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Artificial tree hollow creation for cavity-using wildlife – Trialling an alternative method to that of nest boxes

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ABSTRACT

Tree hollow scarcity is a threat to cavity-dependent vertebrate wildlife world-wide across many landscapes. Currently, only nest boxes are commonly used to mitigate or offset lost cavity-bearing trees, with a number of shortfalls reported using this technique. There is a need to trial alternative techniques to improve artificial cavity provisions. This preliminary study investigated the use of carving hollows directly into tree trunks using chainsaws. Sixteen hollows of two simple cavity types were created in a timber production forest in south-eastern Australia. One cavity type comprised a basal entrance (38 mm in diameter) which provided a space above the entrance, intended for bats, and the other cavity type provided a space below a 38 mm or 76 mm entrance, intended for marsupials and birds. Five species used the hollows over a 15-month cavity monitoring period; feathertail glider (*Acrobates pygmaeus*) (in 75% of the hollows), brown antechinus (*Antechinus stuartii*) (75%), sugar glider (*Petaurus breviceps*) (63%), long-eared bat (*Nyctophilus* sp.) (50%) and white-throated treecreeper (*Cormobates leucophaea*) (25%). Camera monitoring revealed hollow inspection after only one day post hollow creation by white-throated treecreepers and feathertail gliders, and nest building by white-throated treecreepers after three days. No hollow host tree failure occurred for either of the two hollow wall widths trialled over two years of monitoring tree stability. Wound-wood formed and partly enclosed the hollows' faceplates over time, improving the sturdiness of the hollow and likely resulted in hollows closely resembling natural cavities. Mechanically created tree hollows have a broad application potential across many landscapes with the prospect to overcome some of the reported drawbacks of nest boxes. More research is required to document long-term performance and effectiveness of this technique.

1. Introduction

A large number of species of vertebrate wildlife world-wide rely on tree cavities for their survival (e.g. Robb et al., 1996; Gibbons and Lindenmayer, 2002; Fenger et al., 2006; Goldingay, 2009). Cavity-dependent mammals use cavities for shelter, nest sites and the rearing of young, and some, such as many species of echolocating bats, for thermoregulation (Geiser and Ruf, 1995; O'Donnell and Sedgeley, 1999; Rueegger, 2016). Loss of cavity-bearing trees is a threat to cavity-dependent wildlife in many landscapes (Cockle et al., 2011; Manning et al., 2012; Lindenmayer et al., 2014) and localised tree cavity scarcity has the potential to impact on population size, abundance and diversity (Marsden and Pilgrim, 2003; Cockle et al., 2011). In Australia, there are no primary cavity-using vertebrate species (i.e. species that create cavities, such as woodpeckers). Instead, the large diversity of Australian cavity-dependent vertebrate fauna are secondary cavity users that rely on pre-existing cavities formed as a consequence of the activities of fungi, invertebrates, wind or fire (e.g. Inions et al., 1989; Adkins, 2006; McLean et al., 2015). Cavity development through natural processes is slow and likely to take more than 100 years (e.g. Cameron, 2006; Vesk et al., 2008; Ranius et al., 2009). Therefore, the depletion of hollow-bearing trees through urbanisation, deforestation, plantation forestry, poor silvicultural and urban forest practices has invariably led to current and future local tree cavity scarcities in many landscapes. Indeed, a number of wildlife species dependent on tree cavities are formally recognised as threatened worldwide, with more species predicted to become threatened if the trend of hollow-bearing tree decline is not reversed (Lindenmayer et al., 2014).

In landscapes where cavity-bearing trees are depleted, local tree hollow abundance needs to be considered by management authorities where cavity-dependent fauna are a conservation priority. Part of that management includes assessing whether the present and predicted tree hollow abundance is sufficient to support viable local populations. Where a tree hollow paucity is identified, there is a need to devise a response to increase hollow numbers. To date, deploying habitat boxes (i.e. nest and roost boxes) is the only commonly used technique to

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Fig. 1. (a) Faceplates for large entrance marsupial/bird hollow, bat hollow and small entrance marsupial/bird hollow (from left to right); (b) transitional stage of creating the cavity, showing the plunge cuts that allowed the hammering out of individual wood pieces; (c) finished cavity; (d) finished large entry marsupial/bird hollow with heat/motion activated camera installed on bracket above cavity, (e) completed marsupial/bird hollow with small entrance, and (f) completed bat hollow.

mitigate local tree hollow scarcity (e.g. Newton, 1994; Rodríguez et al., 2011; Goldingay et al., 2015) and there has been debate concerning how effective boxes are (e.g. Lindenmayer et al., 2015; Le Roux et al., 2015; Goldingay et al., 2015; Rueegger, 2016; Lindenmayer et al., 2017).

Given the high use of habitat boxes to mitigate or offset lost cavity-bearing trees in Australia (Lindenmayer et al., 2017) and the recurrent negative reports on the effectiveness of habitat boxes (Lindenmayer et al., 2009, 2015; Le Roux et al., 2015; Rueegger, 2016; Lindenmayer et al., 2017), there is a need to trial other methods in an attempt to improve the effectiveness of artificial hollows. One alternative method to habitat boxes is to mechanically create tree hollows. This technique has received surprisingly little attention. The description of mechanical hollow creation briefly appeared in North-American publications in the early 1980's by Carey and Gill (1983) and Gano and Mosher (1983). In the 1990's, mechanical cavity creation re-emerged in North American literature for a specific species, the red-cockaded woodpecker (*Leuconotopicus borealis*) (Copeyon, 1990; Allen, 1991; Saenz et al., 2001; Hooper et al., 2004; Cox and McCormick, 2016), describing two cavity creation techniques. One where cavities were created into tree trunks through drilling (Copeyon, 1990; Taylor and Hooper, 1991) and the other where artificial wooden boxes were inserted into carved out cavities (Allen, 1991). Both techniques used wood filler and paint in the hollow creation process with pine trees being the hollow host.

In Australia, there has been some mention of using methods to create tree hollows or accelerate tree hollow formation (Gibbons et al., 2000; Harley, 2008; Beyer et al., 2008; Le Roux et al., 2014), however, such field experiments have not been described. Although