AN EXPERIMENTAL STUDY OF THE IMPACT OF GAPS AND CLUSTERS SILVICULTURE ON INSECTIVOROUS BIRDS IN A CONTINUOUS FOREST LANDSCAPE

Andrew John Huggett
B.Env.Sc.(Hons.) (University of Wollongong)

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CITATION

"To strive, to seek, to find, and not to yield"

(*Ulysses*, Lord Alfred Tennyson)

DEDICATION

This thesis is dedicated to the memory of S.G. (Bill) Lane.

CERTIFICATION

I certify that the substance of this thesis has not already been submitted for any degree and is not currently being submitted for any other degree or qualification.

I certify that any help received in preparing this thesis, and all sources used, have been acknowledged in this thesis.

Andrew John Huggett

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ABSTRACT

The forests of north-eastern New South Wales have outstanding biological significance. They support 430 species of vertebrate fauna, of which 35 are endemic to the region, and 82 are endangered, threatened or rare. They contain the second highest diversity of bird species in Australia, after the wet tropics of north Queensland. Coastal moist eucalypt forests within this region provide important over-wintering habitat for migratory birds. Despite these values, there has been little prior investigation of the ecology of the avifauna of the north-eastern NSW forests and their responses to logging. This study is the first to examine the impact of gaps and clusters silviculture on birds in the forests of eastern Australia.

I used a BACI (Before/After and Control/Impact) design experiment to investigate the responses of four species of insectivorous, ground- and shrub-foraging birds to two small-scale logging trials over two years. The responses of a further two species to logging were assessed in the second year only. The experiment was conducted in previously logged moist eucalypt forest near Coffs Harbour on the New South Wales mid-north coast. In this continuously forested landscape, I followed and mapped the movements of colour-banded individuals of the study species in plots to determine if and how population size, survivorship, home range, and habitat use changed after logging. I used RANGES V software to estimate home range and quantify habitat use of each monitored bird during these periods. I also observed the foraging and breeding behaviour of each species in these plots.

I found that logging did not significantly reduce the size or survival of monitored populations of the six bird species. Most of these birds were able to persist until the next breeding season in the logged plots in numbers similar to the control plots. This was because about 70% of forest cover was retained in each logged plot and the local forest landscape was not fragmented. However, results obtained for Yellow-throated Scrubwrens *Sericornis citreogularis* indicated that there was a 91% probability of decline in population size and a 93% probability of lower survival after logging. Adopting the Precautionary Principle and using a level of significance of $P<0.10$ would lead one to conclude that this species is affected by logging, despite the failure to reject the null hypotheses at the conventional 5% level. In this case, I elected to minimise the risk of committing a Type I error (ie. falsely

concluding that there had been an impact) by adhering to the 5% level of statistical significance. I also found that logging did not significantly influence the movement of birds between plots, presumably because sufficient suitable habitat was retained in the logged plots or individuals were strongly philopatric or conservative in their response to the disturbance events.

Logging affected the home range structure and habitat use of each study species in different ways. Eastern Yellow Robins *Eopsaltria australis* and White-browed Scrubwrens *S. frontalis* appeared to be quite resilient to logging in the short-term. They maintained the structure of their home ranges by incorporating newly created gaps and thinned areas into their ranges after logging. Some birds of both species expanded their ranges to include woody debris piles left unburnt in gaps after logging. In contrast, Pale-yellow Robins *Tregellasia capito* showed marked sensitivity to logging. They avoided newly created gaps and shifted their home ranges to adjacent retained forest, mostly in riparian zones. Spectacled Monarchs *Monarcha trivirgatus* also avoided new gaps and foraged mostly along creeklines. Yellow-throated Scrubwrens and Rufous Fantails *Rhipidura rufifrons* appeared capable of making a partial but limited adjustment to the effects of logging. Individuals included only the edges (*S. citreogularis*) and outer parts (*R. rufifrons*) of new gaps in their home ranges after logging and foraged mainly in retained forest, especially along moist creeklines and lower slopes. Yellow-throated Scrubwrens maintained the size of their home ranges after logging by relocating to retained forest.

Fine-scale differences in the microhabitat preference and foraging ecology of each study species may account for their contrasting responses to the logging trials. A generalised lifestyle and flexible foraging strategy may have allowed Eastern Yellow Robins and White-browed Scrubwrens to cope with changes in their living space brought about by gapping. Conversely, the habitat specialists, Pale-yellow Robins and Spectacled Monarchs, with narrower foraging strategies and possible aversions to open space seem to have been more affected by gapping. Intermediate between these two groups were Yellow-throated Scrubwrens and Rufous Fantails which appeared to be mildly tolerant of gapping providing that retained (preferably riparian) forest adjoined gaps. Other possible hypotheses that may help explain these responses concern population- and individual-level factors and variation in resource quality and distribution. There are some potential constraints to these

interpretations, namely, small sample sizes, limited experimental replication, short-term nature of the study, and reduced power of statistical tests.

This study leads to a number of important implications for sustainable forest management. Of prime concern is a need to retain riparian buffers and other connective forest cover, undertake further research, and integrate my results into strategic harvest planning to ensure that the essential habitat components of the study species are conserved during future logging operations. I present a set of recommendations to aid the synthesis of these implications into strategic forest management planning and research programs.