

Ecography

**ECOG-00388**

Rayner, L., Lindenmayer, D. B., Wood, J. T., Gibbons, P. and Manning, A. D. 2013. Are protected areas maintaining bird diversity? – *Ecography* 36: xxx–xxx.

**Supplementary material**

# SUPPLEMENTARY MATERIAL: Appendix 1

Rayner, L., Lindenmayer, D. B., Wood, J. T., Gibbons, P. and Manning, A. D. 2013.  
Are protected areas maintaining bird diversity? – Ecology 000: 000-000.

**Table A1. List of species with assigned functional traits.** Nomenclature taken from Christidis and Boles (2008). Habitat guilds taken from Reid and Cunningham (2008). Mobility derived from Reid (1999) and Lindenmayer and Cunningham (2011). Body size, nesting, and foraging traits derived from Ikin et al. (2012) and Lindenmayer and Cunningham (2011). Ground feeder identification taken from Silcocks et al. (2005). Conservation status derived from ACT Flora and Fauna Committee (2011) and Bounds et al. (2010). References are provided in full below.

Common name	Scientific name	Habitat	Mobility	Size	Nest type	Nesting	Main food	Foraging substrate	Ground feeder	Cons. Concern
Australian King-Parrot	<i>Alisterus scapularis</i>	WD	ResSed	LRG	Hollow	Hol	Seeds, Grain, Plants	Gran	Y	N
Australian Magpie	<i>Gymnorhina tibicen</i>	NWD	ResSed	LRG	Bowl	Arb	Invertebrates	Grnd	Y	N
Australian Raven	<i>Corvus coronoides</i>	NWD	ResSed	LRG	Bowl	Arb	Omnivorous	Grnd	Y	N
Australian Wood Duck	<i>Chenonetta jubata</i>	NWD	PMigMig	LRG	Hollow	Hol	Seeds, Grain, Plants	Aqu	Y	N
Black-faced Cuckoo-shrike	<i>Coracina novaehollandiae</i>	NWD	PMigMig	LRG	Cup	Arb	Invertebrates	Arb	N	Y
Brown Thornbill	<i>Acanthiza pusilla</i>	WD	ResSed	SML	Dome	Usty	Invertebrates	Shb	N	N
Brown Treecreeper	<i>Climacteris picumnus</i>	WD	ResSed	SML	Hollow	Hol	Invertebrates	Arb	Y	Y*
Brown-headed Honeyeater	<i>Meliphreptus brevirostris</i>	WD	ResSed	SML	Purse	Arb	Nectar, Pollen, Plants, Inverts	NF	N	N
Buff-rumped Thornbill	<i>Acanthiza reguloides</i>	WD	ResSed	SML	Dome	Opp	Invertebrates	Shb	Y	N
Common Bronzewing	<i>Phaps chalcoptera</i>	WD	PMigMig	LRG	Platform	Opp	Nectar, Pollen, Plants, Inverts	Gran	Y	N
Common Myna	<i>Acridotheres tristis</i>	NWD	ResSed	LRG	Hollow	Hol	Omnivorous	Grnd	Y	N
Common Starling	<i>Sturnus vulgaris</i>	NWD	ResSed	INT	Cup	Opp	Omnivorous	Grnd	Y	N
Crested Pigeon	<i>Ocyphaps lophotes</i>	NWD	ResSed	LRG	Platform	Opp	Seeds, Grain, Plants	Gran	Y	N
Crimson Rosella	<i>Platycercus elegans</i>	WD	ResSed	LRG	Hollow	Hol	Seeds, Grain, Plants	Gran	Y	N
Dusky Woodswallow	<i>Artamus cyanopterus</i>	WD	PMigMig	SML	Bowl	Opp	Invertebrates	Air	N	Y
Eastern Rosella	<i>Platycercus eximius</i>	NWD	ResSed	LRG	Hollow	Hol	Seeds, Grain, Plants	Gran	Y	N
Eastern Spinebill	<i>Acanthorhynchus tenuirostris</i>	WD	PMigMig	SML	Cup	Arb	Nectar, Pollen, Plants, Inverts	NF	N	N
Galah	<i>Cacatua roseicapilla</i>	NWD	ResSed	LRG	Hollow	Hol	Seeds, Grain, Plants	Gran	Y	N
Gang-gang Cockatoo	<i>Callocephalon fimbriatum</i>	WD	PMigMig	LRG	Hollow	Hol	Seeds, Grain, Plants	Gran	Y	N
Golden Whistler	<i>Pachycephala pectoralis</i>	WD	PMigMig	SML	Cup	Usty	Invertebrates	Arb	N	N
Grey Butcherbird	<i>Cracticus torquatus</i>	WD	ResSed	INT	Bowl	Opp	Invertebrates	Grnd	Y	N
Grey Currawong	<i>Strepera versicolor</i>	WD	ResSed	LRG	Bowl	Arb	Invertebrates	Arb	Y	Y
Grey Fantail	<i>Rhipidura fuliginosa</i>	WD	PMigMig	SML	Cup	Arb	Invertebrates	Arb	N	Y
Grey Shrike-thrush	<i>Colluricincla harmonica</i>	WD	ResSed	INT	Cup	Opp	Invertebrates	Arb	Y	Y
Laughing Kookaburra	<i>Dacelo novaeguineae</i>	WD	ResSed	LRG	Hollow	Hol	Vertebrates	Carn	Y	N
Leaden Flycatcher	<i>Myiagra rubecula</i>	WD	PMigMig	SML	Cup	Arb	Invertebrates	Arb	N	N
Magpie-lark	<i>Grallina cyanoleuca</i>	NWD	ResSed	INT	Bowl	Arb	Invertebrates	Grnd	Y	N
Mistletoebird	<i>Dicaeum hirundinaceum</i>	NWD	PMigMig	SML	Purse	Arb	Fruits	NF	N	N
Nankeen Kestrel	<i>Falco cenchroides</i>	NWD	PMigMig	LRG	Various	Opp	Vertebrates	Carn	Y	N
Noisy Friarbird	<i>Philemon corniculatus</i>	WD	PMigMig	LRG	Purse	Arb	Nectar, Pollen, Plants, Inverts	NF	N	N
Noisy Miner	<i>Manorina melanocephala</i>	NWD	ResSed	INT	Cup	Opp	Omnivorous	Arb	N	N
Olive-backed Oriole	<i>Oriolus sagittatus</i>	WD	PMigMig	INT	Purse	Arb	Nectar, Pollen, Plants, Inverts	NF	N	N
Pacific Black Duck	<i>Anas superciliosa</i>	NWD	PMigMig	LRG	Hollow	Opp	Seeds, Grain, Plants	Aqu	Y	N
Pied Currawong	<i>Strepera graculina</i>	NWD	PMigMig	LRG	Bowl	Arb	Omnivorous	Arb	Y	N
Red Wattlebird	<i>Anthochaera carunculata</i>	NWD	PMigMig	LRG	Cup	Arb	Nectar, Pollen, Plants, Inverts	NF	N	N

## SUPPLEMENTARY MATERIAL: Appendix 1

Rayner, L., Lindenmayer, D. B., Wood, J. T., Gibbons, P. and Manning, A. D. 2013. Are protected areas maintaining bird diversity? – *Ecography* 000: 000-000.

Red-rumped Parrot	<i>Psephotus haematonotus</i>	NWD	ResSed	INT	Hollow	Hol	Seeds, Grain or Plants	Gran	Y	Y
Rufous Whistler	<i>Pachycephala rufiventris</i>	WD	PMigMig	SML	Cup	Arb	Invertebrates	Arb	N	N
Sacred Kingfisher	<i>Todiramphus sanctus</i>	WD	PMigMig	SML	Hollow	Hol	Invertebrates	Grnd	Y	N
Scarlet Robin	<i>Petroica multicolor</i>	WD	ResSed	SML	Cup	Arb	Invertebrates	Grnd	Y	Y
Silvereye	<i>Zosterops lateralis</i>	WD	PMigMig	SML	Purse	Arb	Omnivorous	Shb	N	Y
Speckled Warbler	<i>Chthonicola sagittata</i>	WD	ResSed	SML	Dome	Grnd	Invertebrates	Grnd	Y	N
Spotted Pardalote	<i>Pardalotus punctatus</i>	WD	ResSed	SML	Hollow	Hol	Invertebrates	Arb	N	N
Striated Pardalote	<i>Pardalotus striatus</i>	NWD	PMigMig	SML	Hollow	Hol	Invertebrates	Arb	N	N
Striated Thornbill	<i>Acanthiza lineata</i>	WD	ResSed	SML	Dome	Arb	Invertebrates	Arb	N	N
Sulphur-crested Cockatoo	<i>Cacatua galerita</i>	NWD	PMigMig	LRG	Hollow	Hol	Seeds, Grain, Plants	Gran	Y	N
Superb Fairy-wren	<i>Malurus cyaneus</i>	WD	ResSed	SML	Dome	Usty	Invertebrates	Shb	Y	Y
Tree Martin	<i>Hirundo nigricans</i>	WD	PMigMig	SML	Hollow	Hol	Invertebrates	Air	N	Y
Varied Sitella	<i>Daphoenositta chrysoptera</i>	WD	ResSed	SML	Cup	Arb	Invertebrates	Arb	Y	Y*
Weebill	<i>Smicornis brevirostris</i>	WD	ResSed	SML	Purse	Arb	Invertebrates	Arb	N	N
Welcome Swallow	<i>Hirundo neoxena</i>	NWD	PMigMig	SML	Bowl	Opp	Invertebrates	Air	N	N
Western Gerygone	<i>Gerygone fusca</i>	WD	PMigMig	SML	Purse	Arb	Invertebrates	Arb	N	N
White-eared Honeyeater	<i>Lichenostomus leucotis</i>	WD	ResSed	SML	Cup	Usty	Invertebrates	Arb	N	N
White-naped Honeyeater	<i>Melithreptus lunatus</i>	WD	PMigMig	SML	Purse	Arb	Nectar, Pollen, Plants, Inverts	Arb	N	N
White-plumed Honeyeater	<i>Lichenostomus pencillatus</i>	NWD	ResSed	SML	Cup	Arb	Nectar, Pollen, Plants, Inverts	NF	N	Y
White-throated Gerygone	<i>Gerygone olivacea</i>	WD	PMigMig	SML	Purse	Arb	Invertebrates	Arb	N	N
White-throated Treecreeper	<i>Cormobates leucophaeus</i>	WD	ResSed	SML	Hollow	Hol	Invertebrates	Arb	N	N
White-winged Chough	<i>Corcorax melanorhamphos</i>	WD	ResSed	LRG	Bowl	Arb	Invertebrates	Grnd	N	N
Willie Wagtail	<i>Rhipidura leucophrys</i>	NWD	ResSed	SML	Cup	Arb	Invertebrates	Arb	Y	Y
Yellow-faced Honeyeater	<i>Lichenostomus chrysops</i>	WD	PMigMig	SML	Cup	Usty	Omnivorous	NF	N	N
Yellow-rumped Thornbill	<i>Acanthiza chrysorrhoa</i>	NWD	ResSed	SML	Dome	Arb	Invertebrates	Grnd	N	N

Habitat abbreviations: NWD=non-woodland dependent, WD=woodland dependent; Mobility abbreviations: ResSed=resident or sedentary, PMigMig=part migratory or migratory; Size abbreviations: SML=small, INT=intermediate, LRG=large; Nesting abbreviations: Hol=hollow, Arb=arboreal, Usty=understorey, Opp=opportunistic, Grnd=ground; Foraging substrate abbreviations: Gran=granivore, Grnd=ground insectivore, Aqu=aquatic, Arb=arboreal insectivore, Shb=shrub insectivore, NF=nectar and fruit, Air=aerial insectivore, Carn=carnivore; Y=Yes; N=No; \*Listed as vulnerable by ACT Flora and Fauna Committee.

ACT Flora and Fauna Committee. 2011. Thirteenth Annual Report: 2010-2011. Online at: [www.environment.act.gov.au/cpr/conservation\\_and\\_ecological\\_communities/act\\_flora\\_and\\_fauna\\_committee](http://www.environment.act.gov.au/cpr/conservation_and_ecological_communities/act_flora_and_fauna_committee)

Bounds, J., Taws, N. and Cunningham, R. 2010. A Statistical Analysis of Trends in Occupancy Rates of Woodland Birds in the Act, December 1998 to December 2008: The Ten-Year Data Analysis. - *Canberra Bird Notes* 35: 158-92

Christidis, L., and Boles, W. 2008. Systematics and taxonomy of Australian birds. - Collingwood: CSIRO Publishing

Ikin, K., Knight, E., Lindenmayer, D. B., Fischer, J. and Manning, A. D. 2012. Linking bird species traits to vegetation characteristics in a future urban development zone: implications for urban planning. *Urban. Ecosyst.* 15: 961-977.

Lindenmayer D.B. and Cunningham R.B. 2011. Longitudinal patterns in bird reporting rates in a threatened ecosystem: Is change regionally consistent? - *Biol. Conserv.* 144: 430-440.

Reid, J. R. W. 1999. Threatened and declining birds in the New South Wales sheep-wheat belt: I. Diagnosis, characteristics and management. - Canberra: CSIRO Wildlife and Ecology.

Reid J. and Cunningham R.B. 2008. Statistical Analysis of the First Six Years of Bird Surveys for the Cowra Woodland Birds Program: Trends and Implications for Woodland Bird Conservation in the Cowra Shire, NSW. Unpublished Report to Lachlan Catchment Management Authority, Birds Australia and The Fenner School of Environment and Society, ANU, Canberra.

Silcocks, A., Tzaros, C., Weston, M., and Olsen, P. 2005. An interim guild classification for woodland and grassland birds in Australia: Birds Australia Supplementary Report. – Birds Australia.

## SUPPLEMENTARY MATERIAL: Appendix 2

Rayner, L., Lindenmayer, D. B., Wood, J. T., Gibbons, P. and Manning, A. D. 2013. Are protected areas maintaining bird diversity? – *Ecography* 000: 000-000.

**Table A2. Static and long-term environmental descriptors used in analyses.** Variables were compared across reservation categories to examine the differences in physical characteristics, and temporal change in ecological processes, associated with protected areas through time. Selected variables were also investigated for their relationship with bird occurrence using RLQ analysis. All variables were either collected as, or transformed to, annual measures. Measures at the Site and Local scale were calculated within a 50 and 500 metre radius of sites respectively. Longitudinal estimates were calculated for each site/reserve using remotely-sensed time-series data. Further information on data is available via the references provided below.

Environmental descriptor	Data source	Data description	Scale	Data type (period)
Reserve area	ACT Environment and Sustainable Development Directorate	The total area of each reserve measured in hectares.	Reserve	Static value (2010)
Elevation	Australian Capital Territory, Parks, Conservation and Lands	The mean elevation of each reserve calculated in ArcGIS using spatial data provided by Australian Capital Territory, Parks, Conservation and Lands.	Reserve	Static mean (2010)
Landscape position (twi)	Fenner School of Environment and Society, The Australian National University	The mean topographic wetness index (twi) is derived by dividing contributing catchment by slope. It is a continuous terrain-based measure of position in the landscape, ranging from negative values on ridges (with no contributing catchment) and upper slopes (small contributing catchment/steep slope) to increasingly higher positive values through lower slopes, valley flats and eventually drainage lines.	Reserve	Static mean (2010)
Potential productivity (fpi)	National Carbon Accounting Service. Also see Landsberg & Kesteven <i>et al.</i> (2004) below.	Monthly values of environmental constraints on productivity indices were averaged to provide annual estimates for each site. Productivity indices (here named “potential productivity”) are expressed by modifiers calculated from abiotic measures. These measures included temperature, vapour pressure deficit ( <i>VPLD</i> ) of the atmosphere, soil water deficit and number of frost days.	On-site	Temporal (Jan. 2000 – Dec. 2010)
Plant productivity (fPAR)	Mackey, B. and colleagues. Also see Berry <i>et al.</i> 2007 and Mackey <i>et al.</i> (2008) below.	Monthly measures of normalized difference vegetation index (NDVI) are treated to extract the fraction of photosynthetically active radiation absorbed by vegetation (fPAR, here named “plant productivity”, but also referred to as a measure of “greenness” or a “greenness index”). Monthly calculations were summed to provide annual totals. This provides a relative measure of plant production per year. Unavailable months of data (Jan, Feb, March 2000 and Sep, Oct, Nov, Dec 2010) were imputed using generalised linear models.	On-site	Temporal (Apr. 2000 – Aug. 2010)
Woody vegetation cover	National Carbon Accounting Service. Also see Furby & CSIRO (2002).	Landsat satellite imagery is used to discriminate between forest and non-forest cover. Forest cover (here named “woody vegetation cover”) is defined as vegetation with a minimum 20 per cent canopy cover, potentially reaching 2 metres high and a minimum area of 0.2 hectares. NB: this product does not adequately represent sparse open woodland or scattered trees. Mean values of woody cover were used in analyses.	Reserve and Local	Temporal (Jan. 2000 – Dec. 2010)
Urban proximity	ACT Environment and Sustainable Development Directorate and	The proximity of sites to the urban boundary was calculated using the near function in ArcGIS with spatial data provided by ACT Environment and Sustainable Development Directorate. Estimates of distance for each year were cross-checked using aerial imagery of the Canberra region provided by Australian Capital Territory, Parks, Conservation and Lands.	Regional	Temporal (Jan. 2000 – Dec. 2010)

Berry, S., Mackey, B. and Brown, T. 2007. Potential applications of remotely sensed vegetation greenness to habitat analysis and the conservation of dispersive fauna. – *Pac. Conserv. Biol.* 13: 120-127.

Furby, S. and CSIRO Mathematical and Information Sciences. 2002. Land cover change: specification for remote sensing analysis. National Carbon Accounting System Technical Report No. 9. - Australian Greenhouse Office, Canberra, 401pp.

Kesteven, J., Landsberg, J. and URS Australia. 2004. Developing a National Forest Productivity Model. National Carbon Accounting System Technical Report No. 23. - Australian Greenhouse Office, Canberra, 102 pp.

Landsberg, J. and Kesteven, J. 2001. Spatial estimation of plant productivity. In: Richards, G. (ed.) Biomass Estimation: Approaches for Assessment of Stocks and Stock Change. National Carbon Accounting System Technical Report No.27. - Australian Greenhouse Office, Canberra, pp. 33–50.

Mackey B. Berry S. and Brown T. 2008. Reconciling approaches to biogeographic regionalization: a systematic and generic framework examined with a case study of the Australian continent. – *J. Biogeog.* 35: 213–229.



# SUPPLEMENTARY MATERIAL: Appendix 4

Rayner, L., Lindenmayer, D. B., Wood, J. T., Gibbons, P. and Manning, A. D. 2013. Are protected areas maintaining bird diversity? – *Ecography* 000: 000-000.

**Table A4. Differences and long-term trends in species richness and individual species across reservation categories.** Analyses of richness include survey effort as a fixed effect, which was highly significant for species richness ( $p < 0.001$ ) and marginally significant for the number of species of conservation concern ( $p = 0.065$ ). Location explained a significant amount of variation in both models of richness, and for 40 individual species. Site explained a significant amount of variation in both models of richness, and for 45 individual species. Random effects of location and site were pooled, and explained a significant amount of variance, for 11 of the more spatially restricted species (denoted by \*). All species occurred in  $>1\%$  of surveys and are listed in order of detection rate. Scientific names are provided in Appendix 1.

Response measure	Surveys present (%)	Sites pres. (n)	Total obs. (n)	Reservation category		Pre-1995 reserved		Post-1995 reserved		Unreserved		Reservation x Year		Pre-1995 reserved trend		Post-1995 reserved trend		Unreserved trend	
				$\chi^2_3$	P	Est.	S.E.	Est.	S.E.	Est.	S.E.	$\chi^2_3$	P	Slope	S.E.	Slope	S.E.	Slope	S.E.
Richness	100.00	92	13507	596.7	<0.001	1.567	0.090	1.670	0.099	1.813	0.089	76.1	<0.001	-0.034	0.005	0.008	0.004	0.020	0.004
Species of concern richness	59.87	91	3355	32.05	<0.001	0.101	0.192	0.444	0.205	0.985	0.183	63.91	<0.001	-0.118	0.015	-0.003	0.011	-0.003	0.009
Crimson Rosella	43.58	92	1642	0.41	0.938	-0.150	0.373	-0.137	0.388	-0.217	0.430	6.50	0.090	-0.011	0.023	-0.005	0.019	0.050	0.020
Striated Pardalote	35.75	92	1347	23.40	<0.001	-1.653	0.340	-0.124	0.366	-0.331	0.341	41.08	<0.001	-0.133	0.027	0.078	0.020	0.019	0.020
Weebill	34.90	88	1315	14.63	0.002	-0.819	0.309	-0.834	0.323	-0.461	0.282	61.84	<0.001	-0.129	0.025	0.075	0.022	0.102	0.021
Australian Magpie	30.41	92	1146	36.32	<0.001	-0.547	0.239	-1.116	0.259	-0.899	0.225	19.40	<0.001	0.046	0.023	0.006	0.022	0.084	0.021
Eastern Rosella	28.48	89	1073	12.68	0.005	-1.355	0.480	-0.922	0.566	-1.016	0.497	6.08	0.108	-0.020	0.025	0.030	0.025	0.044	0.022
Grey Fantail	24.04	86	906	148.28	<0.001	-2.062	0.240	-1.416	0.193	-0.914	0.189	41.31	<0.001	-0.198	0.033	-0.008	0.023	-0.049	0.021
Galah	23.67	83	892	47.31	<0.001	-1.166	0.378	-1.997	0.401	-1.222	0.339	50.21	<0.001	0.086	0.026	0.008	0.029	0.145	0.023
Buff-rumped Thornbill	18.90	75	712	32.78	<0.001	-2.261	0.521	-1.759	0.576	-2.019	0.585	21.96	<0.001	-0.161	0.037	0.020	0.023	0.038	0.027
Noisy Miner	18.37	56	692	19.65	<0.001	-2.968	1.067	-2.526	1.016	-3.300	1.112	67.34	<0.001	0.264	0.045	0.158	0.035	0.157	0.044
Common Starling	15.61	47	588	38.03	<0.001	-4.487	0.840	-3.054	0.949	-1.911	0.877	7.67	0.053	-0.123	0.050	-0.053	0.044	0.014	0.027
Superb Fairy-wren	15.10	55	569	36.00	<0.001	-2.696	0.719	-3.973	0.795	-1.575	0.703	43.82	<0.001	-0.228	0.035	-0.072	0.059	-0.025	0.024
Sulphur-crested Cockatoo	14.78	78	557	64.25	<0.001	-2.143	0.427	-1.812	0.454	-2.229	0.415	19.54	<0.001	0.108	0.031	0.010	0.027	0.079	0.030
Spotted Pardalote	14.68	89	553	330.40	<0.001	-2.043	0.184	-1.631	0.183	-1.952	0.164	13.22	0.004	-0.080	0.034	0.057	0.023	0.035	0.028
Rufous Whistler *	13.16	76	496	373.00	<0.001	-3.667	0.287	-1.805	0.176	-1.762	0.178	14.11	0.003	-0.166	0.058	-0.008	0.025	-0.061	0.025
Red Wattlebird	11.65	82	439	206.70	<0.001	-1.191	0.241	-2.973	0.307	-2.684	0.261	16.31	<0.001	0.027	0.025	0.023	0.037	0.147	0.038
Pied Currawong	11.44	72	431	28.86	<0.001	-2.064	0.659	-2.119	0.732	-2.807	0.651	18.41	<0.001	0.038	0.025	-0.015	0.049	0.154	0.039
Striated Thornbill	11.12	71	419	38.39	<0.001	-2.989	0.665	-3.275	0.793	-2.441	0.723	18.86	<0.001	-0.165	0.064	-0.051	0.027	-0.089	0.030
Australian Raven	10.56	85	398	128.27	<0.001	-2.268	0.307	-2.577	0.346	-1.967	0.315	29.90	<0.001	0.035	0.033	0.041	0.038	0.152	0.029
Noisy Friarbird	10.16	89	383	195.24	<0.001	-2.308	0.264	-1.959	0.287	-2.650	0.269	3.08	0.379	-0.007	0.034	0.023	0.028	0.057	0.037
White-throated Treecreeper	10.06	62	379	52.71	<0.001	-3.314	0.630	-3.074	0.728	-3.072	0.701	26.26	<0.001	-0.251	0.053	-0.051	0.028	-0.020	0.034
Yellow-rumped Thornbill	9.98	70	376	131.81	<0.001	-2.972	0.389	-2.762	0.410	-2.160	0.351	17.59	<0.001	-0.159	0.045	0.067	0.034	0.035	0.028
Black-faced Cuckoo-shrike	9.82	87	370	285.5	<0.001	-2.615	0.237	-2.184	0.247	-2.252	0.217	6.09	0.107	-0.096	0.039	-0.002	0.032	0.002	0.031
Yellow-faced Honeyeater	9.16	83	345	223.70	<0.001	-2.072	0.260	-3.222	0.308	-2.072	0.256	2.37	0.499	-0.033	0.035	0.006	0.042	0.034	0.028
White-plumed Honeyeater	8.17	41	308	77.65	<0.001	-6.529	1.015	-3.789	0.791	-2.630	0.711	10.36	0.016	-0.326	0.212	-0.165	0.061	-0.023	0.030
Mistletoebird	6.61	64	249	55.06	<0.001	-3.238	0.655	-3.664	0.744	-2.833	0.638	23.77	<0.001	-0.229	0.062	0.077	0.036	-0.088	0.038
Magpie-lark	6.40	54	241	148.93	<0.001	-3.482	0.452	-3.431	0.499	-3.145	0.424	20.72	<0.001	-0.042	0.049	-0.005	0.043	0.188	0.042

## SUPPLEMENTARY MATERIAL: Appendix 4

Rayner, L., Lindenmayer, D. B., Wood, J. T., Gibbons, P. and Manning, A. D. 2013.  
Are protected areas maintaining bird diversity? – Ecography 000: 000-000.

White-throated Gerygone	6.24	60	235	180.85	<0.001	-5.368	0.654	-2.883	0.464	-2.841	0.396	17.53	<0.001	-0.423	0.117	-0.001	0.034	-0.076	0.036
White-winged Chough	5.79	61	218	176.57	<0.001	-3.624	0.423	-2.913	0.413	-3.436	0.381	24.93	<0.001	-0.080	0.057	0.101	0.034	0.196	0.052
Red-rumped Parrot	5.73	21	216	111.69	<0.001	-6.680	0.925	-6.813	1.065	-3.236	0.660	21.90	<0.001	-0.545	0.129	0.329	0.162	-0.005	0.031
Crested Pigeon	5.65	49	213	90.87	<0.001	-3.538	0.638	-4.240	0.698	-3.824	0.657	53.58	<0.001	0.230	0.047	0.271	0.068	0.170	0.046
Scarlet Robin	5.47	60	206	155.11	<0.001	-3.636	0.437	-3.091	0.463	-3.265	0.423	5.55	0.136	-0.032	0.071	-0.072	0.032	0.030	0.045
Common Myna	5.39	34	203	80.27	<0.001	-3.770	0.733	-5.030	0.909	-4.195	0.784	68.24	<0.001	-0.319	0.045	0.162	0.119	0.201	0.049
Australian Wood Duck	5.28	50	199	129.36	<0.001	-4.462	0.567	-3.418	0.554	-3.150	0.473	1.84	0.607	0.001	0.066	0.023	0.042	0.052	0.042
Speckled Warbler	4.64	51	175	135.78	<0.001	-3.170	0.497	-4.064	0.551	-3.473	0.477	26.20	<0.001	-0.107	0.047	0.180	0.058	0.157	0.047
Laughing Kookaburra	4.25	61	160	242.90	<0.001	-3.298	0.349	-3.989	0.420	-2.902	0.331	2.97	0.397	0.022	0.053	-0.073	0.063	0.046	0.039
Western Gerygone	3.93	50	148	112.37	<0.001	-6.070	0.828	-3.030	0.560	-3.309	0.537	1.77	0.622	0.132	0.192	-0.027	0.040	-0.040	0.044
Willie Wagtail *	3.90	40	147	413.20	<0.001	-5.981	0.700	-4.202	0.325	-3.197	0.270	7.30	0.063	-0.408	0.156	0.036	0.055	-0.002	0.038
White-eared Honeyeater	3.77	54	142	196.20	<0.001	-3.395	0.396	-3.881	0.440	-3.400	0.398	32.25	<0.001	-0.049	0.057	0.126	0.056	0.263	0.051
Brown-headed Honeyeater *	3.69	51	139	666.70	<0.001	-5.013	0.474	-2.860	0.186	-3.640	0.225	8.79	0.032	-0.268	0.125	0.074	0.038	-0.030	0.055
Grey Shrike-thrush	3.40	56	128	458.80	<0.001	-4.700	0.420	-3.493	0.292	-3.009	0.241	8.66	0.034	-0.266	0.103	-0.067	0.054	-0.025	0.040
Tree Martin *	3.37	27	127	273.80	<0.001	-12.28	9.145	-5.870	0.587	-3.035	0.264	28.17	<0.001	0.017	3.000	-0.230	0.155	-0.182	0.036
Silvereye	3.24	50	122	225.10	<0.001	-3.750	0.439	-3.688	0.450	-3.782	0.391	20.21	<0.001	-0.249	0.056	0.010	0.057	-0.012	0.059
Brown Thornbill	3.13	52	118	153.53	<0.001	-4.113	0.526	-4.468	0.621	-3.117	0.448	6.27	0.099	-0.162	0.072	-0.049	0.064	-0.032	0.043
Grey Butcherbird	2.89	47	109	265.20	<0.001	-3.898	0.391	-3.475	0.396	-3.681	0.358	3.24	0.355	0.107	0.070	0.001	0.050	0.054	0.058
Australian King-Parrot	2.81	29	106	45.29	<0.001	-4.436	1.145	-4.667	1.169	-7.109	1.383	10.29	0.016	0.080	0.040	0.167	0.144	0.516	0.236
Golden Whistler *	2.71	54	102	911.20	<0.001	-3.724	0.258	-3.557	0.189	-3.662	0.201	9.34	0.025	-0.207	0.069	0.003	0.053	-0.035	0.057
Common Bronzewing	2.47	40	93	74.92	<0.001	-4.574	0.930	-5.085	0.969	-3.694	0.700	1.07	0.784	-0.005	0.052	0.018	0.083	0.059	0.058
Leaden Flycatcher *	2.42	45	91	716.20	<0.001	-4.346	0.354	-3.736	0.226	-4.114	0.259	10.53	0.015	-0.262	0.089	0.075	0.056	-0.023	0.068
Olive-backed Oriole	2.28	44	86	424.00	<0.001	-4.337	0.422	-3.758	0.398	-4.022	0.359	4.36	0.226	-0.068	0.077	0.034	0.058	0.121	0.067
Eastern Spinebill	2.04	26	77	115.96	<0.001	-5.351	0.792	-4.310	0.728	-4.703	0.719	5.21	0.157	-0.280	0.149	-0.070	0.055	0.020	0.068
Dusky Woodswallow *	1.80	24	68	421.20	<0.001	-5.065	0.505	-5.812	0.542	-3.881	0.296	7.44	0.059	-0.283	0.118	-0.151	0.117	-0.003	0.051
Pacific Black Duck	1.78	14	67	128.41	<0.001	-7.058	1.115	-4.827	0.740	-5.618	0.735	5.93	0.115	0.186	0.240	-0.133	0.058	-0.001	0.106
Varied Sittella *	1.73	40	65	831.10	<0.001	-4.548	0.355	-4.163	0.235	-3.909	0.217	4.76	0.190	-0.212	0.101	0.031	0.072	-0.027	0.064
Grey Currawong	1.65	33	62	117.71	<0.001	-4.240	0.667	-5.345	0.799	-4.448	0.629	7.57	0.056	-0.194	0.079	-0.099	0.823	0.010	0.081
Brown Treecreeper *	1.62	14	61	265.50	<0.001	-7.620	1.740	-41.63	70.48	-4.250	0.360	0.98	0.807	-0.380	0.450	7.730	14.310	0.005	0.050
Welcome Swallow *	1.27	22	48	412.90	<0.001	-5.866	0.686	-5.879	0.585	-4.427	0.328	5.54	0.136	-0.213	0.187	-0.285	0.144	-0.035	0.065
White-naped Honeyeater	1.22	34	46	353.30	<0.001	-4.809	0.469	-4.748	0.460	-4.078	0.356	3.49	0.322	-0.149	0.112	0.056	0.100	0.082	0.069
Gang-gang Cockatoo *	1.19	16	45	266.00	<0.001	-3.371	0.248	-13.283	12.669	-6.481	0.727	2.89	0.408	0.091	0.054	0.020	4.156	0.055	0.234
Sacred Kingfisher	1.04	23	39	135.46	<0.001	-6.065	0.748	-3.851	0.663	-5.123	0.676	12.05	0.007	0.049	0.163	0.163	0.077	0.302	0.110
Nankeen Kestrel	1.01	17	38	201.80	<0.001	-5.343	0.594	-4.746	0.599	-4.956	0.517	4.46	0.216	-0.064	0.100	-0.198	0.099	0.023	0.102