



Woodland Birds for Biodiversity:

Prioritising landscapes for conservation on private land

A method developed by Birds Australia, Nature Conservation Trust of NSW, Trust for Nature and Tasmanian Land Conservancy

March 2010



CARING FOR OUR COUNTRY

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E-mail: mail@birdsaustralia.com.au
ABN 87 004 076 475
Internet www.birdsaustralia.com.au

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Please contact: Dean Ingwersen or Chris Tzaros c/- Birds Australia National Office, Email d.ingwersen@birdsaustralia.com.au or c.tzaros@birdaustralia.com.au

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1 Executive summary

This report forms part of a project developed for the Australian Government's Caring for our Country by Birds Australia, the New South Wales Nature Conservation Trust, Trust for Nature (Victoria) and the Tasmanian Land Conservancy. The project is designed to use flagship threatened bird species to engage community and private landholders in habitat protection. It will prioritise permanent protection of woodland habitat based on comprehensive data, instigate covenants and broker incentives to improve woodland habitat management, prepare management plans for covenanted private land, and facilitate landscape scale restoration to increase landscape scale connectivity and conservation outcomes in the eastern temperate woodlands. This report is focussed on the prioritisation of areas for focussed attention based on the distribution and abundance of threatened and declining woodland birds.

The study area for this project encompasses the temperate woodlands and open forest associations of south-east Australia. The temperate woodland-dependant birds of the study area were ranked according to extinction risk, and several databases were combined to produce the most comprehensive dataset of these species ever (nearly 200,000 records comprise the database). A 5km x 5km grid layer was produced across the study area and this allowed the 'rank scores' for each species to be calculated in each grid cell. Subsequently over 12,600 grid cells have been prioritised according to their relative importance for threatened and declining woodland birds. This data layer will allow maps to be produced which may aid selection of priority landscapes on private land for conservation action and management.

3 Introduction and background

3.1 Project context

One-third of Australia's woodlands and 80% of temperate woodland, the most threatened type, are cleared; less than 5% remains in some parts of southern Australia (Olsen *et al.* 2005). The remaining vegetation is often fragmented, thinned or degraded and in need of active management to maintain it. Woodlands are also poorly represented in reserves (Olsen *et al.* 2005). The project purpose is to engage communities and landholders in addressing the loss, fragmentation and degradation of eastern temperate woodland habitat. Over one-third of Australia's landbird species are woodland dependant and over 40 of them, including the nationally endangered Swift Parrot and Regent Honeyeater, are now threatened. Recent research has shown that the wider woodland avifauna is continuing to decline alarmingly in both extensive and fragmented landscapes (MacNally *et al.* 2009). This downward trend heightens the need for substantial, conservation investment now, in order to decrease the risk of further decline (McCarthy *et al.* 2008). Given the urgency for actions to improve and protect habitats and halt these declines, it is critical that investments from a national perspective be strategic to maximise on-ground outcomes. Having a guide to direct recovery efforts becomes even more important when the target habitat type, in this case woodland, covers such a relatively large expanse of Australia. The prioritisation approach of this study has produced an essential tool for *state*-based organisations to protect the *national* hotspots for suites of woodland birds with greater confidence.

Iconic species are critical to the effective engagement of communities in the protection of native habitat. The project also aims to build on the momentum created by the CfoC-funded Woodland Bird Conservation project, the Swift Parrot and Regent Honeyeater recovery programs, and several key linked revegetation projects to enhance the conservation of threatened and declining woodland birds in the temperate eastern woodland region, and to use these species as flagships for the conservation of other threatened woodland biota. Other flagships will be developed and used as appropriate: threatened bird species in the area of interest include the Superb Parrot, Forty-spotted Pardalote and Grey-crowned Babbler. Other threatened biota which will benefit from this project include Brush-tailed Rock Wallaby, Grey-headed Flying-fox, Green and Golden Bell Frog, Pink-tailed Worm-lizard and Golden Sun Moth.

3.2 Woodland dependant birds – what are they?

Temperate woodland dependant birds can be defined as a suite of species characteristically and commonly found within the lowland temperate woodlands and adjacent open forests of south-eastern Australia. The temperate woodland bird assemblage has a large number of species that are either totally or largely restricted to

temperate woodland/open forest habitat across their south-eastern Australian range (Robinson 1994; Robinson and Traill 1996; Traill & Duncan 2000).

Woodlands, with their open structure, grassy ground layer or sparse understorey, and preponderance of eucalypt-associated resources such as tree hollows, peeling bark, nectar, manna and other carbohydrates, provide a unique environment for this distinctive avian assemblage (Robinson and Traill 1996).

3.3 Woodland 'associated' birds – why are they treated differently?

Many additional species occur within but also extensively beyond temperate woodlands and open forests, but because they lack a strong dependence on this habitat type they are regarded as 'temperate woodland associated' rather than 'dependent'. This includes species that are more characteristically associated with semi-arid vegetation communities inland of the temperate zone, species characteristic of taller wetter forests of the Great Divide, and species characteristic of sub-tropical woodlands north of the temperate zone (see Table 2 for those species not included in this study) (Traill and Duncan 2000).

4 Methods

The general approach used was to compile data on woodland dependant bird species and determine which regions of private land in the temperate woodlands of Victoria, NSW and Tasmania were of greatest value. We sought to identify priority areas for these species by overlaying maps of distribution, landscape attributes and land tenure.

4.1 Study area: defining the temperate woodlands

Temperate woodland and open forest vegetation communities are found primarily on the inland slopes of the Great Dividing Range from southern Queensland, through New South Wales and the Australian Capital Territory, into Victoria and the south-east of South Australia, and in eastern parts of Tasmania. They also persist in some regions on the coastal side of the Divide in areas of lower rainfall and more subtle topographic relief. Eucalypts are the dominant overstorey species but the vegetation can vary significantly across the landscape. At some sites, Buloke and Native Cypress-Pine intersperse eucalypt cover to compose a mixed overstorey. Much of the original vegetation in this area has been extensively cleared and/or modified and the existing woodland vegetation occurs as remnants within a vast agriculturally-dominated landscape. Temperate woodlands have similarly been decimated on the coastal plains of eastern Tasmania where only small isolated fragments exist. Appendix 2 lists the major vegetation types that qualify as temperate woodlands-open forests.

Due to the fact that the classification schemes of the various States in the study area are often quite different and that digital mapping generally does not recognise a broad vegetation community like woodland, we needed to construct a classification based on the distribution of what is generally recognised as woodland and open forest in the literature (e.g. Landsberg 2000, Lunt and Bennett 2000).

The area we defined as our study region is presented in Figure 1, based on the IBRA regions and sub-regions presented in Table 1.

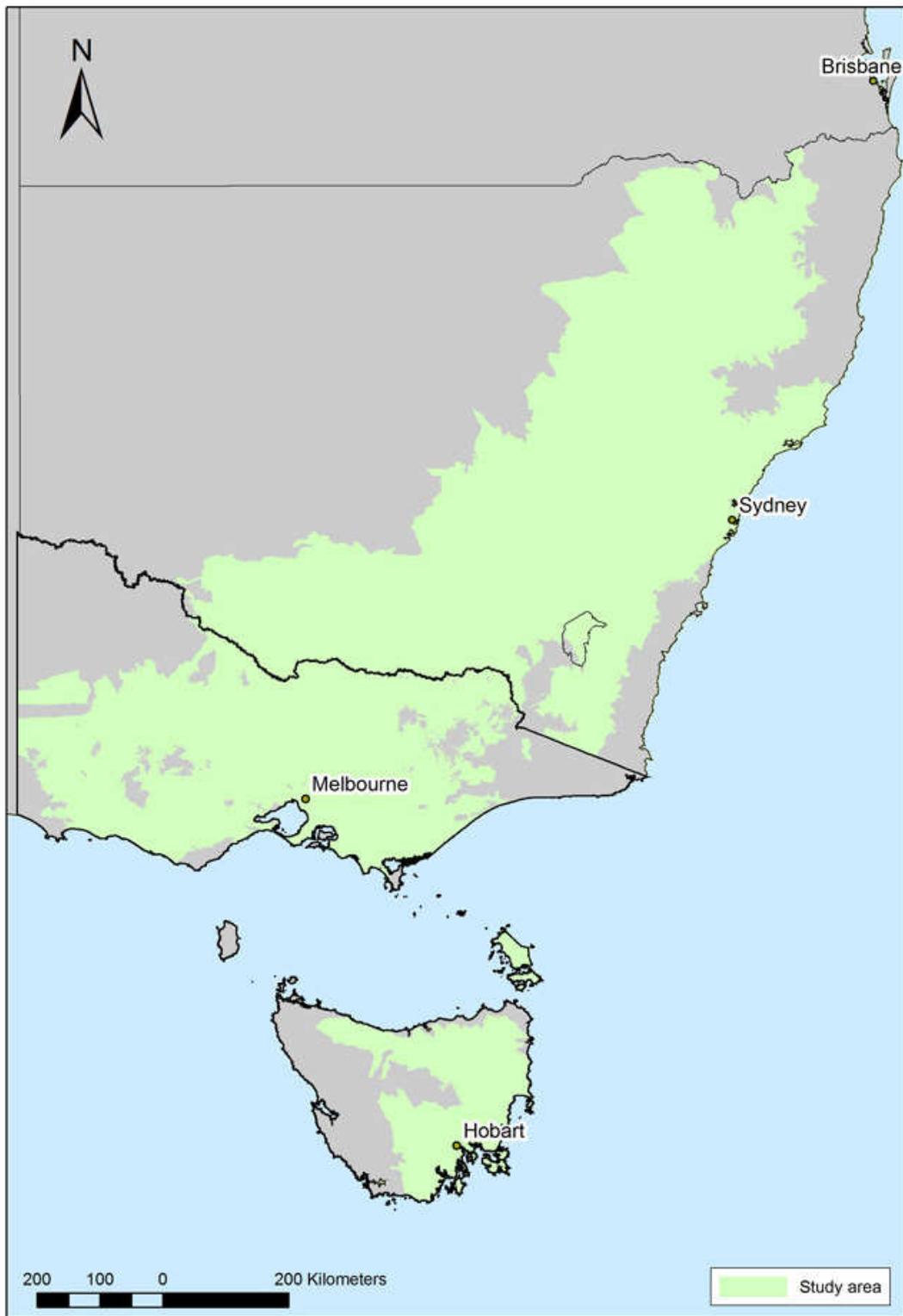


Figure 1. Study region designated via IBRA region and sub-region.

Table 1. IBRA regions, subregions and area used to determine our study region.

IBRA	IBRA sub-regions	Area (hectares)
Brigalow Belt South	Liverpool Range; Pilliga; Pilliga Outwash; Talbragar Valley; Liverpool Plains; Northern Basalts; Northern Outwash	4,967,638
Ben Lomond	Ben Lomond	707,498
Flinders	Flinders	201,071
Murray Darling Depression	Wimmera	2,027,813
Nandewar	Kaputar; Inverell Basalts; Peel	1,634,216
New England Tablelands	Walcha Plateau; Stanthorpe Plateau; Tenterfield Plateau; Armidale Plateau; Bundarra Downs; Round Mountain; Yarrowyck-Kentucky Downs; Ebor Basalt; Moredun Volcanics; Wongwibina Plateau; Binghi Plateau; Deepwater Downs; Beardy River Hills; Severn River Volcanics; Nightcap; Tingha Plateau; Eastern Nandewars; Glen Innes-Guyra Basalts; Stanthorpe Plateau; Northeast Forest Lands	2,675,923
NSW North Coast	Upper Hunter; Karuah Manning; Ellerston; Macleay Gorges; Rocky River Gorge	1,132,225
NSW South Western Slopes	Northern Inland Slopes; Upper Slopes; Lower Slopes	8,571,749
Riverina	Murray Fans; Victorian Riverina; Murrumbidgee	6,721,747
Sydney Basin	Pittwater; Moss Vale; Sydney Cataract; Wyong; Capertee; Yengo; Wollemi; Pittwater; Cumberland; Burragorang; Kerrabee; Hunter	3,260,897
South East Coastal Plain	Warrnambool Plain; Gippsland Plain; Otway Plain	1,691,049
South Eastern Highlands	Highlands - Northern Fall; Monaro; Strzelecki Ranges; Kybeyan-Gourock; Crookwell; Kanangra; Oberon; Murrumbateman; Bongonia; Hill End; Bondo; Orange; Bathurst; South Eastern Highlands	7,868,262
Tasmanian Northern Midlands	Northern Midlands	449,731
Tasmanian Northern Slopes	Northern Slopes	670,340
Tasmanian South East	South East	1,207,579
Tasmanian Southern Ranges	Southern Ranges	861,426
Victorian Midlands	Central Victorian Uplands; Greater Grampians; Goldfields; Dundas Tablelands	3,134,706
Victorian Volcanic Plain	Victorian Volcanic Plain	2,372,520
		50,156,389

4.2 Species selection

For the purposes of this project, 55 species were identified from the Atlas of Australian Birds as ‘temperate woodland dependant’. Expert opinion was also sought to confirm selection of these species. Of the 55 species, 42 are listed as threatened (under Federal or State legislation across the study area) or are considered to be in decline according to key references on the subject of woodland birds in south-eastern Australia (e.g. Robinson 1994, Reid 1999, Traill and Duncan 2000, ACT Government 2004, Barrett *et al.* 2007). The temperate woodland bird community differs from those of adjacent environments by having a high proportion of ground foraging insectivores and granivores (24 species), a high proportion of nectarivores (14 species), a number of species that use tree hollows (14 species), and insectivores that forage in the shrub and canopy layer (10 species). Species included in the mapping of this study are listed in Table 2. Those excluded from analysis are listed in Table 3.

Table 2. Temperate woodland and open forest *dependant* bird species of south-eastern Australia.

Swift Parrot	Flame Robin
Regent Honeyeater	Scarlet Robin
Red-tailed Black-Cockatoo (race	Jacky Winter
Bush Stone-curlew	Red-capped Robin
Black-throated Finch (race <i>cincta</i>)	Black-eared Cuckoo
Forty-spotted Pardalote	Purple-crowned Lorikeet
Superb Parrot	Spotted Quail-thrush
Hooded Robin (race <i>cucullata</i>)	Apostlebird
Grey-crowned Babbler (race <i>temporalis</i>)	Southern Whiteface (race <i>leucopsis</i>)
Barking Owl (race <i>connivens</i>)	Little Lorikeet
Painted Honeyeater	Painted Button-quail
Diamond Firetail	Dusky Woodswallow
Speckled Warbler	White-browed Babbler
Brown Treecreeper (race <i>victoriae</i>)	Blue-faced Honeyeater
Varied Sittella (race <i>chrysoptera</i>)	Crested Shrike-tit
Black-chinned Honeyeater (race <i>gularis</i>)	Restless Flycatcher
Square-tailed Kite	White-bellied Cuckoo-shrike
Turquoise Parrot	Brown-headed Honeyeater (race <i>pallidiceps</i>)
Chestnut-rumped Heathwren	Fuscous Honeyeater
Gilbert's Whistler	Western Gerygone
Crested Bellbird (race <i>gutturalis</i>)	Yellow-tufted Honeyeater (race <i>meltoni</i>)

Table 3. Temperate woodland and open forest *associated* bird species of south-eastern Australia (and hence excluded from our analysis).

Buff-rumped Thornbill	Sacred Kingfisher
Eastern Rosella	Striated Pardalote (race <i>substriatus</i>)
Musk Lorikeet	White-plumed Honeyeater
Noisy Friarbird	White-throated Gerygone
Noisy Miner	White-winged Chough
Olive-backed Oriole	Yellow Thornbill
Red-rumped Parrot	

4.3 Data collection

The data available for this project ranges from 1896 (for some of the historical records of threatened species such as Regent Honeyeater) to January 2010. Data were collected and entered or imported into a Microsoft Access database or Excel spreadsheet, and were collected from a number of sources:

- Atlas of Australian Birds database
- Regent Honeyeater Recovery Team sightings database
- NSW State Wildlife Atlas and Atlas of Victorian Wildlife (Regent Honeyeater data)
- Swift Parrot Recovery Team sightings database
- Tasmanian Threatened Species database (for Swift Parrot and Forty-spotted Pardalote data)

These various sources were utilised to ensure the most comprehensive set of distributional data were available for each species being mapped. Data were vetted (by Dean Ingwersen, Chris Tzaros and Andrew Silcocks [Birds Australia]), compiled and then merged into a single database using ArcMap. Information was spatially defined using GIS.

4.4 Data analysis

We felt it was important to rank the threatened and declining woodland-dependant species used in this analysis to reflect their extinction risk, thereby determining which areas would be of greatest importance to either the most threatened species and/or the areas which contained the greatest richness of threatened and declining temperate woodland birds. Our method for this was to assign a 'rank score' for each species based on values attributed by us to official State and Commonwealth threatened species conservation lists (EPBC Act List of Threatened Fauna 2009, DECCW NSW Threatened Species List 2009, Advisory List of Threatened Vertebrate Fauna in Victoria 2007, DPIPWE Threatened Species List 2004), declines between the first and second Atlas of Australian Birds (from within appropriate woodland bioregions in south-east Australia), and from key papers addressing woodland bird declines (Barrett *et al.* 2007, ACT Government 2004, Reid 1999, Robinson 1994). Although the numerical scores assigned to each species are arbitrary, they have been consistently applied to all species so the total score (species rank) is a reasonable depiction of the species status in terms of the degree to which they are listed as threatened or declining across their range. Scores assigned for each level of threatened/declining category were determined as follows:

- Critically Endangered – 15 points
- Endangered – 10 points

- Vulnerable – 5 points
- Near Threatened – 3 points
- Member of the Victorian Threatened Temperate Woodland Bird Community – 2 points
- Listed as declining in regions by key papers listed above – 1 point
- Declining within the woodland region between Birds Australia’s first and second Atlas of Australian Birds – 1 point.

As an example, the Swift Parrot (*Lathamus discolor*) is listed as Endangered under the EPBC Act (10 points), Victorian FFG Act (10 points), NSW Threatened Species Act (10 points), Tasmanian Threatened Species Act (10 points), as Vulnerable under the ACT Threatened Species Act (5 points) and as a member of the Victorian Threatened Temperate Woodland Bird Community (2 points). This gave the Swift Parrot a ‘rank score’ of 47 points.

In order to make the mapping useful for landscape-scale prioritisation, 5 km x 5 km grid squares were developed in ArcMap and these were overlaid on the threatened bird distribution data. Within each grid cell the total number of Atlas surveys conducted were calculated, as were the total number of records of each species. This allowed for a calculation of reporting rate of each species in each grid square, and a ‘standardisation’ of our data based on survey effort. For each 5km x 5km grid cell the reporting rate for each species was multiplied by our ‘rank score’, and these values were then summed. This summed ‘rank score’ for each grid cell was the value we used to evaluate relative importance of different regions of the temperate woodlands, and forms the basis of our ArcMap layer against which the importance of other variables (e.g. land capability) can be evaluated.

A range of classification schemes were tested including percentile, quantile and equal interval categories. However, due to the highly Poisson distributed nature of the data (i.e. many low values and a few extremely high values), none of these traditional methods satisfactorily characterised the data. Index values were defined in ArcMap v9.1 using a “natural breaks” classification based on a “Jenks” optimisation algorithm. In short, this method finds the best breaks between data by minimising the sum of squared differences within groupings of data (see formula below).

$$SSD_{i..j} = \sum_{n=i}^j (A[n] - mean_{i..j})^2$$

It should be noted that any results presented here are not inferential in nature – we are determining areas of high conservation value for woodland birds based on known records, not on possible distribution or habitat suitability..

5 Results

5.1 Distribution and occurrence of species

From the database we constructed, 152,445 individual records of the focal threatened and declining woodland bird species occur within the study area. When our 5km x 5km grid overlay is applied 8,122 grids have at least one record of our chosen woodland birds. Mean total rank score per grid cell was 12.87 ± 0.19 s.e., with a range from 0.04 to 100 (this higher value was set as an arbitrary cutoff to reduce the effect of a small number outliers)

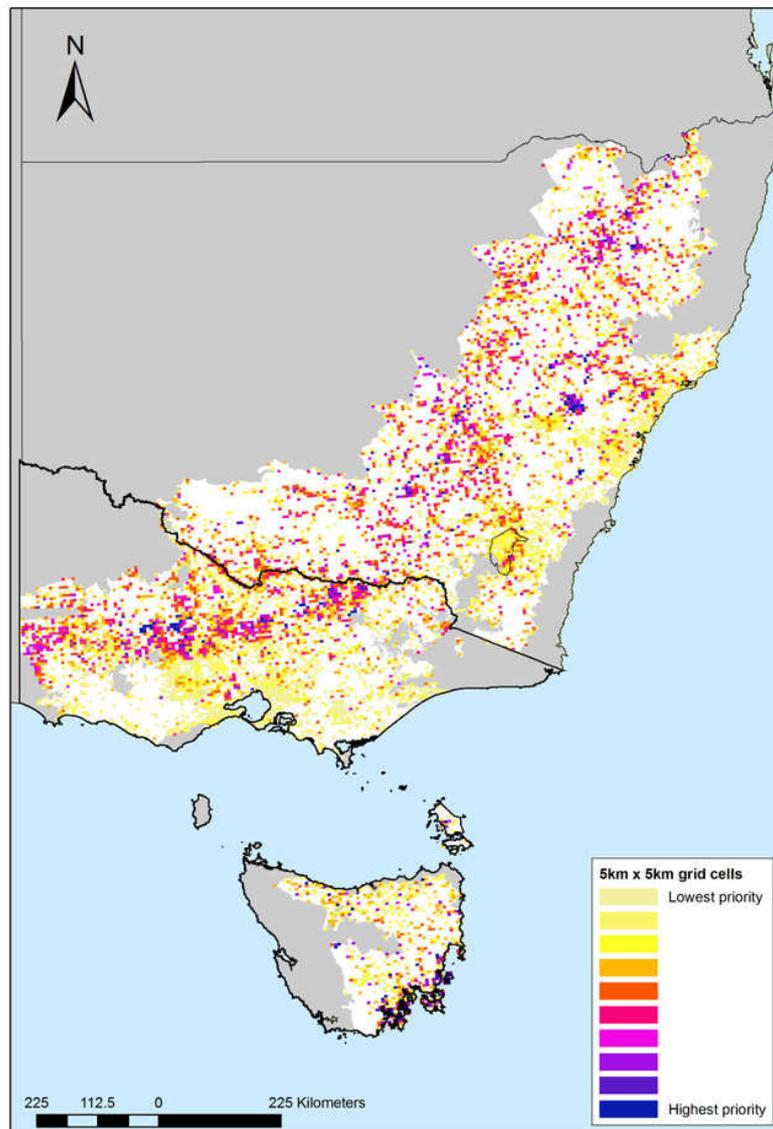


Figure 2. Priority sites for woodland bird conservation based on 5km x 5km grid prioritisation.

5.2 Priority sites by State

The data layer containing the prioritisation applies the process on a 'national' scale, but allows the selection of smaller areas for focussing attention (i.e. more detail on where to

invest in woodland bird conservation is apparent on a smaller scale). Views of the three States which are the focus of this study are presented in Figures 3, 4 and 5.

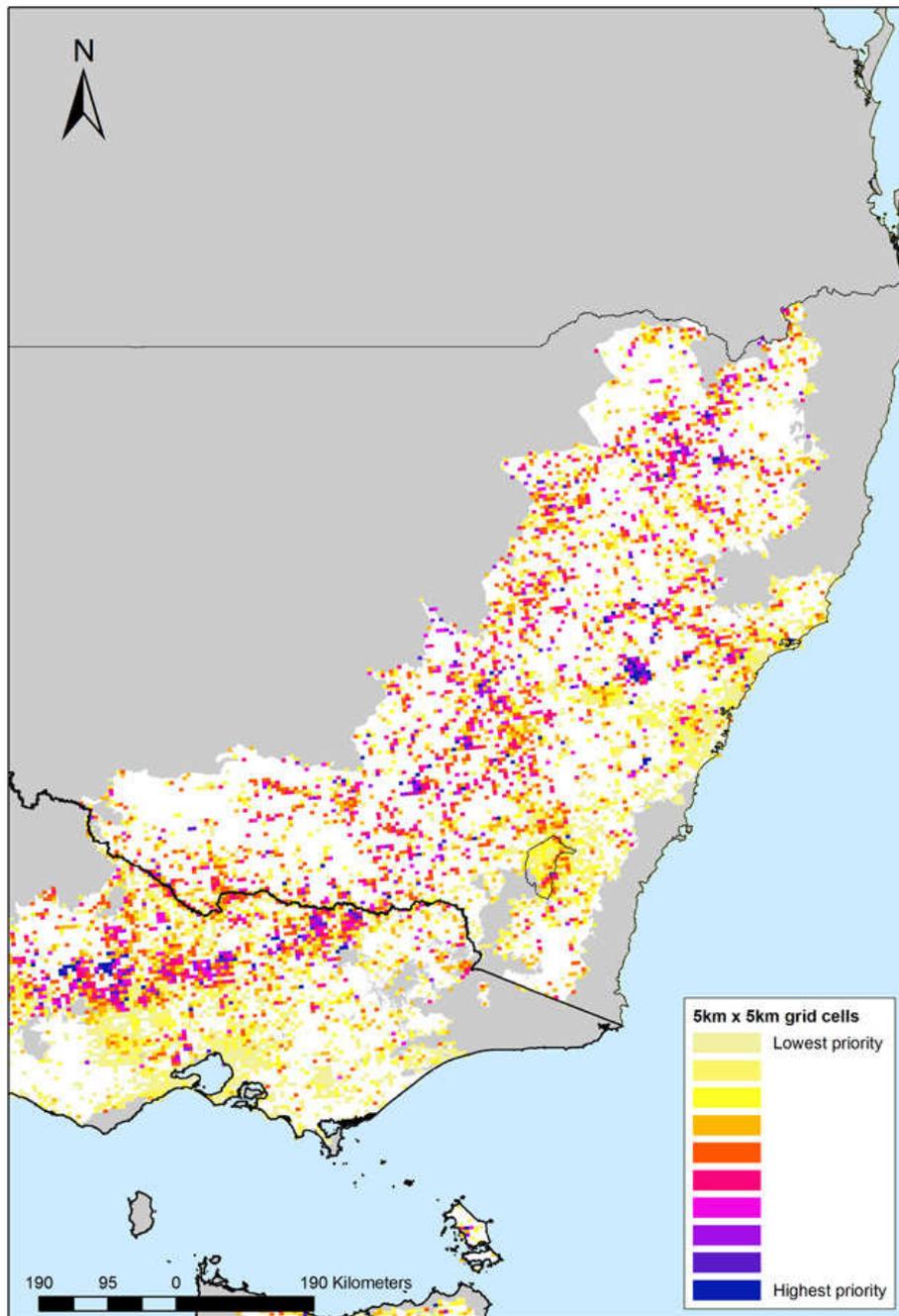


Figure 3. Priority sites for woodland bird conservation based on 5km x 5km grid prioritisation in NSW.

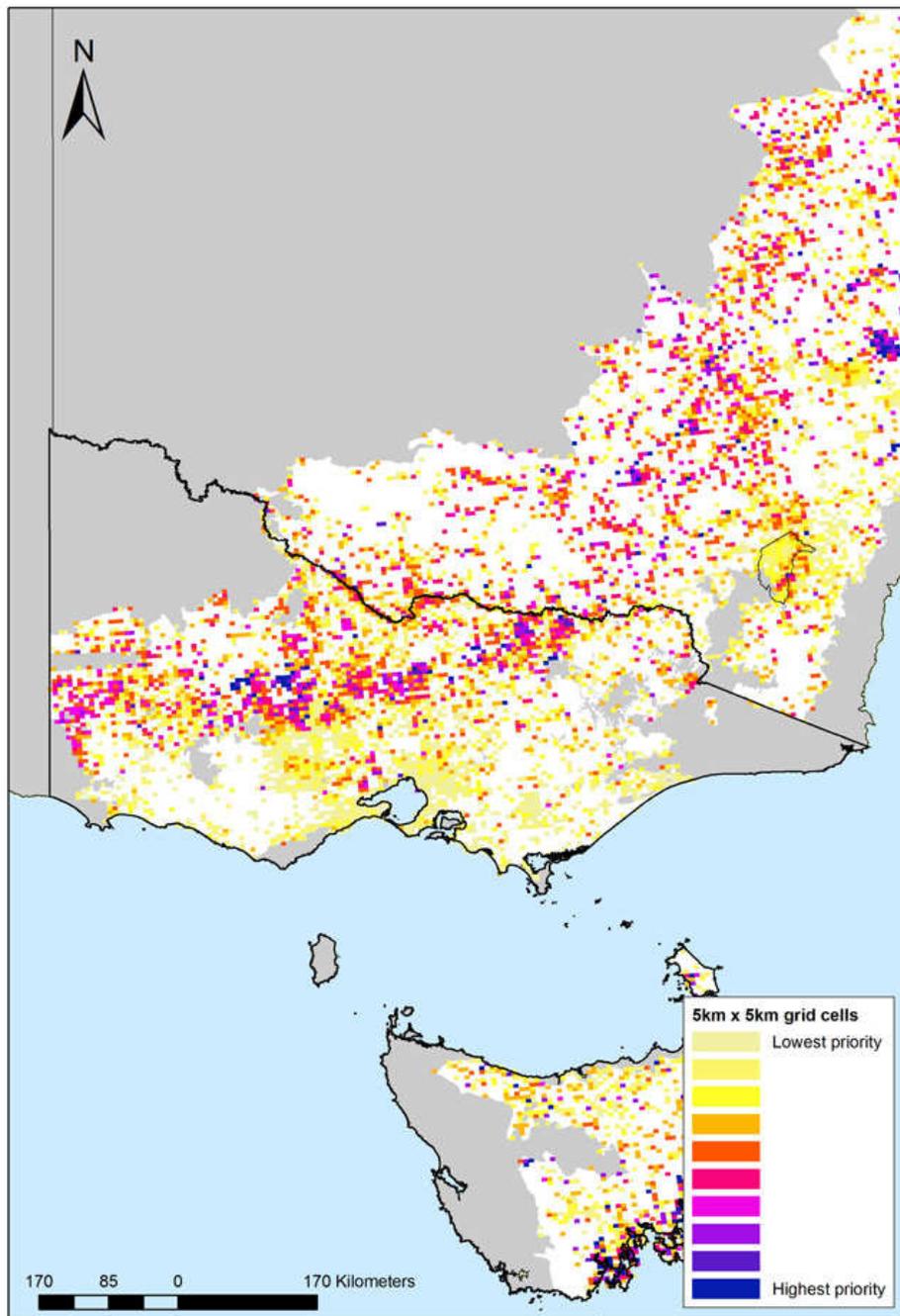


Figure 4. Priority sites for woodland bird conservation based on 5km x 5km grid prioritisation in Vic.

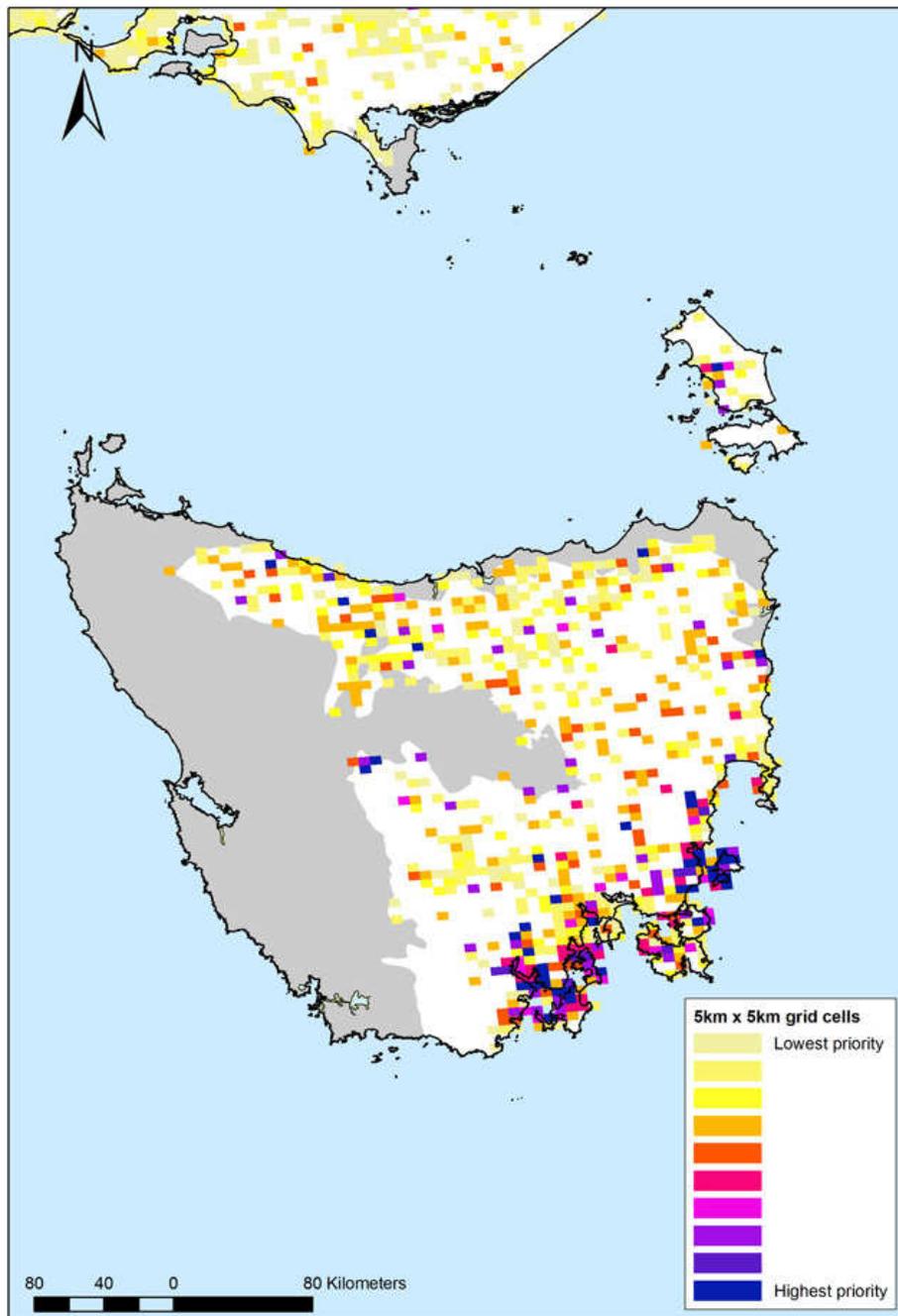


Figure 5. Priority sites for woodland bird conservation based on 5km x 5km grid prioritisation in Tasmania.

5.3 Priority sites by landscape

The ultimate aim of this study was to allow conservation planners and covenanters view priority areas at a focus scale. As examples, a closer view of a region of central-west Victoria (Fig 6) and the Capertee Valley in NSW (Fig 7) are presented.

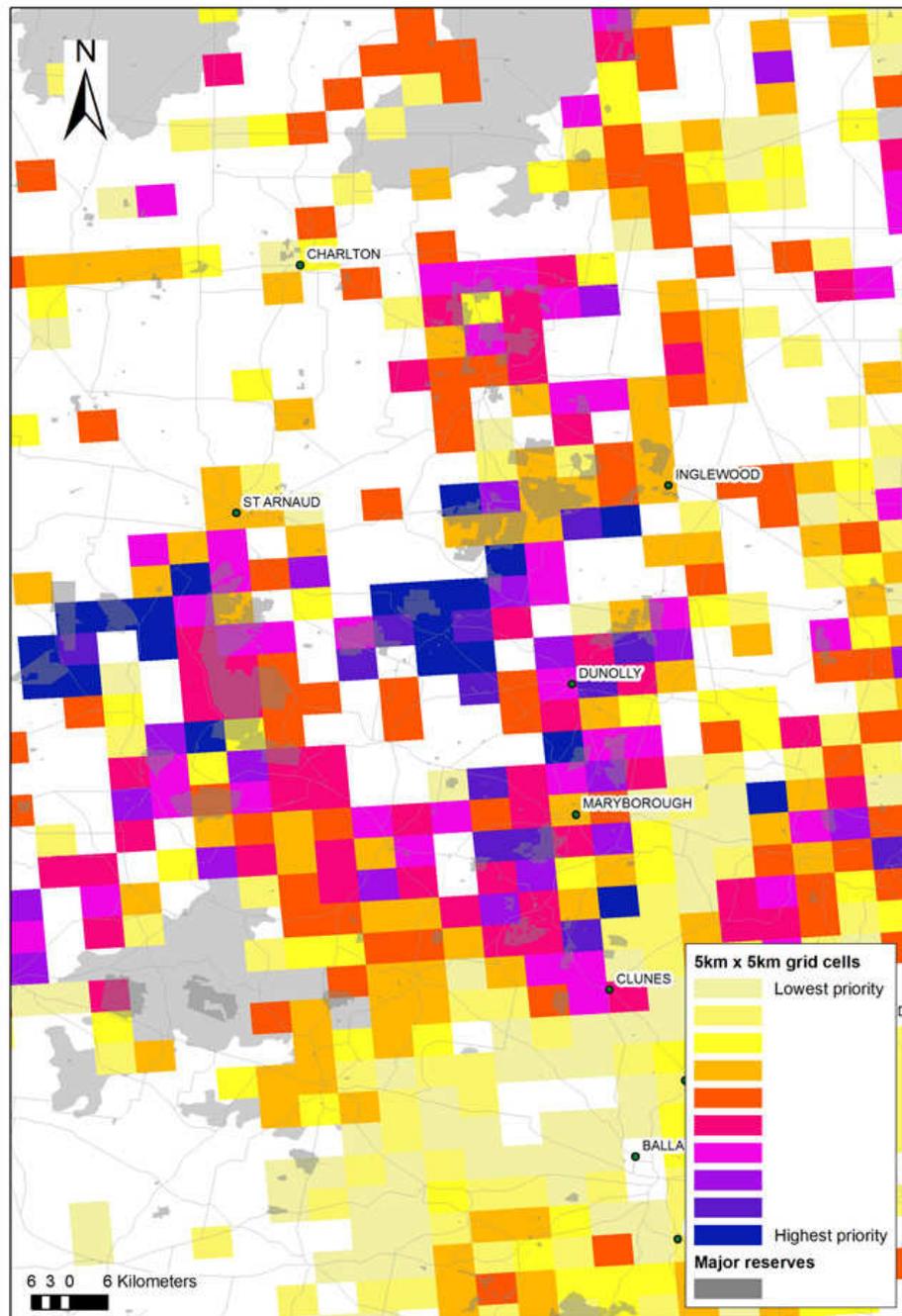


Figure 6. Priority sites for woodland bird conservation based on 5km x 5km grid prioritisation in central-west Victoria.

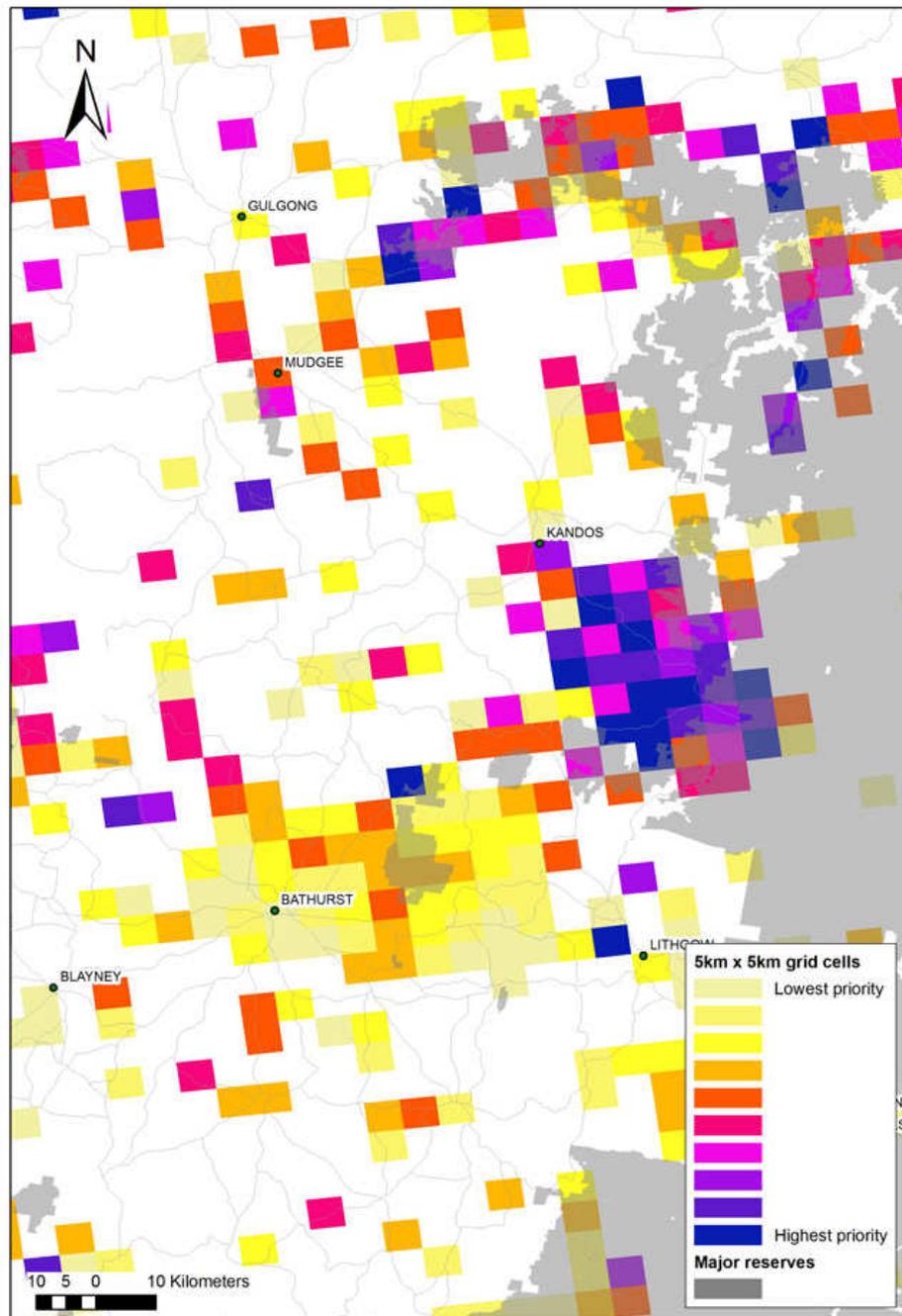


Figure 7. Priority sites for woodland bird conservation based on 5km x 5km grid prioritisation in Capertee Valley, NSW.

6 Next steps

The next step with the prioritisation process is to set some explicit conservation objectives for the target species and identified 'hot spots' for woodland birds to further refine our conservation efforts. The mapping outputs from this project would serve as an important tool to help plan for the *retention* of critical woodland habitat attributes at key sites throughout the landscape, and identify where remedial action (e.g. promotion of structural complexity through improved management of practices such as extractive industries) should occur. Additionally, the mapping will help identify areas where our greatest gains might occur in terms of woodland habitat *restoration* for woodland birds, such as the revegetation and regeneration of low elevation, high fertility sites such as broad riverine flats, drainage lines, areas adjacent to existing remnants and districts where there is existing high remnant vegetation connectivity (Mac Nally *et al.* 2009). Restoration of fertile sites offers multiple benefits such as faster tree growth rates, improved eucalypt flowering, increased invertebrate resources and opportunities for linkages with linear habitat resources such as riparian zones along creeks and rivers. Applying optimal investment to lowland woodlands not only targets a suite of woodland birds that are most at risk of extinction, but it enhances the resilience of all woodland birds to the ongoing affects of climate change.

The prioritisation of areas through this process also assists our capacity to initiate appropriate woodland bird community monitoring programs that will enable us to assess the functionality of many of our woodland landscapes and the results of our conservation actions.

7 Acknowledgements

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And a final thanks to all of the land owners in the study area who have already entered into conservation agreements or management on their properties.

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Appendix 1: Status and rank of woodland dependant bird species

Temperate woodland and open forest dependant bird species of south-eastern Australia. *Conservation Status*: CE = Critically Endangered, E = Endangered, V = Vulnerable, NT = Near Threatened, TW = Member of Victorian Temperate Woodland Bird Community, D = Decliner (Robinson 1994, Reid 1999), R = Rare (Robinson 1994), DA = Declining ACT region (ACT Government 2004), EX = Extinct ACT region (ACT Government 2004), Atlas decliner = < reporting rate in second atlas *cf.* first atlas (Barrett *et al.* 2003, Barrett *et al.* 2007). *Species rank* (sum of scores across range): CE = 15, E = 10, V = 5, NT = 3, TW = 2, D = 1, R = 1, DA = 1, EX = 1, AD = 1

Species	Conservation status					Atlas decliner	Species rank
	EPBC	NSW	AC	Vic	Tas		
Swift Parrot	E	E	V	E,TW	E		47
Regent Honeyeater	E	E	E	CE,TW			47
Red-tailed Black-Cockatoo (south-eastern, race)	E	E		E			30
Bush Stone-curlew		E		E,TW			22
Black-throated Finch (southern, race <i>cincta</i>)	E	E					20
Forty-spotted Pardalote	E				E		20
Superb Parrot		V	V	E			20
Hooded Robin (south-eastern, race <i>cucullata</i>)		V, D	V,	NT,TW,		Y	19
Grey-crowned Babbler (eastern, race <i>temporalis</i>)		V, D		E,TW			18
Barking Owl (southern, race <i>connivens</i>)		V		E,TW			17
Painted Honeyeater		V	V	V,TW			17
Diamond Firetail		V, D	DA	V,TW, D		Y	16
Speckled Warbler		V, D	DA	V,TW, D			14
Brown Treecreeper (south-eastern, race <i>victoriae</i>)		V, D	V	TW		Y	14
Varied Sittella (race <i>chrysoptera</i>)		V, D	V			Y	12
Black-chinned Honeyeater (eastern, race <i>gularis</i>)		V		NT,TW			10
Square-tailed Kite		V		V			10
Turquoise Parrot		V		NT, TW			10
Chestnut-rumped Heathwren		D		V,TW, D			9
Gilbert's Whistler		V, D	R	D			8
Crested Bellbird (southern, race <i>gutturalis</i>)		D		V, D			7
Flame Robin		V	DA			Y	7
Scarlet Robin		V	DA			Y	7
Jacky Winter		D	DA	TW, D		Y	6
Red-capped Robin		D	R	TW, D		Y	6
Black-eared Cuckoo			R	NT, D			5
Purple-crowned Lorikeet		V					5
Spotted Quail-thrush		D		NT, D			4
Apostlebird		D	Ex	R		Y	4
Southern Whiteface (eastern, race <i>leucopsis</i>)		D	D	D		Y	4
Little Lorikeet			R	TW, D			4
Painted Button-quail		D		TW		Y	4
Dusky Woodswallow		D	DA			Y	3
White-browed Babbler		D	Ex	D			3
Blue-faced Honeyeater			D	D			2
Crested Shrike-tit		D	DA				2
Restless Flycatcher		D				Y	2
White-bellied Cuckoo-shrike		D		D			2
Brown-headed Honeyeater (race <i>pallidiceps</i>)				TW			2
Fuscous Honeyeater				TW			2
Western Gerygone				TW			2
Yellow-tufted Honeyeater (race <i>meltoni</i>)				TW			2

Appendix 2: Main tree species of woodland and open forest in south-eastern Australia

Mainland (inland)	Blakely's Red Gum <i>Eucalyptus blakelyi</i>
	River Red Gum <i>Eucalyptus camaldulensis</i>
	Grey Box <i>Eucalyptus microcarpa</i>
	Narrow-leaved Grey Box <i>Eucalyptus pilligaensis</i>
	Yellow Box <i>Eucalyptus melliodora</i>
	White Box <i>Eucalyptus albens</i>
	Red Box <i>Eucalyptus polyanthemos</i>
	Apple Box <i>Eucalyptus bridgesiana</i>
	Fuzzy Box <i>Eucalyptus conica</i>
	Black Box <i>Eucalyptus largiflorens</i>
	Long-leaved Box <i>Eucalyptus goniocalyx</i>
	Poplar (Bimble) Box <i>Eucalyptus populnea</i>
	Red Ironbark <i>Eucalyptus tricarpa</i>
	Mugga Ironbark <i>Eucalyptus sideroxylon</i>
	Silver-leaved Ironbark <i>Eucalyptus malanophloia</i>
	Narrow-leaved Ironbark <i>Eucalyptus crebra</i>
	Yellow Gum <i>Eucalyptus leucoxylon</i>
	Scribbly (White) Gum <i>Eucalyptus rossii</i>
	Brittle Gum <i>Eucalyptus mannifera</i>
	Black Gum <i>Eucalyptus aggregata</i>
	Red Stringybark <i>Eucalyptus macrorhyncha</i>
	Brown Stringybark <i>Eucalyptus baxteri</i>
	Thin-leaved Stringybark <i>Eucalyptus eugenoides</i>
	White Cypress-pine <i>Callitris glaucophylla</i>
	Black Cypress-pine <i>Callitris endlicheri</i>
	Buloke <i>Allocasuarina leumannii</i>
	River She-oak <i>Casuarina cunninghamiana</i>
Mainland (coastal)	Forest Red Gum <i>Eucalyptus tereticornis</i>
	Spotted Gum <i>Corymbia maculata</i>
	Coast Grey Box <i>Eucalyptus bosistoana</i>
	Grey Box <i>Eucalyptus molluccana</i>
	Grey Ironbark <i>Eucalyptus paniculata</i>
	Broad-leaved Ironbark <i>Eucalyptus fibrosa</i>
Tasmania	Tasmanian Blue Gum <i>Eucalyptus globulus</i>
	White (Manna) Gum <i>Eucalyptus viminalis</i>
	Black Gum <i>Eucalyptus ovata</i>