Department of Parks and Wildlife

Information Sheet 88 / 2016
Science and Conservation Division

Ant communities of gimlet woodlands and how they change over centuries following fire

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Background

The Great Western Woodlands (GWW) forms the world's largest extant Mediterranean-climate woodland. Unlike other Mediterranean-climate ecosystems the *Eucalyptus*-dominated woodlands of the GWW rarely burn when mature due to their open canopy structure and patchy distribution of fuel, and can exist for centuries without being disturbed by fire (see Science and Conservation Division Information Sheet 65/2013). Recent decades, however, have seen an unusually high number of wildfires that collectively have burnt a large proportion of the GWW, and this has raised concerns about the conservation of mature woodlands. Understanding how these woodlands and their associated fauna change with aspects of the fire regime, such as time since fire, is crucial for identification of appropriate fire return intervals for biodiversity conservation.

We have been studying the changes that occur over centuries after fire in *E. salubris* (gimlet) woodlands; a widespread vegetation community throughout the GWW (see Science and Conservation Division Information Sheets 68/2013 and 72/2014). As gimlet woodlands recover after fire their floristic composition and structure systematically changes, affecting physical conditions and the availability of resources for fauna. According to theory posited in the habitat accommodation model, these changes drive a succession of animal species, which enter and leave according to their habitat requirements. As a consequence, some animal species are characteristic of vegetation that has been recently burnt, while others prefer intermediate periods since fire, or long-unburnt vegetation. It is important to know whether this prediction holds true in the GWW, so that fire managers can plan for maintaining mid and late post-fire successional habitats.

Inland arid Australia, including the GWW, has an extraordinarily diverse ant fauna which performs many important roles in the maintenance of healthy ecosystems. There have, however, been very few studies investigating the successional patterns of ant communities in ecosystems like gimlet woodlands which burn infrequently and take centuries to recover. In this study we explore the response of ant species and functional groups (aggregations of species based upon their responses to environmental stress and disturbance) to time since fire. Additionally, we test whether post-fire changes in the occurrence of ants match post-fire changes in vegetation structure.

Gimlet woodland in the Great Western Woodlands (left), which were sampled for terrestrial ants with wet pitfall traps (40 mm diameter) filled with ethylene glycol, shown here (right) with captured ants prior to collection, sorting and identification.

Findings

- A total of 37273 individuals of 232 species and 35 genera were captured. The richest genera were *Melophorus* (41 species), *Camponotus* (38), *Monomorium* (36) and *Iridomyrmex* (19). *Iridomyrmex chasei* was by far the most abundant species, contributing 56% of all individuals.
- Site species richness ranged from 10 to 35 (mean ± SE, 23.5 ± 0.8).
- Overall ant species richness and composition did not show clear post-fire successional patterns.
- Richness and abundance of specific ant functional groups changed with time since fire, with Dominant Dolichoderinae and Hot-Climate Specialists more prominent in more-open recently-burnt and long-unburnt habitat, and Cold-Climate Specialists more prominent in less-open habitat at an intermediate time since fire (Fig. 1).
- This matching temporal pattern of changes in ant functional groups and vegetation structure (Fig. 1) suggests that ant occurrence is mediated through changes in habitat, as posited by the habitat accommodation model, and not simply time since disturbance.
- *Camponotus* sp. (terebrans gp.), which is the sole host of the larvae of a critically endangered butterfly (Arid Bronze Azure, *Ogyris subterrestris petrina*), was recorded at 12 sites.

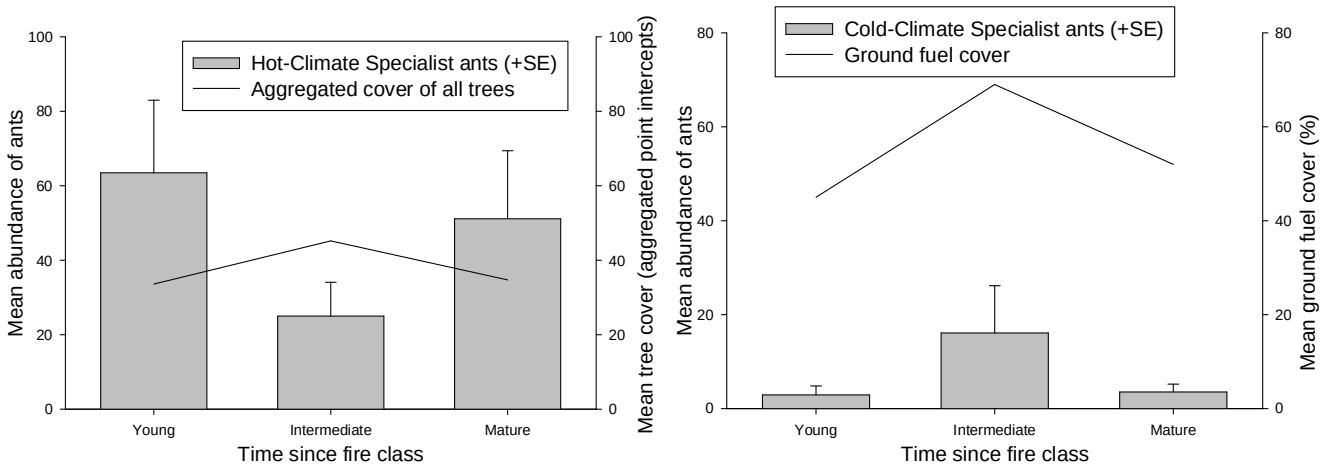

Fig. 1. Changes in the abundance of Hot-Climate Specialist (left) and Cold-Climate Specialist (right) ant functional groups with time since fire class ('Young', <12 years post-fire; 'Intermediate', 38-120 years; and 'Mature', >140 years). Added to both figures are line plots of changes in selected vegetation structural variables that are likely important habitat features for ants. Tree cover is the aggregation of cover of all individual tree species, and Ground fuel refers to all dead vegetation on the ground surface (litter, logs etc), with the remainder of ground cover being either bare ground or biological soil crust.

Management Implications

- Current fire management in gimlet woodlands aims to minimise wildfire occurrence, which is consistent with the maintenance of ant functional diversity at a regional scale given the long time periods over which post-fire changes in ant functional groups occur.
- The combination of recent large wildfires and predicted fire-facilitating climate changes suggest that extensive future shifts in the relative dominance of ant functional groups are likely if fire management is unsuccessful in limiting wildfires occurring in mature woodlands.
- Records of *Camponotus* sp. (terebrans gp.) are being used to direct searches for new populations of the Arid Bronze Azure butterfly.

The CSIRO ant collection held at the Tropical Ecosystems Research Centre, Darwin, was used to identify and classify ants captured in this research.

Further reading: Gosper CR, Pettit MJ, Andersen AN, Yates CJ and Prober SM (2015) Multi-century dynamics of ant communities following fire in Mediterranean-climate woodlands: are changes congruent with vegetation succession? *Forest Ecology and Management* 342, 30-38.

This research is jointly funded by Parks and Wildlife (GWW Conservation Strategy), CSIRO and the TERN supersite and transect networks.

Produced and published by the Science and Conservation Division, Department of Parks and Wildlife, Western Australia, Locked Bag 104, Bentley Delivery Centre, WA 6983

GREAT WESTERN WOODLANDS