A Native Vegetation Assessment Methodology for Diverse Regenerating Farmlands

DOCUMENT DETAILS

Method Name: A Native Vegetation Assessment Methodology for Diverse Regenerating Farmlands

Method Reference #: AfN-METHOD-NV-05

Relevant Environmental Asset Class: Native Vegetation

Accuracy Level: Very High (95%) or High (90%)

Author: David Heislers, Kilter Rural

Date of latest review by the Independent Science Committee: 09 December 2020

Date of Accreditation by the Accounting for Nature Ltd Executive: 09 December 2020

Last updated: 13 December 2023

License fees associated with using this Method: Subject to licence fees, please contact Kilter Rural

Contact: methods@accountingfornature.org

NOTE: A Method License Agreement must be signed to use this Method for the purpose of developing an Environmental Account for Certification under the Accounting for Nature® Standard. Contact Kilter Rural for more information.

DISCLAIMER

A NATIVE VEGETATION ASSESSMENT METHODOLOGY FOR DIVERSE REGENERATING FARMLANDS

Applicable for Kilter Rural managed properties and other semi-arid farmlands

Accredited Method under Accounting for Nature®

Version 2.1

December 2023

VERSION

Version 2.1, December 2023

Original version accredited by AfN in December 2020

Document Type: Methodology

Author: David Heislers, Landscape and Sustainability Analyst, Kilter Rural

Approvals:

Version	Approver	Date	Status/Conditions
1. Draft	Author	30 November 2020	
1. Draft	Kilter Rural Executive	30 November 2020	
1. Final	AfN Ltd SAC	9 December 2020	Accredited
2. Final	AfN Ltd technical experts	8 February 2022	Accreditation reconfirmed
2.1 Final	AfN Ltd	13 December 2023	Updated terminology

DISCLAIMER

The author of this document takes no responsibility for any liability or damage (legal, brand or otherwise) arising from the use of this pending Accounting for Nature® accredited methodology. No representation, warranty or guarantee express or implied is made in this document. Whilst care is taken in the compilation of this information, the author will not be liable for any errors, omissions, misstatements or mistakes in any information or damages resulting from the use of this information or any decision or action taken in reliance on this information. Professional legal, financial and other expert advice should be sought by users of this document as necessary.

ACKNOWLEDGMENT

This document reflects the status of a process that began in 2016 when Kilter Rural was invited by the Wentworth Group of Concerned Scientists (WG) to trial their Accounting for Nature (AfN) methodology at the farm scale. Its architecture is the result of extensive engagement between Kilter Rural and members of the WG, and more recently members of the AfN Independent Science Committee (formerly the Science Accreditation Committee). Its development has been assisted by co-funding from the National Australia Bank. Its author would also like to acknowledge valuable conceptual contributions from peers working in the environmental accounting space particularly Matt Taylor of the Tasmanian Land Conservancy. Natural Decisions P/L has been pivotal in assisting us in structuring the document and its technical revision.

Contents

ACRONYMS

AfN	Accounting for Nature Ltd
B-B	Braun-Blanquet visual cover estimation technique
CMA	Catchment Management Authority
DELWP	Dept Environment, Land, Water and Planning (Vic)
EA	Environmental Account
EVC	Ecological Vegetation Community
GIS	Geographic Information System
HH	Habitat Hectares
ICS	Indicator Condition Score
IS	Information Statement
LMR	Land management regime
LMU	Land Management Unit
NV	Native Vegetation
NVQ	Native Vegetation Quality
PP	Photopoint
KR	Kilter Rural
VAST	Vegetation Assets states and Transitions
VQA	Vegetation Quality Assessment (of Victoria)
QoA	Quality of Assessment (Rating)

1. INTRODUCTION AND CONTEXT OF THE METHOD

This Native Vegetation Accounting Method has been developed by Kilter Rural (KR), an Australian private company founded in 2004 to deliver a transformative investment model for farmland, water and ecosystem regeneration. For 15 years Kilter has been transforming irrigated landscapes in need of ecological renewal, marrying returns to investors with significant environmental and social dividends.

KR currently invests in the regeneration of farming landscapes across northern Victoria. Typically, these landscapes have been highly modified with almost total historical clearing of native vegetation, agricultural intensification and resultant hydrological change that has fundamentally altered the extent, condition and values of native vegetation and consequent loss of biodiversity.

The KR model of farming landscape regeneration seeks to integrate productive agriculture with revegetation and conservation of habitat and biodiversity at scale, in essence aiming to significantly reverse the legacy effects of clearing and development to build resilience to future threats from climate change.

Up to 95% of original native vegetation has in the past been deliberately removed or lost due to other pressures (e.g. rising water tables) from the farmland typically managed by KR. As a result, the baseline[1] for native vegetation is extremely low, in terms of both extent and quality. Furthermore, the magnitude and nature of the pressures and impacts has altered some fundamental physical properties of the landscape (e.g. soil structure and chemical composition) which means the ability to restore ecological processes and native vegetation to pre-clearing benchmarks is compromised by hysteresis effects.

KR is aiming at between 30 and 50% of its farming landscapes for ecological restoration and is employing a range of passive and active management techniques to improve both the extent and quality of native vegetation.

KR has sought to pursue a consistent scientifically supported and independent framework to measure, report and track trends in condition with a view that its regenerative landscape vision can be understood, shared and ultimately provide the potential for reward (financial and non-financial) for every land manager that is in a position to become a part of the momentum for landscape ecological renewal.

KR believes that environmental accounting (EA) in agribusiness can shape the future for genuinely sustainable food and agriculture. The ability to monitor and compare the health and condition of natural assets is invaluable in informing management decisions to deliver long-term sustainable food and fibre to consumers, and long-term value and new revenue streams to its investors.

Kilter Rural has adopted the *Accounting for Nature®* Framework for its environmental accounting requirements. It believes that AfN provides its landscape managers with an accountable, repeatable and transparent approach that also values farm level monitoring and observation in assessing the condition of a farm's natural assets.

[1] At the time of property acquisition

Kilter Rural have been collaborating with the Wentworth Group of Concerned Scientists since 2016, and in 2018 produced the first environmental account under AfN at the farm scale. That account was developed using the Future Farming Landscape (FFL) investment at Winlaton, in northern Victoria, as a test case. It encompassed both native vegetation and soil condition and was afforded *Proof of Concept* Accreditation in June 2019.

The native vegetation assessment framework described in this document has evolved from that FFL Winlaton EA experience. It has been developed in the context of the northern Victorian plains landscape (Victorian Riverina and Murray Fans subregions within the Riverina bioregion under the IBRA[2]), however it has potential for wider application across other landscapes in Victoria, NSW and in other farming landscapes across Australia.

In December 2020 the original version (V1) of the native vegetation method was accredited by Accounting for Nature Ltd (AfN). Subsequent field application of the accredited method by KR has revealed the opportunity for minor modifications and improvements to the original method, presented here as a revised and updated version (V2).

[2] Interim Biogeographic Regionalisation for Australia, Version 7

2. AIM AND SCOPE

2.1 Purpose

KR requires a repeatable methodology for assessing large scale, dispersed farms of generally <5% remnant vegetation, that also provides its farm managers a practical tool to support the key management interventions of revegetation and protection.

Specifically, this native vegetation (NV) accounting methodology is designed:

1. As a tool for Kilter Rural to track the condition of native vegetation in order to understand, review and refine its farmland management activities
2. To support clear and credible reporting to farmland investors on the condition of native vegetation, as a commitment of Kilter Rural to the principles of Impact Investment
3. To provide metrics and data on condition improvement that will enable participation in ecosystem service markets that continue to evolve to value the public benefits of rural land stewardship
4. To help facilitate the efforts of other land managers that wish to participate in the regeneration of Australia's highly modified rural landscapes

The methodology must meet a high level of technical robustness, but also be practical and be cost effective to implement.

2.2 Scale

The method is designed to operate at the 'large farm' or 'landscape' scale across both dispersed and contiguous properties. KR managed farmland projects typically comprise many individual and dispersed properties across broader landscape regions[3]. Owing to the patchwork nature of KR managed landscapes, the method supports the assessment of many distinct types of native vegetation patches[4], varying in size from 1 to 100 ha or more and each with a unique combination of geology, soils, farming and management history.

2.3 Scope

The scope of this methodology is to enable:

1. A statement of condition of NV assets at a given point in time; and
2. A statement of the change in condition of NV assets through time

The method is intended for use in the first instance across KR managed properties in northern Victoria; however, it should be easily extendable for broader application across SE Australia in agricultural landscapes with a similar pattern of clearing, disturbance and fragmentation.

The method uses Ecological Vegetation Classes (EVCs) - or the equivalent in non-Victorian jurisdictions - as the standard unit for classifying vegetation types. EVCs are described through a combination of floristics, lifeforms and ecological characteristics that are typically associated with

[3] Landscape areas greater than 10,000 ha

[4] A native vegetation patch (patch) is a discrete area of native vegetation of an assigned EVC and management context, which may or may not be connected to other discrete vegetation entities.

specific environmental attributes. Each EVC includes a collection of floristic communities that occur across a biogeographic range, and although differing in species composition, have similar habitat and ecological processes operating.

The Accounting for Nature® Framework explicitly applies the 'un-degraded' state as the default reference against which condition and change in condition is assessed. This equates to a benchmark for EVCs which have been described at a bioregional scale[5] in Victoria and have been developed to comparatively assess (against benchmark) the vegetation quality of EVCs at the site scale.

Native vegetation condition indicators in this method align with the Victoria's Habitat Hectares (HH) approach[6]. Indicators include Extent, of NV Composition (Structure, Diversity, and Recruitment) and of Configuration (landscape context). Minor adaptations to the approach (from HH) have been made to support the practical and routine application of the method by a farm manager/employee with appropriate knowledge and experience to assess native vegetation[7].

Understanding the trend in NV condition is critical in charting farmland ecological improvement, measuring progress towards future targets and to assess the efficacy of management that aims to improve the biodiversity values of KR managed land. It is understood that such change may be due to either management influence or external factors[8], though in its current form this methodology does not intend a process for counterfactual analysis to isolate these effects.

It is expected that material and statistically meaningful change in NV condition will require decadal commitments to management, monitoring and assessment. It is reasonable expectation that especially in the semi-arid landscapes of northern Victoria (and taking account of the noise associated with year-to-year seasonality) that it may take 3-5 years or even longer to detect change[9], from both natural processes and even the more active forms of farm management intervention (e.g. direct seeding of NV).

NV condition measurement frequencies of this method reflects this expectation of just gradual change over time, that is also helpful in managing real-world resourcing constraints of monitoring in a commercial farmland setting.

[5] https://www.environment.vic.gov.au/biodiversity/bioregions-and-evc-benchmarks

[6] The Habitat Hectare method is a site-based vegetation assessment method that measures the condition of native vegetation against a benchmark for the same vegetation type or Ecological Vegetation Class (EVC). The benchmark represents the average mature condition of the EVC, prior to European settlement.

[7] A working knowledge of Habitat Hectares field assessment is required

[8] It is important to note that while management aims to improve the condition of native vegetation assets over time, external factors (especially climate related), may mitigate against this.

[9] In these landscapes, episodic events (with decadal timeframes) such as flooding, play a critical role in ecosystem recovery.

2.4 Output

The Accounting for Nature® Framework requires that application of this methodology will produce:

- A native vegetation Environmental Account (EA), nominally a workbook of spreadsheets (e.g. Excel) that contains the Asset Tables (detailing condition of the asset) and Data Tables (observations of surveyed asset entities)
- An Information Statement (IS)

Upon certification of a time-dated Account, the IS will be published on the Accounting for Nature® Environmental Account Registry.

2.5 Accuracy Levels

The Accounting for Nature® Standard makes provision for assigning Accuracy Levels to an accredited Method that reflect the robustness of the measurement or estimation of the condition of the environmental asset, taking into account the purpose and the scale for which an environmental account has been created.

Methods are assigned an Accuracy Level, which reflects the robustness of its processes for the measurement or estimation of the condition of the environmental assets. Accuracy Levels consider both qualitative measures, such as the use of expert judgment; and more quantitative judgements, which use statistical rules to describe confidence such as standard error analysis; or a combination of both.

As a rule, the higher the Accuracy Level, the greater the confidence in the accuracy and objectivity of the condition assessment and the higher the confidence that the indicators can detect change.

Accounts generated by this methodology are expected to provide a Very High (95%) or High (90%) Accuracy Level under the Accounting for Nature® Framework. This is determined by the intensity of observational data obtained from quantitative survey.

3. FUNDAMENTALS OF THE KILTER METHOD (OVERVIEW)

The methodology is designed to operate at a 'large farm' scale, for a landscape with a diverse land use history. It offers a repeatable methodology for assessing landscape-scale projects of the order of 2,000-10,000ha of dispersed property. Farmland will typically hold <5% remnant vegetation of many disparate patches holding generally poor but variable condition.

This methodology offers these design aspects:

- At its core being quantitatively collected field data on NV quality, supplemented by aerial imagery for configuration, based on an adapted version of Victoria's Habitat Hectares approach
- It provides condition assessment to the level of discrete mapped native vegetation patches at the sub-paddock scale, which underpin its value as a practical farm management tool
- It aims to detect change in condition that might be expected to occur within 3-5 year timeframes, generally aligning with the expectations of adaptive farm management practice
- It can potentially be applied by a farm officer with experience in native vegetation assessment, who is either an accredited AfN Expert or be operating in association with one

3.1 The Asset

The Environmental Asset this Method measures is Native Vegetation.

Spatial patches of native vegetation (described in Step 1, Method Implementation) are characterized by their Ecological Vegetation Class (EVC)[10] as represented in their modelled state (refer metadata link, Victorian Native Vegetation – Modelled 1750 Ecological Vegetation Classes).

Ecological Vegetation Classes (EVCs) relate to a single EVC within one bioregion/subregion[11]. For example, in the Kilter Winlaton farms in northwest Victoria, the dominant bioregional subregion is *Victorian Riverina*, followed by *Murray Fans*. Dominant EVCs here are typically variants of floodplain woodlands and shrubby grasslands. Benchmark descriptions of Victoria's EVCs have been developed to assess native vegetation as part of Victoria's Vegetation Quality Assessment (VQA or 'Habitat Hectares') method.

In this method the current existence of native vegetation is determined by land management purpose. All spatially definable patches of the farmland that are intended to support native vegetation - whether remnant, passive regrowth, actively revegetated or of future planned revegetation - is considered as NV asset extent. In effect all land areas outside current (or planned) agricultural and infrastructure footprints can be considered as extent.

[10] Ecological Vegetation Classes are mapped at the bioregional/sub-regional scale and assigned a relevant conservation status (endangered, vulnerable, depleted, least concern or rare) at this scale.

[11] Note that EVC benchmarks are assigned at a bioregional scale. Unless there is material difference in benchmark description of a given EVC in different bioregions that may be represented across the farmland area then just the dominant bioregion EVC can be assumed.

3.2 Asset Condition Indicators

The Accounting for Nature® Guidelines for Developing Methods to assess the condition of Native Vegetation (the 'Vegetation Method Guidelines') establishes three indicator themes to be used to describe native vegetation condition: the extent of vegetation, its composition and its configuration. This is described in more detail for this method in Tables 2 and 3.

Table 2: NATIVE VEGETATION ASSET DELINEATION			
Realm	**Asset** **Sub-Asset**	**Condition Indicator Themes**	**Comment in relation to the Kilter method**
Land	Native Vegetation Bio-region EVC	Extent	Land that is dedicated to the sustained growth of native vegetation (so both active and passive regeneration)
		Composition Structure Diversity Recruitment	Practical adaption of *site quality* element of Vic Habitat Hectares approach
		Configuration (Connectivity)	Practical adaption of l*andscape context* element of Vic Habitat Hectares approach

The selection of the underlying Indicators relating to native vegetation quality, or NVQ (i.e. relating to composition and configuration) in this methodology is based on the vegetation quality attributes and their relative proportionality of Victoria's Habitat Hectare (HH) approach (Parkes *et al*., 2003). Table 3 summarises these indicators and the adaption of their HH form for practical application in this method.

Table 3: VEGETATION QUALITY ATTRIBUTES		
Indicator Theme	**Indictors required by Habitat Hectares (HH)**	**Indicators required by this method**
Composition	Large Trees (10% total score)	Large Trees (10%)
	Canopy Cover (5%)	Canopy Cover *of >5m trees* (5%)
	Understorey[12] (25%)	% cover of lifeform groups (12.5%)
		Species richness[13] (12.5%)
	Weed Cover (15%)	Weed Cover (15%)
	Organic Litter Cover (5%)	Organic Litter Cover (5%)
	Logs (5%)	Logs (5%)
	Recruitment (10%)	Recruitment[14] (10%)
Configuration	Patch size (10%)	Patch size (10%)
	(NV within) Neighbourhood (10%)	NV within *1km radius* (10%)
	Distance to Core Neighbourhood (5%)	Distance to Core Neighbourhood (5%)

Note: For treeless EVCs the relevant indicators are reweighted to add to 100.

[12] Understorey in Habitat Hectares is an amalgam of lifeform structure and richness attributes
[13] This also includes overstorey species
[14] Recruitment scoring is simplified from HH approach

3.3 Sampling of the Indicators

As prescribed in the Vegetation Method Guidelines, there requires adequate sampling of NVQ Indicators to meet standard error tests for the different Accuracy Levels. This methodology is aimed at Very High (95%) or High (90%) accuracy, depending on the level of sampling selected for a project. The statistical test requires that native vegetation type and condition is stratified into generalised *assessment units* of which minimum sampling frequencies are based on assessment unit areas. In this methodology one sample is equivalent to a survey of the full VQA Indicator set (of Table 3) for a vegetation patch. This methodology specifies that this is done by incorporating a 100m transect survey with the more traditional HH site survey. The inclusion of a transect enables more reliable and repeatable survey of understorey and groundcover condition within a vegetation patch. Traditional HH site survey is still required to assess more macro or dispersed vegetation elements within a patch such as overstory and recruitment.

3.4 Measurement of the Indicators

Unique to this methodology is that it involves the complementary use of a range of data collection types and techniques to interpret and provide evidence of indicator condition, including:

- transect surveys
- site level surveys
- aerial imagery
- supportive photopoint evidence

The primary quantitative data collection tool is the transect survey. This enables highly repeatable collection of data relating to most understory and groundcover elements of vegetation quality. These are the vegetation elements that will tend to change most quickly over time and impact on condition scores.

Described in more detail in Appendix 1, a transect is nominally of length 100m (or estimated by pacing out 100 steps) with a 4m wide viewing strip. This *belt transect* approach has been developed and applied for NV assessment in northern Victorian landscapes (Rumpff & Begley et al., 2019).

Appendix 1 further specifies the application of Habitat Hectare (HH) *site survey* at a sampling location. While this enables the collection of all the VQA elements, its purpose in the method is to characterise those more macro or widely dispersed elements of a vegetation patch such as large tree condition, canopy cover, lying timber (logs) and recruitment that are unlikely to be effectively captured within a constrained transect. The dispersed nature of these latter elements is particularly relevant for regenerating woodlands which are often of sparse and varied condition on Kilter managed farmlands. Apart from perhaps recruitment, these site level indicators are likely to change less quickly over time, and so the inherent error in collecting observations over the broader area of a site (typically 1-2 ha) is less critical.

Modification in this method from the traditional HH assessment approach is required primarily because it (HH) wasn't principally designed as a monitoring tool, rather to support assessment for government biodiversity protection grant and offset programs. In particular:

- HH is designed to be used at an overall vegetation site/project level for one-off assessment (not to be systematically repeatable to support ongoing management and reporting objectives) repeatable
- its scoring of understorey does not readily resolve structure (lifeform covers) from species richness in order to easily capture and understand change

There are several other HH indicator collection and scoring elements that are overly onerous, complex or require deep expert skill (e.g. recruitment) for routine practical application. While this methodology supports variation to the measurement and scoring of several of the HH indicators, it maintains the HH weightings for indicator contribution to overall condition score.

In order to get a more consistent and repeatable data collection the Kilter method also adopts the use of the Braun-Blanquet (B-B) approach to the visual estimation of abundances, especially relevant for lifeform covers and weediness. B-B has been used extensively in ecological survey and aims to minimise the potential for assessor interpretative subjectivity.

The variations described above allow for a workable field method that can be applied by a suitably skilled farm officer, who is either an accredited AfN Expert or is operating under the close guidance of one.

Photopoints and Imagery

In this method site photographs are routinely used to provide supportive evidence of native vegetation condition at a survey location. Photos are collected at the ends of transects; taken of particular features of a site during survey; and potentially collected from permanent long term photopoints that are associated with a vegetation patch.

Contemporary aerial imagery such as that freely provided by Google Earth is also useful to an assessor applying this method. It is particularly useful in identifying the distribution of macro-elements (esp. trees, canopy) that characterise a patch. Imagery can also be used to initially plan potential locations of site and transect surveys in a vegetation patch before final placement in the field. While most assessors would tend to rely on site survey to quantify macro-elements, it is plausible that contemporary imagery could be used to determine (or confirm) VQA elements such as large tree counts and canopy densities.

4. IMPLEMENTING THE METHOD

The method employs the following seven steps:

Step 1: Define accounting area

Step 2: Define native vegetation sub-assets

Step 3: Stratifying and NV asset patches

Step 4: Design of data collection for NV assets

Step 5: Applying NV condition assessment

Step 6: Calculating aggregate NV condition scores and the Econd®

Step 7: Compile Account

Step 1: Define accounting area

For a project under this methodology the accounting area is defined as the farm area under management. It forms the basis what is being reported to an investor client(s). Native vegetation reference condition (benchmark) assumes 100% cover (full extent) across the accounting area, irrespective of whether the land has current ecological, agricultural or other function.

This means that current areas of intensive agricultural production (e.g. horticulture, cropping etc.) and farm infrastructure will automatically assume vegetation condition scores of zero (and therefore reduce the maximum possible farmland Econd®), while all remaining areas are considered as native vegetation footprint and able to effectively contribute to the Econd®. Native vegetation on Kilter managed farmland can have the purposes of biodiversity conservation, grazing, forestry or combination.

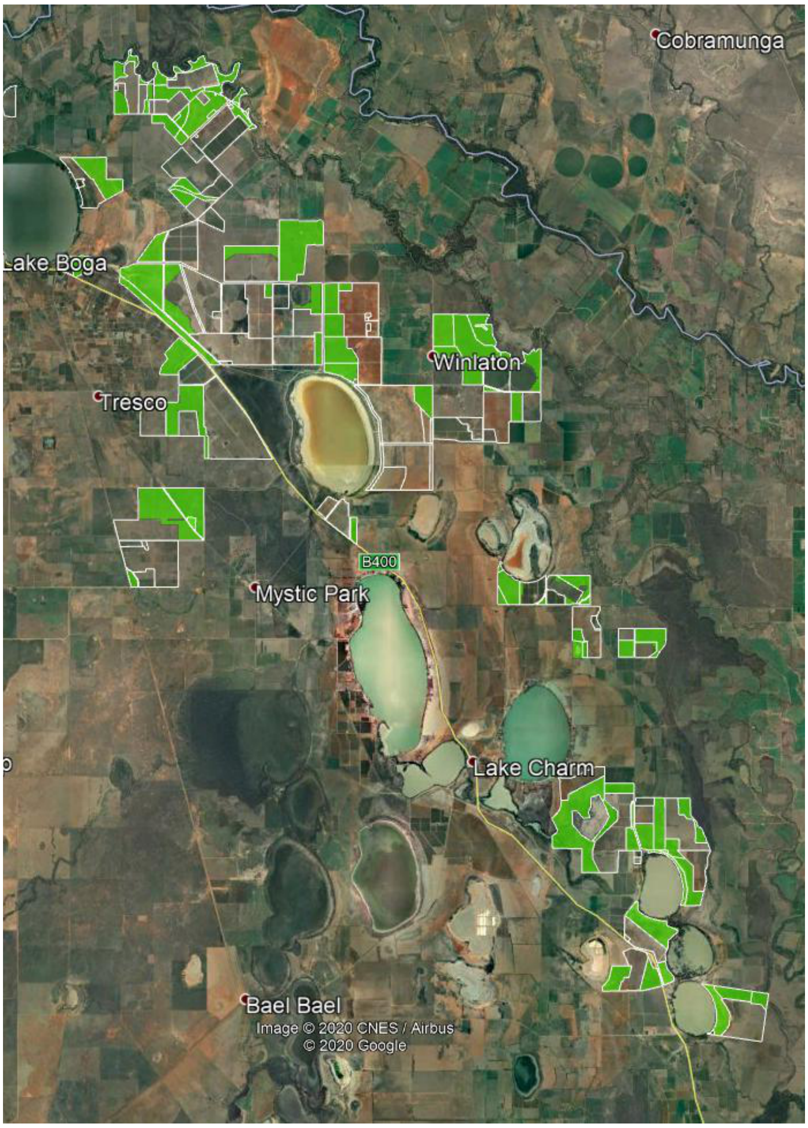
For the purposes of reporting to assist management, an account under this method should be able to be constructed to also enable calculation of vegetation condition to the resolution of a single property (of a multi-property farm), or land management unit (e.g. paddock within a property), or other useful spatial reporting elements within the accounting area.

<u>The outputs from Step 1 will be:</u>

A map defining the accounting area together within a spatial data file compatible with geographical information systems, such as a Google Earth kmz or ArcGIS shapefile, in a commonly applied Australian datum (specific details to be specified within an information statement).

Figure 2 provides a view of the entire KR managed Winlaton Project, including the relationship between the overall farm accounting area, properties, land management units (LMUs) and current native vegetation extent.

Figure 2: A generalised image and map of the FFL Winlaton project indicating the overall farmland area (comprising 36 semi-contiguous properties), land management units (white outlines) and land with current NV extent (green shaded). Unshaded areas generally represent agricultural and associated infrastructure footprint.



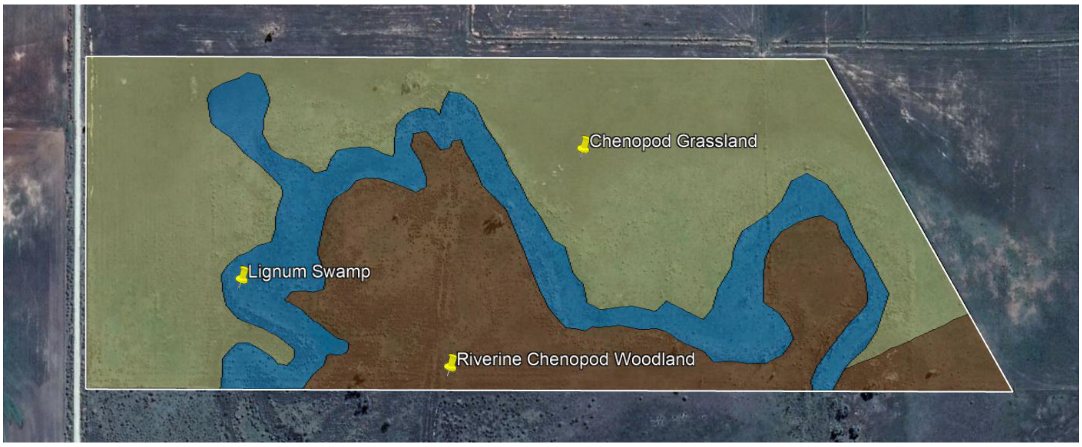
Step 2: Define native vegetation sub-assets

The method applies Victoria's standard approach to the classification of ecosystems, Ecological Vegetation Classes (EVCs).

Individual patches of currently existing native vegetation (NV) within the project accounting area are defined as the fundamental spatial asset patches of an account, with each patch characterized by an EVC and a common management context (e.g. with the boundary of a paddock[15]). Native vegetation patches in this farm-based method have a spectrum of management contexts, from higher value and protected patches in biodiversity paddocks, to grazed native forage dryland paddocks, to regrowth patches within and around cropping paddocks.

In the Winlaton example there are about 180 such patches. Figure 3 provides an illustration of the relationship between land management units and EVCs that dictate the spatial definition of native vegetation patches.

Figure 3: An LMU (or paddock) with existing native vegetation and represented by three EVCs. This defines three NV spatial patches, each individually identified and able to be allocated to an assessment unit (note that if an EVC has multiple areas within the 'paddock' it can be regarded as a single NV patch).



The attribution of a patch with its 1750 Ecological Vegetation Community (EVC) in the first instance is determined from the statewide spatial layer *Victorian Native Vegetation - Modelled 1750 Ecological Vegetation Classes* (refer metadata link). As this data is designed for regional scale application (1:25,000 to 1:100,000) this attribution should be ground-checked. This may result in EVC characterisation[16] and boundaries being adjusted to match on-ground reality. It might also be reasonable to group together like-EVCs that exhibit only subtle physical differences (e.g. the two minor extent mallee vegetation EVCs of the FFL Winlaton example). Such practical adjustments are required to be described in an account's Information Statement (IS).

[15] A paddock in this context may either be a singular fenced patch, or multiple fenced entities managed in a common fashion (e.g. protected biodiversity, grazing)

[16] On-ground assessment of native vegetation in some cases reveals that the mapped EVC assignment is not matched with reality, for at least part of or in some cases the entire patch of native vegetation. The modelled 1750 EVCs provides a starting basis from which to accurately assign a patch to its appropriate EVC.

The Composition of an NV patch in this method is benchmarked against a description of its 1750 reference state. In Victoria these descriptions are available for each bioregion from DELWP (Link: Bioregions and EVC Benchmarks). These descriptions outline the lifeforms, typical species, abundances as well as other characteristics that are relevant to the Condition Indicators applied in this method (Step 5). If there are adjustments required to published reference benchmarks such as from local expert knowledge then full transparency of these variations is required within an IS.

The outputs of Step 2 will be:

1. A table listing all native vegetation patches present in the accounting area, along with their internal spatial linkages (property, LMU etc).
2. Maps defining both the pre-clearing (benchmark) and current extent of NV EVCs in the accounting area, also available as GIS spatial data files in a commonly accessible form such as a Google Earth kmz or ArcGIS shapefile in a commonly applied Australian datum.

By way of example, Table 4 shows a 'whole of farm' summary of EVC extent - pre-1750 and current (2018) - for the FFL Winlaton Project.

Table 4: FFL WINLATON EVC SUMMARY

EVC Code	EVC name	Pre-1750 Extent (ha)	2018 Extent (ha)	2018 % Extent
CG	Chenopod Grassland	1807	1,103	12.3%
GRF/RSF	Grassy Riv. Forest/Riv. Swamp Forest	124	61	0.7%
LBH	Lakebed Herbland	3	3	0.0%
LSW	Lignum Swampy Woodland	368	173	1.9%
LW	Lignum Wetland	25	25	0.3%
PS	Plains Savannah	137	132	1.5%
RPM/WM	Ridged Plains/Woorinen Mallee	61	61	0.7%
RCW	Riverine Chenopod Woodland	5392	2,425	27.1%
SaCW	Semi-arid Chenopod Woodland	915	687	7.7%
SaW	Semi-arid Woodland	127	112	1.2%
	All EVCs	8,959	4,781	53.4%

Step 3: Stratifying NV assets

To satisfy the sampling requirements of the Vegetation Method Guidelines, current native vegetation Extent (for each EVC) is required to be split into assessment units. Assessment units are spatial subsets of the accounting area defined by intersecting sub-assets (EVCs) with broad condition states.

From a farmland perspective this stratification can occur by a general consideration for each vegetation patch of its current condition (e.g. low, moderate, high or a suitable proxy of) to ensure a spread of condition states is captured. An Information statement will provide a description of the nature of the condition states applied to a project accounted under this method.

Using FFL Winlaton as an example there is potential for up to 30 assessment units assuming its 10 EVCs and 3 condition states. Table 5 shows the number of NV Patches, their combined hectares and % Current Extent for each assessment unit.

Table 5: FFL WINLATON ASSESSMENT UNITS

EVC Code	**EVC name**	**High Condition** ***no./ha (% Extent)***	**Moderate Condition** ***no./ha (% Extent)***	**Low Condition** ***no./ha (% Extent)***
CG	Chenopod Grassland	2/37 (1%)	**21/557 (13%)**	**14/135 (3%)**
GRF/RSF	Grassy Riv. Forest/Riv. Swamp Forest	0/0 (0%)	4/51 (1%)	1/10 (0%)
LBH	Lakebed Herbland	0/0 (0%)	0/0 (0%)	1/3 (0%)
LSW	Lignum Swampy Woodland	**4/62 (0%)**	3/43(1%)	**3/68 (2%)**
LW	Lignum Wetland	0/0 (0%)	1/25 (1%)	0/0 (0%)
PS	Plains Savannah	0/0 (0%)	**4/90 (2%)**	0/0 (0%)
RPM/WM	Ridged Plains/Woorinen Mallee	0/0 (0%)	**3/61 (1%)**	0/0 (0%)
RCW	Riverine Chenopod Woodland	**20/674 (16%)**	**46/1487 (35%)**	**21/361 (8%)**
SaCW	Semi-arid Chenopod Woodland	**8/140 (3%)**	**19/299 (7%)**	**5/95 (2%)**
SaW	Semi-arid Woodland	2/9 (0%)	**4/103 (2%)**	0/0 (0%)
Note: bold entries in this table refer to assessment units that are deemed as *material* for a Level 1 Account (refer to Step 4)				

<u>The outputs from Step 3 will be:</u>

Maps defining assessment units within the Current NV Extent, also available as GIS spatial data files in a commonly accessible form such as a Google Earth kmz or ArcGIS shapefile in a commonly applied Australian datum.

Step 4: Design of data collection for condition of NV assets

This step describes the frequency and distribution of data collection, based on the assessment units described above, to satisfy the Accuracy Levels for this methodology.

Sampling frequency to inform Accuracy Levels

Thresholds relating to both the quality of data collection and its sampling intensity are required to satisfy Accuracy Levels in Accredited methodologies. For this method to satisfy either a Very High (95%) or High (90%) accuracy a suite of data equivalent to that identified in Table 9 (of Step 5b) is required to be collected from each sampled vegetation patch. This sampling must entail a transect and site survey pair to capture the full range of understory and overstory condition elements of a patch, in addition to a GIS supported configuration analysis. Table 6 describes the sampling intensities that are required to achieve either a Very High or High Accuracy Level under this method[17].

Table 6: SAMPLING INTENSITY TO MEET ACCURACY LEVEL REQUIREMENTS		
Assessment Unit Area	**Min no. sites for Very High (95%) Accuracy**	**Min no. sites for High (90%) Accuracy**
1-2 ha	1	1
>2 and ≤20 ha	2	2
>20 and ≤60 ha	3	3
>60 and ≤500 ha	5	4
>500 ha	7	5
Materiality	>95% of Total NV Extent represented	>90%

Depending upon the Accuracy Level there is also a *materiality* test that is applicable under the Vegetation Method Guidelines. The application of materiality helps minimise the application of significant resources to small parts of the accounting area. The Guidelines states that for an account aiming for Very High (95%) Accuracy, then assessment units totaling up to 5% of current extent can be excluded from measurement. For a High (90%) Accuracy account this threshold is 10%. The bold entries in Table 5 are the material assessment units that would need to be sampled for Very High Accuracy Environmental Account assuming the Winlaton project example (by progressively removing all smaller units up to a maximum of 5% total area).

Table 7 shows the survey effort required for assessment units in order to meet the Accuracy Level sampling thresholds for the FFL Winlaton Project example. For the purposes of demonstration, like-EVCs have been conveniently grouped (that might be justifiable for an actual project).

Table 7: SURVEY EFFORT REQUIREMENTS FOR ASSESSMENT UNITS									
EVC/EVC Group	**High condition**			**Moderate condition**			**Low condition**		
	Area (Ha)	No. Very High (95%) Sites	No. High (90%) Sites	Area (Ha)	No. Very High (95%) Sites	No. High (90%) Sites	Area (Ha)	No. Very High (95%) Sites	No. High (90%) Sites
CG	37	3	3	557	5	4	135	5	4
RCW, GRF	674	7	5	1538	7	5	371	5	4
SACW, SaW	140	5	4	402	5	4	95	5	4
LSW	62	5	4	43	3	3	68	5	4
RPM/WM/PS	0	0	0	151	5	4	0	0	0
Total surveys (per condition class)		20	16		25	20		20	16
Total surveys	65 Very High (95%) or 52 High (90%) accuracy								

With regard to the Winlaton project trial where there are 180 NV patches defined, a Very High (95%) Accuracy Level would require in-paddock survey in 65 (or 36%) of the patches and for High (90%) Accuracy Level in 52 (or 29%) of the patches.

Locating site and transect surveys in the paddock

Site and transect surveys under this methodology are required to be representative of the vegetation patches that they are required to assess. In the first instance this means ensuring consistency with the EVC and condition class of the parent assessment unit. Fully randomised generation of survey locations is not suited to the sparse and patchily regenerating semi-arid landscapes typical of Kilter managed farmlands. Instead, locational decisions are better made by the judicious interpretation of a skilled native vegetation assessor who can balance the spectrum of variation across a patch.

As the condition of a patch will potentially change unevenly over time, an expert assessor may be able to argue the change in location of a survey during subsequent revisit of a sample location. This would be more likely relate to the location of a transect than the boundary of the broader surveyed site. Any adjustment of sampling locations will be articulated in an IS.

The considerations around and a process for locating survey transects is described in more detail in Appendix 1.

Frequency of survey

Given the complexities of working to rehabilitate a fragmented farming landscape with potentially many NV patches occurring across a project area, this methodology flexibly incorporates a rolling program of sampling over the maximum of a 5-year cycle. An information statement for a project under will specify the length of the measurement cycle and the status of the project within that cycle at the time of reporting.

Rolling monitoring over a multi-year window in northern Victoria is also considered a reasonable proposition because of the amount of time that may be required to capture a material change in condition at a site. This is owing to naturally low vegetation growth rates in semi-arid inland environments that may be further exacerbated by challenging environmental conditions of recovering agricultural land (e.g. salinity, excessive nutrient loads, weed competition). While a singular repeat survey every 3 or 5 years is equally valid, rolling annual sampling offers the prospect of maintaining survey skill and a continual build of knowledge.

Step 5: Applying NV condition assessment

Step 5a: Determining Current Native Vegetation Extent

Native vegetation is defined to exist where farmland is managed in a way that protects, or actively or passively supports the sustained growth of native vegetation. This is the part of the farm that falls outside the farm production footprint (the cropping or exotic pasture area) and infrastructure zones (house blocks, depots, traffic and channel easements). Also excluded from NV Extent are areas where it is reasonably assumed that agricultural or infrastructure development is planned[18].

This definition captures native vegetation of a full spectrum of quality, from higher value remnant native vegetation patches to very low-quality patches that are passively managed (such as a small vegetation patch in the corner of a cropping paddock). NV patches can therefore vary in size, from many 10s of hectares within a fenced regenerating paddock to just a few hectares in the less physically protected corner of a cropping paddock.

Native vegetation will often align with an LMU (or paddock) boundary and therefore be attributed with the area of that LMU. In the case where multiple EVCs are represented in the paddock then at least as many NV patches will be defined with a combined area totalling the LMU area (as in Figure 3).

In LMUs with a primary agronomic purpose there may be parts of that LMU that contain multiple and physically unprotected patches of EVC attributed native vegetation. The area of such can be directly calculated by measurement on aerial imagery (e.g. Google Earth), or by subtracting the agronomic-infrastructure footprint area from the total LMU or paddock area.

Figure 5: Two distinct circumstances of NV Extent (green) in the method. In (i) LMU 1 NV is fully fenced and occupies the entire LMU. In (ii) LMU 2 the primary land use is an agronomic one, pivot irrigated cropping. However, there is residual NV between the agronomic footprint and the LMU boundary that can be accounted as NV Extent (provided that there is no known future intention to develop it for agriculture).

[18] Note that Victorian planning definition of vegetation of a minimum 25% native vegetation content of a patch is acknowledged, but this does not provide a simple and workable definition in this methodology. It also fails to adequately account for the decisions of a land manager that intend to return native vegetation to the landscape (e.g. passive regrowth on ex-cropping land).

Step 5b: Assessment of Native Vegetation Quality

Table 9 shows the (i) indicators, (ii) their contribution to overall condition score and (iii) their primary data capture/interpretation techniques for native vegetation condition assessment of NV patches (the survey approach is described in more detail in Appendix 1).

Its key elements, which are consistent with or of a practical adaption of Habitat Hectares, include:

- Understory life-form cover[19], species richness and weediness are scored using a belt transect. Cover estimates from belt transects are classified using the Braun-Blanquet visual classification system (Braun-Blanquet, 1965).
- Litter is scored using the belt transect with reference to its origin (native or exotic) and reference cover levels
- Specific understory elements including logs and recruitment are scored at the site scale
- Large tree density and canopy cover is determined from traditional HH site survey, potentially assisted by use of aerial imagery
- The configuration indicators are determined from simple GIS assessment of aerial imagery
- 45% of the NV condition score comes from the assessment of understory elements by transect survey

Table 9: ASSESSMENT OF VEGETATION QUALITY INDICATORS OF NV PATCHES WITH IN-PADDOCK SURVEY

Indicator Theme	Indicator	% Score	Data capture type/scale	Comment
Overstorey Composition	Large Trees	10%	Site survey	Potentially supported by aerial imagery to confirm or extrapolate
	Canopy Cover (of >5m trees)	5%	Aerial imagery	As above
Understorey Composition	Understorey lifeform cover	12.5%	Belt transect	Apply Braun-Blanquet cover est. (variation to HH)
	Species Richness	12.5%	Belt transect	Native species count
	Weed Cover	15%	Belt transect	Apply Braun-Blanquet cover est. (variation to HH)
	Organic Litter Cover	5%	Belt transect	Apply as per HH
	Logs	5%	Site survey	Simplified adaption of HH
Recruitment	Recruitment	10%	Site survey	Simplified adaption of HH
Configuration	Patch size	10%	Aerial imagery & GIS	Apply as per HH
	% NV in 1km Neighbourhood	10%	Aerial imagery & GIS	Simplified adaption of HH
	Distance to Core Neigbourhood	5%	Aerial imagery & GIS	Apply as per HH
Notes: If EVC is treeless then tree-related indicators will be unscored and so total score will need to be recalculated out of 100				

[19] Excluding understorey trees and large shrubs. These may be difficult to reasonably represent at the transect scale

In the low density woodland environments typical of Kilter managed farmlands belt transects are unlikely to adequately resolve overstory composition (as previously described in Section 3.4). in this methodology, belt transects in open woodland environments are restricted to understory assessment, with overstorey (and understorey trees/large shrubs), recruitment and several other indicators more appropriately assessed at the site scale. Any variation to these demarcations for a project under this method are to be justified within an IS.

Step 6: Calculating aggregate NV condition scores and the Econd®

The native vegetation Econd® is a function of both (i) Extent, and (ii) intrinsic quality attributes relating to Composition and (iii) Configuration. Even for farmland, where a very significant proportion will remain permanently cleared for agriculture, benchmark Extent is assumed to be 100% of the accounting area. A farm project will typically set modest goals for Extent and this will constrain the maximum possible score for an Econd®.

Assessment unit (AU) condition scores will be an average of the results of the surveys undertaken in native vegetation patches comprising a given AU. Condition scores can be derived for each indicator as well as the summed indicators describing overall condition of the patches and AUs. AU condition scores will be summarised in manner similar to that in Table 11 (the Winlaton example).

Table 11: ASSESSMENT UNIT (AU) CONDITION SCORES (EXAMPLE) [20]

EVC	Condition Class	Assessment Unit (AU)	Area (ha)	Patch IDs	Ave. AU Cond. Score	Ave. EVC Understorey Cond. Score (area weighted)
Chenopod Grassland	High	CG - H	37	See workbook for details	35	29
	Mod	CG - M	557		30	
	Low	CG - L	135		25	
Riverine Chenopod Woodland	High	RCW - H	674		40	31
	Mod	RCW - M	1487		30	
	Low	RCW - L	361		20	
Semi-arid Chenopod Woodland	High	SaCW - H	140		35	30
	Mod	SaCW - M	299		30	
	Low	SaCW - L	95		25	
Lignum Swampy Woodland	High	LSW - H	62		35	30
	Mod	LSW - M	43		30	
	Low	LSW - L	68		25	

The standard error of the condition scores for each assessment unit (standard deviation of site scores divided by square root of number of sites) should also be calculated and be reported in an IS.

Condition scores for sub-assets (EVCs) are determined by area weighted averaging of constituent assessment units (exampled in Table 11).

When condition scores are presented for individual indicators (or indicator themes or other useful groupings of indicators) at the patch, AU or other useful spatial level these should be scaled to values between 0-100.

The overall NV Econd® for a project firstly requires area weighted averaging of the sub-asset (EVC) condition. This value (A) is then by multiplied by the ratio of Current Extent (CE) to Reference Extent (PE) as per the formula:

$$\text{Econd®} = \frac{CE}{PE} x \text{ A}$$

Where:

- CE = Current extent
- PE = pre 1750 extent
- A = Average sub-asset condition score (area weighted)

[20] These are hypothetical numbers

Step 7: Compile the account

This methodology will produce:

- A workbook (nominally Excel) that contains the Asset Tables (detailing condition of the asset patches) and Data Tables (direct recording of observations and/or links to more detailed data or evidence base)
- An Information Statement (IS)

Some important considerations in the development of these documents are discussed below.

Management of data underpinning condition

Where possible the explicit data relating to condition indicators is to be stored in data tables of the account workbook. Where this is not possible the workbook will provide a reference or link to where this data exists for it to be accessible for audit. This will point to evidence such as dated and geolocated field survey sheets and imagery from which condition interpretation occurs or is supported.

Preparing the Information statement

The Information Statement (IS) provides a commentary on the application of the methodology to a specific project. Though the methodology proposed here is designed to apply to Kilter managed large farms in northern Victoria, it is intended to be able to be extended to other semi-arid landscapes of inland SE Australia. A specific project, through an IS, will need to uniquely describe its native vegetation assets and matters such as its represented EVCs (or equivalent) and commensurate benchmarks.

Comparing accounts over time

<u>Reporting and measurement timeframes</u>

The frequency of reporting the account and the periodicity of data collection and measurement underpinning it will be specific to the application of a project under this methodology (and also conveyed in an IS).

In this method a full measurement of sites is expected over a multi-year timeframe of a maximum 5 years. This timeframe reflects:

- The time required to meaningfully resolve native vegetation condition change in slowly and often sporadically regenerating farmlands in semi-arid zones
- The resourcing required to continue to collect, analyse and prepare detailed vegetation condition data from large and diverse landscapes

This methodology proposes that condition data can either be collected (i) at one point in time in a project's monitoring cycle (max 5 years) cycle, or (ii) it be distributed throughout this cycle. The advantage of the latter, especially over large farmlands, is that it allows the evening out the application of resources as well as maintaining continuity of effort, skill levels and building of knowledge.

Even under a multi-year cyclical monitoring effort, a project can report annually but with declaration that its input data is collected over a rolling measurement cycle. Description of this cycle and the distribution of effort is to be fully described in an IS.

The first full account of a project will be required to have a complete sampling of its accounting area completed. This could potentially occur with a full sampling in the first year of a project (following this a project could revert to distributed sampling over a multi-year cycle). In years between completed monitoring cycles an updated account will be presented as a partial update.

<u>Time series consistency</u>

Projects undertaken by Kilter Rural will typically have a dynamic project area size as new properties are progressively purchased (and occasionally sold) that is integral with its investment model. This will have implications for a varying accounting area over time.

When land is added to the project accounting area, any defined native vegetation extent on this will be required to be represented as new NV Extent in an account. This will unavoidably impact on the Econd® at the project level (reflecting both changes in Extent and the Quality of this). Changes in accounting area are required to be fully disclosed within an Information Statement. Trend lines in condition over time are required to be transparently represented in an account and - if there is a change in accounting area - may require adoption of *broken series* (as per the Native Vegetation Method Guidelines).

REFERENCES

Accounting for Nature Ltd (2020). *Technical Protocol to Guide the Development of Native Vegetation Condition Accounts.* Draft Version 2.1 – April 2020. Accounting for Nature Limited, Sydney, Australia

Braun-Blanquet (1965). *Plant sociology: the study of plant communities.* Hafner Publishing Company

Central West CMA, ~2010. *Project Management Guide*. A manual for collecting photopoint and step-point data

Parkes D., Newell G. and Cheal D. (2003). *Assessing the quality of native vegetation: The 'habitat hectares' approach*. Ecological Management & Restoration 4, S29–S38.

Queensland Government. Ecological Condition Profiles for Regional Ecosystem Condition Assessment

State of Victoria (2004a). Department of Sustainability and Environment. Vegetation Quality Assessment Manual. Available at https://www.environment.vic.gov.au/native-vegetation/native-vegetation/biodiversity-information-and-site-assessment

State of Victoria (2004b). Department of Sustainability and Environment. EVC/Bioregion benchmarks for Vegetation Quality Assessment. Available at: https://www.environment.vic.gov.au/biodiversity/bioregions-and-evc-benchmarks

Rumpff L., Begley J. *et al.* (2019). State and Transition Model for Grey Box Woodlands in the Goulburn Broken Catchment. Information Guide and Monitoring Method. Supported by the Goulburn Broken CMA under the National Landcare Program. In Preparation.

Tasmanian Wildlife Conservancy (2020). *WildTracker: Native Vegetation Methodology.* An Accounting for Nature certified natural asset assessment methodology.

Thackway, R. (2015). Tracking the transformation of vegetated landscapes using The VAST-2 System. Version 1.1. Brochure. Available at http://vasttransformations.com/

Thackway R., Cosier P., McIntosh E., Saunders D., Possingham H. and Sbrocchi C.D. (2015). https://wentworthgroup.org/2015/11/draft-protocol-for-constructing-a-native-vegetation-condition-account/2015/. Australian Regional EA Working Paper Series

APPENDIX 1: NV PATCH ASSESSMENT WITH FIELD SURVEY

Rationale

The assessment of the quality of a NV patch in the method requires information and interpretation from multiple survey scales:

- Representative belt transect surveys to primarily assess understory and groundcover condition indicators
- Site level surveys (consistent with Victoria's Habitat Hectares) to assess overstory and other often dispersed NV condition indicators
- Aerial imagery to score configuration-related indicators and assist with confirmation and/or broader extrapolation of site survey indicators

The Kilter NV assessment method is broadly based on the Habitat Hectares (HH) framework, adopting its condition indicators (called components), data collection standards and scoring approach in determining an overall condition score. However, the adoption of some of these elements in this method are modified from their treatment in HH. This is primarily because HH wasn't designed for ongoing repeat measurement. Amongst its particular shortcomings:

- It is designed for assessment at the vegetation site level rather than more replicable, constrained transects assumed of a method under the Native Vegetation Method Guidelines
- Its understorey assessment is quite generalised, it does not uniquely resolve life-form densities and species richness analysis in a way that enables useful tracking of change

There are several other indicator collection and scoring elements of HH that are overly onerous, complex or require deep expert skill for routine practical application. The Kilter NV method has adapted changes to manage these deficiencies.

One practical change is the integration of the Braun-Blanquet (or B-B) visual estimate classification for the estimation of cover or abundances (e.g. for lifeforms and weediness). This is known to address assessor interpretative subjectivity. B-B has been used extensively in ecological survey (it has recently been adopted in a NV assessment method by the Tasmanian Land Conservancy as part of its Wildtracker program)

The variations described above are essential for a workable field method that can be applied by an experienced native vegetation assessor, or knowledgeable farm employee that is able to operate under the close guidance of an assessor.

The data collection modes and scoring proportions of indicators of this method are described in Table A1.1 (rear). The set of indicator scoring tables (to convert field data to scores) are presented in A1.2. Victoria' s Habitat Hectare field assessment manual (State of Victoria, 2004a) is available here.

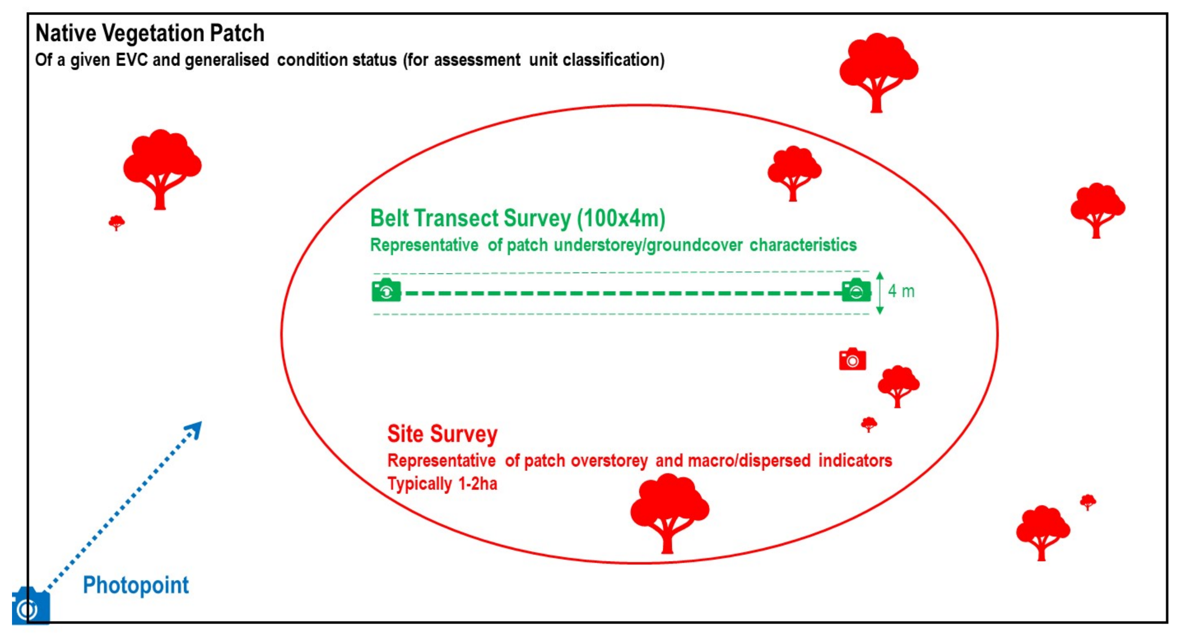
Where a particular project has reason to vary from these standards then this will need to clearly explained and justified within an information statement of an account.

Field Survey Methods

Figure A1.1 illustrates the various elements of field survey of a vegetation patch. Field survey can be undertaken by an individual assessor, though is usefully supported by a data recorder (human or technology). It Is designed to be routinely undertaken in the field with minimal equipment, requiring just survey forms (clipboard or direct digital entry), compact camera and, if required, the HH assessment manual and/or vegetation ID guides.

Some planning and effort is required to initially set-up a site (defining site boundaries, locating and pegging the belt transect), though it is envisaged that once established it would take an assessor no more than 1.5 hrs to routinely resurvey a site.

FIGURE A1.1: ELEMENTS OF THE IN-PADDOCK SURVEY METHOD



Site survey

In low density woodland environments where larger NV elements (in particular) may be highly dispersed, transects are unlikely to representatively capture these aspects. This method therefore opts for an accompanying site survey - consistent with field assessment under Victoria's Habitat Hectares approach - to capture these elements. The location of a site survey, typically of a workable 1-2ha size and that is deemed by an assessor to representative of the broader vegetation patch within it sits, will usually be determined before locating a transect internally within it.

The particular indicators of NV condition on Kilter managed lands that are more amenable to assessment at the site scale are:

- Large trees (density & crown health)
- Canopy cover (& crown health)
- Logs (typically related to dispersed trees)
- Recruitment (in part relates to dispersed overstory)

However, it would be good practice to collect measurements of all compositional indicators in the site survey in the case that they become useful at a later time.

Belt transect survey

The concept of a belt transect for farm native vegetation assessment has been developed by Rumpff & Begley et al (2019) for use on woodlands vegetation communities of the Goulburn Broken CMA.

In the Kilter method a belt transect location will be selected by an assessor in what they interpret as a representative part of the broader surveyed site. Its dimensions are a nominal 100m (length) x 4m (width), though, as long as 400m2 is surveyable by tight visual survey, then transects may be split or be squarer in dimension (maintaining a field of view is obviously critical). The assessor will walk the length of the transect scanning an estimated 4m wide strip to collect observations. Transect length is pre-determined by measurement (tape or wheel) or by pacing (~1m steps) if this is more practical. The ends of the transects will be pegged and coordinates recorded with a GPS so that these can be returned to for subsequent repeat survey.

The incorporation of transect survey in the method brings a repeatable frame for measurement for condition indicators amenable to this scale of survey. This will generally apply to indicators that are finer in resolution and potentially more ubiquitous across a site, including:

- Indicators of understory lifeform covers and richness
- Indicators of weediness and leaf litter

It is possible that at a project level that the most appropriate observations of a given indicator may vary from the site versus transect demarcations stated above. Potentially some indicators could be usefully informed (and this be argued) by data from both survey scales. Any adjustments from the demarcations described above will need to be justified within an account's information statement.

Accessory photopoint capture

Photopoints associated with field survey allows capture of a visual record that provides a line of evidence in the scoring of native vegetation condition. While a formal photo record is attached to either end of a transect upon survey; and opportunistic photographs of interesting site features is encouraged, the recapture of formal photopoints at or near survey locations (that may be historical) is especially valuable in capturing change over time.

Locating Survey Sites and Transects

The locations of both survey sites and transect under this method are required to be representative of their parent vegetation patch, and therefore consistent with the average characteristics of assessment unit (EVC and general condition) within it lies. This can be challenging on the highly variable and often sporadic responses of recovering landscapes from prior agricultural history, that's quite typical of Kilter managed farmland. Randomised generation of survey locations is not suited to this circumstance. Instead, the decision on survey location is best informed by the judicious interpretation of an expert vegetation assessor. All things being equal then practical considerations such as site accessibility will also be a determining factor in locations[21].

[21] Practical considerations are also important in the initial planning of surveys in the selection of native vegetation patches to sample to represent an assessment unit

Locating transects is most challenging because of the small footprint that they occupy relative to potential variation across a site – the judgment of an expert assessor is even more important. One important consideration in siting transects is that their area is not proportionally overwhelmed by larger overstorey elements. For instance the inclusion of a large single tree (or it's sizeable canopy cover) within a transect may be out of proportion with what's happening across the greater patch.

It is also possible that to maintain representativeness of a transect and survey site to its parent patch over time that their locations may need to be adjusted. This would be a decision of the expert assessor upon re-examining a patch. This is more likely to be a consideration for a transect than the larger dimensioned site.

Table A1.1: Summary of indicator scoring under the Kilter method

These indicators and their proportionalilty are drawn from Victoria's Habitat Hectares. Adaptions of HH for use in this method are specified.

Indicator	% Tot Score	Scoring Approach	Assessment Scale	Scoring	Comment
Large Trees	10%	Score 0-10 As for HH	Site survey. Aerial imagery may assist in confirmation of tree density and/or extrapolating results over a broader assessed area	Select score from HH (i) large tree count rel. BM and (ii) canopy health 5x3 score table	Large tree score will tend to be stable over significant (e.g. decadal) time frames and therefore unlikely to be sensitive to much change b/w monitoring cycles
Canopy cover	5%	Score 0-5 As for HH	Site survey. Aerial imagery may assist in confirmation of canopy cover and/or extrapolating results over a broader assessed area	Select score from HH (i) canopy cover rel. BM and (ii) canopy health 3x3 score table	Canopy cover score will tend to be stable over significant (e.g. decadal) time frames and therefore unlikely to be sensitive to much change b/w monitoring cycles
Understorey Structure	12.5%	Score 0-12.5 Modified from HH	Belt transect survey	Average of estimated % cover of lifeforms rel. BM covers using Braun-Blanquet (B-B) visual estimate classification	Scoring modified from HH chiefly as indicator is disentangled from richness and utilises B-B. This indicator is likely to be reasonably sensitive to change b/w monitoring cycles
Richness	12.5%	Score 0-12.5 Modified from HH	Belt transect survey	Proportion of observed no. species v's no. BM species averaged across lifeforms	Scoring modified from HH as it is separated from structure and is calculated across all plant lifeforms. This indicator is likely to be sensitive to change b/w monitoring cycles.
Weediness	15%	Score 0-15 Modified from HH	Belt transect survey	Based on estimate of % cover of key reference lifeforms using Braun-Blanquet (B-B) visual estimate classification	Scoring modified from HH as cover categories are based on B-B and weed severity is not considered. Likely to be reasonably sensitive to change b/w monitoring cycles.
Recruitment	10%	Score 0-10 Modified from HH	Site survey and Belt transect survey	Based on % of BM overstorey and shrub species that exhibit field assessed 'adequate' recruitment	Likely to be sensitive to change between monitoring cycles
Native Litter	5%	Score 0-5 As for HH	Belt transect survey	Select score from HH score table that considers cover rel. BM and source (native or exotic)	Could be sensitive to change b/w monitoring cycles
Logs	5%	Score 0-5 Modified from HH	Site survey	Based on % of BM large log length	Varies from HH as only considers large log length. A stable indicator that is unlikely to be sensitive to change b/w monitoring cycles

Patch size	10%	Score 0-10 As for HH	Aerial imagery and GIS	Match site (NV patch) to category in HH score table	Unlikely to be sensitive to change over time
Neighbourhood	10%	Score 0-10 Modified from HH	Aerial imagery and GIS	% area covered by native vegetation within 1 km of the NV patch (rounded to nearest 20%)	Varies from HH as only considers NV within 1km. Unlikely to be sensitive to change over time
Distance to >50 ha core Area	5%	Score 0-5 As for HH	Aerial imagery and GIS	Select from HH score table that considers distance to core area and its disturbance level	Unlikely to be sensitive to change over time
Note: For treeless EVCs, total score (of 100) requires reproportioning of relevant indicators (after removal of large tree, canopy and log indicators)					

Table A1.2: Indicator scoring tables for the Kilter NV method

These score tables are drawn from and/or adjusted from Victoria's Habitat Hectares

Group	Sub-group	Indicator	Survey type	Measurement(s)	Max Score	Scoring					
Composition	Overstorey	Large Trees	Site	# large Trees	10	% of Ref. # large Trees			Canopy Health		
		of >ref. dbh		Crown health category				-	>30	>70	
						lower limit	upper limit	Poor	Fair	Good	*code*
						0	0.1	0	0	0	0
						0.1	20	1	2	3	<20
						20	40	2	3	4	<40
						40	60	4	5	6	<60
						60	80	6	7	8	<80
						80	100	8	9	10	<100
		Canopy Cover	Site	% Cover	5	% of Ref. Canopy Cover			Canopy Health		
		trees>5m in height		Crown health category				-	>30	>70	
						lower limit	upper limit	Poor	Fair	Good	*code*
						0	10	0	0	0	<10
						10	50	1	2	3	<50
						50	150	3	4	5	>50
	Understorey	Structure	Site - for UT/LS	% Cover of lifeform groups	12.5	Lifeform Cat	B-B Obs	B-B Ref	Obs/Ref	Proportioned	
		cover of main lifeform groups	Transect - all other			UT/LS					
						MS/SS/PS					
						H					
						G					
						B/L/SC					
									Score (of 15):		
		Weediness	Transect	% cover	15			Braun-Blanquet Visual Est. Category			
								lower limit	upper limit	Score	*code*
								0	0.1	15	5
								0.1	5	12	4
								5	15	9	3
								15	30	6	2
								30	60	3	1
								60	100	0	0
		Logs	Site	m per 0.1ha	5			% of Ref. log density			
		(or stumps, >10cm diam)					lower limit	upper limit	Score	*code*	
							0	0.1	0	0	
							0.1	20	1	1	
							20	40	2	2	
							40	60	3	3	
							60	80	4	4	
							80	100	5	5	
		Litter	Transect	% Cover	5	% BM Cover		none	Native dom.	Exotic dom.	
				Native/non-native dominance		lower limit	upper limit	-	N	E	*code*
						0	10	0	0	0	<10
						10	50	0	3	2	<50
						50	150	0	5	4	>50
						150		0	3	2	<50
	General Site	Richness	Site+Transect	# species	12.5		# Obs. Species	# Ref. Species	Obs/Ref	Score (of 10)	
		Include Overstorey									
		Recruitment	Site+Transect	# species with *adequate* recruitment	10	Lifeform Cat	# Obs. Species	# Ref. Species	Obs/Ref	Proportioned	
						Overstorey					
						Shrubs					
									Score (of 10):		
Configuration		Patch Size	Desktop	Area	10			Size Category			
		Of which NV entity is a whole or part							Score		
								<2ha	1		
								2-5ha	2		
								5-10ha	4		
								10-20ha	6		
								>20ha sig. dist	8		
								>20ha sig. undist	10		
		Neighborhood	Desktop	Area	10		% NV Area	Sig. Dist.	Sig. Undist.		
		NV with 1km of patch									
							No >10ha patch	0	0		
							<20%	1	2		
							21-40%	3	4		
							41-60%	5	6		
							61-80%	7	8		
							81-100%	9	10		
		Core Area Distance	Desktop	Distance	5		Distance	Sig. Dist.	Sig. Undist.		
		Distance to nearest 50ha patch									
							>5km	0	0		
							1-5km	1	2		
							<1km	3	4		
							contiguous	4	5		