RE-EXAMINING THE USE OF RETAINED TREES FOR NESTING BIRDS IN LOGGED DRY EUCALYPT FOREST IN NORTH-EASTERN TASMANIA: ELEVEN YEARS ON

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Summary
Tree hollows are used by many fauna species for breeding and shelter sites. An area in north-eastern Tasmania was surveyed for use of hollows by native bird species in 1989. These nests were resurveyed in 1990, then again after harvesting and wildfire in 1995/96. The present study re-examined these nest sites in 2007, 14 years after disturbance through logging and fire. Loss of nesting sites has been substantial, with 36.7% of the original 30 nests having been lost. Mortality rates were highest in the initial years following disturbance. Some reuse of nesting sites was found, but the rate at which the sites were being reused has also declined since the initial survey. The sustained use of some sites over such a long period suggests that retaining trees in harvested areas may help maintain populations of some hollow-using species, although the high mortality rates of nesting sites highlights the importance of recruiting habitat trees into forested areas.

Introduction

Commercial forestry is a significant industry in Tasmania and native forest harvesting is carried out each year in a large proportion of the forest estate. The Forest Practices Authority has been undertaking research into the effects of forestry activities on biodiversity values for over two decades (e.g. Munks et al. 2007). A particular focus of the research in recent years has been the potential impacts of forestry practices on hollow-dependent fauna, a group of forest dwelling fauna considered most sensitive to alteration of forest structure (Gibbons & Lindenmayer 2002).

Tree hollows provide important breeding and shelter sites for a variety of fauna, and timber harvesting activities inevitably reduce the availability of hollows by removing hollow-bearing trees (Gibbons & Lindenmayer 2002). Timber harvesting can also indirectly increase the mortality rate of the retained hollow-bearing trees, through mechanical damage during logging, post-harvest fires and increased wind exposure (Duhig et al. 2000; Gibbons et al. 2007). In addition to tree loss, some animals are sensitive to disturbance and are expected to not occur, or occur only in reduced densities, in harvested areas (Hingston 2000; Kavanagh 2000; Kavanagh & Stanton 2005; Kavanagh & Webb 1998; Lunney 1987). Examining tree mortality and reuse of nesting trees provides greater insight into the impact of harvesting activities on the dynamics of hollow-bearing trees and their use by fauna in production forest areas.

In 1989 an area in north-eastern Tasmania was surveyed for use of hollows by native bird species (Taylor & Haseler 1993). The located nests were resurveyed in 1990, immediately prior to the area being logged and burnt between 1990 and 1993, and the remaining nest sites were then resurveyed in 1995 and 1996 (Wapstra & Taylor 1998). The present project re-examined these nest sites in 2007, 14 years after disturbance through logging and fire. The aim of this project was to gain information on the survival of the nest sites and the reuse of hollows by birds in the logged, unlogged and burnt areas.

Methods

Study Site

The study area (Fig. 1) is located in north-eastern Tasmania, approximately 40 km north-west of St Helens (Tasmap 5845 Lanka 5876 54537). The area is located on Ordovician granite that ranges in altitude from 100-250 m. The dominant eucalypt is Eucalyptus obliqua, with much of the area having a subdominant layer of E. amygdalina and scattered E. viminalis. The understorey is largely open and dominated by Pteridium esculentum, except for the drainage lines and stream edges which contain Acacia melanoxylon, A. verticillate, Olearia lirata and A. terminalis.

Previous sampling

Between mid-September and early December 1989, hollow-nesting birds were surveyed in the Gladstone forest block of north-eastern Tasmania (Haseler & Taylor 1993; Taylor & Haseler 1993). The survey work involved six visits, each of seven days. Hollow-nesting birds were observed and attempts were made to determine nesting sites using visual surveys and tree watching. Nest sites of several hollow-nesting species were found and 30 were documented in detail: 23 Striated Pardalote nests, three Laughing Kookaburra nests, three Green Rosella nests and one Yellow-tailed Black-Cockatoo nest. The nest sites were resurveyed on 11 occasions between October and December 1990. During this time, 17 of the 23 (73.9%) Striated Pardalote nests and one of the

Green Rosella nests were reused. One of the Kookaburra nests had been felled, and one of the remaining two was found to be reused. The Black-Cockatoo nest was not reused (Haseler & Taylor 1993) (see Table 1).

Logging was carried out across the study area during three periods between August 1990 and January 1993. The harvesting method was seed tree retention, with some wildlife habitat strips and streamside reserves being retained. Seed tree retention silviculture involves removal of all commercial standing trees and retention of trees with seed at a rate of approximately one seed tree every 1-2 tree lengths (Wilkinson 1994). Previously recorded nest trees were retained throughout the area, either in larger reserves, as single standing trees or within small clumps. Approximately half of the area was subject to logging and the wildlife habitat strip was burnt in October 1991 (Wapstra & Taylor 1998). A further nest site (Green Rosella) was located in 1992 during a logging operation (Haseler & Taylor 1993).

The nest sites were resurveyed after these disturbance events between September 1995 and January 1996 (Wapstra & Taylor 1998). Sampling involved five visits, of 2-3 days each. Previously recorded nest trees 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 long. Attempts were made to visit each tree at different times of the day, at least three hours apart. This technique was similar to that used by Haseler & Taylor (1993) in their reuse surveys. The results found that seven of the 30 (23%) original nest sites were lost between 1990 and 1995/96 for a variety of reasons (Table 1). Of the 23 remaining nest trees, only four (17.4%) were being reused by birds, and an extra two by bees (Table 1). Casual observations found four new Striated Pardalote nest sites and two new Green Rosella nest sites.

Current sampling

Between 12-14 November and 10-12 December 2007, attempts were made to resurvey the nest sites known from the previous surveys. These dates were chosen because previous surveys suggested that this was the period with the highest breeding activity. The nest trees were identified and the current status (standing, dead, fallen) of each tree was recorded. Each nesting hollow found in a standing tree was examined four times, twice during both of the survey periods. Examination involved watching the hollow or location of the hollow (when the hollow entrance was not visible) for a 20 minute period. During the surveys, any animal activity at the hollow was noted. No nesting hollow was examined twice on the same day and attempts were made to visit each hollow at different times of the day.

Results

Mortality

Most of the new nesting sites found by Wapstra & Taylor (1998) could not be relocated because a detailed account of the tree location had not been recorded. One of the original nest records was also not surveyed due to a logistical error. In total, 24 nesting sites were re-examined (Table 1). Of the trees examined, one had a section of the branch broken off above the hollow, but it is uncertain if this affected the hollow condition or not. This hollow was surveyed but no birds were observed using it. Two other trees were found to have fallen and another was presumed to have fallen, although a firm identification of a fallen tree was not made. Therefore, 12.5% of the nesting sites were lost in the 11 years since they were last surveyed, giving a mortality rate of 1.1% of nest trees per year.

Hollow reuse

Surveys for the presence of birds were carried out at the 21 remaining nest sites (Fig. 1). Wapstra & Taylor (1998) had recorded the use of eight of these sites by breeding birds. Only two of these 21 sites (9.5%) showed evidence of current use by birds (Fig. 1, Table 1). However, only one of these was confirmed as being used for nesting. This tree was visited frequently by Striated Pardalotes during the 20 minute survey period and birds entering the hollow were observed carrying food. The tree was located at the control site in an area that had not been harvested or burnt. Although Striated Pardalote activity was recorded in the tree during the second survey period, no use of the hollow was observed.

The other observation of activity involved a Striated Pardalote entering a hollow only twice during one 20 minute survey. This tree was located in an unharvested, unburnt wildlife habitat strip and the observation occurred on the second survey during the first sampling period. It is possible that the hollow could have been used for breeding by the Striated Pardalotes in the period between examinations because the incubation period for this species is approximately 14-21 days (D. Milledge pers. comm. from Higgins & Peter 2002). In addition to the two hollows with bird activity, one nest site that was previously used by bees was found to still have bee activity (Fig. 1, Table 1).

Although no formal surveys for extra hollow use in the area were undertaken, an opportunistic observation was made of a nesting hollow being examined by a pair of Green Rosellas (see 'new bird sighting', Fig. 1). One bird was seen perching near the hollow for an extended period. A second bird appeared in the hollow entrance, where it sat for a short while before exiting the hollow and perching near the other bird. This observation was made on the second survey during the first

sampling period. Activity at this nesting hollow was monitored during the second survey period, as for the other sites, but no further activity was noted. The incubation period for Green Rosellas is approximately 19 to 23 days (see Higgins 1999).

Discussion

Mortality

A number of studies have shown that the mortality rate of retained trees can be very high in the initial years after logging (Gibbons et al. 2000; Lindenmayer et al. 1997; Whitford & Williams 2001). In the area surveyed in this study, 22.6% of the nest sites originally located by Taylor and Haseler in 1990 were found to be lost in 1995/96 (4.5% per annum) (Wapstra & Taylor 1998). Mortality rates were higher in the logged than the unlogged area, but there was no difference between burnt and unburnt areas (Wapstra & Taylor 1998). Between 1996 and the present survey in 2007, the mortality rate had dropped to 12.5%, or 1% per annum of the nest sites that could be located. The two trees confirmed to have collapsed were located in the unlogged, unburnt area while the tree that could not be located was presumed to have collapsed, and was located in a logged but unburnt area. Although the small sample size in this study precludes strong conclusions, the results suggest that burn damage was making little contribution to the collapse of the retained trees in this area.

The high rate of loss in the early years following disturbance was due to a number of reasons. Three of the seven nest sites lost were felled either accidentally or for safety reasons (Wapstra & Taylor 1998). Two of the trees did not fall but the part of the tree containing the nest broke off (one from a logged area, the other from an unlogged area). Of the two trees known to have collapsed, one was located in unlogged but burnt forest and the other in logged and unburnt forest. The final tree was from a logged and unburnt area but it was not relocated and was presumed to have collapsed. The higher mortality rate in the logged areas in the initial years after harvest was therefore influenced by the accidental felling of a number of trees. Yet, when these trees are not considered, mortality was still higher in the harvested area than in the unharvested area in the first four years after disturbance (3.6% per annum compared to 1.0%). The higher mortality rate in the unharvested area found during the current survey is most likely a result of the higher number of trees surveyed in these areas (13 nest sites compared to 8).

Reuse

Use of the nest sites surveyed in this study appears to have declined between 1995/96 and 2007. In 1990 (the year prior to harvesting activities), reuse was relatively high, with 17 of 23 Striated Pardalote nests being reused, while one of three Kookaburra nests, one of three Green Rosella nests and the Black-Cockatoo nest were not reused. One of the nest sites was lost, meaning that 65.5% of available nest sites were being reused (Wapstra & Taylor, 1998). In the 1995/96 surveys, reuse of nest sites in the unlogged areas was much reduced and there was higher reuse of nest sites located in the retained strip and the logged area. Of the nest sites still available, 26.1% were reused by birds. Two additional nest sites were being used by bees (Wapstra & Taylor 1998). In this 2007 survey, only 9.5% of the 21 original nest sites, that could be located and that were still standing, showed signs of bird activity. One additional tree was still being used by bees.

The reason for the drop in levels of reuse is unknown. Although no monitoring was undertaken to allow a formal comparison, casual observations suggest that there is an abundance of nesting hollows available in the area and there is still a high degree of Striated Pardalote activity. It is possible that the dimensions of the hollows may have altered over the years, affecting their suitability as nesting sites by the birds. There may also be significant annual variation in the numbers of hollow-nesting birds present at the study area, and our survey periods may simply have coincided with years of low bird abundance.

Conclusion

In total, 20 of the 30 original nest sites located by Haseler and Taylor in 1989 were relocated in the current survey. Three of the these 20 nesting sites were found to have been lost, increasing the total number of nest sites lost, in the 18 years since the first survey, to 11 (36.7% of the original 30).

Although some reuse of nesting sites was found, the rate at which the nest sites were being reused was declining with time since the initial survey. Despite the low rates of reuse, the sustained use of some nesting sites over such a long time period suggests that retaining suitable trees in a harvested area is likely to help maintain populations of some hollow-using fauna species. The high mortality rate of hollow-bearing trees highlights the importance of recruitment into a forested system, to ensure that a perpetual supply of hollows is being provided for hollow-using fauna. There was an observed decline in the use of hollows over time, but we are unable to draw firm conclusions regarding the potential impacts of forestry practices on the use of hollows by birds, because we did not quantify numerous confounding factors, especially aspects of the breeding and migratory biology of the various species present at our study site.

This study has been presented, at least in part, to highlight the value of undertaking long term research and monitoring projects. We strongly advocate continued research into the

potential impacts of different forestry practices on hollow-dependent fauna, and argue for well designed long term projects that combine ecological and descriptive survey with more detailed biological studies on individual species (such as the Striated Pardalote). The nest hollow requirements of many of our hollow-dependent species remain poorly studied and we suggest that such basic information is important in designing meaningful and practical management prescriptions in situations such as the forestry landscape. We urge bird observers to continue providing information on nesting by hollow-nesting birds and to present their observations as widely as possible, to make them available to researchers and policy makers.

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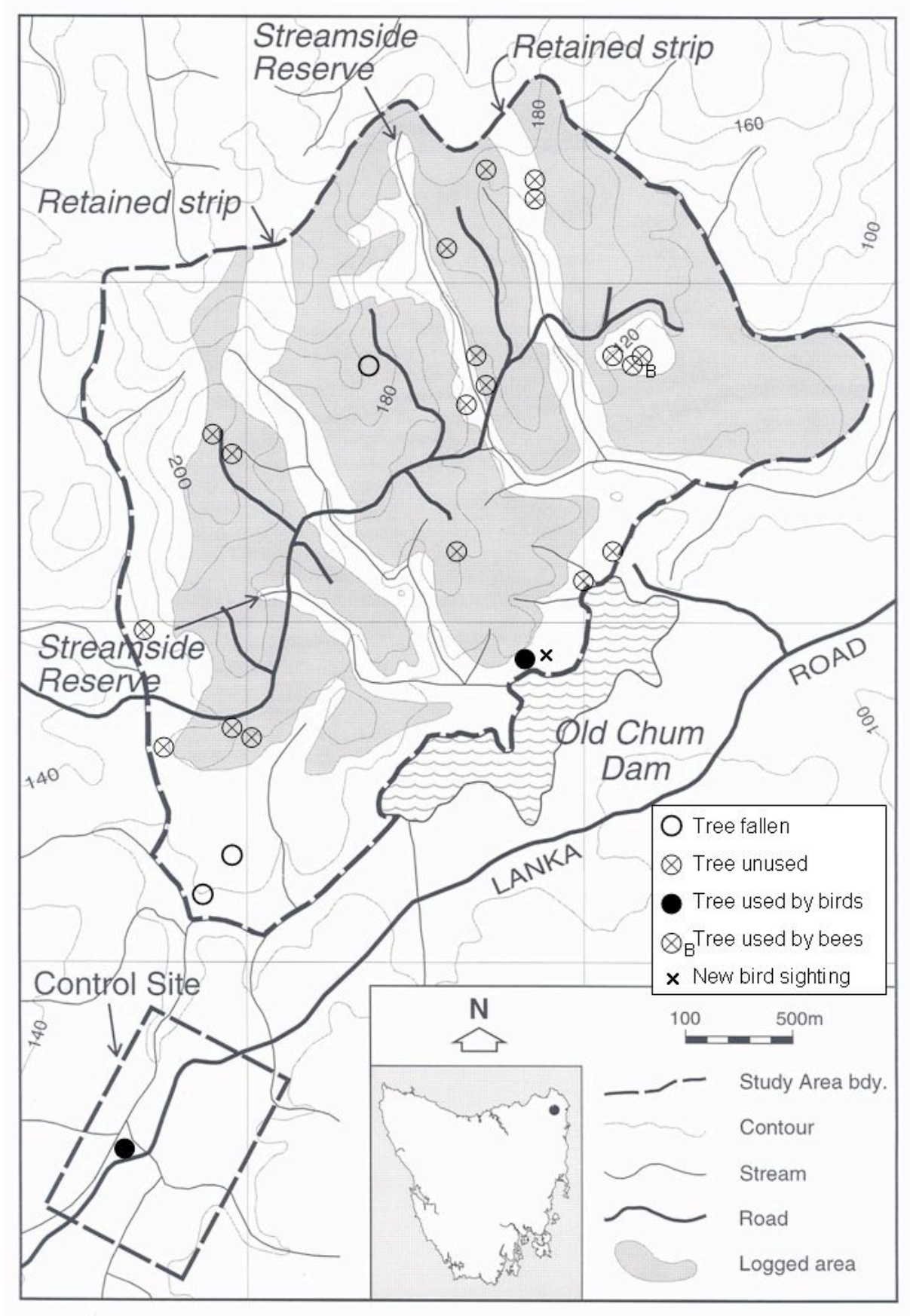

Figure. 1. Location of used, unused and fallen nesting sites in 2007.

Table 1. Details of the surveys for each of the trees found to contain a hollow being used by birds.

Locality	Initial use 1989	1990	998/999	2007
Unlogged, unburnt	Pardalote	NO	NO	NO

Unlogged, unburnt	Pardalote	Pardalote	NO	NO
Unlogged, unburnt	Pardalote	Pardalote	NO	Windthrown
Unlogged, unburnt	Pardalote	NO	NO	Windthrown
Unlogged, unburnt	Pardalote	Pardalote	NO	Pardalote
Unlogged strip, unburnt	Pardalote	Pardalote	Pardalote	Pardalote visit
Unlogged strip, burnt	Pardalote	Pardalote	Fallen	
Unlogged strip, burnt	Pardalote	Pardalote	NO	NO
Unlogged strip, burnt	Pardalote	Pardalote	Pardalote	NO
Unlogged strip, burnt	Pardalote	Pardalote	Pardalote	NO
Unlogged patch, burnt	Pardalote	NO	Top gone	
Unlogged patch, burnt	Pardalote	Pardalote	NO	NO
Unlogged patch, burnt	Pardalote	Pardalote	NO	NO
Logged, unburnt	Pardalote	NO	Felled	
Logged, unburnt	Pardalote	Pardalote	Not relocated	
Logged, unburnt	Pardalote	Pardalote	NO	NO
Logged, unburnt	Pardalote	NO	NO	NO
Logged, unburnt	Pardalote	Pardalote	NO	NO
Logged, burnt	Pardalote	Pardalote	NO	NO
Logged, burnt	Pardalote	NO	NO	NO
Logged, burnt	Pardalote	Pardalote	Limb gone	
Logged, burnt	Pardalote	Pardalote	Felled	
Logged, burnt	Pardalote	Pardalote	Pardalote	NO
Unlogged patch, burnt	Kookaburra	NO	Bees	Bees
Logged, unburnt	Kookaburra	Felled		
Logged, unburnt	Kookaburra	Kookaburra	Windthrown	
Stream reserve, burnt	Rosella	NO	NO	NO
Logged, unburnt	Rosella	NO	NO	Not relocated
Logged, unburnt	Rosella	Rosella	Bees	NO
Logged, burnt	Cockatoo	NO	NO	NO
Logged, unburnt		Rosella Jan 1992	NO	
			Pardalote	
			Pardalote	
			Pardalote	
			Pardalote	
			Rosella	NO
			Rosella	NO
Unlogged strip, unburnt				Examination by Rosellas

'NO' indicates that no bird activity was observed. 'Felled' indicates the tree was cut down. 'Windthrown' indicates the tree fell over. 'Not relocated' indicates that the tree was searched for but not found, and it is presumed the tree fell.