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Original research article

Bird assemblages in Tasmanian clearcuts are influenced by the age of eucalypt regeneration but not by distance from mature forest

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ABSTRACT

Many species of birds are adversely affected by clearcutting of Australian eucalypt forests for timber. However, recolonisation of harvested areas may be enhanced if mature forest is retained nearby (forest influence).

We test the benefits of proximity to mature Tasmanian wet eucalypt forest on birds in adjacent regenerating clearcuts. We hypothesised that bird assemblages in silvicultural regeneration would become more similar to those in adjacent mature forest with increasing proximity to the mature forest. To test this, we sampled birds in regenerating clearcuts using 25 m radius point counts centred 35, 120, and 200 m from mature forest. We also hypothesised that the magnitude of forest influence would decrease with time since harvest, across three age classes of approximately 7, 27 and 45 years-old, because the assemblages in older regeneration would be more similar to those in the mature forest.

We found that distance from mature forest had no significant effects on bird assemblage composition, native species richness per sample, or the incidences of any species. This result was apparent across all three age classes of silvicultural regeneration, despite significant changes in the assemblage composition, native species richness, and incidence of 10 species, with time since harvest.

1. Introduction

Modern harvesting of tall wet forests for timber has generally involved clearcutting, often resulting in the replacement of mature forest with even-aged regrowth forests (Baker and Read, 2011; Bauhus et al., 2009). This silvicultural system is an efficient and safe way of harvesting and regenerating fire-dependent forests (Neyland et al., 2012), but can be detrimental to some biota (Fedrowitz et al., in press; Lindenmayer et al., 2012; Mitchell and Beese, 2002). Of course, reserves outside production forests can provide habitat for species that are more plentiful in mature forests than in regrowth forests. However, it is widely considered that such reserves are often insufficient to support viable populations at landscape scales, and that ecological sustainability of forests also requires management for biodiversity within harvested landscapes (Baker

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et al., 2013a; Bauhus et al., 2009; Gustafsson et al., 2012; Lindenmayer, 2000; Lindenmayer et al., 2006, 2012; Munks et al., 2009).

An example of a group that is more plentiful in mature forests than in regrowth forests is birds inhabiting Australian eucalypt forests. There are few early successional species of birds in eucalypt forests, and most species gradually recolonise regrowth forest as it matures (Atkinson, 2003; Hingston, 2000; Hingston and Grove, 2010; Loyn, 1985; Serong and Lill, 2012; Williams et al., 2001). In Tasmanian wet eucalypt forest, the composition of bird assemblages in even-aged regrowth converged towards that in old-growth forest as the regrowth matured from 6–8 to 75–111 years of age. This was mirrored by a linear increase in the mean number of native species of birds detected per survey with increasing stand age (Hingston and Grove, 2010).

In addition to the age of the forest stand in which birds are surveyed, the surrounding vegetation can also influence assemblages of birds (Betts et al., 2007; Drolet et al., 1999; Hansson, 1983; Schlossberg and King, 2008; Thompson et al., 2012; Tubelis et al., 2004; Wardell-Johnson and Williams, 2000; Zurita et al., 2012). In Tasmanian wet eucalypt forest, assemblages of birds in 30–50-year-old silvicultural regeneration were more similar to those in mature forest when more mature forest was present in the surrounding landscape, and when mature forest was closer to the sample point (Wardlaw et al., 2012).

Because assemblages of birds in regrowth Tasmanian wet eucalypt forest become more similar to those in mature forest with both increasing age of the regrowth (Hingston and Grove, 2010) and decreasing distance from mature forest (Wardlaw et al., 2012), we hypothesise that these two factors may interact to influence birds in silvicultural regeneration. Specifically, we hypothesise that the effect of distance from mature forest on birds in regenerating stands will decrease as the stands mature because the assemblages in older stands will be more similar to those in the mature forest. In other words, we hypothesise that the positive influence of proximity to mature forest on assemblages of birds in silvicultural regeneration will be greater for the earlier stages of succession following clearcutting.

To test this hypothesis, we compare assemblages of birds in silvicultural regeneration in three age classes since clearcutting and at three distances from mature forest. We expect that:

(1) birds will recolonise silvicultural regeneration in the first 50 years after harvesting such that species richness per sample will increase, and assemblage compositions will become more like those of mature forest, with increasing time since harvest;
(2) for birds in silvicultural regeneration, species richness per sample will increase and assemblage compositions will become more similar to those in adjacent mature forest with increasing proximity to mature forest at the edge of the clearcut; and
(3) for birds in silvicultural regeneration, the effect of proximity to mature forest on species richness per sample and assemblage composition will become less pronounced as regeneration matures.

2. Methods

2.1. Study sites

The study was carried out in lowland wet eucalypt forest, dominated by *Eucalyptus obliqua* L'Herit, approximately 60 km west-southwest of Hobart in southern Tasmania, Australia (Fig. 1). We selected 15 study sites at the boundaries between mature forests, which had never been subjected to clearcut harvesting, and silvicultural regeneration following a single clearcutting event. These were divided equally among sites where clearcutting occurred at an average of 45 years (harvested 1966–1970), 27 years (harvested 1983–1989), and 7 years (harvested 2002–2007) previously (Fig. 1). Average heights of the regrowth *E. obliqua* at these ages were 27 m, 22 m, and 7 m, respectively, while average height of the mature forest was 34 m.

At each site we established three transects, separated by at least 60 m, which ran perpendicular to the focal boundary between mature forest and silvicultural regeneration (Fig. 2). Along each transect, we surveyed at four points: one in the mature forest 35 m from the edge (−35 m), and others in the silvicultural regeneration at 35, 120, and 200 m from the edge (Fig. 2). These distances from the edge into regeneration represent distances from the closest mature forest, the maximum being limited to 200 m by the size of clearcuts.

2.2. Survey procedures

All study sites were surveyed for birds between sunrise and sunset on 10 occasions. This entailed one morning and one afternoon survey at each site in five seasonal periods: 24 Sept. 2011–11 Nov. 2011; 17 Nov. 2011–25 Dec. 2011; 27 Dec. 2011–29 Jan. 2012; 29 Jan. 2012–28 Mar. 2012; and 28 Mar. 2012–10 May 2012. Each survey round was completed before any sites were revisited, and the order in which sites were surveyed varied among rounds. At least two days elapsed between repeat surveys of any site. Days of strong winds (>Beaufort scale 4), heavy rain, and hot weather were avoided.

Each survey consisted of the observer (ABH) walking along each transect, and stopping to do a 5-min point-survey at each of the four points. The direction the three transects were walked was varied within each survey to avoid confounding