

## Increased lyrebird presence in a post-fire landscape

Anna Doty<sup>A,B</sup>, Clare Stawski<sup>A</sup>, Julia Nowack<sup>A</sup>, Artiom Bondarenko<sup>A</sup> and Fritz Geiser<sup>A</sup>

<sup>A</sup>Centre for Behavioural and Physiological Ecology, Zoology, University of New England, Armidale, NSW 2351, Australia.

<sup>B</sup>Corresponding author. Email: [adoty@une.edu.au](mailto:adoty@une.edu.au)

**Abstract.** Prescribed fires for fuel reduction affect wildlife in several ways. We observed a marked increase in superb lyrebird (*Menura novaehollandiae*) numbers after a controlled burn in Guy Fawkes River National Park, New South Wales, in April and May 2014. The fire occurred during the winter breeding season; however, congregations of males were often seen together in the burnt landscape, indicating an opportunistic prioritisation of foraging. The low-intensity fire cleared brush and low-level vegetation, thus decreasing foraging effort and potentially attracting the species despite the need to seek mating partners. Controlled burns therefore have the potential to attract superb lyrebirds immediately after fire due to ease of movement and foraging effort.

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Bird abundance and diversity in Australia following controlled burns show complicated relationships, heavily dependent on fire frequency, intensity, timing and location (Tingay and Tingay 1984; Loyn *et al.* 1992; Woinarski and Recher 1997; Andersen *et al.* 2005; Franklin *et al.* 2005; Clarke 2008). Response to controlled burns is largely species-dependent (Christensen and Abbott 1989) and has been shown to result in both an increase (Woinarski 1990; Woinarski *et al.* 2012) or decrease (Wooller and Brooker 1980; Murphy *et al.* 2010) in abundance of avifauna, although the response to low-intensity controlled burns is generally mild (Abbott *et al.* 2003). Both granivores and ground-feeding birds, such as cockatiels, galahs and red-tailed black cockatoos, tend to immediately increase in abundance after a low-intensity controlled burn (Christensen and Abbott 1989; Woinarski 1990).

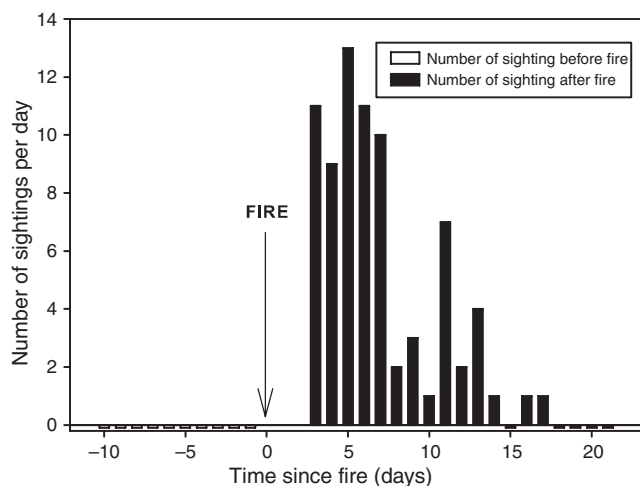
We observed and recorded numbers of superb lyrebirds (*Menura novaehollandiae*) before and after a controlled burn. The superb lyrebird is a large, insectivorous bird inhabiting forests of south-eastern Australia. Superb lyrebirds breed in the winter and construct nests on the ground, at the base of trees or on ferns (Robinson and Frith 1981). They are also highly vulnerable to cat and fox predation due to their ground-dwelling nature (Lill 1980; Bradley and Bradley 1990). Because of a lack of information regarding immediate behavioural reaction of some birds to controlled burns, the aim of our study was to gain knowledge of the response patterns of superb lyrebirds to a low-intensity controlled burn in winter.

On 8 and 9 May 2014, a low-intensity fire was conducted in Guy Fawkes River National Park, New South Wales (30°04'58.6"S, 152°20'00.9"E) by National Parks and Wildlife Service staff. The controlled burn area (379 ha) was bordered on the west and north by an escarpment, a dirt road to the east, and a dirt fire trail to the south. The burn site was entirely restricted to the

prescribed area. Beyond the roads, vegetation remained unburnt. The vegetation community in the study area varied from grassy woodland and open forest dominated by broad-leaved stringybark (*Eucalyptus caliginosa*), yellowbox (*E. mellidora*) and Blakely's redgum (*E. blakelyi*) to tableland open forest dominated by silvertopped stringybark (*E. laevopinea*), grey gum (*E. biturbinata*), broad-leaved stringybark (*E. caliginosa*), New England blackbutt (*E. andrewsii*), mountain gum (*E. dalrympleana*) (Reid *et al.* 1996), *Allocasuarina* spp. and *Banksia* spp. (A. Doty, pers. obs.).

Between 25 April and 26 May 2014, records were made of superb lyrebird sightings. Observations were not recorded during 8–11 May as access was not permitted during and immediately after the fire. Sampling occurred along all roads and trails bordering the prescribed burn area. Observation effort on superb lyrebirds was consistent, as sites were visited daily in the mornings (06:00–12:00 hours) and afternoons (15:00–18:00 hours). These sightings were recorded during a study focusing on the behavioural and physiological patterns of Australian mammals before and after a controlled fire, so lyrebird sightings were made opportunistically. The study commenced 10 days before the controlled burn and extended through 26 May, 17 days after the controlled burn. Owing to the difficulty of distinguishing individual lyrebirds, all observations were recorded; therefore repeat sightings may have occurred.

No observations of superb lyrebird were reported in the two weeks prior to the fire (25 April – 7 May). In contrast, a large number of sightings ( $n = 76$ ) were made immediately after the fire. Sightings were highest for the first five observational days after the fire, with  $10.8 \pm 1.5$  sightings per day and an average of  $5.1 \pm 4.6$  sightings per day over the entire post-fire observational period. The greatest number of sightings of superb lyrebirds on a single observational day ( $n = 13$ ) was recorded on Day 5 after the



**Fig. 1.** Number of sightings of *M. novaehollandiae* per day before and after a control burn. Vertical bars below zero on the x-axis indicate zero sightings for that day. Sightings decreased significantly with time since fire ( $r^2 = 0.71$ ,  $P < 0.01$ , described by the equation  $y = -0.682x + 12.19$ ).

fire. Sightings decreased with an increase in time after fire (Fig. 1). Most superb lyrebird sightings were of males ( $n = 51$ ), with occasional observations of females ( $n = 15$ ) or individuals of an unknown sex ( $n = 6$ ). Most sightings occurred between 06:00 and 13:00 hours, when the study site was visited.

Superb lyrebirds were exclusively observed moving out of the burnt area, across the road and into the unburnt area. Lyrebirds were always observed running very quickly or darting across the road, often in small groups. Most observations ( $n = 65$  of 76) were recorded along a 2-km fire trail, a border infrequently visited by people, and recordings generally occurred in the same areas. Other areas in which lyrebirds were observed included a wide dirt road ( $n = 7$ ) leading to a campsite that bordered the burnt area, and on the campsite itself ( $n = 4$ ).

Our study shows a significant increase in sightings of superb lyrebirds in a post-fire landscape. To our knowledge, this is the first study to note the behavioural response of superb lyrebirds immediately following a low-intensity controlled burn. The removal of the grass layer after a fire has been found to attract ground-feeding avifauna (Woinarski 1990); therefore, the apparent ease of movement and foraging effort in the absence of grass in the burnt landscape was most likely an attractant. A study conducted by Nugent *et al.* (2014) found that, on a long-term scale, lyrebirds favoured foraging in unburnt patches over ground-burnt patches, and were not present in canopy-burnt areas. This indicates that lyrebirds may only favour foraging in a post-burn landscape on a short temporal scale. Lyrebirds have been found to decrease in abundance in the absence of regular fires (Smith 1994), which suppress the spread of wiregrass. Superb lyrebirds spend more than 80% of their foraging time digging for soil invertebrates, and little discrimination is found in prey choice (Lill 1996). Fire may therefore expose more bare ground readily available for digging and thus result in a decrease in foraging effort. Opportunistic foraging by superb lyrebirds in the burnt area apparently was disrupted by vehicle presence and resulted in darting behaviour into the unburnt area. The major reduction in ground cover may have triggered a heightened

predatory awareness and thus resulted in rapid movement from the more exposed burnt area to the more densely vegetated and covered area. The marked decrease of lyrebird sightings with time since fire may have been due to a reduction in visible insect abundance in the burnt area resulting from heavy foraging. As foraging effort potentially grew less rewarding, lyrebirds most likely moved back into their respective territories.

Male superb lyrebirds are highly territorial, usually displaying on mounds, rocks or trees (Kenyon 1972; Lill 1979). Despite the occurrence of the fire during the lyrebird breeding season, males were often seen together in groups, indicating that an increase in available resources overshadowed their perceived need for typical territorial behaviours. Male lyrebirds maintain territories of up to 3.7 ha (Robinson and Frith 1981; Lill 1996). Up to six male lyrebirds were seen running together at once, signifying that males with territories further away may have had to travel up to 1.3 km to forage in the burnt area. An alternative explanation is that some of the birds were displaced from the burn area and returned to their previous territories to forage. However, considering the large number of birds we observed, this was probably only a minority of individuals.

Observations from this study therefore indicate that low-intensity fires may result in an immediate increase in abundance of some granivorous and omnivorous birds and/or sustained populations from an increase in food availability despite a visibly burnt landscape.

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