



Land Restoration Fund (LRF) Native Vegetation Monitoring Method

DOCUMENT DETAILS

Method Name: Land Restoration Fund (LRF) Native Vegetation Monitoring Method

Method Reference #: AfN-METHOD-NV-01

Relevant Environmental Asset Class: Native Vegetation

Confidence Level: Level 1 or Level 2 (depending on indicators used)

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1. Introduction

The Queensland Government's \$500 million Land Restoration Fund (LRF) aims to expand carbon farming in the state by supporting land carbon projects that deliver emissions reduction alongside environmental, social and economic co-benefits.

Demonstrable environmental co-benefits from carbon farming projects are central to the value proposition of the LRF. Evidence of improvement in vegetation condition, in the form of third-party certified environmental accounts, is one pathway to verification of environmental co-benefits under the LRF program. Rules about the types of environmental co-benefits that can be generated by projects in the LRF program are specified in the *LRF co-benefit standard*.

To facilitate environmental co-benefit verification, the Queensland Government has developed this method, to be accredited under the Accounting for Nature® Framework, as a basis for third-party certification of measurement and reporting of native vegetation condition. Originally developed by the Wentworth Group of Concerned Scientists, the Accounting for Nature® Framework enables measurement and reporting on the condition of assets (e.g. vegetation, soil, fauna) through the development of a consistent, credible and auditable set of environmental accounts.¹

This method should be read in conjunction with the *LRF co-benefit standard* and the Accounting for Nature® Standard for Environmental Condition Accounting².

2. Aim and scope

This method steps out a process to develop accounts for native vegetation condition that are fit-for-purpose as a line of evidence for environmental co-benefit verification under the *LRF Co-benefit Standard*, are scientifically robust, generate quality data, and provide appropriate measures of native vegetation condition that can be aggregated.

This method is intended for use in Queensland, particularly in the context of carbon farming projects claiming environmental co-benefits under the *LRF co-benefit standard*. This method can be applied in Queensland above mean sea level. It applies Regional Ecosystems (REs) as the core classification for sub-setting the native vegetation asset. Although the method uses broad vegetation groups as a minimum scale for reporting, REs are central to the details of the native vegetation account and the benchmarking necessary for condition assessment.

Native vegetation assets within the scope of this method include any terrestrial ecosystem or vegetated wetland (i.e. palustrine, estuarine or riverine wetlands) for which the reference RE can be confirmed. Generally, the reference RE for a particular location may be determined through the pre-clearing regional ecosystem mapping available from various online portals, including BioMaps (<http://qldspatial.information.qld.gov.au/biomaps/>).

The Accounting for Nature® Framework explicitly applies the 'un-degraded' state as the default reference against which condition and change in condition are assessed. Therefore, this method assesses vegetation condition in terms of benchmarks for 'native vegetation', but this does not mean that it can only be applied to intact native vegetation. The application of the method to heavily modified ecosystems such as cultivation paddocks may not seem intuitively sensible, but the method can nonetheless be applied to such areas provided they can be assigned to a RE so that appropriate benchmarks can be applied.

¹ Accounting for Nature, 2018.

² Accounting for Nature 2020. *Standard for Environmental Condition Accounting*. Available at: www.accountingfornature.org

As they are far from the ‘un-degraded’ natural reference applied under the Accounting for Nature® Framework, they will receive a low condition score, at least initially. The account purpose would dictate their inclusion or exclusion.

For LRF projects, all areas relevant to the co-benefits being verified must be included, as detailed in section 7. Only areas where it is conservative to assign a condition score of zero should be excluded from the ‘current extent’ at the start of the accounting time-series. For example, areas that are intensively cultivated or dominated by infrastructure, where land-use change is not planned and will not materially affect vegetation condition, can be excluded.

3. Accounting for Nature

Accounting for the condition of environmental assets must address a number of challenges (Cosier and McDonald, 2010):

- no two environmental assets are the same;
- no single indicator can provide a complete picture of ecosystem health;
- often different indicators are needed to describe the same asset in different locations; and
- the cost of data collection creates variation in the quality of information collected

Statements about the condition of any asset must be related to a specific purpose or reference. The Accounting for Nature® Framework uses ‘reference condition benchmarking’ to create a common unit of measure for building sets of environmental accounts that are capable of describing the condition of any environmental asset (native vegetation, soil, rivers, fauna, estuaries, etc.), at any scale.

The common unit, an Econd™, is an index between 0 and 100, where 100 describes the reference condition of an environmental asset. The index is like a percentage and is dimensionless. The standard reference state is one representing an appropriate state of un-degraded condition. The Econd™ for an asset, such as ‘native vegetation’, is calculated as an area-weighted average of the condition of its ‘sub-assets’. Sub-assets are units of interest within the asset, such as vegetation types, that are useful to summarise the asset’s condition in an account table.

The characteristics of the ‘un-degraded’ state of a vegetation asset depend upon its type, and the typology applied here is the Regional Ecosystem framework. In Australian landscapes, un-degraded is often taken to simply mean pre-European. However, the concept of ‘un-degraded’ is not inherently tied to a point in time; it is more about the lack of clearing and other types of modification associated with use for industry, changes subsequent to the loss of traditional fire management, and the impacts of weeds and feral animals. In practice, vegetation condition assessment tools, including the BioCondition method applied in this method, employ pragmatic approaches such as use of sites representing ‘best on offer’ condition in identifying reference condition and estimating benchmark values for condition attributes (Eyre et al. 2017).

The concept of ‘pre-clearing’ as applied to Regional Ecosystems, discussed in Neldner et al. (2017), also enables the attributes of reference condition to be assessed in contemporary vegetation. Reference condition does not need to equate to condition at a particular site in 1750 (see Accounting for Nature 2016 p11). Reference values for indicators of vegetation condition (called ‘attributes’ in BioCondition) are available through published “benchmarks” for many Regional Ecosystems. For Regional Ecosystems that do not have published benchmarks, the Queensland Herbarium can provide advice about indicator benchmarks. Please contact the Herbarium via: queensland.herbarium@des.qld.gov.au.

There is also a published manual for establishing benchmark sites under the BioCondition framework (Eyre et al 2017³).

³ https://www.qld.gov.au/data/assets/pdf_file/0027/68571/reference-sites-biocondition.pdf

4. Confidence Levels

Accounts generated by this method must opt for one of two confidence levels, the levels are referred to as level 1, 2 or level 3 under the Accounting for Nature® Standard, which describes the levels as follows:

The three confidence levels under the Standard are:

A Level 1 (Very High) confidence level applies to Methods that include a comprehensive set of indicators and are likely to have <u>very high accuracy</u> ($\geq 95\%$) when measuring the condition of environmental assets and detecting change in their condition through time.

A Level 2 (High) confidence level applies to Methods that include a relatively comprehensive set of indicators and are likely to have <u>high accuracy</u> ($\geq 90\%$) when measuring the condition of environmental assets and detecting change in their condition through time.
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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> ($\geq 80\%$) when measuring the condition of environmental assets and detecting change in their condition through time.

For confidence level 1 this method employs the full suite of indicators specified in the BioCondition methodology of Eyre et al. (2015) and also requires more sites to increase precision, while confidence level 2 requires the collection of fewer samples and fewer indicators. Both levels require: classifying the accounting area into assessment units by integrating spatial data such as land cover, past disturbance and REs; locating field survey sites, and; a standardised collection of native vegetation attributes through field survey.

5. What does an account look like?

The AfN Format requires accounts to have three components:

1. an Environmental Account Summary;
2. an Information Statement; and
3. the body of the account, containing the Asset Tables (detailing the condition of components of the asset, i.e. sub-assets) and Data Tables (recording observations).

Upon certification of an account, the Information Statement and Environmental Account Summary will be published on the AfN Environmental Account Certification Registry. The body of the account details the condition of specific components of the overall vegetation asset. These components are referred to as sub-assets, and they are the classes for which condition data must be collected.

6. Overview of process

Implementing this method involves the following 8 steps⁴:

Step 1. Define the accounting area

Step 2. Compile existing data

Step 3. Stratify accounting area into assessment units

Step 4. Design field surveys, including provisions for seasonality and materiality

Step 5. Locate, mark and monitor plots

Step 6. Calculate condition scores for assessment units

Step 7. Calculate area-weighted average condition for sub-assets and the overall Econd™ for the account

Step 8. Compile account and submit for accreditation.

If the purpose of the account is related to co-benefits from a planned carbon farming project, steps 1 to 4 are common to the requirements of establishing a carbon project and could be done in parallel to reduce costs.

This method employs existing tools that have been developed for the general assessment of vegetation condition in Queensland, particularly the Regional Ecosystem (RE) framework for the classification and mapping of vegetation assets (Neldner et al. 2017) and the BioCondition method developed to assess RE condition for biodiversity (Eyre et al. 2015, Eyre et al. 2017). The BioCondition manual (Eyre et al. 2015) details measurement approaches for a suite of indicators to be assessed as ‘site-scale’, as well as guidance on their application to different types of vegetation, and advice on stratifying a project area into ‘assessment units’ and designing suitable surveys. This method document briefly reprises key concepts of BioCondition, but readers are referred to the BioCondition manual for detailed advice on the application of that tool and measurement of specific indicators. Similarly, clarification and discussion of concepts and methods for survey and mapping of REs can be found in Neldner et al. (2017).

Regional Ecosystems are the base classification applied to vegetation ‘assets’ under this method. However, REs they can be aggregated into higher-level (smaller-scale) classes as the formal ‘sub-assets’ in the vegetation condition account to restrict the number of sub-assets for reporting as detailed in Table 1. The important point is that all basic processes related to comparing site data to the relevant reference benchmarks will be focussed on the RE, but the site scores can be averaged to broad vegetation groups (1:2M scale) for reporting, and the minimum numbers of sites surveyed will be determined by the number of broad vegetation groups (split as described in Table 1), and broad condition states, rather than the number of REs (and broad condition states).

⁴ Note – these 8 steps are separate the 8 steps for certification prescribed by the Accounting for Nature Framework.

7. Description of steps:

Step 1. Define the accounting area

An account's purpose is the primary consideration when defining the spatial scope of assets to be included. Whether accounts of vegetation condition should be assembled for an entire business, a property or a paddock depends on the purpose of the account.

For the purpose of verification of co-benefits under the Land Restoration Fund standard, the scope of assets must include the extent of all assets within the project area relevant to the co-benefit class that the accounts are intended to verify.

Proponents may also opt to include land outside an area-based carbon project but under their management, but in such cases, they must identify areas within the project from those beyond it during spatial stratification in step 3. As discussed in section 2, only areas where it is conservative to assign a condition score of zero should be excluded from the 'current extent' at the start of the accounting time-series. For example, areas that are intensively cultivated or dominated by infrastructure, where land-use change is not planned and will not materially affect vegetation condition, can be excluded.

For simplicity, and to be conservative in terms of improvements through time, this method requires accounts to maintain a consistent extent of 'vegetation assets' through time. That is, the extent should not increase or decrease.

The output from step 1 will be polygon features defining the accounting area within a spatial data file compatible with geographical information systems, such as a shapefile, in a commonly applied datum such as the Geographic Datum of Australia 1994, Geographic Datum of Australia 2020, or the Map Grid of Australia (1994 or 2020, including specified zone).

Table 1 Asset scope and smallest scale sub-asset classifications suited to verification of the specific environmental co-benefits involving vegetation assets under the Land Restoration Fund's co-benefit standard

Co-benefit	Eligibility	Minimum scale for sub-asset classification
Great Barrier Reef	<p>Either:</p> <p>a) Improve native vegetation in pre-clearing wetlands in Great Barrier Reef catchments,</p> <p>or</p> <p>b) Improve native vegetation condition and improve soil condition within a reef catchment with a sediment target in the Reef Water Quality Improvement Plan</p> <p>Pre-clearing wetlands are Regional Ecosystems (REs) that are estuarine, palustrine or riverine wetlands within the catchment of the Great Barrier Reef. Riverine wetlands include riparian vegetation within 50 metres of drainage lines shown on the Vegetation Management watercourse and drainage map on land zone 3 (riverine wetlands).</p>	1:2M Broad Vegetation Groups split by Wetland classes ⁵

⁵ Wetland classes must differentiate wetlands but can group non-wetland codes as "non-wetland". In other words, wetland codes used to stratify can be Palustrine, Lacustrine, Riverine, Estuarine, or 'non-wetland.'

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Co-benefit	Eligibility	Minimum scale for sub-asset classification
Wetlands	<p>Either:</p> <p>a) Improve the condition of wetland native vegetation or b) Improve the condition of non-wetland vegetation and soil within 100m of a wetland in an Aquatic Conservation Assessment rated as natural or near-natural, and high or very high significance.</p> <p>Wetland native vegetation includes pre-clearing Regional Ecosystems that are palustrine, estuarine or riverine wetlands. Riverine wetlands include riparian vegetation fringing watercourses on land zone 3 and all areas within 50m of drainage lines shown on the Vegetation Management watercourse and drainage map.</p>	1:2M Broad Vegetation Groups split by Wetland classes ⁴
Coastal ecosystems	<p>Improve native vegetation condition in coastal Regional Ecosystems (REs).</p> <p>Coastal REs are pre-clearing Regional Ecosystems on land zones 1, 2 or 3 in a coastal sub-bioregion (Appendix 4).</p>	1:2M Broad Vegetation Groups split by Wetland classes ⁴
Threatened ecosystems	<p>Either: a) improve native vegetation condition in a Regional Ecosystem with a biodiversity status of "of-concern" or "endangered." or b) improve native vegetation condition in a Regional Ecosystem listed as containing threatened ecological communities under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)</p> <p>Regional Ecosystem (RE) biodiversity status is listed in the Regional Ecosystems Description Database (REDD). REs must be of-concern or endangered either at project registration or in the current version of REDD for threatened ecosystem co-benefits to be verified.</p> <p>A list of REs that contain listed threatened ecological communities under the EPBC Act is available on the Department of Environment and Science website.</p>	1:2M Broad Vegetation Groups split by Biodiversity Status

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Co-benefit	Eligibility	Minimum scale for sub-asset classification
Threatened wildlife	<p>Either:</p> <p>a) improve native vegetation condition within areas that meet the definitions of matters of state environmental significance (MSES) as wildlife habitat or national environmental significance (MNES) for threatened species</p> <p>orb) improve native vegetation condition of REs that are potential habitat for threatened species other than highly mobile fauna.</p> <p>Matters of state or national environmental significance for threatened wildlife include habitat for:</p> <p>a) Threatened wildlife under Nature Conservation Act 1992 (NCA)</p> <p>b) Threatened wildlife under the EPBC Act 1999</p> <p>c) Special least concern animals under the NCA including the echidna and platypus</p> <p>d) Special least concern animals under the NCA and EPBC Act - migratory birds under international agreements including:</p> <ul style="list-style-type: none"> • Japan-Australia Migratory Birds Agreement (JAMBA) • China-Agreement Migratory Agreement (CAMBA) • Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA) • Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention) • Ramsar Convention on Wetlands • Agreement on the Conservation of Albatrosses and Petrels (ACAP) <p>Potential habitat means:a) an area indicated as a potential habitat for one or more threatened species (NCA or EPBC Act) in the Department of Environment and Science collection, Modelled potential habitat for selected threatened species – Queensland.</p> <p>Or</p> <p>b) an area identified as “high risk” on the protected plant flora survey trigger map administered by the Queensland Department of Environment and Science.</p>	Threatened species combinations (collections of species with overlapping habitat) split by 1:2M BVGs
Native vegetation	Improve native vegetation condition	1:2M broad vegetation groups split by Biodiversity status

Step 2. Compile existing data and identify sub-assets and their component Regional Ecosystems

This method applies Queensland’s standard approaches to ecosystem classification and vegetation condition assessment, specifically REs. Most other classifications involved in the identification of sub-assets for this method link to Regional Ecosystems, including wetland classes, biodiversity status and broad vegetation groups. This maximises the support available for implementing the method from existing data and associated resources, including familiarity among environmental assessment professionals. The sub-asset classifications listed in Table 1 are the minimum acceptable classification scales. Sub-assets based on Regional Ecosystems would represent a higher level of granularity and provide a more flexible vegetation asset condition account.

All vegetation within the account area must be assigned to a Regional Ecosystem (RE). Guidance on classification and mapping of Queensland vegetation into REs is available from Neldner et al. (2017). The RE descriptions can be accessed online at <https://www.qld.gov.au/environment/plants-animals/plants/ecosystems/descriptions>, and more detailed ‘technical descriptions’ are also available <https://www.qld.gov.au/environment/plants-animals/plants/ecosystems/technical-descriptions>.

Compilation of existing data should include:

1. Pre-clearing Regional Ecosystems – as a starting point to calculate the extent of pre-clearing REs in the account area
2. Remnant Regional Ecosystems
3. Queensland wetland mapping
4. Descriptions of pre-clearing and remnant Regional Ecosystems – to identify pre-clearing wetlands and potential habitat for threatened biodiversity or other values
5. The Regulated Vegetation Management Map
6. Mapping of Matters of State Environmental Significance (MSES)
7. BioCondition benchmarks for Regional Ecosystems

Queensland Government spatial datasets can be downloaded from the Queensland Government’s QSpatial website. Reports on regional ecosystems, wetlands, and MSES can be accessed through the Biomaps application (<http://qldspatial.information.qld.gov.au/biomaps/>).

The outputs of Step 2 will be:

1. a table listing all REs present in the accounting area, along with their descriptions
2. polygon features defining the pre-clearing extent of the REs in the accounting area within a spatial data file compatible with geographical information systems, such as a shapefile, in a commonly applied datum.
3. BioCondition benchmarks for the REs in the accounting area for which published benchmarks are available.

For REs without published BioCondition benchmarks, proponents should seek advice from the Queensland Herbarium regarding the development of a benchmark for that RE, which will generally require the establishment of 2-3 reference sites as described in the BioCondition reference site manual (Eyre et al. 2017).

Step 3. Stratify accounting area into assessment units

Assessment units are mapped entities that break the project area into areas of consistent sub-units. At their simplest, they are combinations of sub-asset classes (e.g. REs or BVGs) and broad condition states. They should be relatively homogenous units defined by combinations of sub-assets and broad condition states, such as 'derived pasture', 'young regrowth' or 'older regrowth'. They do not need to be composed of a single contiguous area. They can be composed of multiple isolated areas, but all should generally be larger than one hectare.

The BioCondition manual provides guidance on how 'assessment units' should be identified, including the figure below (Figure 1). The key difference between standard practises and this method is that this method allows assessment units to be identified based on the scale of classification for sub-assets (e.g. broad vegetation groups by wetlands) rather than individual Res. The relevant benchmarks for specific sites must be those for the individual RE at the site but the reporting averages scores within sub-assets rather than individual REs.

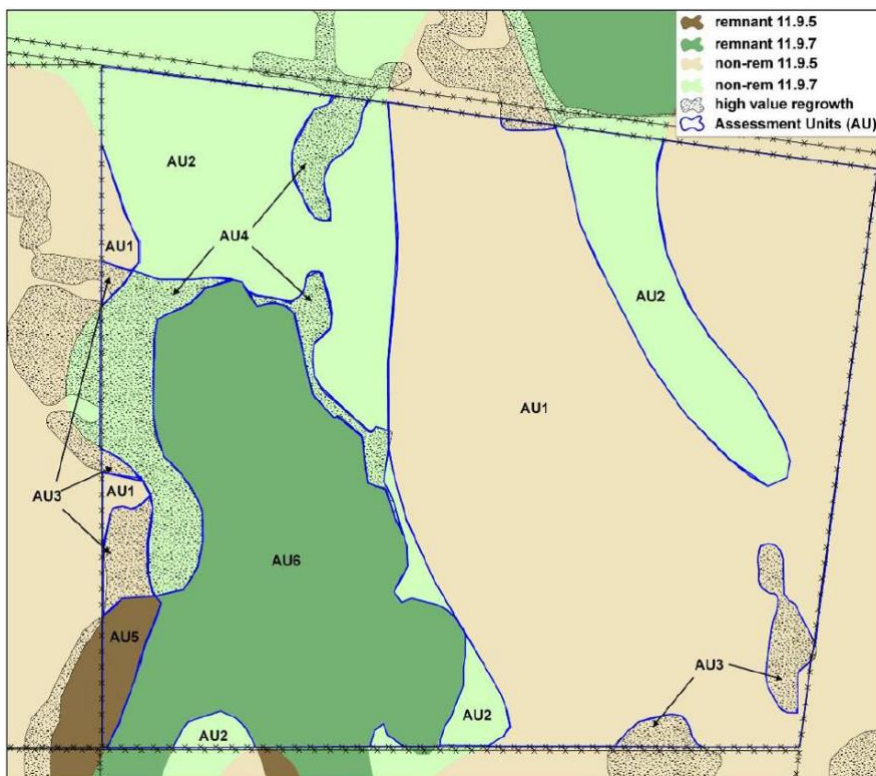


Figure 1 Example of 'assessment units' for a hypothetical project (from BioCondition manual, Eyre et al. (2015)). In this example, six assessment units (AU) have been identified for a paddock based on RE and broad condition classes.

Application of this method to carbon projects can build off the spatial data requirements prescribed for the carbon project. For example, projects implementing area-based carbon farming will require stratification of the project area into carbon estimation areas, which could be a sound first cut of the project's BioCondition assessment areas. Readers are referred to the Commonwealth's CFI mapping [guidelines](#) for further information. Some carbon farming methods include activity-specific guidance on stratification. For vegetation methods, projects should consider the Clean Energy Regulator's guidance on [stratification](#).

Creating assessment units from an initial CEA map may require splitting CEAs into several assessment units if it included highly variable condition, or it could involve the amalgamation of CEAs. Assessment units may

also need to be further subdivided into administrative classes, such as paddocks or project boundaries, for reporting. For LRF projects, if the account includes any 'non-project' areas they must be separate assessment units so that no assessment unit crosses the project boundary and the account for the project can easily be extracted.

The outputs from step 3 will be polygon features defining assessment areas within the pre-clearing extent of the sub-assets (e.g. REs, wetland classes, BVGs) in the accounting area (from steps 1 and 2). These must be stored within a spatial data file compatible with geographical information systems, such as a shapefile, in a commonly applied datum such as the Geographic Datum of Australia 1994, Geographic Datum of Australia 2020, or the Map Grid of Australia (1994 or 2020, including specified zone).

Step 4. Design field surveys, including provisions for seasonality and materiality

Numbers of plots per assessment unit are specified in Table 1. The number of sites specified to deliver accounts with level 2 confidence aligns with the BioCondition manual, but the approach to locating sites differs. BioCondition directs users to select ‘representative’ sites, whereas this method requires random plot placement. This will tend to increase the variability in site scores and means that a higher number of sites are needed for level 1 confidence.

Plot locations should be based on the random selection of intersections in a grid overlaid on each assessment unit, following specification from the carbon method for *Reforestation by Environmental or Mallee Plantings—FullCAM* (see division 3.6, “Establishing a grid overlay”), which are paraphrased in Appendix 1. Sites locations that are randomly selected but are within 25m of infrastructures such as a road or a dam can be moved so that they are centred 50m from areas of relatively intense disturbance associated with the infrastructure. Site orientation should be along the contour (i.e. across the slope) unless they need to be oriented otherwise to stay within the assessment unit or to stay more than 25m away from infrastructures such as roads or dams.

Table 2 Minimum numbers of sites for account confidence levels 1 and 2. Larger assessment units require more sites.

Assessment unit area	Minimum number of sites for Confidence Level 1	Minimum number of sites for Confidence Level 2
1-2 ha	1	1
>2 and ≤20 ha	3	2
>20 and ≤60 ha	5	3
>60 and ≤500 ha	7	5
>500 ha	9	7

The output from step 4 will be a list of locations (spatial coordinates in the relevant datum) for at least the number of sites specified in Table 1 for each of the assessment areas output from step 3.

Step 5. Locate and mark plots, measure attributes

Plots must be permanently marked, for example with a steel picket at the origin. Their location should be within 10m of the location determined by the selection of grid intersections from step 4, unless the site location was moved to accommodate infrastructure as described in step 4.

Monitoring must be undertaken according to the BioCondition manual (Eyre et al. 2015), except where this method document specifies a different approach (e.g. locating sites, calculating attribute scores from measurements (Appendix 2)).

Where the plot sizes specified in the BioCondition manual cannot fit within the ecosystem being surveyed, they should be changed in shape, not area. Similarly, if it is not possible to fit a 100m line-intercept transect within the assessment unit, multiple short transects can be surveyed to yield a total of 100m of transects. In vegetation with tree canopy cover greater than 70%, the line intercept transect may be shortened to 50m.

Data should be recorded on a BioCondition field sheet (copy in the back of BioCondition manual) or similar permanent record of observations made in the field. Measurements for each indicator must be recorded as measured. Do not record indicators as classes. Photographs of field sites should be named using a clear convention including site identifiers and date (e.g. "Site ID"_"date"_"photo number").

Site context scores plus all of the BioCondition attributes listed below must be assessed and scored for each of the two confidence levels (Table 3).

Table 3 Indicators assessed for the two confidence levels.

Indicators required for Confidence Level 1	Indicators required for Confidence Level 2
1. Large trees	1. Large trees
2. Tree canopy height	2. Tree canopy height
3. Recruitment of canopy species	3. Tree canopy cover (%)
4. Tree canopy cover (%)	4. Shrub layer cover (%)
5. Shrub layer cover (%)	5. Non-native plant cover
6. Coarse woody debris	6. Litter cover
7. Native plant species richness for four lifeforms	7. Bare ground*
8. Non-native plant cover	8. Total ground cover of plants*
9. Native perennial grass cover (%)	9. Site context (patch size, connectivity and context)
10. Litter cover	
11. Bare ground*	
12. Total ground cover of plants*	
13. Site context (patch size, connectivity and context)	

*The bare ground and total plant cover attributes must be measured but are not scored under the BioCondition method. Total ground cover of plants is the combined cover of grasses herbs and other ground layer life forms.

The 'Site context' indicator is a measure of the landscape around the sample plots. These landscape-scale attributes should be scored for each survey site using the approach the BioCondition manual describes for 'fragmented landscapes'. Note, this method differs from the BioCondition method by applying the indicators for fragmented landscapes to all sites, regardless of their region. Further, the definition of 'remnant vegetation' applied should be based on the height, cover and composition of the vegetation (as described in Neldner et al. 2017), so that vegetation that is 'structurally remnant' should be treated as remnant. If a project is expected to cause changes in the amount of regrowth or remnant vegetation within the project area, the projected change in the score should be accrued in the account at an even rate over the first 15 years of the account.

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For the other indicators listed in Table 3 (other than site context that is), this method applies continuous scoring to site indicators using transformation depicted in Appendix 2 rather than the interval scoring prescribed in BioCondition.

Follow the process described in the BioCondition manual for dealing with naturally missing attributes and other variances based on vegetation type (e.g. grasslands, mangroves, shrublands, see Table 4 in Eyre *et al.* 2015). Convert values to an index ranging from 0-100 by dividing by the maximum possible value, and multiplying by 100.

The output from Step 5 will be a table of Site data for each assessment unit, in a format similar to that below.

Example data table 1. Site data (one table per assessment unit), grey cells do not require data.

	Reference value	Site 1: Identifier		Site 2: Identifier		Site 3: Identifier	
		Field value	Score	Field value	Score	Field value	Score
Assessment unit							
RE							
Photo IDs							
Large trees							
Tree canopy height							
Recruitment of canopy species							
Tree canopy cover (%)							
Shrub layer cover (%)							
Coarse woody debris							
Native plant species richness for four lifeforms							
Non-native plant cover							
Native perennial grass cover (%)							
Litter cover							
Bare ground*							
Total plant cover*							
Site context							
Total							

Step 6. Calculate condition scores for assessment units

For each assessment unit, calculate the condition score as the average of the scores for all sites within the assessment unit. Proponents must also calculate the standard error of the condition scores for each assessment unit (standard deviation of site scores divided by the square root of the number of sites). The output from step 6 will be an assessment unit table in the format below.

Example data table 2 Assessment unit summary (one table per sub-asset)

Sub-asset	Assessment unit ID	Area (ha)	Component REs	Broad condition	Number of sites	Site IDs	Average condition	Standard error
			<i>List REs</i>	<i>e.g. remnant, regrowth, pasture</i>				

Step 7. Calculate average condition for each sub-asset and for the accounting area

The average condition must be calculated for all sub-assets within the account as the area-weighted average of the condition scores calculated for the assessment units containing each sub-asset. Condition scores for sub-assets must be recorded within the asset table, in the format below.

Example data table 3 Sub-asset summary

Sub-asset	Short description	Component REs	Co-benefit classes	Present in assessment units	Total area (ha)	Average condition score
		<i>List REs</i>	<i>List relevant co-benefit classes from LRF standard</i>	<i>List relevant assessment units</i>		

The overall condition score must then be calculated as the area-weighted average of scores for each sub-asset.

Step 8. Compile account and submit for certification

Steps five to eight should be repeated at regular intervals (up to 5 years or where Base Year recalculation is required, as specified under the Accounting for Nature® Framework) to establish a trend. Ideally, site surveys should occur annually, even if accounts are certified at the maximum of five-yearly intervals.

Regular monitoring will assist in identifying trends in condition within the natural variability in indicators that can arise due to variability in weather and other factors. A well-developed account of vegetation asset change will provide contextual information on seasonal conditions and their impact on indicators such as ground cover in and around the accounting area. Such information can be very useful to place variation in the observed condition in an appropriate context.

8. References

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, 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.

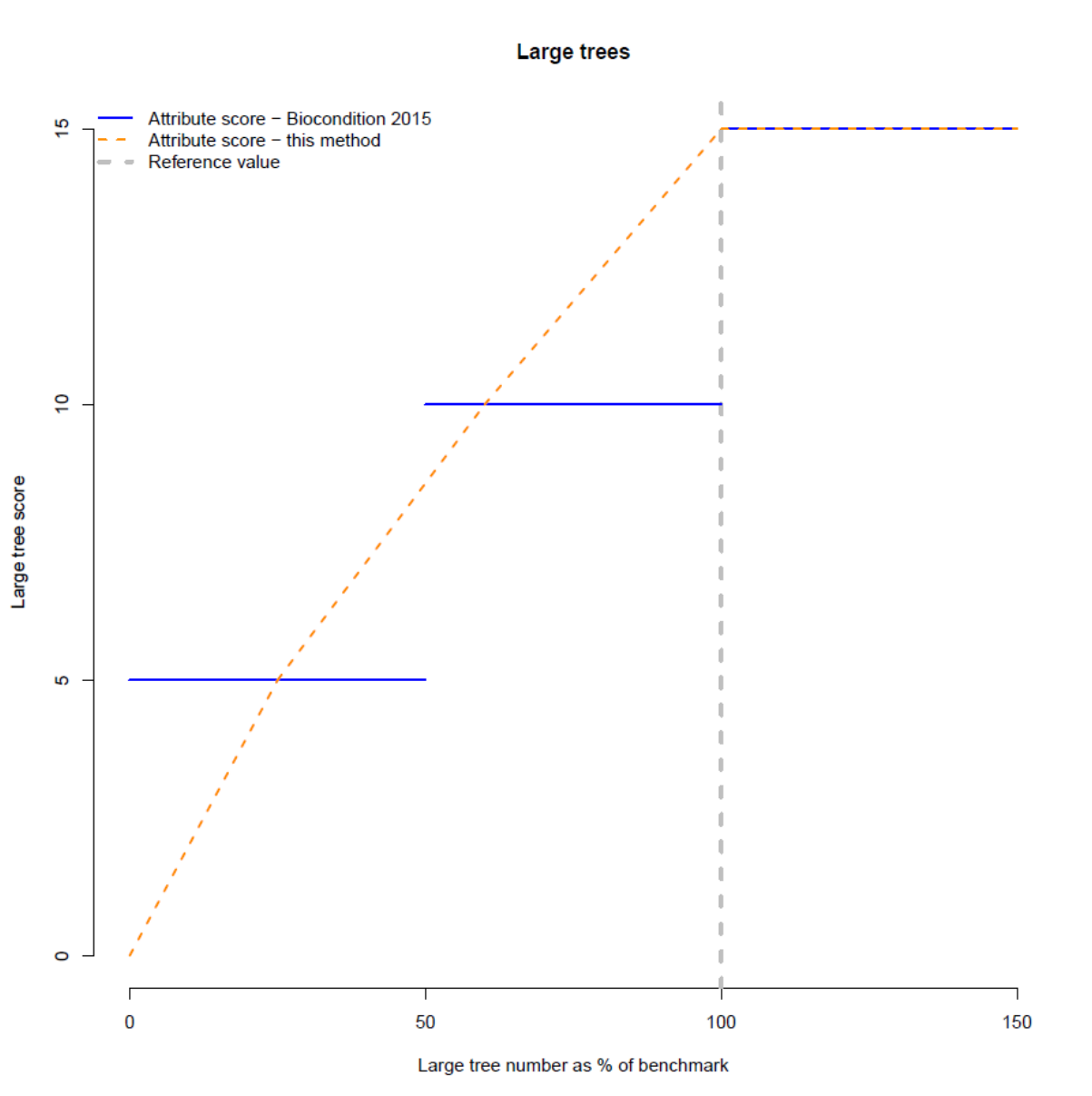
Neldner, V.J., Wilson, B.A., Dillewaard, H.A., Ryan, T.S. and Butler, D.W. (2017) *Methodology for Survey and Mapping of Regional Ecosystems and Vegetation Communities in Queensland. Version 4.0. Updated May 2017*. Queensland Herbarium, Queensland Department of Science, Information Technology and Innovation, Brisbane. 124 pp.

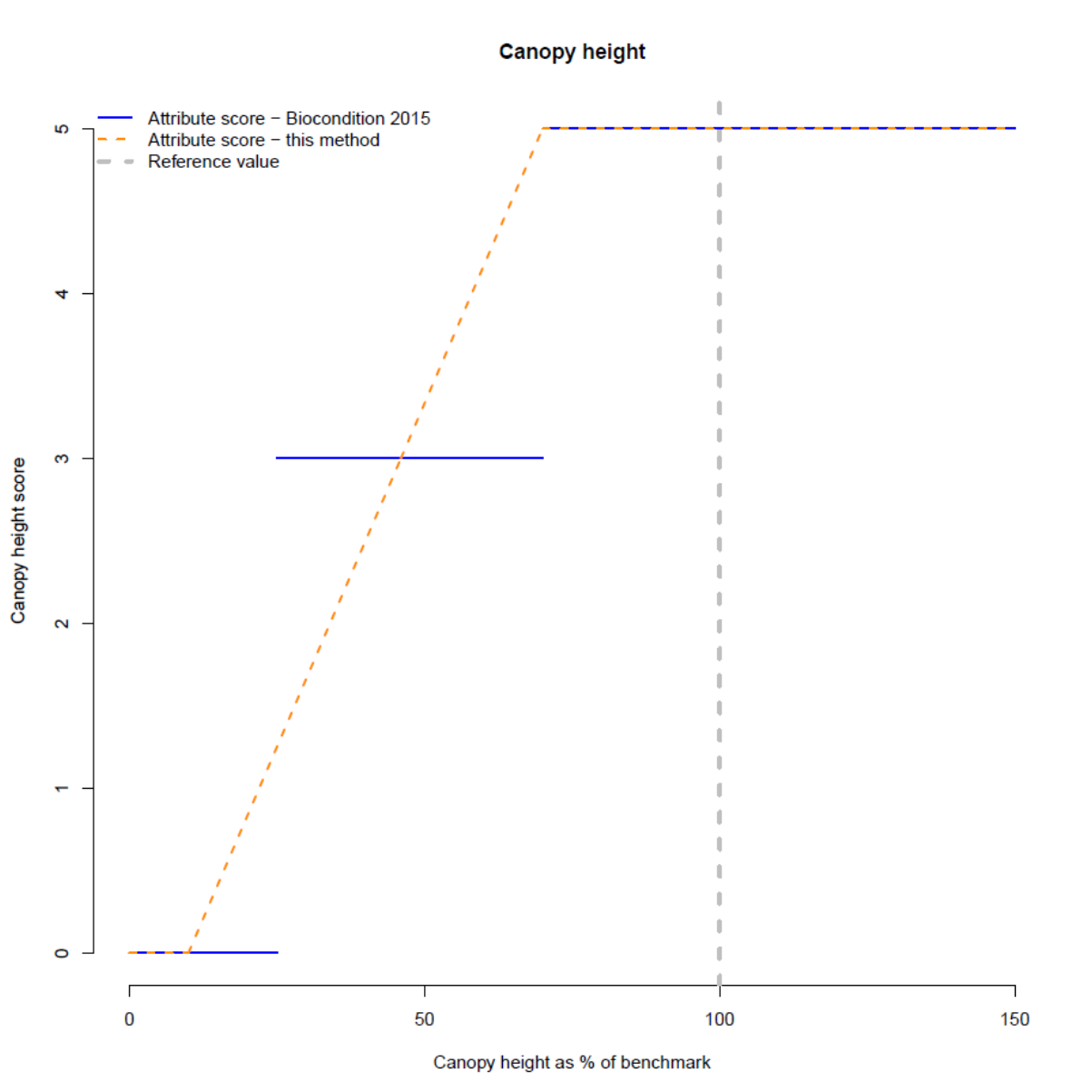
Appendix 1. Establishing a grid overlay for assignment of random plot locations

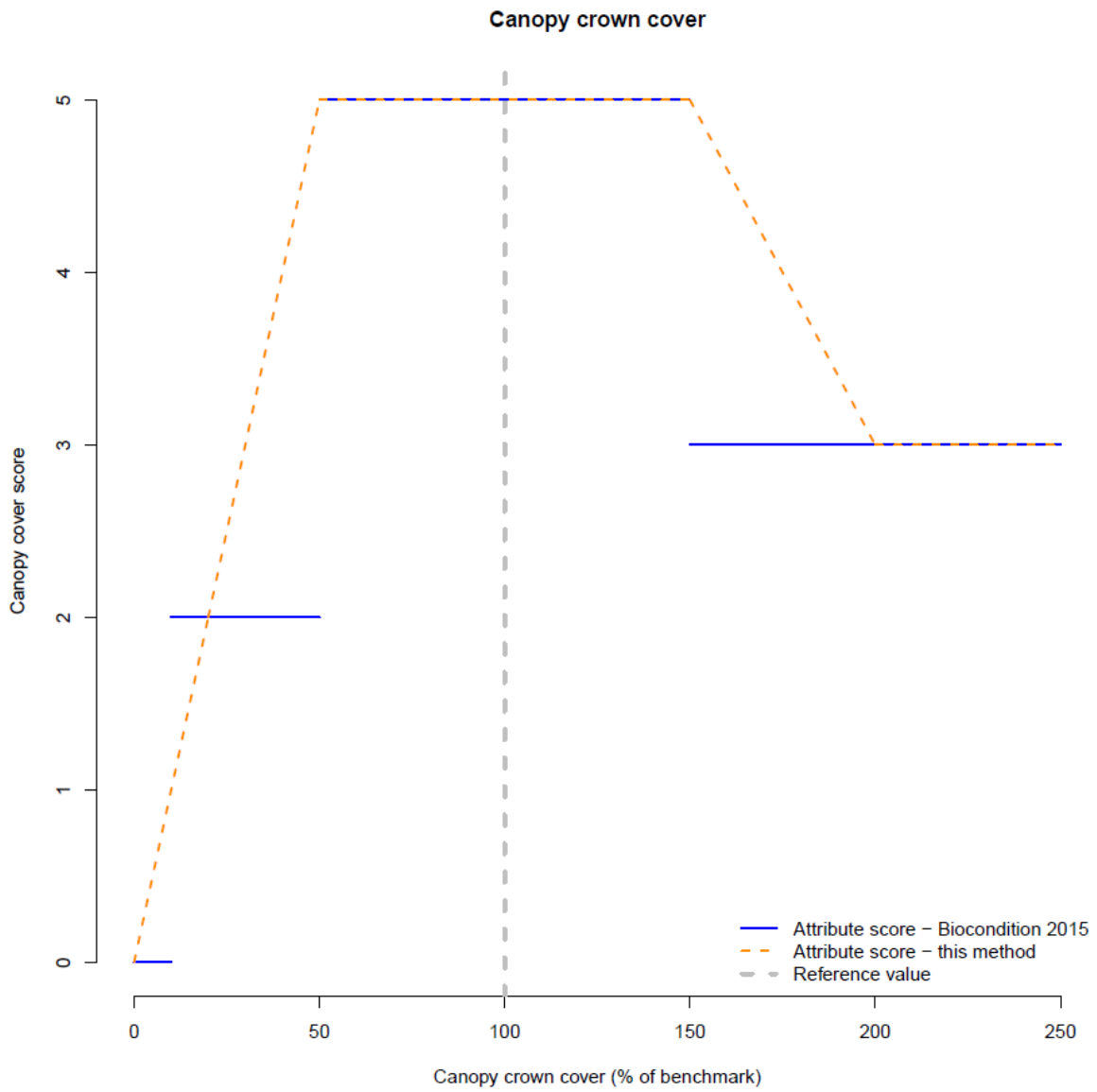
1. The grid must consist of square cells.
2. There must be at least 10 grid intersects within each carbon estimation area being sampled.
3. an anchor point for the grid must be established by randomly selecting easting and northing coordinates within the ranges of easting and northing coordinates for the project area. Noting that a project may require more than one grid anchor point to be established.
4. The easting and northing coordinates referred to in subsection (3) must be from the Map Grid of Australia, known as MGA94, or any Australian standard that replaces MGA94.
5. The orientation of one axis of the grid must be either north-south (aligned to the datum being used in the project's spatial data), or along an azimuth determined by randomly selecting a whole number angle within the range of zero and 89 degrees inclusive, where zero degrees is true north.
6. Each grid intersect must be assigned a unique identifier.
7. Actual plot locations must be located within 10 metres of each intended plot location.

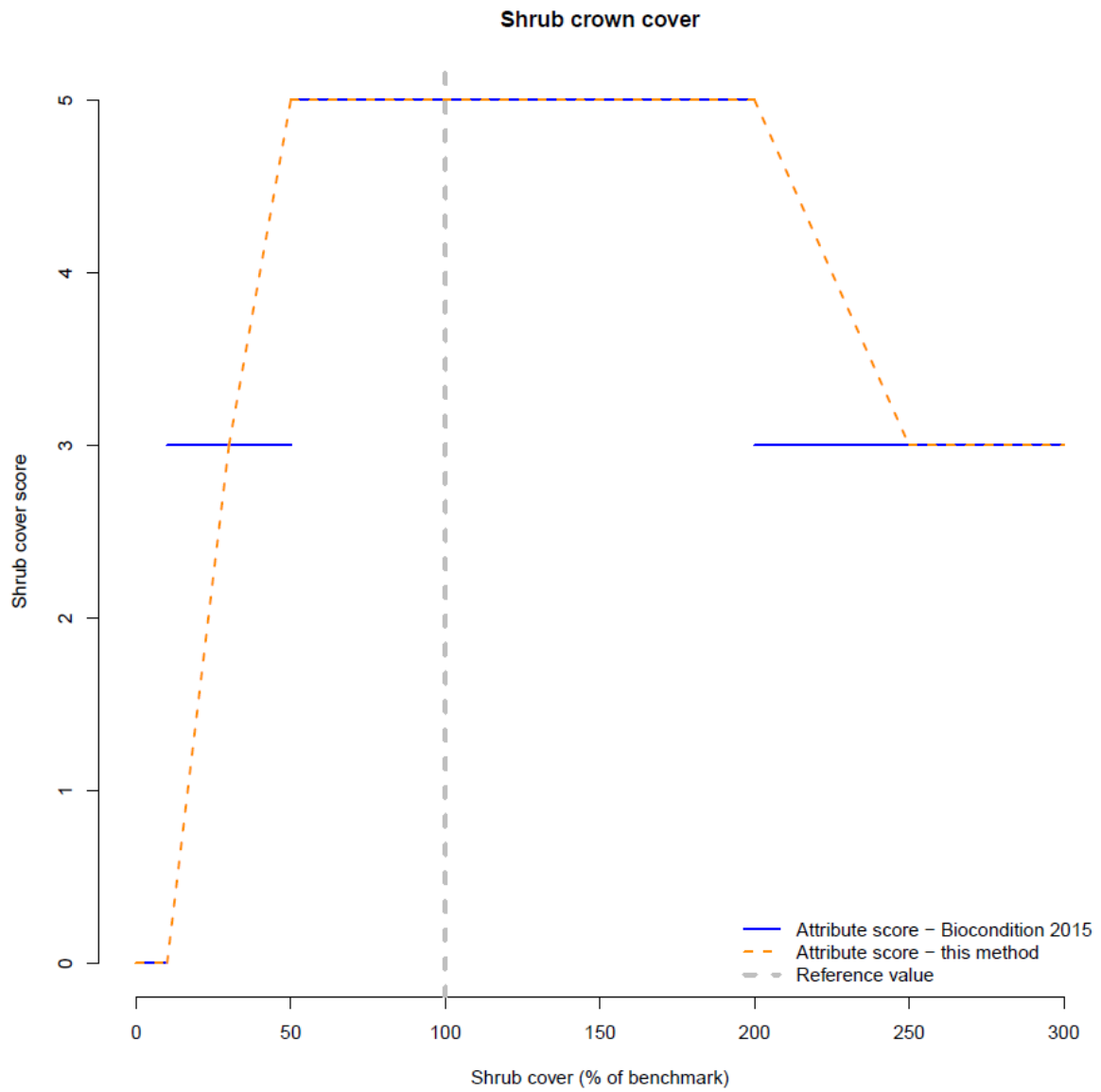
Appendix 2. Modified BioCondition scoring schema for this method.

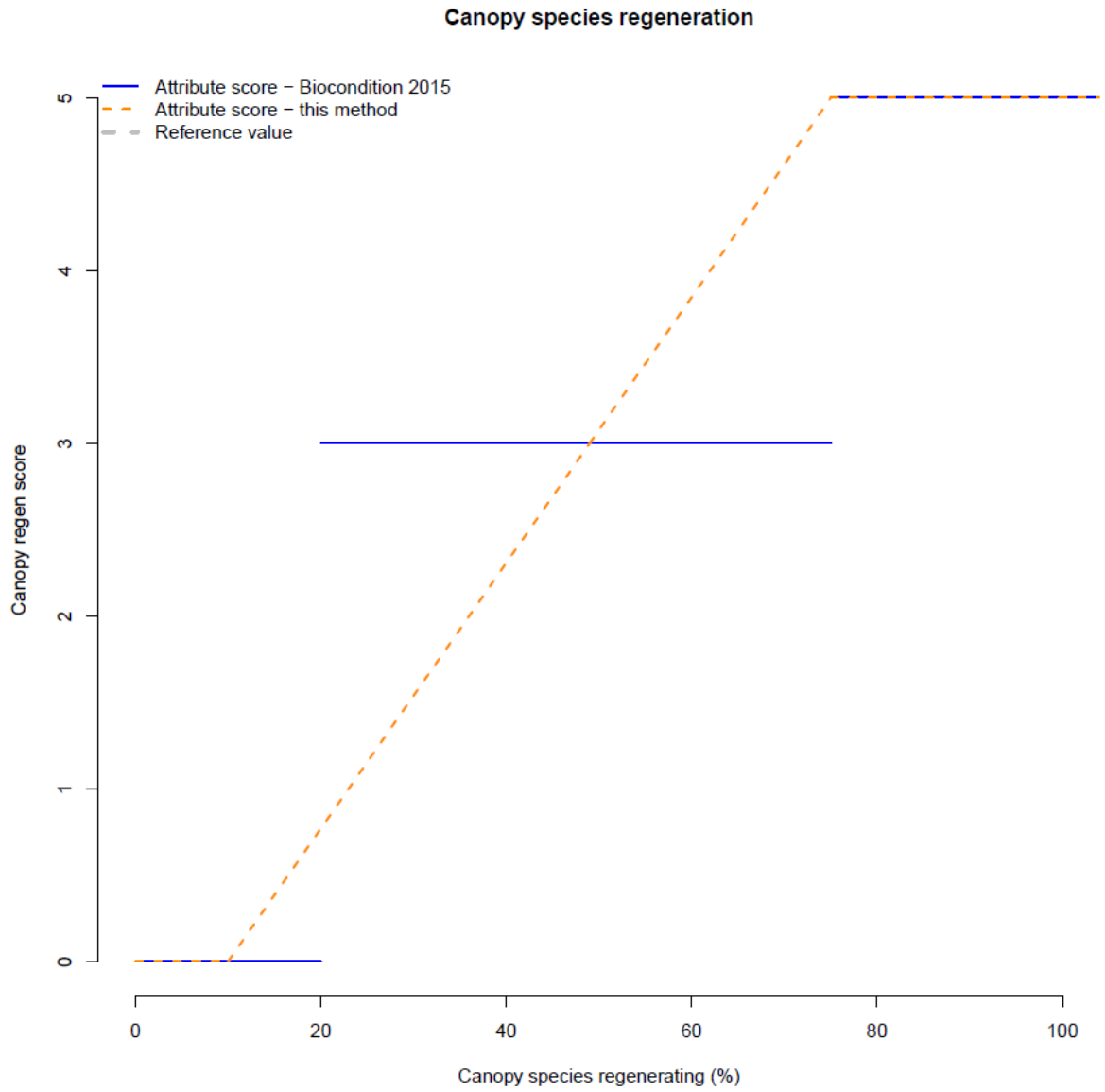
In the following plots, the orange dashed line is a continuous score to be used instead of the scoring categories from the BioCondition framework (Eyre *et al.* 2015, BioCondition scoring schema is represented by blue horizontal lines). The vertical grey dashed line is the benchmark representing the attribute score for the un-degraded reference state. A table at the end of this appendix provides a formula to calculate indicator scores in a syntax that can be copied into MS Excel.

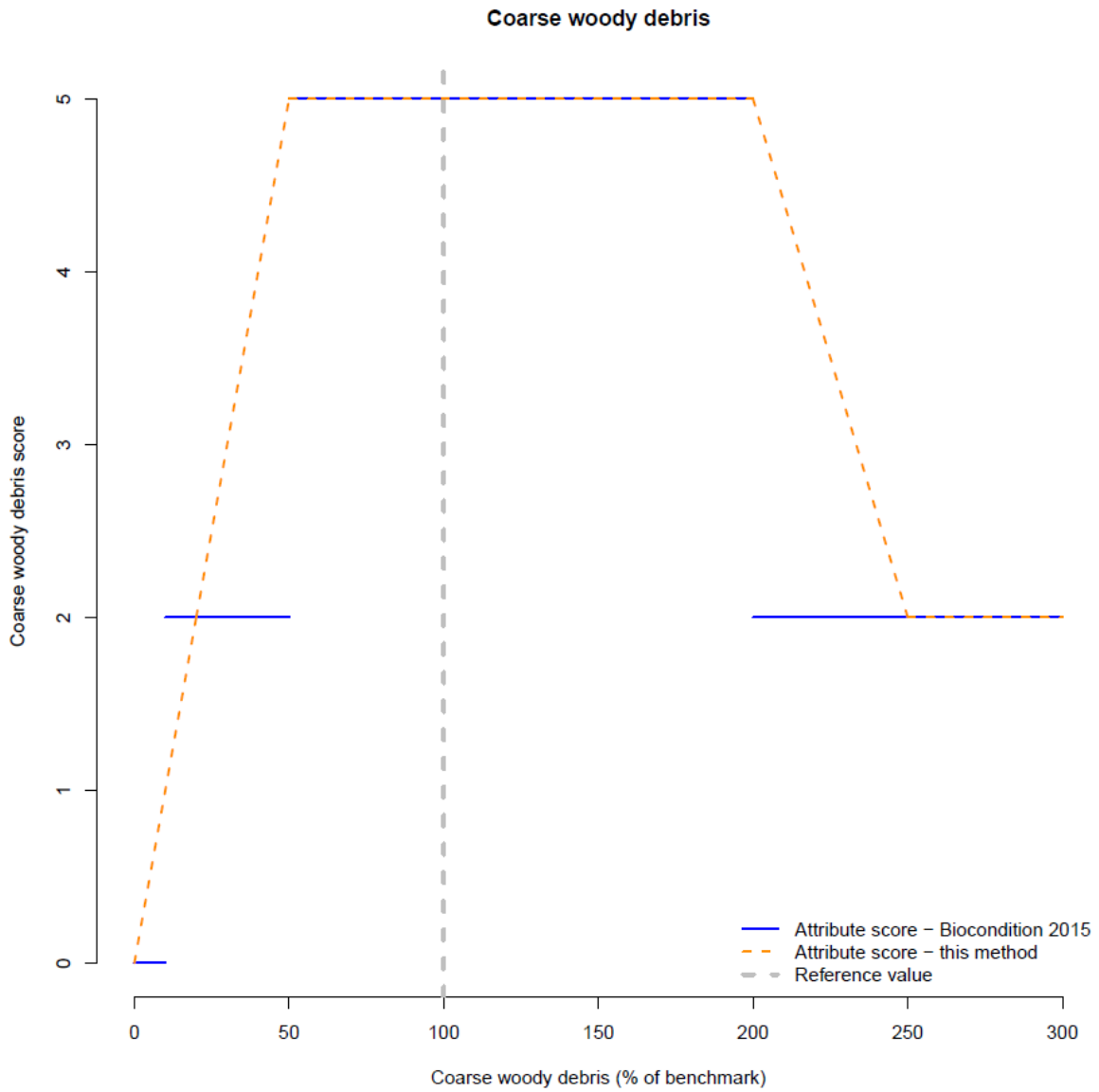


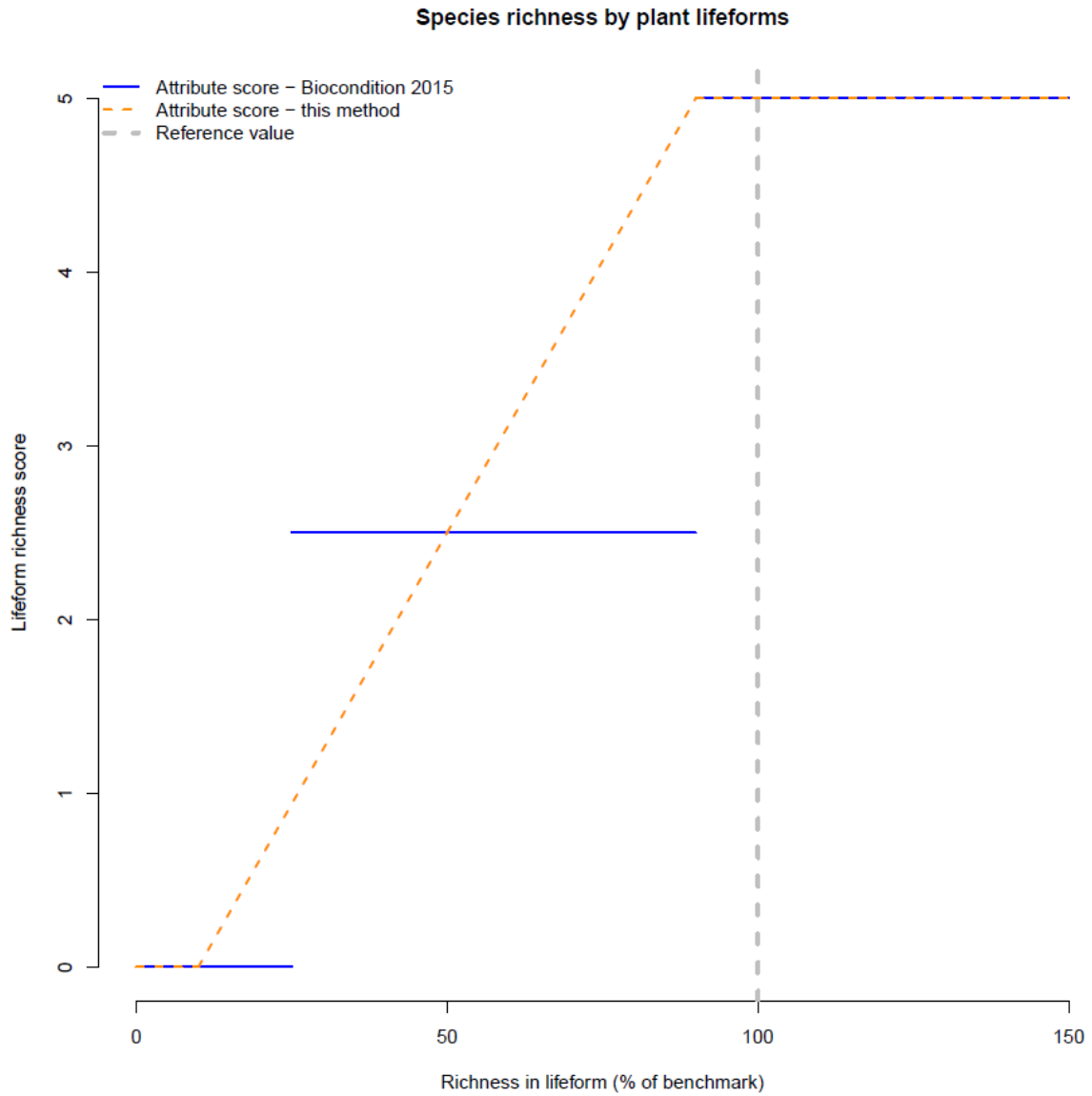


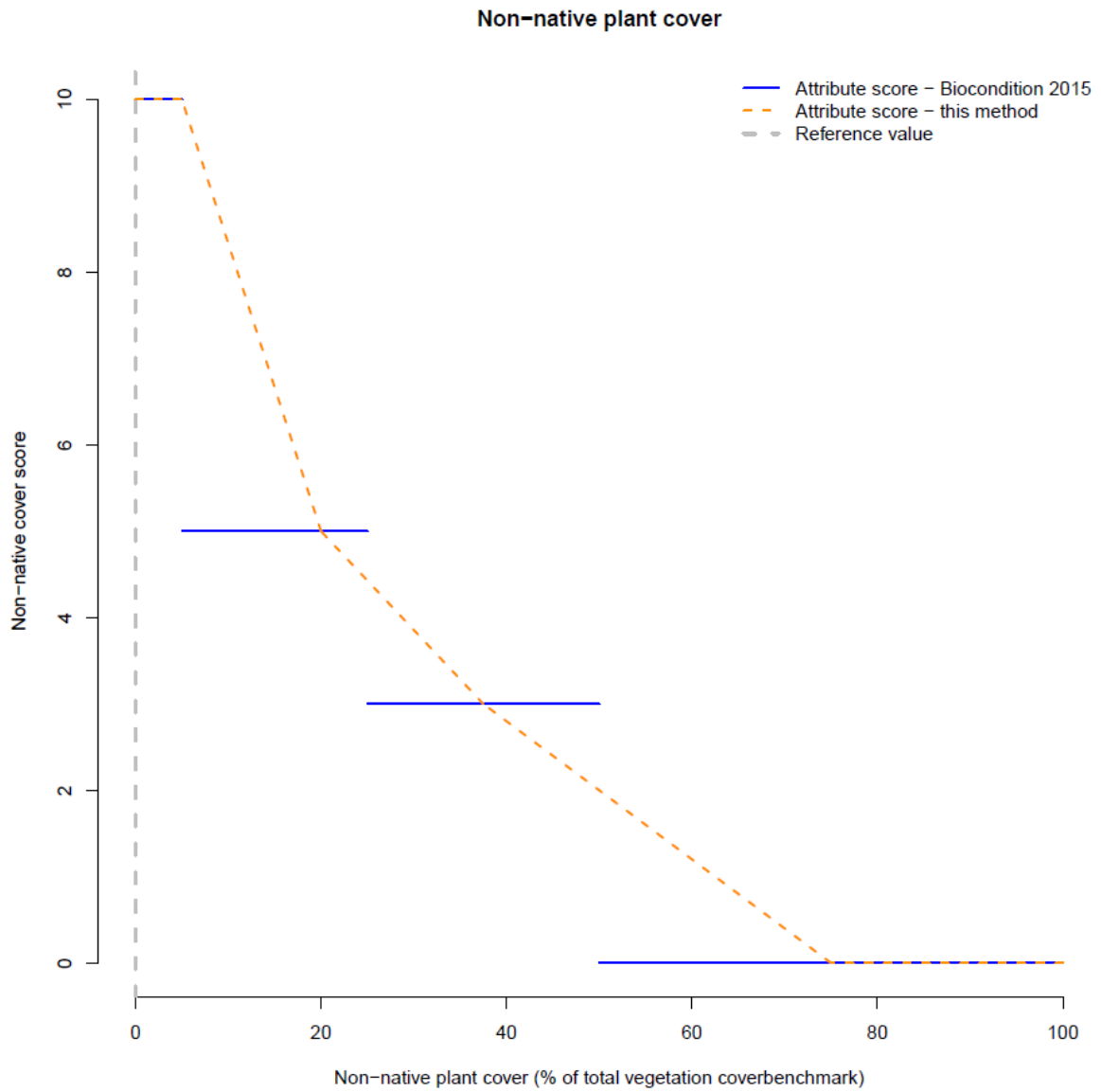


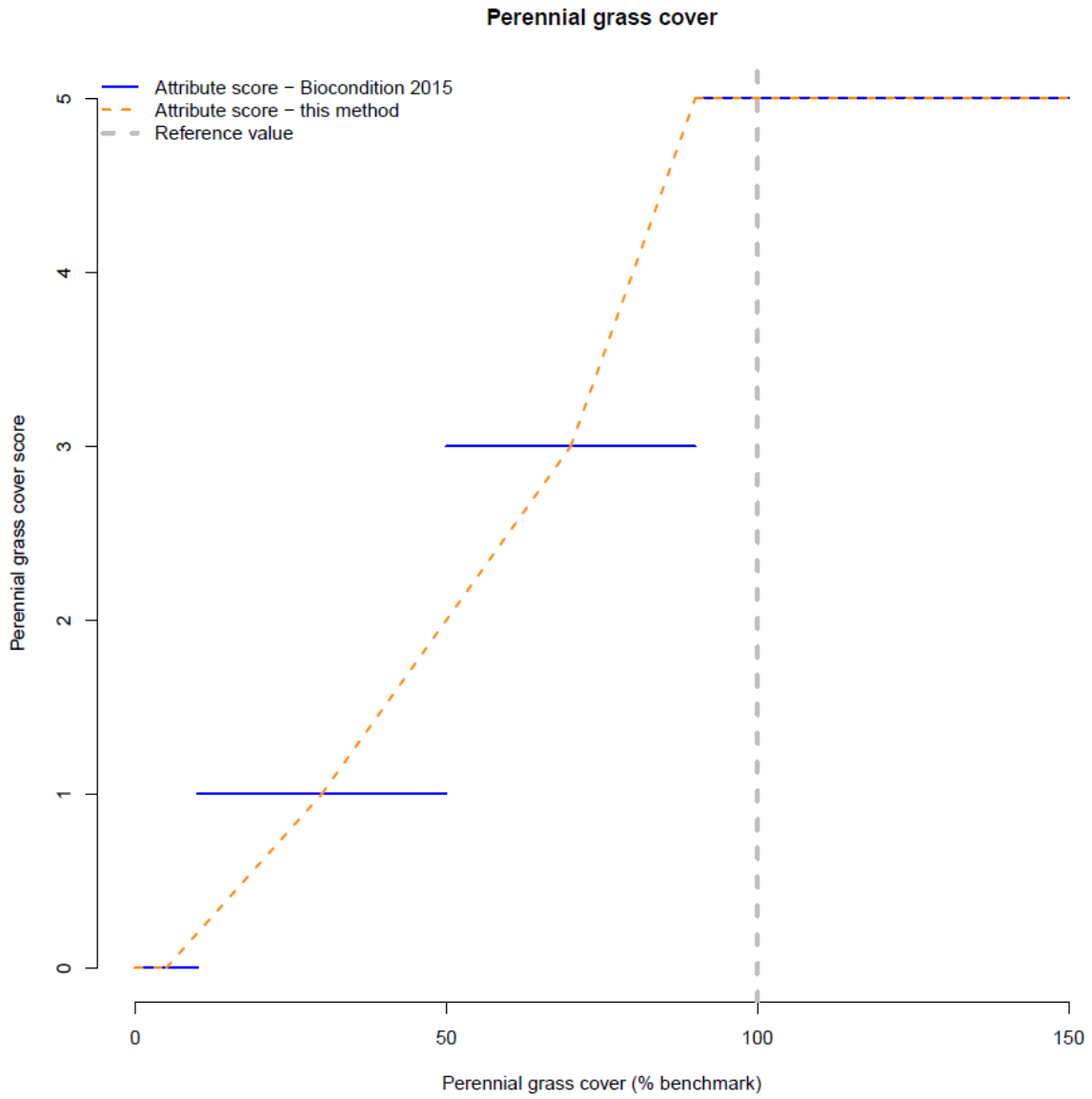


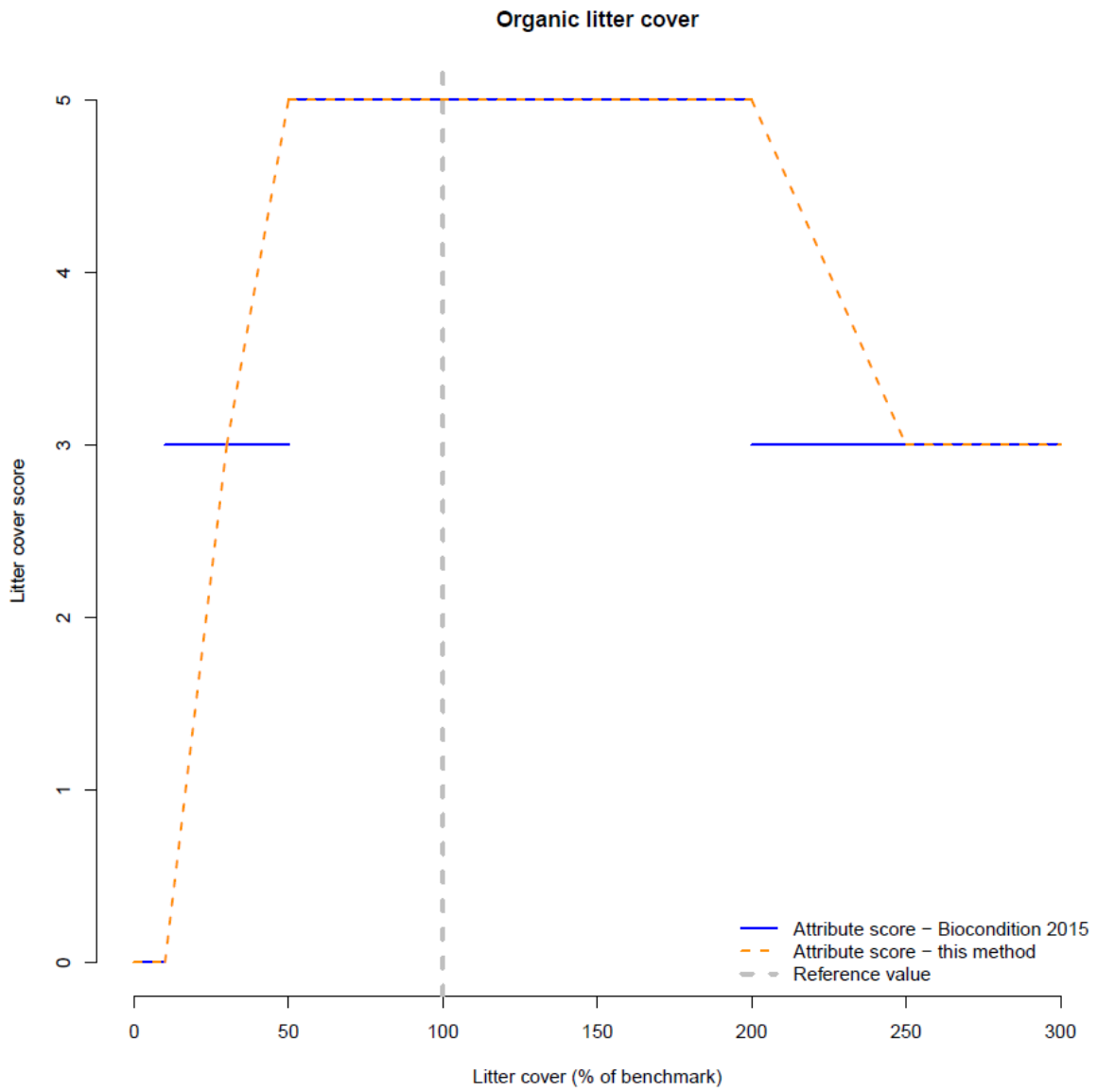












Accounting for Nature® Accredited Method – LRF Native Vegetation Monitoring

Table A2 Formulae for indicator

Indicator	ICS formula [format is nested 'if' statements, structured as "IF(logical test,value if true,value if false)", where 'OBS' = observed value & 'REF' = reference value]
1. Large trees (number in 0.5 ha)	=IF((OBS/REF)<=0.25,((OBS/REF)/0.25)*5,IF((OBS/REF)<=0.6,5+(((OBS/REF)-0.25)/0.35)*5,IF((OBS/REF)<1,10+(((OBS/REF)-0.6)/0.4)*5,15)))
2. Tree canopy height (m)	=IF((OBS/REF)<=0.1,0,IF((OBS/REF)<=0.46,(((OBS/REF)-0.1)/0.36)*3,IF((OBS/REF)<0.7,3+(((OBS/REF)-0.46)/0.23)*2,5)))
3. Recruitment of canopy species	=IF((OBS/100)<=0.1,0,IF((OBS/100)<=0.49,(((OBS/100)-0.1)/0.39)*3,IF((OBS/100)<0.75,3+(((OBS/100)-0.49)/0.26)*2,5)))
4. Tree canopy cover (%)	=IF((OBS/REF)<=0,0,IF((OBS/REF)<=0.2,((OBS/REF)/0.2)*2,IF((OBS/REF)<=0.5,2+(((OBS/REF)-0.2)/0.3)*3,IF((OBS/REF)<=1.5,5,IF((OBS/REF)<=2,5-((OBS/REF)-1.5)*2,3))))))
5. Shrub layer cover (%)	=IF((OBS/REF)<=0.1,0,IF((OBS/REF)<=0.3,(((OBS/REF)-0.1)/0.2)*3,IF((OBS/REF)<=0.5,3+(((OBS/REF)-0.3)/0.2)*2,IF((OBS/REF)<=2,5,IF((OBS/REF)<=2.5,5-((OBS/REF)-2)*2,3))))))
6. Coarse woody debris	=IF((OBS/REF)<=0,0,IF((OBS/REF)<=0.5,((OBS/REF)/0.5)*5,IF((OBS/REF)<=2,5,IF((OBS/REF)<=2.5,5-((OBS/REF)-2)/0.5)*3,1))))
7. Native plant species richness per life form (once per life form)	=IF((OBS/REF)<=0.1,0,IF((OBS/REF)<=0.5,(((OBS/REF)-0.1)/0.4)*2.5,IF((OBS/REF)<0.9,2.5+(((OBS/REF)-0.5)/0.4)*2.5,5)))
8. Non-native plant cover (%)	=IF(OBS>75,0,IF(OBS>37.5,2.5-((OBS-37.5)/37.5)*2.5,IF(OBS>20,5-((OBS-20)/17.5)*2,IF(OBS>5,10-((OBS-5)/15)*5,10))))
9. Native perennial grass cover (%)	=IF((OBS/REF)<=0.05,0,IF((OBS/REF)<=0.3,(((OBS/REF)-0.05)/0.25),IF((OBS/REF)<=0.7,1+(((OBS/REF)-0.3)/0.4)*2,IF((OBS/REF)<=0.9,3+(((OBS/REF)-0.7)/0.2)*2,5))))))
10. Litter cover (%)	=IF((OBS/REF)<=0.1,0,IF((OBS/REF)<=0.3,(((OBS/REF)-0.1)/0.2)*3,IF((OBS/REF)<=0.5,3+(((OBS/REF)-0.3)/0.2)*2,IF((OBS/REF)<=2,5,IF((OBS/REF)<=2.5,5-((OBS/REF)-2)*4,3))))))

Appendix 3. Recommended equipment and resources

The following equipment is desirable for completing a BioCondition assessment:

- 100 m transect tape
- 50 m transect tape (optional)
- 1 x 1 m quadrat for measuring ground cover (or some 1 m long sticks)
- compass (to lay out the site)
- star pickets, with caps, for the 0 m and 50 m point along the transect for relocating the site
- diameter tape or a smaller measuring tape
- the BioCondition manual (Eyre (or a copy of Appendix 1) and copies of the BioCondition assessment datasheet
- access to the Internet in order to obtain information about the REs that occurs on the property or management area; RE maps (remnant, regrowth and pre-clear) and RE descriptions can also be obtained from the QSpatial website. With descriptions of REs available on the Queensland Government Website (<http://www.qld.gov.au/>).
- benchmark documents for each of the REs that will be assessed. (Available on the Queensland Government Website (<http://www.qld.gov.au/>)).
- clinometer, hypsometer or ruler for measuring tree heights
- camera
- clipboard, pencils and erasers
- Global Positioning System (GPS)

Appendix 4. Broad Vegetation Groups of Queensland

BVG 1:2M	BVG 1:5M
1. Complex mesophyll to notophyll vine forests of the Wet Tropics bioregion	1
2. Complex to simple, semi-deciduous mesophyll to notophyll vine forest, sometimes with <i>Araucaria cunninghamii</i>	1
3. Notophyll vine forest/ thicket (sometimes with sclerophyll and / or Araucarian emergents) on coastal dunes and sandmasses	1
4. Notophyll and notophyll feather palm or fan palm vine forest on alluvia, along streamlines and in swamps on ranges	1
5. Notophyll to microphyll vine forests, frequently with <i>Araucaria</i> spp. or <i>Agathis</i> species	1
6. Notophyll vine forest and microphyll fern forest to thicket on high peaks and plateaus	1
7. Semi-evergreen to deciduous microphyll vine thicket	1
8. Wet eucalypt tall open-forest on uplands and alluvia	2
9. Moist to dry eucalypt open-forests to woodlands usually on coastal lowlands and ranges	3
10. <i>Corymbia citriodora</i> dominated open-forests to woodlands on undulating to hilly terrain	3
11. Moist to dry eucalypt open-forests to woodlands mainly on basalt areas (land zone 8)	3
12. Dry eucalypt woodlands to open-woodlands, mostly on shallow soils in hilly terrain (mainly on sandstone and weathered rocks, land zones 7 and 10)	3
13. Dry to moist eucalypt woodlands and open forests, mainly on undulating to hilly terrain of mainly metamorphic and acid igneous rocks, Land zones 11 and 12)	3
14. Woodlands and tall woodlands dominated by <i>Eucalyptus tetrodonta</i> (or <i>E. megasepala</i>), and/ or <i>Corymbia nesophila</i> and/ or <i>E. phoenicea</i>	3
15. Temperate eucalypt woodlands	3
16. <i>Eucalyptus</i> spp. dominated open-forest and woodlands drainage lines and alluvial plains	4
17. <i>Eucalyptus populnea</i> or <i>E. melanophloia</i> (or <i>E. whitei</i>) dry woodlands to open-woodlands on sandplains or depositional plains	5
18. Dry eucalypt woodlands to open-woodlands primarily on sandplains or depositional plains	5
19. <i>Eucalyptus</i> spp. (<i>E. leucophloia</i> , <i>E. leucophylla</i> , <i>E. persistsens</i> , <i>E. normantonensis</i>) low open-woodlands often with <i>Triodia</i> dominated ground layer	6
20. Woodlands to open-forests dominated by <i>Callitris glaucophylla</i> or <i>C. intratropica</i> (landzones 3,5, 10, 12) (BRB, DEU, EIU, MUL)	7
21. <i>Melaleuca</i> spp. dry woodlands to open-woodlands on sandplains or depositional plains	8
22. <i>Melaleuca</i> spp. on seasonally inundated open-forests and woodlands of lowland coastal swamps and fringing lines. (palustine wetlands)	8
23. <i>Acacia aneura</i> dominated associations on red earth plains, sandplains or residuals	9
24. <i>Acacia</i> spp. on residuals. Species include <i>A. stowardii</i> , <i>A. shirleyi</i> , <i>A. microsperma</i> , <i>A. catenulata</i> , <i>Acacia rhodoxylon</i>	10
25. <i>Acacia harpophylla</i> sometimes with <i>Casuarina cristata</i> open-forests to woodlands on heavy clay soils	10
26. <i>Acacia cambagei</i> / <i>A. georginae</i> / <i>A. argyrodendron</i> dominated associations	10
27. Mixed species woodlands - open woodlands (<i>Atalaya</i> , <i>Lysiphillum</i> , <i>Acacia tephрина</i> , wooded downs)	11
28. Open-forests to open-woodlands in coastal locations. Dominant species such as <i>Casuarina</i> spp., <i>Corymbia</i> spp., <i>Allocasuarina</i> spp., <i>Acacia</i> spp., <i>Lophostemon suaveolens</i> , <i>Asteromyrtus</i> spp., <i>Neofabricia myrtifolia</i>	12
29. Heathlands and associated scrubs and shrublands on coastal dunefields and inland/ montane locations	12
30. <i>Astrelba</i> , <i>Dichanthium</i> tussock grasslands	13
31. Mixed open-forblands to open-tussock grasslands in inland locations	13
32. Closed-tussock grasslands in coastal locations	13
33. Hummock grasslands dominated by <i>Triodia</i> spp. or <i>Zygochloa paradoxa</i> associations on dunefields or sandplains	14
34. Wetlands associated with permanent lakes and swamps, as well as ephemeral lakes, claypans and swamps. Includes fringing woodlands and shrublands	15
35. Mangroves and tidal saltmarshes	16