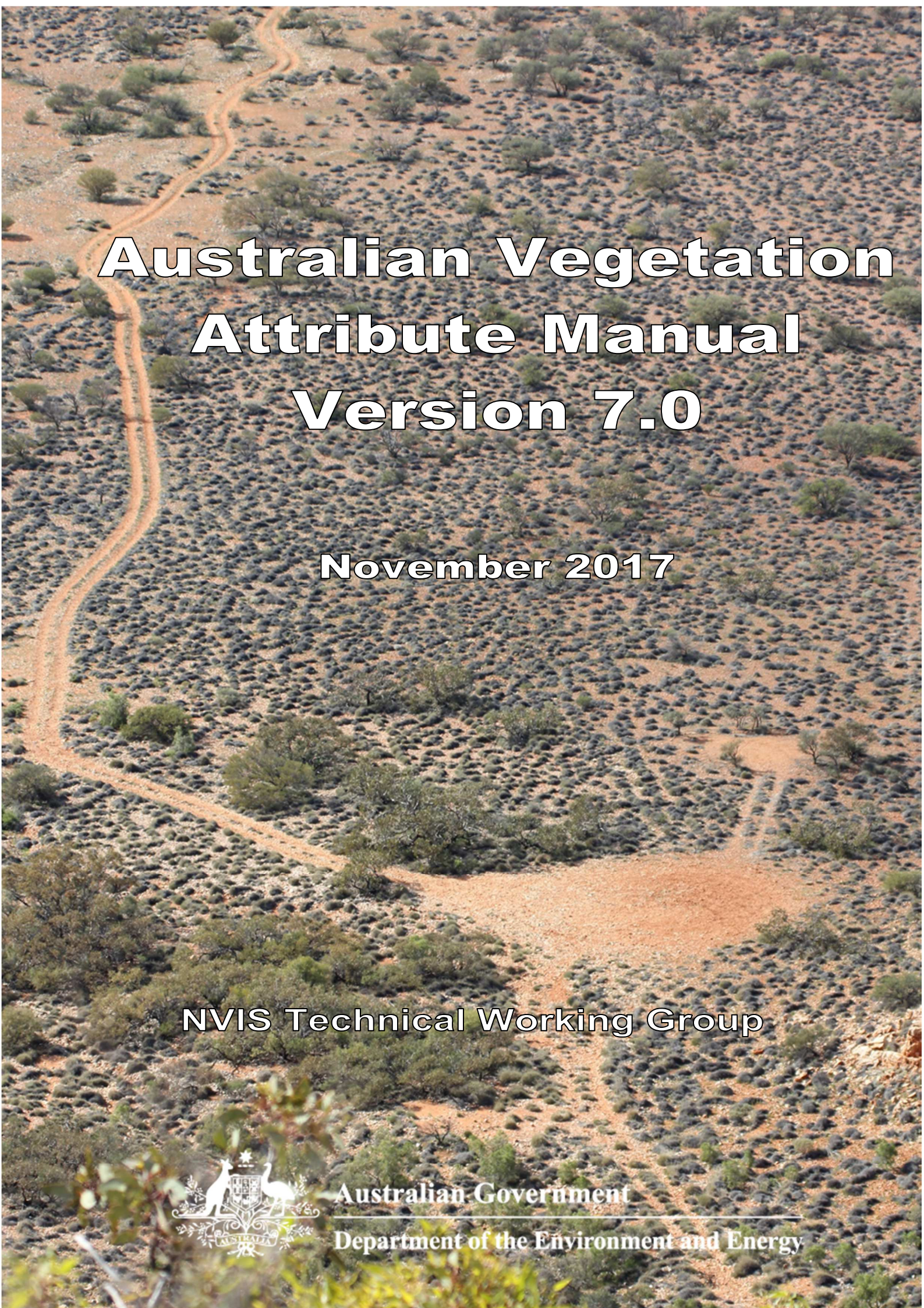

# Australian Vegetation Attribute Manual Version 7.0

November 2017

NVIS Technical Working Group

Australian Government
Department of the Environment and Energy

**Image credits** Front and back cover: CC BY 4.0 (photographer C. deLacey)
View to the southeast from Mount Finke situated in the gazetted locality of Yellabinna, South Australia.

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See Appendix F for list of acknowledgements for all versions.

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**Overview**

**Chapter One** provides an introduction and overview of the National Vegetation Information System and the aims and background in relation to Version 7.0 of the Australian Vegetation Attribute Manual: National Vegetation Information System (referred to hereafter as AVAM 7.0 or the manual). The section also describes the scope of the manual and introduces the NVIS framework, part of which is presently being implemented and described in this manual. Some important recent developments are also described. Vegetation condition is not described in any detail, here, since this is the subject of a number of other initiatives.

**Chapter Two** describes the key concepts and procedures that are required to implement the NVIS framework. It explains the requirements for and the relationships between vegetation structural and floristic attributes and the application of the NVIS Vegetation Hierarchy. The hierarchy provides a way to aggregate and summarise the detailed data recorded in the lower tables of the database. A recent addition is the inclusion of an ecological/land cover classification which integrates data relating to vegetated and non-vegetated features. Chapter two also outlines the importance of understanding the need for documentation of the accuracy and reliability of the data and information entered into the database. Not all data entered into the database are equally weighted. To denote this, the attributes are categorised into those that are mandatory, essential, recommended, optional, etc. Some of the key NVIS-wide tables are too large to put in this section and are therefore placed in the Appendices (e.g. Glossary).

**Chapter Three** describes the design of the NVIS Database including an overview of the purpose and contents of each table. There is also detailed material specifying the spatial components of the NVIS and their linkages to the NVIS Database. Appendices provide further detail, including the treatment of multiple unmapped vegetation types (mosaics or complexes) within a mapping unit.

**Chapter Four** presents a detailed explanation of each attribute, including its purpose, a description and an example of how the attribute should be interpreted. Some attributes have pre-defined pick lists (i.e. lookup tables) of allowable values or codes, while others are designed for numeric or free text content. The primary purpose of this section is to enable the analyst in determining how to translate and compile each attribute in the NVIS framework. The section relies heavily on the concepts and tables in Chapter two and associated Appendices.

**Chapter Five** describes the rules which have been developed to improve the consistency and integrity of the NVIS database. These include rules to highlight inconsistencies and ambiguities within a vegetation description across several tables, for subsequent resolution and rules to generate the simpler levels of the NVIS Vegetation Hierarchy from data entered at a more-detailed level.

Chapter five also provides more details of the implementation rules and of attributes (Chapter four) using the semi-automated XML Transfer System.

The Appendices have additional documents supporting the application of the NVIS Attributes.

# Chapter 1.0 Introduction

## 1.1 Background

The National Vegetation Information System (NVIS) was originally developed to underpin the National Land and Water Resources Audit (NLWRA) assessment of vegetation in Australia (NLWRA, 2001)[1]. The NVIS was developed as a technical framework and database in partnership with the Australian, state and territory governments. The NVIS is currently managed by the NVIS Technical Working Group, with representatives from each of the above jurisdictions and several Australian Government agencies.

The guiding principles of the NVIS partnership and framework (NLWRA, 2001) are:

- resolving data and information differences across administrative and program boundaries to provide comparable and consistent data Australia wide
- collaborative work of mutual benefit
- recognising regional level environmental differences
- flexible and extendable
- fully documented quality and application of the component data sets
- delivering Information to meet current needs, foreshadowing and anticipating long-term needs
- improving the knowledge and information base of Australia's vegetation (pre-European and present) and addressing data gaps
- ensuring use is commensurate with data
- providing information and assessments to support vegetation and other natural resource decision making
- improving data access and dissemination
- recognising the jurisdictional role in meeting specific vegetation information requirements, management responsibilities and obligations.

There is a separate but complementary national forests database, the National Forest Inventory (NFI), which is primarily a data resource for reporting on productivity and sustainability matters in forests. Coordination mechanisms have been established between the NVIS and the NFI to work towards greater consistency between these two information systems. The NFI now uses multiple lines of evidence for reporting on forest types and extent;

[1] National Land and Water Resources Audit, (2001). *Australian Native Vegetation Assessment 2001*. Audit Canberra.

the NVIS is one of the input datasets. The NFI also manages the National Plantation Inventory, which is the authoritative source for such information; the NVIS contains plantation records only as contextual information.

The main products of the NVIS partnership and framework, since AVAM 6.0 (ESCAVI, 2003), include a range of updated data products showing the variety and distribution of Australia's native vegetation. These products are suited to a range of applications and can be used at various scales in a geographic information system (GIS). Data provided by state and territory custodians is highly detailed and consistent with the standardised NVIS attributes, enabling its amalgamation into the NVIS database. Recent agreement with the custodian has resulted in the datasets being made publicly available, under creative commons licensing, in the latest release of the NVIS. The detailed data is also generalised and added to non-NVIS data to fill gaps, and recompiled to create the NVIS Major Vegetation Groups (MVGs) and Major Vegetation Subgroups (MVSs) products – see Appendices D1 and D2 for the respective classifications. These generalised data are suited for national-scale analyses. Users of MVG and MVS products are reminded that these are not the sum total of NVIS. Detailed NVIS data underpins these derived products for the majority of Australia.

The chronological development of NVIS products:

- NVIS Version 4.2 was released in 2016. This updated NVIS data for NSW only. V4.1 data was reused for all other jurisdictions. This version includes 33 MVGs and 85 MVSs as per v4.1. It was used in the State of the Environment Report 2016.
- NVIS Version 4.1 was released in 2012. This comprised new and updated NVIS data from most jurisdictions. All data was reinterpreted into revised MVG and MVS classifications. This version includes 33 MVGs and 85 MVSs, and was used in the State of the Environment Report 2011.
- NVIS Version 3.0 was released in 2006. This version comprised a full refresh, with the publication of updated MVGs. The 30 MVGs are based on structure, growth form and floristic composition of the dominant stratum of each vegetation type. It was used in the State of the Environment Report 2006.
- NVIS Version 2.0 was released in 2003. This version comprised a restructured NVIS database, MVGs and the first MVS product. It also included Level 5 data available to the public for download and via a web mapping system.
- NVIS Version 1.0 was released in 2001. This version featured the first downloadable MVG product and an Australia-wide analysis (NLWRA, 2001).

## 1.2 NVIS Version 4.2 products, analysis tools and functions

The current NVIS Version 4.2[2] comprises the following suite of products and analysis tools:

**NVIS key layers (Version 4.2)**

[2] URL: http://www.environment.gov.au/land/native-vegetation/national-vegetation-information-system/data-products#key42 [accessed July 2017].

- Key Layer for the Sources of Present (Extant) Vegetation Data
- Key Layer for the Sources of Estimated Pre-1750 Vegetation Data
- Lookup table for Dataset Key Layers
- Supporting information

**NVIS Major Vegetation Groups (MVGs) (Version 4.2)**

- Present theme
- Estimated Pre-1750 theme
- Supporting information

**NVIS Major Vegetation Subgroups (MVSs) (Version 4.2)**

- Present theme
- Estimated Pre-1750 theme
- Supporting information

**NVIS Detailed Level 1-6 (Version 4.2)[3]**

- Present theme
- Estimated Pre-1750 theme
- Lookup table for NVIS Detail Level 1-6
- Lookup table for NVIS Level 5 Flat File

**NVIS Analysis Tools**

- NVIS 4.2 Uncertainty - analysis rasters (scaled 0-1)

**NVIS MVG/MVS Conversion Tools**

- Under development

## 1.3 Purpose and intended usage of the NVIS

The NVIS is the only nationally consistent vegetation dataset that describes what native vegetation is where. The NVIS plays an important leadership role and framework in how native vegetation is collected, collated and exchanged across Australia. It is a core dataset that feeds directly into departmental reporting, species and threatened ecological communities modelling, and a range of external uses.

### 1.3.1 Modelling

The quality and effectiveness of any model is limited by the inputs used in the development of the model. The NVIS is used in a broad range of environmental models, as a direct input, as

[3] Western Australian data is downloadable separately, under a different creative commons licence.

training data, to check model error and/or to interpret the model's output (see Table 1 for examples).

**Table 1** Key models and their uses (utilised by the Department of Environment and Energy) which rely on NVIS as an input.

| Model | Use |
|---|---|
| FullCAM | National Inventory Report |
| Matters of National Environmental Significance (MNES) species distribution modelling | EPBC Act – recovery planning, assessments and approvals |
| Threatened Ecological Community (TEC) distribution modelling | EPBC Act – recovery planning, assessments and approvals |
| Connectivity modelling | Biodiversity Conservation Division reporting; Conservation priority setting |
| VAST (Vegetation Assets, States and Transitions) | EPBC Act – State of the Environment |

There is an expectation that these models will improve in resolution and accuracy over time, as in the absence of such improvements to the NVIS any dependent models and associated interpretation will be limited by the NVIS. For example, the Full Carbon Accounting Model (FullCAM) is used to construct Australia's national greenhouse gas emissions account for the land sector. One of the objectives of the FullCAM is to predict vegetation biomass at 25 m resolution (1:2,500), but the resolution is limited by the NVIS, where the scale is often coarser. Without ongoing improvements to the NVIS, our knowledge of vegetation distribution will directly impact on Australia's ability to report on its obligations under the Kyoto agreement and other legislative requirements.

#### 1.3.1.1 Case study 1: Australia's National Carbon Accounting System (NCAS)

The National Inventory Report[4] contains the national greenhouse gas emission estimates. This report is submitted under the United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol (KP).

The National Vegetation Information System (NVIS) is a key input to the FullCAM model, one of a suite of models that was developed as part of the Australian National Carbon Accounting System (NCAS). Within FullCAM, the NVIS is used to estimate the changes in living biomass. Biomass allocation is modelled through specific metrics that related a carbon stock for each relevant Major Vegetation Group (MVGs). The NVIS is used as it

> *……provides a composite of the best available vegetation mapping in Australia. For the forest land converted to cropland and forest land converted to grassland category, various forest characteristics (e.g. forest floor coarse woody debris and litter) are associated with the forest types extracted from the NVIS. The NVIS collates and provides, in a consistent taxonomy and classification, the best available vegetation maps from all available sources. For the purposes of carbon accounting the MVG categories were applied.*[5]

[4] Department of the Environment and Energy (2014). National Inventory Report 2014 (revised). Volume 2. Australian National Greenhouse Accounts. Commonwealth of Australia

[5] Ibid.

In addition, the MVGs are used to spatially separate the land types included in the forest land converted to cropland or grassland classifications.

The vegetation community is the most commonly-used method for defining and communicating a species' distribution by relating the species' observation points and the vegetation type in which they are situated. The NVIS underpins the habitat mapping for most modelling that the department undertakes, including distribution modelling for threatened species, Ecological Communities (EC) and for the purpose of recovery planning.

## .3.2 Reporting

The NVIS is used for native vegetation and biodiversity reporting. As discussed briefly above, the NVIS is used in a broad range of environmental models, as a direct input using MVGs, as training data, to check model error and/or to interpret the model's output. There are a suite of current and developing environmental models that spatially describe an aspect of the environment. Meaningful interpretation of these models relies on the NVIS. This is usually done by relating the model output to MVGs or MVSs. The NVIS is used to report on native vegetation and change since European settlement. The reports that the NVIS has contributed to include:

- State of the Environment Report
- National Greenhouse Accounts
- National Reserve System review
- Australia's Native Vegetation Framework
- Australia's Biodiversity Conservation Strategy 2010–2030

#### 1.3.2.1 Case study 3: State of the Environment Report (SoE) (2011)

The Minster for the Environment must table an environmental report under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) every five years in each house of parliament.

The NVIS is a key dataset that underpins much of the vegetation information in the State of the Environment (SoE) report. It contributes directly to the Land and Biodiversity chapters by describing and mapping the vegetation with Major Vegetation Groups (MVGs). For example,

*Three MVGs each occupy more than 10% of continental land area – hummock grasslands (18%), eucalypt woodlands (12%) and acacia shrublands (11%)….*[6]

It also contributes by enabling quantification of vegetation change, and which vegetation communities have been most impacted by European settlement. For example,

*The greatest areal loss of vegetation since European settlement has been in the eucalypt woodlands (MVG5), which has been reduced by one-third, to around 84 million hectares. Each of*

[6] State of the Environment Report 2011

*Eucalypt open forests (MVG 14), and other grasslands, herblands, sedgelands and rushlands (MVG 21) have suffered similar proportional loss*[7]*…*

A comparison table further illustrates vegetation change, by type, since European settlement (State of the Environment Report 2011; Figs 5.15, 5.16 & 5.17; Table 8.6).

The NVIS is used indirectly to underpin and describe a suite of models on condition, climate change and vegetation extent. This includes the Vegetation Assets, States and Transitions (VAST), analyses for the size of remnant patches of native vegetation in Australia and dissimilarity models (State of the Environment Report 2011; Figs 5.20 & 5.21 respectively) as it is:

*…best available mapping of pre-European continental vegetation (pre-clearing major vegetation groups of the National Vegetation Information System…*[8]

### 1.3.3 External use

Metrics for the NVIS website show that NVIS has been downloaded 4870 times from 2012 to 2017, equating to six downloads per day; this number comprises over 1300 unique individuals and 900 organisations. The most prolific NVIS users are research organisations, with most Australian universities having downloaded it on at least one occasion. Increasingly, it is being used in web viewers, nationally, such as the National Map.

Researchers that use MVGs and MVSs include those from the National Environmental Science Programme (NESP), governments and natural resource management (NRM) groups. As the NVIS is the only simple consistent Australia-wide vegetation model, it is used in a variety of models including the Aurora fire spread model which is discussed in Case Study 4, VAST[9], habitat modelling[10] and reporting such as the State of the Forest Report[11] (ABARES 2013).

[7] State of the Environment 2011 Committee (2011) Australia, State of the Environment 2011. Independent report to the Australian Government Minister for Sustainability, Environment, Water, Population and Communities. Canberra.URL: http://155.187.2.69/soe/2011/report/land/2-3-vegetation.html#ss2-3-1

[8] Dunlop M., Hilbert D.W., Ferrier S., House A., Liedloff A., Prober S.M., Smyth A., Martin T.G., Harwood T., Williams K.J., Fletcher C., and Murphy H. (2012) The Implications of Climate Change for Biodiversity Conservation and the National Reserve System: Final Synthesis. A report prepared for the Department of Sustainability, Environment, Water, Population and Communities, and the Department of Climate Change and Energy Efficiency. CSIRO Climate Adaptation Flagship, Canberra.

[9] Thackway, R. and Lesslie, R. (2006) Reporting vegetation condition using the Vegetation Assets, States, and Transitions (VAST) framework.*Ecological Management and Restoration*. 7 (Suppl. 1): 53-62.

[10] Maggini, R, Kujala, H, Taylor, MFJ, Lee, JR, Possingham, HP, Wintle, BA & Fuller, RA 2013, *Protecting and restoring habitat to help Australia's threatened species adapt to climate change*, National Climate Change Adaptation Research Facility, Gold Coast

[11] Montreal Process Implementation Group for Australia and National Forest Inventory Steering Committee, 2013, *Australia's State of the Forests Report 2013,* ABARES, Canberra, December. CC BY 3.0.

#### 1.3.3.1 Case study 4: Aurora fire modelling

The University of Western Australia (UWA) has successfully designed a fire-spread simulator Australis, which uses a cell-based approach with an underlying irregular grid. The model has been updated to the Aurora fire spread model for national application[12]

Aurora helps fire controllers quickly test various ignition points and weather conditions in order to determine the best days for carrying out prescribed burns or to run scenarios to optimise fire-suppression outcomes for a live fire event.

The NVIS Major Vegetation Sub-groups (MVSs) is a key dataset in the Aurora fire-spread simulator. The MVSs are used to develop relationships between vegetation type to fire spread, fire frequency and fuel accumulation. These relationships have been developed over time through working groups and ongoing research. Nationally, this work is seen as important and is being adopted by other jurisdictions which are using the relationships and/or models for their own purposes.

There is a general need to improve Aurora modelling, which currently functions at a 250 m resolution

*A point spacing of 250 m is used for the user defined simulation. Where the DEM and NVIS datasets have a cell resolution substantially better than this, there is the possibility of using a point spacing of 100 m.*

To be able to improve the Aurora model inputs, the NVIS needs ongoing improvement through data cleaning and compiling the most up-to-date data.

Numerous other uses may form the basis for interesting case studies which have not been elaborated on here. For example, ABARES has a statutory requirement to produce the State of the Forest Report (SoF). The NVIS features as a critical State of the Forest dataset, as it forms the basis of all floristic and much of the structural vegetation information included in the report; "for SoF reporting there is no other dataset that can supplant the NVIS" (*pers. comm*. Claire Howell 2014).

## 1.4 The NVIS framework

The NVIS framework was developed as a collaborative process between the Australian, state and territory Governments – see Appendix F for contributor acknowledgements. The Australian vegetation attributes are a key component of the Framework. Earlier uses of the NVIS framework are documented in Version 6.0 of the Australian Vegetation Attribute Manual[13], and data collected and compiled to this standard (Version 6.0) were used to compile NVIS versions 2.0 to 4.2. As discussed in Sections 1.2 and 1.3, numerous derived products[14],

[12] http://aurora.landgate.wa.gov.au/home.php

[13] 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.

[14] http://www.environment.gov.au/land/native-vegetation/national-vegetation-information-system/data-products

queries and assessments have used such data. The components of the NVIS framework are shown in Figure 1 and a brief description of each of the components is shown in Table 2.

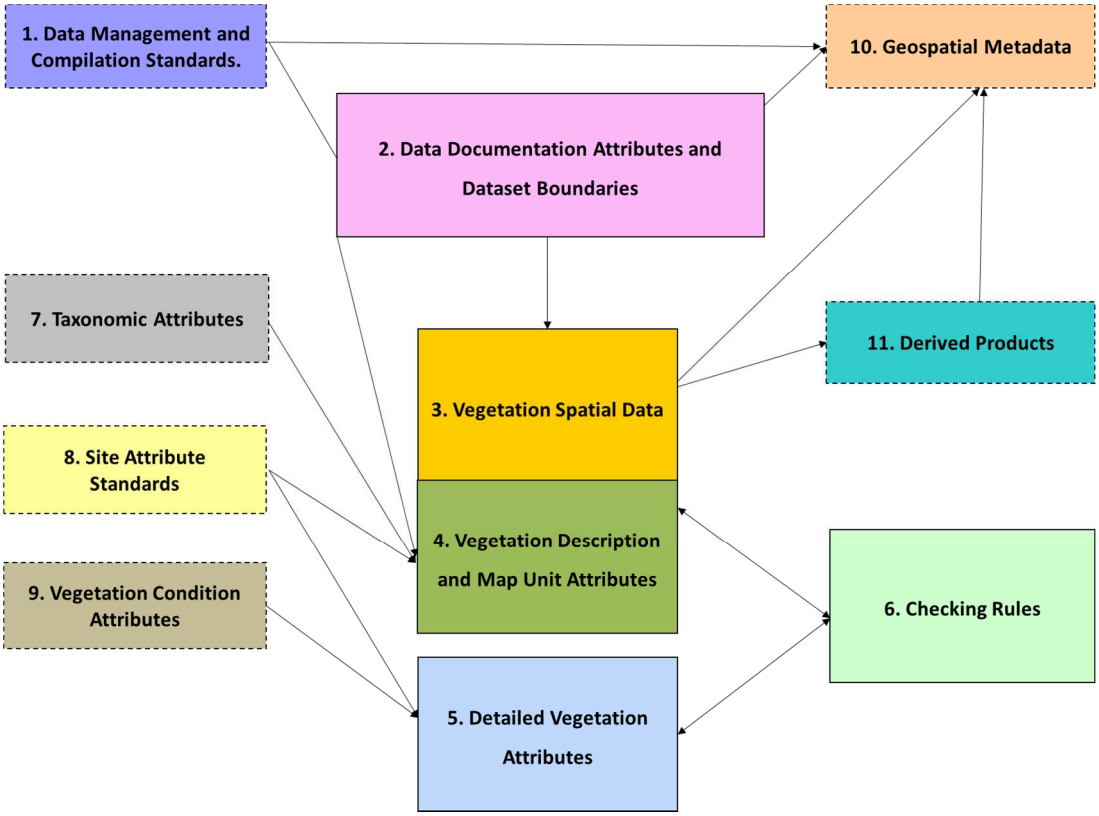


**Figure 1 National Vegetation Information System framework.**

*This manual relates primarily to the first six components (2-6) and their colours*[15] *are consistent with Figure 6 (*Overview of the NVIS Vegetation Attribute Structure V7.0)*, Appendix C (*Entity relationship diagram showing NVIS Database Structure Version 7.0) *and table banners in Chapter 4. The arrows are indicative of the main links between components. In general, the input standards are on the left of the diagram, the main components of NVIS are in the centre and output products are towards the right of the diagram.*

The NVIS framework was developed to enable the compilation of a nationally consistent vegetation dataset from data collected by the states and territories. It provides a comprehensive means of describing and representing vegetation information based on establishing relationships between structural and floristic data. The NVIS vegetation hierarchy, part of the framework, is a system for describing the structural and floristic patterns of assemblages of plants in the landscape. Collectively, different levels in the classification provide a description of vegetation that can be directly related to spatially defined areas on a vegetation map.

[15] *See Appendix M for RBG values*

**Table 2** More details about each component of the NVIS framework, including whether further details are available in this manual.

| Component | Title | Description | Details in AVAM 7.0? |
|---|---|---|---|
| 1 | Data management and compilation guidelines | This component consists of guidelines, standards and protocols to ensure that the consistency and quality of NVIS data meet national standards. In particular, this ensures the interoperability of vegetation data with data for other themes. | No |
| 2 | Data documentation attributes and dataset boundaries | This component deals with additional metadata for the vegetation theme. This includes the documentation of methods and sources used to create vegetation maps and vegetation descriptions. It also describes the data quality and availability of the resulting data sets, including spatial outlines for each vegetation survey. | Yes |
| 3 | Vegetation spatial data | This component consists of spatial data guidelines and protocols, including the standard NVIS spatial attributes. | Yes (partial) |
| 4 | Vegetation description and map unit attributes | This component describes the main attributes used to describe a mapped vegetation type and their inclusion in (unmapped) mosaics. It includes data for the NVIS information hierarchy in non-normalised text strings of increasing complexity. | Yes |
| 5 | Detailed vegetation attributes | This component specifies the normalised data attributes relating to the NVIS information hierarchy, in addition to other attributes and record-level metadata to further describe the vegetation type and the methods employed to collect the data. | Yes |
| 6 | Checking rules | This component covers checking rules to ensure the consistency and quality of the vegetation descriptions and detailed vegetation data. | Yes |
| 7 | Taxonomic attributes | Earlier versions[16] of the Australian Vegetation Attribute Manual comprised tables and attributes to manage taxonomic lists and codes for use in NVIS. Considerable progress has been made outside the NVIS framework to publish human and machine-readable Australian plant names (for example, the Australian Plant Name Index and Australian Plant Census[17]). Internal NVIS compilation protocols need to be reviewed in light of this changing context. | No |
| 8 | Site attribute standards | The revision of site data collection guidelines progressed as a separate exercise to the AVAM and has resulted in a major revision of the Vegetation chapter in the Australian Field and Land Survey | No |

[16] National Land and Water Resources Audit, (2000a). Australian Vegetation Attributes: National Vegetation Information System Version 5.0. Audit Canberra.

[17] Australian National Botanic Gardens (ANBG) (2015) *Australian Plant Name Index*. Maintained in collaboration with the Centre for Australian National Biodiversity Research and the Australian Biological Resources Study.

| Component | Title | Description | Details in AVAM 7.0? |
|---|---|---|---|
| | | Handbook (Hnatiuk *et al*., 2009[18]). Further details are also provided in White *et al*. (2012[19]). | |
| 9 | Vegetation Condition Attributes | In general, most states have devised condition assessment protocols for the evaluation of condition with respect to biodiversity management and regulation. These are based on the concept of reference data (ideally collected from reference sites) for each pre-1750 (pre-European) vegetation type. Other instances of each vegetation type can be evaluated for the extent of modification by land use and other disturbances. The use of these systems for monitoring and reporting is less developed. A national scheme was proposed and applied across Australia (Thackway and Lesslie, 2006[20]; Metcalfe and Bui, 2016[21]) | No |
| 10 | Geospatial Metadata | This component consists of guidelines, standards and protocols to ensure that the consistency and quality of NVIS metadata meet national standards. In particular, this ensures the interoperability of vegetation metadata with metadata for other themes. | No |
| 11 | Derived Products | Derived products are not formally part of the main NVIS database, but should comply with standards outlined in Components 1 and 10. For over a decade, these have been the public face of NVIS. However, with the adoption of Creative Commons licensing, more components of NVIS are now available. | No |

## 1.5 Scope of the Australian Vegetation Attribute Manual

The manual provides a guide to enable the capture, interpretation and management of existing and new vegetation information into a relational database management system. Its primary purpose is to link the vegetation descriptions to map units (map legend information) in a GIS. The manual provides nationally agreed guidelines for translating and compiling mapped vegetation datasets into the NVIS database through describing the NVIS attribute framework and links to the NVIS spatial data.

[18] Hnatiuk R.J., Thackway R. & Walker J. (2009). Vegetation. In: *Australian Soil and Land Survey: Field Handbook* (Third Edition). (Eds National Committee on Soil and Terrain) pp. 73–125. CSIRO Publishing, Melbourne.

[19] White, A., Sparrow, B., Leitch, E., Foulkes, J., Flitton, R., Lowe, A., & Caddy-Retalic, S. (2012). AusPlots rangelands survey protocols manual, Version 1.2.9. South Australia: University of Adelaide Press. DOI: 10.13140/2.1.4287.3607.

[20] Thackway, R. and Lesslie, R. (2006). Reporting vegetation condition using the Vegetation Assets, States, and Transitions (VAST) framework. *Ecological Management and Restoration*. 7 (Suppl. 1): 53-62.

[21] Metcalfe D and Bui E (2016). Land: Vegetation. In: Australia state of the environment 2016, Australian Government Department of the Environment and Energy, Canberra. https://soe.environment.gov.au/theme/land/topic/2016/vegetation-0. DOI 10.4226/94/58b6585f94911

As per the fourth column in Table 2, this manual covers the first six component boxes shown in Figure 1, with detailed material to support components 2, 4, 5 and 6. Component 2 provides guidelines and attributes to describe the vegetation theme-specific metadata relating to datasets from the States and Territories. Components 4 and 5 describe the interpretation of existing vegetation descriptions into the NVIS standards, while component 6 describes detailed rule checks.

This manual describes how to translate, compile and manage the complex results of such vegetation surveys as an input to GIS queries and displays. This manual is not intended to be a guide for the collection of vegetation data in the field. While the attributes are heavily based on those designed for site surveys of vegetation, the reader is referred to a rich literature available on survey design and the collection of vegetation data for observational studies. See authors such as Walker and Hopkins (1990)[22] and Hnatiuk *et al.* (2009)[23] for guidance on data collection for specific attributes. Thackway et al. (2008)[24] provide useful methodological guidelines for vegetation survey and mapping.

Also out of scope are aerial photography interpretation (API) attributes that have not been classified into a workable number of vegetation types. This is often the case in API data that has multiple attributes for each polygon, but the classification into vegetation types has not been done. From an NVIS viewpoint, the permutations and combinations of API attribute values are too numerous to justify the many descriptions that would be required. Modelled vegetation maps may be in or out of scope, depending on the nature of the modelling.

Users of the NVIS spatial and other products presenting the data-rich Levels 5 and 6 may benefit from reading Chapters 2 and 3, while referring to Chapter 4 for detailed explanation of each attribute, including its purpose, a description and an example of how the attribute should be interpreted. Users of higher levels of the NVIS may only wish to keep in mind the height classes for specific growth forms (Tables 5 and 6) and growth form/cover (Table 7). Users of products derived from NVIS are also referred to other supporting documentation such as reports, fact sheets, brochures, maps and the standalone descriptions of Major Vegetation Groups.

The analysis of vegetation information is beyond the scope of this publication. However, the information products listed in Section 1.2 (NVIS Version 4.2 products, analysis tools and functions) and case studies in Section 1.3 (purpose and intended usage of the NVIS) provide the reader an idea of the actual and potential benefits of the NVIS framework.

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[22] Walker J. and M.S. Hopkins (1990). Vegetation. In: McDonald, R.C., R.F., Isbell, J.G., Speight, J. Walker, and M.S. Hopkins. (Eds) *Australian Soil and Land Survey. Field Handbook.* 2nd edn. Melbourne: Inkata Press.

[23] Hnatiuk, R.J., Thackway, R. & Walker, J. (2009). Vegetation. In: *Australian Soil and Land Survey Field Handbook* Third Edition (eds R.C. McDonald, R.F. Isbell, J.G. Speight, R.J. Hnatiuk, R. Thackway, & J. Walker). CSIRO Publishing, Melbourne.

[24] Thackway R., Neldner V.J. and Bolton M.P. (2009). Vegetation. In: Australian Soil and Land Survey Handbook: Guidelines for Surveying Soil and Land Resources. (Eds McKenzie N.J., Grundy M.J., Webster R. and Ringrose-Voase A.J.) pp. 115–142. CSIRO Publishing, Melbourne.

## 1.6 The NVIS database

The original NVIS Database was restructured to operationalise Version 6.0 of this manual (ESCAVI, 2003) and to assist the data custodians to translate and compile existing state and territory vegetation data sets into the NVIS framework.

The structure of this manual (i.e. version 7.0) reflects the current structure of the NVIS database as shown in Figure 4 (basis of classification of 'other cover types' at Levels 1-3 of the NVIS Database) and in Appendix C (entity relationship diagram). Also see Appendix G (NVIS attribute requirements) for a summary of changes to NVIS attributes from V6.0 – V7.0. It is anticipated that changes to the XML transfer protocol to facilitate the newly-incorporated ecological/land cover classification will be minimal.

# Chapter 2.0 NVIS concepts and standard procedures

## 2.1 Vegetation

The NVIS framework provides a comprehensive means of describing and representing vegetation types, based on establishing relationships between structural and floristic data in a relational database management system. It is assumed that field surveys have already been conducted and that observational data has been classified into meaningful vegetation types, which are typically the mapping units used in the region (for example, see Thackway *et al*., 2008). This section primarily deals with the non-spatial vegetation data used to describe each vegetation type, but also includes a short section introducing vegetation-specific metadata used to describe the methods used to survey, classify and map the vegetation of a region.

As discussed in the Section 1.5 (Scope of the Australian Vegetation Attribute Manual), this manual is not intended to be a guide for the collection of vegetation data in the field. Mapping standards generally follow accepted thematic polygon or multi-attribute raster data in the natural resources management sector. However, NVIS accepts the best available vegetation descriptions and spatial data from a number of state, territory and non-government systems. Where necessary, and particularly in relation to data gaps, NVIS will accept the multi-attribute spatial layers resulting from aerial photo interpretation for incorporation into derived products. However, these data result from an earlier task of the vegetation mapping workflow; incorporating classified data is the predominant and most-efficient approach.

The approach to describing vegetation types in NVIS is derived from field survey methods, such as those described above, in that a vegetation profile is first interpreted into a simple model with several layers or strata (upper (U), mid (M) and ground (G)) which have particular structural and floristic properties. These strata are traditionally defined manually, but can be defined from instrumented sources, such as LiDAR[25] or the product of post-survey analyses.

In NVIS, a vegetation type has usually been derived by classifying data from multiple observational points extending over a study area which has been stratified according to one or many variables. The stratified or experimental units tend to have variability around a central tendency. Once classified, the vegetation type can be analysed or interpreted into strata, against which any structural and floristic information is

[25] Quadros, N. and Keysers, J. (2015). Airborne LiDAR acquisition and validation. In: AusCover Good Practice Guidelines: A technical handbook supporting calibration and validation activities of remotely sensed data product. (Eds A. Held, S. Phinn, M. Soto-Berrelov and S. Jones) pp. 268-301. Version 1.2 TERN AusCover, ISBN 978-0-646-94137-0.

recorded in simple measures. In some cases, there is enough primary field data to use these to establish strata following the field surveys. Strata can often be characterised from reflective remote sensing and the challenge of vegetation mapping includes matching a vegetation type recognisable in the field with patterns, reflectance levels and/or environmental variables.

For the purposes of NVIS, vegetation types are regarded as definitive when all of the vegetation of a region has been classified and mapped (Thackway et al., 2009. For the purposes of regulation, mapping and monitoring, many jurisdictions have moved or are moving towards the description of vegetation types according to the concept of "definitive vegetation types[26]", which can be identified and described independently of the spatial units in which they occur. However, it is recognised that, as more data becomes available, often at a finer scale, classifications may change to absorb greater variability than initially anticipated.

## 2.1.1 Key concepts

### 2.1.1.1 Dominance

The concept of dominance is central to the construction of NVIS vegetation descriptions. The proposition is that a particular vegetation type can be represented by information that summarises each property in a simple way. In NVIS, this is generally achieved by truncating copious amounts of data that have been ranked, using a vegetation characteristic, to reflect decreasing "dominance[27]" within each domain of comparison.

This ranking of relative dominance is used for comparisons of the structural properties of strata (Section 2.1.4.3), species and genera within a stratum (Sections 2.1.7.2 and 2.1.7.3) and growth forms within a stratum (Section 2.1.5).

The dominance of the (sub-)stratum[28] provides a useful summary of the vegetation description at the simpler levels (Levels 1 to 3) in the NVIS vegetation hierarchy, and because multiple interpretations of the concept exist[29], interpreters creating NVIS descriptions should use a consistent protocol for the assignment of the dominant stratum for each vegetation type. The dominance of a (sub-)stratum can be indicated by its estimated relative biomass (or coarse surrogate, such as cover times height) across a vegetation type. Among other benefits, delineation of the dominant stratum enables the description of a particular vegetation type to be progressively simplified in the NVIS vegetation hierarchy, as discussed in Section 2.1.3 (The NVIS vegetation hierarchy). Another example of the use of dominance is when comparing species

[26] For example: Plant Community Types in NSW (NSW OEH, 2017); Regional Ecosystems in Queensland (Neldner et al., 2017); Ecological Vegetation Classes in Victoria (Woodgate et al., 1994; Anon (2017).

[27] Probably better termed "relative dominance".

[28] Strata occur in NVIS Level 5; substrata occur in NVIS Level 6.

[29] Kershaw, K.A. and Looney, J.H.H. (1985). Quantitative and Dynamic Plant Ecology. 3rd Edn. Edward Arnold, Melbourne.

listed in an NVIS record. A summary of the type can be generated by documenting the few species that dominate each stratum, in order of decreasing dominance, as measured by suitable vegetation characteristic such as foliage cover or frequency – see Section 2.1.7.2 (Component Data for Species) for further details. Other properties of the vegetation type, particularly values such as height and cover scales are represented by median, modal, average or enumerated values, which are documented in the metadata for each input dataset and in record-level metadata. Such values can contribute to further interpretation and description of each vegetation type[30].

#### 2.1.1.2 Vegetation strata

Figure 2 provides a schematic representation of vegetation layering in a hypothetical vegetation community. These layers may be interpreted into strata which share heights and growth form parameters (Walker and Hopkins, 1990). In complex vegetation structural types, each of the three NVIS Level 5 strata (U, M and G) may be further divided into substrata to a maximum of nine layers in NVIS Level 6 as shown in Table 4 (NVIS (sub-)stratum codes and descriptions), though in less structurally complex vegetation types, not all of the strata need be present.

[30] The comprehensive recording of variability in a vegetation type is beyond the scope of NVIS. The user is referred to relevant site data relating to each vegetation type.


**Figure 2 Vegetation profiles for two different vegetation types.**
*The diagram illustrates the flexibility in assignment of substrata (U1, U2, etc.—see Table 4 for NVIS (sub-)stratum codes and descriptions) at NVIS Level 6. These can be interpreted into three simple strata (as per NVIS Level 5: Upper or Tree, Mid or Shrub and Ground).*

As an example of interpreting layers from field data, Figure 3 (Graphical summary of cover values for an example NVIS Description at Level 5) shows a graphical summary of percentage cover in each of three strata for a *Eucalyptus populnea* grassy woodland.

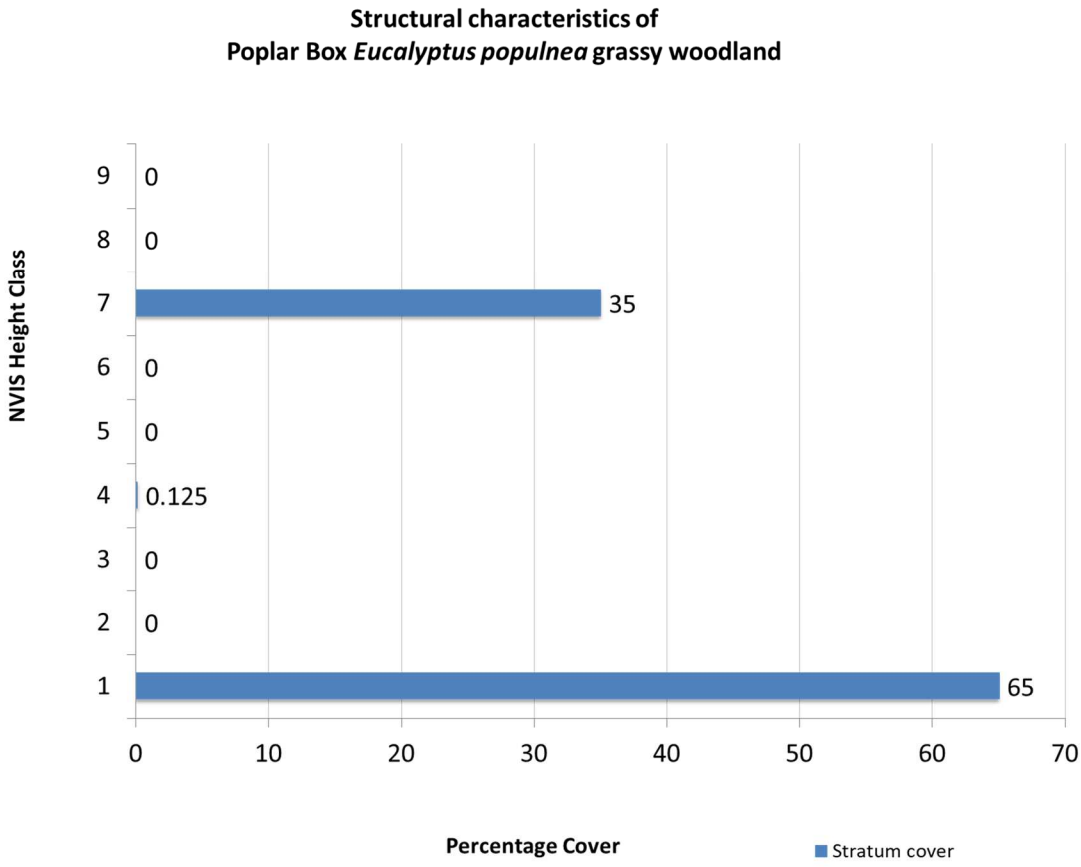


**Figure 3 Graphical summary of cover values for an example NVIS description at Level 5.**

*The tree stratum, U, has a Height Class of 7 and a cover code mid-point of 35% (Cover Code i); the shrub stratum, M, has a Height Class of 4 and a cover code mid-point of 0.125% (and is hence barely visible on the graph; Cover Code 'bi') and the ground stratum, G, has a Height Class of 1 and a cover code mid-point of 65% (Cover Code c). See Table 5 for a list of Height Classes and Table 7 for Cover Codes.*

#### 2.1.1.3 Notation

A number of notation processes have been developed for the data supplier to code Level 5 and 6 data with enough data for the automated generation of simpler vegetation descriptions from the detailed data. These include:

- Dominant stratum
- Dominant genus or genera[31] within a stratum
- Listing species in sub/strata according to decreasing dominance
- Dominant growth form within a stratum
- Listing growth forms in sub/strata according to decreasing dominance

[31] Genera, but not species, are promoted in the Information Hierarchy

- An attribute to generate the "+/-" delimiter between species, commonly used to indicate relatively lower frequencies of occurrence in the vegetation type, compared with the usual comma ",".

Further details are provided in the following sections.

### 2.1.2 Data set documentation and information reliability

The NVIS framework provides a comprehensive means of describing and representing vegetation types, based on establishing relationships between structural and floristic information in a Relational Database Management System. Each dataset provided as input to NVIS needs to have appropriate metadata supplied. This should be in the form of completed attributes in the Dataset Information part of the NVIS database (DATA_SET, Reference and MAPPING_SOURCE tables). The DATA_SET table shown in Appendix C1 (Entity relationship diagram), in particular, has attributes to describe the scope of each input dataset, validation techniques and data accuracy.

The data provider must utilise existing metadata, publications and/or unpublished material associated with the dataset to complete these attributes. Emphasis in documenting metadata has been placed on more detailed reporting relating to an assessment of accuracy, as these measures provide users with valuable information on the source mapping product that is included in NVIS. See Chapter 4 for the details of each vegetation metadata attribute. A very useful corollary of compiling this metadata is that "gaps" in spatial and thematic coverage of Australia are easier to identify and communicate to decision-makers.

Details of each of the attributes of the NVIS framework are presented in Chapter 4. The following sub-sections describe the relationships between each of the attributes, how they are populated and how they are managed within the NVIS framework. A glossary of key terms and definitions which underpin the NVIS framework is presented Appendix A.

### 2.1.3 The NVIS vegetation hierarchy[32]

The NVIS vegetation hierarchy is based on six levels from the highest level of Level 1 (Class) through to the species, growth forms, height and cover recorded in each (sub-)stratum[33] at NVIS Level 6 (Sub-Association level) as shown in Table 3. The purpose of the vegetation hierarchy is to:

- define and therefore standardise the structural and floristic information needed within the different levels of the hierarchy
- provide a framework for quality control and assurance of vegetation description information
- provide progressively simplified descriptions of the each vegetation type to meet a range of user search, analysis and extraction needs

[32] Formerly the NVIS Information Hierarchy, which has now been re-purposed as an umbrella term to include both the NVIS Vegetation Hierarchy and the NVIS Ecological/Land Cover Hierarchy.

[33] The notation (sub-)stratum should be read as substratum and/or stratum, which are the names of the standard layers at Levels 6 and 5, respectively.

- provide a framework for generating outputs (e.g. map products) at the various levels.

**Table 3 The NVIS vegetation hierarchy. The levels below the dark line are the "complex" levels recommended for data compilation.**

| Hierarchical Level <2017[34] | >2017 | Title | Description | NVIS structural/floristic components required |
|---|---|---|---|---|
| I | 1 | **Class** | Dominant growth form for the structurally dominant stratum. | |
| II | 2 | **Structural formation** | Dominant growth form, cover and height (in the standardised notation of Table 7) for the structurally dominant stratum. | |
| III | 3 | **Broad floristic formation** | Dominant genus (or genera) plus growth form, cover and height (in the standardised notation of Table 7) for the structurally dominant stratum. | |
| IV | 4 | **Sub-formation** | Dominant genus (or genera) plus growth form, cover and height (in the standardised notation of Table 7) for each of the three main strata. (i.e. Upper, Mid and Ground) | |
| V | 5 | **Association** | Dominant growth form, height, cover and species (to a maximum of 3 species) for each of the three main strata. (i.e. Upper, Mid and Ground) | |
| VI | 6 | **Sub-Association** | Dominant growth form, height, cover and species (to a maximum of 5 species) for each of the substrata. | |

Level 5 (Association) is the recommended minimum standard for input of vegetation description data into NVIS. At this level, the three predominantly recognised strata[35] and as represented in Figures 2 and 3 (where present), are easily recognised for most vegetation types across Australia. For each stratum, the characteristic height and cover are recorded, and up to 3 growth forms and up to 3 species (for each stratum) can be used to describe the vegetation type at Level 5.

The preferred level for input is Level 6 (the Sub-Association). At this level, up to nine substrata or layers are recognised as described in Table 4, with characteristic height and cover recorded for each substratum; and up to five growth forms and up to five species per substratum can be used to describe the vegetation type at Level 6.

The NVIS vegetation hierarchy is based firstly on structural information and secondly on dominant genus and growth form specified at the substratum level for the Level 6 (Sub-Association level) detail. Usage rules for the NVIS vegetation hierarchy are provided in Table 9 and a detailed example of the information contained at each level of the NVIS hierarchy is given in Table 10.

In general terms, the source component information on growth forms and species is combined with the structural formation terminology to produce an integrated NVIS

[34] Use of the Roman numbering system for NVIS Levels has now been superseded.

[35] Walker J. and Hopkins M. S. (1990). Vegetation. In: *Australian Soil and Land Survey: Field Handbook (Second Edition)*. (Eds R. C. McDonald, R. F. Isbell, J. G. Speight, J. Walker and M. S. Hopkins) pp. 58–86. Inkata Press, Melbourne.

*vegetation description* at the complex NVIS levels (5 and/or 6). Rules are used to automate the generation of simpler levels (Levels 1 to 4) in the NVIS vegetation hierarchy.

This hierarchy is beneficial in that it enables the following functions:

- The input of vegetation description data at the "complex" levels (Levels 5 or 6) enables the automatic generation of simpler levels, thus maintaining consistency in the database as well as reducing workloads.
- The Level 5 (Association) retains sufficient data to allow useful comparison with the Level 6 (Sub-Association). This will be important where a jurisdiction can only enter data at Level 5.
- Growth form information is retained in the middle- and upper-levels of the hierarchy. One of the reasons for including growth form data is that it is often easier to recognise in the field.
- Standardised descriptions provide the basis for comparing vegetation types between datasets with disparate mapping methods and hence identifying equivalent vegetation types.

In NVIS Version 1.0, Levels 1-4 of the NVIS vegetation hierarchy were sometimes used to translate and compile datasets, where further details were not available. However, this approach is not recommended, because the accurate and reliable use of rule sets that underpin the NVIS vegetation hierarchy require mandatory and essential attribute data as outlined in Appendix G (NVIS Attribute Requirements) at Level 5 or 6, before these data can be aggregated to a higher level. Datasets not meeting the NVIS threshold will be of limited use in the development of products.

## 2.1.4 Structural information

### 2.1.4.1 Sub/strata and growth forms

The stratum codes[36] presented in Table 4 show the relationship between the NVIS (sub-)stratum codes, traditional names (Walker & Hopkins, 1990) and the growth forms within each (sub-)stratum. The definitions for growth forms are provided in GROWTH_FORM_CODE[37]

[36] The terminology sub/stratum should be interpreted as follows: substratum (for Level 6 data) and/or stratum (for Level 5 data).

[37] Where possible in NVIS data and program coding, GROWTH_FORM_CODE should be progressively replaced with GR_FORM, to avoid confusion with other, similar single-letter coding systems (e.g. Sivertsen, 2009).

in the GROWTH_FORM Table (see Table 6). The maximum number of substrata within Level 6 (Sub-Association) is nine.

When describing the stratum at Level 4 (the Sub-Formation) the data codes U, M and G are automatically obtained from U1, M1 and G1 respectively (see Chapter 5 for rules which have been developed to improve the consistency and integrity of the NVIS database). Level 5 descriptions are manually-interpreted into a maximum of three strata to give the species, growth forms and structural data from any of the substrata (in the Level 6 description) to best describe the vegetation type at Level 5.

**Table 4 NVIS (sub-)stratum codes and descriptions. Height classes and growth forms in brackets are currently allowed by the rules (see Section 5), but are not recommended. The substratum G3 has been added since AVAM 6.0 (ESCAVI, 2003)**

| NVIS Stratum Code | NVIS Substratum Code | Description | Traditional Stratum Name | Growth Forms[38] | Height Classes[39] | Not permitted |
|---|---|---|---|---|---|---|
| U | U1 | Tallest tree substratum.<br>For forests and woodlands this will generally be the dominant stratum, except where the substratum cover is <5% and hence considered "emergent".<br>For a continuum (e.g. no distinct or discernible layering in the vegetation) the tallest stratum becomes the defining substratum. | Upper, tree Overstorey/Canopy (If only one tree layer occurs it is coded U1) | Trees, tree mallees, palms, vines (mallee shrubs)<br>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.<br>Also: epiphytes, lichens | (6) 5,4,3 | Mid and low grasses, sedges, rushes & forbs.<br>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 | | | | |
| | G3 | Substrate surface | | Bryophytes, lichens, lower plants | 1 | |

[38] See Table 5 for further details.

[39] See Table 6 for further details.

#### 2.1.4.2 Growth forms and heights

The NVIS framework compiles a maximum number of eight height classes (Table 5) relating to specific growth forms (Table 6). Height classes are used to describe each substratum of vegetation found at the Level 6 (Sub-Association). The height refers to the 'top height' of the stratum, which is recorded in the HEIGHT_CLASS attribute in the STRATUM_CODE table (See Section 4.7 Stratum Table Attributes and Description). If another kind of height has been recorded, its origins should be recorded in the HEIGHT_TYPE attribute in the Stratum table (as record-level metadata).

The height classes are assigned to 5 sets of growth forms, as per the columns in Table 5. Woody plants are divided into three classes on the basis of whether they are single-stemmed (trees etc.) or multi-stemmed (shrubs or mallees)—see Table 6 for detailed definitions. The lower-storey growth forms are divided into terrestrial higher plant forms: grasses, grass-like growth forms and forbs, plus lower-plant and/or aquatic forms. Vines and palms are assigned to particular growth form categories for the assignment of height classes, on a case by case basis, according to their particular properties and stratum position in the vegetation description.

**Table 5 Height classes for specific growth forms defined for the NVIS. The word in the body of the table is used to "qualify" the structural formation[40].**

| Height | | Growth Form | | | | |
|---|---|---|---|---|---|---|
| Height Class | Height Range (m) | tree, vine (M & U), palm (single-stemmed) | shrub, heath shrub, chenopod shrub, ferns, samphire shrub, cycad, tree-fern, grass-tree, palm (multi-stemmed) | tree mallee, mallee shrub | tussock grass, hummock grass, other grass, sedge, rush, forbs, vine (G) | bryophyte, lichen, seagrass, 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 |

Where vegetation forms structurally complex vertical layers, up to nine substrata can be used (see Table 4). For example, vegetation in a riparian zone may comprise several upper tree layers, several mid layers of trees and shrubs and a number of ground layers. Where the vegetation is relatively simple e.g. savannah grassland, there are often only two strata comprising trees (e.g. Height Class 7) and grasses (e.g. Height Class 4).

[40] Source: Height classes (non-scalar) are based on several workshops for developing NVIS version 1.0 and incorporate numerous standards, especially Specht (1970) and Muir (1977); growth forms are largely based on Walker & Hopkins (1990).

#### 2.1.4.3 Stratum cover and dominance

The remaining structural attributes needed to describe vegetation structure are cover and an indication of (sub-)stratum dominance. Cover is estimated for each (sub-)stratum and recorded in the Stratum Table. Further details of the cover of each growth form and species can also be recorded in separate tables—see Section 4.6 (Vegetation description attributes and description) for further details.

Cover is an essential attribute (Table 7) in the description of a vegetation type. Cover can be assigned to the stratum (e.g. Figure 2) and/or substratum as part of the vegetation structure at a summary level in the Stratum table in the COVER_CODE field.

A multitude of methods have been used for describing vegetation cover. When providing detailed cover measures in the Stratum table, it is important to fill in the COVER_TYPE attribute in that table. The minimum requirement is for an interpretation of COVER CODE attribute for each (sub-)stratum in the Stratum table (see Section 4.7—Stratum Table Attributes and Description), as this enables comparison between vegetation descriptions originating from different methods.

Dominance of the (sub-)stratum provides a useful summary of the vegetation description at the simpler levels (Levels 1 to 3) in the NVIS vegetation hierarchy (Table 3). The dominance of a (sub-)stratum can be estimated by its relative biomass[41] across a vegetation type. The data provider can estimate the relative biomass of each (sub-)stratum as a multiple of the stratum cover, height and area covered by the (sub-)stratum within the full extent of the vegetation type; quantitative data are not required, just enough to compare strata. Usually, the upper stratum is assigned as dominant, unless it contains isolated vegetation — see Section 2.1.4.4 (Isolated Vegetation) for further discussion.

For data entered at Level 6, the substratum that is dominant over all other substrata in the vegetation type is indicated with a plus “+” symbol, after the substratum code—e.g. “U1+”. For data entered at Level 5, the stratum that is dominant over all other strata in the vegetation type is indicated with a plus “+” symbol after the stratum code. For data entered at Level 5 or 6, the “+” notation is carried through to Level 4. For further details, see the attributes L6_SUB_ASSOCIATION, L5_ASSOCIATION and L4_SUB_FORMATION in Section 4.6 (Vegetation description attributes and description) and examples in Table 10, the *vegetation description* attributes: L6_SUB-ASSOCIATION, L5_ASSOCIATION and L4_SUB-FORMATION. The record in the detailed vegetation data corresponding to the dominant (sub-)stratum has the boolean attribute DOMINANT_STRATUM_FLAG set to “Y” (for Yes) or “T” (for True) in the STRATUM table—see Section 4.7 (Stratum Table Attributes and Description).

[41] The methods used to assign the dominant stratum should be described in the DATA_SET table (in the DS10 CLASSIFICATION METHOD or the proposed field: DS08D – INTERPRETATION OF VEG DESCRIPTIONS).

#### 2.1.4.4 Isolated vegetation

There are many NVIS veg description records where the data supplier has nominated a particular stratum as having isolated vegetation cover (cover codes bi or bc). Normally, this doesn't present a problem. However, in cases, where isolated stratum is nominated as the dominant stratum, there are at least two types of issues that can arise. From conceptual and common sense views, the isolated layer can hardly be deemed 'dominant' over other strata, leaving open the interpretation of a lower stratum or the substrate as 'dominant' in the veg type. Taking a standardised approach in these cases, the dominant stratum should default to the next-lower stratum that doesn't have isolated vegetation.

When all strata are isolated (or absent entirely) no dominant stratum should be nominated; NUMBER_OF_STRATA is set to zero and the interpretation defaults to the abiotic (land or water) surface. This situation can then be managed by interpreting the records into the new ecological/land cover classification—see Section 2.2.

### 2.1.5 Component data for growth forms

Detailed source component data about an unlimited number of growth forms can be entered into the GROWTH_FORM table. However, the NVIS vegetation hierarchy uses only the top three growth forms per stratum at Level 5 and the top five growth forms per substratum at Level 6. (See the subsection on the NVIS vegetation hierarchy, Table 3 and attribute descriptions in the VEG_DESCRIPTION table in Section 4.6 (Vegetation description attributes and description).

The dominance of a growth form can be indicated by its relative biomass (or other suitable and available data, such as cover) within each (sub-)stratum of a vegetation type. The data provider can estimate the growth form's biomass as a multiple of cover, height and area covered by the growth form within the full extent of the vegetation type. Growth forms must be ranked in order of decreasing dominance, using the attribute GROWTH_FORM_RANK in the growth form table. Where available, additional data on the type of dominance (or whether it is an "indicator") of the growth form in a (sub-)stratum can be recorded in the GROWTH_FORM_DOMINANCE_QUALIFIER attribute.

Detailed cover values can be provided for each growth form for each (sub-)stratum in the Growth_Form table in Section 4.8 (Growth Form Attributes and Description). It is important to fill in the COVER_TYPE attribute in the same table.

In some cases, where cover and/or height of a growth form has not been recorded in the field survey, frequency is sometimes used to estimate dominance. This is a useful attribute in its own right (GROWTH_FORM_FREQUENCY), but its use in isolation to estimate dominance is not recommended.

Where data providers to NVIS want to record the growth form as sometimes present in the vegetation description, the attribute GF12 GROWTH_FORM_ALWAYS_THERE in the GROWTH FORM table (Section 4.8) can be set to "N". This facility and data provides the raw data for an

automated program to generate a “+/-“ symbol in front of the growth form in a vegetation description.

**Table 6 Growth forms defined for the NVIS, also used in attribute VG08 and VG09**

| Code | Growth Form | Explanation |
|---|---|---|
| **T** | tree | Woody plants, more than 2 m 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 five trunks of which at least three exceed 100 mm diameter at breast height (1.3 m). Usually 8 m or more. |
| **S** | shrub | Woody plants multi-stemmed at the base (or within 200mm from ground level) or if single stemmed, less than 2 m. |
| **Y** | mallee shrub | Commonly less than 8 m tall, usually with five or more trunks, of which at least three of the largest do not exceed 100 mm diameter at breast height (1.3 m). |
| **Z** | heath shrub | Shrub usually less than 2 m, with sclerophyllous leaves having high fibre: protein ratios and with an area of nanophyll or smaller (less than 225 sq mm). Often a member of one the following families: Ericaceae, Myrtaceae, Fabaceae and Proteaceae. Commonly occur on nutrient-poor substrates. |
| **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 Suaeda. |
| **G** | tussock grass | Grass forming 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; genus is Triodia. |
| **W** | other grass | Member of the family Poaceae, but having neither a distinctive tussock nor hummock appearance. Examples include stoloniferous species such as *Cynodon dactylon*. |
| **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, except tree-fern, above. 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. |

| Code | Growth Form | Explanation |
|---|---|---|
| **K** | epiphyte | Epiphytes, mistletoes and parasites. Plant with roots attached to the aerial portions of other plants. Can often 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 family or the genus Pandanus. (Pandanus is often multi-stemmed). |
| **X** | grass-tree | Australian grass trees. Members of the Xanthorrhoeaceae family. |
| **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 30 m 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 | Algae, fungus. |
| **unknown** | | unknown |

### 2.1.6 Putting the structural formation together

The vegetation structural formations are a standardised terminology used to integrate growth form, height and cover within each stratum. The NVIS terminology for structural characteristics was adapted from Specht (1970), Specht *et al* (1974) and Walker and Hopkins (1990).

The allocation of a height class to a growth form in a substratum by the data custodian gives rise to a particular height qualifier, from the body of Table 5. The height qualifier and growth form are then added to cover information to define the structural formation (Table 7). The structural formation is used in generating Levels 1 to 5 of the NVIS information hierarchy and thus become a relatively user-friendly summary of the dominant growth form, cover and height of a detailed vegetation description at Level 6.

## Table 7 NVIS Structural Formation Terminology

| | Cover Characteristics | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Foliage cover[42] | 70-100 | 30-70 | 10-30 | <10 | ≈0 | 0-5 | unknown |
| | Crown cover[41] | >80 | 50-80 | 20-50 | 0.25-20 | <0.25 | 0-5 | unknown |
| | % Cover[41] | >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 |
| edge | <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 |

[42] See notes in Section 2.1.6.1

#### 2.1.6.1 Notes on Table 7

Table 7 is based on native vegetation, but can be used in a similar fashion for non-native vegetation and revegetation.

* Foliage Cover is defined for each stratum as 'the proportion of the ground, which would be shaded if sunshine came from directly overhead'. It includes branches and leaves and is obtained by multiplying Crown Cover with Crown type (Hnatiuk et al., 2009). It is applied to a stratum in a plot, rather than an individual crown, with the NVIS measure for a vegetation type ideally being a summary of several plots. Foliage Projective Cover, which considers only the vertical projection of photosynthetic components (generally leaves), can be measured by line interception methods for tree, shrub and ground layer vegetation[43].

** Crown Cover (canopy cover) as per Hnatiuk et al. (2009). Although relationships between this attribute and Foliage Cover are dependent on season, species, species age etc., the crown cover category classes have been adopted as the defining measure.

*** The percentage cover is defined as the percentage of a strictly defined plot area, covered by vegetation. This can be an estimate and is a less precise measure than using, for example, a point intercept transect method on ground layer, or overstorey vegetative cover. That is, for precisely measured values (e.g. crown densitometer or point intercept transects) the value measured would be 'foliage' cover. Where less precise or qualitative measures are used these will most probably be recorded as 'percentage' cover.

The last column of Table 7 is designed to cater for situations, in existing data, where the cover value for the growth form is unknown.

### 2.1.7 Floristic information

#### 2.1.7.1 Species nomenclature

Each species should be described using full scientific name in the attribute TAXON_DATA_DESCRIPTION in the TAXON_DATA table (See 4.9 Taxon Data Attributes and Description). This field has been retained in this form for operational reasons (rather than split into components, as in the former TAXON_LISTS table (NLWRA, 2000[44]). The onus is on the data supplier to provide consistent spelling and punctuation (including for the infraspecies rank, where present) for the same taxonomic entity. The nomenclature for undescribed species should carry sufficient information to uniquely identify a source collection and location, e.g. Caladenia "Bordertown" (R.S.Rogers 788)[45]; apply this name to other occurrences

[43] Specht, R.L and Specht (1999). Australian plant communities: dynamics of structure, growth and biodiversity. Oxford Univ. Press, Oxford, 492pp.

[44] National Land and Water Resources Audit, (2000). Australian Vegetation Attributes: National Vegetation Information System Version 5.0. Audit Canberra.

[45] See Appendix B (Recommended Abbreviations and Contractions for Entering Taxonomic Data into NVIS) for guidelines and standards.

of the same taxonomic entity. This is superior to a common practice of using “species A”, “species 1”, etc., with the same label being applied to quite different taxa at different sites.

#### 2.1.7.2 Component data for species

An unlimited number of taxa (species) can be entered into the TAXON_DATA table of the detailed source component data. However, the NVIS vegetation hierarchy (Section 2.1.3) uses only the top three taxa per stratum at Level 5 and the top five taxa per substratum at Level 6. (See also attribute descriptions in the VEG_DESCRIPTION table in Chapter 4).

It is recommended that the order of the species be listed from the most dominant to least dominant using the attribute TAXON_DATA_RANK in the TAXON_DATA table. The dominance of a taxon (species) in each (sub-)stratum can be indicated by its relative cover[46] in each (sub-)stratum of a vegetation type. The data provider usually estimates cover of each species from samples taken across the extent of the vegetation type. There are several variables available in the TAXON_DATA table to record the range of covers for each taxon in the (sub-)stratum. It is important to fill in the COVER_TYPE attribute in the same table, as record-level metadata.

Where available, additional data on the type of dominance of the species (or whether the species is an “indicator”) in a (sub-)stratum can be recorded in the TAXON_DATA_DOMINANCE_QUALIFIER attribute.

Abundance is a concept referring to the number of individuals within an observational unit (or other sampling unit). Density of plants can be estimated where individuals (or particular parts thereof) are easily recognised[47]. However, with many species, the measurement of density is impractical. Abundance can be estimated as frequency or the probability of finding a species in a given quadrat. Frequency is sometimes used to estimate dominance in circumstances where the cover, density and/or height of a species has not been recorded in the field survey. This is not recommended, given the large number of plots per vegetation type to obtain reliable estimates. Where the frequency of a species has been estimated for a vegetation type, the values can be recorded in the NVIS database as an independent variable TAXON_DATA_FREQUENCY. It is easily generated from site survey databases as a percentage of sites containing the species compared with all survey sites.

Where data providers to NVIS want to record the species as sometimes present in the vegetation description, the attribute TAXON_DATA_ALWAYS_THERE in the TAXON_DATA should be set to “N”. This will provide the raw data for an automated program to generate a “+/-“ symbol in front of the species in the vegetation description.

Chapter 4 provides further details on how species information should be interpreted and entered into the VEG_DESCRIPTION and TAXON_DATA tables.

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[46] The methods used to interpret dominance should be described in the DATA_SET table (in DS10 CLASSIFICATION METHOD or the proposed field: DS08D – INTERPRETATION OF VEG DESCRIPTIONS).

[47] Kershaw, K.A. and Looney, J.H.H. (1985). *Quantitative and Dynamic Plant Ecology. 3rd Edn.* Edward Arnold, Melbourne.

#### 2.1.7.3 Dominant genus or genera

In earlier versions of NVIS, anomalies sometimes arose when the dominant species and dominant growth form for a (sub-)stratum were used to generate Level 1-4 descriptions by automated rules. In some cases, the dominant genus did not match the dominant growth form, resulting in anomalies - for example, “Eucalyptus fernlands”. The anomaly arose because Level 4 (and 3) descriptions are characterised by genus (and not species) and the difficulties in assigning dominance in some vegetation types.

A notation system that is semi-independent from species- and growth form dominance has been devised to ensure consistency in the generation of simpler NVIS levels. In Levels 5 and 6, the data provider must assign an up-arrow or hat “^” to the genus or growth form believed to best describe and characterise the vegetation type at Levels 1 to 4 in the VEG_DESCRIPTION table (See Table 3 The NVIS vegetation hierarchy). This is usually, but not always, a dominant or co-dominant species or growth form. Then, the matching growth form or genus (i.e. whatever wasn’t chosen first) should be tagged with an up-arrow or hat “^”. This is Case 1 in Table 8.

NVIS collaborators have agreed that in some cases, one genus is inadequate to describe the floristics of some strata at Level 4. Where two genera are necessary to describe a stratum, a second up-arrow or hat “^” can be added to another genus in the stratum. (At Level 6, the genus can be in a different substratum.) The two genera will be written out in the Level 4 description, delimited with a forward slash “/” (and in Level 3 if the (sub-)stratum is dominant - i.e. is marked with a ‘+’ at Levels 4 to 6, inclusive) in the dominance order specified in TAXON_DATA_RANK. This is case 2 in Table 8.

Where more than two genera are characteristic of the stratum, the word “mixed” can be generated at Level 4 by the use of a double up-arrow or double hat “^^” on one genus in the Level 5 or 6 description. Note that if a double hat is used on one genus in a stratum, one genus is written in Level 4 with the word “mixed”, in brackets, afterwards. Only one growth form hat per stratum is permitted and this must match one of the two genera marked with the double hat. The double hat facility has not been provided for the growth form table, because many growth forms can usually be found in each stratum, if one looks hard enough. In other words, each stratum is “mixed”, by default, with respect to growth forms.

This information is also stored in TAXON_DATA_SUMMARY_FLAG in the TAXON_DATA table and/or GROWTH_FORM_SUMMARY_FLAG in the Growth_Form table—see Section 4.9 (Taxon Data Attributes and Description). Rules 12, 13 and 14 (Chapter 5) check the number and placement of up-arrows in the Level 6 substrata, as per the above specifications and Table 8. However, these rules don’t check whether the growth form matches the selected genus or genera. A table of valid (i.e. matching) growth forms for each genus has been developed by the NVIS collaborators to enable further consistency checking by automated rules. Currently, Rules 29 and 30 in Section 5.1.2 (Data Checking Rules) check Cases 1 and 2. However, the NVIS XML Loader implements all three cases. The XML stylesheet (Appendix K) does not simulate these checks.

**Table 8 Using the up-arrow or "hat[48]" notation.**

| Case | Scenario | Genus per stratum (Level 5) **1st hat** | **2nd hat** | Growth Form** | Result | Notes | Examples |
|---|---|---|---|---|---|---|---|
| 1 | 1 dominant /characteristic genus in the stratum | ^ | - | ^ | Genus 1 & GF promoted to Level 4 (& possibly Level 3) | -GF must match Genus 1. (Rules 29 & 30)<br>-At Level 6, the hats must be in one substratum only. (Rules 12, 13 & 14) | Level 6: U1+ +/-^Eucalyptus carnea+/-Eucalyptus tindaliae+/-Corymbia citriodora+/-Eucalyptus crebra+/-Eucalyptus major\^tree\7\c;U2 +/-Lophostemon confertus\tree\6\i;M1 ^Acacia aulacocarpa,^Alphitonia excelsa,Acacia leiocalyx,Maytenus silvestris\^shrub,tree\4\i;G1 ^Themeda triandra,^Imperata cylindrica,Lepidosperma laterale,Lomandra multiflora subsp. multiflora\^tussock grass,sedge\2\c<br>becomes<br>Level 4: +Eucalyptus mid open forest\ low woodland\ tall open shrubland\ mid tussock grassland<br>and<br>Level 3: Eucalyptus mid open forest |
| 2 | 2 co-dominant /equally characteristic genera in the stratum | ^ | ^ | ^ | Genus 1 & 2 & GF promoted to Level 4 (& possibly Level 3) | -GF must match genus 1 **or** 2. (Rules 29 & 30)<br>-Genus 1 & Genus 2 can be in different substrata in Level 6 (Rules 12, 13 & 14) | Level 6: M1+ ^Eucalyptus preissiana,^Dryandra quercifolia,Banksia lehmanniana,Calothamnus pinifolius,Allocasuarina humilis\^tree mallee,shrub\3\d<br>becomes<br>Level 4: +Eucalyptus/Dryandra low closed mallee forest<br>and<br>Level 3: Eucalyptus/Dryandra low closed mallee forest |
| 3 | 3 or more co-dominant / equally characteristic genera in the stratum | ^^ | - | ^ | Genus 1, "mixed" & GF promoted to Level 4 (& possibly Level 3) | -GF must match Genus 1. (Rules 29 & 30)<br>-Selection of Genus 1 is arbitrary.<br>-At Level 6, the hats must be in one substratum per stratum only. (Rules 12, 13 & 14) | Level 6: M1+ ^^Leptospermum lanigerum,Ozothamnus ferrugineus+/-Leucopogon parviflorus\^shrub\4\c;G1 ^^Epilobium billardierianum ssp. billardierianum,Acaena novae-zelandiae\^forb\-9999\unknown<br>becomes<br>Level 4: +Leptospermum (mixed) tall shrubland\Epilobium (mixed) forbs<br>and<br>Level 3: Leptospermum (mixed) tall shrubland |

[48] "^" is called a "hat" in the table; also called up arrow or circumflex.

* Where more than one genus with a hat, the relative order is taken from the relative dominance in TAXON_DATA_RANK.
** Growth Form per stratum (Level 5)

**Table 8 Notes**

- If the stratum is indicated (with a plus '+' symbol) as the dominant in the vegetation type, the genus (or genera) and growth form will also be promoted to Level 3. (Levels 1 and 2 don't contain genus data).
- All cases (1, 2 & 3) have been implemented in the NVIS database.
- The methods used to interpret dominance of genera and growth forms should be described in the DATA_SET table (in DS10 CLASSIFICATION METHOD or the proposed field: DS08D – INTERPRETATION OF VEG DESCRIPTIONS).

## 2.1.8 Completing the NVIS vegetation description

### 2.1.8.1 Rules for checking data and generating simpler levels

At a national workshop in November 2002, the NVIS collaborators agreed to the implementation of proposed rules to address the structural and content issues impacting on the quality and consistency of the NVIS dataset. These include, *inter alia*, rules to:

Check the quality and consistency of data between the detailed data tables (Stratum, Growth_Form and Taxon_Data) and the Veg_Description table (Section 5.1.2); and

Automatically generate the simpler levels (Levels 1-4) in the NVIS vegetation hierarchy (Algorithms to generate Levels 1-4 follow the specifications in Table 9—Specifications for the NVIS vegetation hierarchy).

The NVIS collaborators have agreed that conversion from Level 6 to 5 is best undertaken through an expert input, since it is currently too complex to automate the process considering the large variety of methods and data collected. With the recent development of automated methods for managing NVIS, this agreement still stands. See Chapter 5 for a description of current progress with the rules.

### 2.1.8.2 Putting the vegetation description together

The source component information on growth forms and species can be combined with the structural formation terminology to produce an integrated NVIS *vegetation description* at the complex NVIS Level (5 and/or 6). The data at these levels should now contain enough information to enable the automated generation of simpler levels (Levels 1 to 4) in the NVIS vegetation hierarchy.

To ensure consistent and understandable vegetation descriptions, the data provider is reminded of the following issues:

1. Identify the substrata (at Level 6) and strata (at Level 5) that are present across the instances of the vegetation type.
2. Add the appropriate height and cover codes for each (sub-)stratum.
3. List the species and growth forms for each (sub-)stratum and rank them in declining order of dominance.
4. Specify the dominant (sub-)stratum as the "+" symbol in the Level 5 and/or 6 fields in the VEG_DESCRIPTION table and add the corresponding value of the DOMINANT_STRATUM_FLAG into the Stratum table. See sections on Stratum Cover and Dominance (Section 2.1.4.3).
5. Specify dominant genera (not species) in each stratum with the up-arrow notation (Table 8), making sure at least on growth form matches a dominant genus.

### 2.1.9 Detailed examples of the NVIS vegetation hierarchy

Table 9 gives specifications for each Level of the NVIS vegetation hierarchy—species, growth form, cover and height. Two examples of completed[49] NVIS vegetation descriptions are given in Table 10. This table also summarises the use of each component of the NVIS information hierarchy (Table 3)—species, growth form, cover and height. Examples provided in Table 9 illustrate, for the same vegetation type, the resultant standardised description of the type at various levels in the NVIS information hierarchy.

[49] "Lower table" details are not shown.

**Table 9 Specifications for the NVIS vegetation hierarchy[50]**

| Level | Description | Combined Requirements | Genera and/or Species | Growth form | Cover | Height |
|---|---|---|---|---|---|---|
| 1 | Class | Dominant growth form for the structurally dominant stratum. | - | One dominant growth form for the structurally dominant stratum | - | - |
| 2 | Structural Formation | Dominant growth form, cover and height (in the standardised notation of Table 7) for the structurally dominant stratum. | - | One dominant growth form for the dominant stratum | One cover class for the dominant stratum | One height class for the dominant stratum |
| 3 | Broad Floristic Formation | Dominant genus (or genera) plus growth form, cover and height (in the standardised notation of Table 7) for the structurally dominant stratum. | One or two dominant genera[1] for the dominant stratum or one genus with the word "(mixed)" for the dominant stratum. | One dominant growth form for dominant stratum | One cover class for dominant stratum | One height class for dominant stratum |
| 4 | Sub-formation | Dominant genus (or genera) plus growth form, cover and height (in the standardised notation of Table 7) for each of the three main strata. (i.e. Upper, Mid and Ground). | One or two dominant genera[1]for each stratum (max 3 strata; i.e. for U, M, G where substantially present). | One dominant growth form for each stratum (max three strata: i.e. for U,M, G, where present) | One cover class for each stratum (max 3 strata) | One height class for each stratum (max three strata) |
| 5 | Association | List up to three growth forms and three species in decreasing order of dominance for the three traditional strata. (i.e. Upper, Mid and Ground). Each stratum has a height and cover code.<br>Nominate dominant stratum. | Up to three species[2] for each stratum (max three strata; i.e. for U, M, G where present).<br>Indicate dominant genus, genera or mixed – see Table 8 (Using the up-arrow or "hat" notation). | Up to three growth forms[3] for each stratum (max three strata; i.e. for U, M, G where present) | One cover class code for each stratum (max three strata; i.e. for U, M, G where present) | One height class code for each stratum (max three strata; i.e. for U, M, G where present) |
| 6 | Sub-association | List up to five growth forms and five species in decreasing order of dominance for up to nine substrata.<br>Each substratum has a height and cover code.<br>Nominate dominant substratum. | Up to five species[2] for each substratum (i.e. for U1, U2, U3, M1, M2, M3, G1, G2, G3 where present).<br>Indicate dominant genus, genera or mixed – see Table 8 (Using the "hat" notation). | Up to five growth forms[3] for each substratum. | One cover class code for each substratum | One height class code for each substratum |

[50] 1- Where there are three or more co-dominant genera in the stratum, use one genus name, followed by "(mixed)"

2 - Indicate characteristic genus in each substratum (Level 6) or substratum (Level 5) with an up arrow or hat "^". Must match characteristic growth form. For further options, see Table 5 (Height classes for specific growth forms defined for the NVIS. The word in the body of the table is used to "qualify" the structural formation).

3 - Indicate characteristic growth form with an up arrow or hat "^". Must match characteristic genus.

**Table 10 Example usage of the NVIS vegetation hierarchy[51].**

| Level | Description | Example 1[52] | Example 2 |
|---|---|---|---|
| 1 | Class | *Tree* | *Tree mallee* |
| 2 | Structural Formation | *Open woodland* | *Mid mallee woodland* |
| 3 | Broad Floristic Formation | *Eucalyptus/Casuarina open woodland* | *Eucalyptus mid mallee woodland* |
| 4 | Sub-formation | *+Eucalyptus/Casuarina open woodland\Acacia (mixed) tall sparse shrubland\Aristida open tussock grassland* | *+Eucalyptus mid mallee woodland\Melaleuca (mixed) shrubs\Lepidosperma (mixed) forb* |
| 5 | Association | *U+ ^Eucalyptus coolabah,^Casuarina cristata,Flindersia maculosa\^tree\7\r;M ^^Acacia salicina,Alectryon oleifolius,Acacia stenophylla\^shrub\4\r;G ^Aristida ramosa,Astrebla squarrosa,Bothriochloa decipiens\^tussock grass,forb,sedge\2\i* | *U+ ^Eucalyptus incrassata+/-Eucalyptus socialis ssp.+/-Eucalyptus brachycalyx\^tree mallee\6\i;M ^^Melaleuca acuminata ssp. acuminata,Santalum acuminatum,Melaleuca lanceolata\^shrub\-9999\unknown;G ^^Lepidosperma viscidum,Triodia scariosa,Helichrysum leucopsideum\^forb+/-sedge+/-hummock grass\-9999\unknown* |
| 6 | Sub-association | *U1+ ^Eucalyptus coolabah,^Casuarina cristata,Flindersia maculosa\^tree\7\r;M1 ^^Acacia salicina,Alectryon oleifolius,Acacia stenophylla+/-Acacia victoriae subsp. Victoriae+/-Eremophila bignoniiflora\^shrub\4\bi;M2 ^Eremophila longifolia+/-Muehlenbeckia florulenta\shrub\3\r;G1 ^Aristida ramosa,Astrebla squarrosa,Bothriochloa decipiens+/-Dichanthium sericeum,Enteropogon acicularis\^tussock grass,forb,sedge\2\i* | *U1+ ^Eucalyptus incrassata+/-Eucalyptus socialis ssp.+/-Eucalyptus brachycalyx+/-Eucalyptus phenax ssp. phenax\^tree mallee\6\i;M1 ^^Melaleuca acuminata ssp. acuminata,Santalum acuminatum,Melaleuca lanceolata\^shrub\-9999\unknown;G1 ^^Lepidosperma viscidum,Triodia scariosa,Helichrysum leucopsideum\^forb+/-sedge+/-hummock grass\-9999\unknown* |

[51] For definitions of U, M, G, U1, U2, U3, M1, M2, M3, G1, G2 and G3 refer to Table 4.

[52] Italics are used for illustrative purposes only; they are not used in the NVIS database.

## 2.2 Controlled vocabulary and classification for other cover types

### 2.2.1 Standardisation of data set documentation

To date, a subset of records in the VEG_DESCRIPTION table has lacked meaningful data in Levels 5 and/or 6. This has prevented the generation of simpler levels (Levels 1 to 4) in the NVIS information hierarchy in those records, leaving maps with white space when data for any NVIS Level are rendered. The problematic unique values comprised five broad elements, namely:

- disturbed vegetation cover
- unclassified vegetation
- non-vegetation features
- non-native vegetation, and
- unclassified/ unknown features.

These five broad elements are collectively referred to as “Other Cover Types”. To avoid the white space issue, these records have historically been assigned to Major Vegetation Groups using the source and environmental descriptions provided by data custodians. Resource limitations have restricted the manual designation of these records into the NVIS information hierarchy. In the interim, these records were purposely assigned to one of eight MVGs until such time that the development of an agreed standardised vocabulary to assist in the allocation process can be implemented. These eight MVGs and reciprocal MGSs are shown in Table 11 below.

**Table 11 Major Vegetation Group (MVGs) and Sub-groups (MVSs) 'other cover types' requiring a standardised vocabulary for the underlying detailed NVIS data.**

| MVG No | MVG name | MVS No | Subgroup name |
|---|---|---|---|
| 24 | Inland aquatic - freshwater, salt lakes, lagoons | 43 | Salt lakes and lagoons |
| | | 44 | Freshwater, dams, lakes, lagoons or aquatic plants |
| 25 | Cleared, non-native vegetation, buildings | 98 | Cleared, non-native vegetation, buildings |
| 26 | Unclassified native vegetation | 97 | Unclassified native vegetation |
| 27 | Naturally bare - sand, rock, claypan, mudflat | 42 | Naturally bare, sand, rock, claypan, mudflat |
| 28 | Sea and estuaries | 46 | Sea, estuaries (includes seagrass) |
| 29 | Regrowth, modified native vegetation | 90 | Regrowth or modified forests and woodlands |
| | | 91 | Regrowth or modified shrublands |
| | | 93 | Regrowth or modified chenopod shrublands, samphire or forblands |
| | | 92 | Regrowth or modified graminoids |
| 30 | Unclassified Forest | 96 | Unclassified Forest |
| 99 | Unknown/no data | 99 | Unknown/No data |

### 2.2.2 Key concepts

Controlled vocabulary and classification has been developed for 'other cover types', in the NVIS information hierarchy; that is for non-native vegetation groups. It was developed using a combination of landcover, naturalness of landform, surfaces and elements.

The vocabulary (called the NVIS Ecological/Land Cover Hierarchy) is applied by prefixing the content to any meaningful[53] data in Levels 1-3 of the the NVIS information hierarchy. In line with this, the systematic approach shown in Figure 4 (Basis of Classification of 'Other Cover Types' at Levels 1-3 of the NVIS Database) provides a comprehensive basis for the classification of existing unique values of SOURCE_DESCRIPTION and ENVIRONMENTAL_DESCRIPTION where there is no meaningful data in the NVIS information hierarchy.

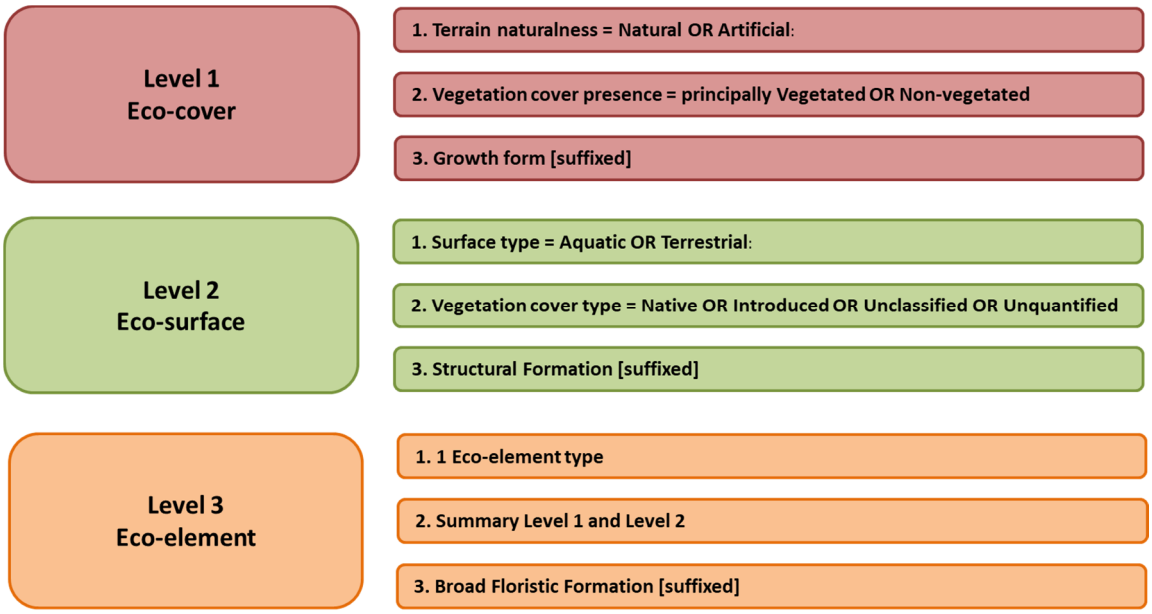


**Figure 4 Basis of classification of 'other cover types' at Levels 1-3 of the NVIS Database**

### 2.2.3 Controlled vocabulary and classification

The controlled vocabulary and classification does not accord precisely with a land cover classification, but instead provides a more comprehensive range of values relating to landform, surfaces and elements as shown in Table 12 (Field names and content for the classification of other cover types). The controlled vocabulary and classification has been developed to be able to be applied to all vegetated and non-vegetated records. It is called the NVIS Ecological/Land Cover Hierarchy and complements the NVIS Vegetation Hierachy to form a (newly-defined) NVIS information hierarchy.

[53] Anything other than unknown, -9999, NA and similar values.

It is important to note that Levels 1 and 2 are not strictly hierarchical and represent separate assessments. Level 3 is hierarchical, in that each value is qualified by the assessments at Levels 1 and 2.

**Table 12 Field names and content for the classification of other cover types.**

| NVIS Level | Former Field Name | Former Field Content | Proposed Field Name | Field Name |
|---|---|---|---|---|
| 1 | Class | *Class* retained and values combined with new classification | Eco-cover | "ecocover" |
| 2 | Structural Formation | *Structural Formation* retained and values combined with new classification | Eco-surface | "ecosurface" |
| 3 | Broad Floristic Formation | *Broad Floristic Formation* retained and values combined with new classification | Eco-element | "ecoelement" |

A schematic representation of the classification is shown below in Figure 5. The implementation for each of the three levels in relation to the NVIS information hierarchy is outlined in Table 13 (Summary of specifications for the NVIS Ecological/Land Cover Classification in the NVIS information hierarchy), and a detailed vocabulary is set out in Appendix O (Controlled vocabulary and classification synonyms). The description and usage of controlled vocabulary and classification, including preferred field names, definitions, usage rules and examples for each of the three levels of the NVIS hierarchy is also set out in Table 14 (Description and usage of the controlled vocabulary and classification (NVIS ecological/land cover hierarchy) in the context of the NVIS information hierarchy).

#### 2.2.3.1 Implementation

In the near term, VEG_DESCRIPTION records where existing Levels 1-3 attributes are without meaningful data have been manually populated[54] with the NVIS Ecological/Land Cover Classification. In some cases, the classification has also been prefixed to meaningful data where an 'other cover type' is an appropriate assignment; for example, records with *Chara* or *Myriophyllum* at Level 3 are clearly aquatic. These assignments have also been successfully tested in the automated assignment of MVGs (Bossard et al., 2017).

[54] An off-line copy of VEG_DESCRIPTION was populated (deLacey *et al*., 2017) and the interpreted values prefixed into the NVIS Database via Python code.

**Table 13 Summary of specifications for the NVIS ecological/land cover classification in the NVIS information hierarchy.**

| Hierarchical Level <2017[55] | >2017 | Title | Description | NVIS structural/floristic components required |
|---|---|---|---|---|
| I | 1 | **Eco-cover** (formerly "class") | **Eco-cover =** Terrain Naturalness + Vegetation Cover (Presence) type + Growth form type | **Terrain naturalness** = Natural or Artificial<br>**Vegetation cover presence** = principally Vegetated or Non-vegetated<br>**Growth form** = dominant growth form for the ecologically or structurally dominant stratum |
| II | 2 | **Eco-surface** (formerly "structural_formation") | **Eco-surface** = Surface type + Vegetation cover + type Structural Formation type | **Surface type** = Aquatic or Terrestrial (Aquatic is further divided into several sub-groups (freshwater, saline etc.).<br>**Vegetation cover type** = principally Native or Introduced or Unclassified or Unquantified<br>**Structural Formation** = Dominant growth form, cover and height for the ecologically or structurally dominant stratum. |
| III | 3 | **Eco-element** (formerly "structural_formation") | **Eco-element** = Eco-element type + Summary level data for Levels 1 and 2 + Broad Floristic Formation | **Eco-element type** = a range of variables as well as further detail about the vegetation cover (lake, wetland, watercourse, salt lake, estuarine/ marine unclassified waterbody)<br>**Summary (L1&2) data =** synopsis for Levels 1 and 2<br>**Broad Floristic Formation** = Dominant growth form, cover, height and dominant land cover genus for the upper most or the ecologically or structurally dominant stratum. |
| IV | 4 | **Sub-Formation** | Where data Level 4 from the NVIS vegetation hierarchy is not present, the value of Eco-element is repeated here. | Dominant growth form, cover, height and dominant genus for each of the three traditional strata. (i.e. Upper, Mid and Ground) |
| V | 5 | **Association** | Where data Level 5 from the NVIS vegetation hierarchy is not present, the value of Eco-element is repeated here. | Dominant growth form, height, cover and species (three species) for the three traditional strata. (i.e. Upper, Mid and Ground) |
| VI | 6 | **Sub-Association** | Where data Level 6 from the NVIS vegetation hierarchy is not present, the value of Eco-element is repeated here. | Dominant growth form, height, cover and species (five species) for all layers/substrata. |

[55] Superseded

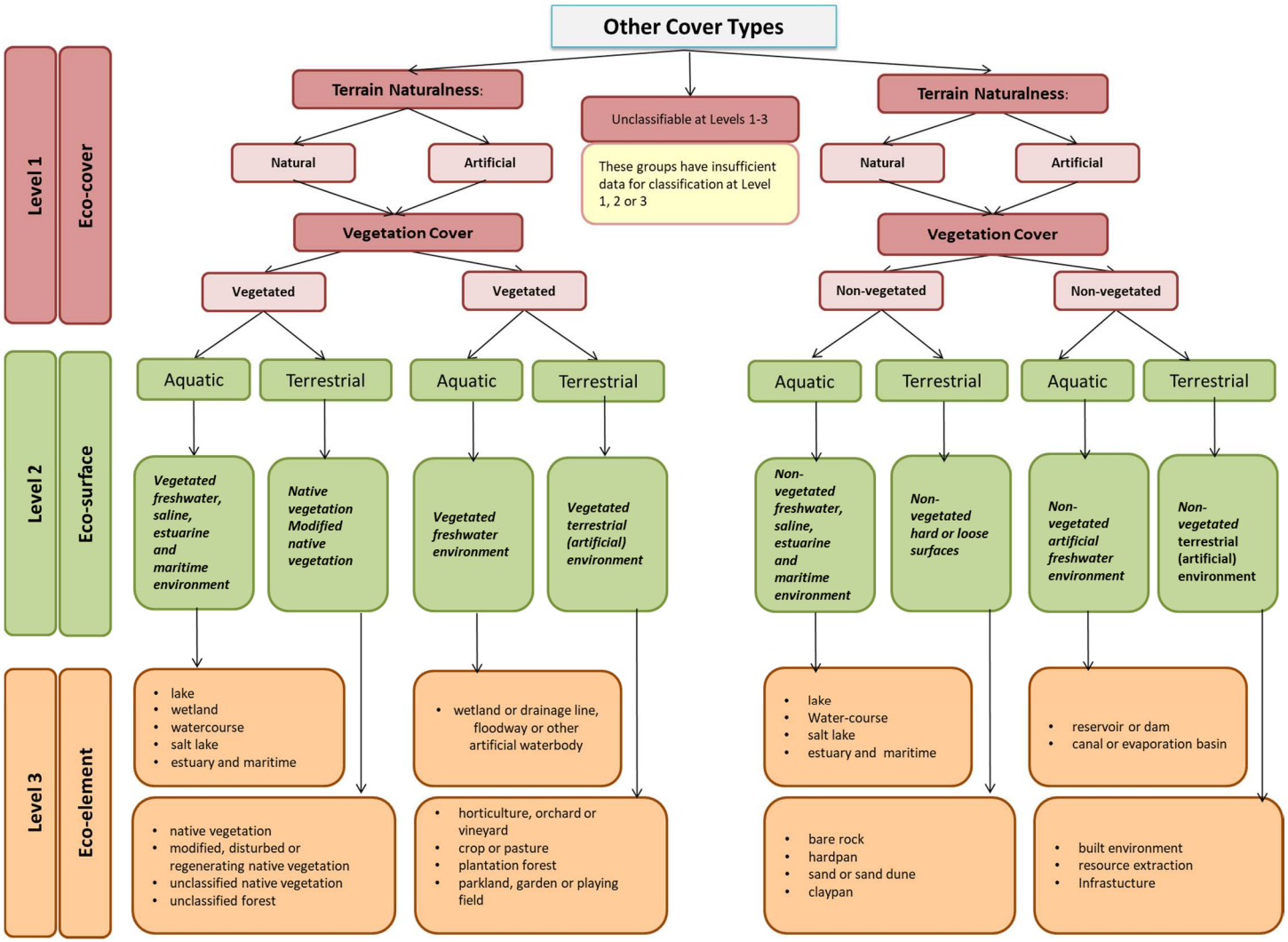


**Figure 5 Classification of 'other cover types' at Level 1-3 of the NVIS database**

**Table 14 Description and usage of the controlled vocabulary and classification (NVIS ecological/land cover hierarchy) in the context of the NVIS information hierarchy.**

| Field & Field Name | Definition | Scope of Field | Implementation |
|---|---|---|---|
| ***NVIS Level* 1**<br><br>***Field title***<br>**Eco-cover** ("class")<br><br>***Preferred field name***<br>"ecocover" | ***Field description***<br>**Eco-cover = terrain naturalness [1A] + vegetation Cover (presence) type [1B] + growth form type [1C]**<br><br>***Definition***<br>**1.** The first couplet (**terrain naturalness type)** delineates the naturalness of the terrain in the broadest sense – it describes whether the surface is natural (or substantially so) or man-made.<br><br>**2.** The second couplet delineates whether the sampling area is vegetated or non-vegetated.<br><br>**3.** Dominant growth form is suffixed in order to maintain the existing data and functionality. | ***Scope***<br>**Eco-cover** is used to describe Level 1 It requires three steps:<br><br>**1** Selection of a single option from the following couplet: **terrain naturalness = natural OR artificial?**<br><br>**2** Selection of a single option from the following couplet: **vegetation cover presence = principally vegetated** OR **non-vegetated?**<br><br>**3. growth form** - dominant growth form for the ecologically or structurally dominant stratum (derived from existing NVIS Level 1, where present) e.g. tree.<br><br>Data that cannot be classified into any of the above groups is assigned as: **unclassifiable.** | ***Examples of Level 1 eco-cover***<br>L1 natural surface; vegetated; growth form;<br><br>or<br><br>L1 artificial surface; vegetated; growth form;<br><br>***Implementation***<br>**Eco-cover** is prefixed to existing **growth form** data, e.g. "natural surface; non-vegetated; tree". |
| ***NVIS Level* 2**<br><br>***Field Title***<br>**Eco-surface**<br>("structural_formation")<br><br>***Preferred field name***<br>"ecosurface" | ***Field description***<br>**Eco-surface = surface type [2A] + vegetation cover type [2B] + structural formation type [2C]**<br><br>***Definition***<br>**1.** Surface type delineates surfaces that are either aquatic or terrestrial and then into a number of sub-groups. | ***Scope***<br>**Eco-surfaces** are used to describe Level 2. It requires three steps:<br><br>**1.** Selection of a single option from the following couplet: **surface type = aquatic** OR **terrestrial?** Aquatic is further divided into several sub-groups (freshwater, saline etc.).<br><br>**2.** Selection of a single option from the following: **vegetation cover type = principally native** OR **introduced** OR **unclassified OR unquantified?** | ***Examples of Level 2 eco-surface***<br>L2 undifferentiated: terrestrial environment; principally introduced vegetation +/- scattered native vegetation cover; structural formation;<br><br>or |

| Field & Field Name | Definition | Scope of Field | Implementation |
|---|---|---|---|
| | **2.** The second option delineates whether the vegetation cover is principally **native** or **introduced.**<br>**3.** Structural formation is suffixed in order to maintain the existing data and functionality. | Data is classified to one of five options:<br>• principally native vegetation cover<br>• principally unclassified native vegetation cover<br>• principally unclassified vegetation cover<br>• principally introduced vegetation +/- scattered native vegetation cover<br>• principally non-vegetated but vegetation component may be minimal or unquantified<br><br>**3. structural formation**<br>Dominant growth form, cover and height for the ecologically or structurally dominant stratum.<br><br>Data that cannot be classified into any of the above groups is assigned as: **unclassifiable.** | L2 aquatic (freshwater) environments; principally with native vegetation cover; structural formation;<br><br>***Implementation***<br>**Eco-surface** is prefixed to existing **structural formation** data, e.g.<br><br>"aquatic (marine/estuarine) environment; principally with native vegetation cover; mid open forest". |
| ***NVIS Level*** **3**<br><br>***Field title***<br>**Eco-element**<br>("structural_formation")<br><br>***Preferred field name***<br>"ecoelement" | ***Field Description***<br>**Eco-element = eco-element type [3A] + summary [L1&2) data [3B] + broad floristic formation [3C]**<br><br>***Definition***<br>1. **Eco-element** type delineates aquatic or terrestrial units into a number of sub-groups.<br>2. The second option delineates whether the vegetation cover is principally **native** or **introduced.**<br>3. Broad Floristic Formation. | ***Scope***<br>**Eco-element** is used to describe Level 3. It requires three steps:<br><br>**1. Eco-element type =** a range of variables as well as further detail about the vegetation cover:<br>• lake<br>• wetland<br>• watercourse<br>• salt lake<br>• estuarine/ marine unclassified waterbody<br><br>**2. Summary (L1&2) data =** synopsis for Levels 1 and 2<br>For example,<br>"[natural surface with native vegetation] | ***Examples of Level 3 eco-element***<br>Lake; L1 natural surface; vegetated; L2 aquatic (freshwater) environments; principally with native vegetation cover; L3 broad floristic formation;<br><br>or<br><br>Reservoir or dam (open-water or substrate); L1 |

| Field & Field Name | Definition | Scope of Field | Implementation |
|---|---|---|---|
| | | Or<br>"[artificial surface with mostly introduced vegetation +/- scattered native vegetation cover]".<br><br>**3. Broad floristic formation** = Dominant growth form, cover, height and dominant land cover genus for the upper most or the ecologically or structurally dominant stratum.<br><br>Data that cannot be classified into any of the above groups is assigned as: **unclassifiable.** | artificial surface; non-vegetated; L2 aquatic (freshwater) environment; principally non-vegetated or if vegetated then minimal or unquantified; L3 broad floristic formation;<br><br>***Implementation***<br>**Eco-element** is prefixed to existing **broad floristic formation** data, e.g.<br><br>"lake [natural surface with native vegetation]; Melaleuca low open forest". |

**Table 15 Example(s) of combining the NVIS ecological/land cover hierarchy with the NVIS vegetation hierarchy to form the NVIS Information hierarchy.**

| Level | Description | Cover, Surface and Element | Example 1[56] | Example 2 |
|---|---|---|---|---|
| 1 | Eco-cover | Terrain naturalness<br>Vegetation cover presence<br>Growth form | L1 natural surface; non-vegetated; *Aquatic* | L1 natural surface; vegetated; *Tree* |
| 2 | Eco-surface | Surface type<br>Vegetation cover type<br>Structural Formation | L2 aquatic (freshwater) environments; principally non-vegetated or if vegetated; then minimal or unquantified; *Low aquatic bed* | L2 terrestrial environments; principally with native vegetation cover; *Open woodland* |
| 3 | Eco-element | Eco-element type<br>Summary (L1&2) data<br>Broad Floristic Formation | Lake (open-water or substrate); L1 natural surface; non-vegetated; L2 aquatic (freshwater) environments; principally non-vegetated or if vegetated; then minimal or unquantified; L3 *Myriophyllum low aquatic bed* | Native vegetation type; L1 natural surface; vegetated; L2 terrestrial environments; principally with native vegetation cove; *Eucalyptus/Casuarina open woodland* |
| 4 | Sub-formation | Dominant growth form, cover, height and dominant genus for each of the three traditional strata. (i.e. Upper, Mid and Ground) | *+Myriophyllum low aquatic bed* | *+Eucalyptus/Casuarina open woodland\Acacia (mixed) tall sparse shrubland\Aristida open tussock grassland* |
| 5 | Association | Dominant growth form, height, cover and species (3 species) for the three traditional strata. (i.e. Upper, Mid and Ground) | *G+ ^Myriophyllum simulans,Potamogeton tricarinatus s.l.,Potamogeton pectinatus\^aquatic,sedge,forb\1\c* | *U+ ^Eucalyptus coolabah,^Casuarina cristata,Flindersia maculosa\^tree\7\r;M ^^Acacia salicina,Alectryon oleifolius,Acacia stenophylla\^shrub\4\r;G ^Aristida ramosa,Astrebla squarrosa,Bothriochloa decipiens\^tussock grass,forb,sedge\2\i* |
| 6 | Sub-association | Dominant growth form, height, cover and species (5 species) for all layers/substrata. | *G1 Villarsia reniformis,Eleocharis acuta,Eleocharis sphacelata,Triglochin procera s.l.,Lachnagrostis filiformis\forb,sedge,tussock grass\4\c;G2+ ^Myriophyllum simulans,Potamogeton tricarinatus s.l.,Potamogeton pectinatus,Marsilea drummondii,Eleocharis pusilla\^aquatic,sedge,forb\1\c* | *U1+ ^Eucalyptus coolabah,^Casuarina cristata,Flindersia maculosa\^tree\7\r;M1 ^^Acacia salicina,Alectryon oleifolius,Acacia stenophylla,Acacia victoriae subsp. victoriae,Eremophila bignoniiflora\^shrub\4\bi;M2 ^Eremophila longifolia,Muehlenbeckia florulenta\shrub\3\r;G1 ^Aristida ramosa,Astrebla squarrosa,Bothriochloa decipiens,Dichanthium sericeum,Enteropogon acicularis\^tussock grass,forb,sedge\2\i* |

[56] The surface is considered non-vegetated in the controlled vocabulary and classification, because most of the aquatic plant biomass is under water.

# Chapter 3.0 NVIS database design and spatial linkages

## 3.1 NVIS design overview

The NVIS database comprises data arranged in four different subsystems, viz:

- A specially formatted table to relate the vegetation descriptions of each map unit to spatial data in a GIS.
- Database fields in the *vegetation description* (VEG_DESCRIPTION) table to provide a standardised, user-friendly summary of the *vegetation description*, including the various levels of the NVIS information hierarchy.
- Relational database tables, which include detailed data on structural, growth form and floristic characteristics of a vegetation type.
- Dataset information (documentation and management) attributes (not shown in Figure 6).
- Three of these subsystems are shown in Figure 6.

Further details of the arrangement of attributes in the NVIS database are given in an entity relationship diagram (Appendix C). Data custodians can use Appendix C1 (Entity relationship diagram showing NVIS Database Structure Version 7.0) as a guide for building an NVIS-compliant database. This would typically involve the addition of more attributes (and perhaps tables) to store additional data and table keys, indices, etc. appropriate to the installation. Similarly, the national compiler of NVIS requires additional tables and attributes to manage the compilation process (Appendix C2: Additional Tables in the NVIS (Australian Government: DoEE)) and develop derived products.

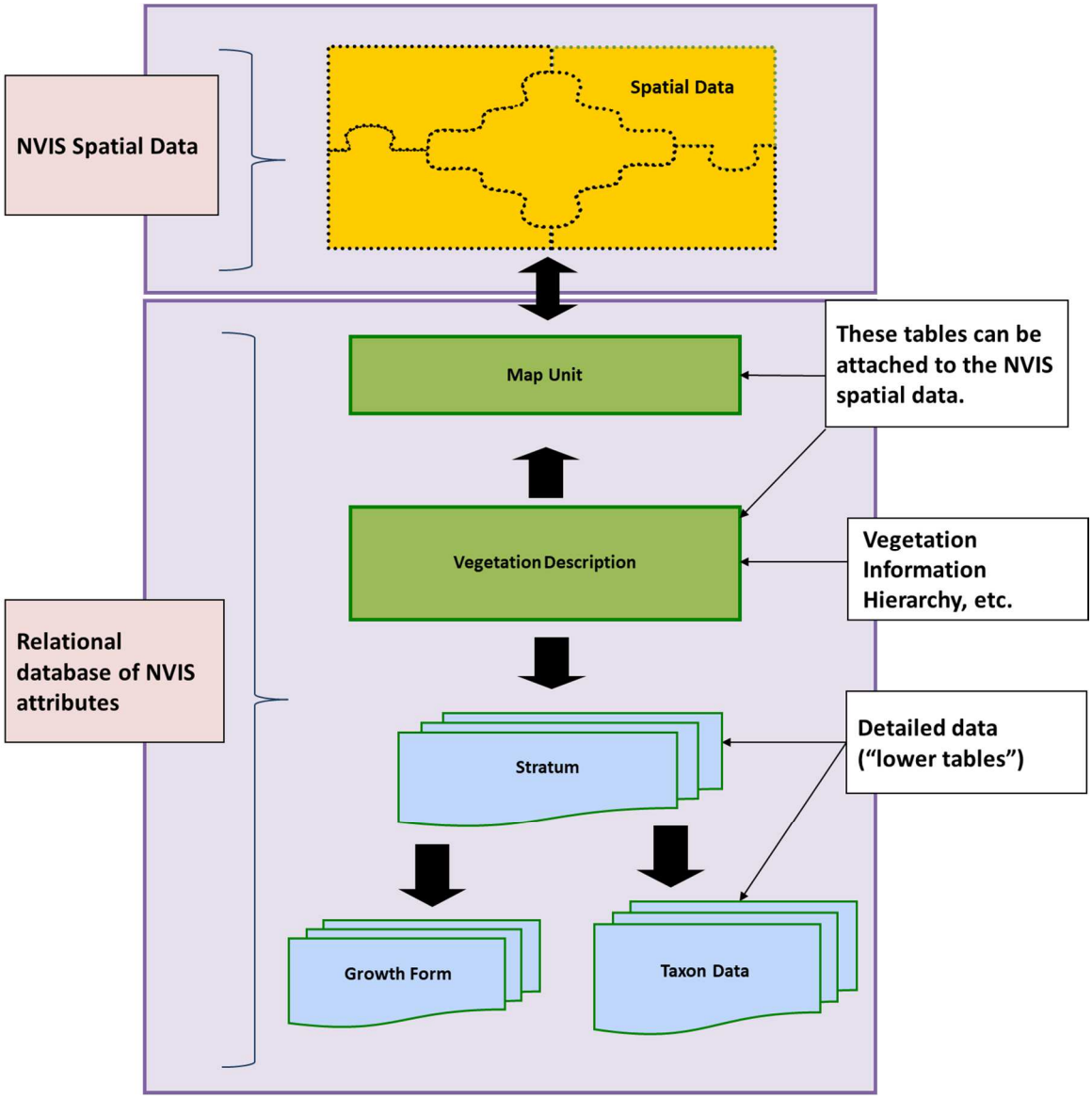


**Figure 6 Overview of the NVIS Vegetation Attribute Structure V7.0.**
The NVIS database comprises data arranged in four different subsystems. Three of these subsystems are shown here. These are: Vegetation Spatial Data, Vegetation Description and Map Unit Attributes and Detailed Vegetation Attributes. For simplicity, the tables and attributes for dataset information are not shown. The arrows here represent data flows, rather than formal relationships between objects. See Appendix C for a more complete diagram of the NVIS database. Colouring of components is consistent with colouring ascribed to the NVIS framework shown in Figure 1 (See Appendix M for RBG values).

## 3.2 NVIS database design and rationale for each table

The NVIS Database and spatial component are provided in Appendix C1. The reasons for the various linkages between each table become more apparent when considering the purpose and intended content of each table. The tables relating to vegetation metadata and

non-spatial vegetation data are described below. The following section describes the particular relationship of spatial tables and data layers to the non-spatial component.

### 3.2.1 Data set table

The DATA_SET table contains data describing the input datasets arising from field surveys and mapping exercises undertaken in particular regions. This is in addition to the GIS dataset description according to national standards. Extra metadata, which has been optimised for vegetation mapping, enables us to answer questions such as:

- What is the name of the dataset?
- What region does it cover? - There is a link to Spatial Key Layers (based on DATA_SET_NUMBER).
- When was plot data collected in the region? - The answer is usually a date range.
- How were plot data collected and used to derived vegetation types?
- How were the vegetation types interpreted from remotely-sensed imagery?

In the section describing DATA_SET attributes (Chapter 4), the attributes are loosely grouped for convenience:

- **Data set identifier information** identifies the dataset and provides links to other tables (including GIS layers) and to external documentation, such as spatial metadata.
- **Vegetation attribute methods and accuracy** describes the methods used to collect field data and classify it into vegetation types for spatial delineation.
- **Spatial methods, positional accuracy and usable scales** describe the methods used to interpret remote imagery, such as aerial photos, and recommended usage scales of the resulting dataset.

### 3.2.2 Mapping source table

Like the DATA_SET table, MAPPING_SOURCE also stores metadata optimised for vegetation mapping. However, each dataset may have more than one source of imagery. The MAPPING_SOURCE table is thus linked to the DATA_SET table in a “many-to-one” relationship. For an example region, broad-scale imagery may have been utilised for the greater part of the region and finer-scale imagery for specific features such as rivers and wetlands. Specific metadata associated with these data tables enables us to answer more questions, including:

- What remotely sensed imagery was used - e.g. LANDSAT-Thematic Mapper or Colour Aerial Photography?
- What was the scale and/or resolution of the imagery?

- What were the dates of collection of the imagery?
- How were the vegetation types transcribed onto spatial media?

### 3.2.3 References table

The references table (REFERENCE) is a very simple facility to list scientific papers and reports relating to particular regional surveys and mapping.

A single dataset can often cite several documents, for example a state-wide standards manual and a particular report for the region.

### 3.2.4 Map unit table

The MAP_UNIT table is described in Section 3.3, since several concepts need to be introduced first.

### 3.2.5 Vegetation description table

The VEG_DESCRIPTION table is the main table storing data relating to each vegetation type. This table also stores data relating to identified (mappable) land cover types. It contains attributes to identify and link each vegetation type to the wider NVIS database and the NVIS information hierarchy[57] (Levels 1 to 6, inclusive). Attributes in the following section have been loosely grouped according to similar content and function:

- **Vegetation identifier information** identifies the vegetation description record within the NVIS database and links it back to the related record in the data supplier's database in a one-to-one manner.
- **Summary information** summarises the number of strata and level of detail of the data.
- **NVIS information hierarchy** contains the same vegetation type described according to the presentation standards at each level of the hierarchy. It comprises data on the NVIS Ecologcial/Land Cover Hierarchy and/or the NVIS vegetation hierarchy, as appropriate.
- **Source information and environmental description** includes additional information on the vegetation type and its environment provided by the data supplier. The content is unmediated by the NVIS rules, hierarchy, etc. and usually contains valuable additional material for understanding the vegetation type.

[57] Comprising the NVIS ecological/land cover hierarchy and/or the NVIS vegetation hierarchy, as appropriate.

### 3.2.6 Stratum table

The STRATUM table is first of three so-called "lower tables". It stores structural data relating to each particular vegetation type/description. In particular, it itemises the (up to nine) substrata identified in the type (at NVIS Level 6—see Table 4 (NVIS (sub-)stratum codes and descriptions) and stores coded data on cover and height relating to each substratum. There are also links to the two other lower tables where one substratum can have:

- many taxa[58] with related ecological measurements (TAXON_DATA table); and,
- many growth forms with related ecological measurements (GROWTH_FORM table).

The Stratum table also has the capability of storing continuous data relating to height and cover alongside record-level metadata attributes describing the origins of those measurements. This function was designed to ensure the scientific validity of compiling coded data between vegetation types originating from datasets which used different collection standards. Also, the recording of continuous data enables recoding of height and cover data to suit particular assessments.

### 3.2.7 Growth form table

Another so-called “lower table”, the GROWTH_FORM table stores data collected against the growth forms found in each substratum of a particular vegetation type. Obviously, each substratum can have several growth forms present and the same growth form can occur in different substrata. Within each record, the growth form is described by a cover value and additional attributes (interpreted by the data supplier) to indicate its relative rank in the substratum and whether it is always there across the vegetation type or only occasionally (the latter generating a '+/-' separator instead of a comma in the Level 6 string.)

There is also an attribute to indicate which growth form best describes the substratum at simplified levels (usually the dominant) in the substratum, so that it is promoted up the NVIS vegetation hierarchy.

### 3.2.8 Taxon data table

The TAXON DATA table stores each taxon (usually species or subspecies) in each substratum in a very similar way to how data is stored in the Growth Form Table. The Taxon Data Table is another so-called “lower table”. Obviously, each substratum can have several taxa (usually species or subspecies) present and the same taxon can occur in different substrata. Within each record, the taxon is described by a cover value and additional attributes (interpreted by the data supplier) to indicate its relative rank in the substratum and whether it is always there across the vegetation type or only occasionally (the latter generating a '+/-' separator instead of a comma in the Level 6 string). There is also a facility to indicate which taxa is or are the most important (usually the dominant) in the substratum, so that it is promoted up the NVIS

[58] Specific limits are documented elsewhere.

vegetation hierarchy. This is more complex than the analogous facility in the Growth Form table. Only genera are promoted up the hierarchy and attribute values are provided to promote one genus, two genera or one genus plus the word "(mixed)" in the substratum—see details outlined in Section 2.1.7.3 (Dominant Genus or Genera) and Table 8 (Using the up-arrow or "hat[59]" notation).

Many vegetation surveys record taxon data direct to species without the prior recognition of strata—e.g. using the Braun-Blanquet cover-abundance scale[60]. In these cases, it may be helpful to start interpreting a vegetation type into NVIS by first populating this table. Especially if height and growth form data are available, the interpretation into (sub-)strata (for the Stratum table) can then be done by grouping species of similar height. Unfortuntely, the cover estimates for species are not additive, but cover measures for at least the dominant stratum should be easily obtainable from site records or remote sensing.

### 3.2.9 Note on the lower tables

The lower tables (STRATUM; GROWTH_FORM AND TAXON_DATA) store data in a normalised format duplicating the same data stored in the Level 6 string (i.e. a non-normalised format) in the *vegetation description* table. This duplication has been retained as a quality assurance mechanism, such that the data in the three lower tables should, when combined by agreed algorithms, produce exactly the same string as in Level 6 – NVIS Rule 34 (See Section 5.1.2.9—Check: Generated Description equals Intended Description).

In addition to the duplicated data, the lower tables store additional data and record-level metadata attributes relating to the three objects (strata, taxa and growth forms). Also, the number of species and growth forms (rows in the respective tables) can well exceed the requirements of a Level 6 string, enabling, for example, the storage of full species lists and associated data for each vegetation type.

### 3.2.10 NVIS flat file

The NVIS Flat File arose from users of NVIS providing feedback about the complexity of extracting detailed data (e.g. upper stratum cover and height codes) from multiple tables in GIS queries. While multi-table searches are feasible[61], the user can spend too much time manually linking tables and the chance of error is high.

As an alternative to the creation of *ad hoc* lookup tables for GIS use, a single large table was created. Level 5 strings in the VEG_DESCRIPTION table[62] were parsed into separate fields for each lower table attribute. The resulting table is essentially a reformatting of the VEG_DECRIPTION table, so it is not shown in Appendix C. Futher data from the INTERP and other tables can be linked as needed.

[59] "^" is called a "hat" in the table; also called up arrow or circumflex.

[60] Or modification thereof.

[61] These links were successfully hard-wired in a pilot web-mapping project in 2007.

[62] The flat file is effectively 1:1 with VEG_DESCRIPTION.

### 3.2.11 Notes on NVIS coordinator tables

The NVIS Coordinator uses additonal tables to manage the collation of NVIS data and the creation of derived products (Appendix C2). Full description of these is beyond the scope of this manual. However, some of the tables that have proven useful include the following:

- The AGENCY and CONTACT tables were defined in previous versions of this manual and have been useful for documenting data supplier details for operational purposes.
- The INTERP table, as a 1:1 extension of the VEG_DESCRIPTION table has proven very useful in routine interpretations of vegetation types into broader categories (especially the Major Vegetation Group (MVG) and Subgroup (MVS) classifications) and for addressing ad hoc queries.
- MVG_DESCRIPTION and MVS_DESCRIPTION are lookup tables storing MVG and MVS numbers, classification names (Appendix D1 and D2) and sort-order fields.
- VERSION_USAGE documents the use of input datasets (in the DATA_SET table), in particular NVIS versions. It includes a simple facility to describe the partial use of an input dataset.

## 3.3 NVIS spatial linkages

The purpose of this section is to document the current structure and its design rationale, and to provide users with a better understanding of the conceptual relationship between spatial units and vegetation descriptions in NVIS.

The relationship between the spatial units of mapping and the vegetation descriptions they contain is fundamental to all vegetation mapping. It is essential that the NVIS system is inclusive and caters for the range of database/GIS system designs that exist in state and territory systems. NVIS needs to be maintained as a well-structured database with all relationships specified clearly and explicitly.

The purpose of this section is to make explicit the relationship in NVIS, between the spatial layer(s) and the attribute database.

### 3.3.1 Conceptual relationship between spatial units and vegetation descriptions in the NVIS

It is necessary to understand clearly the nature of the relationship in vegetation mapping between spatial (mapping) units[63] and vegetation associations (the Vegetation Description Table). Many jurisdictions utilize “mosaics”[64] (i.e. spatial units with multiple vegetation types) within their vegetation mapping systems. In database terms, these mosaics represent a classic “many-to-many” relationship. Many (i.e. more than one) vegetation types (associations) may

[63] For the purposes of this discussion, it is useful to think of each spatial unit as a single, multi-part polygon in ESRI Terminology (ESRI, 2017); if the spatial unit is exploded into single-part polygons, each of these contain identical attribute values.

[64] A general term with a particular meaning in NVIS – see Apendix A (Glossary of Terms).

occur within a particular spatial unit, and many (i.e. more than one) spatial units may contain a particular vegetation association (See Figure 7).

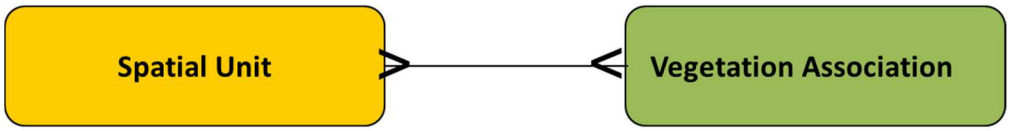


**Figure 7 Default relationship between vegetation descriptions and spatial units**

However, for clarity and ease of management within databases, this kind of relationship is often resolved with a 'breakout table'. A table is incorporated into the relationship diagram representing all the combinations possible in the relationship. This table has "one-to-many" relationships to both initial tables and contains more records than either of the initial tables. For NVIS, the resolved relationships are presented in Figure 8.

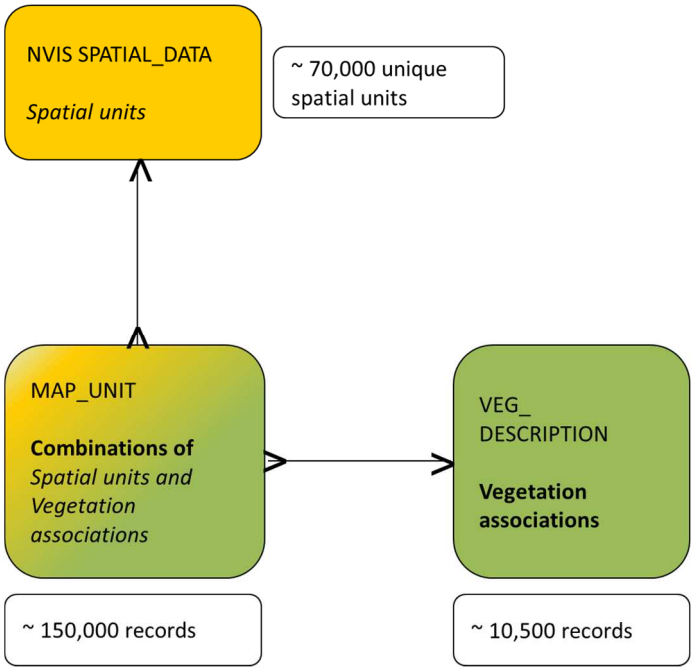


**Figure 8 Resolved relationship between vegetation descriptions and spatial units**

***Notes on the Configuration of Fundamental Entities:***

1. *Records refers to the number of unique records per NVIS table at version 4.2*
2. *Spatial units and vegetation associations are clearly differentiated by this structure.*
3. *The MAP_UNIT table represents the combination of spatial units and vegetation associations in a deep table structure best suited to a database system. It contains information limited to this relationship.*
4. *The relationships from the MAP_UNIT table to both the VEG_DESCRIPTION table and the SPATIAL_DATA are both "many-to-one".*
5. *The NVIS Spatial Data contain the unique spatial units (identified by the MAPUNT_IDENTIFIER field) in a flat table structure best suited to spatial information (GIS) systems.*

### 3.3.2 The NVIS database/spatial linkage details

From the design indicated in Figure 8, the VEG_DESCRIPTION table acts as a definitive reference table (lookup-table in spatial terms) for the two spatial tables. The table has a clear relationship with non-spatial data from vegetation sites summarised for each vegetation type.

#### 3.3.2.1 NVIS spatial data format

The NVIS spatial data are variously labelled, depending on the theme (Extant or Pre-1750 vegetation) and geographic coverage. However, during national compilation and as a final product, they all have a standard schema of attributes (Section 4.9 (Taxon Data Attributes and Description); Appendix C1—entity relationship diagram shows the NVIS database structure version 7.0; and Appendix E—list of NVIS database and spatial fields by Table). In summary, these attributes contain the following fields or groups thereof:

- MAPUNT_IDENTIFIER is effectively a primary key[65] for the mapping unit in this format, because it is unique for each permutation and combination of vegetation types within the mapping unit;
- VEGDSC1 (or NVISDSC1 in the Australian Government) is the pointer to the vegetation type with the most area in the mapping unit;
- VEGDSC2-6 (or NVISDSC2-6) are pointers to other vegetation types in the mapping unit (order of declining area);
- VEGPROP1-6 are proportional area estimates for each vegetation type[66] within the mapping unit;
- NUMBER_OF_VEG_DESCRIPTIONS indicates the number of vegetation descriptions in the vegetation type; and
- SPATIAL_MIX is selected from a lookup table of mosaic types or no mosaics (“pure”).

These attrubutes are essentially a non-normalised version of the MAP_UNIT table (Section 3.3.3.3). Since MAPUNT_IDENTIFIER and the MAP_UNIT table are often the last components to be compiled in a new NVIS version, the VEG_DESCRIPTION table can be linked to the VEGDSC attributes via NVIS_ID. VEGDSC1 is particularly useful, since it can be tested for completeness (not NULL) during the compilation process; when complete, it can be used as a simplifying surrogate for the whole mapping unit for certain purposes[67].

#### 3.3.2.2 Map unit table

The MAP_UNIT table contains the combinations of SPATIAL_UNITS and VEG_DESCRIPTIONS, with one line per VEG_DESCRIPTION, up to a maximum of six rows, each with a vegetation

[65] The GIS system usually has another primary key to manage spatial data.

[66] These estimates are best recorded at the time of map creation.

[67] For example, the development of MVG and MVS raster products.

identifier[68] pointing to the relevant record in VEG_DESCRIPTION. It contains all of the attribute data in the NVIS SPATIAL_DATA, but in a normalised table structure. There are fewer attributes (but more rows) to carry the same data (Section 4.5—Map Unit Table Attributes and Description). An extra identifier (MAP_UNIT_ID) is required as the primary key with MAPUNT_IDENTIFER as a secondary key.

#### 3.3.2.3 Data supply options

The information in the MAP_UNIT table and SPATIAL_DATA is equivalent, and can easily be converted from one structure to another, so data could be supplied to the NVIS coordinator by either means. There are three viable combinations[69] of NVIS SPATIAL DATA attributes, as follows:

> **Option A** involves the data custodian populating all fields in the SPATIAL DATA format (Section 3.3.3.2) above, except for the MAPUNT_IDENTIFIER. The SPATIAL DATA can then be supplied to the NVIS Coordinator. The NVIS Coordinator can then generate map unit records to populate the MAP_UNIT table.
>
> **Option B** involves the data custodian attaching only MAPUNT_IDENTIFIER on the SPATIAL DATA with an accompanying small(-ish) MAP_UNIT table[70] to document the relationships of the mapping units to the vegetation descriptions. The NVIS coordinator can then populate the SPATIAL DATA format from information in the small(-ish) MAP_UNIT table.
>
> **Option C** involves data supplied in some other configuration[71]. This needs to be evaluated on a case by case basis to extract the relevant data to populate the final MAP_UNIT table and SPATIAL DATA. Where insufficient information is supplied, supplementary data will be requested.

#### 3.3.2.4 Examples of spatial linkages

See Appendix L1. There is further discussion of mosaics in Appendix L2.

## 3.4 NVIS key layers

An essential requirement for transfers of spatial data is that a boundary delineating the spatial extent of the dataset is available, either:

- incorporated into the vegetation mapping data; or
- transferred as a separate spatial layer.

---

[68] In lieu of the full vegetation description, which would massively duplicate data.

[69] All options assume that VEG_DESCRIPTION table is completed and has appropriate links in the SPATIAL DATA – SOURCE_CODE or VEG_ID – to ensure overall integrity.

[70] Relevant to the study area or whole jurisdiction.

[71] Fortunately, this is very rare.

Boundaries are required so that the exact area of data updated can be identified and clipped from the existing data compilation. Previously, in some instances, datasets were supplied with mapping of polygons containing native vegetation only, surrounded by areas of unattributed white space. This makes identification of the boundaries between different data sources impossible, and is a particular issue where data sources vary in currency and scale.

In practice, attributes from the DATA_SET and MAPPING_SOURCE tables are routinely compiled into a lookup table for the NVIS Key Layers. The LUT is linked via the DATA_SET_NUMBER, which is held in both the spatial data and LUT.

Key Layers are further documented in the spatial products and their associated metadata and lookup tables (See Section 1.2— NVIS Version 4.2 products, analysis tools and functions).

# Chapter 4.0 NVIS attributes listed and described in detail

## 4.1 Introduction

- The attributes provide details about those fields necessary to describe vegetation.
- However, they generally do *not* describe the primary and secondary key fields needed to implement a working database[72].
- Each attribute is categorised according to the requirement within the NVIS Database (See Appendix G for details).
- Some attributes have a defined set of allowable values. These are listed in lookup tables presented after the relevant attribute details.
- The terminology (sub-)stratum should be interpreted as follows: substratum (for Level 6 data) and/or stratum (for Level 5 data).
- When filling out long textual fields referring to external literature (especially "grey" literature), please consider the user who may not have access to traditional library facilities. Linking to material with an on-line address is preferable.
- Most textual lookup values are in lower case.

### 4.1.1 Missing information

Where information is missing for populating the following attributes, the standard codes in Table 16 should be used, unless otherwise advised in the allowable values (lookup tables) listed under specific attributes in the sections following. Other similar values, such as 'NA' or 'not applicable' should not be used unless allowable in particular lookup tables.

**Table 16 Codes used to describe unknown or missing information**

| Type of Missing Value | Numeric Fields | Text Fields |
|---|---|---|
| Blank fields.<br>Fields which are not applicable to the data set. | -9999 | not applicable* |
| Unknown values,<br>No data available,<br>Lost or missing values (missing values may include values that could not be incorporated into the NVIS due to lack of time, incompatible data formats, etc.) | -9999 | unknown* |

* note lower case

[72] Except for the Map_Unit table, because of its central importance.

## 4.2 Table attributes

The table attributes and allowable values are set out in the following section. The attributes have been grouped into the standard NVIS tables as shown in Appendix C (Entity relationship diagram showing NVIS Database Structure Version 7.0) and then sub-headings according to similar content and function. Table 17 shows the entire list of tables and attributes described between Sections 4.2 and 4.10.

Appendix P (Proposed Attributes/Fields) shows Attributes and Fields which are proposed improvements to the NVIS Database. Appendix I (Obsolete Attributes) lists attributes recommended for deletion.

**Table 17 List of all NVIS attributes described**

| Section | Table no. | Data Set |
|---|---|---|
| **4.3 Data Set Table Attributes and Description (DATA_SET)** | | |
| **4.3.1 Data Set Identifier Information** | DS01 | DATA SET NAME |
| | DS02 | DATA SET NUMBER |
| | DS03 | VEGETATION THEME CODE |
| | DS04 | VEGETATION THEME CONSTRAINTS |
| | DS05 | ANZLIC METADATA IDENTIFIER |
| | DS06 | ANZLIC METADATA NAME |
| | DS07 | ANZLIC METADATA URL |
| **4.3.2 Vegetation Attribute Methods and Accuracy** | DS08 | STRUCTURAL CLASSIFICATION SYSTEM |
| | DS08A | STRATIFICATION (Proposed – see Appendix P) |
| | DS08B | SURVEY DESIGN (Proposed – see Appendix P) |
| | DS08C | SURVEY DATA (Proposed – see Appendix P) |
| | DS09 | FLORISTIC GROUP TYPE |
| | DS10 | CLASSIFICATION METHOD |
| | DS11 | SAMPLING TYPE |
| | DS12 | BOTANICAL EXPERTISE |
| **4.3.3 Spatial Methods, Positional Accuracy and Usable Scales** | DS13 | POSITIONAL ACCURACY |
| | DS14 | POSITIONAL ACCURACY DETERMINATION |
| | DS15 | POSITIONAL ACCURACY MEASURE |
| | DS16 | MAP PUBLICATION SCALE |
| | DS17 | FINEST SCALE |
| | DS18 | BROADEST SCALE |
| **4.3.4 Summary of Survey and Mapping Methods and Accuracy** | DS19 | SURVEY AND MAP RELIABILITY |
| | DS24 | START YEAR ATTRIBUTE |
| | DS25 | END YEAR ATTRIBUTE |
| | DS26- | START YEAR SPATIAL |
| | DS27 | END YEAR SPATIAL |
| **4.4 Mapping Source Attributes and Description (MAPPING_SOURCE, REFERENCE)** | | |
| **4.4.1 Mapping Source Table** | MS01 | MAPPING SOURCE NUMBER |
| | MS02 | MAPPING METHOD |
| | MS03 | MAPPING EXPERTISE |
| | MS04 | IMAGERY SOURCE |
| | MS05 | IMAGERY SCALE |
| | MS06 | IMAGERY RESOLUTION |
| | MS07 | MAP SOURCE EXTENT |
| | MS08 | DELINEATION MEDIUM |
| | MS09 | START_DATE_SOURCE |
| | MS10 | END DATE SOURCE |

| Section | Table no. | Data Set |
|---|---|---|
| | MS11 | MAP BASE |
| **4.4.1 Mapping Source Table** | MS01 | MAPPING SOURCE NUMBER |
| | MS02 | MAPPING METHOD |
| | MS03 | MAPPING EXPERTISE |
| | MS04 | IMAGERY SOURCE |
| | MS05 | IMAGERY SCALE |
| | MS06 | IMAGERY RESOLUTION |
| | MS07 | MAP SOURCE EXTENT |
| | MS08 | DELINEATION MEDIUM |
| | MS09 | START_DATE_SOURCE |
| | MS10 | END DATE SOURCE |
| | MS11 | MAP BASE |
| **4.4.2 Reference Table** | RF01 | CITATION |
| | RF02 | FORMAT |
| | RF03 | STORAGE LOCATION |
| **4.5 Map Unit Table and Vegetation Description Table Attributes and Description (MAP_UNIT)** | | |
| **4.5.1 Map Unit Identifier Information** | MU01 | MAP UNIT IDENTIFIER |
| **4.5.2 Descriptive Information** | MU02 | SPATIAL MIX |
| | MU03 | MOSAIC TYPE |
| | MU04 | NUMBER OF VEGETATION DESCRIPTIONS |
| | MU05 | VEG DESCRIPTION POSITION |
| | MU06 | VEG DESCRIPTION PROPORTION |
| **4.5.3 Links to Other Tables** | MU07 | DATA SET IDENTIFICATION |
| | MU08 | VEG IDENTIFICATION |
| | MU09 | NVIS IDENTIFICATION |
| | MU10 | SOURCE CODE |
| **4.6 Vegetation Description Attributes and Description (VEG_DESCRIPTION)** | | |
| **4.6.1Vegetation Description Identifier Information** | VG01 | VEGETATION IDENTIFICATION |
| | VG02 | NVIS IDENTIFICATION |
| | VG03 | SOURCE CODE |
| **4.6.2 Summary Information** | VG04 | ECO CLASSIFICATION FLAG – (Proposed - see Appendix P) |
| | VG05 | LEVEL OF DETAIL |
| | VG06 | NUMBER OF STRATA |
| **4.6.2 NVIS information hierarchy** | VG08 | LEVEL 1 (CLASS) – case 1: native vegetation |
| | VG09 | LEVEL 1 (CLASS) – case 2: non-vegetation and non-native vegetation |
| | VG09A | LEVEL 1 (ECOCOVER) – (Proposed - see Appendix P) |
| | VG10 | LEVEL 2 (STRUCTURAL FORMATION) – case 1: native vegetation |
| | VG11 | LEVEL 2 (STRUCTURAL FORMATION) – case 2: non-vegetation and non-native vegetation |
| | VG11A | LEVEL 2 (ECOSURFACE) – (Proposed - see Appendix P) |
| | VG12 | LEVEL 3 (BROAD FLORISTIC FORMATION) – case 1: native vegetation |
| | VG13 | LEVEL 3 (BROAD FLORISTIC FORMATION) – case 2: non-vegetation and non-native vegetation |

| Section | Table no. | Data Set |
|---|---|---|
| | VG13A | LEVEL 3 (ECOELEMENT) – (Proposed - see Appendix P) |
| | VG14 | LEVEL 4 (SUB-FORMATION) |
| | VG15 | LEVEL 5 (ASSOCIATION) |
| | VG16 | LEVEL 6 (SUB-ASSOCIATION) |
| **4.6.3 Source Information** | VG17 | SOURCE DESCRIPTION |
| | VG18 | ENVIRONMENTAL DESCRIPTION |
| **4.7 Stratum Table Attributes and Description (STRATUM)** | | |
| **4.7.1 Stratum Table (Structural Information)** | ST01 | STRATUM CODE |
| | ST02 | SUBSTRATUM RANK |
| | ST03 | NUMBER OF GROWTH FORMS |
| | ST04 | NUMBER OF TAXA |
| | ST05 | COVER TYPE |
| | ST06 | COVER TYPE DERIVATION METHOD |
| | ST07 | COVER MINIMUM VALUE |
| | ST08 | COVER MAXIMUM VALUE |
| | ST09 | COVER MEDIAN VALUE |
| | ST10 | COVER MEAN VALUE |
| | ST11 | COVER CODE |
| | ST12 | HEIGHT TYPE |
| | ST13 | HEIGHT TYPE DERIVATION METHOD |
| | ST14 | HEIGHT MINIMUM VALUE |
| | ST15 | HEIGHT MAXIMUM VALUE |
| | ST16 | HEIGHT MEAN VALUE |
| | ST17 | HEIGHT MEDIAN VALUE |
| | ST18 | HEIGHT CLASS |
| | ST19 | DOMINANT STRATUM FLAG |
| **4.8 Growth Form Attributes and Description (GROWTH_FORM)** | | |
| **4.8.1 Growth Form Table** | GF01 | GROWTH FORM RANK |
| | GF02 | GROWTH FORM CODE |
| | GF02A | GROWTH FORM – (Proposed - see Appendix P) |
| | GF03 | COVER TYPE |
| | GF04 | COVER TYPE DERIVATION METHOD |
| | GF05 | COVER MINIMUM VALUE |
| | GF06 | COVER MAXIMUM VALUE |
| | GF07 | COVER MEDIAN VALUE |
| | GF08 | COVER MEAN VALUE |
| | GF09 | GROWTH FORM DOMINANCE QUALIFIER |
| | GF10 | GROWTH FORM FREQUENCY |
| | GF12 | GROWTH FORM ALWAYS THERE |
| | GF13 | GROWTH FORM SUMMARY FLAG |
| **4.9 Taxon Data Attributes and Description (TAXON_DATA)** | | |
| **4.9.1 Taxon Data** | TD01 | TAXON DATA RANK |
| | TD02 | TAXON DATA DESCRIPTION |
| | TD03 | TAXON DATA SOURCE CODE – (Recommended for deletion – see Appendix I) |
| | TD04 | COVER TYPE |
| | TD05 | COVER TYPE DERIVATION METHOD |
| | TD06 | COVER MINIMUM VALUE |
| | TD07 | COVER MAXIMUM VALUE |
| | TD08 | COVER MEDIAN VALUE |
| | TD09 | COVER MEAN VALUE |

| Section | Table no. | Data Set |
|---|---|---|
| | TD10 | TAXON DATA DOMINANCE QUALIFIER |
| | TD11 | TAXON DATA FREQUENCY |
| | TD12 | TAXON DATA ALWAYS THERE |
| | TD13 | TAXON DATA SUMMARY FLAG |
| **4.10 NVIS Spatial Data (Named variously, but with standard fields)** | | |
| | SD01 | MAPUNT_IDENTIFIER |
| | SD02 | VEGDSC1 |
| | SD03 | VEGDSC2 |
| | SD04 | VEGDSC3 |
| | SD05 | VEGDSC4 |
| | SD06 | VEGDSC5 |
| | SD07 | VEGDSC6 |
| | SD08 | VEGPROP1 |
| | SD09 | VEGPROP2 |
| | SD10 | VEGPROP3 |
| | SD11 | VEGPROP4 |
| | SD12 | VEGPROP5 |
| | SD13 | VEGPROP6 |
| | SD14 | SPATIAL_MIX |
| **4.10 NVIS Spatial Data attributes** | SD15 | NO_VEG_DESC |

## 4.3 Data set table attributes and descriptions

### 4.3.1 Data set identifier information (DATA_SET)

| Table ID | Table Title |
|---|---|
| DS01 | DATA SET NAME |
| DS02 | DATA SET NUMBER |
| LUDS02 | Look-up Table for: DATA SET NUMBER (part) |
| DS03 | VEGETATION THEME CODE |
| LUDS03 | Look-up Table for: VEGETATION THEME CODE |
| DS04 | VEGETATION THEME CONSTRAINTS |
| DS05 | ANZLIC METADATA IDENTIFIER |
| DS06 | ANZLIC METADATA NAME |
| DS07 | ANZLIC METADATA URL |

| **Attribute 1: DS01 DATA SET NAME** | |
|---|---|
| **Field** | **Detail** |
| **Purpose:** | To identify each dataset using a simple title. |
| **Requirement:** | Mandatory |
| **Field Name:** | DATA_SET_NAME |
| **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 in an acronym form). |
| **Value:** | Character (2000) |
| **Example:** | Gippsland Ecological Vegetation Classes - Extant |
| **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 national directory. |
| **Status:** | Implemented in the NVIS Oracle database. |

| Attribute 2: DS02 DATA SET NUMBER | |
|---|---|
| **Field** | **Detail** |
| **Purpose:** | To identify each dataset in a concise and systematic way. |
| **Requirement:** | Australian Government |
| **Field Name:** | DATA_SET_NUMBER |
| **Description:** | This is a number ascribed to the data set by the Australian Government in compiling the NVIS dataset. The number must be used by the data custodian for any subsequent transfers or updates to the vegetation description. |
| **Value:** | Number (10)<br>Format: SDD, where S = State Code (from lookup table); DD is the dataset number, which is assigned by the NVIS Coordinator. |
| **Example:** | 413 |
| **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 is usually of little direct interest to the States and Territories.<br>Note addition of 0 and 9 in the LUT, as used in NVIS versions 3 and 4.<br>Also used in the NVIS (spatial) Key Layers, so that data from the DATA_SET and related tables can be rendered spatially. |
| **Status:** | Implemented in the NVIS Oracle database. |

| Look-up Table 1: LU-DS02 DATA SET NUMBER (Part) | |
|---|---|
| **Code** | **Explanation** |
| **0** | Australian Government |
| **1** | Australian Capital Territory |
| **2** | New South Wales |
| **3** | Northern Territory |
| **4** | Queensland |
| **5** | South Australia |
| **6** | Tasmania |
| **7** | Victoria |
| **8** | Western Australia |
| **9** | Temporary, gap-filling dataset |

| Attribute 3: DS03 VEGETATION THEME CODE | |
|---|---|
| **Field** | **Detail** |
| **Purpose:** | To identify whether the dataset represents pre-1750 and/or extant (present) vegetation. |
| **Requirement:** | Mandatory |
| **Database Field Name:** | VEGETATION_THEME_CODE |
| **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)<br>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 |
| **Comments:** | This is a simple, useful and important attribute for managing NVIS spatial data. |
| **Status:** | Implemented in the NVIS Oracle database. |

| Look-up Table 2: LU-DS03 VEGETATION THEME CODE | |
|---|---|
| **Code** | **Explanation** |
| **B** | The dataset comprises vegetation descriptions and spatial data relating to both extant and pre-clearing |
| **E** | Extant (i.e. present, current) vegetation, including remnants and derived types. |
| **P** | Pre-clearing (i.e. pre-1750 or "natural") vegetation. |

| Attribute 4: DS04 VEGETATION THEME CONSTRAINTS | |
|---|---|
| **Field** | **Detail** |
| **Purpose:** | To describe any major limitations applying to the vegetation theme for the dataset. |
| **Requirement:** | Recommended |
| **Database Field Name:** | VEGETATION_THEME_CONSTRAINTS |
| **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:** | Possible examples include: solely woody vegetation only; solely endangered communities; solely recorded vegetation types conforming to the vegetation regulation act; mapped woody remnant vegetation within the wheatbelt study area, but did not attribute the cleared and semi-native vegetation types; solely derived grasslands. |
| **Comments:** | In terms of spatial constraints, please specify the extent of coverage by the attributes and any exclusions. See also VEGETATION THEME CODE |
| **Status:** | Implemented in the NVIS Oracle database. Requires further provision of content from NVIS stakeholders. |

| Attribute 5: DS05 ANZLIC METADATA IDENTIFIER | |
|---|---|
| **Field** | **Detail** |
| **Purpose:** | To provide a unique, machine-generated, human-readable link to the completed metadata and further information about the data set on the national data directory. |
| **Requirement:** | Recommended |
| **Database Field Name:** | ANZLIC_METADATA_IDENTIFIER |
| **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 GIS metadata complying with national standards before being accepted into the NVIS. The national data directory can be searched at URL: http://data.gov.au/ and has useful extra details such as data set title, publisher, contact information and links to downloadable data. |
| **Status:** | Implemented in the NVIS Oracle database. This appears to be obsolete in its current form. A similar document identifier is in AS/NZS 19115: 2011, but it doesn't appear in 2015 docs. Recommend further evaluation of benefits to justify retention (or not). |

| Attribute 6: DS06 ANZLIC METADATA NAME | |
|---|---|
| **Field** | **Detail** |
| **Purpose:** | To provide name of dataset in the national data directory. |

| | |
|---|---|
| **Requirement:** | Optional |
| **Database Field Name:** | ANZLIC_METADATA_NAME |
| **Description:** | This is the name given to the data set by the publishing organisation. The information should be in plain language (that is, preferably not solely in acronym forms). Should preferably be the same as DS01. |
| **Value:** | Character (2000) |
| **Example:** | Gippsland Ecological Vegetation Classes - Extant |
| **Comments:** | Field may need to be renamed against current national metadata standards and implementation. |
| **Status:** | Implemented in the NVIS Oracle database. Review need for field and details. |

| **Attribute 7: DS07 ANZLIC METADATA URL** | |
|---|---|
| **Field** | **Detail** |
| **Purpose:** | To provide a direct, on-line link to the metadata statement. |
| **Requirement:** | Optional |
| **Database Field Name:** | ANZLIC_METADATA_URL |
| **Description:** | The internet address of the metadata statement. (The national data directory can be searched at URL: http://data.gov.au/). |
| **Value:** | Character (2000) |
| **Example:** | http://data.gov.au/dataset/31915e37-ce5f-446f-932c-f702cc2224d3 |
| **Comments:** | The contents of this field will require maintenance from time to time. |
| **Status:** | Implemented in the NVIS Oracle database. |

### 4.3.2 Vegetation attribute methods and accuracy (DATA_SET)

| Table ID | Table Title |
|---|---|
| DS08 | STRUCTURAL CLASSIFICATION SYSTEM |
| LUDS08 | Look-up Table for: STRUCTURAL CLASSIFICATION SYSTEM |
| DS08A | STRATIFICATION (Proposed – see Appendix P) |
| DS08B | SURVEY DESIGN (Proposed – see Appendix P) |
| DS08C | SURVEY DATA (Proposed – see Appendix P) |
| DS09 | FLORISTIC GROUP TYPE |
| LUDS09 | Look-up Table for: FLORISTIC GROUP TYPE |
| DS10 | CLASSIFICATION METHOD |
| DS11 | SAMPLING TYPE |
| LUDS11 | Look-up Table for: SAMPLING TYPE |
| DS12 | BOTANICAL EXPERTISE |

| **Attribute 8: DS08 STRUCTURAL CLASSIFICATION SYSTEM** | |
|---|---|
| **Field** | **Detail** |
| **Purpose:** | To specify the classification system originally used in the field survey and mapping method. |
| **Requirement:** | QAQC |
| **Database Field Name:** | STRUCTURAL_CLASSFN_SYSTEM |
| **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)<br>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 |
| **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. |
| **Status:** | Implemented in the NVIS Oracle database. |

| **Look-up Table 3: LU-DS08 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, J. S. 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 |

| **Attribute 9: DS09 FLORISTIC GROUP TYPE** | |
|---|---|
| **Field** | **Detail** |
| **Purpose:** | To describe how each vegetation type has been defined in terms of species composition. |
| **Requirement:** | Recommended |
| **Database Field Name:** | FLORISTIC_GROUP_TYPE |
| **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 (3) a mixture of both types of species. |
| **Value:** | Character (20)<br>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. |
| **Status:** | Implemented in the NVIS Oracle database. |

| **Look-up Table 4: LU-DS09 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 10: DS10 CLASSIFICATION METHOD** | |
|---|---|
| **Field** | **Detail** |
| **Purpose:** | To describe the analysis methods used to create the vegetation types. |
| **Requirement:** | QAQC |
| **Database Field Name:** | CLASSIFICATION_METHOD (formerly “CLASSIFICATION_SUPPORT”) |
| **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. The methods used to rank the growth forms and species in each (sub-)stratum should also be specified. |
| **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 Principal Component Analysis (PCA) 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. |
| **Comments:** | The text could often be cut and pasted from an existing project report. Any modifications to the original classification must be reported. |
| **Status:** | Implemented in the NVIS Oracle database. |

| **Attribute 11: DS11 SAMPLING TYPE** | |
|---|---|
| **Field** | **Detail** |
| **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 |
| **Description:** | |
| **Value:** | Character (50)<br>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 |
| **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. |

**Look-up Table 5: LU-DS11 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.<br>**1. Planning and field survey**<br>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 or larger)<br>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.<br>Recording general biophysical and environmental attributes of a landscape unit in which the site is located.<br>Recording the full list of higher plants and various attributes of the species e.g. growth forms<br>Recording the vegetation in strata<br>Recording the structural attributes of the vegetation community e.g. height, cover, strata and growth forms<br>Recording a geo-reference for the site-based quadrats so that they are relocatable and capable of being used in a GIS<br>Recording of metadata for each site e.g. date, observer, etc<br>Entering of the data from site-based quadrats into a relational database and checking of the data.<br>**2. Classifying, interpreting and describing** the vegetation into definitive vegetation types using quadrats<br>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.<br>**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** | Plot area not delineated. 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. |
| **basal area sites** | Plot area not delineated. 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 12: DS12 BOTANICAL EXPERTISE** | |
|---|---|
| **Field** | **Detail** |
| **Purpose:** | To describe, as a whole for the dataset, how reliably plants were identified. |
| **Requirement:** | Recommended |
| **Database Field Name:** | BOTANICAL_EXPERTISE |
| **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. |
| **Comments:** | This information is not intended to describe individual sub-associations or map units. |
| **Status:** | Implemented in the NVIS Oracle database. |

### 4.3.3 Spatial methods, positional accuracy and usable scales (DATA_SET)

| **Table ID** | **Table** |
|---|---|
| DS13 | POSITIONAL ACCURACY |
| DS14 | POSITIONAL ACCURACY DETERMINATION |
| LUDS14 | Look-up Table for: POSITIONAL ACCURACY DETERMINATION |
| DS15 | POSITIONAL ACCURACY MEASURE |
| LUDS15 | Look-up Table for: POSITIONAL ACCURACY MEASURE |
| DS16 | MAP PUBLICATION SCALE |
| DS17 | FINEST SCALE |
| DS18 | BROADEST SCALE |

| **Attribute 13: DS13 POSITIONAL ACCURACY** | |
|---|---|
| **Field** | **Detail** |
| **Purpose:** | To specify the locational accuracy of the spatial coverage. |
| **Requirement:** | QAQC |
| **Database Field Name:** | POSITIONAL_ACCURACY |
| **Description:** | The accuracy of mapped line or cell features in relation to their real world locations (e.g.. 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. |
| **Status:** | Implemented in the NVIS Oracle database. Review need for field and content. |

| Attribute 14: DS14 POSITIONAL ACCURACY DETERMINATION | |
|---|---|
| **Field** | **Detail** |
| **Purpose:** | To identify the method used for assessing POSITIONAL ACCURACY |
| **Requirement:** | QAQC |
| **Field Name:** | POSITIONAL_ACCURACY_DETERM |
| **Description:** | A code indicating the positional source or determination of points, polygons or cells across the data set. The information provided should relate to how data set was mapped i.e.estimate, mapped, rectphoto, satellite etc. |
| **Value:** | Character (20)<br>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. Review need for field and content. |

| Look-up Table 6: LU-DS14 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 15: DS15 POSITIONAL ACCURACY MEASURE | |
|---|---|
| **Field** | **Detail** |
| **Purpose:** | To specify the type of measure and/or calculation used to determine DATASET POSITIONAL ACCURACY. |
| **Requirement:** | Recommended |
| **Database Field Name:** | POSITIONAL_ACCURACY_MEASURE |
| **Description:** | |
| **Value:** | Character (20)<br>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:** | RMSE |
| **Comments:** | |
| **Status:** | Implemented in the NVIS Oracle database. Review need for field and content. |

| Look-up Table 7: LU-DS15 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 16: DS16 MAP PUBLICATION SCALE** | |
|---|---|
| **Field** | **Detail** |
| **Purpose:** | To specify the scale at which the vegetation map/dataset was published. |
| **Requirement:** | Mandatory |
| **Database Field Name:** | MAP_PUBLICATION_SCALE |
| **Description:** | The denominator of the ratio of a distance on a map to its corresponding distance on the ground. |
| **Value:** | Number (10) |
| **Example:** | 50,000; e.g. Kangaroo Island SA. |
| **Comments:** | For unpublished maps or coverages, please specify a nominal scale that would be suited to routine use. |
| **Status:** | Implemented in the NVIS Oracle database. |

| **Attribute 17: DS17 FINEST SCALE** | |
|---|---|
| **Field** | **Detail** |
| **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 |
| **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:** | Numbe r(10)<br>To be used in conjunction with DS 19. BROADEST SCALE |
| **Example:** | 40000 - A 1:50,000 scale map could be used at 1:40,000 scale without too much inaccuracy. However, it could not be used at 1:20,000. 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. |

| **Attribute 18: DS18 BROADEST SCALE** | |
|---|---|
| **Field** | **Detail** |
| **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 |
| **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)<br>To be used in Conjunction with DS 18. FINEST SCALE. |
| **Example:** | 200,000 - A 1:50,000 scale map could be used at 1:200,000 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. |
| **Status:** | Implemented in the NVIS Oracle database. |

### 4.3.4 Summary of survey and mapping methods and accuracy (DATA_SET)

| Table ID | Table |
|---|---|
| DS19 | SURVEY AND MAP RELIABILITY |
| DS24 | START YEAR ATTRIBUTE |
| DS25 | END YEAR ATTRIBUTE |
| DS26 | START YEAR SPATIAL |
| DS27 | END YEAR SPATIAL |

| **Attribute 19: DS19 SURVEY AND MAP RELIABILITY** | |
|---|---|
| **Field** | **Detail** |
| **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 |
| **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 1:20,000 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. |
| **Comments:** | The contents of this attribute should synthesise and summarise the values of other attributes from the DataSet, Mapping Methods and Map Source tables. Refer to external sources, such as project reports for further details. 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. |

| **Attribute 20: DS24 START YEAR ATTRIBUTE** | |
|---|---|
| **Field** | **Detail** |
| **Purpose:** | To document the year of the earliest field collection of vegetation-related attributes used in the survey underpinning the maps. |
| **Requirement:** | Mandatory |

| | |
|---|---|
| **Database Field Name:** | START_YEAR_ATTRIBUTE |
| **Description:** | Year of earliest attributes used in the survey. |
| **Value:** | Number (4) |
| **Example:** | 1978 |
| **Comments:** | This field is later attached to the NVIS key layers and is fundamental to assessing the currency of the attribute data across compiled data products. If required, it could be attached to individual polygons. |
| **Status:** | Replaces START_DATE_SPATIAL (DS20). Implemented in the NVIS Oracle database. |

| **Attribute 21: DS25 END YEAR ATTRIBUTE** | |
|---|---|
| **Field** | **Detail** |
| **Purpose:** | To document the year of the latest field collection of vegetation-related attributes used in the survey underpinning the maps. |
| **Requirement:** | Mandatory |
| **Database Field Name:** | END_YEAR_ATTRIBUTE |
| **Description:** | Year of latest attributes used in the survey. |
| **Value:** | Number (4) |
| **Example:** | 1996 |
| **Comments:** | This field is later attached to the NVIS key layers and is fundamental to assessing the currency of the attribute data across compiled data products. If required, it could be attached to individual polygons. |
| **Status:** | Replaces END_DATE_ATTRIBUTE (DS21). Implemented in the NVIS Oracle database. |

| **Attribute 22: DS26 START YEAR SPATIAL** | |
|---|---|
| **Field** | **Detail** |
| **Purpose:** | To document the year of the earliest image used in the mapping. |
| **Requirement:** | Mandatory |
| **Database Field Name:** | START_YEAR_SPATIAL |
| **Description:** | Year of earliest image used in the mapping. The value for a dataset would normally be extracted from the earliest START_DATE_SOURCE for the dataset in the Map_Source table. |
| **Value:** | Number (4) |
| **Example:** | 1978 |
| **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:** | Replaces START_DATE_SPATIAL (DS22). Implemented in the NVIS Oracle database. |

| **Attribute 23: DS27 END YEAR SPATIAL** | |
|---|---|
| **Field** | **Detail** |
| **Purpose:** | To document the date of the most recent image used in the mapping. |
| **Requirement:** | Mandatory |
| **Database Field Name:** | END_YEAR_SPATIAL |
| **Description:** | Year of latest image used in the mapping. The value for a dataset would normally be extracted from the earliest END_DATE_SPATIAL for the dataset in the Map_Source table. |
| **Value:** | Number (4) |

| | |
|---|---|
| **Example:** | 1996 |
| **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:** | Replaces END_DATE_SPATIAL (DS23). Implemented in the NVIS Oracle database. |

## 4.4 Mapping source attributes and description

### 4.4.1 Mapping source table (methods and sources) (MAPPING_SOURCE)

| Table ID | Table Title |
|---|---|
| MS01 | MAPPING SOURCE NUMBER |
| MS02 | MAPPING METHOD |
| MS03 | MAPPING EXPERTISE |
| MS04 | IMAGERY SOURCE |
| LUMS04 | Look-up Table for: IMAGERY SOURCE |
| MS05 | IMAGERY SCALE |
| MS06 | IMAGERY RESOLUTION |
| MS07 | MAP SOURCE EXTENT |
| MS08 | DELINEATION MEDIUM |
| LUMS08 | Look-up Table for: DELINEATION MEDIUM |
| MS09 | START_DATE_SOURCE |
| MS10 | END DATE SOURCE |
| MS11 | MAP BASE |

| **Attribute 24: MS01 MAPPING SOURCE NUMBER** | |
|---|---|
| **Field** | **Detail** |
| **Purpose:** | To identify each unique combination of map source and mapping method used in each dataset. |
| **Requirement:** | Optional |
| **Database Field Name:** | MAPPING_SOURCE_NUMBER |
| **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:** | Implemented in the NVIS Oracle database. |

| **Attribute 25: MS02 - MAPPING METHOD** | |
|---|---|
| **Field** | **Detail** |
| **Purpose:** | To describe the interpretive tools used for delineating the map units within the data set. |
| **Requirement:** | QAQC |
| **Database Field Name:** | MAPPING_METHOD |

| | |
|---|---|
| **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)<br>Multiple entries allowed. |
| **Example:** | Aerial photo interpretation; manual satellite image interpretation; combination of quantitative modelling and aerial photo interpretation |
| **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. |

| **Attribute 26: MS03 MAPPING EXPERTISE** | |
|---|---|
| **Field** | **Detail** |
| **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 |
| **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) |
| **Example:** | High confidence in the skill and expertise of the interpreter(s) |
| **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. |

| **Attribute 27: MS04 IMAGERY SOURCE** | |
|---|---|
| **Field** | **Detail** |
| **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) |
| **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) |
| **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'. |
| **Comments:** | Additional sources should be added to the lookup table, as required. |
| **Status:** | Implemented in the NVIS Oracle database. |

| **Look-up Table 8: LU-MS04 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 28: MS05 IMAGERY SCALE** | |
|---|---|
| **Field** | **Detail** |
| **Purpose:** | To document the scale of each IMAGERY_SOURCE. |
| **Requirement:** | QAQC |
| **Database Field Name:** | IMAGERY_SCALE |
| **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. |

| **Attribute 29: MS06 IMAGERY RESOLUTION** | |
|---|---|
| **Field** | **Detail** |
| **Purpose:** | To document the resolution of each IMAGERY_SOURCE. |
| **Requirement:** | Recommended |
| **Database Field Name:** | IMAGERY_RESOLUTION |
| **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. |

| **Attribute 30: MS07 MAPPING SOURCE EXTENT** | |
|---|---|
| **Field** | **Detail** |
| **Purpose:** | To describe the extent of the map source and/or mapping method within the dataset. |
| **Requirement:** | Optional |
| **Database Field Name:** | MAPPING_SOURCE_EXTENT |
| **Description:** | A description of the areal coverage of the map source and/or mapping method within the dataset. |
| **Value:** | Character (4000) |
| **Example:** | The interpretation of colour aerial photos was confined to public land in the coastal portion of the dataset. |
| **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:** | Implemented in the NVIS Oracle database. |

| **Attribute 31: MS08 DELINEATION MEDIUM** | |
|---|---|
| **Field** | **Detail** |
| **Purpose:** | To describe the medium on which the map units were delineated. |
| **Requirement:** | Recommended |
| **Database Field Name:** | DELINEATION_MEDIUM |
| **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) |
| **Example:** | Options might include: hardcopy paper; hardcopy mylar film; digital |
| **Comments:** | The use of particular mapping media may have implications for POSITIONAL _ACCURACY. |
| **Status:** | Implemented in the NVIS Oracle database. |

| **Look-up Table 9: LU-MS08 DELINEATION MEDIUM** | |
|---|---|
| **Code** | **Explanation** |
| **digital** | digital |
| **hardcopy mylar film** | hardcopy mylar film |
| **hardcopy paper** | hardcopy paper |
| **hardcopy photographs** | hardcopy photographs |
| **unknown** | unknown |
| **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 |
| **unknown** | unknown |

| **Attribute 32: MS09 START_DATE_SOURCE** | |
|---|---|
| **Field** | **Detail** |
| **Purpose:** | To document the date of the earliest image source used in the particular mapping. |
| **Requirement:** | Recommended |
| **Database Field Name:** | START DATE_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. |
| **Example:** | 09/04/1978 |
| **Comments:** | The earliest mapping source across all mapping methods for a dataset would normally be used in the attribute START_YEAR_SPATIAL to summarise the whole dataset. There is merit in retaining data on dates, here. Dates could be useful for checking particular remote imagery. The date also implies the season of capture, which is often important to know. |
| **Status:** | Implemented in the NVIS Oracle database. |

| **Attribute 33: MS10 END DATE SOURCE** | |
|---|---|
| **Field** | **Detail** |
| **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 |
| **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. |
| **Example:** | 14:25:37 06/06/1996 |
| **Comments:** | The latest mapping source across all mapping methods for a dataset would normally be used in the attribute END_YEAR_SPATIAL to summarise the whole dataset. There is merit in retaining data on dates, here. Dates could be useful for checking particular remote imagery. The date also implies the season of capture, which is often important to know. |
| **Status:** | Implemented in the NVIS Oracle database. |

| **Attribute 34: MS11 MAP BASE** | |
|---|---|
| **Field** | **Detail** |
| **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 |
| **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)<br>Semi-colon delimited |
| **Example:** | AUSLIG (1990) 1:100,000 series; GPS Ground Control Points |
| **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. |

### 4.4.2 Reference table (REFERENCE)

| Table ID | Table |
|---|---|
| RF01 | CITATION |
| RF02 | FORMAT |
| RF03 | STORAGE LOCATION |

| **Attribute 35: RF01 CITATION** | |
|---|---|
| **Field** | **Detail** |
| **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)<br>The entry must include all author's 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. |
| **Comments:** | A very useful attribute when consistently and comprehensively filled out. |
| **Status:** | Implemented in the NVIS Oracle database. |

| **Attribute 36: RF02 FORMAT** | |
|---|---|
| **Field** | **Detail** |
| **Purpose:** | To describe the format(s) in which the reference is available. |
| **Requirement:** | Optional |
| **Database Field Name:** | FORMAT |
| **Description:** | |
| **Value:** | Character (2000)<br>Semi-colon delimited |
| **Example:** | Hardcopy and digital; Hardcopy; Digital; URL |
| **Comments:** | |
| **Status:** | Implemented in the NVIS Oracle database. |

| **Attribute 37: RF03 STORAGE LOCATION** | |
|---|---|
| **Field** | **Detail** |
| **Purpose:** | To specify where the reference can be found. |
| **Requirement:** | Optional |
| **Database Field Name:** | STORAGE_LOCATION |
| **Description:** | The storage location(s) indicating where the reference can be found, including its URL where available. |
| **Value:** | Character (2000)<br>Semi-colon delimited |
| **Example:** | 1. Queensland Herbarium Library 2. National Library<br>3. http://www.environment.gov.au/states/cyp_on_l/reports/lup/cons_con.html |
| **Comments:** | Where long textual fields refer to external literature (especially “grey” literature), please consider the user who may not have access to traditional library facilities. Linking to material with an on-line address is preferable. |
| **Status:** | Implemented in the NVIS Oracle database. Review usage in the on-line world; an URL would be very useful. |

## 4.5 Map unit table attributes and description

### 4.5.1 Map unit identifier information (MAP_UNIT)

| **Table ID Table** | |
|---|---|
| MU01 | MAP UNIT IDENTIFIER |

| **Attribute 38: MU01 MAP UNIT IDENTIFIER** | |
|---|---|
| **Field** | **Detail** |
| **Purpose:** | The purpose of this attribute is to identify the vegetation description(s) relating to each spatial unit, so that they can be linked to the spatial coverage. |
| **Requirement:** | Mandatory |
| **Database Field Name:** | MAPUNT_IDENTIFIER |

| | |
|---|---|
| **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). |
| **Value:** | Number (10); in the format SDDNNNNN, where S=State code, DD=dataset number within the state. S and DD are assigned by the administrator. NNNNN = the mapunit number supplied by the States and Territories (Option B) or by the Australian Government (Options A & C) – see Chapter 3. |
| **Example:** | 76017501 |
| **Comments:** | The MAP_UNIT table is essentially the table used to resolve the many-to-many relationship between the SPATIAL_ATTRIBUTE_FORMAT and VEG_DESCRIPTION tables (See Chapter 3). The map unit can be thought of as describing polygons with a mixture of vegetation types on a vegetation map. |
| **Status:** | Implemented in the NVIS Oracle database and in the NVIS Spatial Data. |

### 4.5.2 Descriptive information (MAP_UNIT)

| Table ID | Table Title |
|---|---|
| MU02 | SPATIAL MIX |
| LUMU02 | Look-up Table for: SPATIAL MIX |
| MU03 | MOSAIC TYPE |
| LUMU03 | Look-up Table for: MOSAIC TYPE |
| MU04 | NUMBER OF VEGETATION DESCRIPTIONS |
| MU05 | VEG DESCRIPTION POSITION |
| MU06 | VEG DESCRIPTION PROPORTION |
| MU07 | NVIS IDENTIFICATION |
| MU08 | SOURCE CODE |

| **Attribute 39: MU02 SPATIAL MIX** | |
|---|---|
| **Field** | **Detail** |
| **Purpose:** | To specify the spatial mix of a map unit. |
| **Requirement:** | Mandatory |
| **Database Field Name:** | SPATIAL_MIX |
| **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. Some cases of spatially mixed map units (mosaics) follow:<br>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).<br>2. Structurally and floristically different vegetation types within one map unit that are not uniquely tied together ecologically (e.g. 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.<br>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 (e.g.. dune and swale complexes). |
| **Value:** | Character (50)<br>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:** | dominant mosaic |
| **Comments:** | Note new values added to LUT and slight change to definition of “equal mosaic” since AVAM 6.0. The meaning of “mosaic” has been changed c.f. AVAM 6.0 to a meaning very similar to “mosaic unknown”, but hasn’t yet been implemented in the Oracle database. |
| **Status:** | Existing data implemented in the NVIS Oracle database to v6.0 standards, with new data to v7.0 standards. Consultation required on next steps.<br>Action required by NVIS collaborators to resolve mosaics, especially within wetland and coastal complexes. |

| **Look-up Table 10: LU-MU02 SPATIAL MIX** | |
|---|---|
| **Code** | **Explanation** |
| pure | The map unit has only one sub-association or discrete floristic group, and this can be adequately described.<br>This is the value to use when, by a particular mapping convention for a region, only one vegetation type is mapped per map unit, as is often the case when regions are mapped at finer scales. |
| 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 60% of the spatial area of the polygon. |
| 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. (There may be additional minor components of the mosaic). Note slightly revised definition c.f. AVAM v6.0. |
| other mosaic | The map unit definitely has 2, 3 or more main sub-associations, which can be described in detail, the spatial extent of each within the polygon is known. (The mosaic cannot be described as a dominant mosaic nor equal mosaic.) Note new option c.f. AVAM v6.0. |
| mosaic | The map unit has more than one sub-association, but no further details are available. |
| 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. |
| unknown | unknown |

| **Attribute 40: MU03 MOSAIC TYPE** | |
|---|---|
| **Field** | **Detail** |
| **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:** | Australian Government |
| **Database Field Name:** | MOSAIC_TYPE |
| **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) |
| **Example:** | M |

| | |
|---|---|
| **Comments:** | This is a data management field; it was used extensively in the database restructure and creation of NVIS 2.0. It may also be useful to have a similar field in Veg_Description table to indicate unresolved mosaics. |
| **Status:** | Implemented in the NVIS Oracle database. |

| **Look-up Table 11: LUMU03 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 41: MU04 NUMBER OF VEGETATION DESCRIPTIONS** | |
|---|---|
| **Field** | **Detail** |
| **Purpose:** | To count the number of discrete vegetation descriptions occurring within the map unit. |
| **Requirement:** | Essential |
| **Database Field Name:** | NUMBER_OF_VEG_DESCRIPTIONS |
| **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.<br>Map Unit has one discrete sub-association = 1<br>Map Unit has two discrete sub-association = 2, etc. |
| **Value:** | Number (10) |
| **Example:** | 3 |
| **Comments:** | This field checks the integrity of the relevant records in the SPATIAL_DATA as part of spatial data compilation protocols used by the NVIS Coordinator. |
| **Status:** | Implemented in the NVIS Oracle database. |

| **Attribute 42: MU05 VEG DESCRIPTION POSITION** | |
|---|---|
| **Field** | **Detail** |
| **Purpose:** | To document the relative areas or proportions of each vegetation description within the map unit. |
| **Requirement:** | Essential |
| **Database Field Name:** | VEG_DESC_POSITION |
| **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'.<br>The number assigned to the remaining sub-associations (if they exist in the unit) should be allocated (ranked) 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) |
| **Example:** | 3 |
| **Comments:** | This number relates directly to the suffix number in the SD02-07 VEGDSC[x]/NVISDSC[x] attributes in NVIS SPATIAL_DATA. |
| **Status:** | Implemented in the NVIS Oracle database. |

| Attribute 43: MU06 VEG DESCRIPTION PROPORTION | |
|---|---|
| **Field** | **Detail** |
| **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) |
| **Example:** | 40 |
| **Comments:** | The value of VEG_DESC_POSITION (as "x") is used to place this value in the relevant attribute SD08-13 VEGPROP[x] in NVIS SPATIAL _DATA |
| **Status:** | Implemented in the NVIS Oracle database. |

### 4.5.3 Map unit links to other tables (MAP_UNIT)

| Table ID | Table Title |
|---|---|
| MU07 | DATA_SET_ID |
| MU08 | VEGETATION IDENTIFICATION |
| MU09 | NVIS IDENTIFICATION |
| MU10 | SOURCE CODE |

| Attribute 44: MU07 DATA SET IDENTIFICATION | |
|---|---|
| **Field** | **Detail** |
| **Purpose:** | Foreign key in the Map_Unit table to link to each unique dataset in the Data_Set table. |
| **Requirement:** | Australian Government. Optional for States and Territories |
| **Database Field Name:** | DATA_SET_ID |
| **Description:** | Primary key for the Data_Set table. |
| **Value:** | Number (10) |
| **Example:** | 300 |
| **Comments:** | Despite the similarity in values, this is not the same as DS02 DATA SET NUMBER. |
| **Status:** | Implemented in the NVIS Oracle database. |

| Attribute 45 MU08 VEGETATION IDENTIFICATION | |
|---|---|
| **Field** | **Detail** |
| **Purpose:** | Foreign key in the Map_Unit table to link to each unique vegetation description in the Veg_Description table. |
| **Requirement:** | Optional for States and Territories |
| **Database Field Name:** | VEG_ID |
| **Description:** | As per VG01 |
| **Value:** | Number (10) |
| **Example:** | 3078 |
| **Comments:** | See VG01 for more information. |
| **Status:** | Implemented in the NVIS Oracle database. |

| Attribute 46: MU09 NVIS IDENTIFICATION | |
|---|---|
| **Field** | **Detail** |
| **Purpose:** | Foreign key in the Map_Unit table to link to each unique vegetation description in the Veg_Description table. |
| **Requirement:** | Australian Government |
| **Database Field Name:** | NVIS_ID |
| **Description:** | As per VG02 |
| **Value:** | Number (10) |
| **Example:** | 30778 |
| **Comments:** | See VG02 for more information. |
| **Status:** | Implemented in the NVIS Oracle database. |

| Attribute 46: MU10 SOURCE CODE | |
|---|---|
| **Field** | **Detail** |
| **Purpose:** | Working attribute to provide an alternative link to each unique vegetation description in the Veg_Description table. |
| **Requirement:** | Australian Government |
| **Database Field Name:** | SOURCE_CODE |
| **Description:** | As per VG03 |
| **Value:** | Character (50) |
| **Example:** | 1023 [F3]; 130 [411]; 2005300; 28c_MV; A1; AH0035; KI023A; Land unit 6b1; a8,10Sr k2Ci [803] |
| **Comments:** | See VG03 for more information. |
| **Status:** | Implemented in the NVIS Oracle database. |

## 4.6 Vegetation description table

### 4.6.1 Vegetation identifier information (VEG_DESCRIPTION)

| Table ID | Table Title |
|---|---|
| VG01 | VEGETATION IDENTIFICATION |
| VG02 | NVIS IDENTIFICATION |
| VG03 | SOURCE CODE |

| Attribute 47: VG01 VEGETATION IDENTIFICATION | |
|---|---|
| **Field** | **Detail** |
| **Purpose:** | To definitively identify each unique vegetation description at the state or territory level using an integer. |
| **Requirement:** | Optional |
| **Database Field Name:** | VEG_ID |
| **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. Equivalent to VG03 SOURCE_CODE. |
| **Value:** | Number (10) |

| | |
|---|---|
| **Example:** | 3078 |
| **Comments:** | Once assigned by the state or territory custodian, the number cannot be changed. This number is used, either explicitly or implicitly, by some states and territories. |
| **Status:** | Implemented in the NVIS Oracle database. In practice, the states and territories have mostly continued to use character fields (see VG03 SOURCE_CODE). |

| **Attribute 48: VG02 NVIS IDENTIFICATION** | |
|---|---|
| **Field** | **Detail** |
| **Purpose:** | To definitively identify each unique vegetation description at the national level using an integer. |
| **Requirement:** | Australian Government |
| **Database Field Name:** | NVIS_ID |
| **Description:** | This is a number assigned by the Australian Government 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:** | 30778 |
| **Comments:** | Once assigned, the number cannot be changed. This field is maintained strongly by the Australian Government. In practice, five digits have been used for all new data since circa 2006 (NVIS V3.0 data and products), with a separate sequence for each state, using the values of DS02 LUT in the first digit. Older NVIS records with four digits are thus easy to spot. |
| **Status:** | Implemented in the NVIS Oracle database. |

| **Attribute 49: VG03 SOURCE CODE** | |
|---|---|
| **Field** | **Detail** |
| **Purpose:** | To enable labelling of each mapping unit with the original mapping code used by the data supplier (usually a state or territory). |
| **Requirement:** | Mandatory |
| **Database Field Name:** | SOURCE_CODE |
| **Description:** | The original vegetation type code used by the data custodian for uniquely labelling and displaying the vegetation type. If there is a hierarchy in the coding, the lowest level (i.e. the most detailed or descriptive level) should be provided. |
| **Value:** | Character (50) |
| **Example:** | 1023 [F3]; 130 [411] [73]; 2005300; 28c_MV; A1; AH0035; KI023A; Land unit 6b1; a8,10Sr k2Ci [803] |
| **Comments:** | This attribute allows the NVIS coding to be matched to the original coding for the sub-association. These codes may not be comparable between data sets or jurisdictions. This field is critical to communicating with collaborators and identifying additional (e.g. published) information on the vegetation description. |
| **Status:** | Implemented in the NVIS Oracle database. |

### 4.6.2 Summary information (VEG_DESCRIPTION)

| Table ID | Table Title |
|---|---|
| VG04 | ECO CLASSIFICATION FLAG – (Proposed – see Appendix P) |

[73] The DATA_SET_NUMBER has been added to the state's code to make the SOURCE_CODE unique.

| | |
|---|---|
| VG05 | LEVEL OF DETAIL |
| LU-VG05 | Look-up Table for: LEVEL OF DETAIL |
| VG06 | NUMBER OF STRATA |

| **Attribute 50: VG05 LEVEL OF DETAIL** | |
|---|---|
| **Field** | **Detail** |
| **Purpose:** | To describe the level of detail in the NVIS vegetation hierarchy at which the vegetation description has been supplied by the data custodian. |
| **Requirement:** | Mandatory |
| **Database Field Name:** | LEVEL_OF_DETAIL |
| **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)<br>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:** | level6_sub-association |
| **Comments:** | For future data supply, the highly recommended expected level of entry would be Association/Level 5 and/or Sub-Association/Level 6.<br>Other levels in the hierarchy have been restored in the LUT, to ensure that older NVIS data can be used.<br>With the addition of land cover data to the VEG_DESCRIPTION table, this field doubles as a control flag for the types of data the user (and computer) can expect down the hierarchy. |
| **Status:** | Implemented in the NVIS Oracle database. |

| **Look-up Table 12: LU-VG05 LEVEL OF DETAIL** | |
|---|---|
| **Code** | **Explanation** |
| **level1_class** | Data recorded and supplied with: Growth form of the dominant stratum. |
| **level2_structural_ formation** | Data recorded and supplied with: Structural formation of the dominant stratum, with growth form, height and cover compiled into standardised terminology according to Tables 3 and 4 in chapter 2. |
| **level3_broad_floristic_formation** | Data recorded and supplied with: Structural formation, as per Level 2, plus one or two characteristic genera for the dominant stratum. |
| **Level4_sub_ formation** | Data recorded and supplied with: As per Level 3, except that each of the upper, middle and ground strata are described by one or two genera and the height, cover and growth forms are compiled into standardised terminology as per Tables 3 and 4 in chapter 2. |
| **level5_association** | Data recorded and supplied with: For each stratum (maximum of three strata): floristic information (up to three 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 |
| **level6_sub_ association** | Data recorded and supplied with: For each layer/substratum (maximum of 8 substrata): floristic information (up to five 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 |

| | |
|---|---|
| **Not applicable** | For use in circumstances where no vegetation data has been provided in the NVIS Information Hierarchy |

| **Attribute 51 VG06 NUMBER OF STRATA** | |
|---|---|
| **Field** | **Detail** |
| **Purpose:** | To identify the number of sub/strata described within a vegetation description. |
| **Requirement:** | QAQC |
| **Database Field Name:** | NUMBER_OF_STRATA |
| **Description:** | This attribute provides a quick summary of the number of discrete substrata occurring within the one vegetation description at Level 6, or the highest equivalent. A maximum number of nine substrata per sub-association can be reported, at Level 6. The value is provided by the data supplier. |
| **Value:** | Number (10); Valid range 0-9; There is no particular importance placed on the order of the substrata, although previous versions of NVIS specified listing the substrata in order of decreasing dominance. Whatever order is chosen should be documented in the Data Set table. Zero has been used for non-vegetation data. |
| **Example:** | 3 |
| **Comments:** | This field is used to check the integrity of the relevant records in the Stratum table through relevant rules (see Section 4). |
| **Status:** | Implemented in the NVIS Oracle database. |

### 4.6.3 NVIS information hierarchy (VEG_DESCRIPTION)

| Table ID | Table Title |
|---|---|
| **VG08** | LEVEL 1 (CLASS)- case 1: native vegetaton |
| **VG09** | LEVEL 1 (CLASS) – case 2: non-vegetation and non-native vegetation |
| **VG10** | LEVEL 2 (STRUCTURAL FORMATION) - case 1: native vegetaton |
| **VG11** | LEVEL 2 (STRUCTURAL FORMATION) – case 2: non-vegetation and non-native vegetation |
| **VG12** | LEVEL 3 (BROAD FLORISTIC FORMATION) - case 1: native vegetaton |
| **VG13** | LEVEL 3 (BROAD FLORISTIC FORMATION) – case 2: non-vegetation and non-native vegetation |
| **LU-VG13** | Look-up Table for: LEVEL 3 (BROAD FLORISTIC FORMATION) – case 2: non-vegetation and non-native vegetation |
| **VG14** | LEVEL 4 (SUB-FORMATION) |
| **VG15** | LEVEL 5 (ASSOCIATION) |
| **VG16** | LEVEL 6 (SUB-ASSOCIATION) |

| **Attribute 52: VG08 LEVEL 1 (CLASS)- case 1: *native vegetation*** | |
|---|---|
| **Field** | **Detail** |
| **Purpose:** | Used to describe the record at Level 1 within the NVIS vegetation hierarchy. This simple specification for L1_CLASS is used where the record describes a native vegetation type. |
| **Requirement:** | Automated. As used in previous NVIS versions. |
| **Database Field Name:** | L1_CLASS |
| **Description:** | The description of class should include the growth form for the ecologically dominant stratum of the vegetation type/description (refer to Table 6). |
| **Value:** | Character (50) |

| | |
|---|---|
| | This is a value set from a defined lookup table (see Table 6). The values in the lookup table are set by the administrator and cannot be added to. |
| **Example:** | Tree |
| **Comments:** | This attribute is derived from Level 5 or 6 using a rule set. |
| **Status:** | Implemented in the NVIS Oracle database. Potential replacement of field name to (L1_ECOCOVER) and inclusion of new values described in VG09 to extend to native vegetation records, if and when cases 1 and 2 are merged. |

| **Attribute 53: VG09 LEVEL 1 (CLASS) – case 2: non-vegetation and non-native vegetation** | |
|---|---|
| **Field** | **Detail** |
| **Purpose:** | Used to describe the record at Level 1 within the NVIS ecological/land cover hierarchy. This more-complex specification for L1_CLASS is used to describe non-vegetation and non-native vegetation records. |
| **Requirement:** | Recommended. Partly Automated |
| **Database Field Name:** | L1_CLASS |
| **Description:** | The field is being redefined to incorporate the Level 1 (eco-cover) values of the NVIS ecological/land cover hierarchy (refer to Table 14 and 15) with internal delimiters between components 1A, 1B and 1C as semi-colons ";".<br><br>**Eco-cover =**<br>Eco-cover = terrain naturalness [1A] + vegetation cover (presence) type [1B] + growth form type [1C]:-<br><br>All permutations of these three variables are (except where vegetation is absent and growth form is null):<br>• L1 natural surface; vegetated; growth form;<br>• L1 artificial surface; vegetated; growth form;<br>• L1 natural surface; non-vegetated; growth form;<br>• L1 artificial surface; non-vegetated; growth form;<br><br>Undifferentiated classes enable the application of "ECOCOVER" for circumstances where any of the three components of the field cannot be determined:<br><br>• L1 undifferentiated: natural surface; vegetated; growth form<br>• L1 undifferentiated: artificial surface; vegetated; growth form<br>• L1 undifferentiated: artificial surface; vegetated; growth form<br>• L1 undifferentiated: natural surface; non-vegetated; growth form<br>• L1 undifferentiated: natural surface; non-vegetated; growth form<br>• L1 undifferentiated: artificial surface; non-vegetated; growth form;<br>• L1 undifferentiated: artificial surface; non-vegetated; growth form;<br><br>Where no information is available, the following will be used:<br><br>• L1 unclassifiable[74]; growth form |
| **Value:** | Character (1000)<br>This is a value set from the Level 1 value permutations above. These are set by the administrator and cannot be added to. |

[74] Note that "unclassifiable" means that it cannot be classified. "Unclassified" means that it has not yet been classified. Undifferentiated means that while some information is available, it is not sufficient to enable progress in classification.

| | |
|---|---|
| **Example:** | "natural surface, vegetated" or "natural surface, non-vegetated" |
| **Comments:** | Dominant growth form is automatically generated on loading Level 6 vegetation data using a rule set, as per case 1 for native vegetation. |
| **Status:** | Implementated in the NVIS Oracle database to include all non-vegetation and non-native vegetation records. Propose changing field name to L1_ECOCOVER in the NVIS database, if and when cases 1 and 2 are merged. |

| **Attribute 54: VG10 LEVEL 2 (STRUCTURAL FORMATION) – case 1: native vegetation** | |
|---|---|
| **Field** | **Detail** |
| **Purpose:** | Used to describe the record at Level 2 within the NVIS vegetation hierarchy (Tables 3 and 9). This simple specification for L2_STRUCTURAL_FORMATION is used where the record describes a native vegetation type. |
| **Requirement:** | Automated. As used in previous NVIS versions. |
| **Database Field Name:** | L2_STRUCTURAL_FORMATION |
| **Description:** | The description of structural formation should include dominant growth form, height and cover (using the terminology of Tables 4, 5, 7 and 8) for the ecologically dominant stratum of the vegetation type/description. |
| **Value:** | Character (2000) |
| **Example:** | Tall open forest |
| **Comments:** | This attribute is derived from Level 5 or 6 using a rule set. |
| **Status:** | Implemented in the NVIS Oracle database. Potential replacement of field name to (L2_ECOSURFACE) and inclusion of new values described in VG11. |

| **Attribute 55: VG11 LEVEL 2 (STRUCTURAL FORMATION) – case 2: non-vegetation and non-native vegetation** | |
|---|---|
| **Field** | **Detail** |
| **Purpose:** | Used to describe the record at Level 2 within the NVIS ecological/land cover hierarchy. This complex specification for L2_STRUCTURAL_FORMATION is used to describe non-vegetation and non-native vegetation records. |
| **Requirement:** | Recomended. Partly Automated |
| **Database Field Name:** | L2_STRUCTURAL_FORMATION |
| **Description:** | The field is being redefined to incorporate the Level 2 values of the NVIS ecological/land cover hierarchy (refer to Tables 14 and 15) with internal delimiters between components 2A, 2B and 2C as semi-colons ";".<br><br>**Eco-surface** =<br>Eco-surface = surface type [2A] + vegetation cover type [2B] + structural formation type [2C]:-<br><br>All permutations of these three variables are (except where vegetation is absent and growth form is null):<br><br>• L2 aquatic (freshwater) environments; principally with native vegetation cover; structural formation;<br>• L2 aquatic (saline) environments; principally with native vegetation cover; structural formation;<br>• L2 aquatic (marine/estuarine) environments; principally with native vegetation cover; structural formation;<br>• L2 terrestrial environments; principally with native vegetation cover; structural formation; |

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| | • L2 terrestrial environment; principally introduced vegetation +/- scattered native vegetation cover; structural formation;<br>• L2 aquatic (freshwater) environments; principally non-vegetated or if vegetated; then minimal or unquantified; structural formation;<br>• L2 aquatic (saline) environments; principally non-vegetated or if vegetated; then minimal or unquantified; structural formation;<br>• L2 aquatic (marine/estuarine) environments; principally non-vegetated or if vegetated; then minimal or unquantified; structural formation;<br>• L2 terrestrial (hard or consolidated surface) environments; principally non-vegetated or if vegetated then minimal or unquantified; structural formation;<br>• L2 terrestrial (loose or unconsolidated surface) environments; principally non-vegetated or if vegetated then minimal or unquantified; structural formation;<br>• L2 aquatic (freshwater) environment; principally non-vegetated or if vegetated then minimal or unquantified; structural formation;<br>• L2 aquatic (saline) environment; principally non-vegetated or if vegetated then minimal or unquantified; structural formation;<br>• L2 aquatic (marine/estuarine; artificial) environment; principally non-vegetated or if vegetated then minimal or unquantified; structural formation;<br>• L2 terrestrial environment; principally non-vegetated or if vegetated then minimal or unquantified; structural formation;<br>• L2 terrestrial environment; principally non-vegetated or if vegetated then minimal or unquantified; structural formation;<br>• L2 aquatic environment; structural formation;<br>• L2 terrestrial environment; structural formation;<br><br>Undifferentiated classes enable the application of "ECOSURFACE" for circumstances where any of the three components of the field cannot be determined:<br><br>• L2 undifferentiated: aquatic (freshwater or saline) environments; principally with native vegetation cover; structural formation;<br>• L2 terrestrial (unclassified) environments; principally with unclassified native vegetation cover; structural formation;<br>• L2 terrestrial (unclassified) environments; principally with unclassified vegetation cover; structural formation;<br>• L2 undifferentiated: aquatic (freshwater) environment; principally introduced vegetation +/- scattered native vegetation cover; structural formation;<br>• L2 undifferentiated: terrestrial environment; principally introduced vegetation +/- scattered native vegetation cover; structural formation;<br>• L2 undifferentiated: aquatic (freshwater or saline) environments; principally non-vegetated or if vegetated; then minimal or unquantified; structural formation;<br>• L2 undifferentiated: terrestrial (loose or unconsolidated; hard or consolidated) environments; principally non-vegetated or if vegetated; then minimal or unquantified; structural formation;<br>• L2 undifferentiated: aquatic (freshwater); environment; principally non-vegetated or if vegetated then minimal or unquantified; structural formation;<br>• L2 undifferentiated: terrestrial environment; principally non-vegetated or if vegetated then minimal or unquantified; structural formation;<br>• L2 terrestrial (unclassified) environments; principally with unclassified native vegetation cover; structural formation;<br>• L2 terrestrial (unclassified) environments; principally with unclassified vegetation cover; structural formation; |

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| | Where no information is available, the following will be used:<br><br>• L2 unclassifiable[75]; structural formation; |
| **Value:** | Character (1000)<br>This is a value set from the Level 2 value permutations above. These are set by the administrator and cannot be added to. |
| **Example:** | "L2 terrestrial environment; principally introduced vegetation +/- scattered native vegetation cover; structural formation:- "<br>or<br>L2 aquatic (freshwater) environments; principally non-vegetated or if vegetated; then minimal or unquantified; structural formation:-" |
| **Comments:** | Structural Formation type is automatically generated on loading Level 6 vegetation data using a rule set. |
| **Status:** | Implemented in the NVIS Oracle database to include all non-vegetation and non-native vegetation records. Propose changing field name in the NVIS database to L2_ECOSURFACE, if and when cases 1 and 2 are merged. |

| **Attribute 56: VG12 LEVEL 3 (BROAD FLORISTIC FORMATION)- case1: native vegetation** | |
|---|---|
| **Field** | **Detail** |
| **Purpose:** | Used to describe the record at Level 3 (i.e. the broad floristic formation defining the vegetation type) within the NVIS vegetation hierarchy. This simple specification for L3_BROAD_FLORISTIC_FORMATION is used where the record describes a native vegetation type. |
| **Requirement:** | Automated. As used in previous NVIS versions. |
| **Database Field Name:** | L3_BROAD_FLORISTIC_FORMATION |
| **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 vegetation hierarchy. |
| **Value:** | Character (2000) |
| **Example:** | Eucalyptus tall open forest |
| **Comments:** | This attribute is derived from Level 5 or 6 using a rule set. |
| **Status:** | Implemented in the NVIS Oracle database. Potential replacement of field name to (L3_ECOELEMENT) and inclusion of new values described in VG13 |

| **Attribute 57: VG13 LEVEL 3 (BROAD FLORISTIC FORMATION) – case 2: non-vegetation and non-native vegetation** | |
|---|---|
| **Field** | **Detail** |
| **Purpose:** | Used to describe the record at Level 3 within the NVIS ecological/land cover hierarchy. This complex specification for L3_BROAD FLORISTIC_FORMATION is used to describe non-vegetation and non-native vegetation records. |
| **Requirement:** | Recommended. Partly Automated |
| **Database Field Name:** | L3_BROAD_FLORISTIC_FORMATION |

[75] Note that "unclassifiable" means that it cannot be classified. "Unclassified" means that it has not yet been classified. Undifferentiated means that while some information is available, it is not sufficient to enable progress in classification.

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| **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 vegetation hierarchy (see Tables 3 and 9). The vegetation component is generated automatically when loading Level 6 vegetation data.<br><br>The field is being redefined to incorporate the Level 3 values of the NVIS ecological/land cover hierarchy with an internal delimiter of a semi-colon ";".<br><br>**Eco-element =**<br>Eco-element = eco-element type [3A] + summary [L1&2) data [3B] + broad floristic formation [3C]:-<br><br>All permutations of these three variables are (except where vegetation is absent and growth form is null). Further detail is given on eco-element types in LU-VG13 Look-up Table for: LEVEL 3 (BROAD FLORISTIC FORMATION):<br>• Lake; L1 natural surface; vegetated; L2 aquatic (freshwater) environments; principally with native vegetation cover; L3 broad floristic formation;<br>• Wetland; L1 natural surface; vegetated; L2 aquatic (freshwater) environments; principally with native vegetation cover; L3 broad floristic formation;<br>• Watercourse; L1 natural surface; vegetated; L2 aquatic (freshwater) environments; principally with native vegetation cover; L3 broad floristic formation;<br>• Salt lake; L1 natural surface; vegetated; L2 aquatic (saline) environments; principally with native vegetation cover; L3 broad floristic formation;<br>• Estuarine and maritime; L1 natural surface; vegetated; L2 aquatic (marine/estuarine) environments; principally with native vegetation cover; L3 broad floristic formation;<br>• Native vegetation type; L1 natural surface; vegetated; L2 terrestrial environments; principally with native vegetation cover; L3 broad floristic formation;<br>• Modified disturbed or regenerating native vegetation; L1 natural surface; vegetated; L2 terrestrial environments; principally with native vegetation cover; L3 broad floristic formation;<br>• Horticulture orchard or vineyard; L1 artificial surface; vegetated; L2 terrestrial environment; principally introduced vegetation +/- scattered native vegetation cover; L3 broad floristic formation;<br>• Crop or pasture; L1 artificial surface; vegetated; L2 terrestrial environment; principally introduced vegetation +/- scattered native vegetation cover; L3 broad floristic formation;<br>• Plantation forest; L1 artificial surface; vegetated; L2 terrestrial environment; principally introduced vegetation +/- scattered native vegetation cover; L3 broad floristic formation;<br>• Parkland, garden or playing field; L1 artificial surface; vegetated; L2 terrestrial environment; principally introduced vegetation +/- scattered native vegetation cover; L3 broad floristic formation;<br>• Lake (open-water or substrate); L1 natural surface; non-vegetated; L2 aquatic (freshwater) environments; principally non-vegetated or if vegetated; then minimal or unquantified; L3 broad floristic formation;<br>• Watercourse (open-water or substrate); L1 natural surface; non-vegetated; L2 aquatic (freshwater) environments; principally non-vegetated or if vegetated; then minimal or unquantified; L3 broad floristic formation; |

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| | • Salt lake (open-water or substrate); L1 natural surface; non-vegetated; L2 aquatic (saline) environments; principally non-vegetated or if vegetated; then minimal or unquantified; L3 broad floristic formation;<br>• Estuarine and maritime (open-water or substrate); L1 natural surface; non-vegetated; L2 aquatic (marine/estuarine) environments; principally non-vegetated or if vegetated; then minimal or unquantified; L3 broad floristic formation;<br>• Bare rock; L1 natural surface; non-vegetated; L2 terrestrial (hard or consolidated surface) environments; principally non-vegetated or if vegetated then minimal or unquantified; L3 broad floristic formation;<br>• Hardpan; L1 natural surface; non-vegetated; L2 terrestrial (hard or consolidated surface) environments; principally non-vegetated or if vegetated then minimal or unquantified; L3 broad floristic formation;<br>• Sand or sand dune; L1 natural surface; non-vegetated; L2 terrestrial (loose or unconsolidated surface) environments; principally non-vegetated or if vegetated then minimal or unquantified; L3 broad floristic formation;<br>• Claypan; L1 natural surface; non-vegetated; L2 terrestrial (loose or unconsolidated surface) environments; principally non-vegetated or if vegetated then minimal or unquantified; L3 broad floristic formation;<br>• Reservoir or dam (open-water or substrate); L1 artificial surface; non-vegetated; L2 aquatic (freshwater) environment; principally non-vegetated or if vegetated then minimal or unquantified; L3 broad floristic formation;<br>• Canal (open-water or substrate); L1 artificial surface; non-vegetated; L2 aquatic (freshwater) environment; principally non-vegetated or if vegetated then minimal or unquantified; L3 broad floristic formation;<br>• Evaporation basin (open-water or substrate); L1 artificial surface; non-vegetated; L2 aquatic (saline) environment; principally non-vegetated or if vegetated then minimal or unquantified; L3 broad floristic formation;<br>• Canal or canal estate (open-water or substrate); L1 artificial surface; non-vegetated; L2 aquatic (marine/estuarine; artificial) environment; principally non-vegetated or if vegetated then minimal or unquantified; L3 broad floristic formation;<br>• Built environment; L1 artificial surface; non-vegetated; L2 terrestrial environment; principally non-vegetated or if vegetated then minimal or unquantified; L3 broad floristic formation;<br>• Resource extraction; L1 artificial surface; non-vegetated; L2 terrestrial environment; principally non-vegetated or if vegetated then minimal or unquantified; L3 broad floristic formation;<br>• Infrastructure; L1 artificial surface; non-vegetated; L2 terrestrial environment; principally non-vegetated or if vegetated then minimal or unquantified; L3 broad floristic formation;<br><br>Undifferentiated[76] classes enable the application of "ECOCOVER" for circumstances where any of the three components of the field cannot be determined:<br><br>• Undifferentiated: lake salt lake wetland watercourse or other freshwater or saline waterbody; L1 undifferentiated: natural surface; vegetated; growth form; L2 undifferentiated: aquatic (freshwater or saline) environments; principally with native vegetation cover; broad floristic formation; L3 broad floristic formation; |

[76] Note that "unclassifiable" means that it cannot be classified. "Unclassified" means that it has not yet been classified. Undifferentiated means that while some information is available, it is not sufficient to enable progress in classification.

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| | • Unclassified native vegetation; L1 natural surface; vegetated; L2 terrestrial (unclassified) environments; principally with unclassified native vegetation cover; L3 broad floristic formation;<br>• Unclassified forest; L1 natural surface; vegetated; L2 terrestrial (unclassified) environments; principally with unclassified vegetation cover; L3 broad floristic formation;<br>• Undifferentiated: wetland, drainage line, floodway or other artificial waterbody; L1 undifferentiated: artificial surface; vegetated; L2 undifferentiated: aquatic (freshwater) environment; L3 broad floristic formation;<br>• Undifferentiated: horticulture, orchard or vineyard, crop or pasture, plantation forest, parkland, garden or playing field, or other cleared surface; L2 undifferentiated: terrestrial environment; principally introduced vegetation +/- scattered native vegetation cover; L3 [broad floristic formation];<br>• Undifferentiated: lake, salt lake, watercourse or other unclassified natural aquatic surface; L1 undifferentiated: natural surface; non-vegetated; L2 undifferentiated: aquatic (freshwater or saline) environments; principally non-vegetated or if vegetated; then minimal or unquantified; L3 broad floristic formation;<br>• Undifferentiated: loose or hard surfaces or other natural exposed surface; L1 undifferentiated: natural surface; non-vegetated; L2 undifferentiated: terrestrial (loose or unconsolidated; hard or consolidated) environments; principally non-vegetated or if vegetated; then minimal or unquantified; L3 [broad floristic formation];<br>• Undifferentiated: reservoir, dam, canal or other artificial open-water surface; L1 undifferentiated: artificial surface; non-vegetated; L2 undifferentiated: aquatic (freshwater); environment; principally non-vegetated or if vegetated then minimal or unquantified; L3 broad floristic formation;<br>• Undifferentiated: built environment, infrastructure or resource extraction or other unclassified artificial non-vegetated surface; L1 undifferentiated: artificial surface; non-vegetated; L2 undifferentiated: terrestrial environment; principally non-vegetated or if vegetated then minimal or unquantified; L3 [broad floristic formation];<br><br>Where no information is available, the following will be used:<br><br>• Unclassifiable Level 3; L1 unclassifiable; L2 unclassifiable Level 2; L3 broad floristic formation;<br>• Undifferentiated aquatic surface; L1 unclassifiable; L2 aquatic environment; L3 broad floristic formation;<br>• Undifferentiated terrestrial surface; L1 unclassifiable; L2 terrestrial environment; L3 broad floristic formation; |
| **Value:** | Character (1000)<br>This is a value set from the Level 3 values above. These are set by the administrator and cannot be added to. |
| **Example:** | Native vegetation type; L1 natural surface; vegetated; L2 terrestrial environments; principally with native vegetation cover; L3 Eucalyptus tall open forest. |
| **Comments:** | The native vegetation component of Broad Floristic Formation is automatically generated on loading Level 6 vegetation data using a rule set. |
| **Status:** | Implemented in the NVIS Oracle database to include all non-vegetation and non-native vegetation records. Potential change of field name to L3_ECOELEMENT in the NVIS database, if and when cases 1 and 2 are merged.c |

| Look-up Table 13: LU-VG13 Look-up Table for: LEVEL 3 (BROAD FLORISTIC FORMATION) – case 2: non-vegetation and non-native vegetation | |
|---|---|
| **Code** | **Explanation** |
| Bare rock | This comprises bare rock surfaces. Vegetation cover either absent, minimal or unquantified. |
| Built environment | This comprises urban, landfill and waste facilities. |
| Canal | This comprises artificial freshwater canals. Vegetation cover either absent, minimal or unquantified. |
| Canal or canal estate | This comprises artificial estuarine canals and canal estates. Vegetation cover either absent, minimal or unquantified. |
| Crop or pasture | This comprises the broad classification of improved pasture, or cropping and improved pasture (for extensive animal husbandry). This class may include scattered/ isolated native tree, shrub or groundcover species. |
| Built-up or resource extraction industries | Urban, industrial, utilities, landfill, other man-made features and transport. |
| Estuarine and maritime | Mudflats, mangroves and saltmarshes. |
| Evaporation basin | This comprises artificial saline evaporation basins. Vegetation cover either absent, minimal or unquantified. |
| Horticulture orchard or vineyard | This comprises the broad classification of horticulture, orchard, vineyard or plant nursery. This class may include scattered/ isolated native tree, shrub or groundcover species. |
| Infrastructure | This comprises infrastructure. |
| Lake | Permanent fresh water or is regularly flooded with fresh water. |
| Modified disturbed or regenerating native vegetation | Native vegetation or disturbed/regenerating native vegetation cover which is modified to the extent that the native vegetation is largely recognisable, but lacks sufficient floristic and structural information to enable allocation to another MVG. |
| Parkland, garden or playing field | This enables the broad classification of parkland, garden or playing field. This class may include scattered/ isolated native tree, shrub or groundcover species. |
| Plantation forest | This enables the broad classification of plantation forest (i.e. planted forests). This class may include scattered/ isolated native tree, shrub or groundcover species. |
| Reservoir or dam | This comprises reservoirs and dams. Vegetation cover either absent, minimal or unquantified. |
| Resource extraction | This comprises resource extraction. |
| Salt lake | A salt lake or saline lake is a landlocked body of water that has a higher concentration of salts than most lakes. |
| Watercourse | A stream or artificially constructed water channel. |
| Wetland | Intermittent fresh water or is regularly flooded with fresh water. They comprise swamps, marshes, billabongs, lakes, lagoons, bogs, fens and peatlands. |
| Unclassified forest; L1 natural surface; vegetated; L2 terrestrial (unclassified) environments; principally with unclassified vegetation | This enables the broad classification of forest vegetation features in circumstances where there is insufficient data to enable classification to be refined. |

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| cover; L3 broad floristic formation; | |
| Unclassified native vegetation; L1 natural surface; vegetated; L2 terrestrial (unclassified) environments; principally with unclassified native vegetation cover; L3 broad floristic formation; | This enables the broad classification of forest vegetation features in circumstances where there is insufficient data to enable classification to be refined. In NVIS v.4.x, it is largely from artefacts generated from the intersection of a forest cover layer with existing Vegetation Survey of NT data. |
| Undifferentiated: lake salt lake wetland watercourse or other freshwater or saline waterbody; L1 undifferentiated: natural surface; vegetated; growth form; L2 undifferentiated: aquatic (freshwater or saline) environments; principally with native vegetation cover; broad floristic formation; L3 broad floristic formation; | This undifferentiated group comprises natural or semi-natural freshwater features and their margins, including the flux between water surfaces, exposed substrate and vegetated components. It allows for classification of data in circumstances where insufficient data is available to enable finer classification. For example, "lake" may not be able to be resolved to saline or freshwater environments due to lack of information. It also enables the classification of mosaic data where the mosaic has not been resolved to polygonal data. |
| Undifferentiated: wetland, drainage line, floodway or other artificial waterbody; L1 undifferentiated: artificial surface; vegetated; L2 undifferentiated: aquatic (freshwater) environment; L3 broad floristic formation; | This undifferentiated group comprises artificial freshwater features and margins, including flux between water surfaces, exposed substrate and vegetated components. For example, "water" may not be able to be resolved to a specific type due to lack of information. It also enables the classification of mosaic data where the mosaic has not been resolved to polygonal data. |
| Undifferentiated: horticulture, orchard or vineyard, crop or pasture, plantation forest, parkland, garden or playing field, or other cleared surface; L2 undifferentiated: terrestrial environment; principally introduced vegetation +/- scattered native vegetation cover; L3 [broad floristic formation]; | This undifferentiated group comprises the broad classification of undifferentiated: horticulture, orchard or vineyard; crop or pasture; plantation forest; parkland, garden or playing field; other cleared surface (vegetation introduced +/- scattered native vegetation). It comprises largely cleared surfaces where the vegetation type is largely unrecognisable. For example, "fruit trees" may not be able to be resolved to a specific type due to lack of information. This class may include scattered/ isolated native tree, shrub or groundcover species. |
| Undifferentiated: lake, salt lake, watercourse or other unclassified | This undifferentiated group comprises natural or semi-natural freshwater features, including the flux between water surfaces and exposed substrate. For example, |

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| natural aquatic surface; L1 undifferentiated: natural surface; non-vegetated; L2 undifferentiated: aquatic (freshwater or saline) environments; principally non-vegetated or if vegetated; then minimal or unquantified; L3 broad floristic formation; | "water" may not be able to be resolved to a specific type due to lack of information. Vegetation cover either absent, minimal or unquantified. |
| Undifferentiated: loose or hard surfaces or other natural exposed surface; L1 undifferentiated: natural surface; non-vegetated; L2 undifferentiated: terrestrial (loose or unconsolidated; hard or consolidated) environments; principally non-vegetated or if vegetated; then minimal or unquantified; L3 [broad floristic formation]; | This undifferentiated group comprises naturally exposed loose or hard surfaces. For example, "gravel" may not be able to be resolved to a specific type due to lack of information. Vegetation cover either absent, minimal or unquantified. |
| Undifferentiated: reservoir, dam, canal or other artificial open-water surface; L1 undifferentiated: artificial surface; non-vegetated; L2 undifferentiated: aquatic (freshwater); environment; principally non-vegetated or if vegetated then minimal or unquantified; L3 broad floristic formation; | This undifferentiated group comprises reservoirs, dams, canals, evaporation basins and other artificial open-water surfaces. For example, "artificial water" may not be able to be resolved to a specific type due to lack of information. Vegetation cover either absent, minimal or unquantified. |
| Undifferentiated: built environment, infrastructure or resource extraction or other unclassified artificial non-vegetated surface; L1 undifferentiated: artificial surface; non-vegetated; L2 undifferentiated: | This undifferentiated group comprises urban and industrial areas, utilities, landfill and other man-made features. For example, "urban and infrastructure with resource extraction" may not be able to be resolved to a specific type due to mosaic data. |

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| terrestrial environment; principally non-vegetated or if vegetated then minimal or unquantified; L3 [broad floristic formation]; | |
| Undifferentiated aquatic surface; L1 unclassifiable; L2 aquatic environment; L3 broad floristic formation; | This undifferentiated group comprises "Undifferentiated aquatic surface". |
| Undifferentiated terrestrial surface; L1 unclassifiable; L2 terrestrial environment; L3 broad floristic formation; | This undifferentiated group comprises "Undifferentiated terrestrial surface", for which no data or information is available other than it is an aquatic surface. |
| Unclassifiable Level 3; L1 unclassifiable; L2 unclassifiable Level 2; L3 broad floristic formation; | This comprises unknown values which will be replaced with "unclassifiable", for which no data or information is available. |

| **Attribute 58: VG14 LEVEL 4 (SUB-FORMATION)** | |
|---|---|
| **Field** | **Detail** |
| **Purpose:** | To describe Level 4 (i.e. the sub-formation defining the vegetation type) within the NVIS vegetation hierarchy (Tables 3 & 9). |
| **Requirement:** | Automated |
| **Database Field Name:** | L4_SUB_FORMATION |
| **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 3, 4, 5 and 7. |
| **Value:** | Character (2000) |
| **Example:** | Eucalyptus tall open forest\Banksia open shrubland\Themeda open tussock grassland |
| **Comments:** | This attribute should be derived from Level 5 or 6 using a rule set. |
| **Status:** | Implemented in the NVIS Oracle database. |

| **Attribute 59: VG15 LEVEL 5 (ASSOCIATION)** | |
|---|---|
| **Field** | **Detail** |
| **Purpose:** | This attribute describes Level 5 (i.e. an association level description of the vegetation type) within the NVIS vegetation hierarchy (refer to Tables 3 and 9). |
| **Requirement:** | Essential |
| **Database Field Name:** | L5_ASSOCIATION |
| **Description:** | For each stratum, the association description of the vegetation type should include floristic information for the dominant and/or diagnostic species (maximum of three 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 Chapter 2. For |

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| | documentation of the dominance and the hats ^, please see Table 8 (Using the up-arrow or “hat” notation). |
| **Value:** | Character (2000) |
| **Example:** | Refer to the Example for Association in Table 10 (Example usage of the NVIS vegetation hierarchy.). |
| **Comments:** | This data is derived from Level 6 using expert knowledge. Level 5 is used to populate the NVIS Flat File (Section 3.2.10). |
| **Status:** | Implemented in the NVIS Oracle database. |

| **Attribute 60: VG16 LEVEL 6 (SUB-ASSOCIATION)** | |
|---|---|
| **Field** | **Detail** |
| **Purpose:** | This attribute describes the sub-association level description of the vegetation description as defined within the NVIS vegetation hierarchy (refer to Tables 3 and 9). |
| **Requirement:** | Essential |
| **Database Field Name:** | L6_SUB_ASSOCIATION |
| **Description:** | For each layer/substratum, the sub-association description of the vegetation type should include floristic information for the dominant and/or diagnostic species (maximum of five species per substratum) plus the structural formation (dominant growth form, cover, height are implied). A maximum of nine substrata (as per Table 4) are allowed and the dominant substratum is indicated by a plus symbol "+". Refer to Chapter 2. For documentation of dominance and the hats ^, please see Table 8. |
| **Value:** | Character (2000) |
| **Example:** | Refer to the example for Sub-Association in Table 10 (Example usage of the NVIS vegetation hierarchy). |
| **Comments:** | This attribute should be entered directly at this level if the source vegetation data will support a sub-association-level description. |
| **Status:** | Implemented in the NVIS Oracle database. |

### 4.6.4 Source information (VEG_DESCRIPTION)

| Table ID | Table Title |
|---|---|
| **VG17** | SOURCE DESCRIPTION |
| **VG18** | ENVIRONMENTAL DESCRIPTION |

| **Attribute 61: VG17 SOURCE DESCRIPTION** | |
|---|---|
| **Field** | **Detail** |
| **Purpose:** | To describe the mapping unit as used by the data supplier. |
| **Requirement:** | Essential |
| **Database Field Name:** | SOURCE_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. |
| **Value:** | Character (2000); free text. |
| **Example:** | Montane grassy woodland or Coastal vine-rich forest. |
| **Comments:** | This attribute provides important extra information on the vegetation type being described. It also allows the NVIS sub-association description to be matched to the original description for the sub-association. These descriptions will generally not be comparable between data sets or jurisdictions. |
| **Status:** | Implemented in the NVIS Oracle database. |

| Attribute 62: VG18 ENVIRONMENTAL DESCRIPTION | |
|---|---|
| **Field** | **Detail** |
| **Purpose:** | To describe the environmental characteristics that consistently occur within the vegetation type. |
| **Requirement:** | Recommended |
| **Database Field Name:** | ENVIRONMENTAL_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 link to published source material. |
| **Value:** | Character (2000); free text. |
| **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. |
| **Comments:** | |
| **Status:** | Implemented in the NVIS Oracle database. |

## 4.7 Stratum table

### 4.7.1 Stratum table (structural information) (STRATUM)

| Table ID | Table Title |
|---|---|
| **ST01** | STRATUM CODE |
| **LU-ST01** | Look-up Table for: STRATUM CODE |
| **ST02** | SUBSTRATUM RANK |
| **ST03** | NUMBER OF GROWTH FORMS |
| **ST04** | NUMBER OF TAXA |
| **ST05** | COVER TYPE |
| **LU-ST05** | Look-up Table for: COVER TYPE |
| **ST06** | COVER TYPE DERIVATION METHOD |
| **ST07** | COVER MINIMUM VALUE |
| **ST08** | COVER MAXIMUM VALUE |
| **ST09** | COVER MEDIAN VALUE |
| **ST10** | COVER MEAN VALUE |
| **ST11** | COVER CODE |
| **LU-ST11** | Look-up Table for: COVER CODE |
| **ST12** | HEIGHT TYPE |
| **LU-ST12** | Look-up Table for: HEIGHT TYPE |
| **ST13** | HEIGHT TYPE DERIVATION METHOD |
| **ST14** | HEIGHT MINIMUM VALUE |
| **ST15** | HEIGHT MAXIMUM VALUE |
| **ST16** | HEIGHT MEAN VALUE |

| | |
|---|---|
| **ST17** | HEIGHT MEDIAN VALUE |
| **ST18** | HEIGHT CLASS |
| **LU-ST18** | Look-up Table for: HEIGHT CLASS |
| **ST19** | DOMINANT STRATUM FLAG |

| **Attribute 63: ST01 STRATUM CODE** | |
|---|---|
| **Field** | **Detail** |
| **Purpose:** | To briefly describe the substratum. |
| **Requirement:** | Essential |
| **Database Field Name:** | STRATUM_CODE |
| **Description:** | The stratum code defines each substratum with a letter that corresponds with the stratum, and a number that describes the position within the stratum of a particular substratum, 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)<br>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:** | U1 |
| **Comments:** | Note that E, for emergent, is no longer a valid value. In the validation of the NVIS (2000) dataset in the Australian Government, most E substrata have been converted to U1 substratum, as appropriate. Several E substrata have been converted to M substrata. |
| **Status:** | Implemented in the NVIS Oracle database. |

| **Look-up Table 14: LU-ST01 STRATUM CODE** | |
|---|---|
| **Code** | **Explanation** |
| **U** | Upper - Tree layer; for data supplied at NVIS Level 5. |
| **U1** | Upper - Tallest substratum. For forests and woodlands this will often, but not always, be the dominant substratum. For a continuum, the tallest stratum becomes the defining stratum. |
| **U2** | Upper - Sub canopy layer, second tree layer |
| **U3** | Upper - Sub canopy layer, third tree layer |
| **M** | Mid - Mid (shrub) layer; for data supplied at NVIS Level 5. |
| **M1** | Mid - Tall shrub layer |
| **M2** | Mid - Mid shrub layer |
| **M3** | Mid - Low shrub layer. |
| **G** | Ground - Ground layer; for data supplied at NVIS Level 5. |
| **G1** | Lower - Tall ground layer. |
| **G2** | Lower - Mid ground layer. |
| **G3** | Lower - Low ground layer. |

| **Attribute 64: ST02 SUBSTRATUM RANK** | |
|---|---|
| **Field** | **Detail** |
| **Purpose:** | To assign a number to each substratum in a stratum in order of decreasing dominance. |
| **Requirement:** | Recommended |
| **Database Field Name:** | SUB_STRATUM_RANK |
| **Description:** | A number assigned to each substratum within a stratum in order of decreasing dominance. Rather than number substrata in order of decreasing dominance across the whole vegetation profile, comparing similar entities will be easier for the assignment of |

| | |
|---|---|
| | dominance to substrata within each stratum. Dominance would be based on an estimate of biomass (cover x height) for each substratum. |
| **Value:** | Number (10); Valid range for NVIS: 1-3. |
| **Example:** | 2 |
| **Comments:** | Applies to data supplied at NVIS Level 6 only. This attribute does not necessarily work on decreasing height of the substratum, as does STRATUM_CODE.<br>This attribute is subject to further review with respect to improving the transparency of generating Level 5 descriptions from Level 6. |
| **Status:** | Implemented in the NVIS Oracle database. |

| **Attribute 65: ST03 NUMBER OF GROWTH FORMS** | |
|---|---|
| **Field** | **Detail** |
| **Purpose:** | To document the number of growth forms recorded for the (sub-)stratum. |
| **Requirement:** | QAQC |
| **Database Field Name:** | NUMBER_OF_GROWTH_FORMS |
| **Description:** | This attribute provides a quick summary of the number of discrete growth forms occurring within one substratum within the vegetation description. It is provided by the data supplier. A maximum number of five growth forms per substratum can be reported. |
| **Value:** | Number (10) |
| **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. |

| **Attribute 66: ST04 NUMBER OF TAXA** | |
|---|---|
| **Field** | **Detail** |
| **Purpose:** | To document the number of taxa recorded for the (sub-)stratum. |
| **Requirement:** | QAQC |
| **Database Field Name:** | NUMBER_OF_TAXA |
| **Description:** | This attribute provides a quick summary of the number of discrete taxa occurring within the one substratum in the vegetation description. It is provided by the data supplier. A maximum number of five taxa per substratum can be reported. |
| **Value:** | Number (10) |
| **Example:** | 3 |
| **Comments:** | This field checks the integrity of the relevant records in the Taxon table through relevant rules (see Section 4). |
| **Status:** | Implemented in the NVIS Oracle database. |

| **Attribute 67: ST05 COVER TYPE** | |
|---|---|
| **Field** | **Detail** |
| **Purpose:** | To briefly specify the type of measure used in the COVER VALUE in the Stratum table. |
| **Requirement:** | Essential |
| **Database Field Name:** | COVER TYPE |
| **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)<br>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:** | 1N |
| **Comments:** | Much of the early NVIS has the values 10Q and 11Q, but these amounted to the same thing, so have been simplified to the value "Q".<br>Note that FREQUENCY and DOMINANCE are separate fields in the GROWTH_FORM and TAXON tables and, where possible, should not be confounded with stratum cover. |
| **Status:** | Implemented in the NVIS Oracle database with slight changes to the allowable values. Old values of 10Q and 11Q have been changed to Q. |

**Look-up Table 15: LU-ST05 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. |
| **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 e.g. Braun-Blanquet. Percentage values may include the minimum and maximum. (Formerly 9C) |
| **Q** | Qualitative: the cover has been estimated by a qualitative method. |
| **not applicable** | not applicable |
| **unknown** | unknown |

| **Attribute 68: ST06 COVER TYPE DERIVATION METHOD** | |
|---|---|
| **Field** | **Detail** |
| **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 |
| **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) |
| **Example:** | Braun-Blanquet |
| **Comments:** | |
| **Status:** | Implemented in the NVIS Oracle database. Recommend upgrade to contents of this field. |

| **Attribute 69: ST07 COVER MINIMUM VALUE** | |
|---|---|
| **Field** | **Detail** |
| **Purpose:** | To record the minimum value of cover for the (sub-)stratum. |
| **Requirement:** | Optional |
| **Database Field Name:** | COVER_MINIMUM_VALUE |
| **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 |

| | |
|---|---|
| **Example:** | 10 |
| **Comments:** | |
| **Status:** | Implemented in the NVIS Oracle database. |

| **Attribute 70: ST08 COVER MAXIMUM VALUE** | |
|---|---|
| **Field** | **Detail** |
| **Purpose:** | To record the maximum value of cover for the (sub-)stratum. |
| **Requirement:** | Optional |
| **Database Field Name:** | COVER_MAXIMUM_VALUE |
| **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:** | |
| **Status:** | Implemented in the NVIS Oracle database. |

| **Attribute 71: ST09 COVER MEDIAN VALUE** | |
|---|---|
| **Field** | **Detail** |
| **Purpose:** | To record the median value of cover for the (sub-)stratum. |
| **Requirement:** | Optional |
| **Database Field Name:** | 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 |
| **Example:** | 60 |
| **Comments:** | |
| **Status:** | Implemented in the NVIS Oracle database. |

| **Attribute 72: ST10 COVER MEAN VALUE** | |
|---|---|
| **Field** | **Detail** |
| **Purpose:** | To record the mean value of cover for the (sub-)stratum. |
| **Requirement:** | Essential |
| **Database Field Name:** | COVER_MEAN_VALUE |
| **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 |
| **Example:** | 60 |
| **Comments:** | |
| **Status:** | Implemented in the NVIS Oracle database. |

| **Attribute 73: ST11 COVER CODE** | |
|---|---|
| **Field** | **Detail** |
| **Purpose:** | To categorise the cover measurement for the stratum or substratum. |

| | |
|---|---|
| **Requirement:** | Essential |
| **Database Field Name:** | COVER_CODE |
| **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)<br>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:** | d |
| **Comments:** | The methods used to translate the associated TYPE and VALUE into the appropriate COVER CODE must be documented. |
| **Status:** | Implemented in the NVIS Oracle database. |

| **Look-up Table 16: LU-ST11 COVER CODE** | |
|---|---|
| **Code** | **Explanation** |
| **d** | Foliage cover 70-100% - Crown cover 80-100% |
| **d** | Ground cover 70-100% |
| **c** | Foliage cover 30-70% - Crown cover 50-80% |
| **c** | Ground cover 30-70% |
| **i** | Foliage cover 10-30% - Crown cover 20-50% |
| **i** | Ground cover 10-30% |
| **r** | Foliage cover less than 10% - Crown cover 0.25-20% |
| **r** | Ground cover less than 10% |
| **bi** | Foliage cover ~0% (scattered) - Crown cover 0-0.25% |
| **bi** | Ground cover ~0% (scattered) |
| **bc** | Foliage cover ~0% (clumped) - Crown cover 0-0.25% |
| **bc** | Ground cover ~0% (clumped) |
| **unknown** | unknown |

| **Attribute 74: ST12 HEIGHT TYPE** | |
|---|---|
| **Field** | **Detail** |
| **Purpose:** | To describe the method used to provide the HEIGHT VALUE. |
| **Requirement:** | QAQC; proposed improvements to the definition of LUT values. |
| **Database Field Name:** | HEIGHT_TYPE |
| **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)<br>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 |
| **Example:** | NV |
| **Comments:** | This attribute is an attempt to standardise the precision and the source of the height measurement.<br>Removal of “CP” as an option and the change in definition of “CT” was proposed.<br>Instead of using an existing code, against which data has been described, it would be |

| | |
|---|---|
| | better to create a new code, such as “CTH” to represent the new concept. Recommend that CT (dominant height) be dropped as an allowable value and CP should be recoded as the new CTH. |
| **Status:** | Implemented in the NVIS Oracle database to v6.0 standards only. LUT values are recommended to apply to new data. |

**Look-up Table 17: LU-ST12 HEIGHT TYPE**

| Code | Height Type | Stratum | Growth Form | Explanation |
|---|---|---|---|---|
| **NV** | Layer Height (general vegetation mapping) | Any | Forest, woodlands, shrublands, grasslands | Layer height of the top stratum (top of the canopy or the top of the bulk of the vegetative material making up the stratum) that may be present. Can apply to any stratum. The min and max values of this will not give any indication of canopy depth if applied to taller strata. |
| **NA** | Average Height (general vegetation mapping) | Any | Forest, woodlands, shrublands, grasslands | Average height of the stratum where the bulk of the vegetative material falls within any particular stratum. This may not strictly result from the measurement of a number individuals, or representative individuals, which fall within the range of the recognised stratum. The mean value becomes essentially a measure of the midpoint of the canopy depth. The min and max values define the depth of the canopy or layer. |
| **NT** | Top Height | U1, U2, M1 | Forests woodlands, shrublands | General height of the top of the tallest canopy layer (ie tallest tree) which may not necessarily be the dominant canopy layer. The min and max values will not give any indication of canopy depth. This height category may indicate U1 as "emergent" layer and U2 as the dominant layer. |
| **CV** | Layer Height | As above | As above | Same type as for NV above but for classed values rather than actual measured values. E.g. where height has been put into height categories (ie 5-10 metres, 10-15m etc) rather than being measured) |
| **CTH** | Top Height | As above | As above | As for NA above but for values put into height classes rather than actual measured values. As per CP in AVAM 6.0. |
| **CA** | Average Height | As above | As above | As for NA above but for values put into height classes rather than actual measured values. |
| **not applicable** | - | - | - | not applicable |
| **unknown** | unknown | - | - | unknown |

**Attribute 75: ST13 HEIGHT TYPE DERIVATION METHOD**

| Field | Detail |
|---|---|
| **Purpose:** | To provide further descriptive information on the HEIGHT TYPE recorded, including the derivation method. |

| | |
|---|---|
| **Requirement:** | Optional |
| **Database Field Name:** | HEIGHT_TYPE_DERIV_METHOD |
| **Description:** | A more detailed description of the HEIGHT_TYPE recorded, including the derivation method. |
| **Value:** | Character (2000) |
| **Example:** | Average height measured by a clinometer in the field. |
| **Comments:** | The unit of this field is metres, or fractions thereof. |
| **Status:** | Implemented in the NVIS Oracle database. |

| **Attribute 76: ST14 HEIGHT MINIMUM VALUE** | |
|---|---|
| **Field** | **Detail** |
| **Purpose:** | To record the minimum value of height for the (sub-)stratum. |
| **Requirement:** | Optional |
| **Database Field Name:** | HEIGHT_MINIMUM_VALUE |
| **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. |
| **Value:** | Number (5,1) |
| **Example:** | 10.0 |
| **Comments:** | The unit of this field is metres, or fractions thereof. |
| **Status:** | Implemented in the NVIS Oracle database. |

| **Attribute 77: ST15 HEIGHT MAXIMUM VALUE** | |
|---|---|
| **Field** | **Detail** |
| **Purpose:** | To record the maximum value of height for the (sub-)stratum. |
| **Requirement:** | Optional |
| **Database Field Name:** | HEIGHT_MAXIMUM_VALUE |
| **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. |
| **Value:** | Number (5,1) |
| **Example:** | 40.0 |
| **Comments:** | The unit of this field is metres, or fractions thereof. |
| **Status:** | Implemented in the NVIS Oracle database. |

| **Attribute 78: ST16 HEIGHT MEAN VALUE** | |
|---|---|
| **Field** | **Detail** |
| **Purpose:** | To record the mean height for the (sub-)stratum |
| **Requirement:** | Essential |
| **Database Field Name:** | HEIGHT_MEAN_VALUE |
| **Description:** | A height value for the HEIGHT TYPE, expressed as the mean value for the (sub-)stratum. |
| **Value:** | Number (5,1) |
| **Example:** | 25.6 |
| **Comments:** | The unit of this field is metres, or fractions thereof. |
| **Status:** | Implemented in the NVIS Oracle database. |

| Attribute 79: ST17 HEIGHT MEDIAN VALUE | |
|---|---|
| **Field** | **Detail** |
| **Purpose:** | To record the median height for the (sub-)stratum. |
| **Requirement:** | Optional |
| **Database Field Name:** | HEIGHT_MEDIAN_VALUE |
| **Description:** | A height value for the HEIGHT TYPE, expressed as the median value for the (sub-)stratum. |
| **Value:** | Number (5,1) |
| **Example:** | 30.0 |
| **Comments:** | The unit of this field is metres, or fractions thereof. |
| **Status:** | Implemented in the NVIS Oracle database. |

| Attribute 80: ST18 HEIGHT CLASS | |
|---|---|
| **Field** | **Detail** |
| **Purpose:** | To categorise the height for each substratum. |
| **Requirement:** | Essential |
| **Database Field Name:** | HEIGHT_CLASS |
| **Description:** | The height class is interpreted by the data custodian from the substratum height value(s) and growth form(s) for the substratum. 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 substratum. |
| **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. |
| **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. |
| **Status:** | Implemented in the NVIS Oracle database as a number field. Unknown height classes should be coded as -9999. |

| Look-up Table 18: LU-ST18 HEIGHT CLASS | |
|---|---|
| **Code** | **Explanation** |
| **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, lichen, bryophyte, seagrasses, epiphytes (in G), vines (in G) |
| **3** | Height range 1 - 2 m - cycads, grass-trees, tree-ferns, shrubs, heath shrubs, chenopod shrubs, ferns, samphire shrubs, 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) |
| **-9999** | unknown |

| **Attribute 81: ST19 DOMINANT STRATUM FLAG** | |
|---|---|
| **Field** | Detail |
| **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 |
| **Description:** | This is a Boolean field added to the dominant substratum 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)<br>Valid entries: "Y" (Yes) or "N" (No); "T" (True) or "F" (False). |
| **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 vegetation hierarchy. Used to automatically generate Levels 1-4 in the NVIS vegetation hierarchy. |
| **Status:** | Implemented in the NVIS Oracle database. |

## 4.8 Growth form table

### 4.8.1 Growth form table (structural information) (GROWTH_FORM)

| Table ID | Table Title |
|---|---|
| **GF01** | GROWTH FORM RANK |
| **GF02** | GROWTH FORM CODE |
| GF02A | GROWTH FORM – (Proposed – see Appendix P) |
| **LU-GF02** | Look-up Table for: GROWTH FORM CODE |
| **GF03** | COVER TYPE |
| **GF04** | COVER TYPE DERIVATION METHOD |
| **GF05** | COVER MINIMUM VALUE |
| **GF06** | COVER MAXIMUM VALUE |
| **GF07** | COVER MEDIAN VALUE |
| **GF08** | COVER MEAN VALUE |
| **GF09** | GROWTH FORM DOMINANCE QUALIFIER |
| **LU-GF09** | Look-up Table for: GROWTH FORM DOMINANCE QUALIFIER |
| **GF10** | GROWTH FORM FREQUENCY |
| **LU-GF10** | Look-up Table for: GROWTH FORM FREQUENCY |
| **GF12** | GROWTH FORM ALWAYS THERE |
| **LU-GF12** | Look-up Table for: GROWTH FORM ALWAYS THERE |
| **GF13** | GROWTH FORM SUMMARY FLAG |

| Attribute 82: GF01 GROWTH FORM RANK | |
|---|---|
| **Field** | **Detail** |
| **Purpose:** | To rank each growth form within the (sub-)stratum in order of decreasing importance in describing the substratum or stratum. |
| **Requirement:** | Essential |
| **Database Field Name:** | GROWTH_ FORM_RANK (was: GROFRM_NUMBER) |
| **Description:** | A number assigned to the growth form indicating the relative importance of the growth form in describing the substratum. |
| **Value:** | Number (10); Valid range for NVIS: 1-5, with no ties. Numbers greater than 5 are optional. |
| **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. |
| **Status:** | Implemented in the NVIS Oracle database. |

| Attribute 83: GF02 GROWTH FORM CODE | |
|---|---|
| **Field** | **Detail** |
| Purpose: | To provide a symbol and name for identifying growth forms in a (sub-)stratum. |
| Requirement: | Essential |
| Database Field Name: | GROWTH_FORM_CODE |
| 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 substratum 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)<br>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: | T |
| Comments: | |
| Status: | Implemented in the NVIS Oracle database and XML Transfer System. Recommend deprecation in NVIS data and programs when practical. Replace with full name as attribute GR_FORM (Appendix P) to avoid confusion with other, similar systems – e.g. Sivertsen (2009) |

| Look-up Table 19: LU-GF02 GROWTH FORM CODE | |
|---|---|
| **Growth Form** | As per growth form definitions in Table 6 |

| Attribute 84: GF03 COVER TYPE | |
|---|---|
| **Field** | **Detail** |
| **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 |

| | |
|---|---|
| **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)<br>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. |
| **Example:** | 3N |
| **Comments:** | N.B. See ST05 COVER_TYPE or TD 04 COVER_TYPE for the lookup table. The value Q has been added to the LUT. |
| **Status:** | Implemented in the NVIS Oracle database. |

| **Attribute 85: GF04 COVER TYPE DERIVATION METHOD** | |
|---|---|
| **Field** | **Detail** |
| **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 |
| **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. |
| **Value:** | Character (2000) |
| **Example:** | Braun-Blanquet |
| **Comments:** | |
| **Status:** | Implemented in the NVIS Oracle database. |

| **Attribute 86: GF05 COVER MINIMUM VALUE** | |
|---|---|
| **Field** | **Detail** |
| **Purpose:** | To record the minimum value of cover for the growth form in the substratum. |
| **Requirement:** | Optional |
| **Database Field Name:** | COVER_MINIMUM_VALUE |
| **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 |
| **Example:** | 10 |
| **Comments:** | |
| **Status:** | Implemented in the NVIS Oracle database. |

| **Attribute 87: GF06 COVER MAXIMUM VALUE** | |
|---|---|
| **Field** | **Detail** |
| **Purpose:** | To record the maximum value of cover for the growth form in the substratum. |
| **Requirement:** | Optional |
| **Database Field Name:** | COVER_MAXIMUM_VALUE |
| **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 |
| **Example:** | 40 |
| **Comments:** | |
| **Status:** | Implemented in the NVIS Oracle database. |

| **Attribute 88: GF07 COVER MEDIAN VALUE** | |
|---|---|
| **Field** | **Detail** |
| **Purpose:** | To record the median value of cover for the growth form in the substratum. |
| **Requirement:** | Optional |
| **Database Field Name:** | COVER_MEDIAN_VALUE |
| **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 |
| **Example:** | 26 |
| **Comments:** | |
| **Status:** | Implemented in the NVIS Oracle database. |

| **Attribute 89: GF08 COVER MEAN VALUE** | |
|---|---|
| **Field** | **Detail** |
| **Purpose:** | To record the mean value of cover for the growth form in the substratum. |
| **Requirement:** | Recommended |
| **Database Field Name:** | COVER_MEAN_VALUE |
| **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 |
| **Example:** | 40 |
| **Comments:** | |
| **Status:** | Implemented in the NVIS Oracle database. |

| **Attribute 90: GF09 GROWTH FORM DOMINANCE QUALIFIER** | |
|---|---|
| **Field** | **Detail** |
| **Purpose:** | To indicate the type of dominance of the growth form in the substratum. |
| **Requirement:** | Recommended |
| **Database Field Name:** | GR_FORM_DOMINANCE_QUALIFIER |
| **Description:** | A value of dominance for the growth form in the substratum. 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)<br>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 |
| **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. |

| **Look-up Table 20: LU-GF09 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 91: GF10 GROWTH FORM FREQUENCY** | |
|---|---|
| **Field** | **Detail** |
| **Purpose:** | To specify the frequency of a particular growth form across the substratum. |
| **Requirement:** | Optional |
| **Database Field Name:** | GROWTH_FORM_FREQUENCY |
| **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)<br>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:** | A |
| **Comments:** | The derivation of this field needs to be comprehensively documented in the Data Set table, for each data set. |
| **Status:** | Implemented in the NVIS Oracle database. |

| **Look-up Table 21: LU-GF10 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 92: GF12 GROWTH FORM ALWAYS THERE** | |
|---|---|
| **Field** | **Detail** |
| **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)<br>A value of N generates a “+/-“ separator symbol in the Level 5 and 6 attributes in the *vegetation description* table. |
| **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:** | Implemented in the NVIS Oracle database. |

| **Attribute 93: LU-GF12 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 Levels 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 94: GF13 GROWTH FORM SUMMARY FLAG** | |
|---|---|
| **Field** | **Detail** |
| **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 |
| **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 substratum 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)<br>Valid entries: "Y" or "N"; "T" or "F". Only one hat per stratum is permitted. |
| **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:** | Implemented in the NVIS Oracle database. |

## 4.9 Taxon data (TAXON_DATA)

| Table ID | Table Title |
|---|---|
| **TD01** | TAXON DATA RANK |
| **TD02** | TAXON DATA DESCRIPTION |
| **TD03** | TAXON DATA SOURCE CODE– (Recommended for deletion – see Appendix I) |
| **TD04** | COVER TYPE |
| **LU-TD04** | Look-up Table for: COVER TYPE |
| **TD05** | COVER TYPE DERIVATION METHOD |
| **TD06** | COVER MINIMUM VALUE |
| **TD07** | COVER MAXIMUM VALUE |
| **TD08** | COVER MEDIAN VALUE |
| **TD09** | COVER MEAN VALUE |
| **TD10** | TAXON DATA DOMINANCE QUALIFIER |
| **LU-TD10** | Look-up Table for: TAXON DATA DOMINANCE QUALIFIER |
| **TD11** | TAXON DATA FREQUENCY |
| **LU-TD11** | Look-up Table for: TAXON DATA FREQUENCY |
| **TD12** | TAXON DATA ALWAYS THERE |
| **LU-TD12** | Look-up Table for: TAXON DATA ALWAYS THERE |
| **TD13** | TAXON DATA SUMMARY FLAG |
| **LU-TD13** | Look-up Table for: TAXON DATA SUMMARY FLAG |

| **Attribute 95: TD01 TAXON DATA RANK** | |
|---|---|
| **Field** | **Detail** |
| **Purpose:** | To number each taxon (species) in order of decreasing importance within each substratum. |
| **Requirement:** | Essential |
| **Database Field Name:** | TAXON_DATA_RANK |
| **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 be allocated according to decreasing importance. A maximum of five taxa are required for NVIS at each substratum. The NVIS has the capacity to record more taxa than five, for each substratum, but they will not be used in the detailed (level 6) descriptions. |
| **Value:** | Number (10); Valid range for NVIS: 1-5, with no ties. Numbers greater than 5 are optional. |
| **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. |
| **Status:** | Implemented in the NVIS Oracle database. |

| **Attribute 96: TD02 TAXON DATA DESCRIPTION** | |
|---|---|
| **Field** | **Detail** |
| **Purpose:** | To describe the taxon against which ecological data is entered in the TAXON_DATA table. |
| **Requirement:** | Essential |
| **Database Field Name:** | TAXON_DATA_DESCRIPTION |
| **Description:** | This field contains the full taxonomic names of the taxon. |

| | |
|---|---|
| **Value:** | Character (2000)<br>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. |
| **Example:** | Eucalyptus obliqua |
| **Comments:** | |
| **Status:** | Implemented in the NVIS Oracle database and XML transfer system. |

| **Attribute 97: TD04 COVER TYPE** | |
|---|---|
| **Field** | **Detail** |
| **Purpose:** | To briefly specify the type of measure used in the COVER VALUE in the Taxon table. |
| **Requirement:** | QAQC |
| **Database Field Name:** | COVER_TYPE |
| **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)<br>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:** | 10Q |
| **Comments:** | The lookup table is the same as for ST05 COVER TYPE; the value Q has been added. |
| **Status:** | Implemented in the NVIS Oracle database. |

| **Look-up Table 22: LU-TD04 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. |
| **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 e.g. Braun-Blanquet. Percentage values may include the minimum and maximum. (Formerly 9C) |
| **Q** | Qualitative: the cover has been estimated by a qualitative method. |
| **not applicable** | not applicable |
| **unknown** | unknown |

| **Attribute 98: TD05 COVER TYPE DERIVATION METHOD** | |
|---|---|
| **Field** | **Detail** |
| **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 |
| **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) |

| | |
|---|---|
| **Example:** | Braun-Blanquet |
| **Comments:** | |
| **Status:** | Implemented in the NVIS Oracle database. |

| **Attribute 99: TD06 COVER MINIMUM VALUE** | |
|---|---|
| **Field** | **Detail** |
| **Purpose:** | To record the minimum value of cover for the taxon in the substratum. |
| **Requirement:** | Optional |
| **Database Field Name:** | COVER_MINIMUM_VALUE |
| **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 |
| **Example:** | 10 |
| **Comments:** | |
| **Status:** | Implemented in the NVIS Oracle database. |

| **Attribute 100: TD07 COVER MAXIMUM VALUE** | |
|---|---|
| **Field** | **Detail** |
| **Purpose:** | To record the maximum value of cover for the taxon in the substratum. |
| **Requirement:** | Optional |
| **Database Field Name:** | COVER_MAXIMUM_VALUE |
| **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 |
| **Example:** | 70 |
| **Comments:** | |
| **Status:** | Implemented in the NVIS Oracle database. |

| **Attribute 101: TD08 COVER MEDIAN VALUE** | |
|---|---|
| **Field** | **Detail** |
| **Purpose:** | To record the median value of cover for the taxon in the substratum. |
| **Requirement:** | Optional |
| **Database Field Name:** | 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 |
| **Example:** | 60 |
| **Comments:** | |
| **Status:** | Implemented in the NVIS Oracle database. |

| **Attribute 102: TD09 COVER MEAN VALUE** | |
|---|---|
| **Field** | **Detail** |
| **Purpose:** | To record the mean value of cover for the taxon in the substratum. |

| | |
|---|---|
| **Requirement:** | Recommended |
| **Database Field Name:** | COVER_MEAN_VALUE |
| **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 |
| **Example:** | 60 |
| **Comments:** | |
| **Status:** | Implemented in the NVIS Oracle database. |

| **Attribute 103: TD10 TAXON DATA DOMINANCE QUALIFIER** | |
|---|---|
| **Field** | **Detail** |
| **Purpose:** | To indicate the type of dominance of the species in the substratum. |
| **Requirement:** | Recommended |
| **Database Field Name:** | TAXON_DATA_DOMINANCE_QUALIFIER |
| **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)<br>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:** | 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. |

| **Look-up Table 23: LU-TD10 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 104: TD11 TAXON DATA FREQUENCY** | |
|---|---|
| **Field** | **Detail** |
| **Purpose:** | To specify the frequency of a particular taxon across the (sub-)stratum. |
| **Requirement:** | Recommended |
| **Database Field Name:** | TAXON_DATA_FREQUENCY |
| **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. |
| **Example:** | A |
| **Comments:** | |
| **Status:** | Implemented in the NVIS Oracle database. |

| **Attribute 105: LU-TD11 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 106: TD12 TAXON DATA ALWAYS THERE** | |
|---|---|
| **Field** | **Detail** |
| **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. |
| **Value:** | Character (20)<br>A value of N generates a +/- separator symbol in the Levels 5 and 6 attributes in the *vegetation description* table. |
| **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. |
| **Status:** | Implemented in the NVIS Oracle database. |

| **Look-up Table 24: LU-TD12 TAXON DATA ALWAYS THERE** | |
|---|---|
| | **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 107: TD13 TAXON DATA SUMMARY FLAG | |
|---|---|
| **Field** | Detail |
| **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 vegetation hierarchy and whether the word "mixed" should be appended to a stratum description. |
| **Requirement:** | Essential |
| **Database Field Name:** | TAXON_DATA_SUMMARY_FLAG |
| **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)<br>Valid entries: "Y", "M" or "N". A maximum of two 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 substrata in the corresponding Level 6 description. A maximum of one genus per stratum can be marked ("M") as descriptive of the stratum at simpler levels in the NVIS information hierarchy. |
| **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 vegetation hierarchy. "Unknown" is not an allowable option; "N" is the default. See Section 2.1.7.3 (Dominant Genus or Genera) for further discussion of the up-arrow or hat nomenclature; Table 8 gives a summary of allowable uses. Where there are two "Y" values 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. |
| **Status:** | Implemented in the NVIS Oracle database. |

| Look-up Table 25: LU-TD13 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. |

## 4.10 NVIS spatial data (Vector data)

The attributes for NVIS Spatial Data are best defined in a GIS system, rather than a relational database. The terminology of ArcGIS is used here in the “Value” explanation.

| Attribute 105: SD01 MAP UNIT IDENTIFIER | |
|---|---|
| **Field** | **Detail** |

| | |
|---|---|
| **Purpose:** | The purpose of this attribute is to identify the vegetation description(s) relating to each spatial unit, so that they can be linked to the non-spatial data (vegetation decriptions, etc.) |
| **Requirement:** | Mandatory |
| **Database Field Name:** | MAPUNT_IDENTIFIER |
| **Description:** | A unique map (spatial) unit identifier. Each permutation of vegetation descriptions and their proportions (where specified) within a unit are assigned a unique number. Can be parsed to label map units with the data set identifier (DATA_SET_NUMBER). |
| **Value:** | Long Integer (0) in the format SDDNNNNN, where S=State code, DD=dataset number within the state. S and DD are assigned by the administrator. NNNNN = the mapunit number supplied by the States and Territories (Option B) or by the Australian Government (Options A & C) – see discussion in Chapter 3. |
| **Example:** | 76017501 |
| **Comments:** | The MAP_UNIT table is essentially the table used to resolve the many-to-many relationship between the SPATIAL_DATA and VEG_DESCRIPTION tables (See Chapter 3). A map unit can be thought of as describing polygons with a mixture of vegetation types on a vegetation map. |
| **Status:** | Implemented in the NVIS Spatial Data. |

| **Attribute 106: SD02 VEGDSC1/NVISDSC1** | |
|---|---|
| **Field** | **Detail** |
| **Purpose:** | The purpose of this attribute is to identify the vegetation description with the greatest area in the mapping unit. |
| **Requirement:** | Mandatory |
| **Database Field Name:** | VEGDSC1 for state/territory agencies; and<br>NVISDSC1 for the NVIS Coordinator |
| **Description:** | Value of the primary key in the VEG_DESCRIPTION table identifying the vegetation description with the greatest area in the mapping unit. |
| **Value:** | Long Integer (0), Not Null. |
| **Example:** | 50151 |
| **Comments:** | |
| **Status:** | Implemented in the NVIS Spatial Data. |

| **Attribute 107-111: SD03-7 VEGDSC[x]/NVISDSC[x]** | |
|---|---|
| **Field** | **Detail** |
| **Purpose:** | The purpose of this attribute is to identify the vegetation description(s). |
| **Requirement:** | Mandatory |
| **Database Field Name:** | VEGDSC[x] for state/territory agencies; and<br>NVISDSC[x] for the NVIS Coordinator<br>Where x is an integer from 2-6, the value of which is supplied by VEG_DESC_POSITION in the MAP_UNIT table. |
| **Description:** | Value of the primary key in the VEG_DESCRIPTION table identifying the vegetation description at the rank position (“x”) in the mapping unit. Up to 6 vegetation descriptions are allowed per map unit. (Map units with more than one vegetation type within them are called mosaics). |
| **Value:** | Long Integer (0) |
| **Example:** | 50672 |
| **Comments:** | Related closely to VEG_ID or NVIS_ID. |
| **Status:** | Implemented in the NVIS Spatial Data. |

| Attribute 112-117: SD07-13 VEGPROP[x] | |
|---|---|
| **Field** | **Detail** |
| **Purpose:** | The purpose of this attribute is to identify the proportion of each vegetation description in the mapping unit. |
| **Requirement:** | Mandatory |
| **Database Field Name:** | VEGPROP[x], where x is an integer from 1-6. |
| **Description:** | This facility enables the recording of the estimated area of each vegetation type within each mapping unit. This should be done subjectively at the time of primary mapping, since, by definition, the areas of each vegetation type in the unit are below the minimum mapping area specifications. |
| **Value:** | Short Integer (4). Percentages should add up to 100% across each mapping unit. |
| **Example:** | 75 |
| **Comments:** | |
| **Status:** | Implemented in the NVIS Spatial Data. |

| Attribute 118: SD14 SPATIAL MIX | |
|---|---|
| **Field** | **Detail** |
| **Purpose:** | The purpose of this attribute is to identify the type of mosaic within the mapping unit. |
| **Requirement:** | Mandatory |
| **Database Field Name:** | SPATIAL_MIX |
| **Description:** | Details as per MU02 SPATIAL_MIX. |
| **Value:** | Text (50). If there is only one vegetation type in the mapping unit, the SPATIAL_MIX is set to “pure”; otherwise it is set to one of the mosaic options in the lookup table LU-MU02. |
| **Example:** | dominant mosaic |
| **Comments:** | |
| **Status:** | Implemented in the NVIS Spatial Data. |

| Attribute 119: SD15 NUMBER OF VEGETATION DESCRIPTIONS | |
|---|---|
| **Field** | **Detail** |
| **Purpose:** | The purpose of this attribute is to identify the number of vegetation description(s) in the mapping unit. |
| **Requirement:** | Mandatory |
| **Database Field Name:** | NO_VEG_DESC |
| **Description:** | As per MU04 NUMBER_OF_VEG_DESCRIPTIONS but with abbreviated attribute name. |
| **Value:** | Short Integer (4). If there is only one vegetation type in the mapping unit, the SPATIAL_MIX is set to “pure”; otherwise it is set to one of the mosaic options in the lookup table LU-MU02. |
| **Example:** | 5 |
| **Comments:** | This field checks the integrity of the relevant records in the SPATIAL_DATA through relevant spatial protocols managed by the NVIS Coordinator. |
| **Status:** | Implemented in the NVIS Spatial Data. |

# Chapter 5.0 Data transfer and checking

## 5.1 Rules for checking data

At a national workshop in November 2002, the NVIS collaborators agreed to the implementation of proposed rules (see Section 5.1.2— Data Checking Rules) to address the structural and content issues impacting on the quality and consistency of data in the NVIS vegetation hierarchy (Section 2.1.3). There are three general types of rules (i.e. automated procedures):

1. Those used to check the validity of data within a field;
2. Those used to check the consistency of data in related fields and tables; and
3. Those used to generate the simpler levels i.e. Levels 1 to 4, in the NVIS vegetation hierarchy (Table 3).

The first category of rules can be operationalised as database triggers within the relevant fields and/or by subsequent automated checking. The second category makes use of overlaps and redundancies within the database to maintain the integrity and consistency of the database content, especially the vegetation descriptions and lower tables (Section 3.2). The third set of rules require the algorithmic collation, conversion and concatenation of multiple fields. The NVIS collaborators have agreed that the conversion from Level 6 to 5 is best undertaken through an expert decision process, as it is too complex to automate the process considering the large variety of vegetation survey methods and data collected.

The following section lists the agreed rules, but their expression may have been changed slightly since ESCAVI (2003) to make them more understandable. Redundant wording has been removed to make them more current. Several complex rules (Rules 12-14, 19-21 and 30 – see Section 5.1.2 and Table 17— List of all NVIS attributes described) have been broken into separate parts for clarity. Rules 12, 13 and 14 have been rewritten in a more consistent manner. Most of the rules have been implemented (See Section 5.2.3.3 and Table 17).

### 5.1.2 Data checking rules

#### 5.1.2.1 Preliminary checks

1. The number_of_strata field must equal the number of substrata actually provided at Level 6.
2. Stratum counts of 0 are allowed to cater for non-vegetation descriptions. If there is a 'no stratum record' then all the following rules are skipped and the parser jumps to the "Various actions on the veg description records".
3. Vacant.

#### 5.1.2.2 Type of update

4. When the Level 6 (or 5) record's attribute is "NEW" then the source_code or veg_id for the State cannot already exist in NVIS.
5. When the Level 6 (or 5) record's attribute is "UPDATE" but the source_code or veg_id for the State does not exist in NVIS, then convert the Level 6 (or 5) record's attribute to 'NEW' and provide an "ACTION WARNING" message to alert the users.
6. When the Level 6 (or 5) record's attribute is "UPDATE" then an update_reason must be provided. If the update_reason is present for records of other status i.e. "NEW", "SPELLING" or "TEST", then it is ignored.
7. To correct the spelling of a Level 6 (or 5) record, its attribute must be set to "SPELLING" and only full taxon_descriptions species can be used. This will replace the previously entered record that was inserted via the "NEW" XML method and has the xml_status flag of 'S' for spelling issues. Messages are provided to indicate if it is successfully deleted and then re-inserted with the correct spelling.

#### 5.1.2.3 Across stratum checks for integrity of the NVIS notation

8. There must be only one (sub-)stratum in a record that has the DOMINANT_STRATUM_FLAG set to 'Y'.
9. There may be only one (or none) of each of the attribute Stratum Codes U1, U2, U3, M1, M2, M3, G1, G2, G3.
10. The number_of_growth_forms field must equal the number of Growth_Form records actually provided.
11. The number_of_taxa field must equal the number of Taxa records actually provided.
12. For the Upper Stratum (U at Level 5)
    a. Only one of the Upper strata - U1, U2 or U3 can be the "dominant substratum"
    b. The taxon_data_summary_flag can be set to ‘Y’ for one or two taxa or to ‘M’ for only one taxon. These can be in up to 2 of the substrata (U1, U2, U3 at Level 6).
    c. The one matching growth_form_summary_flag set to ‘Y’ should be within the same substratum as a taxon_data_summary_flag set to ‘Y’ or ‘M’.
13. For the Mid Stratum (M at Level 5)
    d. One and only one of the Mid strata - M1, M2 or M3 can be the "dominant sub-stratum"
    e. The taxon_data_summary_flag can be set to ‘Y’ for one or two taxa or to ‘M’ for only one taxon. These can be in up to 2 of the substrata (M1, M2, M3 at Level 6).

f. The one matching growth_form_summary_flag set to ‘Y’ should be within the same substratum as a taxon_data_summary_flag set to ‘Y’ or ‘M’.

14. For the Ground Stratum (G at Level 5)

    g. One and only one of the Ground strata - G1, G2 or G3 can be the "dominant sub- stratum"

    h. The taxon_data_summary_flag can be set to ‘Y’ for one or two taxa or to ‘M’ for only one taxon. These can be in up to 2 of the substrata (G1, G2, G3 at Level 6).

    i. The one matching growth_form_summary_flag set to ‘Y’ should be within the same substratum as a taxon_data_summary_flag set to ‘Y’ or ‘M’.

15. The Upper substrata must appear sequentially. The Upper strata must have a valid U1 substratum before a U2 substratum can exist. The Upper strata must have valid U1 and U2 substrata before a U3 can exist.

16. The Mid substrata must appear sequentially. The Mid strata must have a valid M1 substratum before an M2 substratum can exist. The Mid strata must have valid M1 and M2 substrata before an M3 can exist.

17. The Ground substrata must appear sequentially. The Ground strata must have a valid G1 substratum before a G2 substratum can exist. The Ground stratum must have valid G1 and G2 substrata before a G3 can exist.

#### 5.1.2.4 Height by stratum

18. The height classes must be sequential, for example the U2 substratum height must not be greater than the U1 substratum height.

19. Upper stratum height tests:

    a. The Upper strata (U1, U2, U3) height class can only be between 4 and 8.

    b. If an Upper stratum is the dominant stratum, then the height_class cannot be entered as '-9999'.

20. Mid stratum height tests:

    c. The Mid strata (M1, M2, M3) height class can only be between 3 and 6.

    d. If a Mid stratum is the dominant stratum, then the height class cannot be entered as '-9999'.

21. Ground stratum height tests:

    e. The Ground strata (G1, G2, G3) height class can only be between 1 and 5.

    f. If a Ground stratum is the dominant stratum, then the height class cannot be entered as '-9999'.

#### 5.1.2.5 Cover class by stratum

22. If an Upper stratum is the dominant stratum, then the cover_code cannot be '-9999' for this stratum.
23. If a Mid stratum is the dominant stratum, then the cover_code cannot be '-9999' for this stratum.
24. If a Ground stratum is the dominant stratum, then the cover_code cannot be '-9999' for this stratum.

#### 5.1.2.6 Growth form by stratum

25. The Upper strata - U1, U2 and U3 can only be tree, tree mallee, shrub, mallee shrub, palm and/or vine.
26. The Mid strata - M1, M2 and M3 can only be shrub, mallee shrub, heath shrub, chenopod shrub, palm, grass-tree, vine, tree, tree mallee, sedge, rush, cycad, epiphyte, tree-fern, fern and/or unknown[77].
27. The Ground strata - G1, G2 and G3 can only be chenopod shrub, samphire shrub, hummock grass, tussock grass, other grass, sedge, rush, forb, fern, bryophyte, lichen, vine, aquatic, cycad, seagrass, shrub, heath shrub, mallee shrub, tree-fern, grass-tree and/or unknown.

#### 5.1.2.7 Taxa - growth form checks

28. Vacant
29. For each Taxon record check that one of the growth forms listed matches the growth forms shown for that genus in the Genus/Growth Form table.
30. For each stratum (U, M, G)
    a. Check that the taxon and growth form identified with the summary_flag '^' are consistent with the Genus/Growth Form table.
    b. In the case of two taxon_data_summary_flag attributes in a stratum set to ‘Y’, check that the growth form whose growth_form_summary_flag is set to ‘Y’ matches (at least) one of the two above taxa.

#### 5.1.2.8 Spelling checks - taxa

31. For each Taxon record check the spelling of the genus and species against the Australian Government (SPRAT) taxon table (current_flag can be Y/N). If it doesn't match at all, provide a Warning message to the user but the record is still loaded.

[77] The list of allowable growth forms has been extended since AVAM v.6.0 to cater for unexpected vegetation types. However, there are minor inconsistencies between the Oracle Data Loader and the XML Stylesheet test.

32. If the genus and species (without any infraspecies) is in the Taxon Revision table of the Australian Government (SPRAT) taxon database as an old Taxon name (and matches exactly) then create a system administrator warning message to alert the NVIS Coordinator only.

33. If the genus and species followed by a space ' ' (to indicate there is additional infraspecies info), matches in the Taxon Revision table of SPRAT to an old Taxon name of genus and species with extra infraspecies information, then create a system administrator warning message to alert the NVIS Coordinator only.

#### 5.1.2.9 Check: Generated description equals intended description

34. The l6_sub_association field that contains the Level 5/6 veg description data must be identical to the description generated from the mandatory fields in the Stratum table and other lower tables.

## 5.2 Implementing the NVIS rules

Some of the NVIS Rules have been implemented in databases in each jurisdiction. Other rules have been met by data suppliers in an iterative fashion by improvements to protocols for interpreting vegetation types into the NVIS notation.

### 5.2.1 Why XML for NVIS?

NVIS has a good case for using XML. There is a defined community, with agreed standards (for describing vegetation) and a range of technical platforms. The attribute standards can be described in an XML schema, and data can then be transferred between parties in XML format that is independent from any one database instance. The XML enables 'checking' if the attributes, and attribute values, are legal. The wide uptake of XML means that expertise to write code for document conversion should not be a significant issue.

### 5.2.2 What is XML?

XML, or Extensible Markup Language, is an international standard for defining documents for transfer on the World Wide Web and elsewhere. XML has simple "tags" at the beginning and end of each piece of data and thus looks very similar to HTML. For example, some NVIS attribute data in XML looks like:

<taxon_data_description>Eucalyptus oleosa</taxon_data_description>

<cover_maximum_value>25</cover_maximum_value>

<cover_type_deriv_method>Most frequent cover abundance code for the strata species based on Braun-Blanquet ratings</cover_type_deriv_method>

An XML document can be viewed in a web browser and edited by a simple text editor, such as Notepad. However, it is easier to read and manage in a dedicated XML Editor (such as XML Spy, EditiX, etc.). While HTML is a fixed standard, XML is open-ended. A group of stakeholders

in a subject area (e.g. electronic commerce, metadata or vegetation) can define their own tags and structures (i.e. their own 'schema') in XML, for data storage. Documents conforming to the subject area's tags and structures can then be transferred to a variety of computer platforms and the process automated. (Documents not conforming to the schema generate errors, which need correction.)

Because XML is so flexible and adaptable, it is being adopted widely and is becoming an important capability of Relational Database Management Systems. There is a plethora of emerging technologies associated with processing XML documents. These technologies enable XML documents to be written to a wide variety of machine-readable and/or human-readable formats.

### 5.2.3 XML Transfer system (for the transfer of vegetation descriptions)

This section explains the What, Why and How of the XML - NVIS data transfer process. This process is critical for the long-term maintenance of NVIS.

#### 5.2.3.1 Overall system design

The XML Transfer System (Figure 9—Overview of the XML attribute data 'checking' and transfer) automates the data loading process for NVIS VEG_DESCRIPTION and "lower table" data. It has data validation built into it so that only valid data will get into the database (Cases 1 and 2 of Section 5.1—Rules for Checking Data). The accuracy of the data supplied cannot be verified but at least the content will comply with the *Australian Vegetation Attributes Manual 7.0* and each record will be internally consistent. Data that can be derived from other fields in the database no longer have to be included. In particular, the less detailed levels of the NVIS Vegetation hierarchy (Levels 1-4) are now automatically generated from the more detailed data supplied (Case 3 in Appendix L2—Mosaics in the NVIS framework).

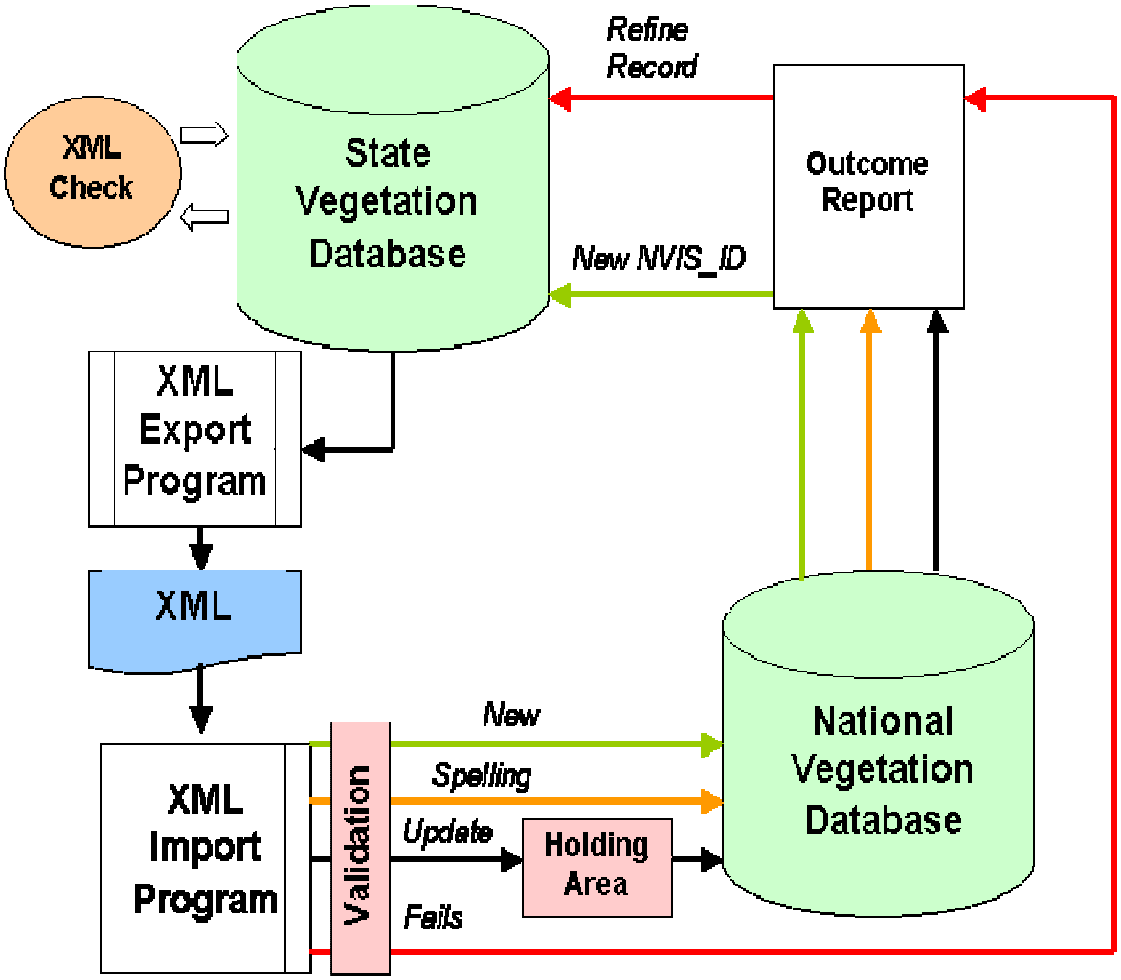


**Figure 9 Overview of the XML attribute data 'checking' and transfer.**

#### 5.2.3.2 XML Transfer system components

The XML Transfer System presently consists of the following items:

- The NVIS XML Schema (Attachment J) implements the standards (for vegetation descriptions and associated lower tables) defined in Version 6.0 of the Australian Vegetation Attribute Manual (ESCAVI, 2003); it also includes some of the changes in this document and is hence labelled as complying with Version 6.1.
- An in-house NVIS Data Loader imports NVIS XML documents into the NVIS Coordinator's Oracle database in the Australian Government. The import program includes testing for conformance to the NVIS XML Schema (via direct checking against the Schema, above) and to the agreed NVIS Rules via PL/SQL code.
- The NVIS XSL Stylesheet (Attachment K) is used by data suppliers to test for conformance to (most) NVIS rules before sending data to the Australian Government

(i.e. the stylesheet simulates the behaviour of the Oracle data loader). This has also proven very useful to the NVIS coordinator to iron out content and notation problems before running the Oracle data loader. Some of these helped debug the XML export programs of other agencies.

- In-house programming code (in XSQL, using Oracle XDK/Java) to export XML documents as part of a test cycle.
- Most jurisdictions have developed NVIS databases with an XML export program or have acess to separate systems for the provision of vegetation description data in the NVIS XML format.

#### 5.2.3.3 Implementing the NVIS rules in the XML transfer system

Most of the rules have been implemented (Table 17), but they remain subject to review and change in the implementation mode. In particular, several rules have been relaxed from preventing loading (i.e. fatal errors) to warnings to data custodians. For example, the suggested height and stratum codings for particular growth forms were found to be too prescriptive to cover all cases of vegetation types in the real world.

As per Table 17, the first category of rules (Section 5.1.1—Rules for Checking Data) has generally been implemented in the NVIS XML Schema. The second category (Section 5.1.1) have been implemented in the NVIS XML Stylesheet to simulate (many of) the rules in the loading program. The third category (Section 5.1.1) has not been implemented in the XML Schema or Stylesheet.

As per Table 17, most rules have been implemented in PL/SQL code in an Oracle environment as part of the XML Data Loader. In particular, the third set of rules has been developed only in PL/SQL, since these require the algorithmic collation, conversion and concatenation of multiple fields. Rules that check against separate data sources, such as the Genus_Growth_Form table and lists of valid species names, have only been implemented in the Data Loader.

**Table 18 Implementation of the NVIS Rules in the XML loader and standalone XML tools.**

| NVIS Rule Number | Implemented in the XML Loader (Oracle PL/SQL code) | Implemented in the NVIS XML Schema | Implemented in the NVIS XML Stylesheet |
|---|---|---|---|
| 1 | Yes? | - | Yes |
| 2 | Yes | Yes | - |
| 3 | -[78] | - | - |
| 4 | Yes[79] | No | No |
| 5 | Yes | No | No |
| 6 | Yes | - | Yes |
| 7 | Yes | No | No |
| 8 | Yes | - | Yes |
| 9 | Yes | - | Yes |
| 10 | Yes | - | Yes |

[78] A dash "-" means "not applicable" in this table.

[79] For SOURCE_CODE only (not VEG_ID)

| NVIS Rule Number | Implemented in the XML Loader (Oracle PL/SQL code) | Implemented in the NVIS XML Schema | Implemented in the NVIS XML Stylesheet |
|---|---|---|---|
| 11 | Yes | - | Yes |
| 12a, b & c | Yes | - | Yes |
| 13a, b & c | Yes | - | Yes |
| 14a, b & c | Yes | - | Yes |
| 15 | Yes | - | Yes |
| 16 | Yes | - | Yes |
| 17 | Yes | - | Yes |
| 18 | Yes | - | Yes |
| 19a & b | Yes | - | Yes |
| 20a & b | Yes | - | Yes |
| 21a & b | Yes | - | Yes |
| 22 | Yes | - | Yes |
| 23 | Yes | - | Yes |
| 24 | Yes | - | Yes |
| 25 | Yes | - | Yes |
| 26 | Yes | - | Yes |
| 27 | Yes | - | Yes |
| 28 | - | - | - |
| 29 | Yes | - | No |
| 30a & b | Yes | - | No |
| 31 | Yes | - | No |
| 32 | Yes | - | No |
| 33 | Yes | - | No |
| 34 | Yes | - | Yes |

#### 5.2.3.4 Status of the NVIS XML transfer system

NVIS stakeholders have been successfully using the XML Transfer System since 2005. All items in the XML Transfer System (Figure 9—Overview of the XML attribute 'checking') have been used operationally. However, most operations have been through the "New" cycle, with Update and Spelling cycles rarely used. Versions 3.0, 3.1, 4.0, 4.1 and 4.2 of NVIS were compiled using the system.

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## Appendix A: Glossary of terms

| Term | Definition | Reference(s) |
|---|---|---|
| | | |
| ABARES | Australian Bureau of Agricultural and Resource Economics and Sciences | |
| Accuracy assessment | Usually a statistical analysis of the closeness of estimates to true values or corresponding population values. An accurate estimator carries little or no bias. It may or may not be precise. | Lund 1995 |
| Alliance | A group of floristically related associations of similar structure. The alliance takes its name from the most characteristic dominant species of its component associations. | Beadle and Costin, 1952 |
| Analysis method | Procedures used to derive new information by bringing together and processing the basic data (polygons, lines, points, labels, etc). Methods used to analyse data and draw conclusions from that data. | Lund 1995; NVIS** |
| API | Aerial photo interpretation/aerial photogrammetry | Brocklehurst, pers. comm., 2000 |
| Aquatic environment | A surface type which is dominated by water surfaces. | |
| Association | An association is defined as a climax community of which the dominant stratum has a qualitatively uniform floristic composition and which exhibits uniform structure as a whole. For each stratum, the association description of the vegetation type should include floristic information for the dominant and/or diagnostic species (maximum of three species per stratum) plus the structural formation (dominant growth form, cover, height are combined as per Table 4). A maximum of three strata (upper, mid and ground; Walker & Hopkins (1990)) are allowed and the dominant stratum is indicated by a plus symbol "+".NVIS Level 5. | Beadle and Costin, 1952; NVIS** |
| Attribute | In a GIS, an attribute is analogous to a data element or column in a data base table. A standardised data field describing qualitative or quantitative information. | Lund 1995; NVIS** |
| Bare rock | This comprises bare rock surfaces. Vegetation cover either absent, minimal or unquantified. | deLacey et al., 2017 |
| Biomass | The total mass (usually measured as dry weight) of all the living organisms in a given area, population, habitat, or trophic level, often expressed as kg/ha or tonnes per ha. For NVIS, this refers to plant material. | Meagher, 1991 |
| Boolean | A logical data type that can have only one of two values: true or false (or Yes/No or 1/0). | Parker, 1994; ERIN* |
| Broad Floristic Formation | Dominant growth form, cover and height (combined into structural formation nomenclature according to Table 4) plus the dominant land cover genus for the dominant stratum. NVIS Level 3. | NVIS** |

| Term | Definition | Reference(s) |
|---|---|---|
| Built environment | Comprises of urban, landfill and waste facilities. | deLacey et al., 2017 |
| Canal | Comprises artificial freshwater canals. Vegetation cover either absent, minimal or unquantified. | deLacey et al., 2017 |
| Canal or canal estate | This comprises artificial estuarine canals and canal estates. Vegetation cover either absent, minimal or unquantified. | deLacey et al., 2017 |
| Canopy | A cover of foliage formed either by the community as a whole or by one of its component layers, it may be continuous or discontinuous. | Beadle and Costin, 1952 |
| Characteristic species | The species which distinguish the vegetation community. | Beadle and Costin, 1952 |
| Class | An upper level of the information hierarchy describing growth form and broad structure of the vegetation. NVIS Level 1. | Walker & Hopkins, 1990 |
| Classification system | The systematic grouping of entities into categories based upon shared characteristics. | Lund, 1995 |
| Claypan | This includes surfaces subject to impeded drainage due to a compact clay surface. Vegetation cover either absent, minimal or unquantified. Other claypans may have specialised vegetation, such as swamp cane grass. | |
| Climax | The final stages of succession; a subjective concept. | Beadle and Costin, 1952 |
| Co-dominant | A species that is equally dominant with one or more other species in the sub-association. In NVIS, co-dominance can also refer to a growth form instead of a species. | NVIS** |
| Community | A natural aggregate of different species of organisms existing in the same environment. Species within the community interact with each other, forming food chains and other ecological systems. They do not generally interact with species in other communities. For the purposes of NVIS, a community is described as an assemblage of plant species which are structurally and floristically similar and form a repeating 'unit' across the landscape. Also see vegetation type below. | Meagher, 1991; NVIS** |
| Cover | The proportion of the ground occupied by perpendicular projection on to it of the aerial parts of the individuals of the species under consideration. | Kershaw and Looney, 1985. |
| Cover abundance | A relatively crude estimate of species quantities which may be expedient but necessarily satisfactory for many vegetation description purposes. Generally expressed in class ranges - e.g.. The Braun-Blanquet cover abundance scale. | Mueller-Dombois, D. and H. Ellenberg, 1974; NVIS** |
| Crop or pasture | This comprises the broad classification of improved pasture or cropping and improved pasture (for extensive animal husbandry). This class may include scattered/isolated native trees, shrubs or groundcover species. | deLacey et al., 2017 |

| Term | Definition | Reference(s) |
|---|---|---|
| Crown cover | The cover produced by the foliage and branches of a tree, or collectively of the trees in a plant community, especially a forest. A canopy may be continuous or not, and may not always be formed only by the dominant species. | Meagher, 1991 |
| Built-up or resource extraction industries | Urban, industrial, utilities, landfill, other man-made features and transport. | deLacey et al., 2017 |
| Data custodian | The data custodian is responsible for ensuring the accuracy, currency, storage, security and distribution of the data set. In fulfilling these responsibilities, the custodian is expected to consult with, and take into account the needs of users other than itself. The custodian may choose to delegate these functions while still retaining responsibility. The custodian of a data set need not necessarily be the holder of the copyright, or the originator of the data, although in many cases the custodian will be both of these. | ANZLIC, 1996 |
| Data set or dataset | A unique, spatially defined collection of data, which is relatively homogeneous and is able to be described by a single metadata statement. | ANZLIC, 1996 |
| Dominant | A common species that is always dominant in the sub-association. It has the greatest biomass and is generally the most frequent. Any number of species could be dominant e.g. 1,2,3,4 or 5 depending on the association. See also co-dominant and sub-dominant. | Wilson and Brocklehurst, pers. comm., 2000 |
| Dominant stratum | The stratum 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. The most important or characteristic stratum of a particular vegetation type. It probably occupies the greatest space. | Beadle and Costin, 1952; Brocklehurst, pers. comm., 2000 |
| Eco-cover | Terrain naturalness + vegetation cover (presence) type + growth form type (Level 1) | |
| Eco-element | Eco-element type + broad floristic formation (Level 3) | |
| Ecological dominance, ecologically predominant | Ecological dominance is defined as the species making the greatest contribution to the overall biomass of the stratum, site, vegetation type etc. | |
| Ecologically dominant stratum | Defined as the stratum making the greatest contribution to the overall biomass of the vegetation type. | NVIS ** |
| Eco-surface | Surface type + vegetation cover + type structural formation type (Level 2) | |
| Ecosystem | An aggregate of animals, plants and other organisms, and the non-living parts of the environment, that interacts and which is relatively self-contained in terms of energy flow. | Meagher, 1991 and Lawrence, 1996 |
| Essential | An attribute that must be filled in to adequately to provide a useful *vegetation description* at all levels in the NVIS information hierarchy. | NVIS** |

| Term | Definition | Reference(s) |
|---|---|---|
| estuarine and marine environments | Specific aquatic eco-elements relating to estuarine and marine environments | |
| Estuarine and maritime | Includes mudflats, mangroves and saltmarshes. | deLacey et al., 2017 |
| Evaporation basin | This comprises artificial saline evaporation basins. Vegetation cover either absent, minimal or unquantified. | deLacey et al., 2017 |
| Extant | Existing at the present time. | Meagher, 1991 |
| Field | Database attribute | NVIS** |
| Floristics | A description or study of the plant species that occur in a defined area or vegetation type. | Meagher, 1991 |
| Foliage cover | Is the percentage of the same site occupied by the vertical projection of foliage and branches (if woody). | Carnahan, 1976 |
| Formation | The synthetic structural unit to which are referred all climax communities exhibiting the same structural form, irrespective of floristic composition. | Beadle and Costin, 1952 |
| Frequency | The number of occurrences of one type of event in relation to the total number of events observed in a sample. For NVIS, this could be the number of sites containing a growth forms and/or species compared with the total number of sites in the survey. | Meagher, 1991; NVIS** |
| GPS | Global Positioning System | Parker, 1994 |
| Growth-form | Habit or general appearance of a plant. Similar in definition to “life form”, but growth form in NVIS is oriented to the classification of Australia’s vegetation, as per Walker & Hopkins (1990). | NVIS** |
| Habit | The general appearance of a plant (such as shrubby, prostrate, erect, climbing, twining, etc.) used particularly in horticulture. | Meagher, 1991 |
| Hardpan | This includes surfaces impermeable to water or where a subsurface layer dramatically impedes drainage. Vegetation cover either absent, minimal or unquantified. | |
| Height | Measurement from base to top of a stratum, growth form and/or species. Can be calculated for a given community to derive the average height for a given stratum. | Fowler & Fowler, 1996; NVIS** |
| Horticulture orchard or vineyard | This comprises the broad classification of horticulture, orchard, vineyard or plant nursery. This class may include scattered/isolated native trees, shrubs or groundcover species. | deLacey et al., 2017 |
| Image | The recorded representation of an object produced by optical, electro-optical, optical mechanical, or electronic means. It is generally used when the electromagnetic radiation emitted or reflected from a scene is not directly recorded on film. | Harrison & Jupp, 1990 |

| Term | Definition | Reference(s) |
|---|---|---|
| Indicator/diagnostic species | A species that characterises a particular vegetation type but which may not necessarily be the most dominant. | Brocklehurst, pers. comm., 2000 |
| Information hierarchy | The systematic arrangement of NVIS vegetation attributes in order of descriptive complexity. (See Tables 3 & 9). | NVIS** |
| Infrastructure | Physical and organisational structures and facilities, such as roads and buildings. | deLacey et al., 2017 |
| Jurisdiction | The jurisdiction is the name of the State or Country in which the custodian of the data set is domiciled. | ANZLIC 1996 |
| Lake | Permanent fresh water or is regularly flooded with fresh water. | deLacey et al., 2017 |
| Layer | An item with planar geometry. Used in at least two different meanings in this manual:<br>1. As a synonym for stratum or substratum in discussing a vegetation profile; and<br>2. As a GIS dataset in general. In rare cases, it may be necessary to refer to a particular ESRI data format called a "layer". | NVIS** |
| Level | The attribute groupings within the NVIS information hierarchy that recognise information of similar spatial, structural, growth form and floristic detail. | NVIS** |
| Life-form | The form characteristically taken by a plant at maturity. (Many categorisations of life forms in the botanical literature are inadequate, or too complicated, for the purpose of classifying Australian vegetation types.) See also Growth Form. | Parker, 1994; ERIN* |
| Lower tables | An informal term to refer to the tables sitting below VEG_DESCRIPTION in the E:R Diagram (Appendix C1); comprises the STRATUM, GROWTH_FORM and TAXON_DATA tables. | NVIS** |
| Mandatory | An attribute that must be filled in adequately to identify, locate and manage the main components of the database and information transfer. | Bolton, 1992 |
| Map unit | A map unit is a spatial category which contains a vegetation type or group of co-occurring vegetation types. The map unit is commonly an item in a map legend and is delineated on the map by means of one-to-many polygons. | NVIS** |
| Mapping methods | The identification of selected features, the determination of their boundaries or locations, and the delineation of those boundaries or locations on a suitable base using predefined criteria. Methods or techniques used to produce both the spatial and attribute information for a particular vegetation map. | Lund 1995; Brocklehurst, pers. comm., 2003 |
| Metadata | A written description for a data set. Metadata should conform to the ANZLIC Metadata Guidelines, 1996. | ANZLIC, 1996 |
| Missing values | Values that have not been recorded for a given data set. Sometimes referred to as Null values or as –9999 in a GIS system. | NVIS** |

| Term | Definition | Reference(s) |
|---|---|---|
| Model | A theoretical representation of a system used to predict changes under the influence of various factors. | Meagher, 1991 |
| Modified disturbed or regenerating native vegetation | Native vegetation or disturbed/regenerating native vegetation cover which is modified to the extent that the native vegetation is largely recognisable, but lacks sufficient floristic and structural information to enable allocation to another MVG. | deLacey et al., 2017 |
| Mosaic | Two or more vegetation descriptions present within a map unit. This is where the scale of mapping or the spatial patterns is too complex for each vegetation type to be mapped separately. | ERIN*; NVIS ** |
| Native vegetation type | Native vegetation comprises a range of native plant species forming a largely recognisable vegetation type. A range of major vegetation types which are characterised by native vegetation cover. | |
| NVIS | National Vegetation Information System | |
| Parkland, garden or playing field | This enables the broad classification of parkland, garden or playing field. This class may include scattered/ isolated native tree, shrub or groundcover species. | deLacey et al., 2017 |
| Percentage cover | The cover of any vegetation as a percentage for a given area. | ERIN* |
| Physiognomic | Physiognomy is the external appearance of vegetation including such features as colour, luxuriance, seasonality and overall compositional features that can be quickly determined by means of visual assessment. A vegetation classification based on the appearance or physical characteristics of the dominant taxon is called a physiognomic classification. The NVIS hierarchy is a physiognomic-floristic classification, with higher levels containing physiognomic information and the lower, more detailed levels, containing both physiognomic and floristic information. | Jones et al, 1990; Brocklehurst, pers. comm., 2003 |
| Plantation forest | This enables the broad classification of plantation forest (i.e. planted forests). This class may include scattered/ isolated native tree, shrub or groundcover species. | deLacey et al., 2017 |
| Positional accuracy | The degree of conformity with which horizontal positions and vertical values are represented on a map, chart, or related product in relation to an established standard. | Lund 1995 |
| Pre-clearing | Vegetation types and extent before European settlement in Australia. Often referred to as pre-1750 and pre-European vegetation. | ERIN* |
| Reservoir or dam | This comprises reservoirs and dams. Vegetation cover either absent, minimal or unquantified. | deLacey et al., 2017 |
| Reservoir, canal or evaporative basins | This comprises reservoirs or other man-made structures for the containment of water. Vegetation cover either absent, minimal or unquantified. | |

| Term | Definition | Reference(s) |
|---|---|---|
| Resolution | The resolvability of features for a given map scale. Scale affects resolution. In a larger scale map, the resolution of features more closely matches real-world features because the extent of reduction from ground to map is less. Map resolution may refer to a "minimum mapping unit" or the accuracy at which a given map scale can depict the location and shape of map features. | ESRI, 1994; Lund 1995 |
| Resource extraction | This comprises resource extraction. | deLacey et al., 2017 |
| Salt lake | A landlocked body of water that has a higher concentration of salts than most lakes. | deLacey et al., 2017 |
| Sand or sand dune | This includes sand surfaces, beaches, riparian sand, sandplains and dunes. Vegetation cover either absent, minimal or unquantified. | |
| Scale | Map scale indicates how much the given area was reduced. For the same size map, features on a small-scale map (1:1,000,000) will be smaller than those on a large-scale map (1:1,200). | ESRI, 1994 |
| SoE | State of the Environment. | |
| Species | A group of organisms that are biologically capable of breeding and producing fertile offspring. It is the lowest normal taxonomic unit in use. | Meagher, 1991 |
| Spectral class | A class which is developed on the basis of the pixel spectral, or radiance, data and/or channels derived from radiance data. In terms of thematic mapping all the pixels which fall into a spectral class are interactively overlaid with a distinct colour to aid in interpretation. | Harrison & Jupp, 1990. |
| Stratum/Substratum | A layer in a community produced by the occurrence at approximately the same level of an aggregation of plants of the same habit. | Beadle and Costin, 1952; NVIS** |
| Structural formation | Formation classes defined by growth form and crown separation (woody plants) or foliage cover (ground stratum), and qualified by height class. NVIS Level 2. | Walker and Hopkins, 1990 |
| Structure | The spatial arrangement (vertically and horizontally) of plants within a community. | Beadle and Costin, 1952; NVIS** |
| Sub-association | A sub division of the association determined by a variation in the most important subordinate stratum of the association, without significant qualitative changes in the dominant stratum. In NVIS, for each layer/substratum, the sub-association description of the vegetation type should include floristic information for the dominant and/or diagnostic species (maximum of five species per substratum) plus the structural formation (dominant growth form, cover, height are combined as per Table 4). A maximum of eight substrata (as per Table 2) are allowed and the dominant substratum is indicated by a plus symbol "+" NVIS Level 6. | Beadle and Costin, 1952; NVIS** |
| Sub-dominant | A species that occurs frequently in the vegetation type but has a lesser relative biomass than the dominant species. | Wilson & Brocklehurst, pers. comm., 2000. |

| Term | Definition | Reference(s) |
|---|---|---|
| Sub-formation | Dominant growth form, cover and height (combined into structural formation nomenclature according to Table 4) plus the dominant land cover genus for the three traditional strata. (i.e. upper, mid and ground). NVIS Level 4. | NVIS** |
| Taxon (plural = taxa) | Any of the groups into which living things are formally classified by the scientific community, e.g. species. The taxa in the Linnean system are commonly Kingdom, Phylum, Class, Order, Family, Genus, Species and sub-species/varieties/forms. | Meagher, 1991; ERIN* |
| Terrain naturalness | Naturalness of the landscape in the broadest sense. | |
| Terrestrial environment | A surface type which is dominated by land-based surfaces. | |
| Unclassifiable | Note that “unclassifiable” means that it cannot be classified. | |
| Unclassified | Unclassified means that it has not yet been classified. | |
| Undifferentiated | Undifferentiated means that while some information is available, it is not sufficient to enable progress in classification. | |
| URL | Universal Resource Locator | ERIN* |
| Vegetated | Plants growing above the land and/or water surface. | |
| Vegetation | All plants within a specified area. It is usually considered generally and not taxonomically. | Lawrence, 1996 |
| Vegetation description | A set of attribute values pertaining to a vegetation type and contained in the NVIS information hierarchy and supporting tables. | NVIS** |
| Vegetation type | A community that has a floristically uniform structure and composition, often described by its dominant species. In NVIS, a vegetation type is commonly represented by a vegetation description. | Meagher, 1991; ERIN* |
| Watercourse | A stream or artificially constructed water channel. | deLacey et al., 2017 |
| Wetland | Intermittent fresh water or is regularly flooded with fresh water. They comprise swamps, marshes, billabongs, lakes, lagoons, bogs, fens and peatlands. | deLacey et al., 2017 |

ERIN* -pers. comm. staff in the Environmental Resources Information Network, Department of the Environment and Energy.
NVIS** - defined in this document for the purposes of NVIS, including the NVIS information hierarchy.

# Appendix B Recommended abbreviations and contractions for entering taxonomic data into NVIS

| Term | Definition |
|---|---|
| cv. | cultivar |
| F. | form/ *forma* |
| fam. | family |
| gen. nov. | *genus novus* - a newly described genus |
| ined. | *ineditus* (unpublished) |
| ms. | manuscript (unpublished manuscript name - generally follows an author name) |
| p.p. | pro parte (in part) |
| sect. | section/*sectio* |
| s. lat. | *sensu lato* (in the broad sense) |
| s. str. | *sensu stricto* (in the narrow or strict sense) |
| sp. | species (singular) |
| sp. aff. | species with affinity to …, or close to … (NB. 'aff. sp.' should not be used) |
| sp. nov. | *species novus* – a newly described species (NB. 'nov. sp.' should not be used) |
| spp. | species (plural) |
| ssp | not preferred option - see subsp. |
| subg. | subgenus |
| subsp. | subspecies |
| subspp. | subspecies (plural) |
| syn. | synonym |
| var. | variety |

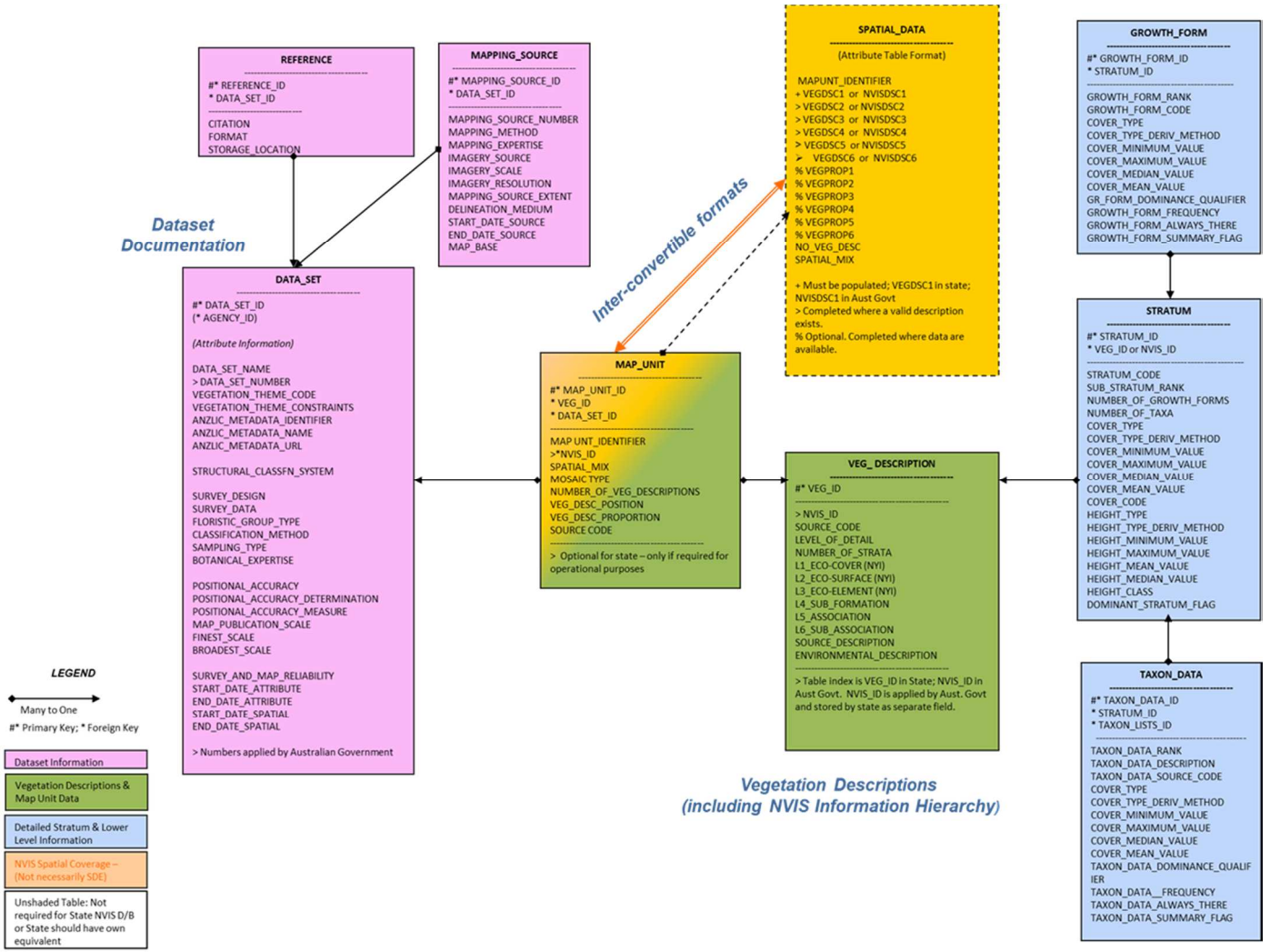
The above abbreviations were adapted from Chapman (2002) and the Herbarium Information Standards and Protocols for Interchange of Data (Conn, 1999; HISPID5, 2007). HISPID was developed by a committee of representatives from all Australian Herbaria.

Notes

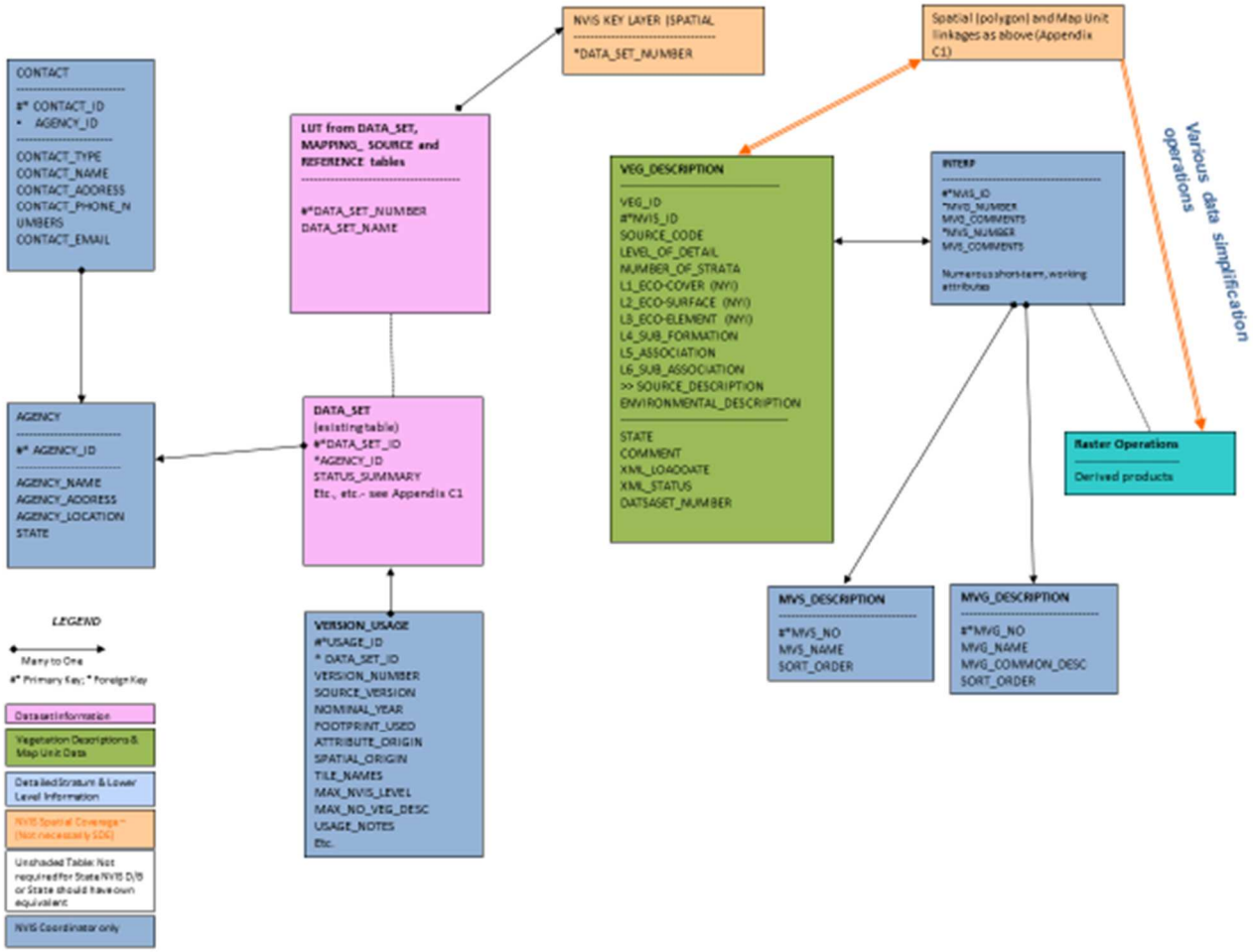
- The above abbreviations are normally used in the INFRASPECIFIC_RANK attribute in the Taxon_Lists table and in the appropriate place in the full taxon name in the attribute TAXON_DATA_DESCRIPTION in the Taxon_Data table.
- Where full stops are shown, these should be recorded in the data.
- Species names in the NVIS database are input, managed and output in normal, not italic typeface. Future output tools may include the facility to output species names in italics.
- The common practice in the written literature of abbreviating the genus to its initial capital letter is not permitted in the NVIS database, since ambiguity would soon result.
- Hybrids add considerable complexity to a database (HISPID5, 2007) and are not presently catered for in NVIS.

- The above abbreviations have been combined from the allowable values for HISPID5 (2007) fields: spql and isprk.

## Appendix C1: Entity relationship diagram showing NVIS database structure Version 7.0



## Appendix C2: Additional tables in the NVIS (Australian Government: Department of the Environment and Energy)



## Appendix D1: NVIS 4.2 Major Vegetation Groups (preferred sort order)

| MVG No | MVG Name | Key |
|---|---|---|
| 1 | Rainforests and Vine Thickets | |
| 2 | Eucalypt Tall Open Forests | |
| 3 | Eucalypt Open Forests | |
| 4 | Eucalypt Low Open Forests | |
| 5 | Eucalypt Woodlands | |
| 6 | Acacia Forests and Woodlands | |
| 7 | Callitris Forests and Woodlands | |
| 8 | Casuarina Forests and Woodlands | |
| 9 | Melaleuca Forests and Woodlands | |
| 10 | Other Forests and Woodlands | |
| 11 | Eucalypt Open Woodlands | |
| 12 | Tropical Eucalypt Woodlands/Grasslands | |
| 13 | Acacia Open Woodlands | |
| 14 | Mallee Woodlands and Shrublands | |
| 15 | Low Closed Forests and Tall Closed Shrublands | |
| 16 | Acacia Shrublands | |
| 17 | Other Shrublands | |
| 18 | Heathlands | |
| 19 | Tussock Grasslands | |
| 20 | Hummock Grasslands | |
| 21 | Other Grasslands, Herblands, Sedgelands and Rushlands | |
| 22 | Chenopod Shrublands, Samphire Shrublands and Forblands | |
| 23 | Mangroves | |
| 24 | Inland Aquatic - freshwater, salt lakes, lagoons | |
| 25 | Cleared, Non-Native Vegetation, Buildings | |
| 26 | Unclassified Native Vegetation | |
| 27 | Naturally Bare - sand, rock, claypan, mudflat | |
| 28 | Sea and Estuaries | |
| 29 | Regrowth, Modified Native Vegetation | |
| 30 | Unclassified Forest | |
| 31 | Other Open Woodlands | |
| 32 | Mallee Open Woodlands and Sparse Mallee Shrublands | |
| 99 | Unknown/No Data | |

## Appendix D2: NVIS 4.2 Major Vegetation Subgroups (preferred sort order)

| MVS No | MVS Name | Key |
|---|---|---|
| 1 | Cool temperate rainforest | |
| 2 | Tropical or sub-tropical rainforest | |
| 6 | Warm temperate rainforest | |
| 62 | Dry rainforest or vine thickets | |
| 40 | Mangroves | |
| 3 | Eucalyptus (+/- tall) open forest with a dense broad-leaved and/or tree-fern understorey (wet sclerophyll) | |
| 54 | Eucalyptus tall open forest with a fine-leaved shrubby understorey | |
| 60 | Eucalyptus tall open forests and open forests with ferns, herbs, sedges, rushes or wet tussock grasses | |
| 4 | Eucalyptus open forests with a shrubby understorey | |
| 5 | Eucalyptus open forests with a grassy understorey | |
| 8 | Eucalyptus woodlands with a shrubby understorey | |
| 65 | Eucalyptus woodlands with a chenopod or samphire understorey | |
| 9 | Eucalyptus woodlands with a tussock grass understorey | |
| 10 | Eucalyptus woodlands with a hummock grass understorey | |
| 59 | Eucalyptus woodlands with ferns, herbs, sedges, rushes or wet tussock grassland | |
| 13 | Brigalow (Acacia harpophylla) forests and woodlands | |
| 20 | Mulga (Acacia aneura) woodlands +/- tussock grass +/- forbs | |
| 51 | Mulga (Acacia aneura) woodlands and shrublands with hummock grass | |
| 14 | Other Acacia forests and woodlands | |
| 12 | Callitris forests and woodlands | |
| 26 | Casuarina and Allocasuarina forests and woodlands | |
| 15 | Melaleuca open forests and woodlands | |
| 7 | Tropical Eucalyptus open forests and woodlands with a tall annual grassy understorey | |
| 11 | Tropical mixed spp forests and woodlands | |
| 50 | Banksia woodlands | |
| 58 | Leptospermum forests and woodlands | |
| 16 | Other forests and woodlands | |
| 29 | Mallee with a dense shrubby understorey | |

| MVS No | MVS Name | Key |
|---|---|---|
| 55 | Mallee  with an open shrubby understorey | |
| 61 | Mallee with a tussock grass understorey | |
| 27 | Mallee with hummock grass | |
| 28 | Low closed forest or tall closed shrublands (including Acacia, Melaleuca and Banksia) | |
| 47 | Eucalyptus open woodlands with shrubby understorey | |
| 48 | Eucalyptus open woodlands with a grassy understorey | |
| 53 | Eucalyptus low open woodlands with a shrubby understorey | |
| 56 | Eucalyptus (+/- low) open woodlands with a chenopod or samphire understorey | |
| 19 | Eucalyptus low open woodlands with tussock grass | |
| 18 | Eucalyptus low open woodlands with hummock grass | |
| 21 | Other Acacia tall open shrublands and [tall] shrublands | |
| 49 | Melaleuca shrublands and open shrublands | |
| 57 | Lignum shrublands and wetlands | |
| 30 | Heathlands | |
| 32 | Other shrublands | |
| 69 | Open mallee woodlands and sparse mallee shrublands with a dense shrubby understorey | |
| 68 | Open mallee woodlands and sparse mallee shrublands with an open shrubby understorey | |
| 67 | Open mallee woodlands and sparse mallee shrublands with a tussock grass understorey | |
| 66 | Open mallee woodlands and sparse mallee shrublands with a hummock grass understorey | |
| 45 | Mulga (Acacia aneura) open woodlands and sparse shrublands +/- tussock grass | |
| 52 | Mulga (Acacia aneura) open woodlands and sparse shrublands with hummock grass | |
| 25 | Acacia (+/- low) open woodlands and sparse shrublands with a shrubby understorey | |
| 22 | Acacia (+/- low) open woodlands and shrublands with chenopods | |
| 24 | Acacia (+/- low) open woodlands and shrublands +/- tussock grass | |
| 23 | Acacia (+/- low) open woodlands and shrublands with hummock grass | |
| 70 | Callitris open woodlands | |
| 74 | Casuarina and Allocasuarina open woodlands with a shrubby understorey | |
| 73 | Casuarina and Allocasuarina open woodlands with a chenopod shrub understorey | |
| 71 | Casuarina and Allocasuarina open woodlands with a tussock grass understorey | |
| 72 | Casuarina and Allocasuarina open woodlands with a hummock grass understorey | |

| MVS No | MVS Name | Key |
|---|---|---|
| 75 | Melaleuca open woodlands | |
| 79 | Other open Woodlands | |
| 80 | Other sparse shrublands and sparse heathlands | |
| 34 | Mitchell grass (Astrebla) tussock grasslands | |
| 35 | Blue grass (Dicanthium) and tall bunch grass (Vitiveria syn: Chrysopogon) tussock grasslands | |
| 36 | Temperate tussock grasslands | |
| 37 | Other tussock grasslands | |
| 33 | Hummock grasslands | |
| 38 | Wet tussock grassland with herbs, sedges or rushes, herblands or ferns | |
| 63 | Sedgelands, rushs or reeds | |
| 64 | Other grasslands | |
| 41 | Saline or brackish sedgelands or grasslands | |
| 31 | Saltbush and bluebush shrublands | |
| 39 | Mixed chenopod, samphire +/- forbs | |
| 17 | Boulders/rock with algae, lichen or scattered plants, or alpine fjaeldmarks | |
| 44 | Freshwater, dams, lakes, lagoons or aquatic plants | |
| 43 | Salt lakes and lagoons | |
| 42 | Naturally bare, sand, rock, claypan, mudflat | |
| 46 | Sea, estuaries (includes seagrass) | |
| 90 | Regrowth or modified forests and woodlands | |
| 91 | Regrowth or modified shrublands | |
| 93 | Regrowth or modified chenopod shrublands, samphire or forblands | |
| 92 | Regrowth or modified graminoids | |
| 96 | Unclassified forest | |
| 97 | Unclassified native vegetation | |
| 98 | Cleared, non-native vegetation, buildings | |
| 99 | Unknown/No data | |

## Appendix E: List of NVIS database and spatial fields by table

| Field_Name | Nullable? | Field_Definition (in Oracle) | Comments |
|---|---|---|---|
| DATA_SET_ID | NOT NULL | NUMBER(10) | Primary key for table |
| AGENCY_ID | NOT NULL | NUMBER(10) | Foreign key used by Aust. Govt |
| ---------- *(Identifier Fields)* ---------- | ---------- | ---------- | |
| DATA_SET_NAME | NOT NULL | VARCHAR2(2000) | |
| DATA_SET_NUMBER | NOT NULL | NUMBER(10) | Used by Aust Govt; optional for States and Territories |
| VEGETATION_THEME_CODE | NOT NULL | VARCHAR2(20) | |
| VEGETATION_THEME_CONSTRAINTS | | VARCHAR2(2000) | |
| ---------- *(Attribute Information)* ------ | ---------- | ---------- | |
| ANZLIC_METADATA_IDENTIFIER | | VARCHAR2(50) | |
| ANZLIC_METADATA_NAME | | VARCHAR2(2000) | |
| ANZLIC_METADATA_URL | | VARCHAR2(2000) | |
| STRUCTURAL_CLASSFN_SYSTEM | NOT NULL | VARCHAR2(50) | |
| FLORISTIC_GROUP_TYPE | | VARCHAR2(20) | |
| CLASSIFICATION_METHOD | NOT NULL | VARCHAR2(4000) | |
| SAMPLING_TYPE | NOT NULL | VARCHAR2(50) | |
| BOTANICAL_EXPERTISE | | VARCHAR2(2000) | |
| POSITIONAL_ACCURACY | NOT NULL | NUMBER(5,1) | |
| POSITIONAL_ACCURACY_DETERM | NOT NULL | VARCHAR2(20) | |
| POSITIONAL_ACCURACY_MEASURE | | VARCHAR2(20) | |
| MAP_PUBLICATION_SCALE | NOT NULL | NUMBER(10) | |
| FINEST_SCALE | | NUMBER(10) | |
| BROADEST_SCALE | | NUMBER(10) | |
| SURVEY_AND_MAP_RELIABILITY | NOT NULL | VARCHAR2(2000) | |
| START_YEAR_ATTRIBUTE | NOT NULL | NUMBER(4) | |
| END_YEAR_ATTRIBUTE | NOT NULL | NUMBER(4) | |
| START_YEAR_SPATIAL | NOT NULL | NUMBER(4) | |
| END_YEAR_SPATIAL | NOT NULL | NUMBER(4) | |
| EDIT_NOTES | | VARCHAR2(1000) | Working field for Aust. Govt |
| STATUS_SUMMARY | | VARCHAR2(20) | Working field for Aust. Govt |
| MAPPING_SOURCE | | | |
| MAPPING_SOURCE_ID | NOT NULL | NUMBER(10) | Primary key for table |
| DATA_SET_ID | NOT NULL | NUMBER(10) | Foreign key |
| ---------- | ---------- | ---------- | |
| MAPPING_SOURCE_NUMBER | | NUMBER(10) | |
| MAPPING_METHOD | NOT NULL | VARCHAR2(2000) | |
| MAPPING_EXPERTISE | | VARCHAR2(2000) | |
| IMAGERY_SOURCE | NOT NULL | VARCHAR2(2000) | |
| IMAGERY_SCALE | NOT NULL | NUMBER(10) | |
| IMAGERY_RESOLUTION | | NUMBER(10) | |
| MAPPING_SOURCE_EXTENT | | VARCHAR2(4000) | |

| Field_Name | Nullable? | Field_Definition (in Oracle) | Comments |
|---|---|---|---|
| DELINEATION_ MEDIUM | | VARCHAR2(2000) | |
| START_DATE_SOURCE | | DATE | |
| END_DATE_SOURCE | | DATE | |
| MAP_BASE | | VARCHAR2(2000) | |
| REFERENCE | | | |
| REFERENCE_ID | NOT NULL | NUMBER(10) | Primary key for table |
| DATA_SET_ID | NOT NULL | NUMBER(10) | Foreign key |
| ---------- | ---------- | ---------- | |
| CITATION | NOT NULL | VARCHAR2(2000) | |
| FORMAT | | VARCHAR2(2000) | |
| STORAGE_LOCATION | | VARCHAR2(2000) | |
| MAP_UNIT | | | |
| MAP_UNIT_ID | NOT NULL | NUMBER(10) | Primary key for table |
| VEG_ID | NOT NULL | NUMBER(10) | Foreign key |
| DATA_SET_ID | NOT NULL | NUMBER(10) | Foreign key |
| ---------- | ---------- | ---------- | |
| MAPUNT_IDENTIFIER | NOT NULL | NUMBER(10) | |
| NVIS_ID | NOT NULL | NUMBER(10) | Secondary key for Aust. Govt. States may decide to include this for operational reasons |
| SPATIAL_MIX | NOT NULL | VARCHAR2(50) | |
| MOSAIC_TYPE | | VARCHAR2(1) | Working field for Aust. Govt |
| NUMBER_OF_VEG_DESCRIPTIONS | NOT NULL | NUMBER(10) | |
| VEG_DESC_POSITION | NOT NULL | NUMBER(10) | |
| VEG_DESC_PROPORTION | | NUMBER(10) | |
| SOURCE_CODE | NOT NULL | VARCHAR2(50) | Working field for Aust. Govt |
| VEG_DESCRIPTION | | | |
| VEG_ID | NOT NULL | NUMBER(10) | Primary key for State/Territory systems |
| NVIS_ID | | NUMBER(10) | NOT NULL primary key in Aust Govt system |
| ---------- | ---------- | ---------- | |
| SOURCE_CODE | NOT NULL | VARCHAR2(50) | Alternative primary key for State/Territory systems |
| LEVEL_OF_DETAIL | NOT NULL | VARCHAR2(50) | |
| NUMBER_OF_STRATA | NOT NULL | NUMBER(10) | |
| L1_CLASS | NOT NULL | VARCHAR2(2000) | Field size changed to VARCHAR2(2000) to house Level 1 of new ecological/land cover classification until new L1-3 fields can be created. |
| L2_STRUCTURAL_FORMATION | NOT NULL | VARCHAR2(2000) | |
| L3_BROAD_FLORISTIC_FORMATION | NOT NULL | VARCHAR2(2000) | |
| L4_SUB_FORMATION | NOT NULL | VARCHAR2(2000) | |
| L5_ASSOCIATION | NOT NULL | VARCHAR2(2000) | |
| L6_SUB_ASSOCIATION | NOT NULL | VARCHAR2(2000) | |

| Field_Name | Nullable? | Field_Definition (in Oracle) | Comments |
|---|---|---|---|
| SOURCE_DESCRIPTION | NOT NULL | VARCHAR2(2000) | |
| ENVIRONMENTAL_DESCRIPTION | | VARCHAR2(2000) | |
| STATE | | VARCHAR2(20) | Working field for Aust. Govt |
| COMMENTS | | VARCHAR2(2000) | Working field for Aust. Govt |
| XML_LOADDATE | | DATE | Working field for Aust. Govt |
| XML_STATUS | | VARCHAR2(50) | Working field for Aust. Govt |
| DATA_SET_NUMBER | | NUMBER(10) | Working field for Aust. Govt |
| STRATUM | | | |
| STRATUM_ID | NOT NULL | NUMBER(10) | Primary key |
| VEG_ID | NOT NULL | NUMBER(10) | Foreign key (NVIS_ID in Aust. Govt system) |
| ---------- | ---------- | ---------- | |
| STRATUM_CODE | NOT NULL | VARCHAR2(20) | |
| SUB_STRATUM_RANK | | NUMBER(10) | |
| NUMBER_OF_GROWTH_FORMS | NOT NULL | NUMBER(10) | |
| NUMBER_OF_TAXA | NOT NULL | NUMBER(10) | |
| COVER_TYPE | NOT NULL | VARCHAR2(20) | |
| COVER_TYPE_DERIV_METHOD | | VARCHAR2(2000) | |
| COVER_MINIMUM_VALUE | | NUMBER(5,1) | |
| COVER_MAXIMUM_VALUE | | NUMBER(5,1) | |
| COVER_MEDIAN_VALUE | | NUMBER(5,1) | |
| COVER_MEAN_VALUE | NOT NULL | NUMBER(5,1) | |
| COVER_CODE | NOT NULL | VARCHAR2(20) | |
| HEIGHT_TYPE | NOT NULL | VARCHAR2(20) | |
| HEIGHT_TYPE_DERIV_METHOD | | VARCHAR2(2000) | |
| HEIGHT_MINIMUM_VALUE | | NUMBER(5,1) | |
| HEIGHT_MAXIMUM_VALUE | | NUMBER(5,1) | |
| HEIGHT_MEAN_VALUE | NOT NULL | NUMBER(5,1) | |
| HEIGHT_MEDIAN_VALUE | | NUMBER(5,1) | |
| HEIGHT_CLASS | NOT NULL | NUMBER(10) | |
| DOMINANT_STRATUM_FLAG | NOT NULL | VARCHAR2(1) | |
| TAXON_DATA | | | TAXON |
| TAXON_DATA_ID | NOT NULL | NUMBER(10) | Primary key |
| STRATUM_ID | NOT NULL | NUMBER(10) | Foreign key |
| ---------- | ---------- | ---------- | |
| TAXON_DATA_RANK | NOT NULL | NUMBER(10) | |
| TAXON_DATA_DESCRIPTION | NOT NULL | VARCHAR2(2000) | |
| TAXON_DATA_SOURCE_CODE | | VARCHAR2(50) | Recommended for deletion. |
| COVER_TYPE | NOT NULL | VARCHAR2(20) | |
| COVER_TYPE_DERIV_METHOD | | VARCHAR2(2000) | |
| COVER_MINIMUM_VALUE | | NUMBER(5,1) | |
| COVER_MAXIMUM_VALUE | | NUMBER(5,1) | |
| COVER_MEDIAN_VALUE | | NUMBER(5,1) | |
| COVER_MEAN_VALUE | | NUMBER(5,1) | |
| TAXON_DATA_DOMINANCE_QUALIFIER | | VARCHAR2(20) | |

| Field_Name | Nullable? | Field_Definition (in Oracle) | Comments |
|---|---|---|---|
| TAXON_DATA_FREQUENCY | | VARCHAR2(20) | |
| TAXON_DATA_ALWAYS_THERE | NOT NULL | VARCHAR2(20) | |
| TAXON_DATA_SUMMARY_FLAG | NOT NULL | VARCHAR2(1) | |
| GROWTH_FORM | | | |
| GROWTH_FORM_ID | NOT NULL | NUMBER(10) | Primary key |
| STRATUM_ID | NOT NULL | NUMBER(10) | Foreign key |
| ---------- | ---------- | ---------- | |
| GROWTH_FORM_RANK | | NUMBER(10) | |
| GROWTH_FORM_CODE | NOT NULL | VARCHAR2(20) | Recommended for deletion and replacement with the GR_FORM attribute. |
| COVER_TYPE | | VARCHAR2(20) | |
| COVER_TYPE_DERIV_METHOD | | VARCHAR2(2000) | |
| COVER_MINIMUM_VALUE | | NUMBER(5,1) | |
| COVER_MAXIMUM_VALUE | | NUMBER(5,1) | |
| COVER_MEDIAN_VALUE | | NUMBER(5,1) | |
| COVER_MEAN_VALUE | | NUMBER(5,1) | |
| GR_FORM_DOMINANCE_QUALIFIER | | VARCHAR2(20) | |
| GROWTH_FORM_FREQUENCY | | VARCHAR2(20) | |
| GROWTH_FORM_ALWAYS_THERE | | VARCHAR2(20) | |
| GROWTH_FORM_SUMMARY_FLAG | NOT NULL | VARCHAR2(1) | |

| Field_Name | Nullable? | Field_Definition (in ArcGIS) | Comments |
|---|---|---|---|
| SPATIAL_DATA (Feature Class, SDE or shapefile) | | | |
| MAPUNT_IDENTIFIER | NOT_NULL | Long Integer (0) | Primary key for non-spatial Attributes, assuming multipart polygons. |
| NO_VEG_DESC | NOT NULL | Short Integer (4) | |
| SPATIAL_MIX | NOT NULL | Text (50) | |
| VEGDSC1 | NOT NULL | Long Integer (0) | Foreign key |
| VEGDSC2 | | Long Integer (0) | Foreign key |
| VEGDSC3 | | Long Integer (0) | Foreign key |
| VEGDSC4 | | Long Integer (0) | Foreign key |
| VEGDSC5 | | Long Integer (0) | Foreign key |
| VEGDSC6 | | Long Integer (0) | Foreign key |
| VEGPROP1 | | Short Integer (4) | |
| VEGPROP2 | | Short Integer (4) | |
| VEGPROP3 | | Short Integer (4) | |
| VEGPROP4 | | Short Integer (4) | |
| VEGPROP5 | | Short Integer (4) | |
| VEGPROP6 | | Short Integer (4) | |
| DATA_SET_NUMBER | | Long Integer (0) | Working field for Aust. Govt |

## Appendix F: Acknowledgements: Australian Vegetation Attributes V1.0 – 7.0

**Contributors**
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Australian Capital Territory
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## Appendix G: The NVIS attribute requirements

Each NVIS attribute presented in Chapter 4 has a standardised descriptor code in the row titled 'Requirement'. Table 19 following, defines the use of these descriptors and codes. When interpreting existing data into the NVIS database, the data custodian is requested to record at least the attributes in the following *essential* categories, so that the data can be easily incorporated into the existing NVIS framework:

- mandatory
- QAQC (Quality Control & Quality Assurance); and
- essential

When planning new vegetation surveys, the data custodian is encouraged to collect information which is identified as *recommended* and *optional*, as well as the above categories, so that the NVIS data can be refined and extended to better meet user needs.

**Table 19 NVIS Attribute requirements**

| Requirement Descriptor[80] | Description | Required For: |
|---|---|---|
| Mandatory | Administrative/ reference data. | Identification, location and management of the main components of the vegetation database and information transfer. |
| QAQC | These Quality Control & Quality Assurance attributes are needed to provide information on the origins, methods and quality of the data. | Quality Assurance and Quality Control of the Data. Assessment of the limitations of the data by potential users. |
| Essential | Essential | Defining and population of a useful vegetation description at all levels in the NVIS information hierarchy. |
| Recommended | If used, the attribute will contribute to a more complete dataset. | Improved efficiency of databasing and/or field to meet additional user requirements and/or quantitative evidence to underpin interpreted field(s). |
| Automated | Derived from other attributes by an automatic (rule-based) process. | A complete NVIS hierarchy; useful summary data. |
| Optional | Included to provide more flexibility and clarification for additional information where required. If used, the attribute will contribute to a more complete dataset. | Experimentation with additional fields. |
| Proposed | New or amended fields recommended for addition, deletion or change by NVIS coordinator, reviewers and stakeholders. | Improvements to the NVIS framework. |

Each requirement descriptor is further elaborated, below:

[80] Code used in Chapter 4 descriptions of each NVIS attribute.

**1. Mandatory**

This is basic identifier information to enable storage, management and transfer of NVIS data records. The absence of content in these fields renders the relevant records unusable.

Some of this identifier information, for example the NVIS_ID – see the Veg_Description and Map_Unit tables in Chapter 4, is generated by the Australian Government, upon receipt of new data from data custodians.

**2. QAQC**

These Quality Assurance and Quality Control attributes are necessary to provide information on the origins, methods and quality of the data. The absence of content in these fields would render the relevant datasets and records of questionable utility. Users of the data would be uncertain of the origins and tolerances of the data and whether it was suitable for their analyses.

For example, the IMAGERY_SOURCE gives a description of the base images used to make the vegetation map. The custodian should distinguish between aerial photographs and satellite imagery, since each source has inherent strengths and weaknesses.

**3. Essential**

These attributes need to be filled out to define and populate a useful vegetation description at all levels in the NVIS information hierarchy. For example, the COVER_CODE in the Stratum table is essential to creating a valid vegetation description in the Veg_Description table.

Data sets compiled into the NVIS, that do not include the required descriptions or codes for all essential attributes will be meaningless or of very limited utility. Where the attribute is essential, the data custodian is required to complete missing information as listed in Table 15 (Example(s) of combining the NVIS Ecological/Land Cover Hierarchy with the NVIS vegetation hierarchy to form the NVIS information hierarchy). Some incomplete records will be incorporated, but will have limited functionality with respect to the information hierarchy.

**4. Recommended**

Through experience with using the NVIS dataset, supply of content in these fields enhances the utility of the record. It provides a requirement class between the mandatory/essential/QAQC and Optional for the NVIS collaborators to progressively improve the national collection and databasing of vegetation information. For example, the COVER_MEAN_VALUE in the Growth_Form table is not essential for an NVIS vegetation description, but provides evidence to support the assignment of dominance among the growth forms (attributes: GROWTH_FORM_DOMINANCE_QUALIFIER and GROWTH_FORM_RANK).

**5. Automated**

These attributes are derived by an automatic, rule-based program and thus do not need to be filled out by the data custodian. For example, the attributes to store Levels I to 4 components of the NVIS information hierarchy in the Veg_Description table.

**6. Optional**

Attributes defined as optional have been included to provide the data custodian a means to experiment with additional attributes that may be of use in the NVIS framework. Attributes defined as optional are not critical to the data set, although every effort should still be made to include them in the NVIS. The NVIS collaborators review these fields from time to time.

**7. Proposed**

From time to time, NVIS stakeholders identify changes that would improve the NVIS database. See Appendix P for proposed additional attributes for the NVIS Database.

## Appendix H: Summary of changes Australian Vegetation Attributes V6.0 – V7.0

Since the compilation of the NVIS (2001) dataset, the NVIS database has been redesigned to improve its efficiency. Major changes were made in tables dealing with map units and vegetation descriptions, to reduce duplication and excessive redundancy. These processes provided recommendations for improvements to attribute definitions and look-up tables in ESCAVI (2003).

Subsequent to the restructuring of the NVIS database in 2003, an XML-based data transfer protocol was developed and implemented. This implemented the agreed rules to improve the consistency of content and to generate higher levels in the NVIS vegetation hierarchy.

Major changes from Version 6.0 to 7.0 include:

- Re-writing the Introduction to make the purpose and applications of NVIS clearer.
- Making the relationship between NVIS and derived products clearer.
- Documentation of the spatial linkages of the NVIS database and the recommended treatment of mosaics in the system.
- Addition and integration of land cover into the NVIS framework.
- A standardised coloring system for the NVIS framework so that the components can be tracked across diagrams and tabular information.
- Improved indexing of the NVIS attributes and associated lookup tables.
- Added a new section and Appendices to document the XML Transfer System.
- Changes to the entity:relationship diagram of the NVIS database to bring it up to date with current usage.
- Addition of an entity:relationship diagram for additional tables used by the NVIS coordinator.
- Recommended deprecation and probable deletion of the Taxon Lists and Taxon Lists.

Origin tables, after reviewing the checking of plant names in NVIS. Currently, this is via the Species Profile and Threats (SPRAT) database[81] which was designed to manage multiple lists; in future, checking names against web services is probably the path ahead.

Minor changes from Version 6.0 to 7.0 include:

- Removed reference to 'ecologically-dominant stratum[82]' in the definition of Levels 1, 2 and 3 of the the NVIS vegetation hierarchy (Table 3—The NVIS vegetation hierarchy).
- Changed some field lengths to a few standard lengths, to simplify program declarations.
- Added the full names for growth forms to encourage their use c.f. one-letter growth form codes which have reached saturation. Several revisions of NVIS and different systems in each state mean that the single-letter code is sometimes ambiguous when datasets are compiled at the national level. With full names, the intention of the

[81] http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl

[82] Since no references could be located to document a repeatable protocol.

vegetation interpreter is definite. However, documentation of the single-letter codes have been retained, for now, since these are still used in back-end computer operations and the XML Transfer System.

- Added new values to the LUT for SPATIAL_MIX to cater for a greater range of mosaics.
- Altered threshold for dominant mosaic from 70% to 60% to enable more mosaics to be characterised in this way; where proportion data are available, very few meet the 70% threshold.
- Slight changes to allowable values in ST05 COVER TYPE.
- Changes to allowable values in ST12 HEIGHT TYPE.
- Several new attributes proposed to better document input datasets and the interpretation of vegetation types into the NVIS notation.
- Rewrote the agreed rules (Section 5.1.2—Data Checking Rules) to be clearer and more in line with current practice.
- Commonwealth changed to Australian Government or NVIS coordinator, depending on the context.
- Updated and extended the references.
- Appendix I: Obsolete attributes.

**(Australian Vegetation Attributes deleted from Version 6.0 or scheduled for deletion.)**

- Mentions of Table numbers in the attribute descriptions may be for Version 5.0, 6.0 or 7.0 of the attribute manual.
- For cited references, see ESCAVI (2003).

### Deletions from the data set table

In the NVIS Oracle Database (**Data_Set table)**, the data from the next four fields has been parsed into new, simpler fields with the year only. These are much easier to use than date fields. (Two similar fields in MAPPING_SOURCE retain date fields, since there is merit in retaining data on dates. Dates could be useful for checking particular remotely-sensed imagery and indicate the season of capture, which is often important to know.)

| 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** |
| **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:** | **09/04/1978** |

| | |
|---|---|
| **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.** |
| **Status:** | **Implemented in the NVIS Oracle database. Deprecation and deletion recommended.** |

| **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** |
| **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:** | **06/06/1996** |
| **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.** |
| **Status:** | **Implemented in the NVIS Oracle database. Deprecation and deletion recommended.** |

| **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)** |
| **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.** |
| **Example:** | **09/04/1978** |
| **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. Deprecation and deletion recommended.** |

| 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)** |
| **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.** |
| **Example:** | **06/06/1996** |
| **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. Deprecation and deletion recommended.** |

**Deletions from the reference table**

The primary key REFERENCE_ID is adequate for identifying each reference and the REFERENCE NUMBER is not needed.

| Attribute: RF 1 - REFERENCE NUMBER | |
|---|---|
| **Heading** | **Details** |
| **Purpose:** | **To uniquely identify each reference within each dataset.** |
| **Requirement:** | **Optional** |
| **Database Field Name:** | **REF_NUMBER** |
| **Description:** | **A unique identifier for each reference beginning from 1 in each dataset.** |
| **Value:** | **Number(10); Valid range 1-999999999** |
| **Example:** | **15** |
| **Review:** | **Doesn't seem to add much value and would seem to unnecessarily link generic references to one dataset. Multiple entry of generic references would be the result. Recommend further review with a view to deletion.** |
| **Status:** | **Implemented in the NVIS Oracle database.** |

**Deletions from the map unit table**

Duplicated vegetation attributes in the MAP_UNIT table were only temporary working fields following the 2003 restructure of NVIS. Most of the fields, except SOURCE-CODE[83], can now be dropped.

| Attribute: MU 13A - SOURCE CODE COMPONENT | |
|---|---|
| **Heading** | **Details** |
| **Purpose:** | **To split the source code as supplied by the data supplier into its components. This assists with the matching of source codes to NVIS descriptions.** |
| **Requirement:** | **Mandatory** |
| **Database Field Name:** | **SRC_CODE_COMPONENT** |
| **Description:** | **A single state source code for a vegetation type. The source codes of the component vegetation associations within the mosaic exist as independent entities within the state system and map directly to NVIS descriptions. There should be no inconsistency with mapping source code to vegetation description. Vegetation descriptions are not duplicated so there is no residual redundancy.** |
| **Value:** | **Character(50)** |
| **Example:** | **9069100~1; 10bh_B~2** |
| **Review:** | **This field has been filled out by the Commonwealth as an interim measure. Many source codes for mosaics need to be resolved into their component vegetation descriptions by data custodians.** |
| **Status:** | **Implemented in the NVIS Oracle database. NB: This field must be retained in the MAP_UNIT table as an interim measure until all mosaics are resolved into their component vegetation descriptions.** |

| Attribute: MU 14 - SOURCE DESCRIPTION | |
|---|---|
| **Heading** | **Details** |
| **Purpose:** | **To describe the mapping unit as used by the data supplier.** |
| **Requirement:** | **Mandatory** |
| **Database Field Name:** | **SOURCE_DESCRIPTION** |
| **Description:** | **The original short description used by the data custodian for characterising the map unit. It is commonly used as the legend for mapping purposes.** |
| **Value:** | **Character (2000).** |
| **Example:** | **Montane grassy woodland; Coastal vine-rich forest** |
| **Review:** | **Most mosaics are yet to be resolved into their component vegetation descriptions.** |

[83] Duplicated from the Veg_Description table.

| | |
|---|---|
| **Status:** | **Implemented in the NVIS Oracle database. This field has been retained in the MAP_UNIT table as an interim measure until all mosaics are resolved into their component vegetation descriptions. SOURCE_DESCRIPTION, the equivalent field in the table:VEG_DESCRIPTION, will be retained.** |

**Deleted taxon data information**

The following attribute has been deleted from the TAXON_DATA table.

| **Attribute 108: TD03 TAXON DATA SOURCE CODE** | |
|---|---|
| **Field** | **Detail** |
| **Purpose:** | To supply a code for the taxon against which ecological data is entered in the TAXON_DATA table. |
| **Requirement:** | Optional |
| **Database Field Name:** | TAXON_DATA_SOURCE_CODE |
| **Description:** | The data supplier's unique source code for the taxon. 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 a remanant of previous NVIS practice. |
| **Status:** | Implemented in the NVIS Oracle database and the XML transfer system. Recommend deprecation in future. |

**Deleted structural information**

The following attribute has been deleted from the STRATUM table.

| **Attribute: STR 22 - TAXON DESCRIPTIONS** | |
|---|---|
| **Heading** | **Details** |
| **Purpose:** | **To describe the dominant species of the substratum.** |
| **Requirement:** | **Mandatory** |
| **Database Field Name:** | **TAXON_DESCRIPTIONS** |
| **Description:** | **The full taxonomic names of the dominant taxa for the substratum as listed in the GR2. DOMINANCE SEPARATOR attribute.** |
| **Value:** | **Character (255).** |
| **Example:** | **Eucalyptus obliqua** |
| **Review:** | **As part of the restructure (2001-2002), this field was found to duplicate information in the VEG_DESCRIPTION table (sub-association and/or association descriptions) and in the TAXON table (TAXDSC_ID can be linked to TAXON_DESCRIPTION table to generate species names.). Data custodians often appear to use this field to provide fuller species lists for a vegetation type. However, the chance of major inconsistencies remain, unless the field** |

| | |
|---|---|
| | **is redefined to include only supplementary species - i.e. those species not recorded in the other tables.** |
| **Status:** | **Implemented in the NVIS Oracle database. Obsolete. Needs to be deleted from the database. Recommend investigation of requirement for full species lists in a vegetation description; then, if required, additional design work is needed.** |

**Deleted taxon list origin information**

This table exists, but is obsolete with the data only current to NVIS version 1.0. The whole table can thus be deleted[84]. Need to review NVIS linkages to SPRAT and web services for Australian plant names provided by the Centre for Plant Biodiversity Research.

| **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** |
| **Comments:** | |
| **Status:** | **Implemented in the NVIS Oracle database.** |

| **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)** |
| **Example:** | **4** |
| **Comments:** | **May need two attributes.** |

[84] Any relevant data can be retrieved from previous NVIS versions.

| | |
|---|---|
| **Status:** | **Implemented in the NVIS Oracle database. Deprecation and deletion recommended.** |

**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 assign 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** |
| **Comments:** | **Any known limitations, errors, caveats or user instructions should be added in this attribute.** |
| **Status:** | **Implemented in the NVIS Oracle database. Deprecation and deletion recommended.** |

**Deleted taxon source information**

This table exists, but is obsolete with the data only current to NVIS version 1.0. The whole table can thus be deleted[85]. Need to review NVIS linkages to SPRAT and web services for Australian plant names provided by the Centre for Plant Biodiversity Research.

| Attribute: TL01 - TAXON LISTS SOURCE CODE | |
|---|---|
| **Heading** | **Details** |
| **Purpose:** | |
| **Requirement:** | **Optional** |
| **Database Field Name:** | **TAXON_LISTS_SOURCE_CODE** |
| **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.<br>Codes are not used in the current NVIS compilations, so are definitely obsolete, here.** |
| **Status:** | **Implemented in the NVIS Oracle database. Deprecation and deletion recommended.** |

| 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** |
| **Description:** | **Recognised Family name as at time of entry into the database. The data custodian must use the latest taxonomic name for each species.** |
| **Value:** | **Character(50).** |
| **Example:** | **Myrtaceae** |
| **Comments:** | |
| **Status:** | **Implemented in the NVIS Oracle database. Deprecation and deletion recommended.** |

| Attribute: TL03 - TAXON LISTS GENUS | |
|---|---|
| **Heading** | **Details** |

[85] Any relevant data can be retrieved from previous NVIS versions.

| | |
|---|---|
| **Purpose:** | **To describe a genus of a taxon in the master list of a jurisdiction.** |
| **Requirement:** | **Essential** |
| **Database Field Name:** | **TAXON_LISTS_GENUS** |
| **Description:** | **Recognised Genus name as at 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:** | |
| **Status:** | **Implemented in the NVIS Oracle database. Deprecation and deletion recommended.** |

| **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** |
| **Description:** | **Recognised Species name as at time of entry into the database. The data custodian must use the currently-accepted taxonomic name for each species.** |
| **Value:** | **Character(50).** |
| **Example:** | **tetrodonta** |
| **Comments:** | |
| **Status:** | **Implemented in the NVIS Oracle database. Deprecation and deletion recommended.** |

| **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** |
| **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:** | |
| **Status:** | **Implemented in the NVIS Oracle database. Deprecation and deletion recommended.** |

| **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** |
| **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.** |
| **Status:** | **Implemented in the NVIS Oracle database. Deprecation and deletion recommended.** |

**Look-up Table for: TAXON LISTS INFRASPECIES RANK**

| Code | Explanation |
|---|---|
| subsp. | subspecies - Taxon description is at the subspecies level. |
| var. | variety - Taxon description is at the variety level. |
| cv. | cultivar - Taxon description is at the cultivar level. |
| f. | form - Taxon description is at the form level. |
| s. lat. | sensu lato - The taxon description is at the species level refers to a wide interpretation of the species. |
| 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** |
| **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. Deprecation and deletion recommended.** |

| Attribute: TL08 - TAXON LISTS INFRASPECIES AUTHOR | |
|---|---|
| **Heading** | **Details** |
| **Purpose:** | |
| **Requirement:** | **Recommended** |
| **Database Field Name:** | **TAXON_LISTS_INFRA_SP_AUTHOR** |
| **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:** | |
| **Status:** | **Implemented in the NVIS Oracle database. Deprecation and deletion recommended.** |

| 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** |
| **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. Deprecation and deletion recommended.** |

| **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. Deprecation and deletion recommended.** |

## Appendix I1: Examples of NVIS spatial linkages[86]

The way in which the contents of the spatial data and closely-related tables have been structured in practice is best illustrated by looking at some extracts of records from the relevant tables. The inter-convertibility of the spatial information and what is meant by "flat" and "deep" table structures should become clearer by examining these tables[87]. The same or related records are illustrated in all extracts below, with the colouring[88] used to track records across the two spatial formats (SPATIAL_DATA and MAP_UNIT). In the following example, from the Flinders Ranges in South Australia, the vegetation type labelled as FR002 (NVIS_ID=50151) is the most extensive in six mapping units. In one unit it is the only vegetation type present; in the other five it is accompanied by other described types (FR004, FR005 and FR008) in various permutations. In NVIS version 4.2, the vegetation type FR0002/50151 is also present in seven other mosaics[89] in a minor position – i.e. other than the first.

### VEG_DESCRIPTION table example

The structure of the VEG_DESCRIPTION table (Table 20) is relatively straight-forward. Many of the fields in this table are quite long and hence difficult to display. Hence in this example, the more complex levels of the NVIS hierarchy have been left blank. The records of vegetation descriptions in this table (referenced by NVIS_ID) are those referred to in the spatial data examples below.

**Table 20 Extract from VEG_DESCRIPTION table, with only some fields shown**

| NVIS_ID | SOURCE CODE | LEVEL OF DETAIL | NO. OF STRATA | L1_CLASS | L2_STRUCTURAL_FORMATION | L3 | L4 | L5 | L6 | SOURCE_DESCRIPTION | ENVIRONMENTAL_DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50151 | FR0002 | level6_sub_association | 2 | Samphire shrub | Low open samphire shrubland | | | | | shrub | Swamps and Closed drainage depressions;Drainage lines, floodouts, lakes and Run-on landforms;Saline;Swamps and low-lying depressions |
| 50153 | FR0004 | level6_sub_association | 3 | Shrub | Tall open shrubland | | | | | shrub | Terraces and Floodouts;Drainage lines, floodouts, lakes and Run-on landforms, surrounding ranges;Clay to Sand/Loam;Alluvial;Assoc with water courses and low-lying areas |
| 50154 | FR0005 | level6_sub_association | 1 | Shrub | Shrubland | | | | | shrub | Floodouts;Drainage lines, floodouts, lakes and Run-on landforms, surrounding ranges;Clay to Loam;Alluvial, saline;Terminal floodouts |
| 50157 | FR0008 | level6_sub_association | 2 | Chenopod shrub | Low chenopod shrubland | | | | | shrub | Plains;Plains and rises;Clay to Clay/Loam/Sand;Hard soil |

### SPATIAL_DATA example

[86] Adapted from unpublished NVIS material prepared by G. Rozenbilds.

[87] In the table, the attribute names and values have been truncated and/or omitted to fit the material into a manageable space.

[88] These colours are not related to the NVIS components elsewhere in this Manual.

[89] These are not shown in these examples.

This is the attribute table attached to the spatial data (Table 21). It demonstrates a "flat" or horizontal table structure with one record[90] per MAPUNT_IDENTIFIER. This structure is the most practical for using in a GIS. Successive vegetation associations within a mosaic are identified by attributes NVISDSC1, NVISDSC2, NVISDSC3[91] etc. across the table. In this example, mosaics have been identified and resolved into the component vegetation types. However, the type of mosaic has not been specified and the (unmapped) proportions within each mosaic have not been recorded.

**Table 21 Extract from SPATIAL_DATA (The colours are used to track record linkages and are specific to this Appendix).**

| MAPUNT IDENTIFIER | NO OF VEG DESC | SPATIAL MIX | NVISDSC1 | NVISDSC2 | NVISDSC3 | NVISDS C4-6 (not shown) | VEG PROP1 | VEG PROP2 | VEG PROP3 | VEGPROP4-6 (not shown) |
|---|---|---|---|---|---|---|---|---|---|---|
| 59102832 | 1 | pure | 50151 | 0 | 0 | | 0 | 0 | 0 | |
| 59101270 | 2 | mosaic unknown | 50151 | 50153 | 0 | | 0 | 0 | 0 | |
| 59101271 | 3 | mosaic unknown | 50151 | 50153 | 50154 | | 0 | 0 | 0 | |
| 59101272 | 2 | mosaic unknown | 50151 | 50154 | 0 | | 0 | 0 | 0 | |
| 59101273 | 2 | mosaic unknown | 50151 | 50157 | 0 | | 0 | 0 | 0 | |
| 59101274 | 3 | mosaic unknown | 50151 | 50157 | 50153 | | 0 | 0 | 0 | |

[90] Assuming multipart polygons (ESRI, 2017). In practice, NVIS spatial data is usually managed in single-part polygons.

[91] This extends to a maximum of six veg types in a mosaic.

### MAP_UNIT Table example

The MAP_UNIT table (Table 22) demonstrates a “deep” or vertical structure for the spatial data which is a more efficient structure in a relational database. It contains several records per MAPUNT_IDENTIFIER, one for each vegetation association within a mosaic, successively down the table. The codes within the NVIS_ID field refers to the NVIS_IDS in the VEG_DESCRIPTION table above.

**Table 22 Extract from MAP UNIT table (The colours are used to track record linkages and are specific to this Appendix).**

| MAPUNT IDENTIFIER | NVIS_ID | SPATIAL MIX | NUMBER OF VEG DESC | VEG DESC POSITION | VEG DESC PROP'N |
|---|---|---|---|---|---|
| 59102832 | 50151 | pure | 1 | 1 | 100 |
| 59101270 | 50151 | mosaic unknown | 2 | 1 | -9999 |
| 59101270 | 50153 | mosaic unknown | 2 | 2 | -9999 |
| 59101271 | 50151 | mosaic unknown | 3 | 1 | -9999 |
| 59101271 | 50153 | mosaic unknown | 3 | 2 | -9999 |
| 59101271 | 50154 | mosaic unknown | 3 | 3 | -9999 |
| 59101272 | 50151 | mosaic unknown | 2 | 1 | -9999 |
| 59101272 | 50154 | mosaic unknown | 2 | 2 | -9999 |
| 59101273 | 50151 | mosaic unknown | 2 | 1 | -9999 |
| 59101273 | 50157 | mosaic unknown | 2 | 2 | -9999 |
| 59101274 | 50151 | mosaic unknown | 3 | 1 | -9999 |
| 59101274 | 50157 | mosaic unknown | 3 | 2 | -9999 |
| 59101274 | 50153 | mosaic unknown | 3 | 3 | -9999 |

### Discussion

The data in the two tables immediately above is directly equivalent. The fields MAPUNT_IDENTIFIER, SPATIAL_MIX, and NUMBER_OF_VEG_DESCRIPTIONS are common to both, (other than limits to field names in the SPATIAL_DATA). NVIS_ID in the MAP_UNIT table is equivalent to NVISDSC1, NVISDSC2, NVISDSC3 etc. VEG_DESC_PROPORTION (MAP_UNIT table) is equivalent to VEG_PROP1, VEG_PROP2, VEG_PROP3 etc. VEG_DESC_POSITION in the MAP_UNIT table is identified by the numeral in the attribute name of the attributes NVISDSC1, NVISDSC2, NVISDSC3 in the SPATIAL_ DATA. Note that the examples in the records above utilize up to three vegetation descriptions within a spatial unit; up to six are permissible as per the detailed NVIS structure diagram.

The SPATIAL_DATA structure is best suited to the spatial (GIS) systems environment and likewise the MAP_UNIT table to a database environment. However, both configurations of the spatial data have a vital role to play in the NVIS system. For example, to query the spatial coverage for a particular vegetation association the NVIS_ID in the VEG_DESCRIPTION table must be joined to each NVISDSC in the SPATIAL_COVERAGE in turn. It would be more efficient to conduct a single query within the database, linking the NVIS_IDs in the MAP_UNIT and VEG_DESCRIPTION tables to identify all spatial units where the association is found, whatever its position in a mosaic. In practice, the querying of mosaic contents is best done algorithmically using a procedural computer language, such as Perl or Python; see Figure 6— also included for reference below.

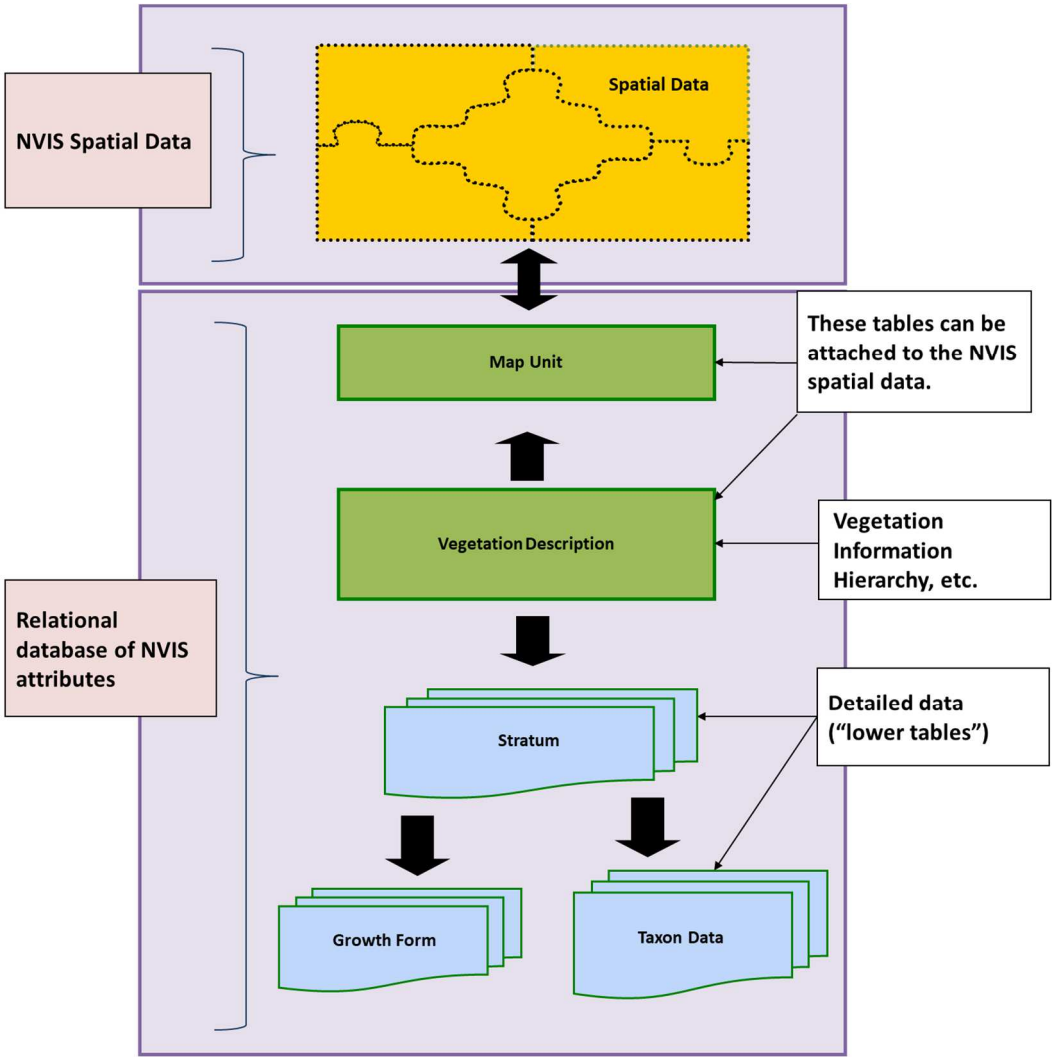


**Figure 6 (repeated) Overview of the NVIS Vegetation Attribute Structure V7.0.**

*The NVIS database comprises data arranged in four different subsystems. Three of these subsystems are shown here. These are vegetation spatial data; vegetation description plus map unit attributes and detailed vegetation attributes. For simplicity, the tables and attributes for dataset information are not shown. The arrows, here, represent data flows, rather than formal relationships between objects. See Appendix C for a more complete diagram.*

## Appendix I2: Mosaics in the NVIS framework[92]

### Introduction

The NVIS system attempts to cater for all variations in the treatment of mosaics. Mosaics exist where there is more than one vegetation association related to a spatial or mapping unit. The solution devised is inextricably bound up with the conceptual shift in focus from spatial unit descriptors to vegetation descriptions – see Chapter 3 and Appendix L1. The system is required to accommodate a variety of geographic data models found in Australia. The NVIS system handles some configurations better than others. Consequently, there is an optimal or recommended structure for handling mosaics within the NVIS framework.

The following section attempts to explain the reasoning behind the optimal solution for handling mosaics. There are several cases when representing the variability of vegetation within a mapping unit (Table 23). Why does this matter? Because vegetation mapping usually involves interpretation and simplification, driven by resource constraints in mapping an area in a reasonable timeframe (Thackway et al., 2009). These considerations can be managed, in part, by the selection of minimum mapping area and the level of vegetation classification. Vegetation types identified from field survey can be included in mapping units in various permutations and combinations, but their exact configuration within the map unit is unknown. Sometimes mosaics or complexes are unavoidable, such as wetlands with the seasonal and other changes of vegetation types (and open water) or hummock/hollow microrelief.

**Table 23 Representation of real world mosaics in vegetation mapping.**

| Example | Vegetation Descriptions | Description |
|---|---|---|
| Case 1<br>Not a Mosaic | **A** | Single label and description<br>(The most common spatial configuration) |
| Case 2<br>Resolved Mosaic | **B**, **C**, **D** | Multiple independent labels and descriptions |
| Case 3<br>Unresolved Mosaic | E<br>(<=>Y)<br>(<=>Z) | Single label – multiple related associations (and descriptions)<br>(Often referred to as a “complex”) |

### Case 1 No mosaics

This is the situation conventionally found in most vegetation mapping, where a polygon or class of polygons has a single interpretation or identity. In this example, a single vegetation association is the contents of the mapping unit – i.e a SPATIAL_MIX of “pure”. However, especially at coarse scales, these vegetation maps often include unresolved mosaics (complexes – see Case 3, below) to hasten the mapping.

### Case 2 Resolved mosaics

This situation arises where the focus of mapping is upon representing the location and distribution of unique vegetation associations, which are identified separately and distinctly within the system. These are sometimes represented as combinations of the components e.g.

[92] Adapted from unpublished NVIS material prepared by G. Rozenbilds.

in syntax like B, C, D or B/C/D. However, within the NVIS framework the requirement is for the components to be differentiated and held separately as the contents of separate fields within the SPATIAL_DATA format:

- NVISDSC1: B
- NVISDSC2: C and
- NVISDSC3: D.

The same information is held as separate records (NVIS_IDS) for the same MAPUNT_IDENTIFIER in the MAP_UNIT table (Appendix L1).

**Case 3 Unresolved mosaics (complexes)**

An "unresolved mosaic" or "complex" arises when multiple vegetation types are shoehorned into a single mapping unit. The essential feature is that a single label on the spatial coverage is related to several vegetation associations. However, the individual vegetation associations are not identified in the mapping sytem as separate units[93], so there is redundancy and difficulty in comparing the extent of each type across a study area. This is indicative of a mapping system where the emphasis is upon ascribing values to spatial units, and it is unlikely that "definitive vegetation types" have been developed (Thackway *et al.*, 2009).

The vegetation descriptions for these mosaic units may have been developed as a "complex" of either the entire composite or as distinct components. In either case, they do not possess a separate and distinct label or identifier. The vegetation associations within these mosaics may be unique to a specific spatial unit within the system, either individually or in combination with other mosaic spatial units. In the latter situation, further complications may arise in relation to duplication and consistency because a vegetation association does not possess a single, unique identity within the system.

**Handling of unresolved mosaics**

The issue of unresolved mosaics in NVIS has become less problematic and few remain. An interim solution was devised in the update of NVIS version 1.0 to 2.0. It is recommended that for the supply of NVIS data (to v7.0 standards), any unresolved mosaics should be resolved to their components on a permanent basis.

[93] The vegetation associations in a complex are sometimes described in project reports. The NVIS framework attempts to formalise relationships of these descriptions in the database and spatial data.

## Appendix J: RBG Values for colour-coding NVIS framework components

| Old value (<2017) | New value (>2017) | New value RBG |
|---|---|---|
| 1. Data Management and Compilation Standards. | 1. Data Management and Compilation Standards. | R 153<br>B 153<br>G 255 |
| 2. Data Documentation Attributes and Dataset Boundaries | 2. Data Documentation Attributes and Dataset Boundaries | R 251<br>B 183<br>G 246 |
| 3. Vegetation Spatial Data | 3. Vegetation Spatial Data | R 255<br>B 204<br>G 000 |
| 4. Vegetation Description and Map Unit Attributes | 4. Vegetation Description and Map Unit Attributes | R 155<br>B 157<br>G 089 |
| 5. Detailed Vegetation Attributes | 5. Detailed Vegetation Attributes | R 192<br>B 215<br>G 252 |
| 6. Checking Rules | 6. Checking Rules | R 204<br>B 255<br>G 204 |
| 7. Taxonomic Attributes | 7. Taxonomic Attributes | R 192<br>B 192<br>G 192 |
| 8. Site Attribute Standards | 8. Site Attribute Standards | R 255<br>B 255<br>G 153 |
| 9. Vegetation Condition Attributes | 9. Vegetation Condition Attributes | R 170<br>B 234<br>G 037 |
| 10. Geospatial Metadata | 10. Geospatial Metadata | R 255<br>B 204<br>G 153 |
| 11. Derived Products | 11. Derived Products | R 051<br>B 204<br>G 204 |
| Commonwealth only | Commonwealth only | R 149<br>B 179<br>G 215 |

# Appendix K: Key to Major Vegetation Groups

**Background**

- Major Vegetation Groups were developed for the original NLWRA Vegetation Assessment (NLWRA, 2001). Profiles of each MVG were published in that document.
- For Version 3.0 of NVIS the MVG classification was revised. The detailed NVIS was completely resupplied and each vegetation description was allocated manually to an appropriate MVG.
- Spatial products, including MVGs and Major Vegetation Subgroups, were developed as the basis for analysing vegetation change from the estimated pre-1750 distributions to the present. These products were also published via a download facility (http://www.environment.gov.au/erin/nvis/data-products.html) and placed on web mapping tools.
- Promotional products were also developed, including a booklet containing a CD with upgraded MVG profiles (DEWR, 2007).
- A similar process was followed to update version 4.1 of the MVG classification and spatial product. However, instead of writing new profiles, it was seen as a higher priority to document the allocation decision process, so that it is more transparent and repeatable. Hence this key.
- Several other projects in Australia are using the FAO Land Cover Classification scheme, which will shortly become the ISO 19144-2 standard. In order to clarify the place of MVGs in a wider land cover classification, the first seven couplets of the key are devoted to the Dichotomous Phase of the FAO/ISO Land Cover Classification (see the Attachment for further details).
- It is recognised that the MVG classification is deficient in distinguishing the finer points of non-native and non-vegetation classes, even at the high-level Dichotomous Phase of the FAO/ISO LCC (Di Gregorio, 2005). However, this reflects the purpose of MVGs and the source data, both of which relate to documenting the extent of and changes to native vegetation in Australia. For example the distinction between natural and cultural aquatic non-vegetation cover would generally be better done by geographers experienced in hydrology rather than vegetation scientists. The user is referred to other land cover datasets, where non-vegetation and/or non-native vegetation has been collected and collated in a consistent and systematic manner.

**Using the Key**

- The user would normally take a completed NVIS description and examine its contents with a view to allocating into a particular MVG. Such a description would have a Level 5 and/or Level 6 description (ESCAVI, 2003), although preliminary assignment to an MVG is possible from a Level 3 description.
- In some cases, non-NVIS data provide sufficient information for a vegetation type (or source polygon in the case of air photo interpretation (API) data) to key out the feature to an MVG.
- In most cases, NVIS data is useful to “visualise” the community structure and composition.
- Look at the ‘dominant stratum’ (i.e. the “+” notation after the stratum code) assigned by the data custodian. This data for this stratum would normally be sufficient to key out the description to an MVG.
- The dominant genus/genera and dominant growth form (as indicated by the “^/hat” notation) for the stratum would give most information needed.
- In some cases, the species in that stratum may indicate particular MVG pathways, for example MVG1 Rainforests and Vine Thickets. At least, the species provide a cross-check for unusual descriptions (especially their height and cover codes) that may represent data errors or real plant communities.
- In some circumstances, the ‘dominant stratum’ assignment is questionable (for example, where a significant tree or shrub stratum is ignored in favour of the ground stratum) and another appropriate stratum should be selected.
- The SOURCE_DESCRIPTION and ENVIRONMENTAL _DESCRIPTION can also used to check the veracity of the custodian’s Level 5/6 description and your MVG assignment.

- Take the data assembled above for the particular vegetation description and work through the key in Table 1.
- In difficult cases, the SOURCE_CODE can be used to access published source reports and tabular material, using the Library and Internet systems.
- Unpublished material can also be sought from the relevant data custodians.
- Discussion with the custodian and vegetation experts on particular issues (i.e. a set of borderline and other problem vegetation descriptions) would also be fruitful.

| Key No. | Criteria | MVG or Couplet | Broader groupings or MVG Name |
|---|---|---|---|
| 0 | Areas for which no data are provided/available | MVG99 | Unknown/ data gap. |
| | Areas with land cover and/or vegetation data are provided/available | 1 | |
| 1 | A. Primarily Vegetated Areas<br>(this group includes vascular and non-vascular plant communities) | 2 | |
| | B. Primarily Non-Vegetated Areas | 3 | |
| 2 | A1. Terrestrial Primarily Vegetated Areas | 4 | |
| | A2. Aquatic or Regularly Flooded Primarily Vegetated Area | 5 | |
| 3 | B1. Terrestrial Primarily Non-Vegetated Areas | 6 | |
| | B2. Aquatic or Regularly Flooded Primarily Non-Vegetated Areas | 7 | |
| 4 | A11. Cultivated and Managed Terrestrial Areas | MVG25 | Cleared, non-native vegetation, buildings i.e. most MVGs. |
| | A12. Natural and Semi-Natural Vegetation | 9 | |
| 5 | A23. Cultivated Aquatic or Regularly Flooded Areas | MVG25 | Cleared, non-native vegetation, buildings. |
| | A24. Natural and Semi-Natural Aquatic or Regularly Flooded Vegetation | 9 | |
| 6 | B15. Artificial Surfaces and Associated Areas | MVG25 | Cleared, non-native vegetation, buildings. |
| | B16. Bare Areas | MVG27 | Naturally bare – sand, rock, claypan, mudflat |
| 7 | B27. Artificial Waterbodies, Snow and Ice | MVG24 | Inland aquatic – freshwater, salt lakes, lagoons. |
| | B28. Natural Waterbodies, Snow and Ice | 8 | |

| Key No. | Criteria | MVG or Couplet | Broader groupings or MVG Name |
|---|---|---|---|
| 8 | Mostly terrestrial/inland aquatic systems | MVG24 | Inland aquatic – freshwater, salt lakes, lagoons. |
| | Marine and marine-influenced aquatic systems | MVG28 | Sea and estuaries. |
| 9 | Native and semi-native vegetation with no further details | MVG26 | Unclassified native vegetation. |
| | Native and semi-native vegetation identified as "regrowth" by data provider, but limited further details provided. | MVG29 | Regrowth, modified native vegetation. |
| | Native and semi-native terrestrial vegetation | 10 | |
| 10 | Ecosystems dominated by vascular plants | 11 | |
| | Ecosystems dominated by lower plants. Vascular plants, if present, are very sparse (<1% cover). There is no specific MVG for this class (see also the Glossary Appendix A of Di Gregorio (2005)). | 39 | |
| 11 | Plant communities dominated by woody plants (trees and shrubs) – i.e. forests, woodlands, open woodlands, shrublands, mallee | 12 | |
| | Plant communities dominated by non-woody growth forms | 36 | |
| 12 | Woody plants growing in or near the intertidal zone | MVG23 | Mangroves. |
| | Woody plants growing in dryland, wetland or riparian habitats | 13 | i.e. the majority of vegetation types. |
| 13 | Plant communities dominated by trees.<br>Note that trees are usually single-stemmed and do not include mallees, mallee forms or shrubs | 14 | |
| | Plant communities dominated by multi-stemmed woody plants (shrubs or mallee growth forms)<br>Note that shrubs are multi-stemmed within 200mm of base or, if single-stemmed, are less than 2m tall. This group includes all communities dominated by mallees and mallee forms. | 27 | |
| 14 | Trees with crown cover > 20% (i.e. FPC > 10%) – forests and woodlands | 16 | |

| Key No. | Criteria | MVG or Couplet | Broader groupings or MVG Name |
|---|---|---|---|
| | Trees with crown cover < 20% i.e. FPC < 10%, but not scattered, nor clumped (open woodlands) | 24 | |
| | Trees with crown cover 0-5%, including isolated, scattered and clumped trees. | 15 | |
| 15 | Dominant stratum consisting of shrubs | 27 | |
| | Dominant stratum comprising non-woody (herbaceous, grassy, etc.) growth forms. | 36 | |
| 16 | Dominant trees with crown cover > 80% (i.e. FPC > 70%) – closed forests (NVIS cover_code = d) | 17 | |
| | Dominant trees with crown cover 20 – 80% (i.e. FPC 10 – 70%)- open forests and woodlands (NVIS cover_code = c or i) | 18 | |
| 17 | Plant community consisting of Indo-Malayan (tropical) species, with no genus clearly dominant; occasionally the plant community has a characteristic "Australian" genus as a co-dominant but not dominant (e.g. *Syncarpia, Eucalyptus, Lophostemon*, etc.); alternatively dominant trees from one or more Antarctican (cool temperate) genera (*Nothofagus, Podocarpus*, etc.) | MVG1 | Rainforests and vine thickets. |
| | Plant community dominated by low trees of characteristic "Australian" genera (*Melaleuca, Acacia, Leptospermum, Lophostemon, Syncarpia*, etc.) | MVG15 | Low Closed Forests and Tall Closed Shrublands. |
| | Plant community details not specified or likely to be erroneous; unlikely to be Indo-Malayan species. | MVG30 | Unclassified Forest. |
| | Plant community dominated by trees of: *Acacia auriculiformis, A. mangium, A. celsa, A. melanoxylon, A. polystachya* or in mixtures with rainforest genera. | MVG1 | Rainforests and vine thickets. |
| 18 | Tree stratum dominated by *Eucalyptus, Corymbia* and/or related genera (e.g. *Angophora, Syncarpia*, etc.). This group includes most eucalypt forests and woodlands in Australia | 19 | |

| Key No. | Criteria | MVG or Couplet | Broader groupings or MVG Name |
|---|---|---|---|
| | Tree stratum dominated by genera other than *Eucalyptus* (and relatives). This group includes communities where *Lophostemon* is dominant | 22 | |
| 19 | Dominant trees with crown cover 50-80% (FPC 30-70%) – open forests | 21 | |
| | Dominant trees with crown cover 20-50% (FPC 10-30%) – woodlands | 20 | |
| 20 | Ground stratum dominated by tall (> 0.5m) annual *Sorghum* spp. This group also includes open woodlands. | MVG12 | Tropical Eucalypt Woodlands/Grasslands. |
| | Tall annual *Sorghum* spp. absent from the ground stratum or only present in small amounts | MVG5 | Eucalypt Woodlands. |
| 21 | Trees with [stand] height > 30m | MVG2 | Eucalypt Tall Open Forests. |
| | Trees with [stand] height 10 – 30m | MVG3 | Eucalypt Open Forests. |
| | Trees with [stand] height < 10m | MVG4 | Eucalypt Low Open Forests. |
| 22 | Tree stratum dominated by one or more of the genera: *Acacia, Callitris, Casuarina* sens. lat., *Melaleuca* | 23 | |
| | Plant community consisting of Indo-Malayan (tropical) species, with no genus clearly dominant; occasionally the plant community has a characteristic "Australian" genus as a co-dominant but not dominant (e.g. *Syncarpia, Eucalyptus, Lophostemon*, etc.); alternatively dominant trees from one or more Antarctican (cool temperate) genera (*Nothofagus, Podocarpus*, etc.). This group includes semi-evergreen vine thicket. | MVG1 | Rainforests and vine thickets. |
| | Tree stratum not dominated by the above genera nor rainforest species in closed forest formations. (Also includes 'mixed' communities of the major genera (*Acacia, Callitris, Casuarina* sens. lat., *Eucalyptus, Melaleuca*, etc.) communities with no clear dominant and communities with *Syncarpia, Tristaniopsis, Lophostemon, Adansonia, Agonis, Alectryon, Archidensdropsis, Asteromyrtus, Banksia, Brachychiton, Cochlospermum, Erythrophleum, Excoecaria*, *Grevillea, Leptospermum, Livistona, Lysiphyllum, Macropteranthes, Neofabricia,* | MVG10 | Other Forests and Woodlands. |

| Key No. | Criteria | MVG or Couplet | Broader groupings or MVG Name |
|---|---|---|---|
| | *Notelaea, Pandanus, Terminalia* and *Thryptomene*as as dominant species) | | |
| 23 | Tree stratum dominated by the genus *Acacia*. | MVG6 | Acacia Forests and Woodlands. |
| | Tree stratum dominated by the genus *Callitris* (may be *Eucalyptus* co-dominant) | MVG7 | Callitris Forests and Woodlands. |
| | Tree stratum dominated by the genus *Casuarina, Allocasuarina*, etc. | MVG8 | Casuarina Forests and Woodlands. |
| | Tree stratum dominated by the genus *Melaleuca* and/or *Callistemon* | MVG9 | Melaleuca Forests and Woodlands. |
| 24 | Tree stratum dominated by the genus *Eucalyptus* (& close relatives) or Acacia. | 25 | |
| | Tree stratum not dominated by the genera *Eucalyptus* (and close relatives) nor *Acacia*. This group includes Tree stratum dominated by the genus *Callitris, Casuarina* sens. lat., *Melaleuca, Callistemon, Alectryon, Lysiphyllum, Lophostemon, Exceocaria, Grevillea, Terminalia, Adansonia, Bombax, Ventilago, Archidendropsis,* etc. | MVG31 | Other Open Woodlands |
| 25 | Tree stratum dominated by *Eucalyptus, Corymbia* and/or related genera (e.g. *Angophora*) | 26 | |
| | Tree stratum dominated by the genus Acacia | MVG13 | Acacia Open Woodlands. |
| 26 | Ground stratum dominated by tall (> 2m) annual Sorghum spp. | MVG12 | Tropical Eucalypt Woodlands/Grasslands. |
| | Tall annual Sorghum spp. absent from the ground stratum or only present in small amounts. This group includes most open woodlands in Australia. | MVG11 | Eucalypt Open Woodlands. |
| 27 | Plant communities dominated by multi-stemmed Eucalyptus species, i.e. mallee growth form. This group includes tree and shrub mallee. | 28 | |
| | Plant communities not dominated by mallee growth form – i.e. all other multi-stemmed shrub growth forms. This group includes most shrublands. NB: mallee growth form may still be 'present' in the community, but not dominant. | 30 | |
| 28 | Mallee eucalypts with crown cover > 20% (i.e. FPC > 10%) | MVG14 | Mallee Woodlands and Shrublands. |

| Key No. | Criteria | MVG or Couplet | Broader groupings or MVG Name |
|---|---|---|---|
| | Mallee eucalypts with crown cover < 20% i.e. FPC < 10%, but not scattered, nor clumped | MVG32 | Mallee Open Woodlands and Sparse Mallee Shrublands. |
| | Mallee eucalypts with crown cover 0-5%, including isolated, scattered and clumped trees | 29 | |
| 29 | Plant communities dominated by woody plants (trees and shrubs) – i.e. forests, woodlands, open woodlands, shrublands, mallee | 30 | |
| | Plant communities dominated by non-woody growth forms | 37 | |
| 30 | Plant community dominated by shrubs and/or tall shrubs with crown cover > 80% i.e. FPC > 70% | 31 | Dense shrublands |
| | Plant community dominated by shrubs and/or tall shrubs with crown cover < 80% (i.e. FPC <70%). This group includes sparse shrublands | 32 | Shrublands and open shrublands |
| 31 | Plant community consisting of Indo-Malayan (tropical) species, with no genus clearly dominant; alternatively dominant shrubs from one or more Antarctican (cool temperate) genera (*Nothofagus, Podocarpus, Athrotaxis,* etc.) | MVG1 | Rainforests and Vine Thickets. |
| | Plant community dominated by tall (>2m) shrubs of characteristic “Australian” genera (*Melaleuca, Acacia, Leptospermum*, etc.) | MVG15 | Low Closed Forests and Tall Closed Shrublands. |
| | Plant community dominated by hard, usually fine-leaved shrubs (generally < 2m tall) of many genera from the following plant families: Epacridaceae, Fabaceae, Myrtaceae, Casuarinaceae and Proteaceae. | MVG18 | Heathlands. |
| 32 | Shrub stratum dominated by the genus *Acacia* | MVG16 | Acacia Shrublands |
| | Shrub stratum not dominated by the genus *Acacia* (though *Acacia* may still be present). | 33 | |
| 33 | Plant community dominated by shrubs with semi-succulent leaves – i.e. of the families Chenopodiaceae, Frankeniaceae and/or the genus Nitraria. This group includes Saltbushes, bluebushes, samphires, etc. | MVG22 | Chenopod Shrublands, Samphire Shrublands and Forblands. |
| | Plant community with non-succulent leaves. | 34 | |

| Key No. | Criteria | MVG or Couplet | Broader groupings or MVG Name |
|---|---|---|---|
| 34 | Plant community dominated by hard, usually fine-leaved shrubs of many genera from the following plant families: Epacridaceae, Fabaceae, Myrtaceae, Casuarinaceae and Proteaceae | 35 | |
| | Plant community dominated by shrubs with softer and/or larger leaves from the following genera (*Melaleuca, Callistemon, Casuarina* sens. lat., *Senna, Eremophila*, *Grevillea, Santalum, Muehlenbeckia*). | MVG17 | Other Shrublands. |
| 35 | Shrub stratum generally lower than 2m. This group includes typical heathlands. | MVG18 | Heathlands. |
| | Shrub stratum generally taller than 2m. This group includes taller "heathlands" tending to scrub. Some low trees may actually be tall shrubs. | MVG17 | Other Shrublands. |
| 36 | Plant communities dominated by graminoid growth forms (grasses, rushes and sedges) | 37 | |
| | Plant communities dominated by herbaceous dicotyledons (i.e. broad-leaved plants and forbs from the class Magnoliopsida) though grasses and/or sedge species may still be present. This group includes dryland or wetland habitats. | MVG22 | Chenopod Shrublands, Samphire Shrublands and Forblands |
| 37 | Plant communities dominated by grasses (family Poaceae). This group includes tall annual Sorghum grasslands | 38 | |
| | Plant communities dominated by rushes (family Juncaceae) and/or sedges (Cyperaceae, Restionaceae, etc.) – usually in wetland habitats | MVG21 | Other Grasslands, Herblands, Sedgelands and Rushlands |
| 38 | Grasses forming distinct tussocks (i.e. the majority of grasses). This group includes communities dominated by perennial and annual grasses | MVG19 | Tussock Grasslands |
| | Grasses forming distinct hummocks – usually of the genus *Triodia, Plectrachne* or *Zygochloa* | MVG20 | Hummock Grasslands |
| | Grasses not forming tussocks nor hummocks – couch grasses (e.g. Sporobolus), stoloniferous grasses, etc. | MVG21 | Other Grasslands, Herblands, Sedgelands and Rushlands |
| 39 | Algal crusts remaining behind in a water feature – lake, stream bed, etc. | MVG24 | Inland aquatic – freshwater, salt lakes, lagoons. |

| Key No. | Criteria | MVG or Couplet | Broader groupings or MVG Name |
|---|---|---|---|
| | Lichen +/- mosses +/- liverworts on rocks. | MVG27 | Naturally bare – sand, rock, claypan, mudflat |

## Appendix L: Controlled vocabulary and classification

Note: Light blue rows with **bold text** show "undifferentiated" Level 3 groups where insufficient data is available for more refined classification of values.

| Field name | ecocover | ecosurface | ecoelement | MVG | Description | Examples |
|---|---|---|---|---|---|---|
| Long name | Eco-cover | Eco-surface | Eco-element | | | |
| NVIS Hierarchy Level | Level 1 | Level 2 | Level 3 | | | |
| Format | Eco-cover = Terrain Naturalness [1A] + Vegetation Cover (Presence) type [1B] + Growth form type [1C] | Eco-surface = Surface type [2A] + Vegetation Cover type [2B] + Structural Formation type [2C] | Eco-element = Eco-element type [3A] + Summary [L1&2) data [3B] + Broad Floristic Formation [3C] | | | |
| Comprising | Level 1 | Level 2 | Comprising 1, 2, 3 | | | |
| Formula | [1A] + [1B] + [1C] | [2A] + [2B] + [2C] | [3A] + [[1A] + [1B]] + [[2A] + [2B]] + [3C] | | | |
| | **L1 undifferentiated: natural surface; vegetated; growth form;** | **L2 undifferentiated: aquatic (freshwater or saline) environments; principally with native vegetation cover; structural formation;** | **Undifferentiated: lake salt lake wetland watercourse or other freshwater or saline waterbody; L1 undifferentiated: natural surface; vegetated; growth form; L2 undifferentiated: aquatic (freshwater or saline) environments; principally with native vegetation cover;broad floristic** | **3-5; 9-11; 13; 15; 17-18; 21-22; 24; 31** | **This undifferentiated group comprises natural or semi-natural freshwater features and their margins, including the flux between water surfaces, exposed substrate and vegetated components. It allows for classification of** | **Fringing lacustrine, wetland or riparian vegetation, Melaleuca Shrublands or herbland, rushland and sedgelands** |

| Field name | ecocover | ecosurface | ecoelement | MVG | Description | Examples |
|---|---|---|---|---|---|---|
| | | | **formation; L3 broad floristic formation;** | | **data in circumstances where insufficient data is available to enable finer classification. For example, "lake" may not be able to be resolved to saline or freshwater environments due to lack of information. It also enables the classification of mosaic data where the mosaic has not been resolved to polygonal data.** | |
| | L1 natural surface; vegetated; growth form; | L2 aquatic (freshwater) environments; principally with native vegetation cover; structural formation; | Lake; L1 natural surface; vegetated; L2 aquatic (freshwater) environments; principally with native vegetation cover; L3 broad floristic formation; | 3-5; 9-11; 13; 15; 17-18; 21-22; 24; 31 | This comprises natural or semi-natural freshwater lakes and their margins, including the flux between water surfaces, exposed substrate and vegetated components. It enables the classification of mosaic data where the mosaic has not been resolved to polygonal data. | Fringing lacustrine vegetation, Melaleuca Shrublands or woodland assemblages |

| Field name | ecocover | ecosurface | ecoelement | MVG | Description | Examples |
|---|---|---|---|---|---|---|
| | L1 natural surface; vegetated; growth form; | L2 aquatic (freshwater) environments; principally with native vegetation cover; structural formation; | Wetland; L1 natural surface; vegetated; L2 aquatic (freshwater) environments; principally with native vegetation cover; L3 broad floristic formation; | 3-5; 9-11; 13; 15; 17-18; 21-22; 24; 31 | This comprises natural or semi-natural freshwater wetlands and their margins, including the flux between water surfaces, exposed substrate and vegetated components. It enables the classification of mosaic data where the mosaic has not been resolved to polygonal data. | Herbland, sedgeland, and rushland assemblages. |
| | L1 natural surface; vegetated; growth form; | L2 aquatic (freshwater) environments; principally with native vegetation cover; structural formation; | Watercourse; L1 natural surface; vegetated; L2 aquatic (freshwater) environments; principally with native vegetation cover; L3 broad floristic formation; | 3-5; 9-11; 13; 15; 17-18; 21-22; 24; 31 | This comprises natural or semi-natural freshwater watercourses and their margins, including the flux between water surfaces, exposed substrate and vegetated components. It enables the classification of mosaic data where the mosaic has not been resolved to polygonal data. | Fringing riparian vegetation, for example Eucalyptus open forest or woodland assemblages. |
| | L1 natural surface; | L2 aquatic (saline) environments; principally | Salt lake; L1 natural surface; vegetated; L2 | 3-5; 9-11; 13; | This comprises natural or semi-natural salt | Halophyte assemblages associated with salt lakes. |

| Field name | ecocover | ecosurface | ecoelement | MVG | Description | Examples |
|---|---|---|---|---|---|---|
| | vegetated; growth form; | with native vegetation cover; structural formation; | aquatic (saline) environments; principally with native vegetation cover; L3 broad floristic formation; | 15; 17-18; 21-22; 24; 31 | lakes and their margins, including the flux between water surfaces, exposed substrate and vegetated components. It enables the classification of mosaic data where the mosaic has not been resolved to polygonal data. | |
| | L1 natural surface; vegetated; growth form; | L2 aquatic (marine/estuarine) environments; principally with native vegetation cover; structural formation; | Estuarine and maritime; L1 natural surface; vegetated; L2 aquatic (marine/estuarine) environments; principally with native vegetation cover; L3 broad floristic formation; | 21-22; 24; 28 | This includes natural or semi-natural estuarine and marine features and their margins, including the flux between water surfaces, exposed substrate and vegetated components. It enables the classification of mosaic data where the mosaic has not been resolved to polygonal data. | Sea-grass assemblage. |
| | L1 natural surface; vegetated; growth form; | L2 terrestrial environments; principally with native vegetation cover; structural formation; | Native vegetation type; L1 natural surface; vegetated; L2 terrestrial environments; principally with native vegetation | 1-23; 31-32 | This enables the classification of natural or semi-natural vegetation cover. | As per respective Major Vegetation Groups. |

| Field name | ecocover | ecosurface | ecoelement | MVG | Description | Examples |
|---|---|---|---|---|---|---|
| | | | cove; L3 broad floristic formation; | | | |
| | L1 natural surface; vegetated; growth form; | L2 terrestrial environments; principally with native vegetation cover; structural formation; | Modified disturbed or regenerating native vegetation; L1 natural surface; vegetated; L2 terrestrial environments; principally with native vegetation cover; L3 broad floristic formation; | 29 | Native vegetation or disturbed/regenerating native vegetation cover which is modified to the extent that the native vegetation is largely recognisable, but lacks sufficient floristic and structural information to enable allocation to another MVG. | A scattered remnant of native vegetation or disturbed/regenerating vegetation which is largely recognisable, but lacks sufficient floristic and structural information to enable allocation to and MVG. |
| | L1 natural surface; vegetated; growth form; | L2 terrestrial (unclassified) environments; principally with unclassified native vegetation cover; structural formation; | Unclassified native vegetation; L1 natural surface; vegetated; L2 terrestrial (unclassified) environments; principally with unclassified native vegetation cover; L3 broad floristic formation; | 26 | This enables the broad classification of forest vegetation features in circumstances where the vegeation cover has not yet been classified. In NVIS v.4.x, it is largely from artefacts generated from the intersection of a forest cover layer with existing data. Vegetation Survey of NT data. | Unclassified native vegetation cover excluding unclassified forest. |
| | L1 natural surface; vegetated; growth form; | L2 terrestrial (unclassified) environments; principally with unclassified vegetation cover; structural formation; | Unclassified forest; L1 natural surface; vegetated; L2 terrestrial (unclassified) environments; principally | 30 | This enables the broad classification of forest vegetation features in circumstances where it | Unclassified forest vegetation cover. |

| Field name | ecocover | ecosurface | ecoelement | MVG | Description | Examples |
|---|---|---|---|---|---|---|
| | | | with unclassified vegetation cover; L3 broad floristic formation; | | has not yet been classified. | |
| | **L1 undifferentiated: artificial surface; vegetated; growth form;** | **L2 undifferentiated: aquatic (freshwater) environment; principally introduced vegetation +/- scattered native vegetation cover; structural formation;** | **Undifferentiated: wetland, drainage line, floodway or other artificial waterbody; L1 undifferentiated: artificial surface; vegetated; L2 undifferentiated: aquatic (freshwater) environment; L3 broad floristic formation;** | **24** | **This undifferentiated group comprises artificial freshwater features and margins, including flux between water surfaces, exposed substrate and vegetated components. For example, "water" may not be able to be resolved to a specific type due to lack of information. It also enables the classification of mosaic data where the mosaic has not been resolved to polygonal data.** | **Fringing lacustrine vegetation such as artificial sedgeland, and rushlands.** |
| | **L1 undifferentiated: artificial surface; vegetated; growth form;** | **L2 undifferentiated: terrestrial environment; principally introduced vegetation +/- scattered native vegetation cover; structural formation;** | **Undifferentiated: horticulture, orchard or vineyard, crop or pasture, plantation forest, parkland, garden or playing field, or other cleared surface; L2 undifferentiated: terrestrial environment; principally introduced** | **25** | **This undifferentiated group comprises the broad classification of undifferentiated: horticulture, orchard or vineyard; crop or pasture; plantation forest; parkland, garden or playing field; other cleared** | **Horticulture, orchards, vineyards and plant nurseries.** |

| Field name | ecocover | ecosurface | ecoelement | MVG | Description | Examples |
|---|---|---|---|---|---|---|
| | | | **vegetation +/- scattered native vegetation cover; L3 [broad floristic formation];** | | **surface (vegetation introduced +/- scattered native vegetation). It comprises largely cleared surfaces where the vegetation type is largely unrecognisable. For example, "fruit trees" may not be able to be resolved to a specific type due to lack of information. This class may include scattered/ isolated native tree, shrub or groundcover species.** | |
| | L1 artificial surface; vegetated; growth form; | L2 terrestrial environment; principally introduced vegetation +/- scattered native vegetation cover; structural formation; | Horticulture orchard or vineyard; L1 artificial surface; vegetated; L2 terrestrial environment; principally introduced vegetation +/- scattered native vegetation cover; L3 broad floristic formation; | 25 | This comprises the broad classification of horticulture, orchard, vineyard or plant nursery. This class may include scattered/ isolated native tree, shrub or groundcover species. | Horticulture, orchards, vineyards and plant nurseries. |
| | L1 artificial surface; vegetated; growth form; | L2 terrestrial environment; principally introduced vegetation +/- scattered native vegetation cover; structural formation; | Crop or pasture; L1 artificial surface; vegetated; L2 terrestrial environment; principally introduced vegetation +/- | 25 | This comprises the broad classification of improved pasture or cropping and improved pasture (for extensive | Improved pasture or cropping and extensive animal husbandry. |

| Field name | ecocover | ecosurface | ecoelement | MVG | Description | Examples |
|---|---|---|---|---|---|---|
| | | | scattered native vegetation cover; L3 broad floristic formation; | | animal husbandry). This class may include scattered/ isolated native tree, shrub or groundcover species. | |
| | L1 artificial surface; vegetated; growth form; | L2 terrestrial environment; principally introduced vegetation +/- scattered native vegetation cover; structural formation; | Plantation forest; L1 artificial surface; vegetated; L2 terrestrial environment; principally introduced vegetation +/- scattered native vegetation cover; L3 broad floristic formation; | 25 | This enables the broad classification of plantation forest (i.e. planted forests). This class may include scattered/isolated native tree, shrub or groundcover species. | Plantation forests. |
| | L1 artificial surface; vegetated; growth form; | L2 terrestrial environment; principally introduced vegetation +/- scattered native vegetation cover; structural formation; | Parkland, garden or playing field; L1 artificial surface; vegetated; L2 terrestrial environment; principally introduced vegetation +/- scattered native vegetation cover; L3 broad floristic formation; | 25 | This enables the broad classification of parkland, garden or playing field. This class may include scattered/isolated native tree, shrub or groundcover species. | Parklands, gardens and playing fields. |
| | **L1 undifferentiated: natural surface; non-vegetated; growth form;** | **L2 undifferentiated: aquatic (freshwater or saline) environments; principally non-vegetated or if vegetated; then minimal or unquantified; structural formation;** | **Undifferentiated: lake, salt lake, watercourse or other unclassified natural aquatic surface; L1 undifferentiated: natural surface; non-vegetated; L2 undifferentiated: aquatic (freshwater or saline) environments; principally non-vegetated or if vegetated; then** | **24** | **This undifferentiated group comprises natural or semi-natural freshwater features, including the flux between water surfaces and exposed substrate. For example, "water" may not be able to be resolved to a specific** | **Aquatic surfaces or associated substrate.** |

| Field name | ecocover | ecosurface | ecoelement | MVG | Description | Examples |
|---|---|---|---|---|---|---|
| | | | **minimal or unquantified; L3 broad floristic formation;** | | **type due to lack of information. Vegetation cover either absent, minimal or unquantified.** | |
| | L1 natural surface; non-vegetated; growth form; | L2 aquatic (freshwater) environments; principally non-vegetated or if vegetated; then minimal or unquantified; structural formation; | Lake (open-water or substrate); L1 natural surface; non-vegetated; L2 aquatic (freshwater) environments; principally non-vegetated or if vegetated; then minimal or unquantified; L3 broad floristic formation; | 24 | This comprises natural or semi-natural freshwater lakes, including the flux between water surfaces and exposed substrate. Vegetation cover either absent, minimal or unquantified. | Aquatic surfaces or associated substrate. |
| | L1 natural surface; non-vegetated; growth form; | L2 aquatic (freshwater) environments; principally non-vegetated or if vegetated; then minimal or unquantified; structural formation; | Watercourse (open-water or substrate); L1 natural surface; non-vegetated; L2 aquatic (freshwater) environments; principally non-vegetated or if vegetated; then minimal or unquantified; L3 broad floristic formation; | 24 | This comprises natural or semi-natural freshwater watercourses, including the flux between water surfaces and exposed substrate. Vegetation cover either absent, minimal or unquantified. | Aquatic surfaces or associated substrate. |
| | L1 natural surface; non-vegetated; growth form; | L2 aquatic (saline) environments; principally non-vegetated or if vegetated; then minimal or unquantified; structural formation; | Salt lake (open-water or substrate); L1 natural surface; non-vegetated; L2 aquatic (saline) environments; principally non-vegetated or if | 24 | This comprises natural or semi-natural salt lakes, including the flux between water surfaces and exposed substrate. Vegetation | Bare surfaced inland salt lakes. |

| Field name | ecocover | ecosurface | ecoelement | MVG | Description | Examples |
|---|---|---|---|---|---|---|
| | | | vegetated; then minimal or unquantified; L3 broad floristic formation; | | cover either absent, minimal or unquantified. | |
| | L1 natural surface; non-vegetated; growth form; | L2 aquatic (marine/estuarine) environments; principally non-vegetated or if vegetated; then minimal or unquantified; structural formation; | Estuarine and maritime (open-water or substrate); L1 natural surface; non-vegetated; L2 aquatic (marine/estuarine) environments; principally non-vegetated or if vegetated; then minimal or unquantified; L3 broad floristic formation; | 24; 28 | This comprises natural or semi-natural estuarine and marine surfaces below high water mark and includes the flux between water surfaces and regularly exposed substrate. Vegetation cover either absent, minimal or unquantified. | Estuaries and marine surface, and tidally associated substrate. |
| | **L1 undifferentiated: natural surface; non-vegetated; growth form;** | **L2 undifferentiated: terrestrial (loose or unconsolidated; hard or consolidated) environments; principally non-vegetated or if vegetated; then minimal or unquantified; structural formation;** | **Undifferentiated: loose or hard surfaces or other natural exposed surface; L1 undifferentiated: natural surface; non-vegetated; L2 undifferentiated: terrestrial (loose or unconsolidated; hard or consolidated) environments; principally non-vegetated or if vegetated; then minimal or unquantified; L3 [broad floristic formation];** | **27** | **This undifferentiated group comprises naturally exposed loose or hard surfaces. For example, "gravel" may not be able to be resolved to a specific type due to lack of information. Vegetation cover either absent, minimal or unquantified.** | **Bare rock, hardpan, claypan sand and sand dunes and other loose or hard surfaces.** |
| | L1 natural surface; non- | L2 terrestrial (hard or consolidated surface) environments; principally | Bare rock; L1 natural surface; non-vegetated; L2 terrestrial (hard or | 27 | This comprises bare rock surfaces. Vegetation cover | Bare rock surfaces. |

| Field name | ecocover | ecosurface | ecoelement | MVG | Description | Examples |
|---|---|---|---|---|---|---|
| | vegetated; growth form; | non-vegetated or if vegetated then minimal or unquantified; structural formation; | consolidated surface) environments; principally non-vegetated or if vegetated then minimal or unquantified; L3 broad floristic formation; | | either absent, minimal or unquantified. | |
| | L1 natural surface; non-vegetated; growth form; | L2 terrestrial (hard or consolidated surface) environments; principally non-vegetated or if vegetated then minimal or unquantified; structural formation; | Hardpan; L1 natural surface; non-vegetated; L2 terrestrial (hard or consolidated surface) environments; principally non-vegetated or if vegetated then minimal or unquantified; L3 broad floristic formation; | 27 | This comprises hard-pan surfaces. Vegetation cover either absent, minimal or unquantified. | Hardpan surfaces. |
| | L1 natural surface; non-vegetated; growth form; | L2 terrestrial (loose or unconsolidated surface) environments; principally non-vegetated or if vegetated then minimal or unquantified; structural formation; | Sand or sand dune; L1 natural surface; non-vegetated; L2 terrestrial (loose or unconsolidated surface) environments; principally non-vegetated or if vegetated then minimal or unquantified; L3 broad floristic formation; | 27 | This comprises sand and sand dune surfaces. Vegetation cover either absent, minimal or unquantified. | Sand and sand dune surfaces. |
| | L1 natural surface; non-vegetated; growth form; | L2 terrestrial (loose or unconsolidated surface) environments; principally non-vegetated or if vegetated then minimal or unquantified; structural formation; | Claypan; L1 natural surface; non-vegetated; L2 terrestrial (loose or unconsolidated surface) environments; principally non-vegetated or if vegetated then minimal or | 27 | This comprises claypan surfaces. Vegetation cover either absent, minimal or unquantified. | Claypan surfaces. |

| Field name | ecocover | ecosurface | ecoelement | MVG | Description | Examples |
|---|---|---|---|---|---|---|
| | | | unquantified; L3 broad floristic formation; | | | |
| | **L1 undifferentiated: artificial surface; non-vegetated; growth form;** | **L2 undifferentiated: aquatic (freshwater); environment; principally non-vegetated or if vegetated then minimal or unquantified; structural formation;** | **Undifferentiated: reservoir, dam, canal or other artificial open-water surface; L1 undifferentiated: artificial surface; non-vegetated; L2 undifferentiated: aquatic (freshwater); environment; principally non-vegetated or if vegetated then minimal or unquantified; L3 broad floristic formation;** | **24** | **This undifferentiated group comprises reservoirs, dams, canals and evaporation basins, and other artificial open-water surface. For example, "artificial water" may not be able to be resolved to a specific type due to lack of information. Vegetation cover either absent, minimal or unquantified** | **Water or associated substrate, vegetation cover either absent, minimal or unquantified.** |
| | L1 artificial surface; non-vegetated; growth form; | L2 aquatic (freshwater) environment; principally non-vegetated or if vegetated then minimal or unquantified; structural formation; | Reservoir or dam (open-water or substrate); L1 artificial surface; non-vegetated; L2 aquatic (freshwater) environment; principally non-vegetated or if vegetated then minimal or unquantified; L3 broad floristic formation; | 24 | This comprises reservoirs and dams. Vegetation cover either absent, minimal or unquantified. | Water or associated substrate, vegetation cover either absent, minimal or unquantified. |
| | L1 artificial surface; non-vegetated; growth form; | L2 aquatic (freshwater) environment; principally non-vegetated or if vegetated then minimal or unquantified; structural formation; | Canal (open-water or substrate); L1 artificial surface; non-vegetated; L2 aquatic (freshwater) environment; principally non-vegetated or if | 24 | This comprises artificial freshwater canals. Vegetation cover either absent, minimal or unquantified. | Water or associated substrate, vegetation cover either absent, minimal or unquantified. |

| Field name | ecocover | ecosurface | ecoelement | MVG | Description | Examples |
|---|---|---|---|---|---|---|
| | | | vegetated then minimal or unquantified; L3 broad floristic formation; | | | |
| | L1 artificial surface; non-vegetated; growth form; | L2 aquatic (saline) environment; principally non-vegetated or if vegetated then minimal or unquantified; structural formation; | Evaporation basin (open-water or substrate); L1 artificial surface; non-vegetated; L2 aquatic (saline) environment; principally non-vegetated or if vegetated then minimal or unquantified; L3 broad floristic formation; | 24 | This comprises artificial saline evaporation basins. Vegetation cover either absent, minimal or unquantified. | Water or associated substrate, vegetation cover either absent, minimal or unquantified. |
| | L1 artificial surface; non-vegetated; growth form; | L2 aquatic (marine/estuarine; artificial) environment; principally non-vegetated or if vegetated then minimal or unquantified; structural formation; | Canal or canal estate (open-water or substrate); L1 artificial surface; non-vegetated; L2 aquatic (marine/estuarine; artificial) environment; principally non-vegetated or if vegetated then minimal or unquantified; L3 broad floristic formation; | 28 | This comprises artificial estuarine canals and canal estates. Vegetation cover either absent, minimal or unquantified. | Water or associated substrate, vegetation cover either absent, minimal or unquantified. |
| | **L1 undifferentiated: artificial surface; non-vegetated; growth form;** | **L2 undifferentiated: terrestrial environment; principally non-vegetated or if vegetated then minimal or unquantified; structural formation;** | **Undifferentiated: built environment, infrastructure or resource extraction or other unclassified artificial non-vegetated surface; L1 undifferentiated: artificial surface; non-vegetated;** | **25** | **This undifferentiated group comprises urban and industrial areas, utilities, landfill, and other man-made features. For example, "urban and infrastructure with** | **Settlements, urban and industrial areas, utilities, and landfill.** |

| Field name | ecocover | ecosurface | ecoelement | MVG | Description | Examples |
|---|---|---|---|---|---|---|
| | | | **L2 undifferentiated: terrestrial environment; principally non-vegetated or if vegetated then minimal or unquantified; L3 [broad floristic formation];** | | **resource extraction" may not be able to be resolved to a specific type due to mosaic data.** | |
| | L1 artificial surface; non-vegetated; growth form; | L2 terrestrial environment; principally non-vegetated or if vegetated then minimal or unquantified; structural formation; | Built environment; L1 artificial surface; non-vegetated; L2 terrestrial environment; principally non-vegetated or if vegetated then minimal or unquantified; L3 broad floristic formation; | 25 | This comprises urban, landfill and waste facilities. | Settlements, urban, landfill, and waste facilities. |
| | L1 artificial surface; non-vegetated; growth form; | L2 terrestrial environment; principally non-vegetated or if vegetated then minimal or unquantified; structural formation; | Resource extraction; L1 artificial surface; non-vegetated; L2 terrestrial environment; principally non-vegetated or if vegetated then minimal or unquantified; L3 broad floristic formation; | 25 | This comprises resource extraction. | Mines and gravel pits. |
| | L1 artificial surface; non-vegetated; growth form; | L2 terrestrial environment; principally non-vegetated or if vegetated then minimal or unquantified; structural formation; | Infrastructure; L1 artificial surface; non-vegetated; L2 terrestrial environment; principally non-vegetated or if vegetated then minimal or unquantified; L3 broad floristic formation; | 25 | This comprises infrastructure. | Pipelines, roads, and airfields. |
| | L1 unclassifiable; growth form; | L2 unclassifiable Level 2; structural formation; | Unclassifiable Level 3; L1 unclassifiable; L2 | 99 | This comprises unknown values which | No information is available at any level. |

| Field name | ecocover | ecosurface | ecoelement | MVG | Description | Examples |
|---|---|---|---|---|---|---|
| | | | unclassifiable Level 2; L3 broad floristic formation; | | will be replaced with "unclassifiable"; for which no data or information is available. | |
| | L1 unclassifiable; growth form; | L2 aquatic environment; structural formation; | Undifferentiated aquatic surface; L1 unclassifiable; L2 aquatic environment; L3 broad floristic formation; | 24 | This undifferentiated group comprises "Undifferentiated aquatic surface". | For example "water" may not be able to be resolved to a specific type due to mosaic data. |
| | L1 unclassifiable; growth form; | L2 terrestrial environment; structural formation; | Undifferentiated terrestrial surface; L1 unclassifiable; L2 terrestrial environment; L3 broad floristic formation; | 99 | This undifferentiated group comprises "Undifferentiated terrestrial surface"; for which no data or information is available other than it is an aquatic surface. | For example "flat" may not be able to be resolved to a specific type due to mosaic data. |

## Appendix M: Controlled Vocabulary and Classification Synonyms

| Level 1<br>ecocover | Level 2<br>ecosurface | Level 3<br>ecoelement | MVG | Synonyms |
|---|---|---|---|---|
| **L1 undifferentiated: natural surface; vegetated; growth form:-** | **L2 undifferentiated: aquatic (freshwater or saline) environments; principally with native vegetation cover; structural formation:-** | **L3 undifferentiated: lake salt lake wetland watercourse or other freshwater or saline waterbody; L1 and L2; broad floristic formation:-** | **3-5; 9-11; 13; 15; 17-18; 21-22; 24; 31** | **lake; lagoon; pond; wetland; marsh; watercourse; river; stream; creek; drainage line; floodway; billabong** |
| L1 natural surface; vegetated; growth form:- | L2 aquatic (freshwater) environments; principally with native vegetation cover; structural formation:- | L3 lake; L1 and L2; broad floristic formation:- | 3-5; 9-11; 13; 15; 17-18; 21-22; 24; 31 | lake, lagoon, pond |
| L1 natural surface; vegetated; growth form:- | L2 aquatic (freshwater) environments; principally with native vegetation cover; structural formation:- | L3 wetland; L1 and L2; broad floristic formation:- | 3-5; 9-11; 13; 15; 17-18; 21-22; 24; 31 | wetland, marsh, swamp |
| L1 natural surface; vegetated; growth form:- | L2 aquatic (freshwater) environments; principally with native vegetation cover; structural formation:- | L3 watercourse; L1 and L2; broad floristic formation:- | 3-5; 9-11; 13; 15; 17-18; 21-22; 24; 31 | watercourse, river, stream, creek, drainage line, floodway, **billabong** |
| L1 natural surface; vegetated; growth form:- | L2 aquatic (saline) environments; principally with native vegetation cover; structural formation:- | L3 salt lake; L1 and L2; broad floristic formation:- | 3-5; 9-11; 13; 15; 17-18; 21-22; 24; 31 | salt lake, salt pan, saltpan |
| L1 natural surface; vegetated; growth form:- | L2 aquatic (marine/estuarine) environments; principally with native vegetation cover; structural formation:- | L3 estuarine and maritime; L1 and L2; broad floristic formation:- | 21-22; 24; 28 | estuarine, marine, sea grass, seagrass, sea-grass, Halophila, Posidonia, Ruppia, Zostera |
| L1 natural surface; vegetated; growth form:- | L2 terrestrial environments; principally with native vegetation cover; structural formation:- | L3 native vegetation type; L1 and L2; broad floristic formation:- | 1-23; 31-32 | native vegetation |
| L1 natural surface; vegetated; growth form:- | L2 terrestrial environments; principally with native vegetation cover; structural formation:- | L3 modified disturbed or regenerating native vegetation; L1 and L2; broad floristic formation:- | 29 | modified, disturbed, regenerating |
| L1 natural surface; vegetated; growth form:- | L2 terrestrial (unclassified) environments; principally with unclassified native vegetation cover; structural formation:- | L3 unclassified native vegetation; L1 and L2; broad floristic formation:- | 26 | native vegetation |

| Level 1<br>ecocover | Level 2<br>ecosurface | Level 3<br>ecoelement | MVG | Synonyms |
|---|---|---|---|---|
| L1 natural surface; vegetated; growth form:- | L2 terrestrial (unclassified) environments; principally with unclassified vegetation cover; structural formation:- | L3 unclassified forest; L1 and L2; broad floristic formation:- | 30 | forest, forest cover, forest vegetation cover |
| **L1 undifferentiated: artificial surface; vegetated; growth form:-** | **L2 undifferentiated: aquatic (freshwater) environment; principally introduced vegetation +/- scattered native vegetation cover; structural formation:-** | **L3 undifferentiated: wetland, drainage line, floodway or other artificial waterbody; L1 and L2; broad floristic formation:-** | **24** | **lake, lagoon, pond** |
| **L1 undifferentiated: artificial surface; vegetated; growth form:-** | **L2 undifferentiated: terrestrial environment; principally introduced vegetation +/- scattered native vegetation cover; structural formation:-** | **L3 undifferentiated: horticulture, orchard or vineyard, crop or pasture, plantation forest, parkland, garden or playing field, or other cleared surface; L1 and L2; broad floristic formation:-** | **25** | **horticulture, orchard or vineyard; crop or pasture; plantation forest; parkland, garden or playing field; other cleared surface** |
| L1 artificial surface; vegetated; growth form:- | L2 terrestrial environment; principally introduced vegetation +/- scattered native vegetation cover; structural formation:- | L3 horticulture orchard or vineyard; L1 and L2; broad floristic formation:- | 25 | orchard, vineyard, plant nursery |
| L1 artificial surface; vegetated; growth form:- | L2 terrestrial environment; principally introduced vegetation +/- scattered native vegetation cover; structural formation:- | L3 crop or pasture; L1 and L2; broad floristic formation:- | 25 | crop, pasture, improved pasture, grazing, crop, pasture |
| L1 artificial surface; vegetated; growth form:- | L2 terrestrial environment; principally introduced vegetation +/- scattered native vegetation cover; structural formation:- | L3 plantation forest; L1 and L2; broad floristic formation:- | 25 | plantation, silviculture, Pinus, hoop |
| L1 artificial surface; vegetated; growth form:- | L2 terrestrial environment; principally introduced vegetation +/- scattered native vegetation cover; structural formation:- | L3 parkland, garden or playing field; L1 and L2; broad floristic formation:- | 25 | parkland, garden, playing field, golf course |
| **L1 undifferentiated: natural surface; non-vegetated; growth form:-** | **L2 undifferentiated: aquatic (freshwater or saline) environments; principally non-vegetated or if vegetated; then minimal or unquantified; structural formation:-** | **L3 undifferentiated: lake, salt lake, watercourse or other unclassified natural aquatic surface; L1 and L2; broad floristic formation:-** | **24** | **lagoon, pond** |

| Level 1<br>ecocover | Level 2<br>ecosurface | Level 3<br>ecoelement | MVG | Synonyms |
|---|---|---|---|---|
| L1 natural surface; non-vegetated; growth form:- | L2 aquatic (freshwater) environments; principally non-vegetated or if vegetated; then minimal or unquantified; structural formation:- | L3 lake; L1 and L2; broad floristic formation:- | 24 | lagoon, pond |
| L1 natural surface; non-vegetated; growth form:- | L2 aquatic (freshwater) environments; principally non-vegetated or if vegetated; then minimal or unquantified; structural formation:- | L3 watercourse; L1 and L2; broad floristic formation:- | 24 | watercourse, river, stream, creek, drainage line |
| L1 natural surface; non-vegetated; growth form:- | L2 aquatic (saline) environments; principally non-vegetated or if vegetated; then minimal or unquantified; structural formation:- | L3 salt lake; L1 and L2; broad floristic formation:- | 24 | salt lake, salt pan, saltpan |
| L1 natural surface; non-vegetated; growth form:- | L2 aquatic (marine/estuarine) environments; principally non-vegetated or if vegetated; then minimal or unquantified; structural formation:- | L3 estuarine and maritime; L1 and L2; broad floristic formation:- | 24; 28 | sea, estuary, ocean, mud flat, mudflat, mud-flat, tidal zone |
| **L1 undifferentiated: natural surface; non-vegetated; growth form:-** | **L2 undifferentiated: terrestrial (loose or unconsolidated; hard or consolidated) environments; principally non-vegetated or if vegetated; then minimal or unquantified; structural formation:-** | **L3 undifferentiated: loose or hard surfaces or other natural exposed surface; L1 and L2; broad floristic formation:-** | **27** | **bare rock, hardpan, calcrete, laterite, sand, sand dune, shingle, gravel, claypan** |
| L1 natural surface; non-vegetated; growth form:- | L2 terrestrial (hard or consolidated surface) environments; principally non-vegetated or if vegetated; then minimal or unquantified; structural formation:- | L3 bare rock; L1 and L2; broad floristic formation:- | 27 | bare rock, sandstone, granite, |
| L1 natural surface; non-vegetated; growth form:- | L2 terrestrial (hard or consolidated surface) environments; principally non-vegetated or if vegetated; then minimal or unquantified; structural formation:- | L3 hardpan; L1 and L2; broad floristic formation:- | 27 | hardpan, calcrete, laterite |

| Level 1<br>ecocover | Level 2<br>ecosurface | Level 3<br>ecoelement | MVG | Synonyms |
|---|---|---|---|---|
| L1 natural surface; non-vegetated; growth form:- | L2 terrestrial (loose or unconsolidated surface) environments; principally non-vegetated or if vegetated; then minimal or unquantified; structural formation:- | L3 sand or sand dune; L1 and L2; broad floristic formation:- | 27 | sand, sand dune, shingle, gravel |
| L1 natural surface; non-vegetated; growth form:- | L2 terrestrial (loose or unconsolidated surface) environments; principally non-vegetated or if vegetated; then minimal or unquantified; structural formation:- | L3 claypan; L1 and L2; broad floristic formation:- | 27 | claypan |
| **L1 undifferentiated: artificial surface; non-vegetated; growth form:-** | **L2 undifferentiated: aquatic (freshwater); environment; principally non-vegetated or if vegetated; then minimal or unquantified; structural formation:-** | **L3 undifferentiated: reservoir, dam, canal or other artificial open-water surface; L1 and L2; broad floristic formation:-** | **24** | **reservoir, dam, weir** |
| L1 artificial surface; non-vegetated; growth form:- | L2 aquatic (freshwater) environment; principally non-vegetated or if vegetated; then minimal or unquantified; structural formation:- | L3 reservoir or dam; L1 and L2; broad floristic formation:- | 24 | reservoir, dam, weir |
| L1 artificial surface; non-vegetated; growth form:- | L2 aquatic (freshwater) environment; principally non-vegetated or if vegetated; then minimal or unquantified; structural formation:- | L3 canal; L1 and L2; broad floristic formation:- | 24 | canal |
| L1 artificial surface; non-vegetated; growth form:- | L2 aquatic (saline) environment; principally non-vegetated or if vegetated; then minimal or unquantified; structural formation:- | L3 evaporation basin; L1 and L2; broad floristic formation:- | 24 | salt works |
| L1 artificial surface; non-vegetated; growth form:- | L2 aquatic (marine/estuarine; artificial) environment; principally non-vegetated or if vegetated; then minimal or unquantified; structural formation:- | L3 canal or canal estate; L1 and L2; broad floristic formation:- | 28 | estuarine canal |
| **L1 undifferentiated: artificial surface; non-** | **L2 undifferentiated: terrestrial environment; principally non-vegetated or** | **L3 undifferentiated: built environment, infrastructure or** | **25** | **built environment, built-up, settlement, urban,** |

| Level 1<br>ecocover | Level 2<br>ecosurface | Level 3<br>ecoelement | MVG | Synonyms |
|---|---|---|---|---|
| **vegetated; growth form:-** | **if vegetated then minimal or unquantified; structural formation:-** | **resource extraction or other unclassified artificial non-vegetated surface; L1 and L2; broad floristic formation:-** | | **industrial, utilities, landfill, and other man-made** |
| L1 artificial surface; non-vegetated; growth form:- | L2 terrestrial environment; principally non-vegetated or if vegetated; then minimal or unquantified; structural formation:- | L3 built environment [artificial surface, mostly non-vegetated or if vegetated, then minimal or unquantified, i.e. exposed surface]; broad floristic formation:- | 25 | built-up, settlement, urban, suburban, town, village, landfill, waste facilities |
| L1 artificial surface; non-vegetated; growth form:- | L2 terrestrial environment; principally non-vegetated or if vegetated; then minimal or unquantified; structural formation:- | L3 resource extraction; L1 and L2; broad floristic formation:- | 25 | resource extraction, mine, gravel pit, borrow pit |
| L1 artificial surface; non-vegetated; growth form:- | L2 terrestrial environment; principally non-vegetated or if vegetated; then minimal or unquantified; structural formation:- | L3 infrastructure; L1 and L2; broad floristic formation:- | 25 | infrastructure, pipeline, roads, airfields |
| L1 unclassifiable; growth form:- | L2 unclassifiable Level 2; structural formation:- | L3 unclassifiable Level 3; L1 and L2; broad floristic formation:- | 99 | |
| L1 unclassifiable; growth form:- | L2 aquatic environment; structural formation:- | L3 undifferentiated aquatic surface; L1 and L2; broad floristic formation:- | 99 | |
| L1 unclassifiable; growth form:- | L2 terrestrial environment; structural formation:- | L3 undifferentiated terrestrial surface; L1 and L2; broad floristic formation:- | 99 | |

## Appendix N: Proposed attributes/fields

The following attributes are proposed as an enhancement or refinement to the existing NVIS database within the NVIS framework. Most are in the DATA_SET table.

The first two attributes give important context to the SAMPLING_TYPE attribute. The third gives further context to the data underpinning particular vegetation maps. The fourth describes the process of interpreting an existing vegetation description into the NVIS framework.

The fifth attribute is proposed for improving the databasing of growth forms and the sixth for managing the new classification.

| **Attribute: DS08A STRATIFICATION** | |
|---|---|
| **Field** | **Detail** |
| **Purpose:** | To specify the ways in which the study area has been partitioned (stratified) to underpin the survey design and sampling. |
| **Requirement:** | QAQC |
| **Database Field Name:** | STRATIFICATION_SYSTEM |
| **Description:** | The stratification to include all the layers and/or rules that were used to stratify the study area. |
| **Value:** | Character(2000) |
| **Example:** | 1. Altitude (25m DEM); Geology (1:100,000 map) and aspect (2 classes NE/SW from 25m DEM) were intersected using ARC View to partition the study area.<br>2. Air Photo Interpretation was used to identify vegetation patterns which were used as the primary partitioning of the study area. Allocated sites are sampled at 'crest', 'slope', 'flat below slope' were these exist. |
| **Comments** | Each unique partition is known as an Environmental Sampling Unit or ESU. |
| **Status:** | Proposed inclusion |

| **Attribute: DS08B – SURVEY DESIGN** | |
|---|---|
| **Field** | **Detail** |
| **Purpose:** | To specify survey design rules used to implement survey under the stratification described. Add any other relevant descriptions of the sampling approach. |
| **Requirement:** | QAQC |
| **Database Field Name:** | SURVEY _DESIGN |
| **Description:** | To include all design and implementation rules for survey. May refer to other documentation (e.g. survey standards manuals) |
| **Value:** | Character(2000) |
| **Example:** | For each Environmental Stratification Unit (ESU) sites were allocated randomly according to the following rules:<br>1. total ESU area <500ha - 1 plot<br>2. total ESU area 501 - 1500ha - 2 plots<br>3. total ESU area 1501 - 3000ha - 3 plots<br>4. total ESU area 3001 - 5000ha - 4 plots<br>5. total ESU area 5001 - 7500ha - 5 plots<br>6. total ESU area 7501 – 10,500ha - 6 plots<br>7. total ESU area >10,500ha - 7 plots |
| **Comments** | |
| **Status:** | Proposed inclusion |

| **Attribute: DS08C –SURVEY DATA** |
|---|

| Field | Detail |
|---|---|
| **Purpose:** | To specify the data points used in both defining and describing the individual vegetation types. Also any site data used for verifying the types. |
| **Requirement:** | QAQC |
| **Database Field Name:** | SURVEY _DATA |
| **Description:** | To include a description of all data used in producing the final vegetation types. This should include all relevant floristic, structural and environmental data. May refer to other documentation (e.g. survey standards manuals). This does not imply that all data points need to be identified. Supplementary data (e.g. disturbance history) which are not used to define or describe a vegetation type should *not* be included here. Similarly, please separately describe the nature of data used to verify the final vegetation types and/or for any related purpose. |
| **Value:** | Character(2000) |
| **Example:** | 1. Structure Modal height (+/- range) for each layer; Crown Cover % for each layer; distribution of each layer (uniform, patchy etc)<br>2. Floristic Dominant species in each layer (cover/frequency combination); all living species in each layer; for each species – cover, abundance & growth form.<br>3. Environment Site geology, elevation, slope, aspect, landform types and context, microrelief, runoff & soil surface texture & colour. |
| **Comments** | |
| **Status:** | Proposed inclusion |

| **Attribute: DS08D – INTERPRETATION OF VEG DESCRIPTIONS** | |
|---|---|
| **Field** | **Detail** |
| **Purpose:** | To specify the processs and decisions made in interpreting the defined vegetation types into the NVIS notation. |
| **Requirement:** | QAQC |
| **Database Field Name:** | INTERP_METHODS |
| **Description:** | Levels 1-4 of the NVIS vegetation hierarchy are unusually sensitive to the assignment of dominance, especially of (sub-)strata, at Level 6. Particular emphasis should be placed describing the methods (and data) used:<br>to recognise (sub-)strata<br>to assign the dominant (sub-)stratum<br>to rank species and growth forms within each (sub-)stratum<br>to assign dominant genera and growth forms. |
| **Value:** | Character(2000) |
| **Example:** | TBA |
| **Comments** | |
| **Status:** | Proposed inclusion |

| Attribute: GF02A GROWTH FORM | |
|---|---|
| **Field** | **Detail** |
| Purpose: | To provide a name for identifying growth forms in a (sub-)stratum. |
| Requirement: | Recommended |
| Database Field Name: | GR_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 substratum 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)<br>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: | Tree |
| Comments: | There is less chance of a mistake when the full name of the growth form is enumerated, c.f. a single-letter code. Use the same lookup table, but with a different starting column, as for GROWTH FORM CODE (Table 6). |
| Status: | Proposed. |

| Attribute: VG04 ECO CLASSIFICATION FLAG | |
|---|---|
| **Field** | **Detail** |
| **Purpose:** | To identify whether the record has an Ecological/Land Cover classification in Levels 1-3 |
| **Requirement:** | Recommended |
| **Database Field Name:** | ECO_CLASSIFICATION_FLAG |
| **Description:** | This is used to readily identify whether the record has been classified with the Ecological/Land Cover classification (Levels 1-3) as distinct from the NVIS information hierarchy (Levels 1-6) with the standard vegetation data. |
| **Value:** | Character(1)<br>This is a value set from a defined by Y = classification present; N= classification not yet applied. |
| **Example:** | Y |
| **Comments:** | This is a new field which is required for understanding the permutations and computations of the two hierarchies in the NVIS Information Hierarchy. It would also be useful for automation, so that programs know what data are present in the NVIS information hierarchy. |
| **Status:** | Proposed. |

| Attribute: VG09A LEVEL 1 (ECOCOVER) | |
|---|---|
| **Field** | **Detail** |
| **Purpose:** | Used to describe the record at Level 1 within the NVIS ecological/land cover hierarchy. Would be used to describe all cases – i.e. native vegetation, non-vegetation and non-native vegetation records. |
| **Requirement:** | Recommended. Partly Automated |
| **Database Field Name:** | L1_ECOCOVER |
| **Description/Value/Example/Comments** | As per attribute VG09 |
| **Status** | Proposed new field to replace current VG08 and VG09. |

| Attribute: VG11A LEVEL 2 (ECOSURFACE) | |
|---|---|
| **Field** | **Detail** |
| **Purpose:** | Used to describe the record at Level 2 within the NVIS ecological/land cover hierarchy. Would be used to describe all cases – i.e. native vegetation, non-vegetation and non-native vegetation records. |
| **Requirement:** | Recommended. Partly Automated |
| **Database Field Name:** | L2_ECOSURFACE |
| **Description/Value/Example/Comments** | As per attribute VG11 |
| **Status** | Proposed new field to replace current VG10 and VG11. |

| Attribute: VG13A LEVEL 3 (ECOELEMENT) | |
|---|---|
| **Field** | **Detail** |
| **Purpose:** | Used to describe the record at Level 3 within the NVIS ecological/land cover hierarchy. Would be used to describe all cases – i.e. native vegetation, non-vegetation and non-native vegetation records. |
| **Requirement:** | Recommended. Partly Automated |
| **Database Field Name:** | L3_ECOELEMENT |
| **Description/Value/Example/Comments** | As per attribute VG13 |
| **Status** | Proposed new field to replace current VG12 and VG13. |