

## 7. Native Fauna

### Key Findings

- Two NRM regions provided information for native fauna environmental accounts using a combination of survey data, threatened status and expert analysis.
- The trial has demonstrated that threatened species lists can be used to provide a broad understanding of the condition of vertebrate native fauna (mammals, birds, reptiles, amphibians, fish) at a regional scale. They are not able to describe trend, nor are they suitable for regional scale policy or investment decision making.
- It is possible to construct more detailed regional scale accounts for native birds by assigning a condition score based on a combination of survey data, threatened status and expert analysis. For this method to produce reliable trend data, adjustments will need to be made to standardise existing bird survey programs.
- Rapid advances in remote sensing and telemetry technologies such as motion sensor cameras and audio recognition systems are currently being trialled at a property (reserve) scale by a range of organisations, and these technologies may improve the quality and viability of regional scale native fauna monitoring in future.



### Introduction

Changes in land use and management and the introduction of feral pests and weeds have placed significant pressures on Australia's native fauna (State of the Environment Committee 2011).

For over a decade, successive national, state and territory State of the Environment reports have reported that information on individual fauna species or groups of fauna species remains poor (State of the Environment Committee 2011). As a result, it is difficult to determine trends in condition of Australia's native fauna although overall trends are presumed to be in decline. Reversing the decline in native fauna relies, in part, on better understanding of the current threats and changes in populations for species in Australia (Likens and Lindenmayer 2011). Human-induced pressures on native fauna occur at local or regional scales, and management must be informed by data on changes to fauna that have been generated at those scales (DEWHA 2009).

At present there is no standardised set of indicators for measuring the condition of native fauna, and jurisdictional reports differ from one another in terms of indicators used, approaches taken, and styles and periods of reporting (ACEAS n.d.). Defined indicators are used in formal conservation listing processes; however, the major weaknesses are that they are not sensitive to small changes in populations, not all species on the lists are monitored so changes in status are not necessarily detected (DEWHA 2009), and these processes do not provide spatial information on which to base land use policies or on-ground investments.

Native fauna is identified as an environmental asset in 80% of NRM regional strategic plans, often described as threatened species, migratory species or biodiversity (GHD 2012). Native fauna accounts were submitted by four of these regions as part of this trial. This chapter presents an analysis of the NRM regions' approaches to the measurement of native terrestrial fauna condition as part of the trial. Marine fauna are covered in a separate chapter.

Four different approaches to assessment of native fauna were presented for evaluation during the trial (**Table 45**):

- Combining bird monitoring data, historical bird lists from the region and threatened status information with expert analysis to produce regional condition accounts for native birds (Central West CMA, Northern Agricultural Catchments Council);
- Vertebrate fauna assessments using regional interpretation of threatened species listing processes (Central West CMA);
- Vertebrate fauna assessments using state-wide threatened species assessments (Queensland Murray Darling); and
- Using habitat condition as a surrogate measure of native fauna (SEQ Catchments).

Table 45: Assets and indicators of condition for native fauna accounts.

REGION	Focus of account	Faunal groupings	Indicators of condition
Central West Catchment Management Authority	All Vertebrate fauna	five vertebrate classes: mammals, birds, reptiles, amphibians, fish five functional groupings of birds: resident, regular visitor, irregular visitor, vagrant, exotic	Species richness Assigned condition score
Northern Agricultural Catchments Council	Native Birds	five functional groupings: resident, regular visitor, irregular visitor, vagrant, exotic	Assigned condition score
Queensland Murray-Darling Committee	Threatened species	Threatened species described in state listing processes	Assigned condition score
SEQ Catchments	Habitat	Used 'habitat' as a surrogate measure	Habitat extent

Use of state-wide threatened species lists was not considered suitable for a regional account as it does not provide a region-specific understanding of the condition of native fauna. Habitat was also not considered an appropriate measure of the condition of native fauna, because even supposedly pristine habitat can contain foxes and other feral animals which impact on the condition of many native animals (DEWHA 2009), while exotic vegetation can provide habitat for native fauna. These two methods are not discussed further.

## Comparison of Approaches

**Vertebrate Fauna Accounts:** Accounting for the condition of all known native fauna species at regular intervals to measure trend is the ultimate objective of a native fauna account. This is impractical for two reasons. Firstly, not all species have been identified. For example, invertebrates constitute the majority of species of fauna, but relatively few have been described, let alone studied. The second reason is that even with the rapid advances in remote sensing technology in recent years, it is still impossible to regularly monitor across a landscape the presence and abundance of most of those species that have been identified.

Vertebrates are the only faunal group in which most species have been described, and are therefore the obvious candidates for use in environmental accounting. The challenge for vertebrate monitoring is that many Australian mammals, amphibians and reptiles are cryptic and nocturnal, making them difficult and expensive to detect and monitor across a landscape at present. Rapid advances in remote sensing technologies, such as motion sensor cameras and audio recognition systems built from voice recognition software, may improve the viability of native vertebrate fauna monitoring in future.

**Native Bird Accounts:** Unlike many mammals, reptiles and amphibians, native birds are more amenable to record and study. Birds are conspicuous, have been well studied, and are relatively easy to identify without catching and handling. While official bird counts in some parts of the world go back centuries, Australia is the only continent over which two bird atlases have been conducted (1977-1981 and 1998-2002) and while continental coverage is limited, many thousands of BirdLife Australia volunteers collect data from a wide range of localities (Birdlife Australia 2014). Technological advances such as Eremaea eBird (Audubon Society & Cornell Lab of Ornithology, 2014) currently produce 8,000 bird lists each month across Australia, primarily from volunteers.

### Classification of Assets

Central West CMA contributed two asset accounts: one account for the five vertebrate groups (mammals, birds, reptiles, amphibians and fish) and a more detailed account for native birds. Northern Agricultural Catchments Council provided a detailed regional account for native birds.

#### Native fauna assets:

The Central West CMA native fauna account was created by commissioning an expert assessment of state and national threatened species lists to describe the condition of each native vertebrate species. This information was then aggregated to provide a measure of the overall condition of each of the five vertebrate fauna groups across the region

**Native bird assets:**

Birds are conspicuous, well-studied taxa in Australia and the breadth of existing information provided an opportunity to test the feasibility of using this information to measure the condition and trend of native birds. The results of this analysis are documented in a methods paper (D. Saunders, Sbrocchi, McDonald, Tulloch & Possingham 2015) (see **Supplementary Material 6**).

Employing advice from the methods statement on birds (Saunders *et al.* 2015), bird assets in Central West and Northern Agricultural Catchments were categorised by ecologists based on their pattern of occurrence within a region (Saunders and McAleer 2012):

- Resident: apparently present all year;
- Regular visitor: not present all year, but conform to a regular pattern of occurrence;
- Irregular visitor: not present all year or every year, but when present are present at similar times of year;
- Vagrant: rare occurrence, conforming to no pattern of occurrence; and
- Exotic: not native to the region.

Both the Central West CMA and Northern Agricultural Catchments Council used this method to produce a regional scale bird asset account. Central West CMA also assigned these categories across three different landscape formations to produce separate accounts for plains, slopes and tablelands within the region (**Figure 47**).

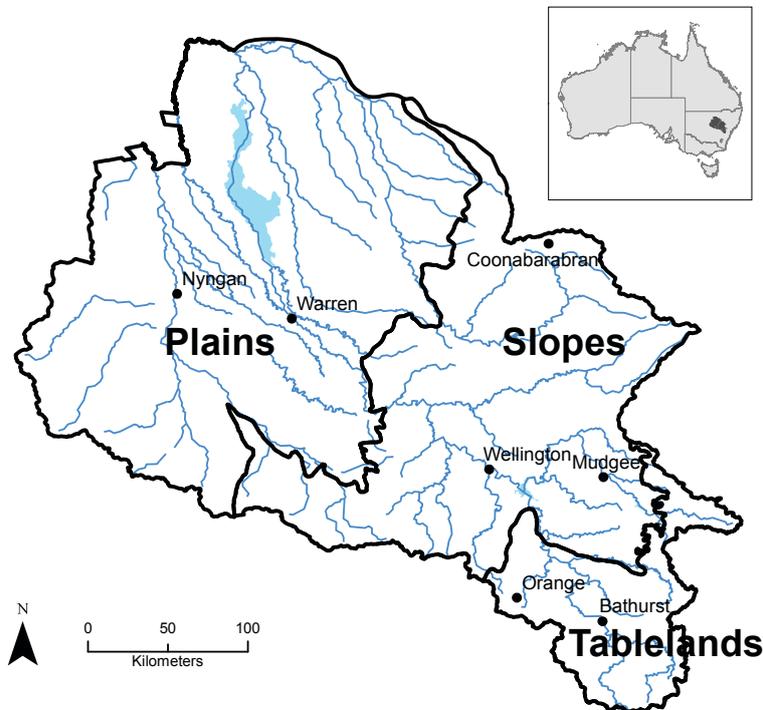


Figure 47: Landscape formations used to assign native bird categories, Central West CMA region, NSW

**Selection of Indicators and Estimation of Reference Benchmarks**

The native fauna account for the NSW Central West CMA region and the native bird accounts for the Central West CMA and Northern Agricultural Catchments Council region in WA both used expert analysis to assign an indicator condition score based on the threatened status of each species.



This approach is based on a broad interpretation of the EPBC and IUCN criteria for determining threatened status (IUCN, 2012):

- Least concern (LC): species is widespread and abundant in the region (condition score 100);
- Near threatened (NT): species is likely to become endangered in the near future as a result of threats operating in the region (condition score 70);
- Vulnerable (VU): high risk of endangerment of the species in the region, where threats operating are resulting in major declines in range and abundance (condition score 30);
- Endangered (EN): high risk of species becoming extinct in the region (condition score 10);
- Critically endangered (CE): severe reduction in numbers with 20% probability of extinction in the region in the near future (condition score 5); and
- Extinct in the region (EW): species is regionally extinct in the wild (although it may exist in other regions) (condition score 0).

The difference between the Central West CMA and Northern Agricultural Catchments Council's native birds accounts is that the latter was able to access a number of historical bird survey lists, which provided a higher level of precision and also creates potential to show trend in the condition of bird species across the region over time.

### Data Sources and Analysis

Data for Central West CMA's vertebrate fauna and native bird accounts were sourced from a study commissioned as part of the region's strategic planning process (Goldney *et al.* 2007) based on a report (Goldney, Kerle & Fleming 2007).

For their native bird account, Northern Agricultural Catchments Council used 12 historical lists of birds of the region, data from two Bird Life Australia atlases (1977-1981 and 1998-2002), data from long-term weekly bird records (1987-2002 and 1988-2013) from two large properties in the region, state and federal threatened species lists and expert opinion (Table 46). For details of methods see the Working Paper 2 in Supplementary Material 5 (Sbrocchi *et al.* 2015).

Table 46: Sources of data and analysis for native fauna accounts used in the environmental accounts trial.

REGION	Focus of account	Data Source	Analysis
Central West Catchment Management Authority	Vertebrate fauna Birds	Goldney and Kerle, based on regional conservation listings (Goldney <i>et al.</i> 2007) Atlas of Living Australia	Dr Anne Kerle
Northern Agricultural Catchments Council	Birds	(Denis A. Saunders & McAleer, 2012) (Denis A Saunders & Doley, 2013)	Dr Denis Saunders

### Indicator Condition Scores

Table 47 provides an example of how the regional interpretation of threatened species listing criteria is able to be used to assign a condition score for native birds in the Northern Agricultural Catchments Council region of WA. Only resident species, regular visitors and irregular visitors were used to create the regional account. Vagrant and exotic species were excluded (see Working Paper Series in Supplementary Material 5). Indicator condition scores calculated for each species for both regions are available in the online accounts spreadsheets (NRM Regions Australia).

**Table 47: Assigned condition scores for a selection of native bird species within each functional group in the Northern Agricultural Catchments Council region, WA.**

Functional Group	Common Name	Scientific Name	Assigned Condition Score
Resident	Emu	<i>Dromaius novaehollandiae</i>	30
	Whistling Kite	<i>Haliastur sphenurus</i>	5
	Australian Bustard	<i>Ardeotis australis</i>	10
	Australasian Grebe	<i>Tachybaptus novaehollandiae</i>	100
	Grey Currawong	<i>Strepera versicolor</i>	10
	Silvereye	<i>Zosterops lateralis</i>	30
	Zebra Finch	<i>Taeniopygia guttata</i>	100
Regular visitors	Grey Fantail	<i>Rhipidura fuliginosa</i>	100
	Rufous Songlark	<i>Cincloramphus mathewsi</i>	30
	Western Gerygone	<i>Gerygone fusca</i>	30
	Little Crow	<i>Corvus bennetti</i>	100
	Sacred Kingfisher	<i>Todiramphus sanctus</i>	30
	Rainbow Bee-eater	<i>Merops ornatus</i>	100
	White-winged Triller	<i>Lalage sueurii</i>	30
Irregular visitors	Little Button-quail	<i>Turnix velox</i>	100
	Banded Stilt	<i>Cladorhynchus leucocephalus</i>	100
	Fairy Martin	<i>Hirunda ariel</i>	30
	Crimson Chat	<i>Epthianura tricolor</i>	100

**Table 48** shows the results of aggregating the indicator condition scores for individual species into the categories of residents, regular visitors and irregular visitors in the Northern Agricultural Catchments Council region of Western Australia. Where species are grouped in categories, it is common practice to take the median of the scores to calculate the regional score. However, because the condition score was based on broad criteria, it would require a substantial change in the scores of individual species to reflect change in the overall score for any fauna group. It was therefore decided that taking the mean was a more fitting function to apply to the data (Hugh Possingham, pers. comm.).

**Table 48: Assigned Indicator Condition Scores, grouped into three functional categories (resident, regular visitors and irregular visitors) for the Northern Agricultural Catchments council region, Western Australia.**

Class	Indicator (unit)	Reference Benchmark	2012		
			Measure	ICS	Econd
<b>Total</b>					<b>75</b>
<b>Residents</b>					<b>60</b>
	Assigned condition score	100	60	60	
<b>Regular visitor</b>					<b>81</b>
	Assigned condition score	100	81	81	
<b>Irregular visitor</b>					<b>84</b>
	Assigned condition score	100	84	84	

## Environmental Condition Index (*Econd*)

In these native fauna accounts, indicator condition scores were based on a single indicator, so *Econds* and indicator scores for individual species have the same value. Individual species *Econds* were calculated and then averaging scores were used to calculate regional *Econds*. **Table 49** is an example of the Native Fauna account for the Central West CMA region. It shows the *Econds* for a subset of each of the fauna species in the actual account, and the results of their aggregation to describe the overall condition of each of the five vertebrate groups.

**Table 49: Selection of the Native Fauna Asset Condition Account for the Central West CMA region of NSW, showing regional *Econds* and *Econds* for a sample of species for each of the five vertebrate groups.**

Mammals		Birds		Reptiles		Amphibians		Fish	
Native Species = 68		Native species = 309		Native species = 113		Native species = 36		Native species = 17	
Regional Econd = 32		Regional Econd = 28		Regional Econd = 60		Regional Econd = 48		Regional Econd = 27	
Name	<i>Econd</i>	Name	<i>Econd</i>	Name	<i>Econd</i>	Name	<i>Econd</i>	Name	<i>Econd</i>
Platypus	30	Emu	30	Broad Shelled River Turtle	100	Eastern Sign Bearing Froglet	100	Flyspecked Hardyhead	30
Short Beaked Echidna	30	Malleefowl	10	Eastern Long Necked Tortoise	100	Common Eastern Froglet	100	Crimson Spotted Rainbow Fish	10
Tiger Quoll	10	Stubble Quail	30	Murray Turtle	100	Sloan's Froglet	30	Bony Herring	30
Brush Tailed Phascogale	0	Brown Quail	30	Marbled Gecko	100	Giant Burrowing Frog	30	Mountain Galaxias	30
Yellow Footed Antechinus	30	King Quail	10	Spiny Tailed Gecko	30	Eastern Banjo Frog	30	Australian Smelt	30
Brown Antechinus	30	Kookaburra	100	Eastern Spiny Tailed Gecko	100	Long Thumbed Frog	30	Olive Perchlet	10
Western Grey kangaroo	100	Major Mitchell's Cockatoo	30	Highland Copperhead	100	Giant Banjo Frog	30	Golden Perch	100
Narrow Nosed Planigale	10	Wandering Whistling Duck	30	Dwyer's Snake	30	Ornate Burrowing Frog	0	Flathead Gudgeon	30

In the Northern Agricultural Catchments Council region, *Econds* for each native bird species were aggregated for the three functional groups of resident, regular visitors and irregular visitors (**Table 48**). It shows that resident species were in a poorer condition (Resident Bird Species *Econd* 60) than either Regular Visitors (*Econd* 81) or Irregular Visitors (*Econd* 84).

In the native bird asset account for the Central West CMA region, these three functional groups were also able to be described for the three land systems within the region (**Table 50**). It shows that in all zones in this region (tableland, slopes and plains), resident birds showed a higher condition than regular visitors, and irregular visitors showed the lowest condition overall.

**Table 50: *Econds* for Native Bird Assets within different land systems within the Central West CMA region of NSW**

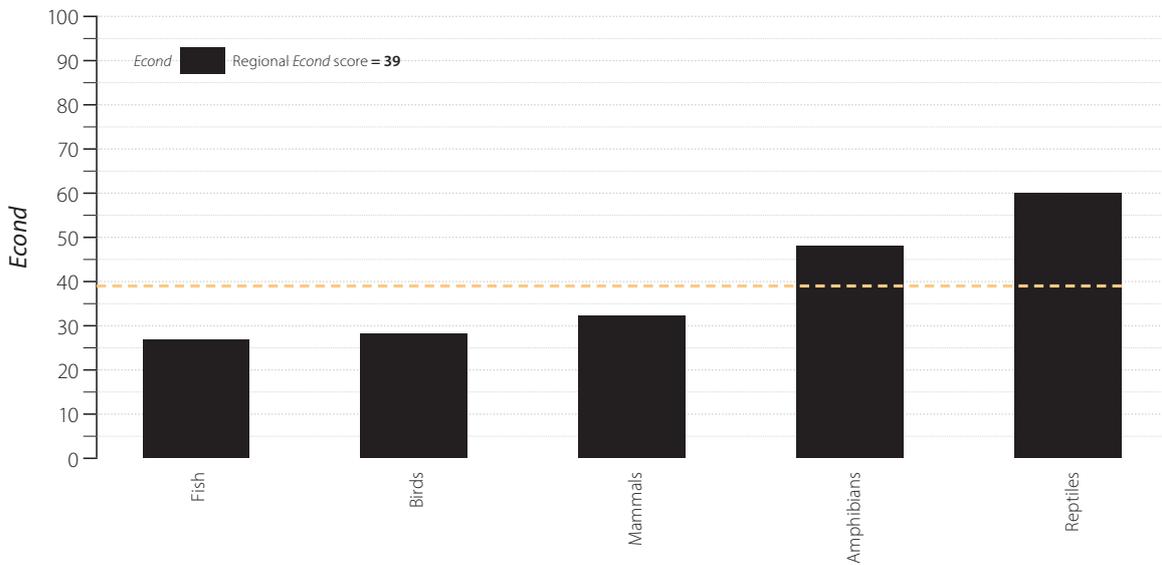
Class	Indicator (unit)	Reference Benchmark	2007	
			ICS	<i>Econd</i>
Tablelands	Residents	100	37	30
	Regular visitors	100	27	
	Irregular visitors	100	26	
Slopes	Residents	100	34	27
	Regular visitors	100	28	
	Irregular visitors	100	20	
Plains	Residents	100	36	27
	Regular visitors	100	26	
	Irregular visitors	100	20	

In this trial, for the Central West CMA and Northern Agricultural Catchments Council accounts, expert opinion and historical records were used to derive baselines of species believed to exist in the regions at settlement by Europeans. *Econds* were generated for only one time period.

Data contributing to Central West CMA accounts were based on existing information assembled in 2007, whereas data for Northern Agricultural Catchments Council accounts were assembled from weekly bird records from two large properties, historical records and through an expert elicitation process conducted for the trial in 2012.

To create bird asset accounts which will reveal changes in condition of the asset over time it will be necessary to collect data from a number of sites throughout each region over time. Sites would need to sample all vegetation associations within the region and data on bird species collected at regular intervals with a minimum of four samples each year to account for visiting species.

**Figure 48** shows the significant variation in the condition of the five classes of vertebrate fauna in the Central West CMA region of NSW in 2008. It shows that reptiles and amphibians (with *Econds* of 60 and 48 respectively) are in significantly better condition than fish, birds and mammals (with *Econds* of 27, 28 and 33 respectively).



**Figure 48:** Native fauna *Econds* for vertebrate classes in Central West CMA, NSW.

**Figure 49** shows the condition of individual species of mammals in the Central West CMA region in 2007. It shows that of the 42 species of native mammals recorded in the region, 14% are extinct in the region (*Econd* = 0), and a further 26 % are endangered (*Econd* = 10).

**Figure 50** shows the condition of the resident native bird species in the Northern Agricultural region of WA. It shows that of the 136 resident species, 10% are either critically endangered (*Econd* = 5) or endangered (*Econd* = 10).





Table 51 and Figure 51 show the condition of native birds in the Northern Agricultural Catchments Council region in WA (an *Econd* of 75) is significantly higher than the condition of native birds in the Central West CMA region of NSW (an *Econd* of 28).

Table 51: Condition of native birds in the Northern Agricultural Catchments Council region of WA (2012) and the Central West CMA region of NSW (2007).

Region	<i>Econd</i>
<b>Northern Agricultural Catchments Council (WA)</b>	
Birds	75
Residents	60
Regular visitors	81
Irregular visitors	84
<b>Central West CMA (NSW)</b>	
Birds	28
Residents	36
Regular visitors	27
Irregular visitors	22

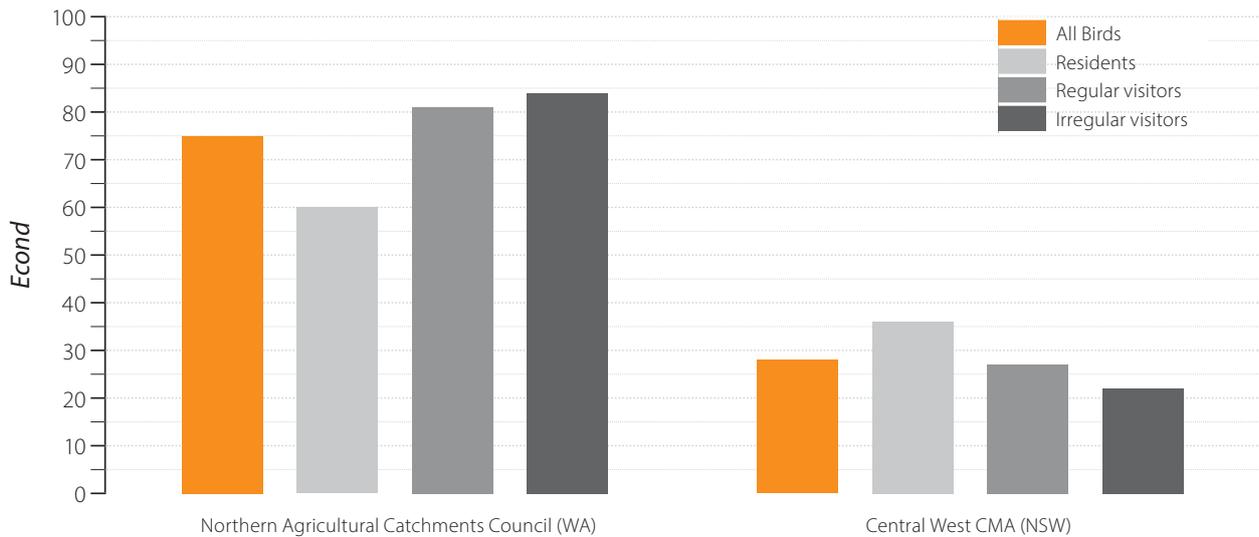


Figure 51: Relative condition of native birds in the Northern Agricultural Catchments Council region of WA and the Central West CMA region of NSW.

Bird functional groupings can be further attributed to particular areas of the region. Birds use the landscape differently. Figure 52 and Figure 53 show how species distributions vary between the tablelands, slopes and plains in the Central West CMA region of NSW.

It shows that irregular visitors on the tablelands are in better condition than those on the slopes and plains, and resident birds are in a similar condition in all parts of the Central West CMA region.

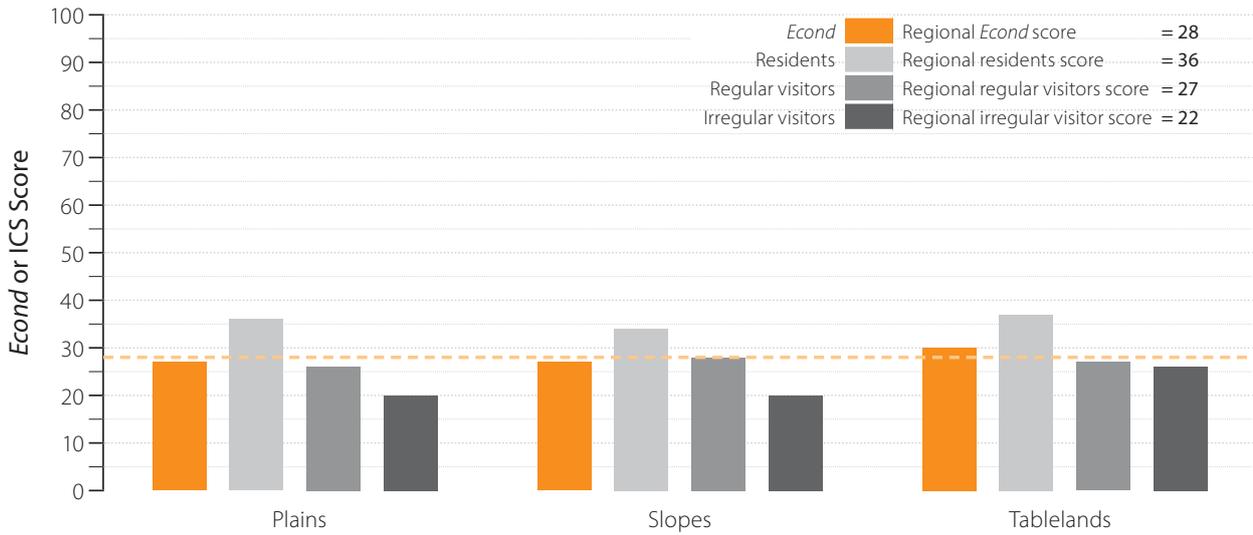


Figure 52: *Econds* and indicator condition scores for native birds, Central West CMA, NSW.

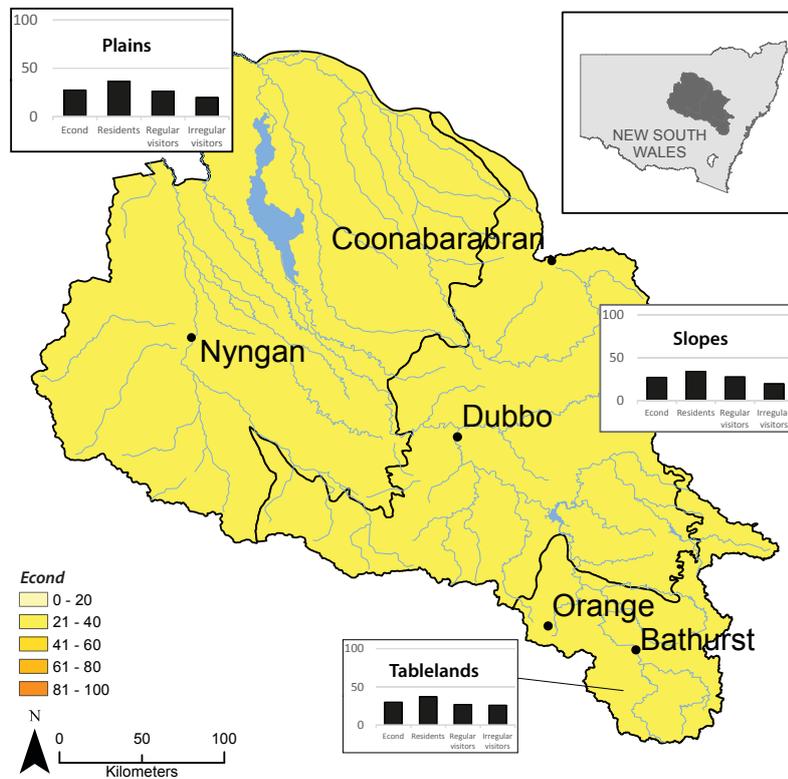


Figure 53: *Econds* and Indicator Condition Scores mapped for different landscapes in the Central West region of NSW.

## Discussion

The trial found that describing native fauna assets in taxonomic (eg vertebrate classes) and functional (eg tablelands) groups improves the understanding of the condition of native fauna in a region. For native bird assets, the trial utilised a method developed for birds (Saunders & McAleer 2012) to categorise residents, regular visitors and irregular visitors to understand not only the habitat requirements of birds, but also management and investment implications for these groups.

The trial has also demonstrated that sub-regional accounting for birds can give a greater understanding of the condition of birds in various parts of the landscape within a region. This shows how asset condition accounts can be useful for targeting management to, for example, resident, highly threatened or species of international significance.

Species richness was not included in the *Econd* calculation. While species richness is a useful measure of quantity, the indicator was redundant because the assigned condition score method incorporated more detailed and robust measures of quantity through population and abundance estimates. As such, including species richness would be double counting.

Both the traditional fauna assessment and the citizen science approach required an expert to undertake or coordinate the regional surveys, synthesise and interpret a range of data and confirm the score assignments. This required access to regional expertise which may not be available in all regions without support from state agencies.

Rapid advances in remote sensing technologies such as motion sensor cameras and audio recognition systems are currently being trialled at a property (reserve) scale by a range of organisations, and these technologies may improve the viability of regional scale native fauna monitoring in future (Meek *et al.* 2014; O'Connell, Nichols & Ullas Karanth 2011).



## Conclusions

The trial has shown that threatened species lists can be used to provide a broad understanding of the condition of native fauna at a regional scale. They are not, however, able to describe trend, nor are they suitable for regional scale decision making.

Given the difficulty in collecting vertebrate data, a regional native bird account is a useful first step in accounting for native fauna within a region, until technology reaches the point where it becomes cost-effective to monitor the condition of other vertebrate groups.

The two approaches to sampling birds demonstrated equally credible baseline accounts from a traditional native fauna assessment approach (used by Central West CMA) and with more precision from data collected by landholders on large properties over a 20-year time period (Northern Agricultural Catchments Council). The Northern Agricultural Catchments Council account also demonstrates that it is possible to use citizen science (in this case historical bird survey records) to construct accurate regional scale environmental accounts for native bird species, by assigning a condition score based on a combination of survey data, threatened status and expert analysis.

Although the approach used by the Northern Agricultural Catchments Council is feasible and robust, the trial also found that trend data are difficult to obtain as even to obtain a baseline of expected occurrence for some fauna may take decades (Goldney *et al.* 2007; Saunders & Doley 2013). Many more sites would need to be sampled on a regular basis to generate trend data.

New technologies such as Eremea eBird (Audubon Society & Cornell Lab of Ornithology 2014) are becoming increasingly available, but for this information to be able to be used to create reliable trend series accounts, adjustments will need to be made to standardise birds surveys that consistently survey long-term ecological monitoring sites (Likens and Lindenmayer 2011), preferably for each native vegetation type, across a region. This is a role the region NRM bodies could facilitate in partnership with organisations such as Birdlife Australia and others.

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