

Government Gazette

of the State of

New South Wales

Number 93

Friday, 25 August 2017

The New South Wales Government Gazette is the permanent public record of official notices issued by the New South Wales Government. It also contains local council and other notices and private advertisements.

The Gazette is compiled by the Parliamentary Counsel's Office and published on the NSW legislation website (www.legislation.nsw.gov.au) under the authority of the NSW Government. The website contains a permanent archive of past Gazettes.

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Interim Grasslands and other Groundcover Assessment Method

Determining conservation value of
grasslands and groundcover
vegetation in NSW

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ISBN 978 1 76039 890 3
OEH 2017/0443
August 2017

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1. Background to the Grasslands and other Groundcover Assessment Method

Grasslands and other groundcover vegetation communities have been the foundation of grazing agriculture in New South Wales since the early 1800s. Landholders operating grazing systems require flexibility to manage their grazing land effectively.

However, natural grassland communities with moderate to high conservation value are rare in many NSW landscapes. Relatively undisturbed native grasslands and rare groundcover communities are important for biodiversity as they can contain a large number of native flora species, provide habitat for wildlife and deliver a suite of ecosystem services.

In light of this, this Grasslands and other Groundcover Assessment Method specifies how to determine the conservation value of groundcover vegetation, including grasslands. It has provision for three categories: low conservation value, moderate conservation value and high conservation value. The primary purpose of defining conservation value of groundcover in this context is to support the land management framework under the *Local Land Services Act 2013* (LLS Act).

1.1 The legislative framework

The LLS Act and Local Land Services Regulation 2014 provides for a native vegetation regulatory map (NVR Map) that indicates land where native vegetation clearing is regulated. This map spatially defines areas of the state, including as 'category 1 – unregulated land', 'category 2 – regulated land' or 'category 2 – sensitive regulated land' in the context of clearing native vegetation under the LLS Act.

Sections 60K and 60L LLS Act allow for a review of categorisation of land on the NVR Map. The review process allows for the relevant landholder to request a review of the map classification. The Chief Executive of Office of Environment and Heritage (OEH) is also required to keep the categorisation of land on the map under review.

The LLS Act prescribes that land should be designated as category 1 – exempt land if the Chief Executive of OEH reasonably believes that 'the land contains low conservation value grasslands'.

The regulations specify that:

- land contains low conservation value grasslands or other groundcover if the land is determined to contain low conservation value grasslands or other groundcover under the 'Grasslands and other Groundcover Assessment Method'
- if the land is determined to contain high conservation value grasslands or other groundcover under the 'Grasslands and other Groundcover Assessment Method', it constitutes category 2 – sensitive regulated land.

1.2 Purpose of the Interim Grasslands and other Groundcover Assessment Method

The Interim Grasslands and other Groundcover Assessment Method defines a method to enable an appropriately qualified assessor to determine conservation value of groundcover vegetation based on:

- the relative cover of perennial exotic vegetation
- a botanical assessment that is conducted according to the vegetation integrity (refer to section 3.3).

The conservation value of the groundcover vegetation (including grasslands) will be designated one of three categories: 'low', 'moderate' or 'high'.

The information gained from this assessment can be used in the NVR Map review process. It represents one avenue for an application to recategorise land based on the presence of low conservation value or high conservation value grassland or other groundcover vegetation.

The Grasslands and other Groundcover Assessment Method may also be used by OEH to designate certain grasslands or other groundcover as high conservation value grasslands or other groundcover, including based on remote sensing and other mapping methods that can assess this value at a landscape scale.

The Grasslands and other Groundcover Assessment Method also provides guidance on when it is **not** appropriate to use this method.

This method must only be used for the assessment of conservation value of groundcover-dominated vegetation types (defined in section 3.1). This includes both natural and derived groundcover (e.g. secondary grasslands). It must **not** be used to characterise the conservation value, or support clearing, of woody vegetation (e.g. trees and shrubs), or communities that contain woody vegetation (e.g. woodland).

This method must **not** be used to characterise vegetation for development assessment purposes. To assess vegetation for development assessment purposes, the Biodiversity Assessment Method (BAM) must be applied by a person accredited under the BAM process.

OEH will consult on this interim method concurrent with the NVR Map, with the intention that the method will be finalised with the commencement of the map.

1.3 Factors affecting conservation value

A range of factors affect the conservation value of groundcover vegetation. These factors include, but are not limited to:

- condition of the groundcover, including the diversity and types of native plant species and the presence of exotic plant species, particularly perennial species and noxious weeds
- the history of anthropogenic and natural disturbance
- the proportion of the native groundcover vegetation remaining in the landscape relative to its original extent
- whether the vegetation is listed as a threatened ecological community under NSW or Commonwealth legislation
- the presence of threatened flora and the role of the vegetation as habitat for threatened fauna
- connectivity to similar communities or woody communities, and the value as fauna corridors.

It should be noted that assessment of groundcover conservation value using this method does not preclude a determination of threatened communities and threatened species under other state and Commonwealth legislation.

1.4 Who will use this method?

This method must be used by appropriately qualified assessors who are familiar with groundcover flora species and appropriate vegetation survey methods. Refer to section 2.2 for more information.

2. Overview of the grasslands and other groundcover assessment process

2.1 Assessment process

This assessment process follows a series of stages to determine, firstly, if this method is suitable to use for the vegetation assessment (Stage 1), and then to assess the conservation value of the vegetation using field-based assessment (Stage 2 and Stage 3).

Stage 1: Assessment of suitability – is an assessment of whether this method is appropriate to use. This includes if the vegetation meets the definition of ‘groundcover vegetation’.

Stage 2: Exotic assessment – is an assessment of exotic perennial cover using a transect-intercept method to determine whether vegetation is regarded as native vegetation.

Stage 3: Native species assessment – is an assessment of vegetation condition relative to the benchmark using the vegetation integrity method (refer to section 3.3).

If the outcome of the Stage 1 assessment is that this method is appropriate for assessing the conservation value of the subject vegetation, users may either proceed to Stage 2 or Stage 3 in order to complete the assessment of conservation value. If the outcome of the Stage 1 assessment is that this method is not appropriate for use in relation to the subject vegetation, this method must not be used and the vegetation cannot be described as low, moderate or high conservation value grasslands or groundcover. Figure 1 illustrates this process.

Data gathered during the assessment process must be entered into the Grasslands and other Groundcover Assessment Method electronic tool. This tool uses decision rules as described in this document to determine the conservation value of the vegetation that has been assessed. This determination is presented as a Groundcover Assessment Certificate. The conservation value of grasslands or other groundcover is stated on the Groundcover Assessment Certificate that is produced after proper application of the assessment process. If no certificate has been produced or it has been produced based on incorrect application of the assessment process, then the conservation value of the vegetation cannot be said to have been determined under the Grasslands and other Groundcover Assessment Method.

Note: this assessment process does not apply to determinations of high conservation value grasslands or groundcover under section 5.

Grasslands and other Groundcover Assessment Method

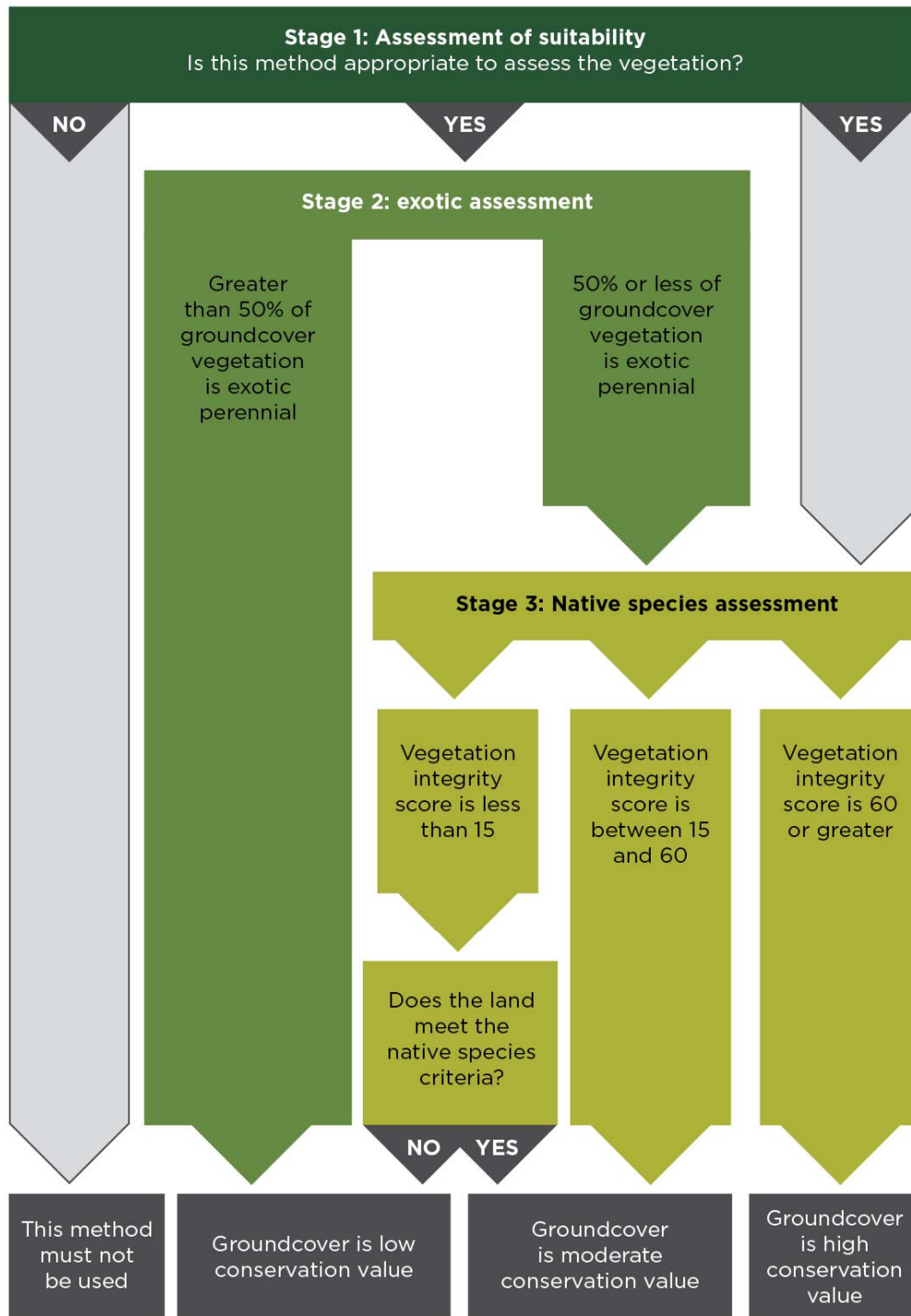


Figure 1 Flow diagram of the Grasslands and other Groundcover Assessment Method

Note: For information on the low and high threshold values (15 and 60), see Section 3.3.6.

2.2 Assessors

Determination of groundcover and grassland conservation value requires the identification of exotic and native grasses and forbs. Many species are superficially similar, and a high level of botanical skill is required to confidently identify native from exotic species. In addition, assessment requires the application of vegetation survey methods in a scientific manner at the appropriate time of the year to maximise ability to identify plant species.

Appropriately qualified assessors are required for on-site assessment to ensure transparency and consistency within this method. Assessors are required to meet at least two of the following three prerequisites to carry out each stage described in this method and for the Groundcover Assessment Certificate to be valid.

Table 1 Assessor prerequisites

	Assessor prerequisite	Explanation
1.	A minimum of three years of experience in flora survey (must include vegetation community survey and Plant Community Type allocation), or if no tertiary qualifications are held, five years of experience in flora survey (over the last seven years prior to commencing the assessment) as demonstrated in a CV which covers the last seven-year period.	This prerequisite determines if the assessor has appropriate experience in botanical survey.
2.	Relevant tertiary qualifications in natural sciences, or additional work experience.	<p>The assessor should have studied natural science subjects as part of the degree, such as: terrestrial ecology, terrestrial botany, terrestrial zoology, or subjects that relate to the observation and description of biodiversity and landforms as they provide an important foundation to work experience.</p> <p>If a university degree did not include these subjects, how has the assessor gained this knowledge, e.g. via a Technical and Further Education (TAFE) certificate, or more work experience.</p> <p>This is a part of ensuring community confidence in the Grasslands and other Groundcover Assessment Method.</p>
3.	Attend OEH Grasslands and other Groundcover Assessment Method training and obtain a certificate of completion.	OEH will conduct Grasslands and other Groundcover Assessment Method training and issue a certificate of completion. This will include a code of conduct segment, with professional and ethical standards.

3. Staged approach for assessing grasslands and other groundcover

3.1 Stage 1: Assessment of suitability

Stage 1 is required to ensure that this method is appropriate for assessing the subject vegetation. Stage 1 must be completed for all assessments. If, after Stage 1, it is determined that this method is not appropriate to use, the conservation value of the subject vegetation cannot be said to have been determined in accordance with the Grasslands and other Groundcover Assessment Method.

Note: this does not apply to determinations of high conservation value grasslands or groundcover under section 5.

In using the Grasslands and other Groundcover Assessment Method electronic tool, the assessor is required to provide a declaration that the vegetation is suitable for assessment using this method because it meets all the requirements below.

3.1.1 Does the vegetation meet the definition of grassland or other groundcover?

The definition of groundcover within this document is 'any type of herbaceous vegetation'. It typically comprises herbaceous vegetation (e.g. forbs, grasses, sedges, rushes, and some chenopods) less than one metre high.

3.1.2 Is the vegetation in an appropriate area?

The Grasslands and other Groundcover Method is used to assess vegetation in areas that fulfil the Area Requirements outlined here. Grasslands are the most common type of groundcover vegetation in New South Wales. While it is expected that this method will most often be applied to grasslands, it may also be applied to other groundcover. Other groundcover vegetation communities include alpine herbfields, inland floodplain swamps (sedgeland), and montane bogs and fens. Many of these are wetland communities and are regionally rare. The method for assessing 'grasslands' and 'other groundcover' follows the same process.

'Grasslands' include all groundcover vegetation classified by Keith (2004). They are generally characterised by:

- perennial grasses (tussock, hummock and sod forms)
- a low abundance or absence of woody plants
- the presence of broad-leaved forbs in the grassy matrix.

Natural grasslands occur in naturally treeless areas. Derived (or secondary) native grasslands can occur in areas where trees have been cleared from the original community (e.g. grassy woodlands). Natural grasslands tend to be of high conservation value, but derived communities can also be of high conservation value in their own right. Both natural and derived grasslands are included within the scope of this method.

Groundcover vegetation can occur in combination with taller canopy vegetation (e.g. grassy woodlands). However, this method cannot be used to assess any groundcover or grasslands vegetation that is:

1. within a vegetation community that is dominated by low woody vegetation (e.g. heathlands, shrublands, etc.), or
2. within an area where woody vegetation occupies more than two per cent of the vegetation zone (see section 3.2.1) when measured as crown cover.

If vegetation is as described in 1 or 2 above, then the area does not meet Area Requirements and the Grasslands and other Groundcover Method cannot be used.

Measurement of crown cover should be undertaken as specified by the National Committee on Soil and Terrain (2009) in *Australian Soil and Land Survey: Field Handbook*. Where woody vegetation exceeds this two per cent threshold the groundcover or grasslands in the area cannot be assessed using the Grasslands and other Groundcover Assessment Method.

Note that any woody vegetation (e.g. trees) that is within an area of grasslands or other groundcover that can be assessed using this method is not considered as part of the grasslands vegetation. Therefore, a determination in accordance with this method that an area of grasslands is of low conservation value does not mean that the woody vegetation in the subject area is also of low conservation value.

For the purposes of determining whether a given area of grasslands or other groundcover vegetation meets the Area Requirements, the area of vegetation selected for assessment on a landholding must be a contiguous area and must not be chosen to deliberately exclude patches of higher woody vegetation density.

Areas of equivalent Plant Community Type (PCT) in similar condition are to be assessed as vegetation zones. If a vegetation zone (see section 3.2.1) contains more than two per cent woody vegetation as measured by crown cover, the vegetation does not meet the definition of 'groundcover vegetation' and the Grasslands and other Groundcover Assessment Method must not be used.

3.1.3 Is the condition of the vegetation suitable for assessment?

The Grasslands and other Groundcover Assessment Method, including any surveys, cannot be used to classify vegetation as of low or moderate conservation value:

- if the vegetation has been disrupted within six months prior to the assessment (e.g. by fire, heavy grazing, drought, etc.) such that the typical assemblage of species is absent
- when total groundcover vegetation is less than 10 per cent cover across a vegetation zone. This is insufficient representation to determine dominance by native or exotic vegetation, or
- if the vegetation is a wetland community.

If an assessor is unsure whether vegetation cover is more than 10 per cent, and hence is unsure whether the Grasslands and other Groundcover Assessment Method can be used, the cover assessment method (see section 3.2.5) can also be used to estimate total vegetation cover through a preliminary recording of 'vegetation' and 'other' (including bare ground, rock, litter, etc.) at each metre of the 100 metre transect.

3.2 Stage 2: Exotic assessment

Stage 2 is a simple assessment of exotic perennial vegetation cover. It is not necessary to conduct Stage 2 if it is presumed that the vegetation is native-dominated; assessors can proceed directly to Stage 3.

This method requires use of a transect-intercept method for estimating percentage cover of exotic perennial and native vegetation. The method requires survey data to be collected within each 'vegetation zone' that is in the subject area (which has met the Area Requirements in Stage 1).

For this assessment, assessors need only collect data for 'exotic perennial' and 'native' groundcover categories.

Whether a plant is native, exotic and/or perennial is determined through reference to PlantNET (The NSW Plant Information Network System), an online database maintained by the Royal Botanic Gardens and Domain Trust.

Grasslands or groundcover cannot be designated as low conservation value under the exotic assessment if they are designated as category 2 – regulated land.

Note that a NVR Map review will take into account other factors that may designate land as category 2 – regulated land under section 60I(2) LLS Act. These factors may override a determination of low conservation value. It is suggested that assessors obtain a Category Explanation Report prior to using the Grasslands and other Groundcover Assessment Method to determine if any of these factors apply.

3.2.1 Defining vegetation zones

A vegetation zone means an area of native vegetation within the subject area that is the same PCT and has a similar broad condition state. Assistance in the determination of PCT is to be obtained through OEH's BioNet Vegetation Information System Classification database.

Vegetation areas of equivalent PCT that are in different condition states must be stratified into different vegetation zones. Condition states may vary based on disturbance, geology, and position in the landscape. It is possible to have adjacent areas of identical PCT that are different vegetation zones. Each vegetation zone should be assessed independently.

A vegetation zone may comprise a number of discontinuous areas within the overall subject area, provided that the vegetation within the zone is the equivalent PCT and in a similar broad condition state. Vegetation zones must represent apparent changes in vegetation and must not be manipulated to create desired results.

3.2.2 Timing of survey

Surveys should be conducted at a time when the native cover is likely to be at its highest proportion of native to exotic species. This will vary by region throughout the state and is dependent on several factors, including:

- recent climatic conditions
- soil moisture (as affected by precipitation, soil type and position in landscape)
- seasonal growth habits of different species (e.g. C3 versus C4 grasses)
- grazing pressures (e.g. stocking rates, timing of grazing)
- other disturbances (e.g. flood, wildfire, native and feral herbivore grazing, etc.)

Assessments should not be conducted when vegetation cover is low (e.g. during or immediately after drought events or fire, or immediately following heavy grazing). Assessments of wetland groundcover communities should not be undertaken in a dry period when there is no indicative flora.

There may be instances in which an accurate assessment of exotic-dominant cover can be made out-of-season, such as at a site extensively dominated by perennial exotic species. In these instances, the assessor is required to justify in the report declaration why an out-of-season assessment is appropriate and will deliver reliable results.

3.2.3 Survey effort: number and length of transects

For vegetation zones larger than two hectares, multiple assessment transects are required. Table 2 details the minimum number of transects required. Note that this is a minimum number; an assessor can choose more transects if they require greater certainty in the results, or if the broad vegetation zone is variable. It is unlikely that vegetation zones greater than 100 hectares will be encountered, as most groundcover communities are a mosaic of condition states.

Table 2 Minimum number of transects required per vegetation zone area

Vegetation zone area (hectares)	Minimum number of transects
< 2	1 transect
> 2–5	2 transects
> 5–20	3 transects
> 20–50	4 transects
> 50–100	5 transects
> 100–250	6 transects
> 250–1000	7 transects. More plots may be needed if the condition of the vegetation is variable across the zone.
> 1000	8 transects. More plots may be needed if the condition of the vegetation is variable across the zone.

Transects must be a minimum of 100 metres in total length, or equivalent. Where the vegetation zone is narrow or small, multiple shorter transects can be used to get a total length of at least 100 metres (e.g. three 35-metre transects).

3.2.4 Selection of transect location

Within each vegetation zone, transects must be located randomly. This can be accomplished by:

- establishing points on a map, and establishing transects around randomly-assigned points
- walking a random distance into the vegetation zone and establishing the transect in a random direction at this point.

Transects must not be placed near fence lines, ecotones or other boundaries that may impact on the vegetation condition. If transect location is determined remotely (i.e. from a map), field workers should move the points if the vegetation type is different from what is expected.

3.2.5 Cover assessment method

The transect-intercept method estimates cover of different land cover types. This estimate uses the sum of 'hits' for each land cover type at each metre along one or more transects.

At each metre along a minimum 100 metre transect, the assessor must record the presence (a 'hit') of each exotic perennial or native species. A hit is recorded if a vertical pin intercepts the live or dead **crown** of each plant (i.e. the pin does not need to physically intercept foliage). More than one category of plant (or group) can be recorded at each point (i.e. if the pin intercepts an exotic perennial grass and a native forb), but each group must only be recorded once per point. Hits of other vegetation (e.g. exotic annual species) are not to be recorded in this part of the assessment. An example unfilled data sheet is presented in Table 3.

Table 3 Example unfilled transect-intercept data sheet

Point	Native groundcover	Exotic perennial groundcover	Non-vegetation (e.g. bare ground, rock etc.)
1			
2			
3			
4			
...
100			
Total			

If the native/exotic status of a species is unknown, it must be assumed to be native.

3.2.6 Calculation of percentage cover

The calculation of cover for the groups is as follows:

1. Sum the number of hits from each group.
2. For each group, divide the number of hits by the total points on the transect (typically 100) to obtain the percentage cover.
3. If more than one transect is measured per vegetation zone, take the average percentage cover for the vegetation zone.
4. Compare the average percentage cover for 'native' with 'exotic perennial'. If exotic perennial is greater, the groundcover in the vegetation zone is regarded as low conservation value. If the native cover is greater, assessors should proceed to Step 3 to determine the conservation value.

Some steps in the above calculation are automatically completed in the Grasslands and other Groundcover Assessment Method electronic tool.

Example

In a five hectare vegetation zone, three transects are required to assess the vegetation (see Table 2). Using the cover assessment method at section 3.2.5, an assessor records the following values in three 100 metre transect assessments:

Table 4 Example of filled transect-intercept data sheet

Transect	Native hits	Exotic perennial hits
1	23	75
2	20	51
3	17	39
Average	20	55

In this case, the average number of exotic perennial hits (55) is greater than the average number of native hits (20). This means that the vegetation zone is regarded as non-native, and is classified as low conservation value.

3.3 Stage 3: Native species assessment

Stage 3 is a more detailed examination of the structure and composition of the vegetation using a vegetation integrity assessment. Stage 3 also includes provisions for a threatened species assessment based on the vegetation integrity results. Vegetation integrity is defined as the degree to which the composition, structure and function of the vegetation at a site has been altered from a 'near natural state' (in the absence of human disturbance). It combines assessments of composition, structure and function attributes relative to benchmark values to produce a vegetation integrity score. The vegetation integrity score is calculated in the Grasslands and other Groundcover Assessment Method electronic tool and used to categorise the conservation value of the groundcover vegetation.

Under the 'Native Species Criteria', grasslands or groundcover cannot be designated as low conservation value under the native species assessment:

where threatened species have been mapped by OEH as having been present on the land, or are known to be present by the assessor. A list of candidate threatened species for specific locations may be produced as part of the electronic tools.

The vegetation integrity method uses the concept of vegetation 'growth form groups'. Each native species is assigned to a growth form group based on its most common growth form (statewide) at maturity stage. These growth form groups are used to categorise vegetation and derive benchmarks. The growth form groups used within this method are:

- tree
- shrub
- grass and grass-like
- forb
- fern
- other (typically includes vines, epiphytes and tree ferns).

The assessor must assign a native plant species to a growth form group according to the definitions set out in Appendix A. An assessor must allocate a species to one growth form group based on the mature growth form of the species. Office of Environment and Heritage will provide a growth form group look-up table for the purpose of assigning each plant species to a growth form group. Where the assessor is unsure of the correct growth form group for a species, the growth form look-up table should be consulted.

To assess the conservation value of groundcover (as opposed to woody vegetation), only 'composition' and 'structure' attributes are used in the vegetation integrity calculator (i.e. 'function' attributes are not required). Composition is assessed through a survey of native species in each growth form group in fixed-area plots. Structure is assessed by an estimate of the native species cover for each growth form group using a visual estimate method.

3.3.1 Stratifying vegetation zones

Vegetation zones are comprised of areas of equivalent PCTs that are in similar broad condition states. These condition states vary based on disturbance, geology, and their position on the landscape. Hence, it is possible to have adjacent areas of identical PCTs that are different vegetation zones. Each vegetation zone should be assessed independently.

3.3.2 Timing of survey

Surveys should be conducted at a time when the native cover is likely to be at its highest proportion of native to exotic species. This will vary by region throughout the state and is dependent on several factors, including:

- recent climatic conditions
- soil moisture (as affected by precipitation, soil type and position in landscape)
- seasonal growth habits of different species (e.g. C3 versus C4 grasses)
- grazing pressures (e.g. stocking rates, timing of grazing)
- other disturbances (e.g. flood, wildfire, native and feral herbivore grazing, etc.).

Assessments should not be conducted when vegetation cover is low (e.g. during or immediately after drought events or fire, or immediately following heavy grazing). Assessments of wetland groundcover communities should not be undertaken when in a drying period and there is no indicative flora.

There may be instances in which an accurate assessment of exotic-dominant cover can be made out-of-season, such as a site extensively dominated by perennial exotic species. In these instances, the assessor is required to justify in the report declaration why an out-of-season assessment is appropriate and will deliver reliable results.

3.3.3 Survey effort: number of plots

For vegetation zones more than two hectares in area, multiple survey plots are required. Table 5 details the minimum number of survey plots required within each vegetation zone. Note that this is a minimum number; an assessor can choose more locations if they require greater certainty in the results, or if the broad vegetation zone is variable. It is unlikely that vegetation zones greater than 100 hectares will be encountered, as most groundcover communities are a mosaic of condition states.

Table 5 Minimum number of survey plots required per vegetation zone area

Vegetation zone area (hectares)	Minimum number of 20 x 20 m plots
< 2	1 plot
> 2-5	2 plots
> 5-20	3 plots
> 20-50	4 plots
> 50-100	5 plots
> 100-250	6 plots
> 250-1000	7 plots. More plots may be needed if the condition of the vegetation is variable across the zone.
> 1000	8 plots. More plots may be needed if the condition of the vegetation is variable across the zone.

3.3.4 Selection of survey locations

Within each vegetation zone, the survey location must be located randomly. This can be accomplished by:

- establishing points on a map, and establishing survey plots around randomly-assigned points
- walking a random distance into the vegetation zone and establishing the survey plot at this point.

Survey plots must not be placed near fence lines, ecotones or other boundaries that may impact on the vegetation condition. If the survey location is determined remotely (i.e. from a map), field workers should move the points if the vegetation type is different from what is expected.

3.3.5 Vegetation integrity surveys

Composition

Assessment of composition is based on the number of native plant species (richness) observed and recorded by the assessor within a plot for each growth form group.

The assessor must assign a native plant species to a growth form group according to the definitions set out in Appendix A. An assessor must allocate a species to one growth form group based on the mature growth form of the species.

The minimum vegetation survey data required to be recorded by the assessor for assessing composition at each 20 metre by 20 metre condition plot are:

- the full species name (genus/species) for the three dominant native species within each growth form group. Dominant native species means those native species that contribute most to the total cover of the growth form group
- the genus name or the full species name where practicable for all other species. Practicable means that sufficient plant material is present to make a species level identification and the assessor has sufficient skills and knowledge to make the identification in the field
- whether each species is native, exotic, or high threat exotic. A list of high threat exotic species will be made available by OEH
- the growth form group to which each native species has been allocated.

The composition of each growth form group is assessed by counting the number of different native plant species recorded within each growth form group within each 20 metre by 20 metre condition plot.

Structure

Structure is the assessment of foliage cover for each growth form group within the 20 metre by 20 metre plot boundary. Foliage cover for a growth form group is the percentage of cover of all living plant material of all individuals of the species present for that group. This includes leaves, twigs, branchlets and branches, as well as canopy overhanging the plot, even if the stem is outside the plot.

The assessor must record an estimate of the foliage cover for each native and exotic species present within the 20 metre by 20 metre plot. Foliage cover estimates for each species must draw from the following number series: 0.1, 0.2, 0.3,...1, 2, 3,...10, 15, 20, 25,...100%.

The assessor must not use methods such as Braun-Blanquet (or other) classes, or a transect point intercept method to record the foliage cover score for a growth form group.

The structure of each growth form group for the 20 metre by 20 metre plot is recorded by the assessor as the sum of all the individual foliage cover estimates of all native plant species recorded within each growth form group within each plot.

The assessor must assign each non-native (exotic) plant species a foliage cover estimate and either E (exotic) or HTE (high threat exotic) status.

3.3.6 Determining the vegetation integrity score

Vegetation integrity refers to the condition of a vegetation community relative to benchmark condition, based on compositional, structural and functional attributes of that community. Data-derived benchmark values have been developed for vegetation attributes at the Keith Class level for each Interim Biogeographical Regionalisation of Australia region within New South Wales. As PCTs are nested within Keith Class, the Keith Class is known from the PCT allocation. Keith Classes are a broader description of vegetation associations, and are detailed within Keith (2004).

Attributes for composition and structure are entered in the vegetation integrity calculator, as part of the Grasslands and other Groundcover Assessment Method electronic tools. The vegetation integrity score is then calculated based on the Keith Class and Interim Biogeographical Regionalisation of Australia region in which the assessment takes place.

Where multiple survey locations are used within a vegetation zone, the average of the vegetation integrity scores is used.

In the case of derived grasslands, the assessor must use the PCT that is most likely to have occurred prior to human intervention. A vegetation zone that is mapped as derived vegetation must be assessed against the benchmark data which in the opinion of the assessor is the most likely original PCT, or against the benchmark data for the vegetation class of the most likely original PCT.

Derived groundcover should be assessed only against benchmarks for groundcover vegetation within this method (i.e. benchmark value for trees and shrubs are not included in the calculation of vegetation integrity under this method).

Assessors use benchmarks generated from published sources or local reference sites. These benchmarks must be generated in accordance with the guidelines included as Appendix B.

The relationship between the vegetation integrity score and the classification of conservation value is presented in Table 6. These threshold vegetation integrity scores were developed through expert elicitation analysis and comparison with existing threatened ecological community data.

Table 6 Relationship between vegetation integrity score and conservation value category

Vegetation integrity score	Conservation value category
<15	Low conservation value
15–60	Moderate conservation value
>60	High conservation value

4. Reporting

A Groundcover Assessment Certificate is provided at the completion of the Grasslands and other Groundcover Assessment Method electronic tools. The following information is required as part of the electronic tools and may be presented on the certificate.

4.1 Site information

The required information is:

- site name and size
- site location
- name of assessor (including evidence of qualification)
- date of assessment and/or date of reporting
- the Interim Biogeographical Regionalisation of Australia region in which the site is located
- the number of vegetation zones assessed.

For each vegetation zone, the following details are required, depending on which stage/s of assessment was undertaken.

4.2 Stage 1

The required information is:

- a checklist of conditions to determine if the Grasslands and other Groundcover Assessment Method is appropriate to use in the vegetation zone
- a declaration that the Grasslands and other Groundcover Assessment Method is appropriate to use.

4.3 Vegetation zone information (Stage 2 and 3):

The required information is:

- The size of vegetation zone
- a description of the vegetation type: Keith Class and/or PCT based on the BioNet Vegetation Information System Classification database
- plot data for the transect-intercept method (Stage 2) and/or vegetation integrity method (Stage 3).

As part of the NVR Map review process, the following information may be requested to support the certificate:

- spatial representation of subject area and vegetation zone locations within it (map)
- photographs that clearly show the type of groundcover in the mapped area
- an assessment of the suitability of the time of survey; based on season, disturbance and climatic factors (if Stage 2 was not conducted)
- an assessment of the presence of threatened species (if required).

5. Determining high conservation value grasslands and other groundcover

In addition to the method outlined in this document, the Chief Executive of OEH may determine grasslands or other groundcover to be of high conservation value if the vegetation is:

- within a state- or federally-listed endangered or critically endangered grassland or other groundcover ecological community, identified via satellite imagery or air photo interpretation
- within a state- or federally-listed endangered or critically endangered grassland or other groundcover ecological community identified by a field survey
- within a grassland or other groundcover PCT that has five per cent or less of its original extent remaining in New South Wales
- within a threatened wetland groundcover community.

Any remote sensing or imagery relied upon for a determination that grasslands or other groundcover is of high conservation value must incorporate appropriate field validation and be of appropriate spatial resolution to provide paddock-scale detail.

6. References

Keith, D.A. 2004. *Ocean Shores to Desert Dunes: the Native Vegetation of New South Wales*. NSW Department of Environment and Conservation, Hurstville, New South Wales.

Natural Resources Advisory Council. 2010. *Understanding Our Native Grasslands*. Natural Resources Advisory Council New South Wales.

National Committee on Soil and Terrain. 2009. *Australian Soil and Land Survey Field Handbook (3rd edition)*. CSIRO Publishing, Melbourne.

NSW Office of Environment and Heritage. 2017. *Biodiversity Assessment Method*. NSW Office of Environment and Heritage.

Appendix A: Growth form definitions

For the composition and structure components of the vegetation integrity assessment in section 3.3, the assessor must assign all observed native plant species to a growth form group according to the definitions set out in Table 7. All species native to New South Wales have been pre-assigned growth form groups based on their most common, mature growth form.

Definitions are from the *NSW Interim Vegetation Standard* (Sivertsen 2009) and the National Vegetation Information System V6 (Department of Environment and Heritage 2003).

Table 7 Growth form groups and growth form definition

Growth form group	Growth form	Growth form definition
Trees	Tree	Woody plant with a single stem or branches well above the base.
	Mallee tree	Woody plant, multi-stemmed with fewer than 5 stems of which at least 3 exceed 100 mm at breast height (1.3m). Of the genus <i>Eucalyptus</i> .
Shrubs	Shrub	Woody plant, multi-stemmed at the base (or within 200 mm from ground level).
	Mallee shrub	Woody plant, multi-stemmed with more than 5 stems of which at least 3 of the largest do not exceed 100 mm at breast height (1.3m). Of the genus <i>Eucalyptus</i> .
	Heath shrub	Shrub commonly with ericoid leaves (nanophyll or smaller). Commonly occur on nutrient-poor substrates. Often a member of the families: Asteraceae, Ericaceae, Myrtaceae, Fabaceae and Proteaceae.
	Chenopod shrub	Single or multi-stemmed, semi-succulent shrub of the family Chenopodiaceae exhibiting drought and salt tolerance.
	Samphire shrub	Leafless Chenopods of the genus <i>Tecticornia</i> (syn. <i>Halosarcia</i>) and <i>Sarcocornia</i> (samphires) with fleshy, jointed stems.
Grass and grass-like	Tussock grass	Forms discrete but open tussocks usually with distinct individual shoots. These are the common agricultural grasses. Member of the family Poaceae.
	Hummock grass	Coarse xeromorphic grass with a mound-like form often dead in the middle. Member of the genera are <i>Triodia</i> and <i>Plectrachne</i> .
	Other grasses	Member of the family Poaceae, but having neither a distinctive tussock nor hummock appearance (e.g. sod (rhizomatous, stoloniferous) grasses).
	Sedge	Herbaceous, usually perennial erect plant generally with a tufted habit and of the family Cyperaceae.
	Rush	Herbaceous, usually perennial erect monocot that is neither a grass nor a sedge. Include the monocotyledon families

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Growth form group	Growth form	Growth form definition
		Juncaceae, Typhaceae, Restionaceae, and the genus <i>Lomandra</i> .
Forb		Herbaceous or slightly woody, annual, biennial or sometimes perennial plant, usually a dicotyledon. Member of the families Liliaceae, Iridaceae, Xyridaceae and Orchidaceae (ground orchids).
Fern		Ferns and fern allies. Characterised by large and usually branched leaves (fronds), herbaceous and terrestrial to aquatic. Spores in sporangia on the leaves.
Other	Tree fern	Characterised by large and usually branched leaves (fronds), arborescent and terrestrial; spores in sporangia on the leaves.
	Palm & palm-like	Palms (family Arecaceae or genus <i>Pandanus</i>) and other arborescent monocotyledons (genus <i>Agave</i> , <i>Doryanthes</i>).
	Cycad	Palm-like plant, stemless to arborescent with fruit in cones. Members of the families Cycadaceae and Zamiaceae.
	Xanthorrhoea	Stemless to arborescent grasstrees of the genus <i>Xanthorrhoea</i> .
	Vine	Climbing, twining, winding or sprawling plants usually with a woody stem.
	Epiphyte	Plant with roots attached to the aerial portions of other plants. Often could also be another growth form, such as fern or forb. Includes mistletoes.

Appendix B: Guidelines for the collection of benchmark data

Benchmark data from local reference sites may be used where that data more accurately reflects the local environmental conditions and condition attributes for a PCT. Where local benchmark data is developed, it must be derived from measurements taken on reference sites that measure the same PCT in a relatively unmodified condition or from published sources. The Chief Executive of OEH must approve the use of benchmark data from local reference sites or published sources.

Locating reference sites

Reference sites are sites with relatively little evidence of modification by humans since European (post-1750) settlement, as indicated by:

- minimal exotic weed cover
- minimal grazing and trampling by introduced or overabundant native herbivores
- minimal soil disturbance
- no evidence of very recent major perturbation such as fire or flood
- not subject to high frequency burning
- evidence of recruitment of native plant species.

It may be difficult to find totally unmodified sites, particularly in highly cleared regions. Vegetation in relatively unmodified condition can be found in some travelling stock routes and reserves, national parks and nature reserves, state forests (especially flora reserves), cemeteries, roadsides and commons. Reference sites can occur in small remnants, such as narrow roadsides and cemeteries.

Number of reference plots

To obtain a reasonable composite picture that encompasses the variation in condition variables, a minimum of three reference plots/transects for each variable should be measured for each PCT (or vegetation class), with more plots/transects being desirable.

Published sources

Benchmarks may also be obtained from published sources.