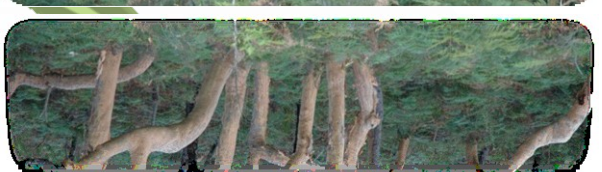
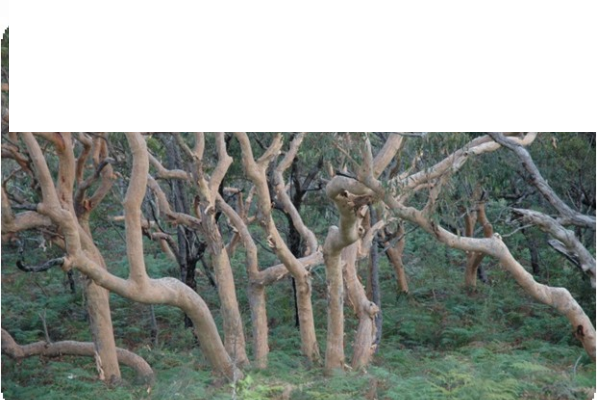
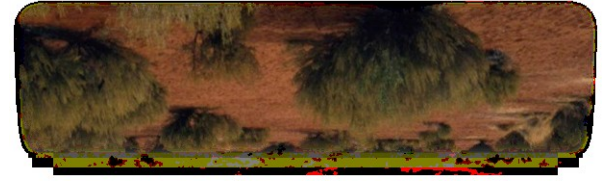
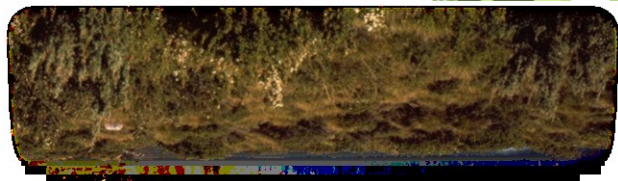


Review of Australia's Major Vegetation classification and descriptions

David A. Keith and Belinda J. Pellow

Report to the Australian Department of the Environment 2015



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Prepared by the Centre for Ecosystem Science (UNSW)
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for the Department of the Environment

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Introduction

The Australian Government, in collaboration with state and territory jurisdictions, maintains the National Vegetation Information System (NVIS), a repository for spatial data and associated thematic information on Australian native vegetation (NLWRA 2001; ESCVI 2003). NVIS includes a hierarchical database with some 18000 records of mapped vegetation types from all states and territories within Australia. The NVIS information hierarchy was augmented with an additional attribution of 'Major Vegetation Groups' (MVGs), enabling a high-level continental-scale synthesis to support the Australian Government's reporting responsibilities under international agreements such as the Montreal and Kyoto Protocols (Montreal Process Implementation Group for Australia and National Forest Inventory Steering Committee 2013), and to inform the first national audit of native vegetation (NLWRA 2001).

Major Vegetation Groups are composed of a large number of vegetation types with similar structural and/or floristic characteristics (NLWRA 2001). Subsequent revisions of the MVG classification have introduced Major Vegetation Subgroups (MVSs), enabling a finer level of characterisation in a continental context. Due to the complex relationships between structural, floristic and ecological attributes of vegetation, MVSs are not strictly nested within MVGs (i.e. individual MVSs may be represented in one or more MVGs). The current classification (NVIS 4.1) includes 27 MVGs (with five additional land cover categories based on FAO classification) and 85 MVSs (Department of the Environment and Water Resources 2007).

To support improved delivery of the Australian Government's Natural Resource Management programmes, the Environmental Resources Information Network (ERIN), the custodian of the NVIS, engaged the Centre for Ecosystem Science (CES) at the University of NSW to update and improve the descriptive fact sheets for Major Vegetation Groups and to undertake a review of the MVG/MVS classification. The aims of this project were to:

1. Review and update of MVG Fact Sheets, including new fact sheets for MVGs 31 and 32; and
2. Review all MVSs to determine their current applicability.

This report describes the outcomes of that work. It first describes the strategic review of MVSs (aim 2) in the context of their relationships to MVGs within the Major Vegetation classification framework. It then describes the detailed revisions to MVG fact sheets (aim 1).

Methods

Strategic Review of Major Vegetation Classification

A brief email survey was undertaken to obtain an overview of the current usage, demands and expectations of the Major Vegetation classification. The survey included: i) all state and territory members of the NVIS network; ii) a sample of vegetation scientists; iii) a sample of non-government users. Participants were asked for responses to three questions:

1. What are your primary needs for a classification and national-scale map of Major Vegetation Groups (MVGs) and Major Vegetation Subgroups (MVS)?
2. Do you think the MVG & MVS data currently served through NVIS would meet those needs more effectively by:
 - a. Revising the descriptions of the units?
 - b. Adjusting the circumscriptions of some units?
 - c. Revising interpretation of the map data for some units?
3. If you answered yes to 2a-2c, please write a couple of sentences to explain the kind of revisions most needed to improve MVGs and MVSs.

Responses were collated and summarised to interpret the primary needs for a spatially explicit national-scale vegetation classification. Relevant scientific literature was reviewed to identify the features of a classification required to meet these needs. This, together with improvements elicited

from NVIS users in the email survey, was used to shape recommendations on future development of the Major Vegetation classification framework to meet current and future needs.

Revision of Major Vegetation Subgroup (MVS) units

In consultation with ERIN data managers, each of the 85 MVS units currently within NVIS 4.1 were reviewed to evaluate the degree to which they represented major ecological variation within and between MVGs. Where representation of ecological relationships could be improved, alternative configurations of MVSs within MVGs were prepared for discussion with ERIN data managers. When classifications were agreed, brief descriptions were compiled using information from regional literature (Beadle 1981; Groves 1994; Keith 2004; Harris & Kitchener 2005; Victorian Department of Sustainability and Environment 2004; Beard et al. 2013; Neldner et al. 2014) in combination with records from the NVIS database. Alternative names were proposed for MVSs, where these could transparently reflect their key characteristics.

Preparation of diagnostic dichotomous keys to Major Vegetation Subgroups (MVSs)

Dichotomous keys were prepared to assist the diagnosis of MVSs within each MVG. These were developed by expanding and adjusting draft keys prepared by ERIN. Couplets within the keys were based on features that permit the clearest possible discrimination between MVS units within an MVG. In most cases, the key enumerates multiple features to strengthen diagnostic power. It was not possible to test the keys in the time available for the project.

Update of descriptions for Major Vegetation Groups

Existing fact sheets for 23 MVGs (and other cover types) were revised and two new fact sheets were prepared for MVGs 31 and 32, respectively. This was based on a comprehensive review and synthesis of relevant descriptive data including:

- i. Available descriptive data for NVIS levels 5 and 6 relating to the relevant MVGs;
- ii. Current map data served by ERIN for the relevant MVGs;
- iii. Relevant literature pertaining to the relevant MVGs throughout their distribution.
- iv. Photographs illustrating key features of each MVG.

During synthesis, all relevant descriptive data were critically evaluated, and examined for consistency between sources and with mapped distributions. This enabled identification and interpretation of key descriptive features of MVGs and MVSs. As far as possible, variability within MVGs was documented by incorporating brief descriptions of MVSs. Information on vegetation change, key values and management issues was also extracted from the literature for inclusion in the updated fact sheets. To improve transparency, sources of information were attributed with in-text citations. Additional photographs to illustrate key features of MVGs were sought to supplement or replace existing photographs to improve illustration of key features. These were licenced for creative commons release.

In consultation with ERIN data managers, the format of the fact sheets was revised to enable explicit reference to key features of MVGs. The fact sheets were formatted in the following sections.

- Overview
- Photographs of relevant MVG (licensed)
- Facts and figures
- Structure and physiognomy
- Indicative flora
- Environment
- Geography and map (map to be supplied by ERIN)
- Change
- Tenure

- Key values
- Management issues
- References
- Data sources

Results and Discussion

Identifying needs: applications of the Major Vegetation Classification

Seven of the nine government agencies responded to the survey, as well as six scientists and three non-government organisations. Three main groups of uses were identified from the responses (Table 1). The documented uses are unlikely to be exhaustive, but provide an informative overview of applications by many essentially independent user groups.

Table 1. Synopsis of uses of Major Vegetation classification (MVGs and MVSs) in Australia. Numbers in parentheses represent the numbers of users that identified each application. Bottom row shows total number of users for the three broad groups of application. The numbers exclude two of the nine government jurisdictions that did not respond to the survey and two that stated that they did not use the national classification.

International reporting	Biodiversity assessment	Comparative framework
<ul style="list-style-type: none"> • National Forest Inventory time series for Montreal Protocol (1) • vegetation component of carbon accounting for Kyoto Protocol (2) 	<ul style="list-style-type: none"> • conservation investment planning (3) • representation in protected areas (3) • status evaluation for specific vegetation types (6) • mapping of threatened ecological communities (1) • distribution modelling (2) • fire management (1) • threatened species habitat characterisation (3) • grant application reporting (1) • heritage area assessments (1) • state of environment reporting and related audits for biodiversity (1) 	<ul style="list-style-type: none"> • survey stratification (2) • cross-border comparison and national context (2) • grouping of fine-scale vegetation units (3) • global vegetation mapping (1)
3	22	8

Australia has reporting obligations under a number of international agreements (e.g. Montreal Process; Kyoto Protocol), which are met by Australian Government agencies. Two of these involve reporting on the national extent of forest at regular intervals (Montreal Process Implementation Group for Australia and National Forest Inventory Steering Committee 2013; Commonwealth of Australia 2015), for which the map base for Major Vegetation Groups forms the primary data source (Table 1).

There is a diverse and growing range of applications of the Major Vegetation classification for biodiversity assessments (Table 1). These include tracking the remaining area of native vegetation, design of protected area networks, mapping of potential habitat for threatened species and

communities, and decision making on conservation investments. Conservation assessment was the application of the Major Vegetation classification that had the largest and most diverse group of users, including the Commonwealth, states and territories, research scientists and non-government conservation and land management organisations.

The third group of applications involves use of the Major Vegetation classification as a comparative framework to stratify surveys and research sites, scaling up of fine-resolution vegetation units, comparing vegetation across jurisdictional borders and contributions to global vegetation mapping (Table 1). These applications are mainly implemented by government agencies, but other users include the Terrestrial Ecosystem Research Network.

The earliest applications of the Major Vegetation classification were to meet Commonwealth reporting responsibilities, particularly for the Montreal Process and national land and water resources audit (NLWRA 2001; Montreal Process Implementation Group for Australia and National Forest Inventory Steering Committee 2013). However, the current range of applications reflects a growth and diversification of needs over the past decade.

Fit for purpose: classification features to meet needs

The diversity of needs for a national vegetation classification and map base creates difficulties in the design of a general system to meet all needs. Some applications require the classification to predict particular vegetation properties, while other applications require quite different features to be represented by the units of a classification. For example, effective carbon accounting over large geographic domains is predicated on map units that are informative about vegetation biomass. Use of vegetation maps in fire management requires the units to be informative about fuel type and accumulation rates. Forest reporting requires the units to conform with the nationally agreed definition of 'forest' (*viz. dominated by trees having usually a single stem and a mature or potentially mature stand height exceeding 2 metres and with existing or potential crown cover of overstorey strata about equal to or greater than 20 per cent*) (Montreal Process Implementation Group for Australia and National Forest Inventory Steering Committee 2013). At a broad level, these applications are best served by a classification founded on structural features reflecting the height and density of plant biomass across different vertical strata.

In contrast, the wide range of conservation applications and most of the comparative applications (Table 1) require the units to represent different groups of biota – they must perform well as 'biodiversity surrogates' (Pressey 2004; Hermoso et al. 2013). This is essential to draw credible inferences about representation of biodiversity in protected areas, losses of biodiversity related to change in vegetation extent; the distribution of threatened species and ecological communities; and is therefore key to informing sound decisions that seek effective returns on conservation investments. To perform well on these tasks, a vegetation classification needs to be based on ecological features. These include factors that influence the distribution of biota (environmental gradients and ecological processes that define species niches), as well as the composition of the biota itself (Keith 2009; Hermoso et al. 2013; Keith et al. 2015).

Thus for one group of applications, the structural form (specifically biomass) of vegetation is key to outcomes, irrespective of how that structure is produced, while for another group of uses the ecological identity of biotic elements is key to outcomes. In nature, structural features of vegetation sometimes coincide with ecological features, sometimes they do not. Consequently, there may be conflicting goals in the design of a unifying classification system. The emphasis on characteristics of vegetation structure and taxonomy as a basis for defining Major Vegetation Groups and Subgroups reflects early priority needs to support reporting on forests. Consequently, this appears to limit the performance on some conservation applications, the demand for which has increased in more recent years.

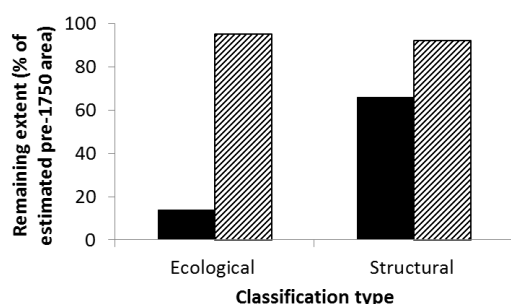
One of the key issues for biodiversity applications, such as state of environment reporting, is averaging effects. This applies to cases where two or more ecologically contrasting units with different biota have similar vegetation structure, and are thus lumped into a single structurally defined category. If the ecological units are exposed to different types of resource use and threatening processes, they may have very different status in terms of conservation metrics. However, the true status is masked when the ecological units are lumped into a single structural category because the extreme metric values for each ecological unit are averaged to moderate values for the combined structural category. Box 1 illustrates an example of the effect.

Box 1. Averaging effects: sub optimal fit-for-purpose performance for contrasting applications.

In Australia, eucalypt woodlands are distributed extensively in a belt around the arid core of the continent. These vary in structure throughout their range, particularly with regard to canopy cover. In the NVIS, this structural variation is recognised by classifying eucalypt woodlands into two Major Vegetation Groups: MVG 5 (Eucalypt Woodlands) and MVG 11 (Eucalypt Open Woodlands). These categories are useful for reporting on forest inventories and related applications because MVG 5 meets the agreed definition of 'forest', whereas MVG 11 does not (Montreal Process Implementation Group for Australia and National Forest Inventory Steering Committee 2013).

As well as varying structurally, Australian eucalypt woodlands vary greatly in their biodiversity. For example there is a major ecological contrast between tropical eucalypt woodlands, which share a number of ecological features with other savannah biomes in Africa, southeast Asia and South America, and temperate eucalypt woodlands, which have no close ecological analogues on other land masses. Moreover, tropical and temperate woodlands share very few species of plants and animals in common. Consequently, any effective conservation strategy should aim to conserve representative and viable samples of both tropical and temperate eucalypt woodlands and track their status independently (e.g. in state-of-environment reporting).

The tropical eucalypt woodlands are one of the last largely intact tracts of woodland on earth, having so far avoided effects of high-density human population growth and exploitation for broad-scale agriculture. In contrast, the status of temperate eucalypt woodlands is rather dire due to their exposure to broad-scale agricultural development over more than two centuries. When classified ecologically into two broad groups that represent major contrasts in species composition, the status of tropical and temperate woodlands is highly contrasting: more than 95% of tropical woodlands remaining intact (data from Fox et al. 2001); while less than 15% remains of temperate woodlands within the wheatbelts of southeastern and southwestern Australia (data from Lunt and Bennett 2000; Keith 2004; Beard et al. 2013). When classified into broad structural categories, the equivalent metrics are 66% remaining for eucalypt woodland (MVG 5) and 92% remaining for open eucalypt woodland (MVG 11) (data from NVIS v4.1; see also NLWRA 2001). The % remaining statistics derived from the structural classification and map therefore mask the greatly contrasting conservation status of biodiversity in tropical and temperate eucalypt woodlands (see figure). In essence, the large initial and remaining area of tropical woodlands masks the precipitous trends in the extent of temperate woodlands.



Similar artefacts derived from averaging effects are evident when these types of analyses are applied to other vegetation types such as eucalypt forests, acacia forests and woodlands, grasslands and various shrublands. Conversely, averaging effects would also reduce the performance of forest reporting if a structural classification was replaced by an inappropriate ecological classification that did not align with the agreed definition of forest.

A number of users identified difficulty in extracting distributional data for ecological units such as savanna, temperate woodlands, grasslands, alpine vegetation and wetlands that correspond poorly with structurally defined groups or where it is practically difficult to interpret their structural features in a consistent way. In many cases, this can

be resolved by reference to Level 5 or 6 of the NVIS information hierarchy, as many of the source vegetation units that are aggregated into MVGs and MVSs are ecologically homogeneous to the degree required to support inferences about biodiversity. However, interpretation at this level for national (or subnational) synthesis is extremely onerous given the large number of records (>18000) within the NVIS and the scope of accessible descriptive data, which is limited to between three and five dominant taxa in each vertical stratum.

The need to improve predictive performance of broad classification units is reflected in a range of suggested improvements to the classification elicited from NVIS users. In summary these include:

- Restructuring the classification towards an exclusive hierarchical relationship between MVGs and MVSs. Ideally any given MVS should be uniquely nested within a single MVG.
- Evaluate and improve alignment between MVGs/MVSs and broad units currently adopted by states/territories where these exist (e.g. Keith 2004; Beard et al. 2013; Neldner et al. 2014).
- Increasing the number of MVSs to c. 100 by splitting the most heterogeneous units, and providing more detailed descriptions. While the number of MVGs (25) provide a useful level of resolution for national overview, some users felt more resolution at the MVS level would benefit their applications.
- Adjusting MVSs and adding more detailed descriptions to capture major structural differences, major compositional differences and major landform differences.
- Rationalising 'Other' groups, which are currently circumscribed as leftovers from more clearly defined groups (MVGs 10, 17, 21, 31 and numerous MVSs). The structural and ecological heterogeneity of these groupings was seen as problematic. Some could be resolved by merging elements into other groups.
- Improving consistency or better-accommodating inconsistencies between data contributors in attribution of NVIS levels V and VI through the interpretation of concepts such as dominance, regrowth, grassland with scattered trees cf. open woodland, heathland and mallee cf. mallee heath, etc.
- Disentangling 'regrowth' from the concept of 'MVG' by revising the NVIS attribution such that any MVG can exist in a range of regrowth states.
- Recent improvements to edge matching across state borders were widely acknowledged. Some further work on this is needed to resolve remaining anomalies.
- Adjusting MVGs/MVSs where necessary to enable simple cross-walk relationships between Australia's national vegetation classification and the international vegetation classification system currently under development (Faber-Langendoen et al. 2014).
- Adjusting circumscriptions of particular MVGs and MVSs to make them more homogeneous and consistent (see details below).
- Maintaining and strengthening close working relationships with data contributors in state agencies to ensure currency and consistency.
- Linking the database entries and descriptions of MVGs and NVSs to the Australian Plant Name Index to ensure nomenclature is up to date.
- Streamlining the process of assigning NVIS Level 5/6 records to MVGs and MVSs.

Proposed framework for a national Major Vegetation classification

A key challenge for future development of the national vegetation classification system is how to improve its ability to meet requirements for biodiversity applications without compromising its performance or consistency for reporting changes in forest inventory or carbon accounting mandated by international agreements (Box 1). Temporal consistency is important, for example in forest mapping, to ensure that recorded trends in forest extent reflect genuine change, rather than changes in methods of forest classification and mapping. This places significant constraints on modifications to existing Major Vegetation Groups to improve their utility for biodiversity applications.

One strategic solution to this trade-off is to adopt an ecological concept for Major Vegetation Subgroups that is at a resolution fine enough for them to display a greater degree of homogeneity in

both compositional and structural properties. Such an approach is consistent with many of the suggestions elicited from NVIS users and would facilitate the establishment of major ecological groupings that could sit alongside the structurally based MVGs (Figure 1).

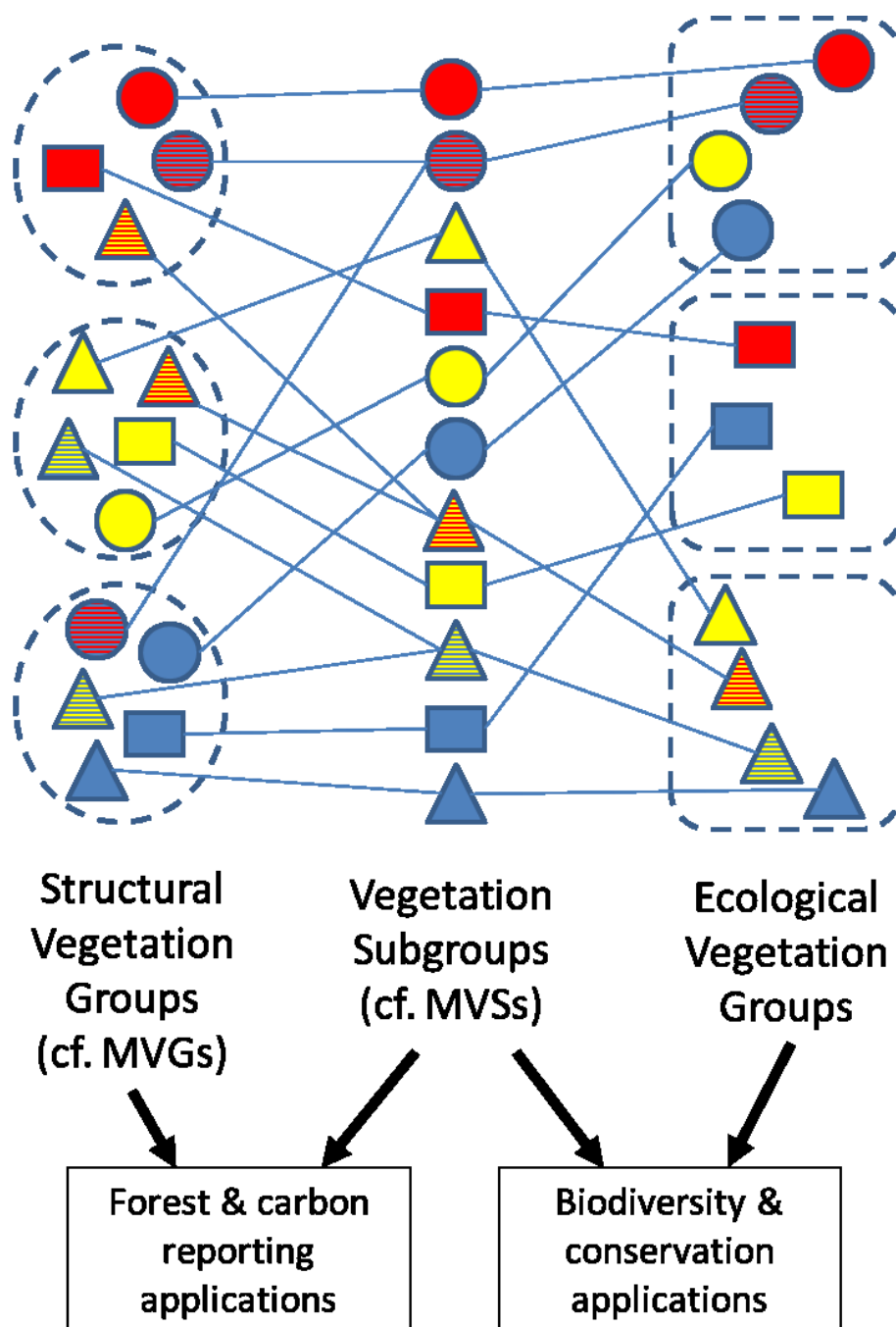


Figure 1. Schematic representation of proposed vegetation classification framework. This involves a greater number of more homogeneous vegetation subgroups, which are assignable to structural vegetation groups (dashed ellipses) on the basis of their structural features (represented by shared colours of the objects) and to ecological vegetation groups (dashed rectangles) on the basis of their floristic and ecological features (represented by shared shapes of the objects). Unbroken lines represent the membership of subgroups to structural and ecological groups, respectively. Hatched shapes represent vegetation subgroups with a wide range of structural expressions, and which are therefore assignable to two or more structural groups.

The potential benefits of this dual system include the following:

1. MVGs could be aggregated into either:

- a. major structural groupings (consistent with the current concept of MVGs) or;
 - b. major ecological groupings,
 providing users with alternative products that serve different applications more effectively than any single product could.
2. MVSs would be fully nested within major ecological groupings
3. With some relatively minor adjustments to some MVGs, revised MVSs would reduce the current overlaps whereby some MVSs are represented within multiple structurally based MVGs
4. Enhanced ecological homogeneity at the MVS level would facilitate:
 - a. more detailed descriptions of the units;
 - b. explicit diagnostic keys for identification; and
 - c. successful modelling of their distributions using environmental spatial data due to the tighter relationships between the occurrence of the subgroups and environmental variables.

A proposed typology of ecological subgroups and their relationships to existing structurally defined Major Vegetation is given in Table 2. The proposed subgroups are unlikely to represent the full range of variation within all major groups. Detailed recommendations for subgroup classifications within each MVG are given below. The currently proposed classification includes 82 subgroups, fewer than the notional practical limit of c. 100 units, allowing some flexibility to further resolve heterogeneous units. At this stage the proposed classification (Table 2) does not resolve major ecological vegetation groups, but such groups could be developed with a modest amount of further work. Further input and consultation with jurisdictional experts will also produce a more comprehensive typology of subgroups that corresponds well with established state typologies within a parsimonious number of approximately 100 subgroups. See detailed recommendations for each MVG for specific options to develop the subgroup level of the classification.

Table 2. Proposed subgroups within Structural Vegetation Groups (MVGs). Note: subgroups have been matched as closely as possible to existing MVS numbers, although there may be some variation in concepts (see Recommendation 3 below).

MVG NO	MVG name	MVS NO	Subgroup name	Representation in other MVGs
1	Rainforests and Vine Thickets	1	Cool temperate rainforest	
		2	Tropical and sub-tropical rainforest	
		6	Warm Temperate Rainforest	
		62	Dry rainforest and vine thickets	
		##	Monsoon vine forests	
2	Eucalypt Tall Open Forests	3	Subtropical broadleaf wet sclerophyll forests	
		##	Cool temperate ferny wet sclerophyll forests	
		54	Subtropical open wet sclerophyll forests	MVG 3
		60	Cool temperate open wet sclerophyll forests	MVG 3
		##	Western wet sclerophyll forests	
3	Subtropical and Temperate Eucalypt Open Forests	4	Eastern dry shrubby sclerophyll forests	
		5	Dry shrub/grass sclerophyll forests	
		##	Western dry shrubby sclerophyll forests	
		##	Riparian eucalypt forests	
		54	Subtropical open wet sclerophyll forests	MVG 2
		60	Cool temperate open wet sclerophyll forests	MVG 2
4	Tropical Eucalypt Open Forests	##	Tropical eucalypt savannah forest	

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5	Eucalypt Woodlands	9	Eastern temperate grassy woodlands	
		59	Subalpine woodlands	
		##?	Western temperate shrubby woodlands	
		65	Semi-arid floodplain and wadi woodlands	MVG 11
		8	Semi-arid upland woodlands	MVG 11
6	Acacia Forests and Woodlands	13	Brigalow forests and woodlands	
		##	Gidgee woodlands	MVG 13
		14	Upland tropical Acacia Woodlands	
		20	Stony mulga woodlands and shrublands	MVG 13, 16
7	Callitris Forests and Woodlands	12	Callitris forests and woodlands	MVG 31
8	Casuarina Forests and Woodlands	26	Calcareous sandplain woodlands	MVG 31
		##	Eastern floodplain/estuarine forests	
		##	River oak forests	
9	Melaleuca Forests and Woodlands	15	Tropical sandplain woodlands	MVG 31
		##	Tropical riparian forests	
		##	Tropical floodplain forests	
		##	Sandplain wetland forests and woodlands	
10	Other Forests and Woodlands	58	Leptospermum forests and woodlands	
		11	Tropical mixed spp forests and woodlands	
		50	Banksia woodlands	
		16	Other forests and woodlands	
11	Eucalypt Open Woodlands	18	Desert eucalypt woodlands	
		8	Semi-arid upland woodlands	MVG 5
		65	Semi-arid floodplain and wadi woodlands	MVG 5
12	Tropical Eucalypt Woodlands/Grasslands	7	Tropical Eucalyptus woodlands with a tall annual grassy understorey	
13	Acacia Open Woodlands	22	Semi-arid myall woodlands	
		23	Sandplain Acacia woodlands and shrublands	MVG 16
		24	Arid myall woodlands	
		##	Gidgee woodlands	MVG 6
		20	Stony mulga woodlands and shrublands	MVG 6, 16
14	Mallee Woodlands and Shrublands	27	Triodia mallee	MVG 32
		55	Shrubby mallee	MVG 32
		61	Chenopod mallee	MVG 32
		29	Heathy mallee	MVG 32
		##	Western mallee	MVG 32
15	Low Closed Forests and Tall Closed Shrublands	28	Littoral scrubs	
16	Acacia shrublands	20	Stony mulga woodlands and shrublands	MVG 6, 13
		23	Sandplain Acacia woodlands and shrublands	MVG 13
17	Other Shrublands	49	Melaleuca shrublands and open shrublands	
		57	Lignum shrublands and wetlands	
		32	Other shrublands	
		80	Sparse shrublands	

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18	Heathlands	30	Southwest heathlands	
		##	Eastern heathlands	
		##	Montane and alpine heathlands	
		##	Tropical heathlands	
19	Tussock Grasslands	34	Tropical arid grasslands	
		36	Temperate tussock grasslands	
		##	Alpine grasslands and herbfields	
20	Hummock Grasslands	33	Hummock grasslands	
21	Other Grasslands, Herblands, Sedgelands and Rushlands	38	Mires	
		63	Coastal floodplain meadows and lagoons	
		##	Inland wetland complex	
		41	Brackish reedlands and sedgelands	
22	Chenopod Shrublands, Samphire Shrublands and Forblands	31	Sandplain bluebush shrublands	
		##	Clay plains saltbush shrublands	
		##	Gibber chenopod shrublands	
		39	Coastal saltmarshes	
		##	Salt lake samphires	
23	Mangroves	40	Mangroves	
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	
31	Other Open Woodlands	26	Calcareous sandplain woodlands	MVG 8
		15	Tropical sandplain woodlands	MVG 9
		12	Callitris forests and woodlands	MVG 7
		79	Other open woodlands	
		72	Desert oak woodlands	
32	Mallee Open Woodlands and Sparse Mallee Shrublands	xx	Western mallee	MVG 14
		29	Heathy mallee	MVG 14
		55	Shrubby mallee	MVG 14
		61	Chenopod mallee	MVG 14
		27	Triodia mallee	MVG 14
99	Unknown/no data	99	Unknown/No data	

Updated descriptions for Major Vegetation Groups

Updated fact sheets for 30 MVGs and new fact sheets for two MVGs are given in Appendix A. The descriptions of MVGs include proposed subgroups that represent ecological variation within the structurally defined major groups (Table 2). Where appropriate, additional photographs (licensed under creative commons by attribution) have been added to illustrate the range of variation within MVGs. In some cases, existing photos have been replaced to give a more balanced illustration of characteristic vegetation within an MVG. For example, the existing fact sheet for MVG 22 included two photographs of alpine herbfield and bolster heath, yet a large majority of the mapped distribution of MVG 22 comprises arid chenopod shrublands. In this case, the alpine photos were replaced with photos showing the range of variation in chenopod shrublands (see also specific recommendations below for MVG 22).

Diagnostic keys for subgroups within Major Vegetation Groups

Dichotomous keys to assist the identification of subgroups within each Major Vegetation Group are presented in Appendix B. These require testing and refinement to ensure optimal reliability of identification outcomes.

Recommendations

Strategic development of the classification system

The following recommendations are to support development of the Major Vegetation classification system to serve traditional and emerging needs. Some may be implementable over relatively short time frames. Others may be implemented over medium time frames as resources permit.

Vegetation Subgroups

1. In consultation with data contributors, continue to resolve vegetation subgroups in line with an ecological concept, whereby units are defined by key ecological features as well as compositional features of vegetation. 'Key ecological features' are locally and regionally relevant environmental gradients and ecological processes that determine species niches. This reform will strengthen the underlying theoretical basis for performance of vegetation subgroups as 'surrogates' for biodiversity.
2. Define the level of variability equitably within vegetation subgroups such that a set of approximately 100 units encompasses the full range of variation in ecological vegetation features on the Australian continent.
3. Label the subgroup level of classification as 'Ecological Vegetation Subgroups' to communicate the underlying concept of their definition and distinguish them from earlier concepts (e.g. understorey growth forms) used to define current MVSs. Give consideration to a fresh numbering system to avoid confusion with pre-existing subgroups defined under earlier concepts (Table 2 and Profiles in Appendix A attempt to match the current MVS numbering where possible, but this may promote confusion).

Major Vegetation Groups

4. Establish a dual system (Figure 1) allowing each NVIS record and each subgroup to be assigned (attributed) to both a structural group (based on the height, density and dominant genera of vertical vegetation strata) and ecological groups (based on ecological features and species composition). This requires definition of the major ecological vegetation groups.
5. Maintain the structural vegetation groups close to the current circumscriptions of MVGs, except where minor adjustments can resolve existing anomalies. This will preserve the consistency of ongoing reporting on forests and carbon stocks.
6. Ensure exclusive nested relationships between vegetation subgroups and ecological vegetation groups, and minimise cases where vegetation subgroups are represented in two or more structural vegetation groups.

7. Label the parallel major groupings as 'Structural Vegetation Groups' (currently Major Vegetation Groups) and 'Ecological Vegetation Groups' to promote transparency about the nature of the units to users.

Incremental improvements and resolution of classification anomalies

The following recommendations have been implemented in the revised versions of fact sheets presented in Appendix A.

8. Rationalise 'Other' groups, which are currently circumscribed as leftovers from more clearly defined groups (e.g. MVGs 10, 17, 21, 31 and numerous MVSs). Some could be resolved by merging elements into other groups.
9. Improving consistency or better-accommodating inconsistencies between data contributors in attribution of NVIS levels V and VI through the interpretation of concepts such as dominance, regrowth, grassland with scattered trees cf. open woodland, heathland and mallee cf. mallee heath, etc.
10. Revise NVIS attribution to incorporate a 'regrowth' field, allowing each NVIS record to be attributed to structurally intact and regrowth states determined in consultation with data contributors (e.g. intact, advanced post-clearing regrowth, young post-clearing regrowth, etc. with agreed definitions). This reform would avoid lumping of different forms of regrowth into a single MVG and improve consistency among data contributors.
11. In consultation with data contributors, continue to resolve edge matching anomalies between and within jurisdictional borders.
12. Develop simple cross-walk relationships between Australia's national vegetation classification and the international vegetation classification system currently under development (Faber-Langendoen et al. 2014).
13. Link the database entries and descriptions of vegetation groups and subgroups to the Australian Plant Name Index to ensure nomenclature is up to date.
14. Investigate options to streamline the assignment of NVIS Level 5/6 records to MVGs and MVSs. Automated scripts for such assignments require accurate and consistent attribution of NVIS records and verification procedures to ensure quality control.
15. Test and refine diagnostic keys to vegetation subgroups with input from data contributors.
16. Over time, update and improve photographic illustrations of vegetation groups and subgroups.

Specific Recommendations for Major Vegetation Groups and Subgroups

MVG 1. Split the existing subgroup MVS 62 to create a new subgroup 'Monsoon vine forests distributed in NT and WA from dry rainforests and vine thickets found in drier areas of Qld and NSW. Monsoon rainforests have a more strongly seasonal drought and some endemic elements not represented in the east. Conversely, eastern vine thickets include many species not represented in the monsoon tropics. Maintain other existing subgroups.

MVG 2. Split the existing MVS 3 into two new subgroups: Subtropical broadleaf wet sclerophyll forest (NSW, QLD); and Cool temperate ferny wet sclerophyll forest (NSW, VIC, TAS) to reflect differences in stand structure (multi-aged cf. more even-aged), species composition and understorey structure. Change name of MVS 54 to reflect its inclusion of forests with both broad- and fine-leaved shrubs in subtropical-warm temperate climates. Change name of MVS 60 to reflect its inclusion of mesic temperate forests with grassy/graminoid understories on both well-drained and boggy substrates. Create new subgroup for wet eucalypt forests in WA, which are compositionally unique.

MVG 3. Split tropical open forests from MVG3, rename as 'Subtropical and temperate open eucalypt forests', and re-assign tropical open forests (savannah forests) to revised MVG 4. This revision will separate disjunct forests with structurally, phenologically and contrasting understories and

compositionally distinct overstories. Include MVS 54 as well as 60 in both MVG3 and MVG2. Retain existing subgroups MVS 4 and 5, but rename 'Eastern dry shrubby sclerophyll forests' and 'Dry shrub/grass sclerophyll forests', respectively, to reflect understorey features and distribution more transparently. Create a new subgroup for dry eucalypt forests in WA, which are compositionally unique. Create a new subgroup for riparian forests 'Riparian eucalypt forests' which share superficial structural resemblance with MVS 5, but are distinctive in terms of composition and function and some structural features (amphibious forbs and graminoids). Some of these riparian forests may also warrant inclusion in MVG 2, although currently few records are assigned there.

MVG 4. Revise the concept of MVG 4 and rename to 'Tropical open forests'. Include in the revised MVG 4 disjunct forests from northern Qld, NT and WA extracted from MVG3, which have structurally, phenologically and contrasting understories and compositionally distinct overstories from those subtropical and temperate forests remaining in MVG 3. Re-assign to other relevant MVGs the relatively small number of records previously assigned to MVG 4 under the 'low open forests' concept. Create a single subgroup 'Tropical eucalypt savannah forest'.

MVG 5. Revise the subgroups, which are currently based on understorey life form, to reflect ecological attributes and align more closely with jurisdictional classifications. Adopt five subgroups as follows: Eastern temperate grassy woodlands (similar to MVS 9, temperate grass box-ironbark forests of ACT, NSW, QLD, VIC SA, TAS); Subalpine woodlands (partially similar to MVS 59, low snow gum and sallee woodlands with mixed shrub/grass understories in cold elevated climates of ACT, NSW, VIC, TAS); Western temperate shrubby woodlands (similar to MVS 8, temperate eucalypt woodlands of WA wheatbelt); Semi-arid floodplain and wadi woodlands (similar to MVS 65, coolabah, black box and river red gum woodlands of inland floodplains and channels in NSW, VIC, QLD, NT, SA, WA); and Semi-arid upland woodlands (woodlands of various Adnataria and Bisectaria eucalypts on semi-arid peneplains, hills and plateaus in NSW, QLD, NT, SA, WA). Transfer MVS 10 (Eucalypt woodlands with Triodia understorey) to MVG 11, as many records are likely to have projective foliage cover <10%.

MVG 6. Retain MVSs 13, 14 and 20, but rename 'Brigalow forests and woodlands', 'Upland tropical Acacia Woodlands' and 'Stony mulga woodlands and shrublands', respectively to reflect structural and ecological features. Create an additional subgroup 'Gidgee woodlands' to reflect ecologically distinct woodlands in NSW, QLD, SA and NT. This new subgroup is also represented in MVG 13, while MVS 20 is also represented in MVGs 13 and 16. This configuration aligns well with Queensland BVGs. Re-assign to MVG 1, 2 or 3, the small number of records of temperate mesic acacia forests that are currently included within MVG6. These occur within matrices of eucalypt forest, typically have eucalypt or emergent or rainforest co-dominants at low densities, and do not match any of the MVSs

MVG 7. Retain MVS 12 as the only subgroup. *Callitris glaucophylla* exhibits a strong regrowth response to various disturbances including selective logging and overgrazing. Consequently some forests and woodlands currently dominated by abundant *Callitris* are derived from eucalypt forests and woodlands (MVGs 3 and 5) and include remnant eucalypts within the stands. Consider re-assigning the regrowth records with appropriate attribution (see Recommendation 10 above) to MVGs 3 and 5. This would retain the relatively restricted *Callitris*-dominated woodlands characteristic of semi-arid sandhills within MVG 7 and MVS 12.

MVG 8. Create three subgroups to reflect major differences in structure, function and composition. The most widespread of these, Calcareous sandplain woodlands dominated by *C. pauper* in semi-arid NSW, VIC, SA, could retain the existing subgroup number, MVS 26. New subgroups include Eastern floodplain/estuarine forests dominated by *C. glauca* in NSW, QLD and River oak forests dominated by *C. cunninghamiana* in ACT, NSW, QLD. *Casuarina cristata* woodlands of subtropical latitudes are typically within a matrix of brigalow and fit with the Queensland BVG concept of Brigalow woodlands. Consequently they are referred to MVG 6.

MVG 9. Create four subgroups to reflect differences in structure, function and composition and align with Queensland BVGs. The most extensive subgroup, Tropical sandplain woodlands dominated by *Melaleuca viridiflora* and allies in WA, NT, QLD, could be assigned to MVS 15. It is less frequently inundated than other subgroups including: Tropical riparian forests (dominated by *M. argyrodendron* and others along stream in WA, NT, QLD); Tropical floodplain forests (dominated by *M. leucadendra* and others in tropical floodplain depressions in NT, QLD); and Sandplain wetland forests and woodlands (coastal sandplain swales and transitional floodplain/sandplain depressions dominated by *Melaleuca quinquenervia* with *Eucalyptus robusta* in QLD, NSW).

MVG 10. This is a disparate group of ecologically unrelated vegetation types that also have some physiognomic and structural dissimilarities. It is one of the MVGs recommended for rationalisation in Recommendation 8 (see above). At this time the four subgroups (MVS 58, 11, 50, 16) are retained pending future revision in which the currently assigned records may be dispersed among other appropriate MVGs. This may require minor adjustment to circumscriptions of those MVGs

MVG 11. Rationalise the subgroups to reduce overlap with MVG 5. Retain MVS 18 and relabel as 'Desert eucalypt woodlands' including those dominated by desert bloodwoods, ghost gums and snappy gums with shrub and hummock grass understories. This could be lumped with MVS 20, many of which have open tree canopies. Some poorly known desert woodlands are dominated by *Corymbia terminalis* sens. lat. with tussock grass and shrub understories may warrant segregation when data improves. Two MVSs assigned to MVG 5 (Semi-arid floodplain and wadi woodlands, and Semi-arid upland woodlands) commonly have structural expressions as open woodland and are thus also represented in MVG 11. The remaining MVS numbers currently assigned to MVG 11 (19, 47, 48, 53, 56) do not cover additional variation and could be retired.

MVG 12. Retain as currently configured with one subgroup (MVS 7), noting that a number of records currently assigned to MVG 5, should be assigned to MVG 12. Delete reference to 'forests' in the label of MVS 12 – forests are assigned to the revised MVG 4.

MVG 13. Retain MVSs 22 and 23, but rename as 'Semi-arid Myall woodlands' and 'Sandplain Acacia woodlands and shrublands' respectively, to reflect structural and ecological features. The latter is also represented in MVG 16. Two subgroups represented in MVG 6 are also represented (more extensively) in MVG 13: 'Gidgee Woodlands' and 'Stony mulga woodlands and shrublands'. The latter is also represented in MVG 16. Create an additional subgroup 'Arid Myall woodland' to reflect ecologically distinct woodlands in western NSW, southern SA and southeast WA. This new subgroup corresponds roughly with existing MVSs 24 and 25. If the former is retained for labelling the new subgroup, the remaining MVS numbers currently assigned to MVG 13 (21, 25, 45, and 52) could be retired because they do not cover additional variation.

MVG 14. Retain existing subgroups and add two others to achieve alignment with classifications of Haslem et al. (2010) and Beard et al. (2013). Relabel existing MVSs 27, 29, 55 and 61 as 'Triodia mallee', 'Heathy Mallee', 'Shrubby mallee' and 'Chenopod mallee', respectively after Haslem et al. (2010). Create an additional subgroup representing compositionally unique 'Western Mallee' restricted to WA. Heathy mallee requires careful interpretation against descriptions to ensure correct diagnosis with respect to mallee heathlands, which include taxonomically distant eucalypts and different shrub species composition in climatically humid regions. All MVG 14 subgroups are also represented in MVG 31.

MVG 15. Resolve into a more homogeneous grouping by re-defining the concept of MVG 15 around coastal littoral scrubs. Unrelated non-littoral scrubs include heathlands (MVG 18) and mire sedgelands (MVG 21) and should be re-assigned to appropriate subgroups within those MVGs. Three geographically and climatically segregated assemblages may later warrant recognition as separate subgroups: open tropical dominated by *Casuarina equisetifolia*, southeastern temperate scrubs dominated by *Banksia integrifolia*, *Leptospermum laevigatum* and *Melaleuca* spp., and

southwestern scrubs dominated by *Agonis flexuosa* and *Melaleuca* spp. At present these are retained in the single MVS 28.

MVG 16. None of the current MVSs are uniquely assigned to MVG 16, which includes shrub-dominated structural expressions of two revised subgroups also represented in MVG 13: 'Sandplain *Acacia* woodlands and shrublands', and 'Stony mulga woodlands and shrublands'. At present, these should be retained as the only subgroups within MVG 16. Future improvements in available data may enable resolution of these broad and regionally variable groupings into a larger number of subgroups.

MVG 17. Retain the most extensive subgroup (MVS 57 lignum shrublands), which corresponds represents a sound ecological concept (inland floodplain shrublands) represented in multiple jurisdictional vegetation units. The *Melaleuca* shrublands represented in MVG 17 as MVS 49 encompass an ecologically broad range of brackish scrubs, mire wetlands and semi-arid shrublands that require rationalisation as resources and data permit. 'Other shrublands' (MVS 32) also include includes disparate assemblages, many of which are likely to be either *Acacia* shrublands (MVG 16) with subjectively variable expressions of dominance or disturbance derivatives in response to overgrazing of other MVGs (e.g. MVG 11, 13, 14, 16). In both cases, re-assignment of records could produce a more parsimonious representation of vegetation relationships. As for MVG 7, consider re-assigning the regrowth records with appropriate attribution (see Recommendation 10 above) to relevant MVGs.

MVG 18. Split the only unique heathland subgroup (MVS 30) into four ecologically and compositionally distinct new subgroups: Southwest heathlands (unique to WA); Eastern heathlands (in QLD, NSW, VIC, SA, TAS); Montane and alpine heathlands (in NSW, TAS, VIC); and Tropical heathlands (in NT and the Kimberley region of WA). The first three of these display substantial ecological and compositional variation that may warrant recognition at subgroup level with future development of the major vegetation classification. The NVIS records currently assigned to MVS 18 under-represent its extent, suggesting that records currently assigned to other MVGs (e.g. 3, 14, 15, 17) warrant re-evaluation.

MVG 19. Combine the two currently recognised tropical grassland subgroups 34 (Mitchell grassland) and 35 (Blue grassland) and relabel as 'Tropical arid grasslands'. The major genera commonly co-occur on black cracking clay plains, and merging them would be consistent with Queensland's classification, which recognises Broad Vegetation Types with two subtypes, both of which include Mitchell grass and Blue grass). Consider creating an additional subgroup for subtropical arid grasslands, in which Blue grass is replaced by other tussock grass genera and chenopod forbs. Retain MVS 36 representing ecologically, physiognomically and structurally distinct temperate tussock grasslands, with variations in coastal and arid climates, that may warrant future recognition as distinct MVGs. Create a new subgroup including distinctive alpine grasslands and herbfields (noting that virtually all herbfields are in the alpine zone) include a tussock grass component with common floristic elements. Rationale 'Other grasslands' (MVS 37) among other MVSs or MVG 21, as appropriate.

MVG 20. Retain the existing subgroup (MVS 33), which provides an adequate representation of broad-scale diversity, given current knowledge of this extensive MVG.

MVG 21. Refine concept of MVG slightly to exclude non-wetland vegetation (currently a minor component). Revise the subgroups, which are currently based on life form, to reflect ecological attributes and align more closely with jurisdictional classifications. Adopt four subgroups as follows: Brackish reedlands and sedgelands (similar to MVS 41); Coastal floodplain meadows and lagoons (similar to MVS 63); Inland wetland complex; and Mires (partly similar to MVS 38). Re-assign 'Other grasslands' to other subgroups within MVG 21 or MVG20, as appropriate. Re-assign components of MVS 17 to MVGs 18 (shrubby fjaeldmark), 19 (herbaceous fjaeldmark), 27 (Boulders/rock) or other MVGs as appropriate.

MVG 22. Split MVS 31 into three subgroups: Sandplain bluebush shrublands; Clay plains saltbush shrublands; and Gibber chenopod shrublands to reflect major structural and compositional differences between arid zone chenopod shrublands. Split MVS 39 into two subgroups: Coastal saltmarsh; and Salt lake samphires to represent structural and compositional variation between variation between tidal and inland salt lake vegetation. Existing subgroups do not include alpine forblands and bolster heaths, which should be re-assigned to MVG 19 (Alpine grasslands and herbfields subgroup) and MVG 18 (Montane and alpine heathlands subgroup), respectively.

MVG 23. Consider splitting the existing MVS 40 into two subgroups representing diverse tropical and subtropical mangrove communities and largely monospecific temperate communities (approximately delineated by 30°S).

MVG 24-29, 99. Maintain two existing subgroups within MVG 24. Maintain single subgroups for MVGs 25-28 and 99. Re-consider subgroups of MVG 29 with regard to Recommendation 10, above.

MVG 30. Re-assign the small number of records currently assigned to MVG 30 to the revised concept of MVG 4. They fit well within this revised group.

MVG 31. Includes open-woodland structural expressions of subgroups also represented within MVGs 7, 8 and 9. Re-assign MVS's 70, 71, 73 and 75 to subgroups Callitris forests and woodlands, Calcareous sandplain woodlands and Tropical sandplain woodlands, as appropriate. Relabel MVS 72 as 'Desert oak woodlands' to clarify key features of the vegetation. Re-assign records in MVS 79 to relevant subgroups or MVGs.

MVG 32. Replace existing subgroups with those described for MVG 14, as understories are indistinguishable in the different structural expressions of the tree layer.

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Appendix 1. Descriptive profiles of Major Vegetation Groups

Appendix 2. Diagnostic keys to subgroups within Major Vegetation Groups

Keith, D. A. & Pellow, B. J. (2015). Review of Australia's Major Vegetation classification and descriptions. Centre for Ecosystem Science, UNSW, Sydney.

These keys were adapted from earlier keys developed by Matt Bolton and Chris Meakin (Environmental Resources Information Network) to support NVIS 4.1 Refer to Hnatiuk et al. (2009) for a leaf size chart and lists of diagnostic features.

Table 1: Key to Major Vegetation Subgroups in MVG1: Rainforests and Vine Thickets (NVIS Version 4.1)

Key No.	Criteria	MVS# or Next Key No.	Broader groupings or MVS Name	Comments
0	<ul style="list-style-type: none"> Simple structure, with single tree stratum with relatively uniform leaf sizes and a lush understorey of tree ferns, ground ferns and bryophytes . Leaves of dominant trees small (nanophyll <2.5 cm or microphyll 2-5-7.5 cm). Usually single dominant tree species with perhaps 1 or 2 subordinates; usually from the Antarctic (cool temperate) genera (<i>Nothofagus</i>, <i>Athrotaxis</i>, <i>Phyllocladus</i>, <i>Atherosperma</i>, <i>Eucryphia</i>, etc.). <i>Acacia melanoxylon</i> emergent or subordinate. High moss and lichen diversity. Palms absent (except on montane Lord Howe Island), few vascular epiphytes and lianes. On various substrates. 	MVS1	Cool temperate rainforest	TAS, VIC, NSW and SE QLD Palms absent.
	<ul style="list-style-type: none"> Tree canopy more structurally complex and floristically more diverse than above. Often with multiple tree canopy layers (e.g. emergent and subcanopy). Vines present and typically conspicuous. Tree species of 	1		

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[illegible]

	<p>sizes larger than notophyll (>12.5 cm). Many co-dominant species and genera in the multi-layered tree canopy, which typically exceeds 25 m tall at maturity. Palms, lianes and epiphytes often abundant. Widespread on basic substrates such as basalt, as well as alluvium, marine sands and fine-grained sedimentary rocks in warm, wet climates receiving at least 1200 mm mean annual rainfall. East of the Great Divide in Queensland and coastal NSW.</p> <ul style="list-style-type: none"> Tree canopies typically simpler than above, mostly with notophyll leaves (7.5 – 12.5 cm) and less than 25 m tall at maturity (may be 10 m or shorter), often with at least some semi-deciduous elements. Palms typically absent except in monsoon forests where <i>Carpentaria</i> and <i>Livistona</i> may occur. Occurs in relatively dry climates receiving less than 1100 mm mean annual rainfall or with distinct winter dry season. 	3		
3	<ul style="list-style-type: none"> Tree canopy dominated by one or a few species, typically with at least some semi-deciduous species. Palms and Bryophytes generally absent, ferns generally uncommon except for <i>Pellaea</i> and <i>Asplenium</i> in the ground layer and <i>Pyrrosia</i> on rocks and tree trunks. Euphorbiaceae, Moraceae, Myrtaceae, Sapindaceae and Sterculiaceae are common tree families. Araucaria and several Acacia species may occur at subtropical latitudes. Understorey and 	MVS62	Dry rainforest and vine thickets	QLD, NSW

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	<p>ground layer typically sparse but may include grasses and herbs. Found on a variety of often rocky substrates where mean annual rainfall is less than 1100mm and as low as 600mm west of the Great Divide or in sheltered gorges within its eastern foothills. Queensland south from Townsville district to northern NSW, becoming confined to the coastal hinterland at latitudes greater than 32°S.</p> <ul style="list-style-type: none"> ▪ Tree canopy almost entirely deciduous or entirely evergreen depending on soil moisture retention and springs in dry season. Evergreen forests may be dominated by one or two species, notably <i>Allosyncarpia ternata</i>, while semi-deciduous forests typically include multiple genera from Combretaceae, Euphorbiaceae, Moraceae, Myrtaceae and Rubiaceae. Occurs on lowlands and floodplains or in rocky gorges where mean annual rainfall is less than 1200 mm, but rarely below 800 mm. Top end of the Northern Territory and Kimberley region of Western Australia. 	MVS ##	Monsoon vine forest	NT, WA
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Table 2: Key to Major Vegetation Subgroups in MVG2: Eucalypt Tall Open Forests (NVIS Version 4.1)

Key No.	Criteria	MVS# or Next Key No.	Broader groupings or MVS Name	Comments
0	<ul style="list-style-type: none"> Understorey is dominated by shrubs, small trees and/or tree ferns. Small trees may include <i>Acacia</i> species but other broad-leaf species typically also present. 	1		Eucalyptus (+/- tall) open forest with a dense broad-leaved and/or tree-fern understorey
	<ul style="list-style-type: none"> Understorey is dominated by non-woody growth forms (ferns, forbs, sedges, rushes or wet tussock grasses) sometimes with scattered shrubs or small trees (mainly <i>Acacia</i> species). Tree ferns rare. 	3		Eucalyptus tall open forests and open forests with wet tussock grasses and ferns, herbs, sedges or rushes
1	<ul style="list-style-type: none"> Occurs in Western Australia. Overstorey includes <i>Eucalyptus diversicolor</i> or <i>Corymbia calophylla</i> or <i>Eucalyptus gomphocephala</i>. Understorey shrubs/trees may include species of <i>Trymalium</i> or <i>Agonis</i>. 	MVS##	Western wet sclerophyll forests	This is the only MVG 2 subgroup represented in WA
	<ul style="list-style-type: none"> Forest has none of the above features. 	2		
2	<ul style="list-style-type: none"> Overstorey includes at least one eucalypt species from section <i>Transversaria</i> (<i>E. grandis</i>, <i>E. saligna</i>, <i>E. resinifera</i>, etc.) and none of the eucalypt species listed below are dominant. Understorey is dominated by broad leaved, mesophyllous (soft-leaved) shrubs, typically including some from Lauraceae, Rubiaceae, Sapindaceae or other families with tropical affinities. 	MVS3	Subtropical broadleaf wet sclerophyll forests	NSW, QLD. Distribution centred on NSW north coast with outliers in Qld tropics and increasingly confined to coastal lowlands in southern NSW

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	<ul style="list-style-type: none"> Overstorey includes at least one eucalypt species from section <i>Maidenaria</i> (<i>E. denticulata</i>, <i>E. cypellocarpa</i>, <i>E. globulus</i>, <i>E. nitens</i>, etc.) or at least one of the following 'ash' species: <i>Eucalyptus regnans</i>; <i>E. fastigata</i>, <i>E. obliqua</i> <i>E. campanulata</i>. Understorey is dominated by broad leaved, mesophyllous (soft-leaved) shrubs or tree ferns, including some from the following genera: <i>Bedfordia</i>, <i>Dicksonia</i>, <i>Olearia</i>, <i>Pomaderris</i>, <i>Prostanthera</i>. 	MVS60	Cool temperate ferny wet sclerophyll forests	NSW, VIC, TAS. Distribution centred on Victorian central highlands and southern Tasmania, increasingly confined to high elevations northward along the NSW escarpment
3	<ul style="list-style-type: none"> Overstorey includes at least one eucalypt species from section <i>Adnataria</i> (<i>E. siderophloia</i>, <i>E. molluccana</i>, etc.) or section <i>Transversaria</i> (<i>E. propinqua</i>, <i>E. resinifera</i>, <i>E. saligna</i>, etc.) or genus <i>Corymbia</i> (<i>C. intermedia</i>, <i>C. maculata</i>, <i>C. variegata</i>, etc.) or any of the following: <i>Eucalyptus microcorys</i>; <i>E. pilularis</i>; <i>Eucalyptus montivaga</i>; <i>Syncarpia glomulifer</i>; <i>Lophostemon confertus</i> and none of the eucalypt species listed below are dominant. Understorey may include C4 grasses such as <i>Imperata</i> or <i>Themeda</i>, and small trees or shrubs of <i>Allocasuarina torulosa</i>, <i>Alphitonia</i>, <i>Breynia</i> or <i>Maytenus</i>. Occurs north from Bega in NSW to Queensland and rarely at altitudes above 600 m south from 30°S. None of the overstorey species listed above are dominant. C3 grass species such as <i>Poa</i> 	MVS54	Subtropical open wet sclerophyll forests	NSW, QLD. Distributed from the central Queensland coastal hinterland to the NSW south coast, with the largest areas on NSW north coast (also represented in MVG 2)
	<ul style="list-style-type: none"> None of the overstorey species listed above are dominant. C3 grass species such as <i>Poa</i> 	MVS##	Cool temperate open wet sclerophyll forests	NSW, QLD(?), VIC, TAS. Occurs from Tasmania to

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	conspicuous in the understorey. Found south from the New England plateau in southern Queensland to southern Tasmania and may occur at any altitudes within that range.			southeast NSW, extending northwards along the tablelands to the NSW/Qld border (also represented in MVG 2)
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Table 3: Key to Major Vegetation Subgroups in MVG3: Eucalypt Open Forests (NVIS Version 4.1)

Key No.	Criteria	MVS# or Next Key No.	Broader groupings or MVS Name	Comments
0	<ul style="list-style-type: none"> Understorey has no 'mesic' attributes such as dominance by ferns or forbs or broad-leaf mesophyllous shrubs, but typically has sclerophyllous shrub species (with or largely without tussock grasses). Overstorey dominated by species of <i>Angophora</i>, <i>Corymbia</i> or <i>Eucalyptus</i> subgenus <i>Eucalyptus</i>, rarely subgenus <i>Symphyomyrtus</i>, except ironbarks (series <i>Crebrae</i> or <i>Paniculatae</i>) or grey gums (series <i>Punctatae</i>). 	1		Dry sclerophyll forests
	<ul style="list-style-type: none"> Understorey not as above, usually with a prominent layer of ferns, forbs and/or soft tussock grasses and no sclerophyllous shrub species. Overstorey dominants typically include at least one species from <i>Eucalyptus</i> subgenus <i>Symphyomyrtus</i> or subgenus <i>Nothocalyptus</i>. 	3		Wet sclerophyll forests
1	<ul style="list-style-type: none"> Understorey dominated by highly sclerophyllous (hard-leaved) shrubs, typically from families Ericaceae, Proteaceae, Myrtaceae Fabaceae or Xanthorrhoeaceae, with a sparse groundlayer of wiry sedges (Cyperaceae) or cord rushes (Restionaceae). Large tussock grasses scarce or absent. Usually on siliceous sands, sandstones or granitoids. 	2		Eucalypt forests with a heathy understorey

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	<ul style="list-style-type: none"> Understorey is dominated by a mixture of shrubs and grasses. Shrubs are mostly semi-sclerophyllous shrubs (e.g. families Apiaceae, Asteraceae, Rhamnaceae), but may include some highly sclerophyllous taxa (as above). Large tussock grasses (e.g. <i>Austrostipa</i>, <i>Cymbopogon</i>, <i>Rytidosperma</i>, <i>Poa</i> or <i>Themeda</i>) usually dominate a semi-continuous groundcover. 	3		Eucalyptus open forests with a mixed shrubby and grassy understorey
2	<ul style="list-style-type: none"> Occurs in eastern states (east of Nullarbor plain). Tree stratum does not include either <i>Eucalyptus marginata</i>, <i>Eucalyptus wandoo</i> or <i>Corymbia calophylla</i>. Occurs in Western Australia. Tree stratum includes <i>Eucalyptus marginata</i>, <i>Eucalyptus wandoo</i>, or <i>Corymbia calophylla</i> or combinations of these species. 	MVS4 MVS##	Eastern dry shrubby sclerophyll forests Western dry shrubby sclerophyll forests	ACT, QLD, NSW, VIC, SA, TAS WA
3	<ul style="list-style-type: none"> Overstorey dominated by <i>Eucalyptus camaldulensis</i> or <i>Eucalyptus rudis</i>. Riparian corridors and floodplains (usually inland). Overstorey not dominated by <i>Eucalyptus camaldulensis</i> or <i>Eucalyptus rudis</i>. Occurs on a variety of landforms, but rarely inland riparian zones. 	MVS## MVS5	Riparian eucalypt forests Dry shrub/grass sclerophyll forests	ACT, QLD, NSW, VIC, SA, WA QLD, NSW, VIC, SA, TAS
4	<ul style="list-style-type: none"> Overstorey includes at least one eucalypt species from section <i>Adnataria</i> (<i>E. siderophloia</i>, <i>E. molluccana</i>, etc.) or section <i>Transversaria</i> (<i>E. propinqua</i>, <i>E. resinifera</i>, 	MVS54	Subtropical open wet sclerophyll forests	NSW, QLD (primarily in MVG 2)

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	<p><i>E. saligna</i>, etc.) or genus <i>Corymbia</i> (<i>C. intermedia</i>, <i>C. maculata</i>, <i>C. variegata</i>, etc.) or any of the following: <i>Eucalyptus microcorys</i>; <i>E. pilularis</i>; <i>Eucalyptus montivaga</i>; <i>Syncarpia glomulifera</i>; <i>Lophostemon confertus</i> and none of the eucalypt species listed below are dominant. Understorey may include C4 grasses such as <i>Imperata</i> or <i>Themeda</i>, and small trees or shrubs of <i>Allocasuarina torulosa</i>, <i>Alphitonia</i>, <i>Breynia</i> or <i>Maytenus</i>. Occurs north from Bega in NSW to Queensland and rarely at altitudes above 600 m south from 30°S.</p>			
<ul style="list-style-type: none"> None of the overstorey species listed above are dominant. C3 grass species such as <i>Poa</i> conspicuous in the understorey. Found south from the New England plateau in southern Queensland to southern Tasmania and may occur at any altitudes within that range. 	MVS60	Cool temperate open wet sclerophyll forests	ACT, NSW, VIC, TAS (primarily in MVG 2)	

Table 4: Key to Major Vegetation Subgroups in MVG4: Tropical Eucalypt Open Forests (NVIS Version 4.1)

Key No.	Criteria	MVS# or Next Key No.	Broader groupings or MVS Name	Comments
0	<ul style="list-style-type: none"> Canopy cover of at least 50% (>30% foliage projective cover) and dominated by eucalypts, usually including at least one of the following: <i>Eucalyptus tetradonta</i>, <i>Eucalyptus miniata</i> and <i>Corymbia nesophila</i>. Understorey often includes palms or cycads with C4 grasses. Restricted to tropical areas receiving typically 1000 – 1400 mm per annum. 	MVS##	Tropical eucalypt savanna forest	

Table 5: Key to Major Vegetation Subgroups in MVG5: Eucalypt Woodlands (NVIS Version 4.1)

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	layer dominated by large perennial tussock grasses, but may include an open layer of perennial tussock species of <i>Astrebla</i> , <i>Austrostipa</i> , <i>Enteropogon</i> , etc. with chenopod forbs and shrubs, and a range of ephemeral species. Mainly in semi-arid climates receiving less than 500 mm mean annual rainfall.			
2	<ul style="list-style-type: none"> Overstorey includes species of <i>Eucalyptus</i> within subgenus <i>Symphyomyrtus</i> section <i>Adnataria</i> (box and ironbark eucalypts) or section <i>Maidenaria</i> (southern blue gums and allies) but species of subgenus <i>Eucalyptus</i> are scarce or absent. Ericoid shrubs not common. Ground layer usually includes a mixture of C3 and C4 grasses. Rarely found at altitudes above 1000 m but reaches high elevations on the New England plateau (NSW). Understorey is dominated by <i>Eucalyptus</i> within subgenus <i>Eucalyptus</i> section <i>Pauciflorae</i> (snow gums) or section <i>Stellulatae</i> (sallees) but species of subgenus <i>Symphyomyrtus</i> (e.g. <i>Eucalyptus rubida</i>) are rarely dominant. Sclerophyllous ericoid shrubs may be present and conspicuous, sometimes more abundant than the tussock grass ground layer, which is dominated by <i>Poa</i> with other C3 grasses. Found most commonly at altitudes above 1000 m 	<p>MVS9</p> <p>MVS##</p>	<p>Eastern temperate grassy woodlands</p> <p>Subalpine woodlands</p>	<p>QLD, ACT, NSW, VIC, SA, TAS (Semi-arid floodplain and wadi woodlands may have abundant tussock grasses in the ground layer, superficially resembling Eastern temperate grassy woodlands. See description below for distinguishing features)</p> <p>ACT, NSW, VIC, TAS</p>
3	<ul style="list-style-type: none"> Understorey is dominated by chenopods 	MVS65	Semi-arid floodplain and wadi	NSW, VIC, QLD, NT, SA, WA

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	<p>(shrubs and forbs), and/or lignum (<i>Duma florulenta</i>) and/or tussock grasses or sedges. Non-chenopod shrubs scarce, except <i>Acacia</i> species may be present as small trees or tall shrubs. Overstorey includes a range of 'coolibah' eucalypts (<i>E. coolabah</i>, <i>E. microtheca</i>, <i>E. barklyensis</i>, etc), <i>E. camaldulensis</i>, <i>E. largiflorens</i>, <i>E. ochrophloia</i> or <i>E. populnea</i>. Occurs on clay soils on depositional plains.</p>		woodlands	(also represented in MVG 11)
	<ul style="list-style-type: none"> Understorey dominated by open layer of non-chenopod shrubs, including species of <i>Dodonaea</i>, <i>Eremophila</i> and <i>Senna</i>. Chenopod shrubs and lignum absent, tussock grasses sparse and mostly ephemeral. <i>Eucalyptus populnea</i> may be dominant but other eucalypts listed above are absent. Occurs on loamy upland peneplains and hills, rarely depositional landforms. 	MVS8	Semi-arid upland woodlands	NSW, QLD, NT, SA, WA (also in MVG 11)

Table 6: Key to Major Vegetation Subgroups in MVG6: Acacia Forests and Woodlands (NVIS Version 4.1)

Key No.	Criteria	MVS# or Next Key No.	Broader groupings or MVS Name	Comments
0	<ul style="list-style-type: none"> Overstorey dominated by <i>Acacia harpophylla</i> (brigalow), <i>Casuarina cristata</i>, <i>Acacia cambagei</i> (gidgee) or <i>Acacia georginae</i>. Shrubs sparse or absent, ground layer usually with a sparse cover of tussock grasses of tribes <i>Chlorideae</i> and <i>Sporoboleae</i>. Occurs on clay-textured alkaline soils in depressions or clay plains. 	1		
	<ul style="list-style-type: none"> Overstorey not dominated by species listed above. Groundcover with tussock grasses mostly from <i>Aristideae</i> and <i>Andropogoneae</i>. Occurs typically on coarse-textured acid soils. 	2		
1	<ul style="list-style-type: none"> Overstorey dominated by <i>Acacia harpophylla</i> and/or <i>Casuarina cristata</i>. Often on basalt plains in regions receiving 500 – 750 mm mean annual rainfall. 	MVS13	Brigalow forests and woodlands	NSW, QLD
	<ul style="list-style-type: none"> Overstorey not dominated by <i>Acacia harpophylla</i> and/or <i>Casuarina cristata</i>. Most commonly dominated by <i>Acacia cambagei</i>, <i>Acacia georginae</i> or <i>Acacia argyrodendron</i>. Often in landscape depressions, including gilgais and dune swales, in regions receiving 200 – 500 mm mean annual rainfall. 	MVS##	Gidgee woodlands	NSW, QLD, SA, NT (also represented in MVG 13)

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2	<ul style="list-style-type: none"> Overstorey dominated by <i>Acacia aneura</i> sens. lat. (Mulga). Understorey is dominated by tussock grasses, forbs or multiple growth forms. Hummock grasses occasionally present. Generally on extensive stony plains with light textured loams and clay subsoils in regions receiving 200 – 500 mm mean annual rainfall. 	MVS20	Stony mulga woodlands and shrublands	NSW, QLD, NT, SA, WA (also represented in MVGs 13 and 16, which account for occurrences in SA and WA, while MVG 6 is essentially confined to QLD and NSW)
	<ul style="list-style-type: none"> Overstorey NOT dominated by <i>Acacia aneura</i> sens. lat. (Mulga). Most commonly dominated by <i>Acacia shirleyi</i>, <i>Acacia catenulata</i> or <i>Acacia petraea</i>. Canopy or subcanopy may include other small trees or shrubs (e.g. <i>Petalostigma</i>, <i>Erythroleum</i> and <i>Macropteranthes</i>). Understorey is includes hummock grasses. On stony uplands and sandstone plateaus mostly in regions receiving 500 – 750 mm mean annual rainfall. 	MVS14	Upland tropical Acacia Woodlands	QLD, NT

Table 7: Key to Major Vegetation Subgroups in MVG7: Callitris Forests and Woodlands (NVIS Version 4.1)

Key No.	Criteria	MVS# or Next Key No.	Broader groupings or MVS Name	Comments
0	<ul style="list-style-type: none"> ▪ Dominated by species of Callitris 	MVS12	Callitris forests and woodlands	Currently includes communities that are naturally dominated by Callitris and other genera at sites apparently unsuitable for eucalypts and some Callitris communities derived from eucalypt forests and woodlands subject to prior logging or overgrazing. The latter are common in southeast Australia and typically include scattered eucalypts as part of the assemblage.

Table 8: Key to Major Vegetation Subgroups in MVG8: Casuarina Forests and Woodlands (NVIS Version 4.1)

Key No.	Criteria	MVS# or Next Key No.	Broader groupings or MVS Name	Comments
0	<ul style="list-style-type: none"> Woodland dominated by <i>Casuarina pauper</i>, sometimes hybridising with <i>C. cristata</i> where their ranges overlap. Other tree species may be locally abundant including <i>Alectryon oleifolius</i>, <i>Myoporum platycarpum</i>, <i>Callitris glauca</i>, <i>Callitris murrayana</i> or <i>Allocasuarina luehmannii</i>. Occurs on calcareous sandplains in semi-arid climates receiving mean annual rainfall of 220-350 mm. None of the species listed above are present. Climate not semi-arid. 	MVS26 1	Calcareous sandplain woodlands	<p>NSW, VIC, SA</p> <p>Woodlands with <i>Casuarina cristata</i> are associated with Brigalow forests and woodlands and assigned to MVG 6.</p> <p>Vegetation dominated by <i>Allocasuarina verticillata</i> occurs in SA and TAS. These form tall scrubs and are assigned to MVG 15.</p>
1	<ul style="list-style-type: none"> Forest dominated by <i>Casuarina cunninghamiana</i>, sometimes with scattered eucalypts, in narrow riparian bands along swiftly flowing streams draining the Great Dividing Range. Forest or woodland dominated by <i>Casuarina glauca</i>, sometimes with <i>Melaleuca</i> species, on coastal floodplains and estuarine wetlands with subsaline soils. 	MVS## MVS##	<p>River oak forests</p> <p>Eastern floodplain/estuarine forests</p>	<p>ACT, NSW, QLD</p> <p>NSW, QLD</p>

Table 9: Key to Major Vegetation Subgroups in MVG9: Melaleuca Forests and Woodlands (NVIS Version 4.1)

Key No.	Criteria	MVS# or Next Key No.	Broader groupings or MVS Name	Comments
0	<ul style="list-style-type: none"> Woodland or open woodland, typically up to 10 m tall and dominated by <i>Melaleuca viridiflora</i>, <i>M. citrolens</i> or <i>M. stenostachya</i>, often interspersed with eucalypts mostly of genus <i>Corymbia</i>. Understorey with a largely continuous ground layer of tussock grasses. Occurs on alluvial sandplains inundated for short periods (up to several weeks) during the wet season. 	MVS15	Tropical sandplain woodlands	WA, NT, QLD, NSW
	<ul style="list-style-type: none"> Forest or woodland, up to 20 m tall and dominated by <i>Melaleuca</i> species other than those listed above, although <i>Melaleuca viridiflora</i> may be present. Understorey with a range of aquatic and floating aquatic plants. Occurs on floodplain depressions, sandplain depressions and riparian corridors. 	1		Taller Melaleuca forests and woodlands associated with more regular or more prolonged inundation
1	<ul style="list-style-type: none"> Riparian woodlands dominated by <i>Melaleuca argentea</i>, <i>Melaleuca fluviatilis</i> and/or <i>Melaleuca leucadendra</i>, sometimes with <i>Casuarina cunninghamiana</i>. Occurs along riparian corridors of tropical streams. 	MVS ##	Tropical riparian forests	WA, NT, QLD, NSW
	<ul style="list-style-type: none"> Wetland forests and woodlands, sometimes with <i>Melaleuca leucadendra</i>, but none of the other taxa listed above. Not associated with streams, but may be inundated with 	2		

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	standing water for varying periods.			
	<ul style="list-style-type: none"> ▪ Distribution exclusively tropical, extending from western Cape York to the Kimberley region of WA on floodplains. Dominated by tropical paperbarks including <i>Melaleuca leucodendra</i>, <i>M. cajuputi</i>, <i>M. saligna</i>, , <i>M. viridiflora</i> or <i>M. clarksonii</i> and <i>Asteromyrtus symphyocarpa</i>. Except in northern and eastern coastal areas of Cape York, <i>Melaleuca quinquenervia</i> is absent. 	MVS##	Tropical floodplain forests	NT, QLD, possibly WA
	<ul style="list-style-type: none"> ▪ Distribution extending from the east coast of Cape York south to the Sydney region, largely non-tropical and associated with coastal sandplains. Dominated by <i>Melaleuca quinquenervia</i>, often with <i>Eucalyptus robusta</i>, <i>E. resinifera</i>, <i>E. tereticornis</i> or <i>Lophostemon suaveolens</i> 	MVS##	Sandplain wetland forests and woodlands	QLD, NSW

Table 10: Key to Major Vegetation Subgroups in MVG10: Other Forests and Woodlands (NVIS Version 4.1)

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	Capricorn. Ground layer not usually dominated by C4 grasses ,although they may be present. Stands typically dominated by a single tree species at site scales, but multiple tree species may dominate south of the Tropic of Capricorn.			<i>Tristaniopsis</i> , or <i>Lophostemon</i> sometimes misplaced here. Re-assign the <i>Syncarpia</i> dominated communities under the appropriate eucalypt MVG.
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Table 11: Key to Major Vegetation Subgroups in MVG11: Eucalypt Open Woodlands (NVIS Version 4.1)

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	<p><i>microtheca</i>, <i>E. barklyensis</i>, etc), <i>E. camaldulensis</i>, <i>E. largiflorens</i> or <i>E. populnea</i>. Occurs on clay soils on depositional plains.</p> <ul style="list-style-type: none"> Understorey dominated by open layer of non-chenopod shrubs, including species of <i>Dodonaea</i>, <i>Eremophila</i> and <i>Senna</i>. Chenopod shrubs and lignum absent, tussock grasses sparse and mostly ephemeral. <i>Eucalyptus populnea</i> may dominant, but other eucalypts listed above are absent. Occurs on loamy upland peneplains and hills, rarely depositional landforms. 	MVS8	Semi-arid upland woodlands	NSW, QLD, NT, SA, WA (also represented in MVG 5)
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Table 12: Key to Major Vegetation Subgroups in MVG12: Tropical Eucalypt Woodlands/Grasslands (NVIS Version 4.1)

Key No.	Criteria	MVS# or Next Key No.	Broader groupings or MVS Name	Comments
	<ul style="list-style-type: none"> Dominated by an open canopy of eucalypts, including <i>Corymbia</i> and <i>Eucalyptus</i> subgenera <i>Fibridia</i> and <i>Leprolaena</i>, and a range of tropical non-eucalypt genera. Understorey is dominated by a prominent cover of C4, tussock grasses including tall annuals. 	MVS7	Tropical Eucalyptus forests and woodlands with an annual tussock grass understorey	Potential subgroups differentiating lowland savanna eucalypt woodlands from rocky upland savannah eucalypt woodlands warrant further investigation. The latter includes hummock grasses (<i>Triodia</i> species) and more conspicuous sclerophyll shrub component with species of (<i>Calytrix</i> , <i>Jacksonia</i> , <i>Acacia</i> and <i>Grevillea</i> , lower abundance of mesic shrubs and palms, and less continuous layer of C4 tussock grasses.

Table 13: Key to Major Vegetation Subgroups in MVG13: Acacia Open Woodlands (NVIS Version 4.1)

Key No.	Criteria	MVS# or Next Key No.	Broader groupings or MVS Name	Comments
0	<ul style="list-style-type: none"> Overstorey dominants include <i>Acacia pendula</i>, <i>Acacia loderi</i> or <i>Acacia papyrocarpa</i>. Hummock grasses rarely present. 	1		Myall woodlands of eastern and southern Australia
	<ul style="list-style-type: none"> Overstorey not dominated by any of the taxa listed above. Hummock grasses sometimes present. 	2		Acacia woodlands of subtropical and warm temperate Australia
1	<ul style="list-style-type: none"> Overstorey dominated by <i>Acacia pendula</i>. Understorey includes chenopod shrubs and forbs and tussock grasses. Found on grey clay plains where mean annual rainfall ranges from 375 mm to 550 mm. 	MVS22	Semi-arid myall woodlands	NSW, QLD
	<ul style="list-style-type: none"> Overstorey dominated by <i>Acacia loderi</i> or <i>Acacia papyrocarpa</i> Acacia. Understorey dominated mostly by non-chenopod shrubs and tussock grasses 	MVS24	Arid myall woodlands	NSW, SA, WA
2	<ul style="list-style-type: none"> Overstorey most commonly dominated by <i>Acacia cambagei</i>, <i>Acacia georginae</i> or <i>Acacia argyrodendron</i>. Other woody plants are uncommon but may include <i>Alectryon</i>, <i>Atriplex</i>, <i>Carissa</i>, <i>Enchylaena</i>, <i>Eremophila</i>, <i>Senna</i> and <i>Terminalia</i>. Typically on fine-textured soils in landscape depressions, including gilgais and dune swales. 	MVS##	Gidgee woodlands	NSW, QLD, SA, NT (also represented in MVG 6)

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	<ul style="list-style-type: none"> Overstorey not dominated by any of the taxa listed above. Most common dominants include <i>Acacia aneura</i> and its allies. Typically on light-textured loams and sands on extensive plains and dunefields. 	3		Mulga woodlands
3	<ul style="list-style-type: none"> Occurs on stony plains and uplands. Primary dominant is <i>Acacia aneura</i> sens. lat., with co-occurring woody species less abundant and usually shorter in stature. Other widespread <i>Acacia</i> species include <i>A. grasbyi</i>, <i>A. estrophiolata</i>, <i>A. victoriae</i>, <i>A. tetragonophylla</i>, <i>A. quadrimarginea</i>, and <i>A. xiphophylla</i>. Understorey cover is variable, usually dominated by tussock grasses. Hummock grasses may be present but not often dominant. Occurs on sand plains. Overstorey dominated by <i>Acacia</i>, often with two or more species co-occurring. <i>Acacia aneura</i> sens. lat., may be present but not often as the primary dominant. Other widespread <i>Acacia</i> species include <i>A. calcicola</i>, <i>A. ligulata</i>, <i>A. murrayana</i>, <i>A. ramulosa</i> and <i>A. tetragonophylla</i>. Understorey usually dominated by hummock grasses, particularly <i>Triodia basedowii</i>. 	MVS20	Stony mulga woodlands and shrublands	NSW, QLD, NT, SA, WA (also represented in MVGs 6 and 16)
		MVS23	Sandplain <i>Acacia</i> woodlands and shrublands	NSW, QLD, NT, SA, WA (also represented in MVG 16)

Table 14: Key to Major Vegetation Subgroups in MVG14: Mallee Woodlands and Shrublands (NVIS Version 4.1)

Key No.	Criteria	MVS# or Next	Broader groupings or MVS Name	Comments
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		Key No.		
0	<ul style="list-style-type: none"> ▪ Dominant or subordinate species of any stratum includes at least one species endemic to Western Australia (e.g. tree stratum includes <i>Eucalyptus eremophila</i>, <i>E. moderata</i>, <i>E. incrassata</i>, <i>E. foecunda</i>, <i>E. redunca</i> or <i>E. uncinata</i>). Distributed west of the Nullarbor Plain in Western Australia ▪ No Western Australian endemics recorded as dominants or subordinates of any stratum. 	MVS ## 1	Western mallee	WA (also represented in MVG 32)
1	<ul style="list-style-type: none"> ▪ Understorey dominated by shrubs other than those in family Chenopodiaceae (<i>Maireana</i>, <i>Rhagodia</i>, <i>Chenopodium</i>, <i>Atriplex</i>, <i>Sclerolaena</i>), typically >1 m tall at maturity. <i>Triodia</i>, if present, not dominant. ▪ Understorey dominated by grasses and/or shrubs or forbs in the family Chenopodiaceae (<i>Maireana</i>, <i>Rhagodia</i>, <i>Chenopodium</i>, <i>Atriplex</i>, <i>Sclerolaena</i>) OR dominated by multiple growth forms including non-chenopod shrubs and <i>Triodia</i>. 	2 3		
2	<ul style="list-style-type: none"> ▪ <i>Callitris verrucosa</i> present in any stratum and/or understorey shrub stratum including sclerophyll (heath) genera <i>Aotus</i>, <i>Baeckea</i>, <i>Brachyloma</i>, <i>Hibbertia</i>, <i>Leptospermum</i> or <i>Phebalium</i>, at maturity typically attaining crown cover > 50% (i.e. FPC > 30%; NVIS 	MVS29	Heathy Mallee	SA, VIC (also represented in MVG 32)

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	<p>cover_codes=d, c). Distributed on white sands in the southern mallee regions of Victoria and SA where mean annual rainfall exceeds 300 mm.</p> <ul style="list-style-type: none"> ▪ <i>Callitris verrocosa</i> absent from all strata and understorey shrub stratum including non-sclerophyll genera such as <i>Alectryon</i>, <i>Dodonaea</i>, <i>Eremophila</i>, <i>Myoporum</i> or <i>Senna</i>, often with <i>Acacia</i> and <i>Grevillea</i>, at maturity typically with crown cover <20% (FPC<10%; NVIS cover_code=r), though sometimes denser. Occurs most commonly in swales and flat expanses of red sandplains (more rarely on white sands) in northwest Victoria, SA and NSW where mean annual rainfall is less than 350 mm. 	MVS55	Shrubby Mallee	NSW, SA, VIC (also represented in MVG 32)
3	<ul style="list-style-type: none"> ▪ Understorey dominated by chenopod shrubs (genera <i>Maireana</i>, <i>Rhagodia</i>, <i>Enchylaena</i>, <i>Chenopodium</i>, <i>Atriplex</i>, <i>Sclerolaena</i>) or tussock grasses. Hummock grasses (<i>Triodia</i> spp.) and <i>Callitris verrucosa</i> absent. Occurs on red heavy-textured sands over a shallow calcrete subsoil in NSW, Vic and SA. ▪ Understorey dominated by hummock grasses (<i>Triodia</i> spp.), may include scattered <i>Callitris</i> and mostly shrubs. Chenopods may be present but not dominant. Occurs on deep dune summits and slopes on red or white sandplains in NSW, Victoria and SA. 	MVS61	Chenopod Mallee	NSW, SA, VIC (also represented in MVG 32)
		MVS27	Triodia Mallee	NSW, SA, VIC (also represented in MVG 32)

Table 15: Key to Major Vegetation Subgroups in MVG15: Low Closed Forests and Tall Closed Shrublands (NVIS Version 4.1)

Key No.	Criteria	MVS# or Next Key No.	Broader groupings or MVS Name	Comments
0	<ul style="list-style-type: none"> Dense canopy of low trees or tall shrubs including species of <i>Casuarina</i>, <i>Agonis</i>, <i>Melaleuca</i>, <i>Banksia</i> or <i>Acacia</i>. Typically coastal littoral situations. Vegetation fits description of the Major Vegetation Group 15 “Low Closed Forests and Tall Closed Shrublands” 	MVS28	Littoral scrubs	Currently a single subgroup but tropical, southeast temperate and southwest temperate assemblages may warrant segregation.

Table 16: Key to Major Vegetation Subgroups in MVG16: Acacia Shrublands (NVIS Version 4.1)

Key No.	Criteria	MVS# or Next Key No.	Broader groupings or MVS Name	Comments
0	<ul style="list-style-type: none"> Occurs on stony plains and uplands. Primary dominant is <i>Acacia aneura</i> sens. lat., with co-occurring woody species less abundant and usually shorter in stature. Other widespread Acacia species include <i>A. victoriae</i>, <i>A. tetragonophylla</i>, <i>A. estrophiolata</i> <i>Acacia grasbyi</i>, <i>A. quadrimarginea</i>, and <i>A. xiphophylla</i>. Understorey cover is variable, usually dominated by tussock grasses. Hummock grasses may be present but not often dominant. 	MVS20	Stony mulga woodlands and shrublands	NSW, QLD, NT, SA, WA
	<ul style="list-style-type: none"> Occurs on sand plains. Overstorey dominated by Acacia, often with two or more species co-occurring. <i>Acacia aneura</i> sens. lat., may be present but not often as the primary dominant. Other widespread Acacia species include <i>A. calcicola</i>, <i>A. ligulata</i>, <i>A. kempeana</i>, <i>A. murrayana</i>, <i>A. ramulosa</i> and <i>A. tetragonophylla</i>. Understorey usually dominated by hummock grasses, particularly <i>Triodia basedowii</i>. 	MVS23	Sandplain Acacia woodlands and shrublands	NSW, QLD, NT, SA, WA

Table 17: Key to Major Vegetation Subgroups in MVG17: Other Shrublands (NVIS Version 4.1)

Key No.	Criteria	MVS# or Next Key No.	Broader groupings or MVS Name	Comments
0	<ul style="list-style-type: none"> Plant community dominated by shrubs of the genus <i>Duma</i> (lignum, formerly <i>Muehlenbeckia</i>) 	MVS57	Lignum shrublands and wetlands	Note that many lignum communities may key out elsewhere under a dominant tree genus
	Plant community not dominated by lignum	1		A large and diverse subgroup, warranting rationalisation
1	<ul style="list-style-type: none"> Plant community dominated by shrubs of one or more <i>Melaleuca</i> spp. 	MVS49	<i>Melaleuca</i> shrublands and open shrublands	
	<ul style="list-style-type: none"> Plant community not dominated by <i>Melaleuca</i> spp. shrubs 	2	Other sparse shrublands and sparse heathlands	
2	<ul style="list-style-type: none"> Plant community dominated shrubs with crown cover of 20 to 80% (FPC 10 to 70%; NVIS cover_code=c, i) 	MVS32	Other shrublands	Note: Denser shrublands MVS 30 and MVS 28 re-assigned to MVG18 and MVG15, respectively
	<ul style="list-style-type: none"> Plant community dominated shrubs with crown cover of <20% (FPC <10%; NVIS cover_code=r) 	MVS80	Sparse shrublands	

Table 18: Key to Major Vegetation Subgroups in MVG18: Heathlands (NVIS Version 4.1)

Key No.	Criteria	MVS# or Next Key No.	Broader groupings or MVS Name	Comments
0	<ul style="list-style-type: none"> Distributed on rocky substrates in NT and WA north of latitude 17°S. Common genera include <i>Acacia</i>, <i>Asteromyrtus</i>, <i>Calytrix</i>, <i>Thryptomene</i>, <i>Grevillea</i>, <i>Hibbertia</i>, <i>Jacksonia</i>, <i>Boronia</i>, <i>Pityrodia</i>, <i>Fimbristylis</i>, <i>Triodia</i>, <i>Micraria</i> and <i>Eriachne</i>. Distributed south of 17°S or, if north of 17°S, then not in NT or WA. 	MVS## 1	Tropical heathlands	NT, WA. The four subgroups are geographically disjunct and have highly distinctive floras with few species in common. Similarity of vegetation structure and life-form composition, and high beta diversity (species turnover) make geographic and environmental variables the best diagnostic characters for subgroup identification. Common genera are listed.
1	<ul style="list-style-type: none"> Distributed in WA, mostly well south of 25°S. Common general include <i>Banksia</i>, <i>Conospermum</i>, <i>Hakea</i>, <i>Petrophile</i>, <i>Calothamnus</i>, <i>Eremaea</i>, <i>Melaleuca</i>, <i>Verticordia</i>, <i>Acacia</i>, <i>Daviesia</i>, <i>Gompholobium</i>, <i>Astroloma</i>, <i>Leucopogon</i>, <i>Lysinema</i>, <i>Boronia</i>, <i>Stylidium</i>, <i>Thysanotus</i>, <i>Anigozanthos</i>, <i>Xanthorrhoea</i>, <i>Mesomelaena</i>, <i>Schoenus</i>, <i>Desmocladius</i> and <i>Lyginia</i>. Mallee growth forms of <i>Eucalyptus</i> may be present. Not distributed in WA 	MVS30 2	Southwest Heathlands	WA
2	<ul style="list-style-type: none"> Shrub canopy rarely growing taller than 1 metre, distributed in cold climates with 	MVS##	Montane and alpine heathlands	NSW, VIC, TAS

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	<p>snow for several weeks of the year at elevations greater than 1600 m on the Great Dividing Range south of Canberra (35°S) or greater than 1000 m on the Tasmanian highlands. Common genera include <i>Grevillea</i>, <i>Orites</i>, <i>Kunzea</i>, <i>Epacris</i>, <i>Leucopogon</i>, <i>Richea</i>, <i>Nematolepis</i>, <i>Prostanthera</i>, <i>Bossiaea</i>, <i>Oxylobium</i>, <i>Baeckea</i>, <i>Podocarpus</i>, <i>Olearia</i>, <i>Ozothamnus</i>, <i>Astelia</i>, <i>Carex</i>, <i>Oreobolus</i>, <i>Schoenus</i>, <i>Poa</i>, <i>Athrotaxis</i>, <i>Microcachrys</i>, <i>Bellenden</i> and in bolster heaths, <i>Abrotnella</i>, <i>Colobanthus</i>, <i>Donatia</i>, <i>Phyllachne</i> and <i>Schizacme</i>.</p>			
<ul style="list-style-type: none"> Occurring at lower elevations than above, rarely experiencing persistent snow. Distributed widely on coastal and hinterland of Qld, NSW, Vic, SA and Tas. Common genera include <i>Allocasuarina</i>, <i>Banksia</i>, <i>Hakea</i>, <i>Leptospermum</i>, <i>Phyllota</i>, <i>Hibbertia</i>, <i>Hypolaena</i>, <i>Caustis</i>, <i>Lepidosperma</i>, <i>Schoenus</i>, <i>Acacia</i>, <i>Dillwynia</i>, <i>Pultenaea</i>, <i>Epacris</i>, <i>Leucopogon</i>, <i>Xanthorrhoea</i> and <i>Lomandra</i>. Mallee growth forms of <i>Eucalyptus</i> may be present. 	MVS##	Eastern heathlands	QLD, NSW, ACT, VIC, SA, TAS	

Table 19: Key to Major Vegetation Subgroups in MVG19: Tussock Grasslands (NVIS Version 4.1)

Key No.	Criteria	MVS# or Next Key No.	Broader groupings or MVS Name	Comments
0	<ul style="list-style-type: none"> Grasslands dominated by the genus <i>Astrebla</i> (Mitchell grass) and other C4 grasses or sometimes with <i>Dichanthium</i> (Blue grasses) and/or <i>Chrysopogon</i> (beard grasses) more abundant. C3 grasses absent. Mostly north of 30°S. Grasslands not dominated by <i>Astrebla</i>, <i>Dichanthium</i> or <i>Chrysopogon</i>, usually with at least some C3 grass genera and south of 29°S except in far SE Qld and NE NSW. 	MVS34 1	Tropical arid grasslands	QLD, NT, WA, northwest NSW
2	<ul style="list-style-type: none"> Grasslands composed entirely of C3 grasses (C4 grasses absent) and forbs (sometimes dominating tussocks). Dominated by <i>Poa</i>, usually with <i>Agrostis</i>, <i>Deyeuxia</i> or <i>Rytidosperma</i>. Alpine areas where snow persists for at least several weeks. Grasslands typically with a mixture of C3 and C4 grasses, tussocks dominating forbs. Common genera include <i>Austrostipa</i>, <i>Bothriochloa</i>, <i>Chloris</i>, <i>Poa</i>, <i>Rytidosperma</i> and <i>Themeda</i>. In temperate to semi-arid environments rarely receiving snow. 	MVS## MVS36	Alpine grasslands and herbfields Temperate tussock grasslands	NSW, VIC, TAS QLD, NSW, ACT, VIC, TAS

Table 20: Key to Major Vegetation Subgroups in MVG20: Hummock Grasslands (NVIS Version 4.1)

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Key No.	Criteria	MVS# or Next Key No.	Broader groupings or MVS Name	Comments
0	<ul style="list-style-type: none"> ▪ Dominated by grasses of the genus <i>Triodia</i> forming distinct hummocks, sometimes with <i>Zygochloa</i> species and ephemeral forbs and grasses. Woody species may be present, but at very low densities. Widespread in arid regions. 	MVS33	Hummock grasslands	Different species of <i>Triodia</i> dominate plant communities in different regions, some of which may warrant subgroup status.

Table 21: Key to Major Vegetation Subgroups in MVG21: Other Grasslands, Herblands, Sedgeland and Rushlands (NVIS Version 4.1)

Key No.	Criteria	MVS# or Next Key No.	Broader groupings or MVS Name	Comments
0	<ul style="list-style-type: none"> Associated with coastal floodplains or estuaries. 	1		
	<ul style="list-style-type: none"> Not associated with coastal floodplains or estuaries. 	2		
1	<ul style="list-style-type: none"> Dominated by erect sedges, rushes or reed-like grasses and inundated regularly by brackish or subsaline tidal water or groundwater. 	MVS41	Brackish reedlands and sedgeland	NSW, NT, QLD, SA, TAS, VIC, WA
	<ul style="list-style-type: none"> Characterised by mosaics of mat-forming grasses or sedges, patches of erect sedges and open water with floating and submerged forbs. Inundated by freshwater with no tidal influence. 	MVS63	Coastal floodplain meadows and lagoons	NSW, NT, QLD, SA, TAS, VIC, WA
2	<ul style="list-style-type: none"> Associated with periodically inundated floodplains of major inland rivers, sometimes dry for extended periods. Characterised by mosaics of mat-forming grasses or sedges, patches of erect sedges or reeds, and open water with floating and submerged forbs. 	MVS##	Inland wetland complex	NSW, NT, QLD, SA, VIC, WA
	<ul style="list-style-type: none"> Not associated with riverine floodplains, but typically associated with slow-draining headwater valleys accumulating peaty soils. 	MVS38	Mires	ACT, NSW, QLD, SA, TAS, VIC, WA

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	Vegetation dominated by dense stratum of sedges (species of <i>Baumea</i> , <i>Carex</i> , <i>Lepidosperma</i> , <i>Schoenus</i> and <i>Gymnoschoenus</i>), usually with shrubs of Myrtaceae and other families.			
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Table 22: Key to Major Vegetation Subgroups in MVG22: Chenopod Shrublands, Samphire Shrublands and Forblands (NVIS Version 4.1)

[illegible]

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	Nitraria billardieri.			shrublands and Clay plains saltbush shrublands may exist
3	<ul style="list-style-type: none"> Occasionally or regularly inundated by tidal waters in the coastal zone. Dominated by <i>Sarcocornia quinquefaria</i>, with <i>Samolus</i>, <i>Suaeda</i>, <i>Selliera</i>, <i>Tecticornia</i> and <i>Triglochin Juncus Baumea</i>, <i>Sporobolus</i> and/or <i>Zoysia</i>. 	MVS39	Coastal saltmarshes	NSW, NT, QLD, SA, VIC, WA, TAS
	<ul style="list-style-type: none"> Never inundated by tidal waters, instead associated with inland salt lakes and plains. Dominated by species of <i>Tecticornia</i> and <i>Sarcocornia</i>. 	MVS##	Salt lake samphires	NSW, NT, QLD, SA, VIC, WA

Table 23: Key to Major Vegetation Subgroups in MVG23: Mangroves (NVIS Version 4.1)

Key No.	Criteria	MVS# or Next Key No.	Broader groupings or MVS Name	Comments
0	<ul style="list-style-type: none"> Woody plants growing in the intertidal zone. 	MVS40	Mangroves	Two subgroups warrant consideration: i) Tropical and subtropical mangroves, occurring north from c. 30°S and characterised by multi-species assemblages at estuary scale, including Rhizophoraceae, Sonnerataceae and other taxa including those below; and ii) Temperate mangroves occurring south from c. 30°S and characterised by <i>Avicennia marina</i> , with or without <i>Aegiceras corniculata</i> .

Table 24: Key to Major Vegetation Subgroups in MVG24: Inland aquatic – freshwater, salt lakes, lagoons (NVIS Version 4.1)

Key No.	Criteria	MVS# or Next Key No.	Broader groupings or MVS Name	Comments
0	▪ Salt lakes and saltwater lagoons	MVS43	Salt lakes and lagoons	
	▪ Freshwater lakes, dams, streams, lagoons or aquatic plants	MVS44	Freshwater, dams, lakes, lagoons or aquatic plants	

Table 25: Key to Major Vegetation Subgroups in MVG25: Cleared, non-native vegetation, buildings (NVIS Version 4.1)

Key No.	Criteria	MVS# or Next Key No.	Broader groupings or MVS Name	Comments
0	▪ Native vegetation has been cleared	MVS98	Cleared, non-native vegetation, buildings	No need, at this stage, to key this beyond MVS98.

Table 26: Key to Major Vegetation Subgroups in MVG26: Unclassified native vegetation (NVIS Version 4.1)

Key No.	Criteria	MVS# or Next Key No.	Broader groupings or MVS Name	Comments
0	▪ Known to be native vegetation, but no other details are available	MVS97	Unclassified native vegetation	No need, at this stage, to key this beyond MVS97.

Table 27: Key to Major Vegetation Subgroups in MVG27: Naturally bare – sand, rock, claypan, mudflat (NVIS Version 4.1)

Key No.	Criteria	MVS# or Next Key No.	Broader groupings or MVS Name	Comments
0	<ul style="list-style-type: none"> Naturally bare areas, perhaps with very sparse or isolated plants (NVIS cover_code=bc,bi) 	MVS42	Naturally bare, sand, rock, claypan, mudflat	No need, at this stage, to key this beyond MVS42.

Table 28: Key to Major Vegetation Subgroups in MVG28: Sea and estuaries (NVIS Version 4.1)

Key No.	Criteria	MVS# or Next Key No.	Broader groupings or MVS Name	Comments
0	<ul style="list-style-type: none"> Areas of ocean, sea and estuaries 	MVS46	Sea, estuaries (includes seagrass)	No need, at this stage, to key this beyond MVS46.

Table 29: Key to Major Vegetation Subgroups in MVG29: Regrowth, modified native vegetation (NVIS Version 4.1)

Key No.	Criteria	MVS# or Next Key No.	Broader groupings or MVS Name	Comments
0	▪ Regrowth or modified vegetation dominated by trees	MVS90	Regrowth or modified forests and woodlands	
	▪ Regrowth or modified vegetation dominated by shrubs, grasses or other growth forms	1		
1	▪ Regrowth or modified vegetation dominated by shrubs or forbs	2	Regrowth or modified graminoids	
	▪ Regrowth or modified vegetation dominated by grasses or grass-like growth forms (e.g. sedges, rushes, etc.)	MVS92		
2	▪ Regrowth or modified vegetation dominated by chenopod (saltbush or samphire) shrubs and/or forbs	MVS93	Regrowth or modified chenopod shrublands, samphire or forblands	
	▪ Regrowth or modified vegetation dominated by shrubs	MVS91	Regrowth or modified shrublands	

Table 30: Key to Major Vegetation Subgroups in MVG30: Unclassified Forest (NVIS Version 4.1)

Key No.	Criteria	MVS# or Next Key No.	Broader groupings or MVS Name	Comments
0	<ul style="list-style-type: none"> ▪ Dominant trees with crown cover > 20% (i.e. FPC > 30%); plant community details not otherwise specified or likely to be erroneous; unlikely to be Indo-Malayan species. 	MVS96	Unclassified forest	No need, at this stage, to key this beyond MVG30.

Table 31: Key to Major Vegetation Subgroups in MVG31: Other Open Woodlands (NVIS Version 4.1)

Key No.	Criteria	MVS# or Next Key No.	Broader groupings or MVS Name	Comments
0	▪ Upper [and/or mid] stratum dominated by the genus <i>Casuarina</i> or <i>Allocasuarina</i>	1		
	▪ Upper [and/or mid] stratum dominated by other genera	2		
1	▪ Overstorey dominated by <i>Allocasuarina decaisneana</i> . Understorey characterised by hummock grasses with scattered shrubs. Occurs in sandy deserts.	MVS72	Desert oak woodlands	
	▪ Overstorey comprising species other than <i>Allocasuarina decaisneana</i> .	MVS26	Calcareous sandplain woodland	Also represented in MVG 8
2	▪ Upper [and/or mid] stratum dominated by the genus <i>Melaleuca</i>	MVS15	Tropical sandplain woodlands	Also represented within MVG 9
	▪ Upper [and/or mid] stratum dominated by other genera	3		
3	▪ Upper [and/or mid] stratum dominated by the genus <i>Callitris</i>	MVS12	Callitris forests and woodlands	Also represented within MVG 7
	▪ Upper [and/or mid] stratum dominated by other genera	MVS79	Other open woodlands	Heterogeneous group requiring rationalisation.

Table 32: Key to Major Vegetation Subgroups in MVG32: Open Mallee Woodlands and Shrublands (NVIS Version 4.1)

Key No.	Criteria	MVS# or Next Key No.	Broader groupings or MVS Name	Comments
0	<ul style="list-style-type: none"> ▪ Dominant or subordinate species of any stratum includes at least one species endemic to Western Australia (e.g. tree stratum includes <i>Eucalyptus eremophila</i>, <i>E. moderata</i>, <i>E. incrassata</i>, <i>E. foecunda</i>, <i>E. redunca</i> or <i>E. uncinata</i>). Distributed west of the Nullarbor Plain in Western Australia ▪ No Western Australian endemics recorded as dominants or subordinates of any stratum. 	MVS ## 1	Western mallee	WA (also represented in MVG 14)
1	<ul style="list-style-type: none"> ▪ Understorey dominated by shrubs other than those in family Chenopodiaceae (<i>Maireana</i>, <i>Rhagodia</i>, <i>Chenopodium</i>, <i>Atriplex</i>, <i>Sclerolaena</i>), typically >1 m tall at maturity. <i>Triodia</i>, if present, not dominant. ▪ Understorey dominated by grasses and/or shrubs or forbs in the family Chenopodiaceae (<i>Maireana</i>, <i>Rhagodia</i>, <i>Chenopodium</i>, <i>Atriplex</i>, <i>Sclerolaena</i>) OR dominated by multiple growth forms including non-chenopod shrubs and <i>Triodia</i>. 	2 3		
2	<ul style="list-style-type: none"> ▪ <i>Callitris verrucosa</i> present in any stratum and/or understorey shrub stratum including 	MVS29	Heathy Mallee	SA, VIC (also represented in MVG 14)

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	<p>sclerophyll (heath) genera <i>Aotus</i>, <i>Baeckea</i>, <i>Brachyloma</i>, <i>Hibbertia</i>, <i>Leptospermum</i> or <i>Phebalium</i>, at maturity typically attaining crown cover > 50% (i.e. FPC > 30%; NVIS cover_codes=d, c). Distributed on white sands in the southern mallee regions of Victoria and SA where mean annual rainfall exceeds 300 mm.</p> <ul style="list-style-type: none"> ▪ <i>Callitris verrocosa</i> absent from all strata and understorey shrub stratum including non-sclerophyll genera such as <i>Alectryon</i>, <i>Dodonaea</i>, <i>Eremophila</i>, <i>Myoporum</i> or <i>Senna</i>, often with <i>Acacia</i> and <i>Grevillea</i>, at maturity typically with crown cover <20% (FPC<10%; NVIS cover_code=r), though sometimes denser. Occurs most commonly in swales and flat expanses of red sandplains (more rarely on white sands) in northwest Victoria, SA and NSW where mean annual rainfall is less than 350 mm. 	MVS55	Shrubby Mallee	NSW, SA, VIC (also represented in MVG 14)
3	<ul style="list-style-type: none"> ▪ Understorey dominated by chenopod shrubs (genera <i>Maireana</i>, <i>Rhagodia</i>, <i>Enchylaena</i>, <i>Chenopodium</i>, <i>Atriplex</i>, <i>Sclerolaena</i>) or tussock grasses. Hummock grasses (<i>Triodia</i> spp.) and <i>Callitris verrucosa</i> absent. Occurs on red heavy-textured sands over a shallowcalcrete subsoil in NSW, Vic and SA. ▪ Understorey dominated by hummock grasses (<i>Triodia</i> spp.), may include scattered <i>Callitris</i> and mostly shrubs. 	<p>MVS61</p> <p>MVS27</p>	<p>Chenopod Mallee</p> <p>Triodia Mallee</p>	<p>NSW, SA, VIC (also represented in MVG 14)</p> <p>NSW, SA, VIC (also represented in MVG 14)</p>

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	Chenopods may be present but not dominant. Occurs on deep dune summits and slopes on red or white sandplains in NSW, Victoria and SA.			
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Table 33: Key to Major Vegetation Subgroups in MVG99: Unknown/no data (NVIS Version 4.1)

Key No.	Criteria	MVS# or Next Key No.	Broader groupings or MVS Name	Comments
0	<ul style="list-style-type: none"> Vegetation description has no further information and is hence a member of the Major Vegetation Group 99 	MVS99	Unknown/no data	No need, at this stage, to key this beyond MVS99.