	Implemented in the NVIS Oracle database.	Implementation of this field in the Avon Vegetation Map database is through the functional equivalent field: AUTHOR [WA_PLANT_NAMES]. Provision may need to be made in the Avon Vegetation Map Database for the NVIS field TAXON_LISTS_INFRA_SP_AUTHOR to accommodate infraspecies author citation in accordance with the NVIS schema if Avon data is to be submitted for inclusion in the National (NVIS) dataset.
Attribute: TL09 - TAXON LISTS COMMON NAME		
Heading	Details	
Purpose:	To describe the common name of a taxon in the master list of a jurisdiction.	
Requirement:	Optional	
Database Field Name:	TAXON_LISTS_COMMON_NAME	functional equivalent VERNACULAR[WA_PLANT_NAMES]
Description:	The common name applied to the species or infraspecies. Useful for publishing and reporting.	
Value:	Character(2000).	
Example:	Sydney bluegum	
Comments:	The common name will only be applicable to this data set unless differences are resolved between data sets.	
Status:	Implemented in the NVIS Oracle database.	Implementation of this field in the ANVMP database is through the functional equivalent field: VERNACULAR[WA_PLANT_NAMES]
Attribute: TL10 - TAXON LISTS REFERENCE		
Heading	Details	

Purpose:	To provide further details of the primary reference describing the species.	
Requirement:	Optional	
Database Field Name:	TAXON_LISTS_REFERENCE	
Description:	The author citation of the recorded taxon (SPECIES and/or INFRASPECIES) in long form	
Value:	Character(2000); Where a secondary reference is present for a taxon, use a semi-colon delimiter after the primary reference and put the secondary reference after it, in this field.	
Example:	Jessop, J. P. (ed) (September 1993) A List of the Vascular Plants of South Australia. Edition IV. Botanic Gardens of Adelaide and State Herbarium, Adelaide.	
Comments:	This is more useful than the abbreviated author name, because it can be more-readily looked up.	
Status:	Implemented in the NVIS Oracle database. Where they exist, incorporate secondary references into this field.	Not implemented in the ANVMP Database. There is no functional equivalent in [WA_PLANT NAMES].

Appendix 8: Comparison of Muir and NVIS Classifications

GROWTH FORM		Muir/NVIS Cover Class Specht (1974) cover term	HEIGHT			COVER (NVIS Percentage class intervals ~ those of muirs - *see Cover Notes below*)									
						d Dense 70-100%		c Mid - Dense 30-70%		i Sparse 10-30%		r Very Sparse 2-10%		bi (NVIS) (~ Muir Scattered) < 2%	bc(NVIS) (~ Muir Scattered) < 2%
			Ht (m)	Ht (m)	Class	Strat	Canopy Cover	Foliage Cover	Canopy Cover	Foliage Cover	Canopy Cover	Foliage Cover	Canopy Cover	Foliage Cover	Foliage Cover	Foliage Cover
Muir	NVIS		Muir	NVIS	NVIS		Muir	NVIS	Muir	NVIS	Muir	NVIS	Muir	NVIS	NVIS only	NVIS only
Trees	tree		>30	>30	8	U	Dense Tall Forest	Tall Closed Forest	Tall Forest	Tall Open Forest	Tall Woodland	Tall Woodland	Open Tall Woodland	Tall Open Woodland	Tall Isolated Trees	Tall Isolated Clumps of Trees
			15-30	10-30	7	U	Dense Forest	Closed Forest	Forest	Open Forest	Woodland	Woodland	Open Woodland	Open Woodland	Isolated Trees	Isolated Clumps of Trees
			5-15				Dense Low Forest A		Low Forest A		Low Woodland A		Open Low Woodland A			
			<5	<10	6	U(M)	Dense Low Forest B	Low Closed Forest	Low Forest B	Low Open Forest	Low Woodland B	Low Woodland	Open Low Woodland B	Low Open Woodland	Low Isolated trees	Low Isolated Clumps of trees
Mallee Tree Form	tree mallee		>8	10-30	7	U	Dense Tree Mallee	Tall Closed Mallee Forest	Tree Mallee	Tall Open Mallee Forest	Open Tree Malle	Tall Mallee Woodland	Very Open Tree Mallee	Tall Open Mallee Woodland	Tall Isolated Mallee Trees	Tall Isolated Clumps of Mallee Trees
				3-10	6	U		Closed Mallee Forest		Open Mallee Forest		Mallee Woodland		Open Mallee Woodland	Isolated Mallee Trees	Isolated Clumps of Mallee Trees
				<3	5	(U)M		Low Closed Mallee Forest		Low Open Mallee Forest		Low Mallee Woodland		Low Open Mallee Woodland	Low Isolated Mallee Trees	Low Isolated Clumps of Mallee Trees
Mallee Shrub Form	mallee shrub			10-30	7	U		Tall Closed Mallee Shrubland		Tall Mallee Shrubland		Tall Open Mallee Shrubland		Tall Sparse Mallee Shrubland	Tall Isolated Mallee Shrubs	Tall Isolated Clumps of Mallee Shrubs
				3-10	6	U		Closed Mallee Shrubland		Mallee Shrubland		Open Mallee Shrubland		Sparse Mallee Shrubland	Isolated Mallee Shrubs	Isolated Clumps of Mallee Shrubs
			<8m	<3	5	M	Dense Shrub Mallee	Low Closed Mallee Shrubland	Shrub Mallee	Low Mallee Shrubland	Open Shrub Mallee	Low Open Mallee Shrubland	Very Open Shrub Mallee	Low Sparse Mallee Shrubland	Low Isolated Mallee Shrubs	Low Isolated Clumps of Mallee Shrubs
Shrubs[1]	shrub, heath shrub		>2	>2	4	M	Dense Thicket	Tall Closed Shrubland	Thicket	Tall Heathland/Tall Shrubland	Scrub	Tall Open Shrubland	Open Scrub	Tall Sparse Shrubland	Tall Isolated Shrubs	Tall Isolated Clumps of Shrubs
			1.5-2.0	1.0-2.0	3	M	Dense Heath A	Closed Heathland/Closed Shrubland	Heath A	Heathland/Shrubland	Low Scrub A	Open Shrubland	Open Low Scrub A	Sparse Shrubland	Isolated Shrubs	Isolated Clumps of Shrubs
			1.0-1.5				Dense Heath B		Heath b		Low Scrub B		Open Low Scrub B			
			0.5-1.0	0.5-1.0	2	G	Dense Low Heath C	Low Closed Heathland/Low Closed Shrubland	Low Heath C	Low Heathland/Low Shrubland	Dwarf Scrub C	Low Open Shrubland	Open Dwarf Scrub C	Low Sparse Shrubland	Low Isolated Shrubs	Low Isolated Clumps of Shrubs
			<0.5	<0.5	1	G	Dense Low Heath D		Low Heath D		Dwarf Scrub D		Open Dwarf Scrub D			
	chenopod shrub		>2	>2	4	M	Dense Thicket	Tall Closed Chenopod Shrubland	Thicket	Tall Chenopod Shrubland	Scrub	Tall Open Chenopod Shrubland	Open Scrub	Tall Sparse Chenopod Shrubland	Tall Isolated Chenopod Shrubs	Tall Isolated Clumps of Chenopod Shrubs
			1.5-2.0	1.0-2.0	3	M	Dense Heath A	Closed Chenopod Shrubland	Heath A	Chenopod Shrubland	Low Scrub A	Open Chenopod Shrubland	Open Low Scrub A	Sparse Chenopod Shrubland	Isolated Chenopod Shrubs	Isolated Clumps of Chenopod Shrubs
			1.0-1.5				Dense Heath B		Heath b		Low Scrub B		Open Low Scrub B			
			0.5-1.0	0.5-1.0	2	G	Dense Low Heath C	Low Closed Chenopod Shrubland	Low Heath C	Low Chenopod Shrubland	Dwarf Scrub C	Low Open Chenopod Shrubland	Open Dwarf Scrub C	Low Sparse Chenopod Shrubland	Low Isolated Chenopod Shrubs	Low Isolated Clumps of Chenopod Shrubs
			<0.5	<0.5	1	G	Dense Low Heath D		Low Heath D		Dwarf Scrub D		Open Dwarf Scrub D			
	samphire shrub		>2	>2	4	M	Dense Thicket	Tall Closed Samphire Shrubland	Thicket	Tall Samphire Shrubland	Scrub	Tall Open Samphire Shrubland	Open Scrub	Tall Sparse Samphire Shrubland	Tall Isolated Samphire Shrubs	Tall Isolated Clumps of Samphire Shrubs
			1.5-2.0	1.0-2.0	3	M	Dense Heath A	Closed Samphire Shrubland	Heath A	Samphire Shrubland	Low Scrub A	Open Samphire Shrubland	Open Low Scrub A	Sparse Samphire Shrubland	Isolated Samphire Shrubs	Isolated Clumps of Samphire Shrubs
			1.0-1.5				Dense Heath B		Heath b		Low Scrub B		Open Low Scrub B			
			0.5-1.0	0.5-1.0	2	G	Dense Low Heath C	Low Closed Samphire Shrubland	Low Heath C	Low Samphire Shrubland	Dwarf Scrub C	Low Open Samphire Shrubland	Open Dwarf Scrub C	Low Sparse Samphire Shrubland	Low Isolated Samphire Shrubs	Low Isolated Clumps of Samphire Shrubs
			<0.5	<0.5	1	G	Dense Low Heath D		Low Heath D		Dwarf Scrub D		Open Dwarf Scrub D			
Mat Plants[2]					1		Dense Mat Plants		Mat Plants		Open Mat Plants		Very Open Mat Plants			
Hummock Grass	hummock Grass		no height category	>2	4	M	Dense Hummock Grass	Tall Closed Hummock Grassland	Mid Dense Hummock Grass	Tall Hummock Grassland	Hummock Grass	Tall Open Hummock Grassland	Open Hummock Grass	Tall Sparse Hummock Grassland	Tall Isolated Hummock Grasses	Tall Isolated Clumps of Hummock Grasses
				1.0-2.0	3	M(G)										
				0.5-1.0	2	G		Closed Hummock Grassland		Hummock Grassland		Open Hummock Grassland		Sparse Hummock Grassland	Isolated Hummock Grasses	Isolated Clumps of Hummock Grasses
				<0.5	1	G		Low Closed Hummock Grassland		Low Hummock Grassland		Low Open Hummock Grassland		Low Sparse Hummock Grassland	Low Isolated Hummock Grasses	Low Isolated Clumps of Hummock Grasses
Bunch Grass	tussock grass		>0.5	>2	4	M	Dense Tall Grass	Tall Closed Tussock Grassland	Tall Grass	Tall Tussock Grassland	Open Tall Grass	Tall Open Tussock grassland	Very Open Tall Grass	Tall Sparse Tussock grassland	Tall Isolated Tussock grasses	Tall Isolated Clumps of Tussock grasses
				1.0-2.0	3	M(G)										
				0.5-1.0	2	G		Closed Tussock Grassland		Tussock Grassland		Open Tussock grassland		Sparse Tussock grassland	Isolated Tussock grasses	Isolated Clumps of Tussock grasses
			<0.5	<0.5	1	G	Dense Low Grass	Low Closed Tussock Grassland	Low Grass	Low Tussock Grassland	Open Low Grass	Low Open Tussock grassland	Very Open Low Grass	Low Sparse Tussock grassland	Low Isolated Tussock grasses	Low Isolated Clumps of Tussock grasses
	other grass		>0.5	>2	4	M	Dense Tall Grass	Tall Closed Grassland	Tall Grass	Tall Grassland	Open Tall Grass	Tall Open grassland	Very Open Tall Grass	Tall Sparse grassland	Tall Isolated grasses	Tall Isolated Clumps of grasses
				1.0-2.0	3	M(G)										
				0.5-1.0	2	G		Closed Grassland		Grassland		Open grassland		Sparse grassland	Isolated grasses	Isolated Clumps of grasses
			<0.5	<0.5	1	G	Dense Low Grass	Low Closed Grassland	Low Grass	Low Grassland	Open Low Grass	Low Open grassland	Very Open Low Grass	Low Sparse grassland	Low Isolated grasses	Low Isolated Clumps of grasses
Herbaceous spp.[3]	forb		no height category	>2	4	M	Dense Herbs	Tall Closed Forbland	Herbs	Tall Forbland	Open Herbs	Tall Open Forbland	Very Open Herbs	Tall Sparse Forbland	Tall Isolated forbs	Tall Isolated Clumps of forbs
				1.0-2.0	3	M(G)										
				0.5-1.0	2	G		Closed Forbland		Forbland		Open Forbland		Sparse Forbland	Isolated forbs	Isolated Clumps of forbs
				<0.5	1	G		Low Closed Forbland		Low Forbland		Low Open Forbland		Low Sparse Forbland	Low isolated forbs	Low isolated Clumps of forbs
Sedges[4]	sedge (includes Cyperaceae, Restionaceae)		>0.5	>2	4	M	Dense Tall Sedges	Tall Closed Sedgeland	Tall Sedges	Tall Sedgeland	Open Tall Sedges	Tall Open Sedgeland	Very Open Tall Sedges	Tall Sparse Sedgeland	Tall Isolated sedges	Tall Isolated Clumps of sedges
				1.0-2.0	3	M(G)										
				0.5-1.0	2	G		Closed Sedgeland		Sedgeland		Open Sedgeland		Sparse Sedgeland	Isolated sedges	Isolated Clumps of sedges
			<0.5	<0.5	1	G	Dense Low Sedges	Low Closed Sedgeland	Low Sedges	Low Sedgeland	Open Low Sedges	Low Open Sedgeland	Very Open Low Sedges	Low Sparse Sedgeland	Low Isolated sedges	Low Isolated Clumps of sedges
	Rush (includes grass like non grasses other than sedges and restios)		>0.5	>2	4	M	Dense Tall Sedges	Tall Closed Rushland	Tall Sedges	Tall Rushland	Open Tall Sedges	Tall Open Rushland	Very Open Tall Sedges	Tall Sparse Rushland	Tall Isolated rushes	Tall Isolated Clumps of rushes
				1.0-2.0	3	M(G)										
				0.5-1.0	2	G		Closed Rushland		Rushland		Open Rushland		Sparse Rushland	Isolated rushes	Isolated Clumps of rushes
			<0.5	<0.5	1	G	Dense Low Sedges	Low Closed Rushland	Low Sedges	Low Rushland	Open Low Sedges	Low Open Rushland	Very Open Low Sedges	Low Sparse Rushland	Low Isolated rushes	Low Isolated Clumps of rushes
Ferns	ferns and fern allies		no height category	>2	4	M	Dense Ferns	Tall Closed Fernland	Ferns	Tall Fernland	Open Ferns	Tall Open Fernland	Very Open Ferns	Tall Sparse Fernland	Tall Isolated Ferns	Tall Isolated Clumps of Ferns
				1.0-2.0	3	M(G)		Closed Fernland		Fernland		Open Fernland		Sparse Fernland	Isolated Ferns	Isolated Clumps of Ferns
				0.5-1.0	2	G		Low Closed Fernland		Low Fernland		Low Open Fernland		Low Sparse Fernland	Low Isolated Ferns	Low Isolated Clumps of Ferns
				<0.5	1	G										
Mosses, Liverwort	Bryophyte		no height category	0.5-1.0	2	G	Dense Mosses	Tall Closed Bryophyteland	Mosses	Tall Bryophyteland	Open Mosses	Tall Open Bryophyteland	Very Open Mosses	Tall Sparse Bryophyteland	Tall Isolated Bryophytes	Tall Isolated Clumps of Bryophytes
				<0.5	1	G		Low Closed Bryophyteland		Low Closed Bryophyteland		Low Closed Open Bryophyteland		Low Closed Sparse Bryophyteland	Low Isolated Bryophytes	Low Isolated Clumps of Bryophytes

Growth Form notes:

[1] Shrubs include: Woody perennials Includes non lignotuberous shrubby Eucalypts, woody Chenopods, Woody Samphires. Muir seems to define heath as shrubs above a certain % cover (30%) and below a certain height (2m)

NVIS "Heath Shrub" is defined as a Shrub usually less than 2m, with sclerophyllous leaves having high fibre:protein ratios and with an area of nanophyll or smaller (less than 225 sq. m.). Often a member of one the following families: Epacridaceae, Myrtaceae, Fabaceae and Proteaceae. Commonly occur on nutrient-poor substrates. (Note: NVIS does not seem to specify any Cover % criteria to defining "heath" - however for this reference table any shrub meeting the NVIS heath shrub criteria but with cover of < 30% is considered a "shrub" not a "heath shrub. In the context of South West Australian heath vegetation - the notion of a "Sparse Heathland" would appear to be a contradiction in terms for most people working with WA vegetation .

[2] Mat Plants: not an NVIS growth form category in itself - Muir defined mat plants are presumably included within the the relevant NVIS growth form with a height class < 0.5m.

[3]Herbaceous spp: include non woody Chenopods, non woody Samphires

NVIS equivalent of Muirs "Herbaceous spp" is "Forb" ie " an Herbaceous or slightly woody annual or sometimes perennial plant - usually a dicot.

[4] Includes Cyperaceae, Juncaceae, Restionaceae, Typhaceae, Xyridaceae and other plants of sedge like form ie herbaceous usually perennial erect plants generally tufted habit. Arise from stolons, tubers, bulbs, rhizomes or seeds.

NVIS "rush" = - Herbaceous, usually perennial erect monocot that is neither a grass nor a sedge. For the purposes of NVIS, rushes include the monocotyledon families Juncaceae, Typhaceae, Liliaceae, Iridaceae, Xyridaceae,Ecdeicolaceae, Anarthriaceae (includes Lyginea), the genus Lomandra; i.e. "graminoid" or grass-like genera. (note: for the Avon Veg Map project, Borya is included in "rush" - although not specified in NVIS manual - as it is a perennial narrow leaved clumping monocot that is not a grass but does not fit the NVIS forb critera: herbaceous annual, dicotyledon. Historically, most vegetation descriptions using the Muir classification refer to Borya as a "herb".

Cover Notes:

Muir Classification does not have cover class equivalent to NVIS bi or bc. Where a muir descripton indicates "scattered" this is could be treated as equivalent to NVIS "bi"

Muir defines cover in terms of "Canopy Cover" ie: The total area encompassed within the circumference of individual foliage clumps, and expressed as a percentage of a given area, e.g. quadrat or formation area. [Muir BG; (1977); Biological survey of the Western Australian wheatbelt. Part 2: Vegetation and habitat of Bendering Reserve.; Records of the Western Australian Museum, Supplement No. 3.]

eg:

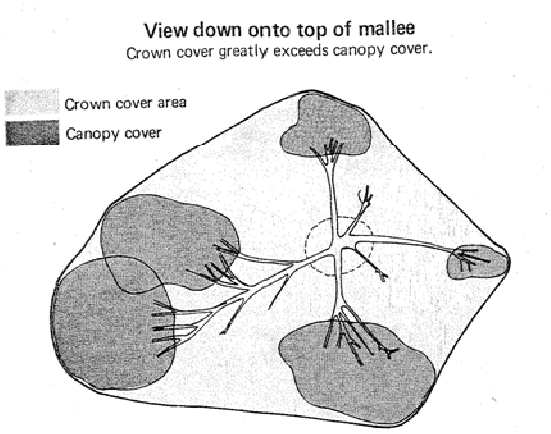


Fig. 1. Crown cover and canopy cover of mallee life-form.

The equivalent percentage measurement used by NVIS is defined by " Foliage Cover": i.e. The percentage of the sample site occupied by the vertical projection of foliage and branches
NVIS foliage cover is slightly different to Muir's Canopy cover in that it includes branches - however given the subjectivity of estimation in the application of Muirs Canopy Cover classes, the NVIS and Muir classes can be viewed to all intents and purposes as equivalent (A. Hopkins pers. com)