



Accounting for Nature and Landcare Farming Native Vegetation Method

DOCUMENT DETAILS

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Accounting for Nature and Landcare Farming Native Vegetation Method (Level 3)

A methodology for producers, and landholders across Australia to measure the condition and track the change in condition of native vegetation.

Version 2.1 – July 2022



Version

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1. Introduction

This Method has been developed to help landholders monitor, report, and verify changes in native vegetation condition within their properties or projects. It outlines how to build an Environmental Account in accordance with the *Accounting for Nature® (AfN) Standard*, in a robust, accountable, repeatable, and transparent way. Accounts developed with this Method will produce credible and verifiable metrics that can support public claims about change in environmental condition.

Under the *AfN Standard*, the condition of an environmental asset (such as native vegetation) is summarised into a single metric, known as the Econd™. The Econd® is an index between 0 and 100, where 100 describes the ‘undegraded’ or ‘best possible’ condition of an environmental asset, and 0 indicates the asset is completely degraded. The Econd™ is calculated by comparing the current condition of native vegetation measured within a property or project, to the expected undegraded Reference Condition.

This Method aims to be practical and time and cost efficient to implement. The main measures of condition are estimated from photo-points and simple to implement field measures. The Method does not require the landholders completing their Environmental Account to have specialised ecological knowledge such as sampling techniques and detailed species identification skills.

1.1. Aim and Scope of this Method

This Method has been developed to assess the condition of native vegetation at the property and/or project scale, Australia-wide.

Purpose	This Method outlines a process to develop an Environmental Account under the <i>Accounting for Nature®</i> Framework that is quick and cost-effective, but sufficiently robust to detect long-term change in the condition of native vegetation. This Method is intended to provide a tool for farmers and other land managers to measure the condition and track the change in the condition of native vegetation (including restoration/rehabilitation) over time.
Application	Australia-wide.
Scope	To measure environmental condition at the property and/or project scale and detect long-term change over time.
Target Audience	Farmers, producers, Indigenous and private land conservation groups, and other landholders.
Decisions to inform	To inform management practices and to report long-term changes in condition.
Confidence Level	Level 3 (Moderate). A Level 3 (Moderate) confidence level would apply to Methods that include a limited set of indicators and are likely to have <u>moderate accuracy</u> (≥80%) when measuring the condition of environmental assets and detecting change in their condition through time.

1.2. What an Environmental Account looks like

The Accounting for Nature® Framework requires Accounts to be comprised of four key components for them to be certified:

1. An **Environmental Account Summary** – a public document that summarises the results of the Environmental Account in a form that is readily communicated to the public.
2. An **Information Statement** – describes in detail the Method/s used and the actions taken to address each of the five steps under the framework, including the rationale behind asset selection, Method used, analysis and management of data and calculation of the Econd®.
3. The **Environmental Account** – a database (such as an Excel file) that contains all the data described in Asset Tables, Data Tables, and Balance Sheets.
4. An **Audit Report** or **Self Verification Report** that verifies the Account was prepared in accordance with the approved Methods, the *AfN Standard* and *AfN Audit rules*.
 - An **Audit Report** is completed by an AfN Accredited Auditor and is required if you are seeking to have your account “Certified” (Tier 1); OR
 - A **Self-verification Report** contains the results of your self-verification assessment and AfN’s Technical Assessment and is required if you are seeking to have your account “Self-verified” (Tier 2).

Upon certification of the Account, the Environmental Account Summary and Information Statement will be published on the AfN Environmental Account Certification Registry. (The data stored in the Environmental Account and the Audit Report are not public documents.)

1.3. Overview of process

This Method includes the following seven steps:



2. Creating the Environmental Account

Step 1. Define purpose, scope, and accounting area

The first step in developing an Environmental Account is to **describe** the Environmental Account through defining its intended **purpose, scope, and accounting area**.

Purpose: Define the specific purpose of the Account. The purpose of the Account informs all subsequent decisions associated with the Account. The purpose of the Account should be clear enough to provide context for third parties or the general public viewing the Account. For example, this Level 3 Method is suitable for farmers wanting to develop an Environmental Account to measure the condition and track change over time, to better understand and inform management of their land.

Scope: Define the scope of the Account. The two main scopes this method supports are:

1. *Snapshot* – a one-off assessment of the condition of native vegetation; and
2. *Long-term change over time* – an ongoing assessment of the change of environmental condition through time.

Accounting area: Generate a map of the accounting area (i.e. property or project) and include information on location and size. A **property** Account encompasses one or a collection of whole properties, while a **project** Account is generally a subset of a property, where specific management actions are taken place. For example, a **project** Account could only include areas within a property that contain native vegetation that is managed for a specific purpose, such as restoration, conservation, or carbon.

The accounting area must stay the same for the lifespan of the Account. If the accounting area changes (such as a new area to be added, or an area to be removed), then a new Account must be 're-set' with the new accounting area. This ensures that results within a single Account are all comparable over time.

Output of Step 1 – Describe the location, purpose, and scope of the Account

- A description of the accounting area including **location** and **size**
- A table describing the **purpose** and **scope** of the Account
- A **map** showing the accounting area

Step 2. Compile existing data and identify sub-assets and land-uses

Download relevant State mapping for the accounting area (refer to Appendix B, for where to find the mapping). This should include:

- Current remnant and regrowth vegetation mapping
- Pre-clearing historic vegetation mapping

Local Landcare, regional NRM groups, or State Herbarium or Environment Departments should be able to assist with this. These groups may also be able to assist in states with no vegetation mapping. In the absence of state-based mapping, federal vegetation mapping under the National Vegetation Information System (NVIS) may be used.

Sub-assets

In the context of native vegetation, **sub-assets** describe the different vegetation types or communities that comprise the 'native vegetation environmental asset'. The pre-clear state vegetation mapping is to be used to identify the sub-assets contained within the accounting area. Broader Vegetation Mapping may be used for larger properties (e.g. Broad Vegetation Group in QLD). The selection of vegetation classification should be appropriate for the intended purpose of the accounts and consider the size of the accounting area and practical considerations associated with monitoring

In addition to the mapping, most State Department websites provide detailed descriptions of each vegetation type mapped within the accounting area. Using the descriptions, the vegetation types mapped within the accounting area should be ground-truthed to confirm the mapping is appropriate and accurate.

Land-use/Broad Condition State

Next, generate a map of the accounting area that identifies areas that fall into different land use/management zones, and/or broad condition state categories (e.g. remnant bushland, ungrazed regrowth, grazed regrowth). When determining different land-uses it is important to consider the purpose of the account and how each land-use interacts with vegetation condition.

If the Accounting Area contains land-uses that are intensively cultivated or dominated by infrastructure, or are expected to never have vegetation, or where vegetation condition can be assumed to be 0, they should be identified and included in the accounting area (note that these types of land uses may not always be present, in particular not in project scale accounts). For these areas, it is generally fair to assume their condition is 0, and as such, the resulting assessment units with these land-uses do not need to be sampled in (i.e. automatically assign an Econd® of 0 for these assessment units, and support with photos).

Other land-uses, such as paddocks with pastures, young woody regrowth that are targets for restoration, or any area that is destined to become native vegetation (e.g. through plantings or regeneration) or expected to score higher than 0 for condition, should also be identified and

included so that the resultant assessment units can each be sampled to determine an Econd® and track its change over time (even if it is very low in the first year of the account).

Materiality is an important consideration when determining land-uses – i.e. if there is a land-use that is classified as a restoration area – but there is a small immaterial area of road/track, or a house located within, then it is not necessary to separate these small features into an independent land-use category.

Example land-use/broad condition state categories in this map can include:

- cropping,
- grazing,
- forestry,
- remnant vegetation managed for carbon and/or conservation,
- retained regrowth vegetation managed for carbon and/or conservation, and
- regeneration/ restoration.

Output of Step 2 – Compile existing data and identify vegetation types

- A map and table of **pre-clear vegetation types** and descriptions of the accounting area
- A map of **land use/broad condition state** within the accounting area

Step 3. Stratify sub-assets into assessment units and identify sampling sites

Once the sub-assets and land-uses have been identified, assessment units must be generated.

Assessment units

Generate 'assessment units' by combining the State vegetation mapping, and land use/management/broad condition state. Assessment units are relatively homogenous units within the accounting area which determine where samples are to be taken. They do not have to be continuous, but rather, can be comprised of multiple small parts (so long as all parts of a single assessment unit have the same vegetation type and land use/management/condition).

If appropriate, assessment units that are smaller than 1ha may be merged with larger assessment units, provided they are all within the same (or similar) vegetation community and have an overall similar broad condition state regardless of land use. This excludes assessment units that have been pre-assigned an Econd® of 0.

Once the assessment units have been defined, permanent sample sites must be established within them.

If broader vegetation mapping has been used to generate assessment units (e.g. BVG in QLD), then the lowest level of vegetation classification will need to be determined for each site (e.g. RE in QLD), to determine the relevant reference benchmarks for that site.

Sampling

Table 1, below, prescribes how to select and establish sample sites within each assessment unit.

Note. Any assessment units that have land-use/broad condition states that are intensively cultivated or dominated by infrastructure, or where land-use change is not materially affecting vegetation condition, it is fair to assume the condition of these areas is 0, and they are not required to be sampled (i.e. automatically assign an Econd of 0 in Step 7, and support with photos in the Information Statement).

If broader vegetation mapping has been used to generate assessment units (e.g. BVG in QLD), then the lowest level of vegetation classification will need to be determined for each site (e.g. RE in QLD), to determine the relevant reference benchmarks for that site.

Sampling

Table 1. Overview of how to select and establish sampling sites within each assessment unit. These sampling guides have been adapted from those outlined in the accredited TLC WildTracker Native Vegetation Methodology (Taylor 2020)

Sample	Implementation
Number of sites per assessment unit	At least one permanent sample site is to be established per 5 ha per assessment unit, up to a maximum of 5 samples per assessment unit. i.e. for assessment units that exceed 25 ha, 5 samples will suffice.

Site selection	Sample sites within each assessment unit should be selected as representative sites of the vegetation type they are assessing. If one assessment unit is comprised of multiple patches, you can choose to establish a sample site within each patch to increase data precision to understand condition within each patch. For ease of access and where reasonable, sample sites should preferentially be located within 200 m of a road , but further than 50 m from infrastructure or 'edges' such as roads, dams, paddocks, or other areas of 'intense disturbance' etc.
Site establishment	The coordinates of each sample site should be recorded, and a labelled star picket should be permanently installed at this location (refer to Step 5 for further details on establishing the permanent monitoring sites). It is recommended to use phone apps such as Google Maps, WildTracker or Avenza to help locate sites in the field.
Timing	Sampling should be undertaken at roughly the same time each year to minimise the possible effects of seasonal variability.

Output of Step 3 - Mapping of assessment units

- A map and table of all **assessment units** with central coordinates of each **sample site** within the accounting area.

Step 4. Understand indicators and determine Reference Benchmarks

Indicators

The Native Vegetation Technical Protocol (Butler et al., 2020) states that **indicators** for native vegetation must represent the following three indicator classes: vegetation extent, configuration, and composition.

- Vegetation extent** The **extent** of native vegetation refers to the area of ‘native’ vegetation within the accounting area. This Method assesses the condition of vegetation within every assessment unit, and therefore within the entire accounting area. Therefore, extent is captured through the stratification process and in Step 7 – where all assessment unit Econd® scores (including those that are assigned an Econd® of 0) are aggregated into a sub-asset Econd® using **area weighted averages**, and the sub-asset Econd® is then aggregated into an overall Econd® score using **area weighted averages**. Refer to step 7 for more details.
- Configuration** The **configuration** of native vegetation relates to the positioning of a specific area of native vegetation within the landscape with regard to its connectivity, context and patch size. In this Method, the configuration indicator is site context, which is measured as the percent of retained remnant vegetation within a 1 km radius of each sample site.
- Composition** The **composition** of native vegetation relates to its structure, function and the assemblage of species. Composition will be assessed primarily through permanent photo monitoring points, which will be supplemented with some simple field measurements.

These indicator classes and their relevant indicators are explained below, in **Table 2**, and defined in **Table A2** (in **Appendix A**).

Reference Benchmarks

Under the Accounting for Nature® Framework, the **Reference Condition Benchmark** (‘Reference Benchmark’) is the condition of the native vegetation type in an ‘undegraded’ state. For example, a vegetation community that has not experienced any negative impacts as a result of disturbance, edge effects, invasive species, or altered management regimes (e.g. fire) would be considered to exist in an ‘undegraded’ state.

With the exception of Western Australia and Northern Territory, most states have published Vegetation Condition Benchmark documents that correspond to the lowest level of vegetation community mapping (eg. Regional Ecosystems in QLD or Plant Community Types in NSW; refer to **Appendix B**) and can be used to estimate this reference condition. In the absence of

published Reference Benchmark documentation, it is recommended that the State government (e.g. Herbariums), local NRM or Landcare groups are consulted to determine whether they have any draft or unpublished Reference Benchmark data.

Alternatively, if there are no existing benchmark data available, the assessor must establish local, 'best on offer' reference condition sites which may be interpreted with expert opinion. Refer to [Eyre et al. \(2017\)](#) for help with selecting local Reference Benchmark sites.

In areas particularly prone to climatic variability where some Indicator Condition Scores are expected to vary due to rainfall or drought, it is strongly encouraged that local Reference Benchmark sites are established and measured each year at the same time as the account. This is called a **Dynamic Reference Benchmark** and can be used to control for the variation in indicators due to climatic variables, such as rainfall.

Regardless of the source of the Reference Benchmark, to ensure full transparency the source of the Reference Benchmarks used in the Account must be described in full in the Information Statement.

The source of the Reference Benchmark for each indicator is summarised below in **Table 2**.

Table 2. Summary of native vegetation indicators, refer to Table A2 in Appendix 2 for definitions.

Indicator class	Indicator	Reference Benchmark
Configuration	<p>Indicator assessed with GIS</p> <ul style="list-style-type: none"> - Context (%) 	The reference condition of context will be measured as the pre-clear extent of vegetation within 1 km of each sample site (assumed to be 100 %).
Composition	<p>Indicators assessed by photos (optional field measures that are verified by photos):</p> <ul style="list-style-type: none"> - Non-native plant cover (%) - Organic litter ground cover (%) - Native perennial grass cover (%) <p>Indicators assessed in the field:</p> <ul style="list-style-type: none"> - Native canopy height (if present) - Native sub-canopy height (if present) - Native canopy cover (%) - Native sub-canopy cover (%) - Native shrub cover (%) 	<p>The reference condition of the composition indicators will be derived from the relevant State's condition assessment framework (refer to Appendix B) or by establishing local 'best on offer' Reference Condition Benchmark sites.</p> <p>If one or two indicators are missing from State Benchmarks (e.g. Victoria benchmarks do not include sub-canopy height) then expert opinion may be used to estimate the Reference Benchmark for those missing indicators.</p>

Naturally missing indicators

Depending on the vegetation type, some indicators may be naturally absent. For example, a grassland naturally does not have a tree canopy or sub-canopy.

Woody Ecosystems

The Reference Benchmark for indicators that are naturally missing from the pre-clear ecosystem, are to be recorded as '0', with the ICS being 'NA.' Naturally missing indicators are not to be included in assessment unit calculations. Refer to the worked example on page 21.

Naturally missing indicators – Grassland Ecosystems

The Reference Benchmark for tree and sub-canopy height and cover that are naturally missing from the pre-clear ecosystem, are to be recorded as '0', with the ICS being 'NA.' Naturally missing indicators are not to be included in assessment unit calculations.

For grasslands, where the Reference Benchmark for shrubs is '0' the Indicator Condition Scoring changes this value to '1' to allow scoring to occur (particularly to identify woody thickening). Refer to the worked example on page 21.

Note, if there are trees greater than ~20 m tall with greater than ~15% cover in an area mapped as a pre-clear grassland, the pre-clear vegetation mapping might be wrong and will need to be confirmed to ensure suitable benchmarks are used for that vegetation type.

Output of Step 4 – determine the Reference Benchmark for each indicator

- A table for each sub-asset describing the **indicators** to be measured in the Account and the **Reference Benchmark** value for each indicator for each **sub-asset**.

Reminder – Register your Environmental Account with AfN

Remember that you need to **register** your Environmental Account with AfN Ltd before commencing Step 5 - Collect Data and Perform Analyses if you are seeking Tier 1 - Certification or Tier 2 - Self Verification.

Step 5. Collect data and perform analyses

Data collection for the Environmental Account involves data collection in the field (i.e. taking photos and field measurements) and desktop analyses (using GIS in conjunction with photo assessments).

If a landholder wishes to conduct the field assessments themselves, but is not confident with the below indicators (in particular the distinction between native perennial and native annual grasses) it is recommended that they contact their local Landcare Group to assist with the first few sampling rounds. You can find your local Landcare group here:

<https://landcareaustralia.org.au/landcare-get-involved/findagroup/?postcode=>

Desktop/remote sensing analyses

The desktop analyses for **configuration** can be completed before going into the field using the following data layers and mapping:

- Aerial imagery (e.g. Google Satellite)
- State pre-clear vegetation mapping (if available)
- Assessment units (generated in **Step 3**)
- Sample sites (generated in **Step 3**)
- State remnant/regrowth vegetation mapping (if available)

If relevant layers are not available, contact your local Landcare group and/or regional NRM body for advice and assistance.

Refer to **Appendix C** for details on how to conduct these analyses for **configuration**.

Establishing a permanent monitoring site

Prior to collecting photographs for **composition** assessment, permanent monitoring sites must be established at each **sample site** to ensure results are consistent and comparable from year to year (refer to **Figure 1 (also Appendix G)** and details on next page).

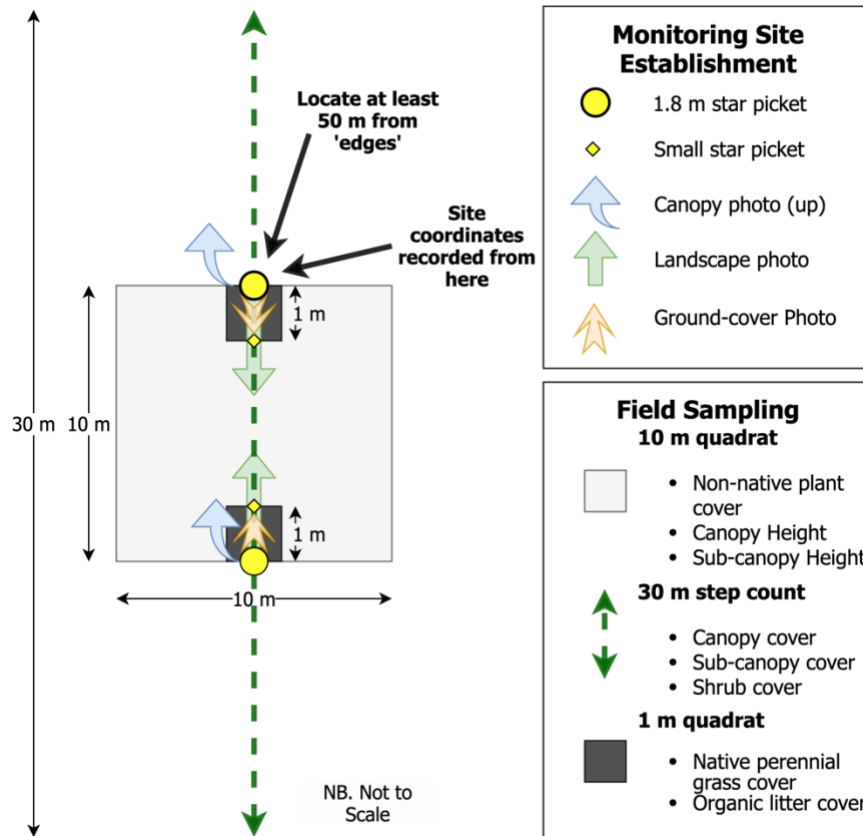


Figure 1. Diagram of the permanent monitoring sites to be established at each sampling site. Remember sampling sites should be established at least 50 m from an 'edge' as described in Table 1.

The following equipment will be required:

- 2 x 1.8 m star pickets
- 2 x 0.6 m star pickets
- Labelling tags
- 10 m tape measure
- Compass (a smartphone with a compass is suitable)

The site should be established as follows (refer to **Figure 1**).

1. At the recorded site coordinates, a 1.8 m star picket should be installed and labelled with the assessment unit number.
2. A second 1.8 m star picket should be installed 10 m away and labelled with the assessment unit number.
3. A 0.6 m star picket should be installed 1 m inwards from each of the 1.8 m star pickets.

Taking photos

The following photographs (with no zoom and no wide-angle) should be taken at each **1.8 m** star picket and clearly labelled:

- **2x canopy photos:** place the camera on top of each star picket and take a photo straight upwards of the canopy (example photo label: AU1.1_1_C);
- **2x landscape photos:** Rest the camera horizontally on the top of the star picket and position the camera so that the top of the opposing star picket is in the centre of the frame (example photo label: AU1.1_1_L);
- **2x ground-cover photos:** Standing at each of the star pickets, point the camera so that the bottom of the closest small star picket is in the centre of the frame (example photo label: AU1.1_1_GC).

NB. It is highly recommended that a copy of the previous monitoring photos are taken on each subsequent photo-monitoring round to help align new photos with previous photos to ensure consistency.



Example canopy Photo



Example landscape photo



Example groundcover photo

Field measurements

Refer to **Figure 1** and **Appendix D** for how to measure height and cover in the field. It is optional whether or not the remaining **composition** indicators (non-native plant cover, organic litter cover, and native perennial grass cover) are measured in the field, or later scored from the photographs by an independent expert; however, field measures are encouraged to increase accuracy. If measured in the field, the scores will need to be verified by an expert from the photos. For guidance on measuring in the field, refer to **Appendix D**.

How to score the composition indicators

A qualified person familiar with the local flora and ecology of the Account region (e.g. Ecologist, Project Officer, or experienced landholder) will assess the following indicators in accordance with Table 3.

If a landholder wishes to conduct the field assessments themselves, but is not confident with the below indicators (in particular the distinction between native perennial and native annual

grasses) it is recommended that they contact their local Landcare Group to assist with the first few sampling rounds. You can find your local Landcare group here:

<https://landcareaustralia.org.au/landcare-get-involved/findagroup/?postcode=>

Table 3. Summary of scoring of composition Indicators

Indicator	Measure	Method	Source
Non-native plant cover	Non-native plant cover (Braun-Blanquet Cover Score)	~ 10 m quadrat Braun-Blanquet	Field measure (depending on skill of assessor) verified by photos Or Average of two canopy photos supplemented by average of two landscape and ground photos
Cover	Canopy cover (%)	30 m Step-count (Appendix D)	Field measure
	Sub-canopy cover (%)	30 m Step-count (Appendix D)	Field measure
	Shrub cover (%)	30 m Step-count (Appendix D)	Field measure
	Organic litter ground cover (%)	~ 1 m quadrat estimate	Field measure (depending on skill of assessor) verified by photos Or Average of two ground photos
	Native perennial grass cover (%)	~ 1 m quadrat estimate	Field measure (depending on skill of assessor) verified by photos Or Average of two ground photos
Height	Canopy (m)	Estimate (Appendix D)	Field measure
	Sub-canopy (m)	Estimate (Appendix D)	Field measure

The Braun-Blanquet (1965) cover scale has been used to estimate non-native plant cover. It is anticipated that this will reduce variability between assessors, and therefore improve consistency in results.

Table 4. Braun-Blanquet Cover Scores to be used for photo-scoring (adapted from TLC Wildtracker Native Vegetation Method and Braun-Blanquet 1965)).

Braun-Blanquet Cover Category for non-native plant cover		Score
Very High	> 61 %	5
High	31- 60%	4
Medium	16 -30%	3
Low	6 – 15%	2
Very Low	1 – 5%	1
Absent	0%	0

Output of Step 5 – Collect data

- A **folder** (preferable stored on the cloud) containing all photographs appropriately labelled according to the assessment unit.
- A **data table** (e.g. a spreadsheet) containing all the raw data for the configuration and each composition indicators for each assessment unit.
- The below table is an example of a data sheet you could use to record data in. Also refer to **Appendix F**.

Assessment unit						
Photos IDs	1 Canopy Photo					
	1 Landscape Photo					
	1 Groundcover Photo					
	2 Canopy Photo					
	2 Landscape Photo					
	2 Groundcover Photo					
Reference Vegetation Type						
Area of assessment unit						
Indicator Class	Indicator	Reference Value	Site ID:	Site ID:	Site ID:	Average
			Lat/long:	Lat/long:	Lat/long:	
			Value	Value	Value	
Configuration	Context (%)	100				
Composition	Non-native plant cover (Braun-Blanquet Cover Score)	0				
	Canopy cover (%)					
	Sub-canopy cover (%)					
	Shrub cover (%)					
	Organic litter ground cover (%)					
	Native perennial grass cover (%)					
	Canopy height (m)					
Sub-canopy height (m)						

Step 6. Calculate Indicator Condition Scores

In general terms, the Indicator Condition Score (ICS) is a proportion of the observed value compared to the Reference Benchmark value. However, the formulas for calculating this can vary considerably between indicators—some incorporate weightings and conditional clauses to reflect the ecological thresholds associated with some vegetation attributes.

Where assessment units were generated with the lowest level of vegetation classification (e.g. in QLD RE or in NSW Plant Community types), the composition values measured across all sites within a single assessment unit should be averaged, and these averaged values used to calculate the ICS.

Where a higher level of vegetation classification was used to generate assessment units (eg. BVG in QLD), then ICS will need to be calculated for each site and the ICS for each indicator then aggregated to give average assessment unit ICS – refer to BVG worked example.

Configuration indicator

The methods used to calculate the ICS for configuration indicators are explained in Table 5.

Table 5. Summary of how to calculate Indicator Condition Scores for configuration indicators

Measure	Method	Indicator Condition Score (ICS)
Context		
Context (%)	GIS	The ICS for context is calculated as the percentage of native vegetation cover within a 1 km radius of the central coordinate of the sampling sites. For example, a 57% cover of native vegetation within a 1 km radius of the sample site gives an ICS for context of 57.

Composition indicators

The methods used to calculate the ICS for composition indicators are explained in Table 6. For ease of calculating, each calculation has been converted into an Excel formula, which can be found in **Appendix E**. All ICS are then averaged to get an overall composition ICS.

Table 6. Summary of how to calculate Indicator Condition Scores for composition indicators

Measure	Method	Indicator Condition Score (ICS)												
Cover														
Canopy cover (%)	30 m Step-count (Appendix D)	<p>An ICS will be calculated for the cover of each strata in accordance with below table (simplified from LRF Method (Butler, 2020)):</p> <table border="1"> <thead> <tr> <th>Cover (as % of benchmark)</th> <th>ICS</th> </tr> </thead> <tbody> <tr> <td>0 – 49 %</td> <td>$ICS = 200 \cdot \frac{Score}{Reference}$</td> </tr> <tr> <td>50 – 150%</td> <td>100</td> </tr> <tr> <td>151 -200 %</td> <td>$ICS = -40 \cdot \frac{Score}{Reference} + 140$</td> </tr> <tr> <td>>200%</td> <td>60</td> </tr> </tbody> </table>	Cover (as % of benchmark)	ICS	0 – 49 %	$ICS = 200 \cdot \frac{Score}{Reference}$	50 – 150%	100	151 -200 %	$ICS = -40 \cdot \frac{Score}{Reference} + 140$	>200%	60		
Cover (as % of benchmark)			ICS											
0 – 49 %			$ICS = 200 \cdot \frac{Score}{Reference}$											
50 – 150%			100											
151 -200 %			$ICS = -40 \cdot \frac{Score}{Reference} + 140$											
>200%	60													
Sub-canopy cover (%)														
Shrub cover (%)	30 m Step-count (Appendix D)	<p>An ICS will be calculated for the cover of each strata in accordance with below table (simplified from LRF method (Butler, 2020)):</p> <table border="1"> <thead> <tr> <th>Cover (as % of benchmark)</th> <th>ICS</th> </tr> </thead> <tbody> <tr> <td><10 %</td> <td>0</td> </tr> <tr> <td>10 – 49 %</td> <td>$ICS = 200 \cdot \frac{Score}{Reference}$</td> </tr> <tr> <td>50 – 200%</td> <td>100</td> </tr> <tr> <td>201 -250 %</td> <td>$ICS = -40 \cdot \frac{Score}{Reference} + 160$</td> </tr> <tr> <td>>250%</td> <td>60</td> </tr> </tbody> </table> <p>Note. A separate formula is included in Appendix E for grasslands. This formula allows scoring for shrub cover, even when the Reference Benchmark is 0.</p>	Cover (as % of benchmark)	ICS	<10 %	0	10 – 49 %	$ICS = 200 \cdot \frac{Score}{Reference}$	50 – 200%	100	201 -250 %	$ICS = -40 \cdot \frac{Score}{Reference} + 160$	>250%	60
Cover (as % of benchmark)			ICS											
<10 %			0											
10 – 49 %			$ICS = 200 \cdot \frac{Score}{Reference}$											
50 – 200%			100											
201 -250 %	$ICS = -40 \cdot \frac{Score}{Reference} + 160$													
>250%	60													
Organic litter ground cover (%)	% Cover estimated from Field measure (depending on skill of assessor) verified by photos Or Photo	<p>An ICS will be calculated for the cover of organic litter cover with below table (simplified from LRF method (Butler, 2020)):</p> <table border="1"> <thead> <tr> <th>Cover (as % of benchmark)</th> <th>ICS</th> </tr> </thead> <tbody> <tr> <td><10 %</td> <td>0</td> </tr> <tr> <td>10 – 50%</td> <td>$ICS = 250 \cdot \frac{Score}{Reference} - 25$</td> </tr> <tr> <td>51– 200%</td> <td>100</td> </tr> <tr> <td>201 -250 %</td> <td>$ICS = -80 \cdot \frac{Score}{Reference} + 260$</td> </tr> <tr> <td>>250%</td> <td>60</td> </tr> </tbody> </table>	Cover (as % of benchmark)	ICS	<10 %	0	10 – 50%	$ICS = 250 \cdot \frac{Score}{Reference} - 25$	51– 200%	100	201 -250 %	$ICS = -80 \cdot \frac{Score}{Reference} + 260$	>250%	60
Cover (as % of benchmark)			ICS											
<10 %			0											
10 – 50%			$ICS = 250 \cdot \frac{Score}{Reference} - 25$											
51– 200%			100											
201 -250 %	$ICS = -80 \cdot \frac{Score}{Reference} + 260$													
>250%	60													

Measure	Method	Indicator Condition Score (ICS)																		
Native perennial grass cover (%)	% Cover estimated from Field measure (depending on skill of assessor) verified by photos	<table border="1"> <thead> <tr> <th>Cover (as % of benchmark)</th> <th>ICS</th> </tr> </thead> <tbody> <tr> <td>≤100 %</td> <td>$ICS = \frac{\text{Score}}{\text{Reference}} \cdot 100$</td> </tr> <tr> <td>>100%</td> <td>100</td> </tr> </tbody> </table>	Cover (as % of benchmark)	ICS	≤100 %	$ICS = \frac{\text{Score}}{\text{Reference}} \cdot 100$	>100%	100												
	Cover (as % of benchmark)		ICS																	
≤100 %	$ICS = \frac{\text{Score}}{\text{Reference}} \cdot 100$																			
>100%	100																			
	Or Photo																			
Height																				
Canopy (m)	Measured in the field (Appendix D)	<p>An ICS will be calculated for the height of each strata in accordance with below table (simplified from LRF method (Butler, 2020)):</p> <table border="1"> <thead> <tr> <th>Height (as % of benchmark)</th> <th>ICS</th> </tr> </thead> <tbody> <tr> <td><10%</td> <td>0</td> </tr> <tr> <td>10 – 19%</td> <td>8</td> </tr> <tr> <td>20 – 29%</td> <td>25</td> </tr> <tr> <td>30 – 39%</td> <td>41</td> </tr> <tr> <td>40 – 49%</td> <td>58</td> </tr> <tr> <td>50 – 59%</td> <td>76</td> </tr> <tr> <td>60 – 69%</td> <td>93</td> </tr> <tr> <td>≥70%</td> <td>100</td> </tr> </tbody> </table>	Height (as % of benchmark)	ICS	<10%	0	10 – 19%	8	20 – 29%	25	30 – 39%	41	40 – 49%	58	50 – 59%	76	60 – 69%	93	≥70%	100
Height (as % of benchmark)			ICS																	
<10%	0																			
10 – 19%	8																			
20 – 29%	25																			
30 – 39%	41																			
40 – 49%	58																			
50 – 59%	76																			
60 – 69%	93																			
≥70%	100																			
Sub-canopy (m)																				
Non-native plant cover																				
Non-native plant cover (Braun-Blanquet Cover Score)	Braun-Blanquet estimated from Field measure (depending on skill of assessor) verified by photos Or Photo	<p>Non-native plant cover will be given an ICS in accordance with the below:</p> <table border="1"> <thead> <tr> <th>Braun-Blanquet Score</th> <th>ICS</th> </tr> </thead> <tbody> <tr> <td>>4.5</td> <td>0</td> </tr> <tr> <td>3.4 – 4.5</td> <td>10</td> </tr> <tr> <td>2.5 – 3.5</td> <td>20</td> </tr> <tr> <td>1.5 – 2.4</td> <td>50</td> </tr> <tr> <td>0.5 - 1.4</td> <td>75</td> </tr> <tr> <td><0.5</td> <td>100</td> </tr> </tbody> </table>	Braun-Blanquet Score	ICS	>4.5	0	3.4 – 4.5	10	2.5 – 3.5	20	1.5 – 2.4	50	0.5 - 1.4	75	<0.5	100				
Braun-Blanquet Score	ICS																			
>4.5	0																			
3.4 – 4.5	10																			
2.5 – 3.5	20																			
1.5 – 2.4	50																			
0.5 - 1.4	75																			
<0.5	100																			

Output of Step 6 – Indicator Condition Scores

- A **data table** (e.g. a spreadsheet) containing all the data (including calculated Indicator Condition Scores) for each assessment unit. An extra column is shown below in the example data table, where you can average the composition ICS.

ASSESSMENT UNIT	Indicator Class	Indicator	Reference Benchmark Value	Average Value	ICS	
Assessment Unit ID	Configuration	Configuration (%)	100			
	Composition	Non-native plant cover (Braun-Blanquet Cover Score)	0			
		Canopy cover (%)				
		Sub-canopy cover (%)				
		Shrub cover (%)				
		Organic litter ground cover (%)				
		Native perennial grass cover (%)				
		Canopy height (m)				
		Sub-canopy height (m)				

Step 7. Calculate Econd®

The Econd® is an index between 0 and 100, where 100 describes the ‘ideal’ or ‘undisturbed’ reference condition of an environmental asset, and 0 indicates the asset is completely degraded.

This Method prescribes instructions for calculating Econd® indices for each assessment unit, and then aggregating these into an Econd® for each sub-asset and then aggregating these into the overall Econd® for the native vegetation Environmental Asset.

The following steps must be taken to calculate the Econd®

1. First, an Econd® index must be calculated for each **assessment unit** (AU) by calculating the weighted average of the configuration ICS (weighted 25%) and the average of all composition ICS (weighted 75%).
2. Next, calculate the **sub-asset Econd®** as the area weighted average of the assessment unit Econd scores, being sure to include **ALL assessment units even those that were assigned 0** (area weighting is critical as it accounts for the extent/size of each assessment unit)
 - *Note: Area weightings for assessment units should be calculated as a proportion of the assessment unit area (ha) to the total accounting area (ha). Remember, the sum of all assessment units should equal the total accounting area. As an example, if a 1,000 ha property comprised two assessment units, one covering 800 ha and the other covering 200 ha, then the property Econd® would be: (Econd® AU1 x 0.8) + (Econd® AU2 x 0.2)*
 - *Note. An alternative approach is to aggregate to the **land-use/broad condition state** level and therefore compare Econd® between land-use/broad condition states.*
3. Next, the Econd® for the native vegetation asset is calculated for the Account as a whole (i.e. project or property) as an area-weighted average of the **sub-asset Econd®** indices.

A worked example (using the lowest level of vegetation mapping) is shown on the next page, and gives an example of how to organise your Environmental Account, and calculate the assessment unit Econd®, sub-asset Econd®, and overall Econd®. A worked example when using Broader Vegetation Groups is included in Appendix H. Both worked examples are available as an excel spreadsheet.

Worked Example – Native Vegetation Account

Step 1 and 2:	Step 3:	Step 4:		Step 5:	Step 6:		Step 7:			
Sub-asset	Assessment unit	Indicator	Reference Benchmark Value	Average Measure	Indicator Condition Score (ICS)		Assessment unit Econd®	Sub-asset Econd®	Asset Econd®	
Regional Ecosystem 11.5.1	RE 11.5.1 - Grazing	Configuration - site context (%)	100.0	50.0	50.0		55.2 (Assessment unit extent times the weighted average of composition (75%) and configuration (25%) ICS) $= (56.9 * 0.75) + (50 * 0.25)$	57.1 (Area-weighted average of Assessment Unit Econd®) $= (55.2 * 0.94) + (87.1 * 0.06)$	62.1 (Area weighted average of each sub-asset Econd®) $= (57.1 * 0.31) + (75.8 * 0.45) + (42.3 * 0.23)$	
		Composition	Tree canopy height (m)	20.0	20.0	100.0				56.9 (Average of all composition Indicators)
			Sub-canopy canopy height (m)	9.0	7.0	100.0				
			Tree canopy cover (%)	25.0	5.0	40.0				
			Sub-canopy cover (%)	20.0	5.0	50.0				
			Native shrub cover (%)	6.0	1.0	33.3				
			Non-native plant cover (BB Score)	0.0	4.0	10.0				
	RE 11.5.1 - Protected woodland	Composition	Configuration - site context (%)	100.0	81.2	81.2				87.1 (The weighted average of composition (75%) and configuration (25%) ICS) $= (89.1 * 0.75) + (81.2 * 0.25)$
	Tree canopy height (m)		20.0	18.8	100.0	89.1 (Average of all composition Indicators)				
	Sub-canopy canopy height (m)		9.0	8.0	100.0					
	Tree canopy cover (%)		25.0	19.5	100.0					
	Sub-canopy cover (%)		20.0	16.0	100.0					
	Native shrub cover (%)		6.0	8.4	100.0					
	Non-native plant cover (BB Score)		0.0	2.0	50.0					
Regional Ecosystem 11.3.2	RE 11.3.2 - Protected woodland	Configuration - site context (%)	100.0	74.1	74.1		75.8 (The weighted average of composition (75%) and configuration (25%) ICS) $= (76.3 * 0.75) + (74.1 * 0.25)$			
		Composition	Tree canopy height (m)	18.0	16.7	100.0		76.3 (Average of all composition Indicators – excluding those naturally absent)		
			Sub-canopy canopy height (m)	0	NA	NA				
			Tree canopy cover (%)	40.0	29.0	100.0				
			Sub-canopy cover (%)	0	NA	NA				
			Native shrub cover (%)	2.0	0.5	50.0				
			Non-native plant cover (BB Score)	0.0	1.0	75.0				
Native perennial grass cover (%)	35.0	22.0	62.9							
Regional Ecosystem 11.4.4	RE 11.4.4 - Protected Grassland	Configuration - site context (%)	100.0	52.0	52.0		50.8 (The weighted average of composition (75%) and configuration (25%) ICS) $= (50.4 * 0.75) + (52 * 0.25)$	42.3 (Area-weighted average of Assessment Unit Econd®) $= (50.8 * 0.83) + (0 * 0.17)$		
		Composition	Tree canopy height (m)	0.0	0.0	NA			50.4 (Average of all composition Indicators – excluding those naturally absent, with the exception of shrubs)	
			Sub-canopy canopy height (m)	0.0	0.0	NA				
			Tree canopy cover (%)	0.0	0.0	NA				
			Sub-canopy cover (%)	0.0	0.0	NA				
			Native shrub cover (%)	0.0	3.0	60.0				
			Non-native plant cover (BB Score)	0.0	2.0	50.0				
	Native perennial grass cover (%)	50.0	22.0	44.0						
	RE 11.4.4 – Intensive Cropping	NA – Assessment Unit is assigned 0 due to the intensive land-use					0			

AREA AND EXTENT WEIGHTINGS			
		Extent	
Sub-asset	Assessment unit	Total Area (ha)	Area Weighting
Regional Ecosystem 11.5.1		809	31%
11.5.1	Grazing	760	94%
	Protected woodland	49	6%
Regional Ecosystem 11.3.2		1,171	45%
11.3.2	Protected Woodland	1,171	100%
Regional Ecosystem 11.4.4		600	23%
11.4.4	Protected Grassland	500	83%
	Intensive Cropping	100	17%
TOTAL		2,580	

INDICATOR WEIGHTING FOR ECOND®	
Configuration	25%
Composition	75%
Total	100%

Output of Step 7 – Calculating the Econd™

- A **data table** (e.g. a spreadsheet) containing all the raw data for each indicator for each assessment unit, now also including the calculations for the Econd® .
- A **summary table** showing the Econd® for each assessment unit, sub-asset and the overall Econd® , similar to that shown in the worked example.

3. Compile Account and submit for certification

Steps five to seven should be repeated at regular intervals (a minimum of every five years or where base year recalculation is required, as specified under the Accounting for Nature® Framework) to establish a trend over time. Ideally, site surveys should occur annually because the purpose of the Account is to detect change; the more frequently you measure the condition, the more easily you can detect change.

If you wish for your account to be certified, it must be verified in accordance with the *Accounting for Nature® Standard*, which outlines the criteria that must be satisfied. The benefit of having an account certified is that AfN allows you to display the Certified Account logo and you are able to make public claims about your account. AfN Certified Accounts require the Environmental Account Summary and Information Statement to be made publicly available.

An AfN Certified Environmental Account may incorporate multiple environmental assets, and always needs to include the following information:

- Information Statement and Environmental Account Summary,
- Environmental Account (including raw data tables); and;
- An **Audit Report** or **Self-verification Report** that verifies the account was prepared in accordance with the approved Methods, the AfN Standard and Audit Rules.
 - o An **Audit Report** is completed by an AfN Accredited Auditor and is required if you are seeking to have your account “Certified” (Tier 1); OR
 - o A **Self-verification Report** contains the results of your self-verification assessment and AfN’s technical Assessment and is required if you are seeking to have your account “Self-verified” (Tier 2).

4. References

- Abed, T., and Stephens, N.C. (2002). Tree measurement manual for farm foresters - Practical guidelines for farm foresters undertaking basic inventory in farm forest plantation stands. National Forest Inventory, BRS, Canberra.
- Braun-Blanquet (1965). Plant sociology: the study of plant communities. Hafner Publishing Company
- Butler, D (2020). Land Restoration Fund Native Vegetation Condition Monitoring Method, Accounting for Nature Limited, Sydney, Australia
- Butler, D. Thackway, R. and Cosier, P. (2020). Technical Protocol for Constructing Native Vegetation Condition Accounts Version 1.0 – May 2020. Accounting for Nature Limited, Sydney, Australia.
- Eyre TJ, Kelly AL and Neldner VJ (2017). Method for the Establishment and Survey of Reference Sites for BioCondition. Version 3. Queensland Herbarium, Department of Science, Information Technology and Innovation, Brisbane.
- Eyre, TJ, Kelly, AL, Neldner, VJ, Wilson, BA, Ferguson, DJ, Laidlaw, MJ and Franks, AJ (2015). BioCondition: A Condition Assessment Framework for Terrestrial Biodiversity in Queensland. Assessment Manual. Version 2.2. Queensland Herbarium, Department of Science, Information Technology, Innovation and Arts, Brisbane.
- Taylor, M (2020). Tasmanian Land Conservancy WildTracker Native Vegetation Methodology, Accounting for Nature Limited, Sydney, Australia

Appendix A. Glossary

Table A1. Summary of key words

Term	Definition
Assessment unit	Assessment units are homogenous units within the accounting area which determine where samples are to be taken. They do not have to be continuous, but rather, can be comprised of multiple small parts (so long as all parts of a single assessment unit have the same vegetation type and land use/management/condition).
Composition	The composition of native vegetation relates to its structure, function, and the assemblage of species.
Configuration	The configuration of native vegetation relates to the configuration of that area of native vegetation within the landscape, with regard to connectivity, context and patch size.
Econd®	An index between 0 and 100 that describes the condition of an environmental asset where 0 means the asset is completely degraded, and 100 means the asset is in pristine condition.
Extent	The extent refers to the area of native vegetation within the accounting area.
Indicator Condition Score	In general terms, the Indicator Condition Score (ICS) is a proportion of the observed value compared to the Reference Benchmark value. However, the formulas for calculating this can vary considerably between indicators—some incorporate weightings and conditional clauses to reflect the ecological thresholds associated with some vegetation attributes.
Native plant	A native species is considered to be any plant that naturally occurs within the pre-clear vegetation type.
Reference Benchmark	The Reference Benchmark is the condition of the native vegetation sub-asset in an ‘undegraded’ state. For example, a vegetation community that has not experienced any negative impacts as a result of disturbance, edge effects, invasive species, or altered management regimes (e.g. fire) would be considered to exist in an ‘undegraded’ or ‘ideal’ state.
Remnant	<p>Woody vegetation is deemed remnant where the dominant canopy has greater than 70 % of the height and 50 % of the cover relative to the undisturbed height and canopy of that vegetation type and is comprised of species characteristic of that vegetation’s undisturbed canopy.</p> <p>Non-woody vegetation is deemed remnant where there is no evidence of disturbance in the last 15 years, and the species composition reflects the vegetation type.</p>

Table A2. Summary of Indicators (definitions derived from Eyre et al, 2015).

Indicator	Definition
Non-native plant cover	Non-native plants include exotic or introduced plant species and includes all species that do not naturally occur within the pre-clear vegetation type . Non-native plant cover is assessed within a ~10 m quadrat using Braun-Blanquet Cover Scores.
Canopy height and cover	The canopy refers to the layer formed collectively by the crowns of adjacent trees, it usually refers to the Ecologically Dominant Layer (the EDL), refer to Figure A1, below. The canopy height is estimated as the median height of the canopy, while the canopy cover, is the percent cover of living native canopy trees , estimated using the step count method, refer to Appendix D.
Sub-canopy height and cover	The sub-canopy sits below the canopy, refer to Figure A1. The sub-canopy height should be estimated as the median height of the sub-canopy, while the sub-canopy cover, is the percent cover of living native sub-canopy trees , estimated using the step count method, refer to Appendix D.
Shrub cover	Shrubs are woody plants that are multi-stemmed from the base or within 20 cm of the ground level), or if single stemmed, less than 2 m tall. Shrub cover refers to the percent cover (estimated using the step count method) of living native shrubs .
Organic litter ground cover	Organic litter cover includes both fine and coarse organic material such as fallen leaves, twigs, and branches <10 cm in diameter. It does not include rocks. Organic litter cover is estimated from a ~1m quadrat.
Native perennial grass cover	Native perennial grasses include any native perennial plant in the family <i>Poaceae</i> , including tussock and hummock grasses (but not including grass-like forbs or graminoids). Native perennial grass cover is estimated from a ~1m quadrat.

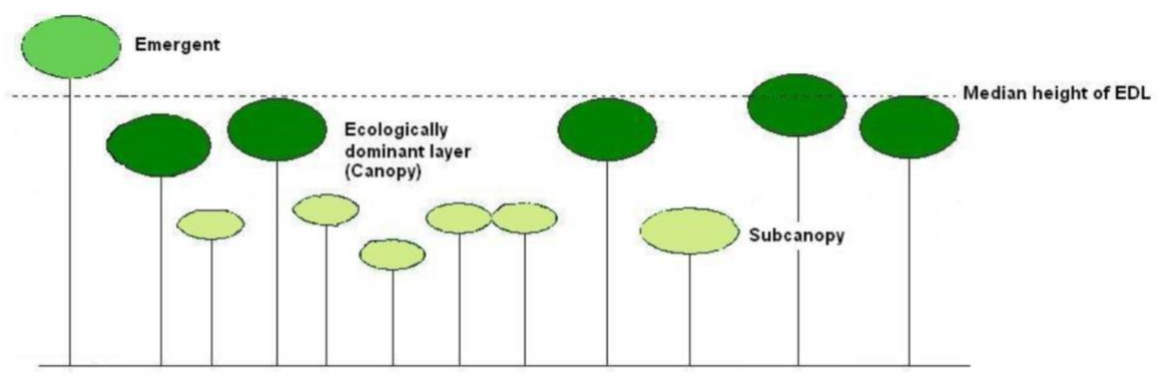


Figure A1. A depiction of the canopy and sub-canopy strata in an ecosystem (Eyre et al (2015)).

Eyre, T.J., Kelly, A.L, Neldner, V.J., Wilson, B.A., Ferguson, D.J., Laidlaw, M.J. and Franks, A.J. (2015). BioCondition: A Condition Assessment Framework for Terrestrial Biodiversity in Queensland. Assessment Manual. Version 2.2. Queensland Herbarium, Department of Science, Information Technology, Innovation and Arts, Brisbane

Appendix B. Overview of sources of State mapping and Reference Benchmarks (based on States' Condition Assessment Frameworks)

Table B1. Summary of vegetation mapping in each Australian State and Territory

State	Vegetation Mapping	Link	Data name and source
ACT	Vegetation Communities	https://actmapi-actgov.opendata.arcgis.com/datasets/act-vegetation-map-2018	ACT Vegetation Map Data provided by the ACT Government.
NSW	NSW Plant Community Types	https://datasets.seed.nsw.gov.au/dataset/nsw-bionet-vegetation-map-catalogue-collection36515	NSW Bionet Vegetation Map Data Collection Data by State Government of NSW and Department of Planning, Industry and Environment.
NT	Vegetation Associations (Uses NVIS framework)	https://nrmaps.nt.gov.au/nrmaps.html (online map) https://denr.nt.gov.au/land-resource-management/info-systems/natural-resource-maps/spatial-data-requests (geospatial data catalogue)	No state-wide vegetation mapping download available (as of December 2021), although various vegetation resource surveys are available. Otherwise the latest version of NVIS should be used
QLD	Regional Ecosystems	http://qldspatial.information.qld.gov.au/catalogue/custom/detail.page?fid={22E1BC4E-BDFA-470A-AED8-04F38B4FCFC3}	Biodiversity Status of Pre-clearing Regional Ecosystems – Queensland Data by State Government of Queensland and Department of Environment and Science.
SA	Floristic Groups (uses NVIS framework)	https://data.environment.sa.gov.au/NatureMaps (online map)	No state-wide vegetation mapping available to download (as of December 2021). Online mapping available or the latest version of NVIS can be used.
TAS	Vegetation Communities	www.dpipwe.tas.gov.au/tasveg	TASVEG- the Digital Vegetation Map of Tasmania Data can be provided by the Tasmanian Government by contacting the Geodata Client Services Section of the Information and Land Services Division, Department of Primary Industries, Parks, Water and Environment.
VIC	Ecological Vegetation Classes	https://discover.data.vic.gov.au/dataset/native-vegetation-modelled-1750-ecological-vegetation-classes (downloadable data) https://www.environment.vic.gov.au/biodiversity/naturekit (online map)	Native Vegetation – Modelled 1750 and Ecological Vegetation Classes Data by the Victorian Government and Department of Environment, Land, Water and Planning
WA	Vegetation Associations	https://catalogue.data.wa.gov.au/dataset/pre-european-dpird-006	Pre-European Vegetation
Australia Wide	Major Vegetation Groups and Sub-groups	https://www.environment.gov.au/land/native-vegetation/national-vegetation-information-system/data-products#mvg51	National Vegetation Information System Data by Commonwealth of Australia.

Table B2. Summary of published composition benchmark documentation for each Australian State and Territory

State	Composition Benchmarks	Link
ACT	Vegetation Benchmarks Database	https://www.environment.act.gov.au/_data/assets/excel_doc/0004/719122/Vegetation-Benchmarks-Database.xls
NSW	BioNet Vegetation Condition Benchmarks	https://www.environment.nsw.gov.au/topics/animals-and-plants/native-vegetation/vegetation-condition-benchmarks
NT	Not available	
QLD	BioCondition Benchmarks	https://www.qld.gov.au/environment/plants-animals/biodiversity/benchmarks%23benchmarks
SA	Native Vegetation Council (NVC) Bushland Assessment Manual	https://www.environment.sa.gov.au/topics/native-vegetation/clearing/vegetation-assessments
TAS	TasVeg Vegetation Condition Assessment	https://dpiwve.tas.gov.au/conservation/development-planning-conservation-assessment/planning-tools/monitoring-and-mapping-tasmanias-vegetation-(tasveg)/vegetation-monitoring-in-tasmania
VIC	Bioregions and EVC Benchmarks	https://www.environment.vic.gov.au/biodiversity/bioregions-and-evc-benchmarks
WA	Not available	
Australia Wide	Not available	NB. Descriptions could contain some broad benchmark information.

Appendix C. How to conduct the spatial analyses for configuration

Configuration

Configuration is measured as the site context. Site context is taken to be the percent of retained remnant vegetation within a 1 km radius of each sample site. It is calculated by adding a 1 km radial buffer around each sample site and then calculating the area of retained remnant vegetation within that buffer. The area of retained vegetation is then divided by the total area of the circle to give the % site context.

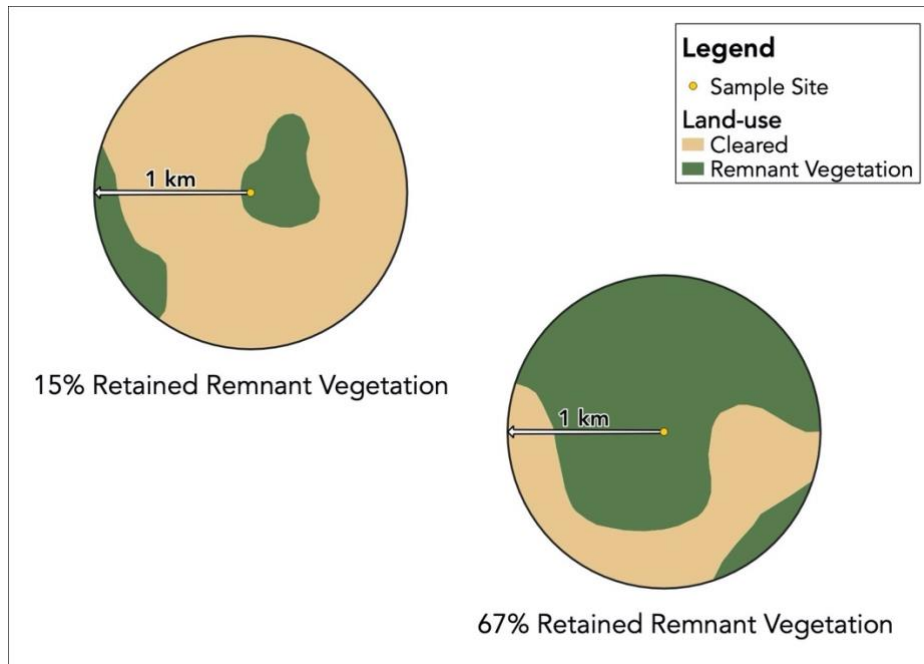


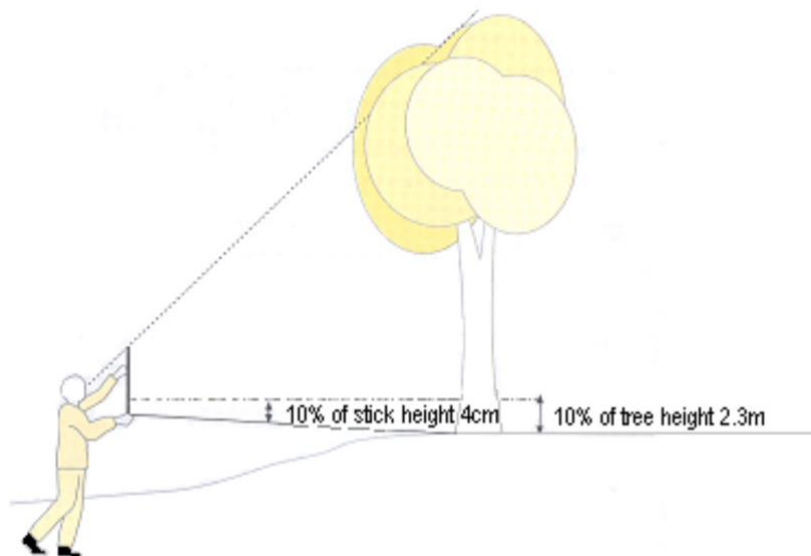
Figure C1. A visualisation of how the configuration indicator- site context (%) is calculated.

Appendix D. How to collect composition field measures

Tree height

Stick or pencil method (requires two people)

1. Select a tree that represents the average height of the strata you are assessing (canopy/sub-canopy)
2. Prepare a stick about 30 – 40 cm long (a 20 cm ruler would also suffice) and mark the stick at a point 10% of its length, this is the 'bottom' of the stick (e.g. if the stick is 30 cm long, mark it 3 cm from one edge)
3. Hold the stick vertically at full arm's length. Line up the bottom of the tree with the bottom of the stick (or if using a ruler, at 0 cm), and the top of the tree with the top of the stick (or if using a ruler, at 30 cm).
4. Have your colleague stand by the tree and measure from the ground up to the point where the 10 % mark aligns on the tree (or the 3 cm mark on a ruler). You will need to direct your colleague to ensure the 10 % mark on the tree is correct
5. As the mark on the stick was 10 % of the total length, the mark on the tree is also 10 % of the total tree height, therefore multiple the measured distance on the tree by 10 to get the total tree height.



Method by

Eyre, T.J., Kelly, A.L, Neldner, V.J., Wilson, B.A., Ferguson, D.J., Laidlaw, M.J. and Franks, A.J. (2015). BioCondition: A Condition Assessment Framework for Terrestrial Biodiversity in Queensland. Assessment Manual. Version 2.2. Queensland Herbarium, Department of Science, Information Technology, Innovation and Arts, Brisbane

And adapted from

Abed, T., and Stephens, N.C. (2002). *Tree measurement manual for farm foresters - Practical guidelines for farm foresters undertaking basic inventory in farm forest plantation stands*. National Forest Inventory, BRS, Canberra.

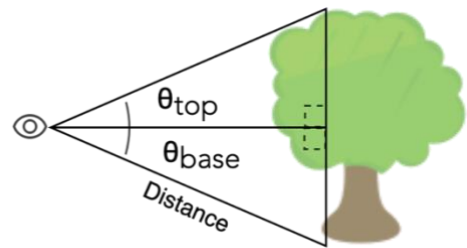
Tree height

Clinometer method

1. Select a tree that represents the average height of the strata you are assessing (canopy/sub-canopy)
2. Start at the base of the tree, and walk outwards, counting your steps (approx. 1 m) until you can see the top of the tree. = **Distance**
3. Look through the clinometer, and line up the horizontal line with the top of the tree, record the angle (in degrees on the left, do not use percent) = θ_{top}
4. Line up the horizontal line in the clinometer with the base of the tree and record the angle (in degrees). = θ_{base}
5. Calculate the height of the tree:

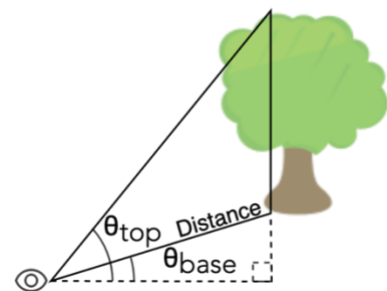
- If your **eyes** are **in-line with or above** the base of the tree:

$$\text{Height}_{\text{above}} = \frac{\text{Distance} \cdot \sin(\theta_{\text{top}} + \theta_{\text{base}})}{\sin(90 - \theta_{\text{top}})}$$



- If your **eyes** are **below** the base of the tree:

$$\text{Height}_{\text{below}} = \frac{\text{Distance} \cdot \sin(\theta_{\text{top}} - \theta_{\text{base}})}{\sin(90 - \theta_{\text{top}})}$$



NB. It is recommended to simply record the three measurements and automatically generate height in an excel spreadsheet using the following formulas (the excel 'SIN' function requires values in radians):

$$\text{Height}_{\text{above}} = (\{\text{Distance}\} * \text{SIN}(\text{RADIANS}(\{\theta_{\text{top}}\} + \{\theta_{\text{base}}\}))) / \text{SIN}(\text{RADIANS}(90 - \{\theta_{\text{top}}\}))$$

$$\text{Height}_{\text{below}} = (\{\text{Distance}\} * \text{SIN}(\text{RADIANS}(\{\theta_{\text{top}}\} - \{\theta_{\text{base}}\}))) / \text{SIN}(\text{RADIANS}(90 - \{\theta_{\text{top}}\}))$$

Method adapted from

Eyre, T.J., Kelly, A.L, Neldner, V.J., Wilson, B.A., Ferguson, D.J., Laidlaw, M.J. and Franks, A.J. (2015). BioCondition: A Condition Assessment Framework for Terrestrial Biodiversity in Queensland. Assessment Manual. Version 2.2. Queensland Herbarium, Department of Science, Information Technology, Innovation and Arts, Brisbane

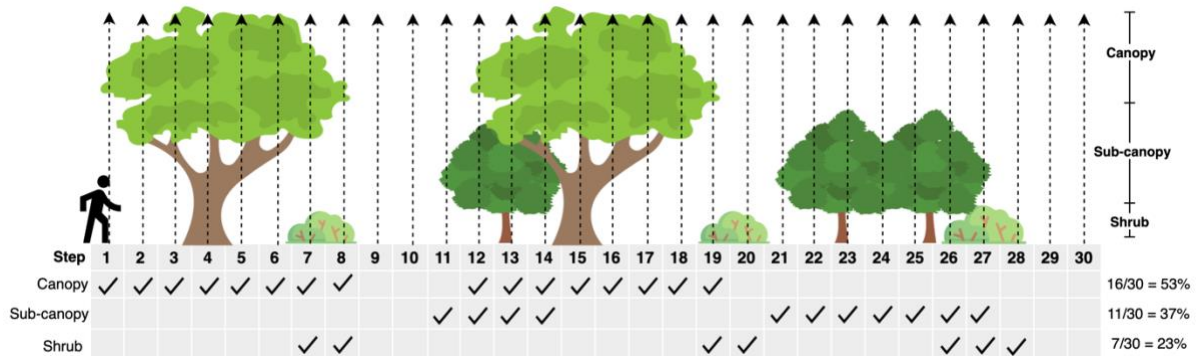
Abed, T., and Stephens, N.C. (2002). *Tree measurement manual for farm foresters - Practical guidelines for farm foresters undertaking basic inventory in farm forest plantation stands*. National Forest Inventory, BRS, Canberra.)

Canopy and sub-canopy cover (also optional for shrub cover)

Cover will be estimated in the field, as it can be extremely hard to estimate from photos. A simplified step-count method has been implemented, see below.

1. Step 10 steps outward away from a 1.8 m star picket.
2. Turn around and slowly step (approx. 1 m) forward (toward the star pickets).
3. At each step, look straight up and record whether or not you are under a canopy and/or sub-canopy by ticking the relevant box in the example data table below.
4. Transform each score into a percent.
 - For example, if you recorded 15 out of 30 steps under canopy. Then $15/30 = 50\%$ canopy cover for this site.

Strata	Step																													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Canopy																														
Sub-Canopy																														
Shrub																														



Icon source: Flaticon.com

1 m quadrat – Organic litter cover and native perennial grass cover

1. At each small star picket, use a 1 m quadrat, 1 m stick, or stand with your legs approximately 1 m wide to help visualise a 1 m quadrat.
2. Within that 1 m quadrat individually estimate the amount of organic litter cover and native perennial grass cover. It is encouraged to round estimates to the nearest five or ten, to improve consistency.

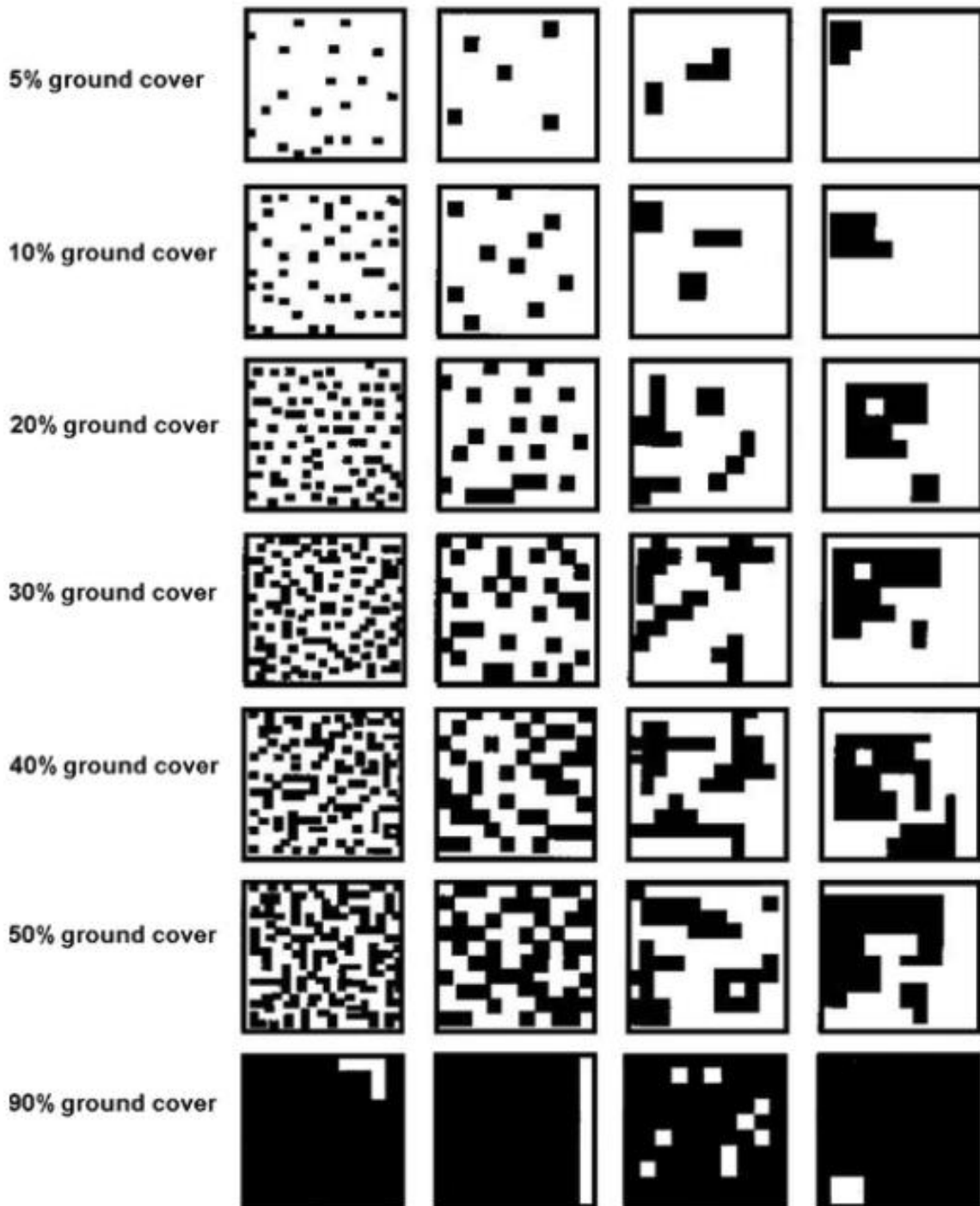


Figure D1. Stylised Guide to help with assessing ground-cover in a 1 m quadrat. (Source: Eyre, et al. 2015)

10x10 m plot - Non-native plant cover

Non-native plant cover is estimated the same way as outlined in the Queensland BioCondition Manual (Eyre et al. 2015). Non-native plant cover is the percentage cover of the total vegetation cover that is comprised of exotic and non-indigenous species, assessed within the 10 x 10 m plot (i.e. between the two star pickets and 5 m either side). Where there are non-native plants present in more than one layer, such as grass in the ground layer and shrub in the shrub layer, then the cover in each layer are added together. The benchmark for non-native plant cover for any vegetation community is zero.

Appendix E. Indicator Condition Scores – Formulas and Graphs

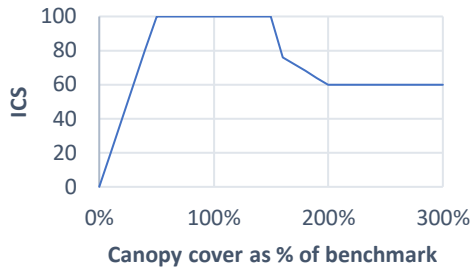
In the below formulas:

OBS = Observed value

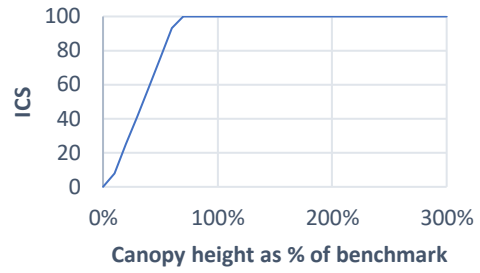
REF = Reference Benchmark Value

Non-native plant cover	=IF(OBS <0.5, 100, IF(OBS <1.5, 75, IF(OBS <2.5, 50, IF(OBS <3.5, 20, IF(OBS <4.5, 10, 0))))
Canopy cover	=IF(REF=0, "NA", IF((OBS/REF)<=0.49, 200*(OBS/REF), IF((OBS/REF)<=1.5, 100, IF((OBS/REF)<=2, -40*(OBS/REF)+140, 60))))
Sub-Canopy cover	=IF(REF=0, "NA", IF((OBS/REF)<=0.49, 200*(OBS/REF), IF((OBS/REF)<=1.5, 100, IF((OBS/REF)<=2, -40*(OBS/REF)+140, 60))))
Shrub cover	<p>For Woody Ecosystems:</p> <p>=IF(REF=0, "NA", IF((OBS/REF)<=0.1, 0, IF((OBS/REF)<=0.49, 200*(OBS/REF), IF((OBS/REF)<=2, 100, IF((OBS/REF)<=2.5, -40*(OBS/REF)+160, 60))))</p> <p>For Grasslands:</p> <p>=IF(REF=0, IF(OBS=0, 100, IF((OBS/1)<=0.1, 0, IF((OBS/1)<=0.49, 200*(OBS/1), IF((OBS/1)<=2, 100, IF((OBS/1)<=2.5, -40*(OBS/1)+160, 60))))), IF((OBS/REF)<=0.1, 0, IF((OBS/REF)<=0.49, 200*(OBS/REF), IF((OBS/REF)<=2, 100, IF((OBS/REF)<=2.5, -40*(OBS/REF)+160, 60))))</p> <p>Combined Formula:</p> <p>=IF(CANOPY COVER REF<>0, IF(REF=0, "NA", IF((OBS/REF)<=0.1, 0, IF((OBS/REF)<=0.49, 200*(OBS/REF), IF((OBS/REF)<=2, 100, IF((OBS/REF)<=2.5, -40*(OBS/REF)+160, 60))))), IF(REF=0, IF(OBS=0, 100, IF((OBS/1)<=0.1, 0, IF((OBS/1)<=0.49, 200*(OBS/1), IF((OBS/1)<=2, 100, IF((OBS/1)<=2.5, -40*(OBS/1)+160, 60))))), IF((OBS/REF)<=0.1, 0, IF((OBS/REF)<=0.49, 200*(OBS/REF), IF((OBS/REF)<=2, 100, IF((OBS/REF)<=2.5, -40*(OBS/REF)+160, 60))))</p>
Litter cover	=IF(REF=0, "NA", IF((OBS/REF)<=0.1, 0, IF((OBS/REF)<=0.5, 250*(OBS/REF)-25, IF((OBS/REF)<=2, 100, IF((OBS/REF)<=2.5, -80*(OBS/REF)+260, 60))))
Native perennial grass cover	=IF(REF=0, "NA", IF((OBS/REF)<1, (OBS/REF)*100, 100))
Canopy height	=IF(REF=0, "NA", IF((OBS/REF)<0.1, 0, IF((OBS/REF)<0.19, 8, IF((OBS/REF)<0.29, 25, IF((OBS/REF)<0.39, 41, IF((OBS/REF)<0.49, 58, IF((OBS/REF)<0.59, 76, IF((OBS/REF)<=0.69, 93, 100))))))
Sub-canopy height	=IF(REF=0, "NA", IF((OBS/REF)<0.1, 0, IF((OBS/REF)<0.19, 8, IF((OBS/REF)<0.29, 25, IF((OBS/REF)<0.39, 41, IF((OBS/REF)<0.49, 58, IF((OBS/REF)<0.59, 76, IF((OBS/REF)<=0.69, 93, 100))))))

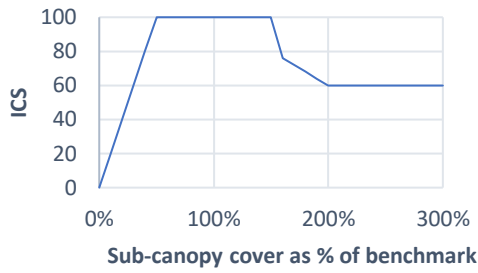
Canopy cover



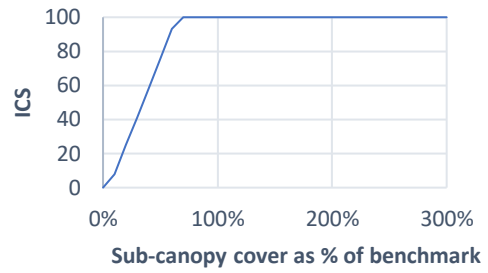
Canopy height



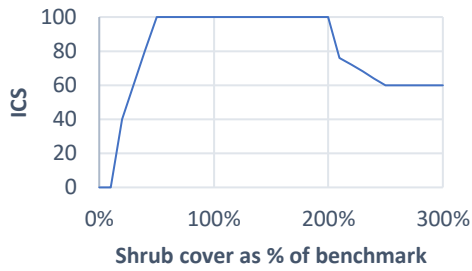
Sub-canopy cover



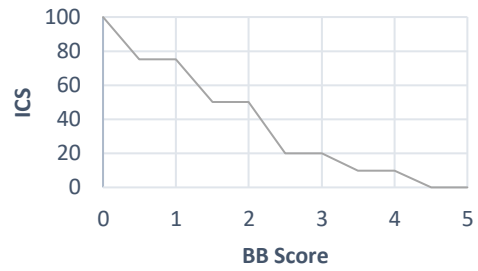
Sub-canopy height



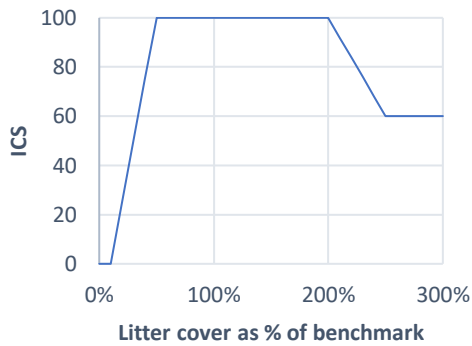
Shrub cover



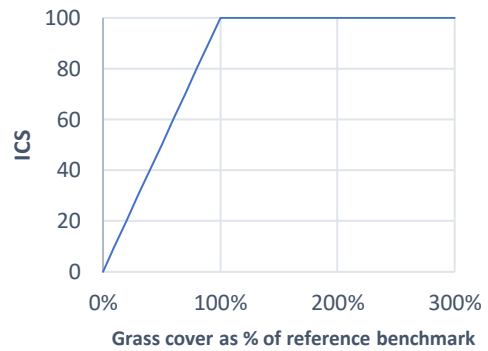
Non-native plant cover



Litter cover



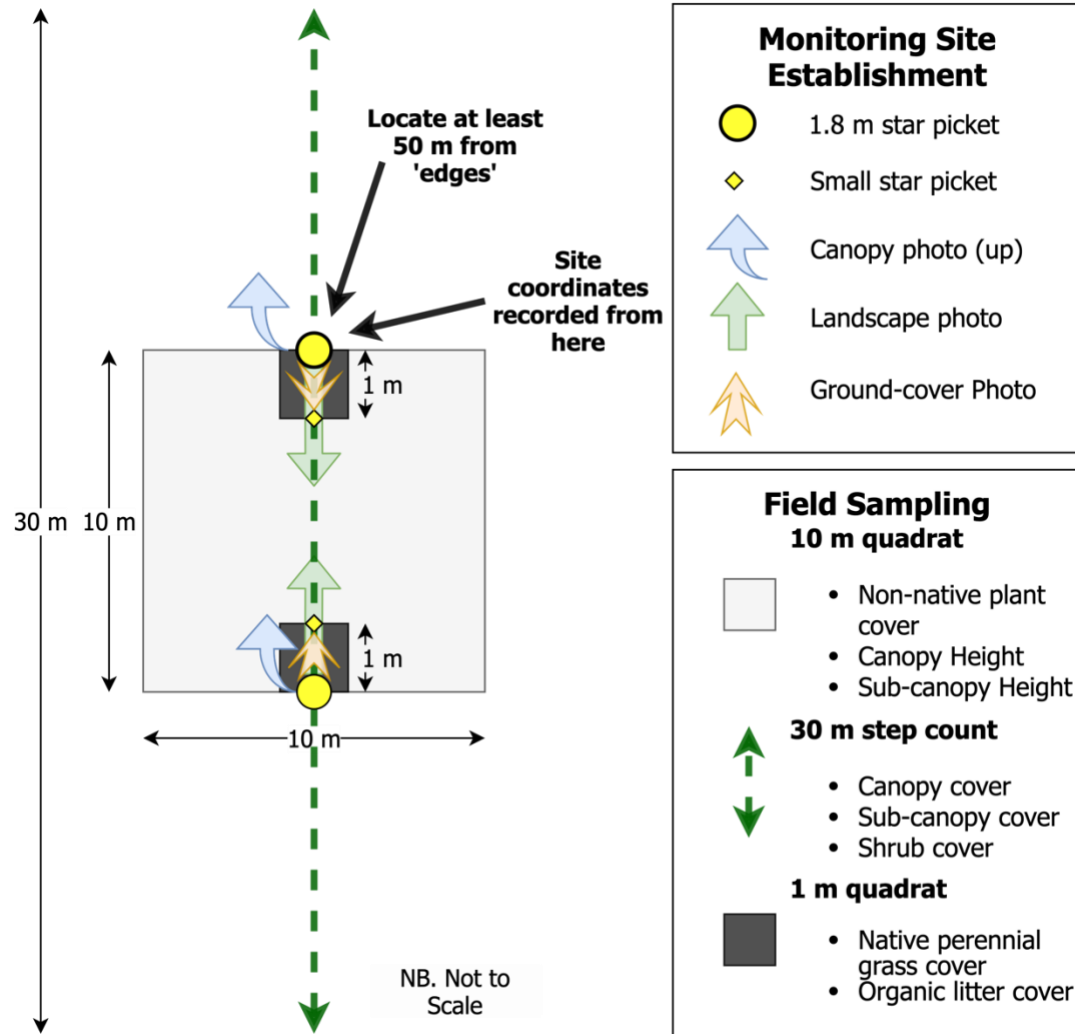
Native perennial grass cover



Appendix F. Example data collection table

Date	Assessors				Non-native Plant Cover Scoring			
Assessment unit and Area					Braun-Blanquet Cover Category		Score	
Reference Vegetation Type (eg. RE, EVC etc)					Very High	> 61 %	5	
Photos IDs	1 Canopy Photo	2 Canopy Photo			High	31- 60%	4	
	1 Landscape Photo	2 Landscape Photo			Medium	16 -30%	3	
	1 Groundcover Photo	2 Groundcover Photo			Low	6 – 15%	2	
Comments/Observations					Very Low	1 – 5%	1	
					Absent	0%	0	
Indicator Class	Indicator	Reference Value	Value	Value	Value	Value	Value	Average
			Site ID:	Site ID:	Site ID:	Site ID:	Site ID:	
			Lat/long (1 Star Picket):	Lat/long (1 Star Picket):	Lat/long (1 Star Picket):	Lat/long (1 Star Picket):	Lat/long (1 Star Picket):	
Configuration	Context (%)	100						
Composition	Non-native plant cover (BB)	0						
	Canopy cover (%)							
	Sub-canopy cover (%)							
	Shrub cover (%)							
	Organic litter ground cover (%)							
	Native perennial grass cover (%)							
	Canopy height (m)							
Sub-canopy height (m)								

Appendix G. Monitoring site establishment



Indicator	Measure	Method
Non-native plant cover	BB Cover Score	10 x 10 m or Photo
Canopy cover	%	30 m step count or Photo
Sub-canopy cover	%	30 m step count or Photo
Shrub cover	%	30 m step count or Photo
Organic litter ground cover	%	1 m quadrat or Photo
Native perennial grass cover	%	1 m quadrat or Photo
Canopy height	meters	Estimate around sample site
Sub-canopy height	meters	Estimate around sample site

Appendix H. Broader Vegetation Mapping – Worked Example

AfN & Landcare Native Vegetation Method (Level 3) - Worked Example using higher vegetation classification

NATIVE VEGETATION ENVIRONMENTAL ACCOUNT CALCULATIONS

Site level Data				Averaged Data (Assessment Units)			
-----------------	--	--	--	----------------------------------	--	--	--

Step 2:	Step 3:	Step 4:		Step 5:	Step 6:				
Sub-asset	Assessment unit	Site & Regional Ecosystem	Indicator	Reference Benchmark Measurement	Site Measure	Site Indicator Condition Score (ICS)			
BVG18b	BVG18b - Grazing	BVG18b_G1 RE 11.5.1	Composition	Configuration - site context (%)	100.00	50.00			
				Tree canopy height (m)	20.00	20.00			
				Sub-canopy canopy height (m)	9.00	7.00			
				Tree canopy cover (%)	25.00	5.00			
				Sub-canopy cover (%)	20.00	5.00			
				Native shrub cover (%)	6.00	1.00			
				Non-native plant cover (BB Score)	0.00	4.00			
				Native perennial grass cover (%)	23.00	80.00			
				Litter cover (%)	45.00	10.00			
				Configuration - site context (%)	100.00	81.20			
				Tree canopy height (m)	20.00	18.80			
				Sub-canopy canopy height (m)	9.00	8.00			
	Tree canopy cover (%)	25.00	19.50						
	Sub-canopy cover (%)	20.00	16.00						
	Native shrub cover (%)	6.00	8.40						
	Non-native plant cover (BB Score)	0.00	2.00						
	Native perennial grass cover (%)	23.00	17.50						
	Litter cover (%)	45.00	38.90						
	BVG18b - Protected woodland	BVG18b_PW1 RE 11.5.1	Composition	Configuration - site context (%)	100.00	81.20			
				Tree canopy height (m)	20.00	18.80			
				Sub-canopy canopy height (m)	9.00	8.00			
				Tree canopy cover (%)	25.00	19.50			
				Sub-canopy cover (%)	20.00	16.00			
				Native shrub cover (%)	6.00	8.40			
Non-native plant cover (BB Score)		0.00	2.00						
Native perennial grass cover (%)		23.00	17.50						
Litter cover (%)		45.00	38.90						
BVG18b_PW2 RE 11.5.2		Composition	Configuration - site context (%)	100.00	81.20				
			Tree canopy height (m)	20.00	18.80				
			Sub-canopy canopy height (m)	9.00	8.00				
	Tree canopy cover (%)		24.00	19.50					
	Sub-canopy cover (%)		13.00	16.00					
	Native shrub cover (%)		7.00	8.40					
Non-native plant cover (BB Score)	0.00	2.00							
Native perennial grass cover (%)	38.00	17.50							
Litter cover (%)	25.00	12.00							
BVG13c	BVG13c - Protected woodland	BVG13c_PW1 RE 11.11.15	Composition	Configuration - site context (%)	100.00	74.10			
				Tree canopy height (m)	18.00	16.67			
				Sub-canopy canopy height (m)	10.00	0.00			
				Tree canopy cover (%)	35.00	29.00			
				Sub-canopy cover (%)	5.00	0.00			
				Native shrub cover (%)	3.00	0.50			
				Non-native plant cover (BB Score)	0.00	1.00			
				Native perennial grass cover (%)	45.00	22.00			
				Litter cover (%)	23.00	21.00			
				BVG13c - Protected woodland	BVG13c_PW2 RE 11.12.1	Composition	Configuration - site context (%)	100.00	74.10
							Tree canopy height (m)	18.00	15.00
							Sub-canopy canopy height (m)	0.00	0.00
	Tree canopy cover (%)	40.00	29.00						
	Sub-canopy cover (%)	0.00	0.00						
	Native shrub cover (%)	2.00	0.50						
	Non-native plant cover (BB Score)	0.00	3.00						
	Native perennial grass cover (%)	35.00	22.00						
	Litter cover (%)	30.00	21.00						
	BVG13c - Protected woodland	BVG13c_PW3 RE 11.12.1	Composition	Configuration - site context (%)	100.00	74.10			
				Tree canopy height (m)	18.00	16.67			
				Sub-canopy canopy height (m)	0.00	0.00			
				Tree canopy cover (%)	40.00	29.00			
				Sub-canopy cover (%)	0.00	0.00			
				Native shrub cover (%)	2.00	0.50			
Non-native plant cover (BB Score)	0.00	4.00							
Native perennial grass cover (%)	35.00	22.00							
Litter cover (%)	30.00	10.00							
BVG30b	BVG30b - Protected grassland	BVG30b_PG1 11.4.4	Composition	Configuration - site context (%)	100.00	52.00			
				Tree canopy height (m)	0.00	0.00			
				Sub-canopy canopy height (m)	0.00	0.00			
				Tree canopy cover (%)	0.00	0.00			
				Sub-canopy cover (%)	0.00	0.00			
				Native shrub cover (%)	0.00	3.00			
	Non-native plant cover (BB Score)	0.00	2.00						
	Native perennial grass cover (%)	50.00	22.00						
	Litter cover (%)	21.00	10.00						
	BVG30b - Intensive Cropping	NA	NA	NA	Configuration - site context (%)	NA	NA		
					Tree canopy height (m)	0.00	0.00		
					Sub-canopy canopy height (m)	0.00	0.00		
Tree canopy cover (%)					0.00	0.00			
Sub-canopy cover (%)					0.00	0.00			
Native shrub cover (%)					0.00	3.00			

Sub-asset	Assessment unit	Indicator	Average Indicator Condition Score (ICS)	Assessment unit Econ ^d	Sub-asset Econ ^a	Asset Econ ^a					
BVG18b	BVG18b - Grazing	Composition	Configuration - site context (%)	50.00	55.21	75.45					
			Tree canopy height (m)	100.00							
			Sub-canopy canopy height (m)	100.00							
			Tree canopy cover (%)	40.00							
			Sub-canopy cover (%)	50.00							
			Native shrub cover (%)	33.33							
			Non-native plant cover (BB Score)	10.00							
			Native perennial grass cover (%)	100.00							
			Litter cover (%)	22.22							
			BVG18b	BVG18b - Protected woodland			Composition	Configuration - site context (%)	81.20	83.89	75.45
								Tree canopy height (m)	100.00		
								Sub-canopy canopy height (m)	100.00		
Tree canopy cover (%)	100.00										
Sub-canopy cover (%)	100.00										
Native shrub cover (%)	100.00										
Non-native plant cover (BB Score)	50.00										
Native perennial grass cover (%)	61.07										
Litter cover (%)	67.22										
BVG13c	BVG13c - Protected woodland	Composition			Configuration - site context (%)	74.10		56.26	57.05		
					Tree canopy height (m)	100.00					
					Sub-canopy canopy height (m)	0.00					
			Tree canopy cover (%)	100.00							
			Sub-canopy cover (%)	0.00							
			Native shrub cover (%)	44.44							
			Non-native plant cover (BB Score)	35.00							
			Native perennial grass cover (%)	58.20							
			Litter cover (%)	64.88							
			BVG30b	BVG30b - Protected grassland	Composition	Configuration - site context (%)	52.00			50.80	14.52
						Tree canopy height (m)	NA				
						Sub-canopy canopy height (m)	NA				
Tree canopy cover (%)	NA										
Sub-canopy cover (%)	NA										
Native shrub cover (%)	60.00										
Non-native plant cover (BB Score)	50.00										
Native perennial grass cover (%)	44.00										
Litter cover (%)	47.62										
BVG30b - Intensive Cropping	NA	NA		Configuration - site context (%)	NA	0.00	14.52				
				Tree canopy height (m)	NA						
				Sub-canopy canopy height (m)	NA						
			Tree canopy cover (%)	NA							
			Sub-canopy cover (%)	NA							
			Native shrub cover (%)	NA							

AREA AND EXTENT WEIGHTINGS			
Sub-asset	Assessment unit	Total Area (ha)	Weighting
BVG18b	Grazing	17.00	0.40
	Protected woodland	5.00	0.29
	Protected woodland	12.00	0.71
BVG13c	Protected Woodland	19.00	0.44
BVG30b	Protected Grassland	19.00	1.00
	Protected Grassland	7.00	0.16
	Intensive Cropping	2.00	0.29
TOTAL		43	

INDICATOR WEIGHTING FOR ECON*	
CONFIGURATION	25%
COMPOSITION	75%