Use of retained trees for nesting by birds in logged eucalypt forest in north-eastern Tasmania

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Abstract

In a previous study in eucalypt forest in north-eastern Tasmania four hollow-nesting bird species (striated pardalote *Pardalotus striatus*, green rosella *Platycercus caledonicus*, laughing kookaburra *Dacelo novaeguineae* and yellow-tailed black cockatoo *Calyptorynchus funereus*) were recorded in 1989 using hollows in 29 trees, with re-use being documented in 1990 when an additional nest tree was discovered. The present study was undertaken in 1995/96 after logging of part of the area, and a wildfire. Several nest trees were destroyed during the logging. In the logged areas, or patches or strips surrounded by logged forest, 19% of trees were windthrown or had lost the limb containing the nest. Re-use of the tree hollows by birds was examined for the 22 remaining trees. Only striated pardalotes were recorded as re-using previous nest sites following logging; 24% of these nest sites were being re-used in 1995/96 compared with 74% in 1990. Re-use of nest sites in 1995/96 appeared to be influenced by location; three of the four nest trees located in retained strips, one of the seven in logged areas and none of the six nest sites in unlogged forest were re-used. Tree martins (a species not recorded nesting in the area before logging) and striated pardalotes were observed in the logged area nesting in trees which had not been recorded as nest sites before logging, and green rosellas were observed using a hollow in a tree within a streamside reserve within the logged area.

Introduction

Tree hollows are known to be important roost and nest sites for many vertebrates (Gibbons 1995, Gibbons and Lindenmayer 1996). Logging of forests leads to a marked reduction in the abundance of such hollows and this in turn can lead to reductions in populations of hollow-dependent species (Manderson 1979, Meredith 1984, Smith and Lindenmayer 1988, Traill 1991). In order to ameliorate such effects prescriptions relating to retention of hollow-bearing trees have been applied by forestry agencies throughout Australia (e.g. Taylor 1991, Department of Conservation and Land Management 1992, and Gibbons and Lindenmayer (1996) for summary of prescriptions used throughout Australia). However, there are few studies which have determined whether such trees are utilised after logging.

Taylor and Haseler (1993) and Haseler and Taylor (1993) documented use of hollow-bearing trees for nesting by four species of birds in eucalypt forest in north-eastern Tasmania. Subsequently, part of their study area was logged. In this paper we report on use made of trees previously utilised for nesting in the areas that remained unlogged, and in areas subject to logging with retention of seed trees and habitat trees.

Methods

Study Area

The study area (Figure 1) is located approximately 40 km north-west of St. Helens in the Gladstone forest block in north-eastern Tasmania (Tasmap 5845 Lanka 5876 54537). Taylor and Haseler (1993), Haseler and Taylor (1993) and Cale (1994) describe the vegetation of the study site prior to logging. The majority of nest sites were located on south-east facing slopes above Old Chum Dam, and one nest site was located in forest to the south-west of the dam (Figure 1). Altitude varies from 100-250 m above sea level and the geology is Ordovician granite.

The dominant eucalypt prior to logging was *Eucalyptus obliqua* with *E. amygdalina* being subdominant over much of the area and dominant in some flatter drainage basins. *E. viminalis* was scattered throughout the study area. The understorey on most upper and middle slopes was very open, being dominated by *Pteridium esculentum* (bracken). Following logging, the understorey of upper and middle slopes became denser, now being dominated by *Pultenaea juniperina*.

Logging was carried out over 180 ha of the 340 ha study area during three periods between August 1990 and January 1993 (Figure 1). Seed trees were retained as a source of regeneration (Wilkinson 1994). Strips of forest 100 m in width, referred to as wildlife habitat strips (Taylor 1991), were retained along two creeklines and upper slopes, and along Old Chum Dam (Figure 1). Streamside reserves of 40 m width (20 m either side of the creek) were retained along other streams in the coupe. Previously recorded nest site trees were retained throughout the area subject to logging; some were located within wildlife habitat strips and streamside reserves, others were retained either as solitary trees, or within small clumps of trees or within a small (3.5 ha) unlogged patch. This patch of forest contained two nest trees.

Approximately half of the area subject to logging, and the wildlife habitat strip containing known nest trees, was burnt by an intense wildfire in October 1991. The burnt area is located to the east of the most westerly of the wildlife habitat strips.

Sampling

Field observations on use of nest trees were undertaken between 9 September 1995 and 3 January 1996, with five visits, each of 2-3 days duration. During these times, the previously recorded nest trees (Haseler and Taylor 1993) were staked out to observe nesting activity. Each nest tree was visited 2-3 times during the three day period, with each visit being 15-20 minutes in duration. An attempt was made to

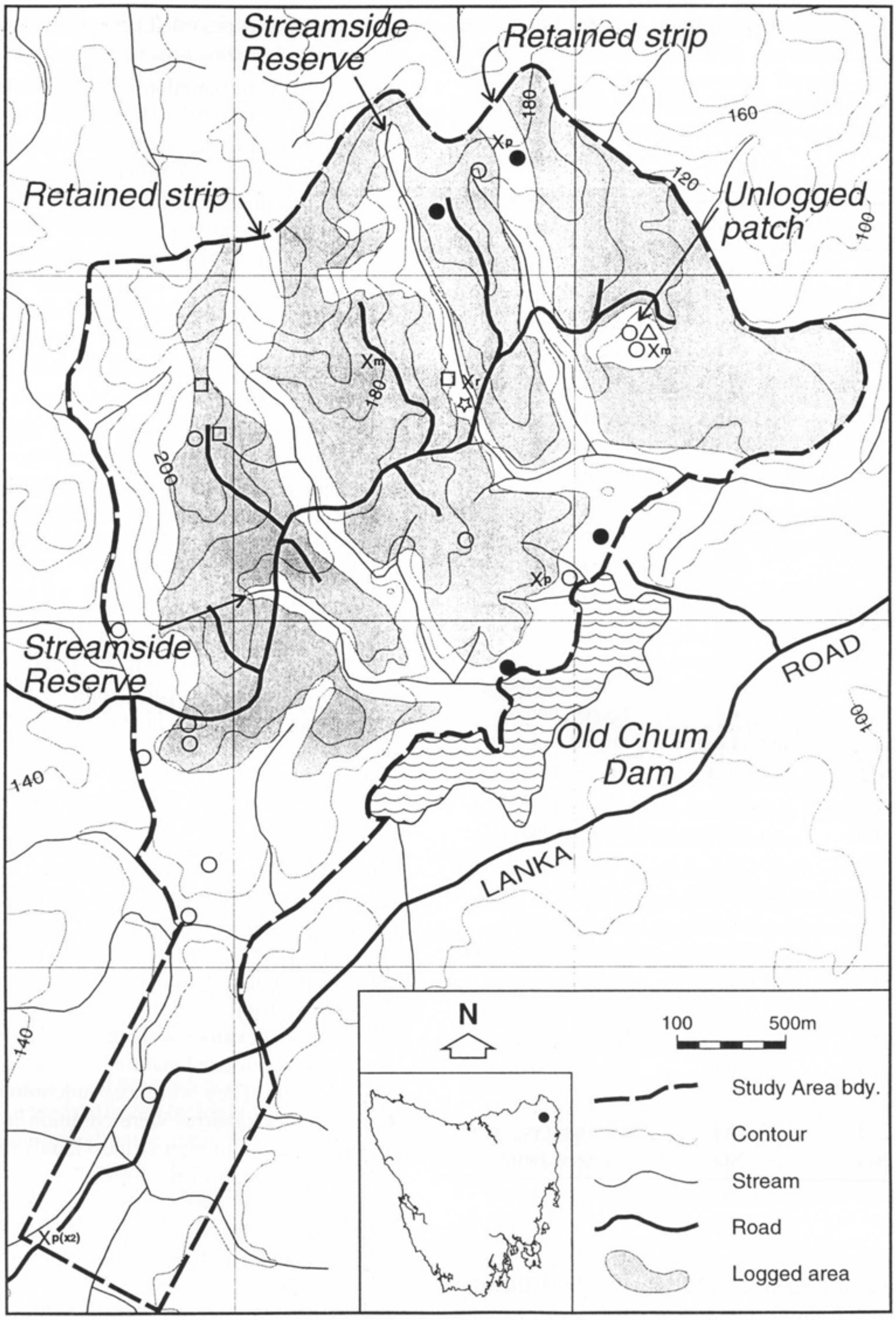

Figure 1: Study area showing the location of logged areas, wildlife habitat strips, streamside reserves and the unlogged patch in the logged area. Striated pardalote nest trees are indicated by circles, green rosellas by squares, laughing kookaburras by triangles and the yellow-tailed black cockatoo by a star . Filled symbols indicate those nest trees from 1990 that were re-used in 1995/96. Trees that were used in 1990 but subsequently felled or windthrown are not shown. New nest records from tree hollows in the 1995/96 survey are indicated by a cross followed by a lower case letter (p = striated pardalote; r = green rosella; m = tree martin)

visit each nest tree at different times of the day, at least three hours apart. Haseler and Taylor (1993) had used a similar method for observing re-use of the nest trees, visiting the study site on 11 days between 12 September and 13 December 1990. During this period, nest sites were observed between 2 and 7 times for periods of 10-20 minutes. No systematic attempt was made during 1995/96 to locate new nest sites within the study area. Field work was limited largely to the observation of previously recorded nest sites to check for re-use following logging of the site.

In addition to the observations on nest trees, pardalote activity was assessed by recording the number of calls heard within an approximate 50 m radius surrounding each observation point at different localities from the study site. The number of calls was recorded for each 5 minute period spent observing previously recorded nest trees. Analysis of variance was used to test for differences in pardalote calls between localities using log transformed data. Differences between pairs of areas were tested using least significant differences.

Table 1. Re-use of 31 nest sites in 1990 and 1995/96 following initial observation in 1989 and logging between 1990 and 1995/96.

Species	Re-use 1990	Re-use 1995/96	Location
Pardalote	YES	NO	unlogged, unburnt
Pardalote	YES	NO	unlogged, unburnt
Pardalote	YES	NO	unlogged, unburnt
Pardalote	NO	NO	unlogged, unburnt
Pardalote	NO	NO	unlogged, unburnt
Pardalote	YES	YES	unlogged strip, unburnt
Pardalote	YES	YES	unlogged strip, burnt
Pardalote	YES	YES	unlogged strip, burnt
Pardalote	YES	NO	unlogged strip, burnt
Pardalote	YES	windthrown	unlogged strip, burnt
Pardalote	YES	NO	unlogged patch, burnt
Pardalote	NO	top gone	unlogged patch, burnt
Pardalote	YES	NO	unlogged patch, burnt
Pardalote	YES	NO	logged, unburnt
Pardalote	YES	NO	logged, unburnt
Pardalote	NO	NO	logged, unburnt
Pardalote	YES	not relocated	logged, unburnt
Pardalote	NO	felled	logged, unburnt
Pardalote	YES	NO	logged, burnt
Pardalote	YES	YES	logged, burnt
Pardalote	NO	NO	logged, burnt
Pardalote	YES	limb gone	logged, burnt
Pardalote	YES	felled	logged, burnt
Kookaburra	NO	used by bees	unlogged patch, burnt
Kookaburra	YES	windthrown	logged, unburnt
Kookaburra	felled	-	logged, unburnt
Rosella	YES	used by bees	logged, unburnt
Rosella	NO	NO	logged, unburnt
Rosella	found 1/92	NO	logged, burnt
Rosella	NO	NO	stream reserve, burnt
Cockatoo	NO	NO	logged, burnt

Results

Twenty nine trees had been recorded as nest sites in the study area in 1989, with re-use being documented in 1990, that is, before logging (Table 1). One of these trees contained two nests. A further nest site of a green rosella was located in 1992 during logging operations. Seven nest sites were lost during the period between 1990 and 1995/96: three had been felled during logging (either accidentally or for safety reasons), one had the branch with the hollow knocked out (probably by wind), another had lost its crown from a windthrown tree falling on it, and two were windthrown. One nest tree could not be relocated, probably felled or windthrown. Thirteen of the residual 26 nest trees remaining after logging were in the area burned in 1991; some of these were in the logged section and some in the streamside reserves, the retained strip or the unlogged patch. Three of these 13 trees were windthrown or lost the limb containing the nest site. In the unburnt area, one out of eight nest trees in the logged section, but none of the five nest trees in the unlogged forest were windthrown. Two nest sites (one for laughing kookaburra and one for green rosella) appeared to be used by bees and no bird activity was recorded near the hollows in these trees in the 1995/96 breeding season.

Re-use of nests by pardalotes was significantly higher in 1990 (74%) than in 1995/96 (24%) (χ^2=10, df=1, p <0.01, Table 1). Four of the 17 striated pardalote nest sites remaining from 1990 were recorded as being re-used by this species in the 1995/96 breeding season. Three of the four nest trees located in wildlife habitat strips (two within the retained strip along Old Chum Dam) were re-used in 1995/96, together with one of the seven in the logged areas. None of the six nest trees within the unlogged areas, or the unlogged patch, were re-used in 1995/96. One of the nest trees within the wildlife habitat strip alongside the dam appeared to be re-used by two pairs of striated pardalotes.

Casual observations resulted in the discovery of four new nest sites for striated pardalotes within the study area: one was in a wildlife habitat strip approximately 20 m from another known nest tree, one in a logged area within 30 m of the dam reserve, and two in the unlogged area to the southwest of the dam.

Based on the monitoring of calls, pardalote activity in 1995/96 differed significantly between logged and unlogged areas ($F_{(2,25)}$=7.2, p<0.01). Activity in larger areas of unlogged forest (17.4±2.8, mean no. calls/5 min.±S.E.) and unlogged strips or patches (11.3±3.8) did not differ significantly, but activity in both these areas was significantly greater (p<0.01) than that in logged areas (1.0±2.0).

There was no re-use in 1995/96 of nest sites previously used by the green rosella, laughing kookaburra or yellow-tailed black cockatoo. In the logged areas green rosellas were not recorded from known nest trees and only twice from around other retained trees but were still common in unlogged areas. However, a new nest site for green rosellas was located in January 1996 in a streamside reserve within the logged area, 40 m away from a previously recorded nest site. Yellow-tailed black cockatoos were recorded only three times, twice from within unlogged mature forest and once flying over the logged area. They were also uncommon before logging. Laughing kookaburras were common in both the unlogged and logged areas though no individuals were observed within the retained patch in the logged area containing the previously used nest. Tree martins were observed nesting in two trees within the logged area in 1995/96. This species was not observed in the study area before logging (Cale 1994).

Discussion

In 1990 there was a relatively high re-use of the nest sites observed a year earlier, suggesting a tendency for individual birds to re-use the same nest sites. Re-use of trees for nesting in unlogged areas was much reduced in 1995/96 compared with 1990. Thus there could be a decline with time in the use of previously known nest sites, perhaps due to an increased mortality of the original birds. Nest site selection by new individuals may be independent of the history of use of a particular nest site. The higher incidence of re-use of nest trees in the retained strip and the logged area compared with the unlogged area might be interpreted as indicating a reduced availability of nest sites in these areas. However, as previously used nest sites were present but unused after logging, it appears that nest sites may not be limiting *per se*. Alternatively, it is possible that factors associated with the logging, such as increased exposure to wind following opening of the canopy, could have made some nest sites unsuitable. There were at least two nest sites in logged areas used by striated pardalotes. It is not known if there is a difference in the attractiveness of nests with different degrees of shelter. The high use of known nest sites by striated pardalotes in the retained strip surrounded by logged areas could be interpreted as a preference for sheltered locations by birds foraging in the adjacent logged areas. However, activity levels (and hence population densities) were also found to be higher in the retained strips than in logged areas. There is likely to have been a reduction in the numbers of nest sites required by pardalotes in the logged areas due to a decline in the population associated with a marked drop in the availability of foraging habitat, that is, the eucalypt canopy.

Information on the number of available nest sites previously used by the other three species before logging (green rosella 4, kookaburra 1 and yellow-tailed black cockatoo 1) was insufficient to draw any conclusions about whether these species would nest in logged areas. Green rosellas, however, were found to nest in a streamside reserve within the logged area. Nelson and Morris (1994) found no differences in hollow occupancy rates for yellow-tailed black cockatoos in silvicultural regrowth, plantations and mature forest in South Gippsland in Victoria. The one remaining previously used nest tree for kookaburras in our study area was being used by bees. Other studies have also highlighted the possibility of bees competing with birds for nesting hollows (Mawson and Long 1994, Oldroyd *et al.* 1994).

Changes in forest structure resulting from logging (particularly partial logging) may facilitate use of logged areas by some species of hollow-nesting birds. Tree martins were observed foraging and nesting in the study area only after logging. This species hawks for insects above and around the tree canopy. Tree martins often nest in open stands (Loyn *et al.* 1980) and the open conditions resulting from logging appear to have produced suitable habitat for this species. Flocks were often observed feeding above patches of retained trees within the study area.

Although sample size is small the evidence suggests a greater rate of windthrow in areas affected by logging (including the retained strip and unlogged patch) than in unlogged areas. There was a significant mortality factor with 19% of nest trees or limbs lost in the logged and/or burnt areas over a four year period. This is most likely due to increased exposure to wind. Inions *et al.* (1989) found that fire led to the loss of many older trees with hollows in south-west Western Australia, and hence in our study the fire after logging could have contributed to the loss. However, while casual observations have shown that some of the loss of retained trees might be attributed to the significant weakening of tree butts by fire, there was no difference between burnt and unburnt areas in the rate of loss of previously used nest trees. Featherston (1983 cited in Australian Biological Research Group 1984) found a similar rate of loss of retained trees (5% annual mortality among seed trees retained in clearfelled coupes) on logged areas in East Gippsland.

This study has shown that at least two of the four hollow nesting species present before logging will utilise retained trees in logged areas or retained strips. However, even though previously used nest trees were present but unused, it is not possible to conclude that hollows in the logged areas were not limiting. Further work is required to determine whether adequate numbers of suitable hollows are present in logged areas. This work would best be undertaken at a time when the bird population had built up again to approximate prelogging levels. Long-term data on the survival of retained trees is also required. If high mortality rates similar to that obtained in the five years after logging continued through the rotation, then few nest trees would be available at the end of the rotation.

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References

Australian Biological Research Group (1984). The impacts of timber production and harvesting on native flora and fauna. **In** *Report of the Board of Inquiry into the Timber Industry Vol II.* Victorian Government Printer, Melbourne.

Cale, P.J. (1994). Temporal changes in the foraging behaviour of insectivorous birds in a sclerophyll forest in Tasmania. *Emu* **94:** 116-126.

Department of Conservation and Land Management (1992). *Management Strategies for the South West Forests of Western Australia.* Department of Conservation and Land Management, Como, Western Australia.

Gibbons, P. (1994). Sustaining key old growth characteristics in native forests used for wood production: the case of habitat tree retention. **In** *Ecology and Sustainability of Southern Temperate Ecosystems* (Eds T. W. Norton and S. R. Dovers). CSIRO, Melbourne.

Gibbons, P. and Lindenmayer, D.B. (1996). Issues associated with the retention of hollow-bearing trees within eucalypt forests managed for wood production. *Forest Ecology and Management* **83:** 245-279.

Haseler, M. and Taylor, R. (1993). Use of tree hollows by birds in sclerophyll forest in north-eastern Tasmania. *Tasforests* **5:** 51-56.

Inions, G.B., Tanton, M.T. and Davey, S.M. (1989). Effect of fire on the availability of hollows in trees used by the common brushtail possum, *Trichosurus vulpecula* Kerr, 1792, and the ringtail possum, *Pseudocheirus peregrinus* Boddaerts, 1785. *Australian Wildlife Research* **16:** 449-458.

Loyn, R.H., MacFarlane, M.A., Chesterfield, E.A. and Harris, J.A. (1980). *Forest utilisation and the flora and fauna in Boola Boola State Forest in south-eastern Victoria.* Forestry Commission of Victoria Bulletin **28.**

Manderson, A.D. (1979). *Aspects of forest management for natural hollows in the Wombat State Forest.* Master of Environmental Studies Thesis, Monash University.

Mawson, P.R. and Long, J.L. (1994). Size and age parameters of nest trees used by four species of parrot and one species of cockatoo in south-west Australia. *Emu* **94:** 149-155.

Meredith, C.W. (1984). Possums or poles? - the effects of silvicultural management on the possums of Chiltern State Park, northeast Victoria. **In:** *Possums and Gliders* (Eds A. P. Smith and L. D. Hume) Surrey Beatty and Sons, Sydney.

Nelson, J.L. and Morris, B.J. (1994). Nesting requirements of the yellow-tailed black-cockatoo, *Calyptorhynchus funereus,* in *Eucalyptus regnans* forest, and implications for forest management. *Wildlife Research* **21:** 267-278.

Oldroyd, B.P., Lawler, S.H. and Crozier, R.H. (1994). Do feral bees (*Apis mellifera*) and regent parrots (*Polytelis anthopeplus*) compete for sites? *Australian Journal of Ecology* **19:** 444-450.

Smith, A.P. and Lindenmayer, D. (1988). Tree hollow requirements of Leadbeater's possum and other possums and gliders in timber production ash forests of the Victorian Central Highlands. *Australian Wildlife Research* **15:** 347-362.

Taylor, R.J. (1991). The role of retained strips for fauna conservation in production forests in Tasmania. **In:** *Conservation of Australia's Forest Fauna* (Ed. D. Lunney) Royal Zoological Society of New South Wales, Sydney.

Taylor, R.J. and Haseler, M. (1993). Occurrence of potential nest trees and their use by birds in sclerophyll forest in north-east Tasmania. *Australian Forestry* **56:** 165-171.

Traill, B.J. (1991). Box-ironbark forests: tree hollows, wildlife and management. **In:** *Conservation of Australia's Forest Fauna* (Ed. D. Lunney) Royal Zoological Society of New South Wales, Sydney.

Wilkinson, G. (1994). *Silvicultural Systems.* Native Forest Silvicultural Technical Bulletin No. 5 Forestry Commission, Tasmania.

Letters to the Editor

I have waited until two Australian Forestry issues and two IFA Newsletters were published, expecting some comment on the summary of the article, 'The influence of habitat structure on insectivorous bat activity in montane ash forests of the Central Highlands, Victoria' (Australian Forestry 60: 138–146). I consider this should be challenged.

It is my opinion the summary contradicts the data in Table 1 of the article as it ignores the results for the oldest age class. How the authors can say 'Overall activity levels increased significantly with increasing age ...' is beyond my understanding.

The data in Table 1 are very variable — with bat activity at age 50 years being less than that at ages 0 and 10 years; and with activity at age 70 years being greater than at 250 years, the summary statement is plainly wrong.

Also I find the final senence of thearticle regarding forest management rather strange since bat activity was recorded at all age levels of the forests from zero to 250 years.

S.J. Quain
W.A. Division

The following response is from Dr Geoff Brown on behalf of the authors G.W. Brown, J.L. Nelson and K.A. Cherry:

"In our summary we state that 'overall activity levels increased significantly with increasing forest age.' Statistically, this is irrefutable for the data that we analysed, even though the mean number of bat passes (used by us as a measure of gross bat activity) for the oldest age-class that we investigated (250+ years old) was not as high as the mean number for the second oldest age-class (165 years old) that we studied (which seems to be Mr Quain's concern). Undoubtedly, the mean number of passes for the older age-classes (63-80, 165, 250+) is greater than those recorded for the three youngest age-classes (<1, 10, 50 years old) studies, and this was our point. These data are quite clearly presented in Table 1.

As for Mr Quain's concern that the final sentence of the paper is 'rather strange since bat activity was recorded at all age levels of the forest', it is not so much that bat activity was recorded at all, but the level of bat activity that is important. We believe that forests should be managed for a range of values, including the conservation of fauna (in fact, this is government policy), and that those habitat resources known to be important (e.g. older aged stands) are retained at appropriate scales and patterns."