Understanding the dispersal dynamics of bell miners: do they disperse and can this be monitored?

Proposed Honours project

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Introduction

The bell miner, *Manorina melanophrys*, is a cooperatively breeding honeyeater that defends territories from other avian species to the point of complete exclusion within territory boundaries (Leseberg et al. 2014). This species has also been implicated in a form of eucalypt dieback, that incorporates a multi-trophic interaction between trees, psyllids, a leaf parasite that feeds primarily on juvenile eucalypt leaves (Stone 1996), and their avian predators, the bell miner. The bell miner feeds primarily on lerp, a sugary coating that psyllids produce for protection rather than the underlying insect itself (Haythorpe and McDonald 2010). Two studies where bell miner colonies have been removed from Olinda State Forest in Victoria and a forest in Queensland in order to assess the changes in the avian assemblages and tree health have found conflicting results (Loyn et al. 1983, Clarke and Schedvin 1999). An inundation of other insectivorous bird species that feed upon and reduce psyllid populations was evident in both studies. However, Loyn et al. (1983) observed an improvement in tree health, whereas Clarke and Schedvin (1999) did not. Clarke and Schedvin (1999) suggested the reason behind the difference in tree health was due to the presence of *Phytophthora cinnamomi* (a pathogenic fungus). As suggested by a recent study on Bell Miner Associated Dieback in wet sclerophyll forest in New South Wales, a reduction in tree health can be caused by a variety of stressors, not just bell miners (Lambert 2015). This species has been found to have nest plasticity and does not always respond to understorey removal (Lambert 2015), as previously suggested to result in colony relocation (Somerville et al. 2011). A colony expansion has only been observed once with two types of groups, a breeding pair and a helpers and a group of unmated males. Both groups were unsuccessful and returned to the original colony after six months (Dare et al. 2008).

The current acoustic method for monitoring bell miners has been tested over four seasons within the same colonies (Lambert and McDonald 2014). However, it is unknown whether the same method could be used in different terrains. In the long term, if dispersal does take place, the colony might end up dispersing into areas with higher levels of background noise such as a flowing waterway in a creek and this could affect the current acoustic method. Therefore, the current acoustic method must be tested within a variety of terrains to determine its success on a landscape scale.

Furthermore, despite the studies already undertaken, little is known about the reasons behind their habitat choice and reasons for dispersal. In order to better understand the relationship between bell miner activities and the potential for them to contribute towards tree dieback, and the reasons behind any dispersal and colony movements that may occur, it is necessary to

accurately determine the movement of bell miner colonies in association with the health of trees and psyllid numbers. A recent study has found that bell miners can be accurately monitored for density using bioacoustics techniques (Lambert and McDonald 2014). However, it is unknown whether this same method can be used long term for monitoring colony dispersal.

Study expectations:

Q1: If bell miners can be monitored within their initial colony location using acoustic methods, then we expect that bell miner colony movement can be monitored as the initial colony disperses.

Q2: If bell miner colonies are able to monitored using acoustic methods during their dispersal, monitoring can occur on a variety of terrains.

Methods

Q1. Can movement patters of bell miner colonies be monitored in space and time using novel acoustic methods to assess if dispersal occurs?

- 10 colonies in similar vegetation structure and general terrain with lantana understorey to assess and monitor densities over four seasons once every three months;
- Density recordings to be taken (i) in the centre of each colony, and (ii) from each cardinal point, 100 metres in each direction from the centre of each colony to detect any movement;
- Recordings should only be made on no wind and no rain days;
- Compare densities throughout the year to see if there is any spatial change to visual presence/absence observations;
- Sample the insect canopy assemblage from 10 trees within each colony throughout the year using a fogging apparatus (for methods see Lambert et al. 2014);
- Measure general tree health within the different bell miner colonies (both within the centre of the colony and at each 100 m cardinal point distance);
- Measure lantana height in each area during surveys (may not be necessary as current unpublished evidence suggests that bell miners choose areas based on vegetation structure eg. Understorey presence and this study is not removing the understorey within a year).

Q2. Can monitoring for dispersal occur in a variety of terrains?

- Choose three types of terrain that occur near Brisbane where bell miners occur eg. Slopes and vegetation thickness (this needs to be initially determined before surveys occur);
- Sample 3 colonies within each terrain type using the acoustic methods of cardinal points;
- Sample during each season to determine if there is any change in dispersal and the ability to access the area.

Fieldwork Timeframe

Month	Activity
1st month	• Q1. Choose 10 sites that have similar terrain and vegetation structure • Q2. Choose three types of terrain with three colonies within each type • Walk around sites to determine accessibility and note any obstructions • Obtain license for insect collections if completing this section and approval from National Parks and State Forest if colonies are located here
2nd month (Winter)	• Sample all colonies using note taker for the first time • Count number of tinks within each recording and put into data sheet • Sample insect canopy assemblages using a fogger and identify insect orders/families
4th month (Spring)	• Resample colonies with note taker and insect canopy assemblages • Put into data sheets
7th month (Summer)	• Resample colonies with note taker and insect canopy assemblages • Put into data sheets • Preliminary analysis on preliminary data to learn techniques
10th month (Autumn)	• Resample colonies with note taker and insect canopy assemblages • Put into data sheets
10th, 11th and 12th month	• Analyse data comparing sites within the same vegetation structure and terrain • Analyse data comparing different terrain types • Write up thesis

References

Clarke, M. F., and N. Schedvin. 1999. Removal of bell miners *Manorina melanophrys* from *Eucalyptus radiata* forest and its effect on avian diversity, psyllids and tree health. Biological Conservation **88**:111-120.

Dare, A. J., P. G. McDonald, and M. F. Clarke. 2008. The social and behavioural dynamics of territory establishment in the Bell Miner *Manorina melanophrys*. Emu **108**:175-180.

Haythorpe, K. M., and P. G. McDonald. 2010. Non-lethal foraging by bell miners on a herbivorous insect: Potential implications for forest health. Austral Ecology **35**:444-450.

Lambert, K. T. A. 2015. Quantifying the importance of lantana removal, soil nutrient profiles, insect assemblages and bell miner density on Bell Miner Associated Dieback. University of New England, Armidale, NSW.

Lambert, K. T. A., N. R. Andrew, and P. G. McDonald. 2014. The influence of avian biodiversity and a weedy understorey on canopy arthropod assembly. Open Journal of Ecology **4**:1003-1013.

Lambert, K. T. A., and P. G. McDonald. 2014. A low-cost, yet simple and highly repeatable system for acoustically surveying cryptic species. Austral Ecology **39**:779-785.

Leseberg, N. P., K. T. A. Lambert, and P. G. McDonald. 2014. Fine-scale impacts on avian biodiversity due to a despotic species, the bell miner (Manorina melanophrys). Austral Ecology.

Loyn, R. H., R. G. Runnalls, and G. Y. Forward. 1983. Territorial bell miners and other birds affecting populations of insect prey. Science **221**:1411-1413.

Somerville, S., W. Somerville, and W. Coyle. 2011. Regenerating native forest using splatter gun techniques to remove Lantana. Ecological Management and Restoration **12**:164-174.

Stone, C. 1996. The role of psyllids (Hemiptera: Psyllidae) and bell miners (*Manorina melanophrys*) in canopy dieback of Sydney blue gum (*Eucalyptus saligna* Sm.). Austral Ecology **21**:450-458.