Short communication

Does logging favour bellbirds and promote tree decline?

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Revised manuscript received 9 September 2004

Summary

Bellbirds are increasing in south-eastern Australia, mainly in unlogged and unburnt forests. Some evidence, recently provided to support the hypothesis that logging favours bellbirds and promotes eucalypt decline, is unconvincing.

Keywords: forest decline; logging effects; birds; *Manorina melanophrys*; Psyllidae; *Eucalyptus*; Australia

Introduction

Eucalypt decline is widespread in forests and rural lands throughout temperate Australia (e.g. Jurskis 2004a). A wide range of causes has been proposed, including salt, climatic perturbations and a variety of pests, pathogens and parasites (e.g. Jurskis and Turner 2002; Jurskis 2004a). Psyllids and bellbirds are often associated with forest decline in south-eastern Australia (e.g. Stone 1999). Decline involving bellbirds has been portrayed as a disease of complex aetiology (e.g. Stone 1999; Old 2000), but this is essentially an elaboration of the 'germ theory' (Manion and Lachance 1992) that 'infection' by a single 'pathogen' kills the trees.

Stone (1999) suggested that selective logging, without effective overstorey regeneration, encouraged dense understorey development, and that dense understoreys are colonised by bellbirds, *Manorina melanophrys*, because they provide nesting sites. Bellbirds then trigger forest decline because they interfere with predators that would otherwise 'regulate' folivorous insects (Stone 1999). This is an elaborate example of the germ theory because repeated defoliation by insects is considered to be the cause of decline, whilst invasion by bellbirds is considered to be the cause of the insect outbreaks.

On the other hand, it has been suggested that psyllids and bellbirds are but two of a much wider range of 'predators' that respond to increased food resources provided by declining trees (Jurskis and Turner 2002; Jurskis 2004a,b). This accords with a general ecological principle that predators do not regulate their prey, but are limited by the abundance and quality of their prey (White 1993). The principle applies equally to herbivores that attack trees and to predators that attack herbivores (White 2004). It directly contradicts the germ theory. Nevertheless, there is continuing debate over whether populations are limited from below or regulated from above (e.g. White 2001) and whether pests initiate or respond to tree decline (e.g. Lowman and Heatwole 1992; Manion and Lachance 1992).

Kavanagh and Stanton (2003) monitored bird populations over 22 y following logging of alternate coupes near Eden. They claimed to have found evidence that supported Stone's (1999) hypothesis. This article examines their evidence in a wider context and argues that it is not convincing.

The study site

The study area was dominated by dry forest of silvertop ash, *Eucalyptus sieberi*, blue-leaved stringybark, *E. agglomerata*, and white stringybark, *E. globoidea* (Kavanagh and Stanton 2003). There were a few small areas of moist forest containing gully peppermint, *E. smithii*, and monkey gum, *E. cypellocarpa*, in the heads of gullies. Kavanagh and Stanton reported an increase in bellbird populations in parts of the study area 22 y after intensive logging, and suggested that this observation supported Stone's (1999) hypothesis. However, the dynamics of the bellbird population in comparison to the dynamics of the understorey did not fit Stone's (1999) model.

Four years after logging, there was a dense layer of shrubs under a regenerating eucalypt canopy (Kavanagh and Stanton 2003). Although this vegetation favoured other insectivorous birds that inhabit dense shrubbery, bellbirds were rare in both logged and unlogged coupes, and were still rare 13 y after logging (Kavanagh and Stanton 2003). The shrubby understorey in the logged coupes thinned out over time, and after 22 y the regenerating eucalypt canopy had almost reached its full height (Kavanagh and Stanton 2003). Bellbirds were then numerous only in the heads of moist gullies in two of the seven logged coupes that were examined (Kavanagh and Stanton 2003).

Bellbirds and tree decline

Kavanagh and Stanton (2003) stated that there were no signs of eucalypt decline in their study area, and implied that the increase in bellbirds could not be a result of increased food provided by outbreaks of pests in declining trees (e.g. White 1993). However, their study did not assess the health of the trees. Three years after their final survey, I observed dead and declining gully peppermint near their sample sites in the two logged coupes where they had reported high numbers of bellbirds. Decline had evidently

commenced in the gully peppermint stands when Kavanagh and Stanton found increased numbers of bellbirds, because the process from initial thinning of the crown through to complete death normally takes several years (e.g. Jurskis and Turner 2002; Jurskis 2004b). In the early stages, declining trees often have dense crowns of epicormic foliage (e.g. Stone 1999), and symptoms are not evident to many observers (e.g. Manion 1991).

When I observed the tree decline, logging had been completed in the previously unlogged coupes. There were no bellbirds in either the 25-y-old regrowth or the newly-logged coupes. Bellbirds had evidently deserted the area during the second (alternate coupe) logging operation. Trees were still declining 3 y after bellbirds had left. This was not consistent with Stone's (1999) hypothesis that colonisation by bellbirds triggers forest decline. However, it was consistent with the observation of Clarke and Schedvin (1999) that trees in a declining unlogged forest continued to decline after bellbirds were deliberately removed.

Bellbirds typically occupy densely shrubbed gullies, usually near water (Anon. 1993). Logging is generally excluded from these areas because they are designated as streamside reserves, filter strips and buffers. In the early 1980s, bellbirds in the Eden region were associated with tall moist forests that were not subject to logging. For example, Recher *et al*. (1985) found bellbirds only in tall unlogged forests along creeks. They found no bellbirds in drier open forests, whether logged or unlogged. Smith (1985) found bellbirds at 70% of rainforest (unlogged) survey sites and 40% of unlogged gully peppermint sites, compared to 30% of sites that had been logged 9–13 y earlier, and 20% of unlogged woollybutt (*E. longifolia*) ridge sites. No bellbirds were found on ridges that had been logged 9–13 y earlier.

Since the 1980s more undisturbed forest (where both logging and prescribed burning are excluded) has been retained in drainage lines (Kavanagh and Stanton 2003). Concurrently, forest decline and bellbird colonies have been expanding (Jurskis and Turner 2002; Jaggers 2004; Jurskis 2004b). However, forest decline and bellbirds are mostly absent from even-aged regrowth stands established by intensive logging and wildfires over the past three decades (Jaggers 2004). The declining trees in the moist gully sites where Kavanagh and Stanton had found high numbers of bellbirds were mostly trees that had been retained in logging, together with coppice regrowth with root systems that were much older than the declining crowns.

The dry type of forest that dominates the area monitored by Kavanagh and Stanton is generally unsuitable for bellbirds. Their surveys could not test the impact of logging on bellbirds, because the number and distribution of bellbirds before the initial logging operation was not known and the logging treatments were not evenly distributed within the small part of the study area containing habitat suitable for bellbirds.

Although Kavanagh and Stanton (2003) found a statistical difference between numbers of bellbirds in logged and unlogged coupes after 22 y, this may have reflected the distribution of bellbirds in the study area before logging, and undoubtedly reflected the distribution of some moist forest types in the study area. The 'increase' in bellbirds in moist gully sites 22 y after the initial alternate-coupe logging may have been a recovery to prelogging levels. Bellbirds deserted the area after the second logging event in 2001. In a nearby study area, bellbirds declined in a coupe that was logged in 1988, before recovering to prelogging levels about six years later and continuing to increase thereafter. Meanwhile, bellbirds increased from a lower base in the adjoining unlogged coupe, and maintained consistently higher numbers than in the logged coupe (Forests NSW unpublished data).

In 1998, when Kavanagh and Stanton (2003) found high numbers of bellbirds in some moist gully sites, trees were declining and bellbird colonies were already established in most large unlogged creek reserves around their study area, as well as in nearby unlogged coupes containing some moist forest types (Jurskis and Turner 2002; Jaggers 2004). Forest decline together with increasing bellbird populations across an increasing range have been widely reported in eastern Australia, often at unlogged and unburnt sites (e.g. Clarke and Schedvin 1999; Old 2000; Higgins *et al.* 2001; Martin *et al*. 2001; Jurskis and Turner 2002; Jurskis *et al*. 2003; Billyard 2004; Jurskis 2004b; Smith 2004).

The role of fire

Exclusion of fire has been suggested as a cause in several cases of forest decline involving bellbirds. In other cases, where there has been no logging, and fire has been excluded for long periods, it has not been considered as a possible cause of environmental change. However, there is much evidence of environmental change, change in forest structure and eucalypt decline with fire exclusion (e.g. Jurskis *et al*. 2003).

Most of Kavanagh and Stanton's (2003) study area, including the small part occupied by moist gully heads and bellbirds, had not been burnt for at least 26 y when they found high numbers of bellbirds. The natural fire regime in this mostly dry forest entailed more frequent fires (Jurskis *et al*. 2003). Fire management is likely to influence both forest health and bellbird populations, but Kavanagh and Stanton (2003) did not consider it as a confounding factor when they interpreted their data on bellbirds. They also did not consider these data in the context of increasing bellbird populations in unlogged areas across eastern Australia.

Acknowledgements

Chris Slade surveyed three coupes for bellbirds in 2003. Bob Bridges and three anonymous referees constructively criticised early drafts of this article.

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