

WOODLAND BIRD ASSEMBLAGES ON THE NEW ENGLAND TABLELANDS,
NORTHEASTERN NEW SOUTH WALES

by

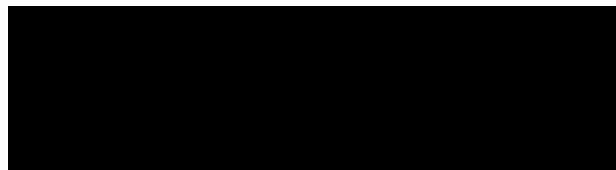
Geoffrey Willmott Barrett
B.Sc. (hons) (University of Sydney)

A thesis submitted for the degree of Doctor of Philosophy of the University of New
England, Armidale, New South Wales, Australia.

June 1995

DECLARATION

I certify that the substance of this thesis has not already been submitted for any degree and is not being currently submitted for any other degree. I certify that any help received in preparing this thesis, and all sources used, have been acknowledged.



Geoff Barrett

June 1995

ACKNOWLEDGMENTS

I found my PhD study to be a long and challenging but ultimately enriching process. I am indebted to my supervisors Hugh Ford and Harry Recher for their guidance and support as well as for fulfilling their role as the focus of frustration for an overwhelmed student. It is my hope that both Hugh and Harry will be my friends in the future. Perhaps it was divine intervention or just plain good luck, but the presence of Bob Howe during the early stages of my thesis work and his continuing support throughout was my good fortune. I wish to also thank Stuart Cairns for providing much needed statistical advice. With his community spirit and love of all things artistic, David Curtis helped me to stay in touch with the social obligations of science. A special thanks to Jo Monaghan and Giselle Whish for reading and polishing the proofs. Jo was also a great support during the writing-up stage. The technical staff in both the Departments of Zoology and Ecosystem management have been great, I couldn't have wanted for a more helpful, cheery bunch.

I have been fortunate to have enjoyed the warmth of friendship since arriving in Armidale to begin my study. To all those with whom I have had a drink and a chat, a kick of the footy or a swim at the Dam, I thank you for your company and support. It would not be right if I didn't mention in particular; Chris Holden, Adrian Stokes, Michael Andren, Mike Ramsey, John and Uschi Munro, Helen Sink, Michael Callahor, Dieter Vögels, Rosemary Lot, Anita Chalmers, Damon Oliver and Jo Monaghan. It was also nice to know that if everything had fallen apart I could have gone back to Sydney and be consoled by friends and family. Mum, Dad, Alan, Elaine and Tanya thank you, there is something particularly special about family. Angus Gray, Nic and Claire I thank you also. It would also not be right if I did not thank my God for watching my way and providing a light when things seemed dim and lack-lustre.

This thesis would not have been possible without financial support from an Australian Postgraduate Research Award (APRA). The World Wide Fund For Nature (WWF) also provided much needed financial support, particularly during the later stages of my project. After my scholarship ran out and the flow of WWF money slowed to a trickle, I became increasingly grateful to the following people who provided me with casual work; Bert Jenkins, Paul Whittington, Francis Quinn and Mary Notestine. As these work commitments clashed with the need to devote more time to writing my thesis I was increasingly supported by the doc. A glance at my mastercard balance reminds me that doing a PhD thesis in ecology is for love rather than money.

ABSTRACT

There is concern that bird species are declining in many parts of the world, particularly in rural landscapes where clearing and fragmentation of habitat has been most extensive. The present study assesses the conservation status of 137 land birds that occur on the New England Tablelands in northeastern New South Wales, Australia. Only a quarter of these species are abundant and widespread, seemingly unaffected or favoured by current land management practices. The remainder are either extinct on the New England Tablelands (6 spp.), are declining (18 spp.), are vulnerable due to an apparent dependence on healthy woodland (35 spp.) or may have always been uncommon on the Tablelands (45 spp.).

Predictive models indicate that bird species richness on the Armidale Plateau, an upland region on the New England Tablelands, tends to be greater where mistletoes, large trees, fallen timber and understorey vegetation are present. More species tend also to occur close to water-courses and in woodland sites where the herbaceous vegetation is well developed. Lower bird species richness tends to be where eucalypt dieback is extensive. The gum-box woodland, that occurs on the richer soils at lower altitude, had fewer bird species than expected. This may be due to this woodland type having been extensively cleared, and that which remains being highly degraded. Another factor may be the increased abundance of territorial species, such as the noisy miner *Manorina melanocephala* and fuscous honeyeater *Lichenostomus fuscus*, in gum-box woodland.

Repeat surveys in transects of fixed area indicate a trend towards more bird species being present in larger woodland patches. However, a single survey in a larger number of sites (294) indicates that bird species richness per site was negatively associated with the area of the woodland patch. This same survey indicates that the number of species per unit area was greatest in the intermediate-sized patches, decreasing in remnants that were either greater than 400 ha or less than six hectares in area. A single survey of

birds, on transects of fixed area, during any season, indicates that bird species richness is at least as high in patches as small as 20 ha as it is in the more extensively wooded areas. Seasonal trends indicate that intermediate-sized woodland patches (particularly 101 to 400 ha) are most important during spring and autumn, when many birds are moving through the landscape on the Armidale Plateau.

The effects of grazing by livestock, tree and understorey removal, and eucalypt dieback, were most pronounced in woodland patches that were less than 6 ha in area. Noisy miners and nest predators were also more common in these smaller woodland patches. The presence of a territorial species such as the noisy miner throughout the landscape, increases the importance of larger woodland patches at a regional level, for conserving bird species richness. A single survey in sites without noisy miners indicated that there was a negative association between bird species richness and area, however, when sites with miners were considered, the opposite trend occurred. This survey suggests that miners were less effective at excluding other bird species from their territories in woodland patches that were greater than 20 ha in area.

The reduced importance of large patches of woodland, and the lack of isolation and edge effects on the bird assemblages is partly due to the presence of extensively wooded areas that surround the Armidale Plateau. It is probably also due to the variegated nature of the landscape on the Armidale Plateau. That is, rather than being a truly fragmented landscape where woodland remnants occur as easily defined patches with discrete boundaries, the woodland remnants have a relatively open canopy, are diffusely fragmented and surrounded by scattered trees. As such, it is likely that the majority of bird species perceive the whole of the landscape to be suitable as habitat, to varying degrees. While this is likely to be so, the majority of bird species appear to use strips of vegetation as fly-ways, rather than cross open grassland. The present study indicates that strips of woodland linking patches of woodland are important, but not essential as corridors for bird movement.

As an overall conclusion, bird species richness can be maintained throughout the landscape on the Armidale Plateau by maintaining habitat heterogeneity, both within and between remnants. While existing large areas of woodland are important for conservation and should be protected from further clearing and fragmentation, it appears that a network of inter-connected remnants, each of which is at least 20 ha in area, would be sufficient to conserve the majority of locally occurring species. The establishment of such a remnant network throughout the 'off-reserve' areas between national parks, State forests and nature reserves, is consistent with sustainable farming initiatives and should be a regional conservation priority. This approach could be appropriate in other rural parts of Australia.

TABLE OF CONTENTS

DECLARATION.....	ii
ACKNOWLEDGMENTS.....	iii
ABSTRACT.....	v
TABLE OF CONTENTS.....	viii
PREFACE.....	xii
CHAPTER 1: GENERAL INTRODUCTION.....	1
CHAPTER 2: FACTORS AFFECTING WOODLAND BIRD ABUNDANCE AND DISTRIBUTION IN A FRAGMENTED RURAL LANDSCAPE.....	12
2.1 INTRODUCTION.....	12
2.2 STUDY AREA.....	14
2.3 METHODS.....	16
2.3.1 Bird Survey.....	16
2.3.2 Environmental Variables.....	18
<i>Trees, Shrubs and Herb Vegetation</i>	18
<i>Landscape Variables</i>	20
<i>Area of Woodland Patch</i>	20
<i>Derived Environmental Variables</i>	21
2.4 ANALYSIS.....	22
2.4.1 Regression Using Principal Components.....	24
2.4.2 Standard Multiple Regression.....	25
<i>Single 20 minute survey (spring 1990)</i>	25
<i>Repeated Measures on 63 Sites</i> <i>(8 surveys over two years)</i>	26
2.4.3 Hybrid Multi dimensional Scaling (HMDS).....	27
2.5 RESULTS.....	30
2.5.1 Cluster Analysis of Environmental Variables.....	30
2.5.2 Principal Components Analysis of Environmental Variables.....	31
2.5.3 Predictive Models.....	31
2.5.4 Regression Models for Bird Groups.....	33
<i>Number of bird species and Simpson's</i> <i>Diversity Index</i>	34
<i>Number of Species and Area</i>	35
<i>Number of birds</i>	36
<i>Uncommon Species</i>	37
<i>Common Species</i>	38
<i>Species With a Low Population Density</i>	38

	<i>Species with a High Population Density</i>	39
	<i>Woodland Species</i>	40
	<i>Open-country Species</i>	41
	<i>Ground-foragers</i>	42
	<i>Understorey Species</i>	43
	<i>Bark-foragers</i>	43
	<i>Foliage-gleaners (and Snatchers)</i>	44
	<i>Fruit-eaters</i>	45
	<i>Honeyeaters</i>	45
	<i>Nest Predators</i>	47
	<i>Hollow-nesters</i>	47
	<i>Summer Visitors</i>	48
	<i>Winter Visitors</i>	49
	<i>Resident Species</i>	49
2.6	DISCUSSION.....	50
2.6.1	Area and Bird Species Richness.....	50
2.6.2	Dieback: Vegetation Biomass.....	52
2.6.3	Grazing and Vegetation Biomass.....	53
2.6.4	Grazing and Herbaceous Vegetation.....	54
2.6.5	Vegetation Species Richness.....	55
2.6.6	Timber Removal.....	56
2.6.7	Edge Effects.....	57
2.6.8	Noisy miners.....	58
2.6.9	Nest Predators.....	59
2.6.10	Mistletoes.....	60
2.6.11	Altitude and Woodland Type.....	61
2.6.12	Linear Habitat Features: Water-courses and Strips of Woodland.....	63
2.6.13	The Armidale Plateau: Management	64
2.6.14	In Summary.....	67
Figure 2.1	Distribution of 294 census sites in woodland patches within a 60 km of Armidale, on the New England Tablelands.....	69
Figure 2.2	The effect of area of woodland patch and presence of noisy miners on the mean number of bird species recorded during a single 20 minute census.....	70
Figure 2.3	The effect of area of woodland patch on the mean number of bird species recorded during a single 20 minute census in stringybark woodland and gum-box woodland.....	71

Figure 2.4	Cumulative number of bird species at sites in different sized woodland patches.....	72
Table 2.1	Bird species groupings.....	73
Table 2.2	The mean values of the 35 environmental variables.....	74
Table 2.3	Correlation matrix for selected habitat variables.....	75
Table 2.4	Summary of site characteristics and associated bird groups..	76
Table 2.5	Principal components analysis of 35 habitat variables.....	77
Table 2.6	Environmental variables that were significant predictors of bird abundance.....	78
Table 2.7	Summary of the frequency of selection of environmental variables as either positive or negative predictors.....	79

CHAPTER 3: SEASONAL INTERACTIONS BETWEEN WOODLAND BIRDS AND AREA OF REMNANT, DOMINANT TREE SPECIES, AND THE USE OF STRIPS OF VEGETATION AS FLY-WAYS.....			80
3.1	INTRODUCTION....		80
3.2	STUDY AREA.....		82
3.3	METHODS.....		83
	3.3.1 Bird Survey.....		83
	3.3.2 Area of Woodland Patch.....		84
	3.3.3 Dominant Tree Species.....		84
	3.3.4 Woodland Patches, Water-courses, Corridors, Peninsulas and Grassland.....		85
	3.3.5 Fly-ways.....		85
	3.3.6 Noisy Miners		86
	3.3.7 Analysis.....		87
3.4	RESULTS.....		88
	3.4.1 Area of Patch		88
	3.4.2 Dominant tree species.....		89
	3.4.3 Woodland Patches, Strips, Water-courses and Grassland.....		90
	3.4.4 Fly-ways.....		91
	3.4.5 Noisy Miners		93
	3.4.6 Temporal Changes in Noisy Miner Territories.....		94
3.5	DISCUSSION.....		95
Figure 3.1	Positioning of strip transects.....		103
Figure 3.2	The mean number of bird species per site in different sized woodland patches during spring, summer, autumn and winter.....		104
Figure 3.3	Seasonal variation in the number of selected bird species in gum-box woodland and stringybark woodland.....		105
Figure 3.4	Seasonal variation in the number of honeyeater species per hectare in gum-box woodland and stringybark woodland.....		106

Figure 3.5	Seasonal variation in the mean number of bird species and the number of birds on transects in woodland patches, along water-courses within woodland patches, in woodland corridors, peninsulas and on grassland transects.....	107
Figure 3.6	The total number flights in woodland patches, along water-courses within woodland patches, in woodland corridors, peninsulas and on grassland transects.....	108
Figure 3.7	The number of flights along and across transects, during spring, summer, autumn and winter, in woodland patches, along water-courses within woodland patches, in corridors, peninsulas and on grassland transects.....	109
Figure 3.8	The mean number of bird species in control sites and sites in which noisy miner territories were temporarily established during winter 1991.....	110
CHAPTER 4: CONSERVATION OF WOODLAND BIRDS IN A		
	FRAGMENTED RURAL LANDSCAPE.....	111
4.1	INTRODUCTION.....	111
4.2	STUDY AREA.....	112
4.3	METHODS.....	113
	4.3.1 Assessment of conservation status of woodland birds.....	113
	4.3.2 Effect of woodland area.....	116
4.4	RESULTS.....	117
	4.4.1 Assessment of conservation status of woodland birds.....	117
	4.4.2 Effect of woodland area.....	118
4.5	DISCUSSION.....	120
Figure 4.1	The effect of area of woodland patch on the mean number of bird species (within 1.2 ha transects, 294 in total).....	127
Figure 4.2	The mean number treecreepers in different sized patches of woodland.....	128
Table 4.1	The conservation status of 137 land birds on the Armidale Plateau.....	129
CHAPTER 5: GENERAL DISCUSSION.....		
REFERENCES.....		
APPENDICES.....		
Appendix 1	Cluster diagram.....	170
Appendix 2	Stepwise regressions of bird groups against 11 principal components	171
Appendix 3	Standard multiple regression models from a single survey... ..	172
Appendix 4	Standard multiple regression models for the 63 sites in which surveys were repeated each season for two years.....	173
Appendix 5	Correlation coefficients for the six most 'influential' habitat variables.....	174

PREFACE

The first and last chapters are the general introduction and general discussion respectively. Chapters 2, 3 and 4 have been written as manuscripts for publication. As a result there is some repetition, particularly in the study site descriptions and methods sections. With the exception of some minor changes, Chapter 4 is presented as it has been published in 1994 in *Pacific Conservation Biology, Vol. 1, pp. 245-256*. This chapter was completed prior to the other thesis chapters and prior to the full data analysis. As a result there are some slight differences in the presentation and interpretation of the results in Chapter 4. In particular, the importance of large woodland patches for conservation may be understated. Chapter 2 is the largest chapter. It describes a broad survey of birds and description of environmental parameters in 294 sites. Associate Professor Bob Howe (University of Wisconsin, Green Bay) provided expertise about the experimental design and data collection during the early stages of this project. Bob also conducted a single survey of birds in 160 of these sites, with his permission these data were used in this thesis. A second person, my co-supervisor Associate Professor Hugh Ford, also assisted with a single survey of birds in 50 sites. The environmental data were collected by up to ten field assistants, their wages paid for by the World Wide Fund For Nature (WWF).