AfN-METHOD-F-02

A Native Woodland Bird Assessment Methodology for Diverse Regenerating Farmlands

ACCREDITED METHOD
Accounting for Nature

Land | Fauna | Woodland Birds

KILTER RURAL | Natural Decisions | Accounting for Nature

Method Name	A native woodland bird assessment methodology for diverse regenerating farmlands
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Environmental Asset	Woodland Birds
Accuracy Level	High (90%); Moderate (80%)
Authors	David Heislers, Kilter Rural; Geoff Park & Anna Roberts, Natural Decisions
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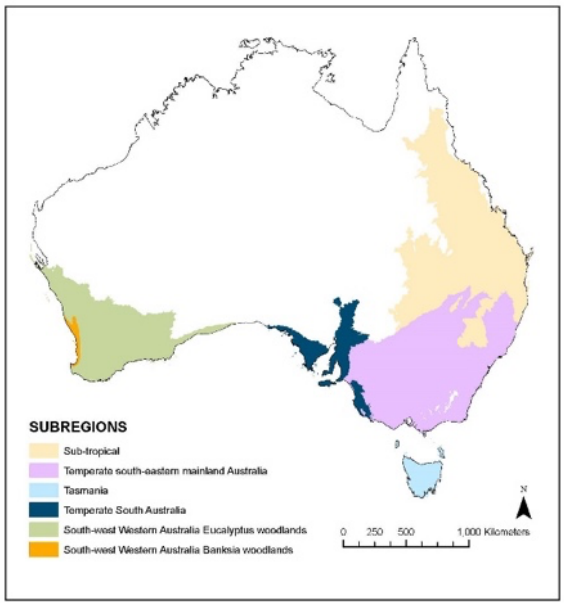
About

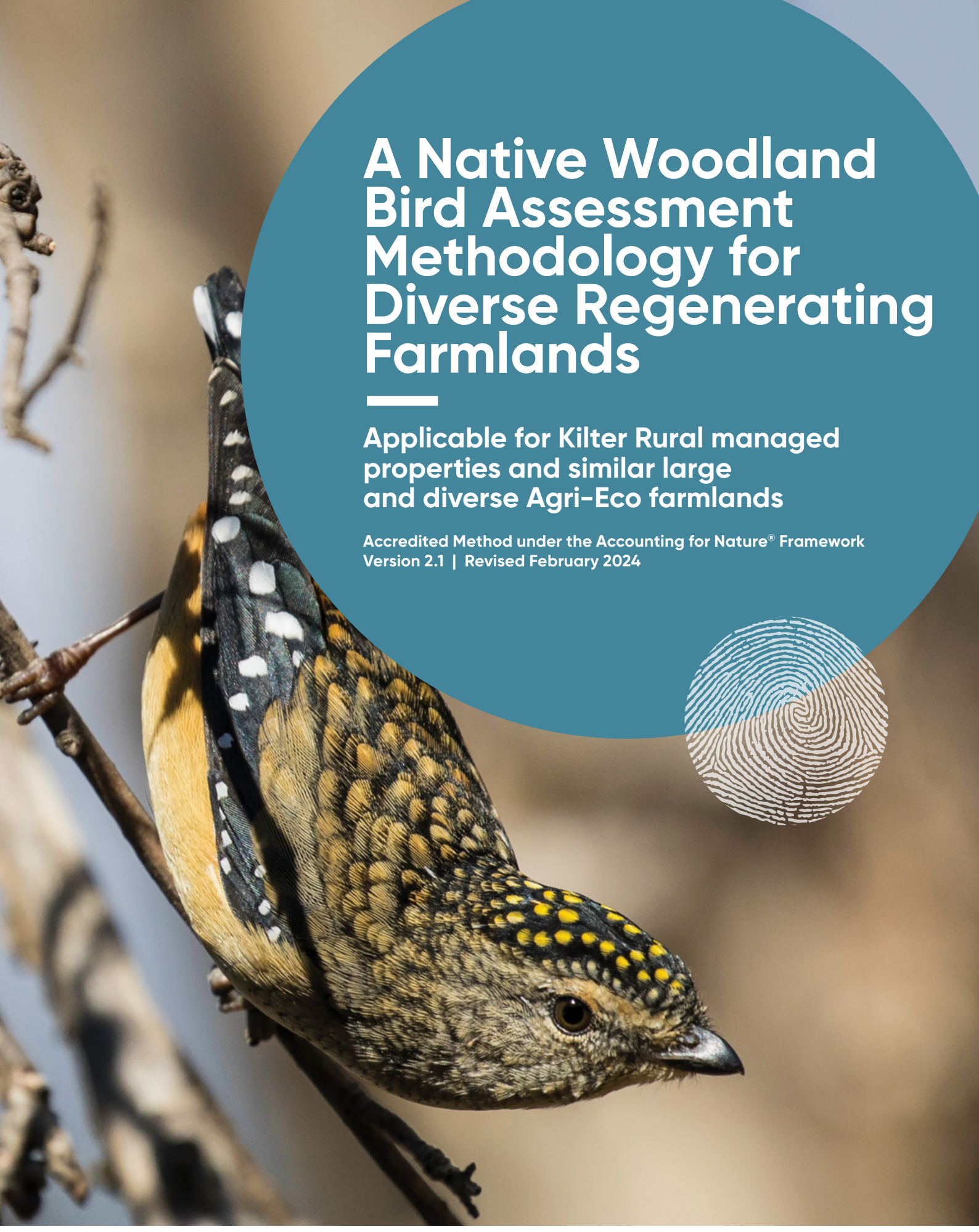
Environmental Asset	Woodland birds
Purpose	The method is designed: 1. To support reporting to interested parties, typically investor clients, on the condition of native woodland birds, and 2. As a tool to track the management of native woodland bird condition in order to understand, review and refine its ongoing land management activities.
Target Audience	Any land manager including conservation managers, indigenous managers and farmers.
Decisions to inform	To inform and assess the condition of native woodland birds.

Application

Reporting Period	1 year – an Econd® developed with this Method represents one year.
Scale and Size	'Large farm' or 'landscape' scale, typically in the thousands of hectares.
Geographical Location	The Method is applicable in Woodlands in Temperate and Sub-tropical Australia as shown to the right. A Woodland is described as an ecosystem with widely spaced trees, the crowns of which do not touch. In temperate Australia, woodlands are mainly dominated by Eucalyptus species. Temperate woodlands occur predominantly in regions with a mean annual rainfall of between 250-800mm. 
Realm	Terrestrial
Biome/Functional Ecosystem Group	The Method is generally applicable to the following Biomes under the IUCN Global Ecosystem Typology: Tropical and Sub-tropical Forests, Temperate-boreal forests and woodlands, Shrublands and shrubby woodlands.

Snapshot

	High Accuracy (90%)	Moderate Accuracy (80%)
Stratification	Generalised vegetation condition and woodland vegetation type.	
Sample Location	Expert Judgement based on vegetation characteristics relating to woodland birds.	
Sample Intensity	One 2 ha 20 min survey every 25 ha or less	One 2 ha 20 min survey per 25 ha to 150 ha
Indicators and measurement techniques	The Method requires a species list to be compiled using 2 ha 20 minute bird surveys. The species list is used to generate the following indicators: • Total Native Species Richness • Proportion of small bodied species (<50g) OR Proportion of species associated with intact communities, depending on what sub-region the site is in.	
Expertise Required	A suitably experienced ecologist with a number of years of field experience surveying native birds with a high level of native bird identification skill and the ability to detect and count native birds using the 2ha 20 minute survey method.	



A Native Woodland Bird Assessment Methodology for Diverse Regenerating Farmlands

Applicable for Kilter Rural managed properties and similar large and diverse Agri-Eco farmlands

Accredited Method under the Accounting for Nature® Framework
Version 2.1 | Revised February 2024

KILTER RURAL

Natural Decisions

Acknowledgement of Country

Kilter Rural acknowledges Australia's Aboriginal and Torres Strait Islander peoples and pays respect to their Elders past, present and emerging. We acknowledge Aboriginal and Torres Strait Islander peoples as Australia's first peoples and as the Traditional Owners of the land and water on which we operate.

VERSION: v2.1, February 2024. Accredited by AfN

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Methodology

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Approvals

Approver	Date	Conditions
Authors	17 June 2021	Submitted to AfN SAC
Authors	17 August 2021	Resubmitted to AfN SAC after addressing comments from 1st reading
Authors	1 October 2021	Updated version responding to comments from Chrissy Elmer (email 16 September 2021)
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AfN Standards & Accreditation Committee	19 November 2021	Approved for Accreditation
Authors	26 November 2021	Cleaned Accredited version
Authors	28 March 2023	Revision after 12 months implementation
Authors	9 February 2024	Terminology updates

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 development is the result of extensive engagement between Kilter Rural, Natural Decisions P/L and members of the WG, and more recently with AfN Ltd. The document draws heavily from the peer reviewed scientific work of Fraser et al (2018) and subsequent discussion with the authors.

Front cover: A Spotted Pardalote (female), a characteristic species in eucalypt woodland communities.

Contents

This document describes a method for the design and implementation of native woodland bird condition assessment that is consistent with the Accounting for Nature® (AfN) framework.

Acronyms

- Accounting Area ..... **AA**
- Account Spreadsheet ..... **AS**
- Accounting for Nature Ltd ..... **AfN**
- Assessment Unit ..... **AU**
- Environmental Account ..... **EA**
- Environmental Account Summary ..... **EAS**
- Ecological Vegetation Community ..... **EVC**
- Geographic Information System ..... **GIS**
- Indicator Condition Score ..... **ICS**
- Information Statement ..... **IS**
- Kilter Rural ..... **KR**
- Native Vegetation ..... **NV**
- (Australian) Temperate and Subtropical Woodland Bird Community ..... **TSWBC**

A Diamond Firetail, of the finch family and resident of the Victoria Riverina bioregion.

1. Introduction

This document describes a method for the design and implementation of native woodland bird condition assessment that is consistent with the Accounting for Nature® (AfN) Framework. Whilst the method has been developed for implementation in Kilter managed properties in northern Victoria, it is a generic approach with potential for application in other woodland communities across Australia.

The development of this method is informed by historical farm bird survey[1], AfN bird method guidelines[2], bird experts, and review and feedback provided by the AfN Independent Science Committee. This updated version offers additional clarity to the method, aided by over 12 months of implementation experience. This method version also incorporates an addendum with parameters for it to be able to be applied to other woodland ecoregions across Australia.

Kilter Rural

Kilter Rural (KR) is one of Australia's most experienced agricultural asset managers in irrigation farmland development, water and supporting ecosystem protection and farmland enhancement. It prides its 15-year plus record in transforming Australian farming landscapes and innovations in water markets to deliver investors sound long-term financial returns with positive environmental and social impact.

Kilter Rural believes that environmental accounting (EA) in agribusiness can shape the future for genuinely sustainable food and agriculture. The compelling combination of technology, science and validated environmental assessment enables progressive operators to track the health and condition of natural assets such as soil, water and native vegetation. Kilter Rural understands that 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 customers and long-term value to its investors.

Kilter Rural has adopted the Wentworth Group of Concerned Scientists' Accounting for Nature® Framework for its environmental accounting requirements across a broad range of natural asset classes. It believes that the Framework 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.

Kilter Rural managed landscapes

Kilter Rural invests in the regeneration of farming landscapes across northern Victoria and southern NSW. Typically these landscapes have been highly modified with almost total clearing of native vegetation, agricultural intensification and resultant hydrological change that has fundamentally altered the extent and condition of native vegetation and consequently the loss of biodiversity.

The KR model of 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 climate change and other threats from human encroachment.

1 Appendix A describes a case study for FFL Winlaton based on data that was collected prior to this methodology being accredited

2 Accounting for Nature® Provisional Guidelines for Bird Methods Version 1.0 (February 2021)

95% or more of KR managed farmlands at time of purchase was in a state of where the original native vegetation had been replaced with mostly intensively irrigated pasture-based agriculture. As a result the 'starting position' for native bird habitat (relevant to this method) is extremely low. Furthermore, the magnitude and nature of the pressures and impacts has likely permanently altered some fundamental properties of the landscape (e.g. soil structure and chemical composition) so that the ability to restore ecological processes to pre-clearing benchmarks is compromised by hysteresis effects.

KR aims to protect and regenerate 30% of the farming landscapes it manages for ecological purpose. It employs a range of passive and active management techniques to improve both the extent and quality of native vegetation and therefore faunal habitat.

Birds as indicators of environmental change

A primary motivation for using indicator species, including birds, as a tool to assess the condition of ecosystems without looking at all elements, is based on their ability to provide information on properties of the environment that are otherwise difficult, inconvenient or expensive to be measured directly (Landres et al. 1988).

While there is considerable literature on the value and limitations of using different taxonomic groups, including birds, as indicators of environmental health, these approaches do have limitations when used alone (See Chambers, 2008).

Nonetheless, birds have a number of attributes that make them useful for monitoring environmental health of ecosystems, including trends over time and responses to management and/or disturbance. These attributes include:

- There are usually good relationships between species richness and abundance of birds and the extent, configuration and quality of habitat
- Birds are at or near the top of the food chain and the presence/absence of different species or guilds of birds can be a useful indicator of ecosystem health
- Most bird species are reasonably easy to detect and survey
- Birds are of interest and concern to the general public and decision-makers and there is strong support for conservation programs that involve birds. This provides excellent opportunities to develop narratives that explain complex ecological processes in ways that are accessible and informative for the broader community.

Brown Thornbill, a small insect feeding species at home in shrubby understorey

2. Aim and Scope

This method describes a process to develop Environmental Asset Accounts for native *woodland birds* that is consistent, and in a practical form, with the AfN provisional guidelines for native bird communities.

The term woodland[3] is generally used in Australia to describe ecosystems which contain widely spaced trees, the crowns of which do not touch. In temperate Australia, woodlands are mainly dominated by Eucalyptus species. Temperate woodlands occur predominantly in regions with a mean annual rainfall of between 250-800mm, forming a transitional zone between the higher rainfall forested margins of the continent and the shrub and grasslands of the arid interior.

It is important to note that some woodland sites to which the method would be applied are in very poor condition, and as a consequence may at present lack key elements (including trees), the restoration of which is a principal focus and intent of Kilter Rural management.

2.1 Purpose

The method has been developed in the first instance for application across the KR managed landscapes in northern Victoria but has been designed in a way that would enable its application to projects with similar context in other agri-ecological regions across Australia.

The method is designed:

1. To support reporting to interested parties, typically investor clients, on the condition of the natural resource asset base (in this instance native woodland birds) on land that Kilter Rural is managing, and
2. As a tool for KR to track the management of natural asset condition in order to understand, review and refine its ongoing land management activities.

2.2 Scale

This method is designed to operate at the 'large farm' or landscape scale, nominally in the thousands of hectares. Native (and introduced) birds are found across KR managed landscapes associated with a variety of habitat types, typically plains woodlands with varying fractions of grassland or shrubland. However this method as it currently stands may only be applied in woodland (or intended woodland) habitats, where these physically exist and/or are known to occur under pre-European settlement reference condition.

Outputs of this method are reportable down to the ecological vegetation community (EVC or equivalent) level; appropriate groupings of such; or other useful characterisations such as generalised woodland bird habitat condition.

2.3 Scope

The scope of the methodology is to collect data over time on species richness – the number of different species represented in an ecological community, landscape or region. Species richness is simply a count of species, and it does not take into account the abundances of the species or their relative abundance distributions.

The determinant of the Econd® in this method is therefore bird species richness (via several metrics associated with this) that is substantially related to the availability of sufficient native woodland vegetation of suitable quality to support diverse native bird populations. As such the method is usefully read in conjunction with 'A Native Vegetation Assessment Methodology for Diverse Regenerating Farmlands' developed by Kilter Rural and accredited by AfN.

The underpinning field survey technique subject to this method records both species presence and abundance, we anticipate in time that incorporating species abundance data will be a valuable future inclusion in a further improved Econd®.

3 http://www.environment.gov.au/land/woodlands

This method as explicitly written applies to the *Temperate South-eastern Mainland Australia subcommunity* of the Australian Temperate and Subtropical Woodland Bird Community (TSWBC), as identified in Figure 1, this being the geographic realm of current Kilter Rural managed farmland projects. However, the revision of this method now enables it to be applied to other woodland bird subcommunities (also identified in Figure 1), provided the subcommunity-specific bird condition parameters (richness metrics) are substituted. These are detailed in Appendix B.

The scope of this methodology is to provide a statement of the change in condition of the native woodland bird community through time. While the magnitude of condition is important to report at any point in time, the trend in condition is critical in charting both bird condition and more general farmland ecological condition over time and the progress towards meeting future condition targets. Condition change may be due to both management influence and external factors, but, in itself this methodology is not designed to explicitly discriminate these[4].

Figure 1: Subcommunities of the Australian Temperate and Subtropical Woodland Bird Community (TSWBC) (Sourced from Fraser et al. 2018)

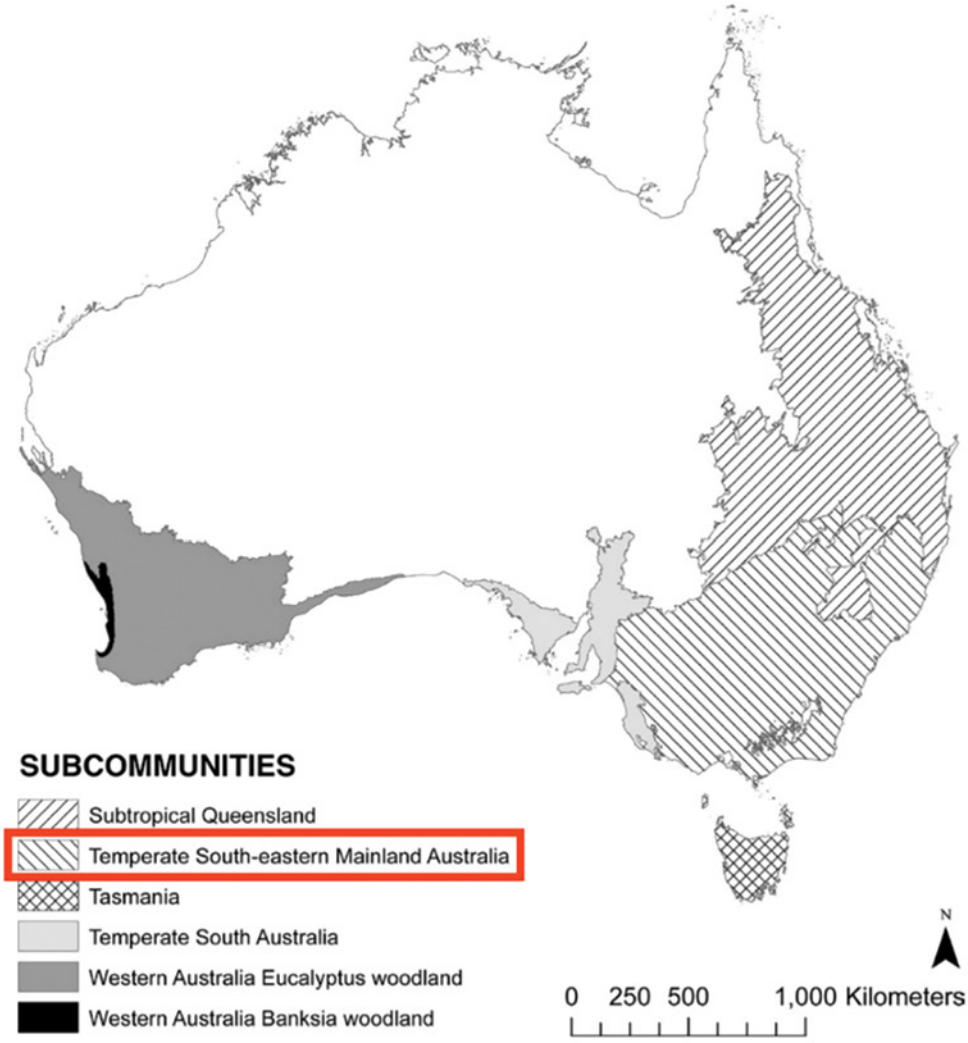


FIGURE 2 Subcommunity variants of the Temperate and Subtropical Woodland Bird Community

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

2.4 Output

The Accounting for Nature® Framework requires that this methodology produces the following:

- An Information Statement (IS)
- The Environmental Asset Account itself, a workbook (nominally Excel) that contains the Asset Tables (detailing condition of the asset entities) and underpinning Data Tables (observations and score translations)

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

2.5 Accuracy Levels

Asset Accounts generated by this method can be developed at either a High (90%), or Moderate (80%) Accuracy Level under the Accounting for Nature® Certification Standard And Method Rules. This is determined by the intensity of observational data obtained from field survey.

Hooded Robins, a keen resident of acacia-eucalypt woodlands

3. Fundamentals of the Method

This methodology is designed to operate at a 'large farm' scale, for a landscape with a diverse land use history. The objective is to develop a repeatable methodology for assessing landscape-scale projects in the range of 2,000-10,000ha of dispersed property, typically with a material quantity of remnant native vegetation and regenerating vegetation set within a commercial agricultural operation.

The method seeks to offer a robust but practical and cost-effective way to measure changes in native woodland birds, capturing both species richness and abundance, but noting that currently it only utilises species richness related data to calculate the Econd®.

The methodology outlined in this document has the following characteristics:

- It is designed to be undertaken by suitably experienced field ecologists[5] in collaboration with farm manager/employee with an interest in monitoring of their natural assets, a basic technical aptitude and a discipline to repeat surveying over time.
- It is constructed to transparently and consistently detect change in the condition of native birds (using metrics based on species richness and compositional elements)[6] over time.
- It is usefully informed by assessment and monitoring of native vegetation (so bird habitat) assets across the Kilter managed landscapes that, handily, are also subject of an existing Accounting for Nature® accredited native vegetation condition methodology.
- With the inherent variability in bird observational data the method, with a minimum of one annual measurement, it intends to detect change in condition that might be expected to occur over medium to long-term timeframes (e.g. 5-10 years), broadly consistent with KR farmland investment and development timeframes.
- It has been developed with an initial focus on woodland ecosystem types, due to the availability of suitable modelling which is used to develop condition metrics. At present such modelling and metrics are currently not available for non-woodland (e.g. grassland) ecosystem types that can be expected to be a significant component of some KR managed lands.

3.1 The Asset

The asset assigned to an account under this methodology is native woodland birds, an Environmental Asset under the Fauna Asset Class.

Native woodland birds are identified in the Working List of Australian Birds (Version 3) as developed by Birdlife Australia (2019). The Working List is used at the species level, noting that species populations are categorised in various ways (e.g. endemic, Australian, introduced, vagrant, extinct etc.).

An account under this method will be constructed at the bird community level, though based on the measurement of species level information.

5 Defined as people with a number of years of field experience surveying native birds with a high level of native bird identification skill and the ability to detect and count native birds using the 2ha-20 minute survey method.

6 For Kilter managed farmlands in SE inland Australia the compositional metric is the proportion of small-bodied bird species.

3.2 Indicators of Bird Condition

The calculation of bird condition in this methodology is founded on the Australian Temperate and Subtropical Woodland Bird Community (TSWBC) condition relationship described in Fraser et al. (2018). In the specific instance of the *Temperate South-eastern Mainland Australia subcommunity*, this relationship is an empirically derived metric requiring these best-fit predictors:

- the number of individual bird species; and
- the proportion of those that are small-bodied (<50g).

A difference to Fraser et al. (2018) is that this methodology is restricted to *native bird* species[7], whereas the former considers all (including exotic) bird species[8,9]. Analysis of data in early method implementation[10] shows that restricting to native species (for both richness and the proportions) marginally reduces calculated condition scores, so slightly raising the condition hurdle. The assumption of native is intuitively reasonable because the existence of exotic species can be deleterious to the occurrence of native species through aggression, competition and predation. The impact of exotic species incursion is arguably a greater issue in highly modified landscapes of the type that Kilter Rural is typically managing and rehabilitating.

This method links to the Kilter Rural native vegetation (NV) assessment methodology in that it (the latter) identifies the existence of woodland vegetation communities (or would-be communities) through its interrogation of pre-1750 Ecological Vegetation Community (EVC) mapping. The managed woodland area (existing or being restored) specified in a NV account provides the accounting area for the Woodland Bird account; and the generalised condition stratification for such can provide the basis for the woodland bird account.

Further work will be required to develop a companion condition metric for 'treeless' shrubland and grassland habitat which is the other major ecosystem type to be considered in inland SE Australia.

3.3 Sampling Design and Implementation

The principal design and survey characteristics of this method are:

- The starting point being the intensity of sampling that can be afforded (that delivers either an High (90%) or Moderate (80%) account) and then forming a reasoned stratification (based on woodland habitat type and generalized condition) to match this.
- The application of the 2ha-20 min field survey technique (Loyn, 1986).

7 This includes species classified under the Working List as vagrants, as well as all migratory.

8 The general reasoning applied in this method, as confirmed in discussion with Hannah Fraser (November 2022), being that non-woodland species tend to be large birds that would, tend to drive down the small-bodied proportion component of the metric.

9 There is no requirement in either approach that to be included a species must be a designated woodland species, the crucial factor being that the area being assessed is a determined woodland.

10 For Girgarre Project (AfN-PROJECT-18) woodland bird accounts 2021,22.

Pardalote nestbox

4. Implementing the Method

Implementing this method involves the following steps:

Step 1: Define accounting area
Step 2: Stratify the accounting area for survey
Step 3: Determine reference condition
Step 4: Design field surveys
Step 5: Conduct surveys
Step 6: Calculate condition scores and the Econd®
Step 7: Compile account and submit for Certification

Step 1: Define accounting area

A Kilter Rural managed project under this method can relate to a particular managed investment, or a geographically concentrated node of farmland within that investment.

While a project area relates to a farmland boundary, the accounting area within a project under this methodology relates to the intended woodland native vegetation footprint within the farmland area, where the intent of management is habitat protection, improvement and/or its restoration (i.e. an AfN 'project-scale' account, where all other areas are able to be excluded).

The rationale for the restriction to the existing or intended woodland vegetation footprint is that resources for bird surveys will always be constrained and therefore effort should be targeted to sites where management for biodiversity improvement is likely to be linked to changes in native bird species richness and abundance.

Other farm areas, where the focus is on agricultural production, will typically have much lower native bird diversity and it is reasonable to predict that this won't change much through time, although some impact is likely to be driven by temporal changes in land use (e.g. pasture to cropping etc.).

A project utilising this method will need to specify how far the accounting area extends into the agricultural precinct e.g. will it include corners of cropping paddocks that are not physically protected.

Box 1 explains how woodland designation is determined for a project's prospective accounting area.

Regenerating woodlands

Box 1: Determining if a site is a woodland

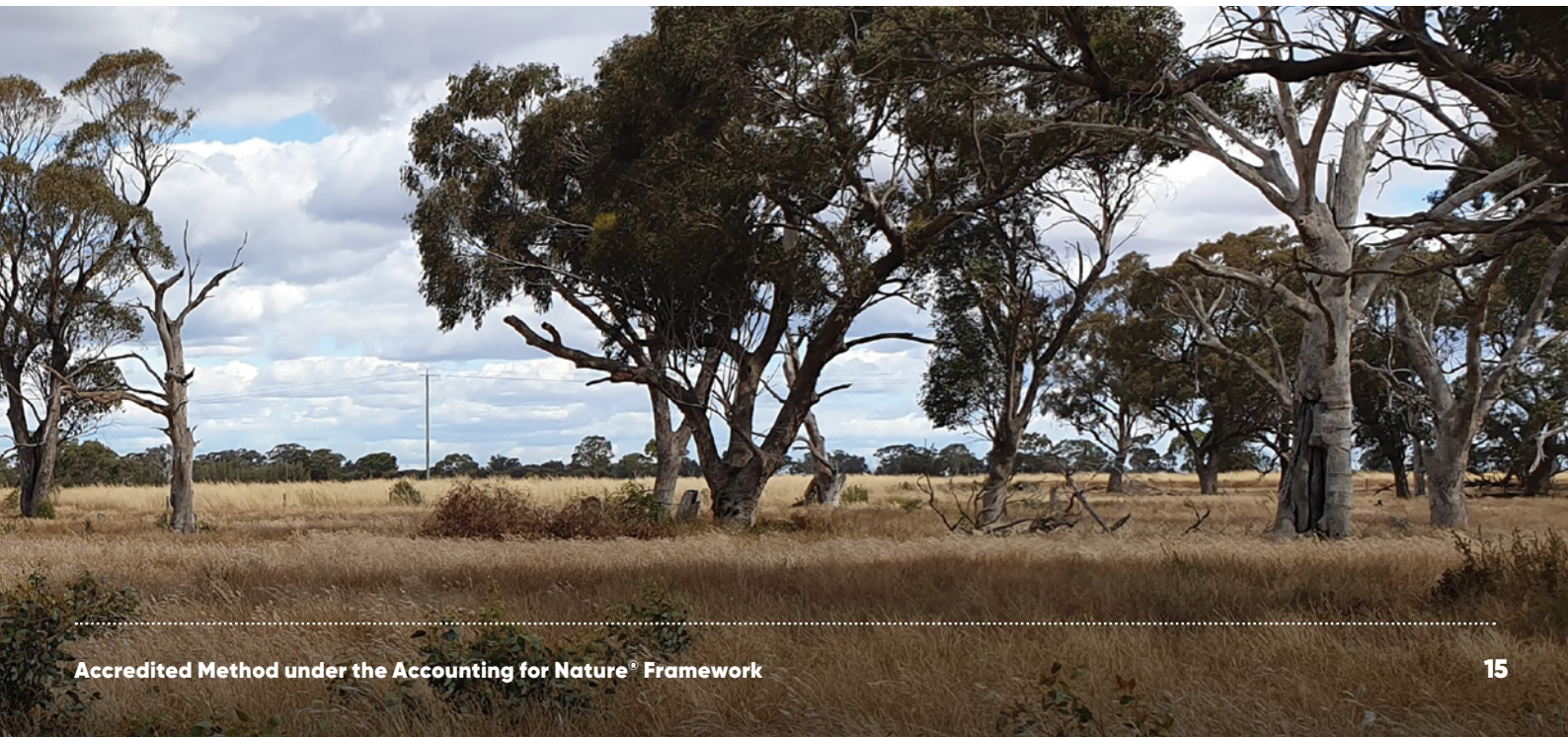
While Figure 1 represents the general extent of temperate and sub-tropical woodlands, including the *Temperate South-eastern Mainland Australia subcommunity* that is the explicit focus of this methodology, a variety of other habitat types (e.g. native grassland, rainforest, heathland) can also be found across this range. It is therefore important when applying the method to determine if the site can be characterised as a woodland. While this can often be established by a simple site assessment (e.g. presence of characteristic woodland flora species and structure), many sites, as is typical of KR managed properties, will be severely altered as a result of past management (e.g. clearing, agricultural intensification). As a result a site that was once a woodland may be dominated by exotic and non-woodland species.

Where woodland designation is physically unclear, the use of benchmark vegetation mapping (e.g. Victoria's pre-1750 Ecological Vegetation Classes) is the basic determinant of original woodland existence. Any expert judgment at the local level that further informs the distribution of reference woodland discrimination, especially that over-rides formal (usually coarser scale) mapping, is required to be explained in a project's information statement.

For the purposes of reporting, an account under this method can be constructed to enable calculation of native woodland bird condition for assessment units (AU) within a project's accounting area, but also potentially score condition to individual properties or appropriate aggregations of these within a multi-property accounting area. The ability to reach down to greater levels of spatial detail – especially to 'fixed' spatial entities such as a property – is important as the accounting area for Kilter projects, by their nature, are dynamic over time (esp. with the progressive addition of new properties to a project area).

The outputs from Step 1 will be:

A map defining the accounting area and surveyable 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. Details of these attributes shall be specified within a project's information statement.



Step 2: Stratify the accounting area for survey

Ascertain resources for survey

This method recognises that intensity of bird surveys will, in a commercial agricultural setting, be fundamentally constrained by availability of resources to fund the expertise required to undertake quality survey.

As such the starting point for prescribing a survey in this method is the intensity of sampling that can be afforded, then designing from this an appropriate stratification of the accounting area.

The selection of sampling intensity for a given project under this methodology (Table 2) will dictate whether it is afforded a High (90%) or Moderate (80%) Accuracy Level. The frequency of sampling, a minimum standard of just one survey per year in this method, will mean that an account under this methodology cannot achieve a Very High (95%) Accuracy Level.

Table 2: Survey intensity and Accuracy Level

Minimum requirement for bird survey intensity across survey zone	Accuracy level	Example project
1 x 20 min – 2 ha survey every 25 ha or less 1 seasonal survey effort per year	High (90%)	KAF Girgarre (20 sites over 290 ha of woodland NV)
1 x 20 min – 2 ha survey for every 25 to 150 ha 1 seasonal survey effort per year	Moderate (80%)	FFL Winlaton (40 sites over 3900 ha of woodland NV)

The ideal season for surveying is typically either spring or autumn and the intent is to undertake annual surveys in the same season over subsequent years. Where additional resources are available for survey then these can be applied in various ways to improve the rigor of survey, such as by (i) increasing survey intensity or by (ii) instituting multiple seasonal surveys each year.

Stratification and distributing survey sites

The stratification of the accounting area in this methodology is required to meaningfully distribute the planned number of sampling sites. Stratification should be a function of woodland vegetation-type and generalized habitat condition (for woodland birds). Typically the relative extent of vegetation-type strata would dictate how sampling sites are numerically apportioned, then expert judgment applied to distribute sampling sites across these strata taking account of a vegetation characteristic relating to habitat condition. However, in small or discrete project areas of just one or two woodland vegetation types, or of relative common habitat condition, it may be appropriate to apply a single stratification based on just one varying factor; or by applying some other demarcating characteristic of woodland bird habitat.

Vegetation type may be to the level of specific vegetation communities (e.g. EVCs), or groups of like-communities that form similar woodland bird habitats (e.g. riverine woodland, shrubby woodland , grassy woodland). The choice of EVCs or to the extent that they are suitable grouped will depend on the maximum number of vegetation type strata that can be meaningfully described by the affordable survey intensity (within High (90%) or Moderate (80%) Accuracy Level limits).

Habitat quality in the formative stages of Kilter managed regenerative landscapes is typically low, patchy and with fuzzy transitions even within a common management zone. The utility of expert judgment is therefore deemed the pragmatic approach to dealing with distributing sampling within vegetation-type strata rather than applying a strict or explicitly mapped vegetation quality attribute[11]. In applying judgment to distributing sites based on habitat quality an expert shall be mindful of both the:

- range of vegetation quality
- relative extents of the different vegetation quality

Some examples of approaches to distributing according to habitat quality:

- Allocating sites across a generalised condition classification within a vegetation type strata. At FFL Winlaton (example described below) this is undertaken on the basis of a semi-quantitative, expert-judged 3-category scale of condition (poor, moderate or good) for vegetation entities within a vegetation type
- By sampling across a range of maturity of vegetation, for instance on its classification as to whether it is a remnant, a new planting or an intended (future) planting
- By sampling according to the density of mature tree development and so using a categorisation such as remnant, scattered mature trees or isolated/absent mature trees. This was the approach applied in the Kilter managed Girgarre farmlands (2nd example below).

Further considerations such as patch size or proximity to core habitat zones could also be useful for distributing sites within vegetation-type/habitat quality strata. The approach applied will depend upon factors such as size, contiguity and historical nature of the project landscape.

The aim will be to satisfy an Accuracy Level of confidence (via survey intensity) across each of the accounting area strata in addition to the full-accounting area. It is reasonable, however, that some bias in survey intensity will be towards smaller, disconnected and widely varying areas of existing woodland over large areas of somewhat more homogenous, young regenerating and/or future (planned) woodland.

The intention of the described approach is to ensure that sampling is optimised, within practical constraints, to cover the range and extent of widely varying vegetation habitat across a typically inhomogeneous and incoherently vegetated (albeit regenerating) landscape. The method enables a pragmatic way of allocating constrained resources for survey while ensuring a robust and informative reporting outcome. An IS for an account under this method shall describe in detail how stratification and sampling distribution is applied.

Allocation of Assessment Units

In this methodology the generalised vegetation condition categories would typically be assigned as assessment units for an account. These categories represent a proxy for relatively homogeneous habitat quality for woodland birds, and so provide a control for variability across the accounting area. However, if habitat condition (or its proxy) is deemed to be relatively homogeneous across the entire accounting area, then assessment units could alternatively be defined on the basis of woodland vegetation-type categories. The explanation of an alternative (to condition category) assessment unit assignment is required to be explained in an information statement.

11 Though a vegetation quality stratification may already be pre-determined, and in a quantitative manner, by a sister NV account

Example 1: The FFL Winlaton farmlands

This project comprises 9,000 ha of farmland across 36 separate properties located between Kerang and Lake Boga in northern Victoria. The native vegetation area comprises 3,890ha ranging from woodland remnant, actively regenerated shrubby woodlands, to passively regenerating ex-irrigation land including grassland. Quality is generally poor but improving and interspersed with small areas of higher quality remnant.

Bird surveys were undertaken in November 2020. It was argued that 4 days of field effort plus time for planning, analysis and reporting) from a qualified ecologist was an acceptable level of resourcing, understanding that this could well be an annual cost. This equated to planning for around surveys at 44 sites that was ultimately achieved in the survey (4 of these serving as external reference sites).

Table 3 outlines the distribution of the 33 survey sites across the woodland EVC accounting area (2,661 ha) to satisfy a woodland bird account. Sites were stratified across three reference woodland EVCs, and then within each of these using a 3-point generalised native vegetation condition assessment (a proxy for woodland bird habitat condition) determined from the 2018 FFL Winlaton Trial Environmental Account.

Surveying averaged an intensity of 1 survey/81ha, within the requirements of a Moderate (80%) Accuracy Asset Account. The Moderate (80%) Accuracy requirement was also satisfied by each of the EVC strata.

A full worked FFL Winlaton case study with example Econd® calculation is presented in Appendix A.

Table 3: Stratification of the FFL Winlaton farmland for a Moderate (80%) Accuracy bird survey

EVC	Riverine chenopod woodland	Semi-arid chenopod woodland	Lignum swamp woodland	All
	RCW	SacW	LSW	
Area (Ha)	1,927	561	173	2,661
# Surveyed Sites	22	8	3	33
Good condition	6	0	2	8
Moderate condition	7	4	0	14
Poor condition	9	4	1	18
Intensity Ha/survey	88	70	58	81

Figure 2: Survey locations on part of the FFL Winlaton farmlands. Native vegetation footprint is shaded green with survey sites coded according to EVC

Eastern Yellow Robin, an attractive mid-sized robin occupying a wide-range of habitats across SE Australia

Example 2: The KAF Girgarre farmlands

This project comprises 1,500 ha of farmland across 8 separate properties centred near Girgarre in northern Victoria. Nearly 290 ha of this comprises limited remnant, but mostly new or planned native vegetation on ex-pasture lands, collectively defining the accounting area.

It was agreed that 2 days of field effort (plus planning and analysis) was an acceptable level of resourcing for bird survey in this project. It was expected that up to 25 sites could be surveyed in the 2 days.

Potential survey sites were distributed across a stratification of the NV footprint based on mapped vegetation type (EVC) and a woodland bird habitat condition proxy based on the maturity and density of trees on the farmland being restored to its original woodland type.

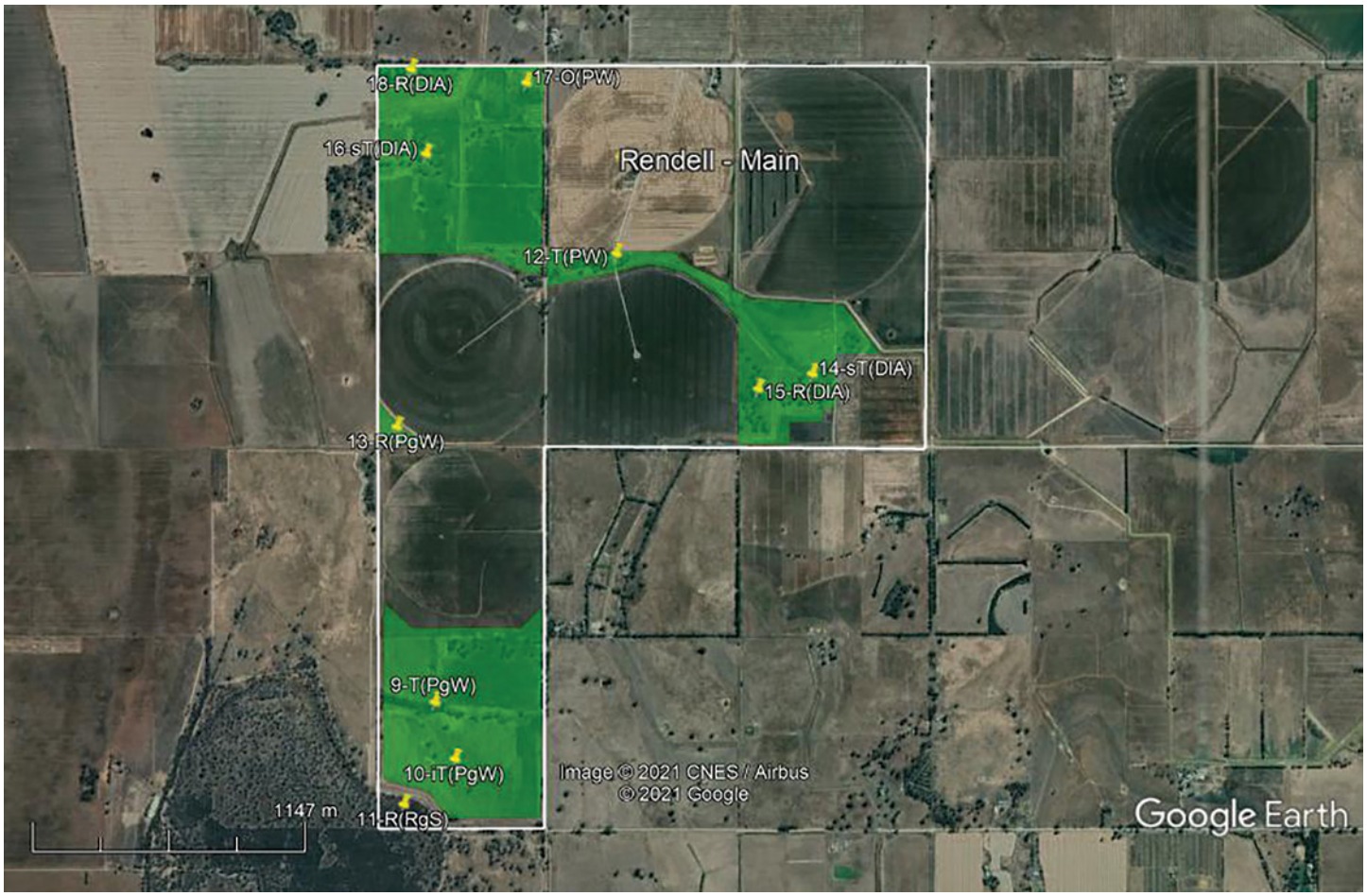
The field effort resulted in 20 surveys being completed, at an intensity of 1 survey/14ha and within the range of a High (90%) Accuracy Asset Account (upon observation the ornithologist undertook some reasoned rationalisation of the original 25 planned sites). Table 4 explains the stratification of survey based on EVC, then a further division based on the habitat condition proxy.

Table 4: Stratification of the KAF Girgarre farmland for a High (90%) Accuracy bird survey

EVC	Plains woodland	Grassy woodland	Lunette woodland	Redgum swamp	Drainage line veg.	All
	PW	GW	LW	RgS	DIA	
Area (Ha)	97	104	14	8	63	286
# Surveyed Sites	8	5	2	1	4	20
Remnant NV	0	1	0	1	2	4
Scattered tree patches	5	2	1	0	2	10
Isolated or no trees	3	2	1	0	0	6
Intensity Ha/survey	12	21	7	8	16	14

Powerful Owl, the largest of Australia's owls commonly preying on possums and large bats

Figure 3: Survey locations on the Rendell property of the Girgarre farmlands. Native vegetation footprint is shaded green with survey sites coded according to EVC and habitat condition proxy



The outputs from Step 2 will be:

Accounting area stratification and assessment unit (AU) extent will be described in map compatible with geographical information systems, such as a Google Earth .kmz or ArcGIS shapefile, in a commonly applied Australian datum such as the Geographic Datum of Australia 1994. The stratification rationale and distribution of AUs shall be specified within a project's information statement.

Step 3: Determine Reference Condition

The proposed method enables an estimate of native woodland bird condition at the site scale. As outlined previously, at the present time there is a good basis for estimating condition for woodland birds, but not for other bird communities such as those associated with shrubland and grassland ecosystems where further research is required to develop appropriately useful and robust metrics.

Reference Condition for the temperate southeastern mainland Australia woodland bird community can be best described as high species richness with a significant proportion of small bodied native bird species. While no specific reference condition benchmark is required to be identified in this method, the model developed by Fraser et al. (2018, refer to Box 2) implicitly accounts for reference condition by computing a condition score between 0 and 1, where 1 would represent the theoretical reference (or 'undegraded') condition and 0 would represent that the bird asset is completely degraded. Box 2 provides an overview of the method developed by Fraser et al. (2018) and an explanation of how this is applied to a survey site.

Box 2: Determining woodland bird community condition

Fraser et al. (2018) devised a method for estimating the condition of the Temperate and Subtropical Woodland Bird Community (TSWBC), comprising six geographically delineated subcommunities.

Condition values were generated through expert elicitation with respondents asked to assign absolute condition values on a scale of 0–100 to each of five woodland bird community calibration sites, based on species lists (from 2ha - 20min bird surveys), where 0 represents the worst possible condition and 100 represents the best possible condition of the TSWBC. The values for expert-judged community condition were examined as to how they related to the key variables identified as being likely to align with condition: (a) species richness, (b) the proportions of species that were small (<50 g), (c) the proportion of species primarily associated with intact communities and (d) the proportion of species primarily associated with degraded communities.

For the Temperate South-eastern Mainland variant subcommunity of the TSWBC, condition was found to be best characterised by species richness combined with the proportion of small bodied (<50g) species. Parameter estimates (See Table 2 in Fraser et al) were generated to describe the quantitative relationship between species richness and % small-bodied to determine site scale community condition. Based on this, site scale woodland bird condition can be estimated using the following equations:

1. *Cond_metric_logit = -2.03+(0.1*total species richness)+(1.63*proportion of small bodied species)*
2. *Condition metric = EXP(Cond_metric_logit)/(1+EXP(Cond_metric_logit))*

The output from the 2nd gives a site-based condition score of between 0 and 1, where 0 notionally represents an entirely clear landscape (of woodland birds) and 1 represents the 'reference condition' – a fully intact woodland bird community, with a high species richness and proportion of small-bodied species.

To illustrate the interplay between these parameters, data for four surveys (at different sites) are provided in Table A. Site surveys 1 and 2 represent actual data from the Winlaton FFL case study, with Survey 1 representing the highest condition score recorded and Survey 2 the highest species richness score recorded. Survey 3 represents a 'best on offer' example that is as close to a modern regenerated woodland condition as could reasonably be contemplated. Survey 4 is a hypothetical site that has been constructed to show a reference condition of ~1, benchmark condition.

Table A: Illustrative example of the relationship between species richness, small-bodied birds and woodland bird community condition

	Survey 1	Survey 2	Survey 3	Survey 4
General habitat condition	Moderate	Moderate	High	Reference
Total species richness	10	14	30	50
% Woodland species*	90%	93%	83%	100%
Number of small-bodied species	10	6	20	30
% small-bodied	100%	43%	67%	60%
Condition metric	0.65	0.52	0.89	0.98

*note that % Woodland species is a value used by Fraser et al. (2018) to assist designating whether a site can be attributed as a woodland or not (requiring to be >70% of all species recorded) if this is unable to be ascertained otherwise.

Step 4 & 5: Design & Conduct Field Surveys

The previous steps (esp. Step 2) have described an approach to selecting a set of sites that provide suitable coverage across the accounting area that accommodates the range of broad habitat types, habitat quality and landscape context.

Resource constraints mean that while it would be better to survey more sites on a regular basis (e.g. seasonally) this is unlikely to be feasible and therefore the following survey schedule is proposed:

- A 2ha - 20min survey for each selected site
- Surveys[12] are conducted annually, typically in autumn or spring[13], which is likely to coincide with a time when native bird species and numbers are at a peak

While it is recommended that the annual surveys be conducted by a suitably qualified and experienced field ecologist/ornithologist there may need to be a hybrid approach that matches available resources. For example this might be:

- Baseline (Year 1) survey conducted by field ecologist/ornithologist in tandem with Kilter Environmental Manager. This would enable the establishment of a robust baseline and provide an opportunity to build local skills and capability.
- The field ecologist (ideally the same person involved in the baseline assessment) to repeat survey every 3 years, with the Kilter Environmental Manager undertaking surveys in the two intervening years under the mentoring of the ecologist/ornithologist.

Depending on resource availability the field ecologist - environmental manager combination could undertake additional surveys at a subset of sites in a different season (e.g. autumn) to further inform aspects of condition (this may not necessarily be accounted for in the Econd®). Where there are multiple surveyors involved, particularly of varying experience, care will be required in representing trends to account for potential bias in judgment.

Step 6: Calculate site condition scores and the overall Econd®

The approach to calculating the overall Econd® for a project's accounting area first requires the native bird condition scores to be calculated for each survey site (the below steps are for the *Temperate South-eastern Mainland Australia woodland subcommunity, see Appendix B for the approach for other subcommunities*):

1. Calculate the total native species richness (i.e. number of native bird species).
2. Calculate the proportion of these species that are small-bodied birds (<50g) for each.
3. Calculate the site-based condition metric according to the following equation steps[14]:
    - Cond_metric_logit = -2.03+(0.1*total native species richness)+(1.63*proportion of small bodied species)
    - Condition metric = EXP(Cond_metric_logit)/(1+EXP(Cond_metric_logit))

In the case that there are multiple surveys for a site in a given survey period (that exceeds the minimum standard for this methodology) then the survey condition metrics are averaged for the site to give a site condition metric.

The output of these steps results in a site-based condition score of between 0 and 1 for each site, where 0 represents an entirely cleared landscape (of woodland birds) and 1 represents a fully intact woodland bird community. Multiply this output by 100 to translate to a site-level Econd®.

From this, the overall Econd® for native woodland birds can be calculated with the following steps:

1. Calculate the average condition scores for each assessment unit (e.g. areas of generalised habitat condition quality) using the average of all sites for each assessment unit.
2. Calculate the overall native woodland bird condition Econd® as the area weighted average of the AU scores (i.e. using the proportion of the area of each AU relative to the full accounting area).

This process is demonstrated in the Appendix A case study.

12 The survey design aims to balance what is feasible from a resource perspective and what might be ideal - noting that 1 day of survey effort may allow coverage of ~10 sites (each surveyed singularly) depending upon local logistics

13 For determining temporal trends the seasonality of surveys needs to be consistent for a given project registered under this method

14 As described in Fraser et al (2019)

Though currently restricted to woodland, this is a step towards a future more comprehensive Econd® for native bird condition across all broad habitat types, pending the development of suitably robust condition metrics for non-woodland habitat communities.

While not included in the Econd® calculation the 2ha – 20min survey employed in this methodology can enable the collection of species abundance data. The challenge for calculating a scaled condition score (and future inclusion into the Econd®) based on abundance is the paucity of empirical data for species abundance and the derivation of definitive and stable reference values. Only with the knowledge from acquisition and analysis of data over time might sensible and reliable values be attained to enable this.

Ultimately the benefit of collecting survey data on both species richness and species abundance means that condition scores can be represented in a variety of different ways that provide insights to the influence of management decisions as well as underlying trends in bird populations.

Step 7: Compile Account

This methodology will produce as a final output:

- 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 the 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.

Preparing the Information Statement (IS)

The 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 farmland currently located in northern Victoria, it is intended that it is extendable to other semi-arid woodland landscapes of inland SE Australia.

A specific project, through an IS, will need to uniquely describe the nature of its woodland bird assets and reference benchmarks.

Comparing accounts over time

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 has implications for a varying accounting area over time.

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; or that surveys are undertaken in different seasons – will likely require adoption of broken line series.

Further, with observational data that is expected to have high random variability, the strength (and therefore presentation) of trends may be enhanced by applying moving averages over multi-year windows that may have implications for reporting requirements identified in future iterations of this method[15].

Even though the accounting area may change, meaningful comparisons of change will be able to occur for 'permanent' spatial entities such as a given property and obviously for individual survey sites.

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15 This method is expected to evolve over time through practice

Appendix A: Winlaton FFL Case Study

This case study provides a worked example of a native woodland bird account for the Winlaton FFL landscape. The case study provides for a simple demonstration of the method (with assumptions) built on real survey data.

From the 19th-23rd November 2020, bird surveys were conducted at selected sites on properties owned by Kilter Rural with a small number of additional sites on crown land that were chosen as reference sites for comparison. The surveys were undertaken by Chris Tzaros, a highly experienced ornithologist and field ecologist.

A total of 44 surveys were singly distributed on sites across four different Ecological Vegetation Classes. However, for the purposes of the Econd® relevant to this Method (so just Woodland sites) and excluding the off-farm reference sites, these are distributed as:

1. 22 surveys/sites on Riverine Chenopod Woodland
2. 3 on Lignum Swamp Woodland
3. 8 on Semi-arid Chenopod Woodland

The case study accounting area assumes three 'woodland' EVC types on the protected native vegetation footprint within the farming boundary of the Kilter properties.

Each survey site was classified into one of three condition classes (poor, moderate, good) based on native vegetation assessment scores, calculated as part of the 2018 Winlaton farmland trial environmental account and using the following (dimensionless) threshold values:

- < 40 - Poor
- 40 -50 Moderate
- > 50 - Good

Table A1 provides a summary of the stratification of survey sites across the three EVCs and three condition states. Whether by EVC or condition class (and so also the full accounting area), survey density lies within a Modeate (80%) Accuracy account thresholds (25-150 ha/site).

Table A1: Summary of survey effort

EVC	Area (Ha)	Total number of sites	Number of sites by condition class			Survey density (Ha/site)
			Poor	Moderate	Good	
Riverine chenopod woodland	1,927	22	9	7	6	88
Semi-arid chenopod woodland	561	8	4	4	0	70
Lignum swamp woodland	173	3	1	0	2	58
Total number of sites		33	14	11	8	
Total area (Ha)	2,661		1,212	898	497	
Survey density (Ha/site)			86	82	62	81

The following steps were then undertaken to undertake the woodland bird community condition scores for each survey site:

1. Calculate total species richness (of native species)
2. Calculate the proportion of all native species at the site that are small birds (<50g)
3. Calculate condition metric.

Table A2 shows a worked example of these steps for five selected survey sites.

Table A2: Worked example of steps involved in calculation of the condition metric

Site code	DMIR4	FOSC5	KCLO2	JMOR4	JMOR5
EVC	Riverine chenopod woodland	Riverine chenopod woodland	Riverine chenopod woodland	Lignum swamp woodland	Semi-arid chenopod woodland
Condition class	Poor	Moderate	Good	Good	Moderate
Total # native bird species	7	8	12	10	6
# small-bodied bird species	0	1	4	9	1
% small-bodied birds	0%	13%	33%	90%	17%
Condition metric	0.21	0.26	0.43	0.61	0.24

The condition classes are attributed as the assessment units in this case study. Woodland bird condition within each AU is calculated as the average of condition scores across all survey sites within it (Table A3).

Table A3: Average woodland bird community condition scores by site condition classes

Site condition class (and AU)	Number of sites	Woodland bird condition score (average)	Site score range
Poor	10	0.26	0.15-0.57
Moderate	15	0.27	0.16-0.43
Good	8	0.34	0.18-0.61

As set out in Table A4, the Econd® is calculated as the area weighted average of woodland bird community condition scores according to the proportional extent of each condition class (assessment unit).

Table A4: Econd® calculation

EVC	Extent (ha)	Assessment unit extent (ha)		
		Poor condition	Moderate condition	Good condition
Riverine chenopod woodland	1,927	771	771	385
Semi-arid chenopod woodland	507	355	172	34
Lignum swamp woodland	173	87	0	87
Woodland EVCs	2,607	1,212	898	497
Assessment unit condition metric		0.26	0.27	0.34
Assessment unit score		26	27	34
Woodland bird Econd®		27		

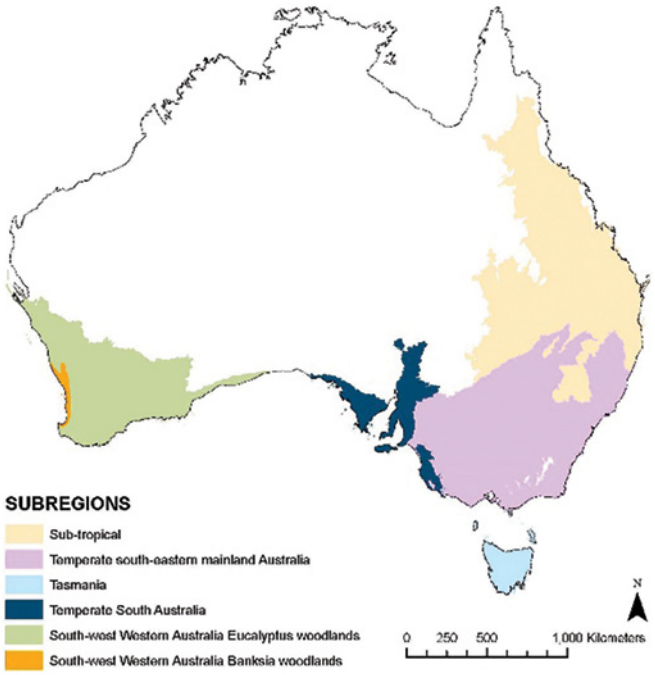
Red Wattle Bird, a large domineering honeyeater with a characteristic raucous call

Appendix B:
Applying the Method to other Woodland Ecoregions

This method can be translated to other subregional woodland variants of the Temperate and Sub-tropical Woodland Bird Threatened Ecological Community.

By substituting relevant metrics and their parameters in the wooodland bird condition equation of Fraser et al. (2018) this method can be applied to other woodland variants of geographical occurrence as shown in Figure B1.

Figure B1: ecoregional variants of the Temperate and Sub-tropical Woodland Bird Threatened Ecological Community[1]



The woodland bird condition metric of each subregion is a function of a selection of the following indicators found to be associated with the condition of the woodland bird community:

1. No. of species (richness)
2. % of small-bodied birds (<50 grams)
3. % of native woodland birds that are associated with intact woodland bird communities. It is important to note that in this context intactness relatesto the bird community, not to the native vegetation or habitat[2].

As described in s3.2, an adaption in this methodology to the condition equations of Fraser et al (2018) is that all the indicators are relative to native bird species (i.e. exotic species excluded).

These indicators (with the above-mentioned method adaption) are described more fully below, while Table B1 outlines the relevant indicators and equations that should be applied to determine condition of woodland bird communities for each ecoregion.

Condition Indicators

Total Native Species Richness

This is the number of native bird species observed at a site.

Proportion small-bodied species

This describes the proportion of the total native species list for the site that are small-bodied (< 50 g at maturity) birds.

Proportion of species associated with intact communities

This describes the proportion of the total native species list for the site that are associated with intact woodland bird communities.

Ecoregional indicators and equations

Substitute the following condition equations for a project in a given ecoregion into Step 6, s4 of this methodology. Please also refer to Fraser et al. (2018) for fuller context and understanding the derivation of these equations.

1 Appendix S1. Detailed Methods for Fraser, H., Simmonds, J. S., Kutt, A. S., and Maron, M. (2018). Systematic definition of threatened fauna communities is critical to their conservation. Diversity and Distributions, (January), 1–16

2 As described in Fraser et al. (2018) This distinction is important, because there is often limited direct relationship between vegetation community condition (typically measured in relation to floral and structural composition) and the species richness or composition of woodland bird communities (Fraser, Rumpff, Yen, Robinson, & Wintle, 2017).

Table B1: Ecoregional indicators and equations

Ecoregion	Key condition indicators	Condition equations
Subtropical Queensland woodlands	› Total Native Species Richness › Proportion of small bodied species <50 g	1. Cond_metric_logit = -2.01+(0.12*total species richness)+(1.60*proportion of small bodied species) 2. Condition metric = EXP(Cond_metric_logit)/(1+EXP(Cond_metric_logit))
Temperate South-eastern mainland woodlands	› Total Native Species Richness › Proportion of small bodied species <50 g	1. Cond_metric_logit = -2.03+(0.1*total species richness)+(1.63*proportion of small bodied species) 2. Condition metric = EXP(Cond_metric_logit)/(1+EXP(Cond_metric_logit))
South Australia woodlands	› Total Native Species Richness › Proportion of small bodied species <50 g	1. Cond_metric_logit = -2.54+(0.13*total species richness)+(1.65*proportion of small bodied species) 2. Condition metric = EXP(Cond_metric_logit)/(1+EXP(Cond_metric_logit))
Tasmania woodlands	› Total Native Species Richness › Proportion of these associated with intact communities	1. Cond_metric_logit = -1.67+(0.1*total species richness)+(1.78*proportion intact) 2. Condition metric = EXP(Cond_metric_logit)/(1+EXP(Cond_metric_logit))
South-west Western Australia Banksia woodlands	› Total Native Species Richness › Proportion of these associated with intact communities	1. Cond_metric_logit = -1.00+(0.14*total species richness)+(0.16*proportion intact) 2. Condition metric = EXP(Cond_metric_logit)/(1+EXP(Cond_metric_logit))
South-west Western Australia Eucalyptus woodlands	› Total Native Species Richness › Proportion of these associated with intact communities	1. Cond_metric_logit = -0.48+(0.05*total species richness)+(1.06*proportion intact) 2. Condition metric = EXP(Cond_metric_logit)/(1+EXP(Cond_metric_logit))

Appendix C: Documentation Checklist for Audit

The output of each step is required to be submitted as supporting documentation to help with audit of an account developed under this Woodland Bird methodology. Unless otherwise indicated (such as items that are included in the Information Statement), the below supporting documents are considered confidential.

Method step	Required outputs (and format type)
1: Define Accounting Area (AA)	A **description** of the accounting area including location and size (IS). A **table** describing the purpose and scope of the account (IS). A **map** showing the accounting area (GIS file such as kmz, shp to an appropriate Australian datum).
2: Stratify the AA for survey	A **description and justification** of the stratification process (IS). **Map(s)** of the stratifying characteristics - typically of local woodland types and their condition (GIS). **Map** of the assessment units - typically one of the stratifying characteristics (GIS).
3: Define reference condition	This is implicit in the condition equations applying to the woodland subcommunity included in an account under the methodology
4&5: Design and conduct field surveys	**Map** of survey site locations - of centres of 20 min – 2ha surveys (GIS). **Survey location descriptions** including coordinates, assessment unit (AS). A **data table** of survey data (AS) including tagging each species as: › Native or non-native › Small-bodied (<50g) or larger (>50g) (in relevant ecoregions) › Associated with intact woodland bird communities or not (in relevant ecoregions)
6: Calculate condition scores and the Econd	A **data table** containing site-level Econd® scores and contributing indicator scores (AS). **Translation table(s)** that convert site level data to assessment unit Econd® scores and an overall Econd® (AS).

Method step	Required outputs (and format type)
7: Compile account and submit for accreditation	**Account spreadsheet (AS,** e.g. Excel workbook or other approved format) providing a consolidation of the survey data and its translation to condition scores. **Information Statement (IS)** describing all facets of the account. **Environmental Account Summary (AS)** – a leading section of the IS. Digital folder containing **spatial datasets (GIS)**.
Useful information to appropriately include in documents	**Aerial images and/or photos of survey sites** to support stratification. **Name and credentials of surveyor.** **Supporting expert resource(s)** that underpin the Environmental Account and Econd® (for example of a qualified expert).
General hints	**In the EA provide clarity between the raw data and its transformation(s) in generating an Econd®.** **Judicious use of trendlines through data** that may be inherently noisy and/or that maybe of varying/multiple seasons.
Abbreviations:	Accounting area ..... AA Account spreadsheet ..... AS Environmental account (general) ..... EA Environmental account summary ..... EAS Geographic spatial file of appropriate digital format ..... GIS (file) Information statement ..... IS

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