Effects of the fire management method of chaining and burning on plant communities

Carl R. Gosper [a,b*], Colin J. Yates [a], Suzanne M. Prober [b]

[a] *Science Division, Department of Environment and Conservation, Locked Bag 104, Bentley Delivery Centre, WA 6983, Australia ([*] corresponding author: carl.gosper@csiro.au)*
[b] *CSIRO Ecosystem Sciences, Private Mail Bag 5, PO Wembley WA 6913, Australia*

Managing fire regimes is increasingly recognized as important for biodiversity conservation in fire-prone regions. In the global biodiversity hotspot of south-west Western Australia, chaining and burning (also known as fuel modification or scrub rolling) is a novel technique used to assist in fire management, for both biodiversity conservation and protection of community assets.

Chaining and burning aims to create a strip, typically 40-100 m wide, with a reduced fuel load to: (i) reduce the likelihood of wildfires crossing the strip; and (ii) facilitate the safe and effective application of prescribed fire [1]. Vegetation is first dislodged using a chain dragged between two machines, then after a period of curing, the vegetation is burnt. Chaining and burning is applied predominantly in shrubland and mallee vegetation, where the vertical distribution of fuel is such that unmodified vegetation usually burns only under severe fire weather [1] and where flattening and drying allows for prescribed fire application under less dangerous conditions. To date, most strips have been single-application, but because the effectiveness of the strips declines over time as plant communities recover, consideration is being given to the re-treatment of existing areas [1].

The effects of chaining and burning on plant communities have been poorly understood until recently, despite the potential consequences of combining two disturbance events: physical damage and fire. To address this, we compared recruitment, resprouting and vegetation structure in mallee-heath subject to chaining and burning and burning only in the Lake Magenta area of the eastern wheatbelt. We hypothesised that outcomes would vary depending on plant functional types defined by disturbance response.

We recorded 90% fewer recruits of obligate seeders (plants killed by complete scorching) with a canopy seed store in chained and burnt compared to only burnt plots, and a 44% decrease in their species richness [2]. Their seeds are likely to have been destroyed in the fire after being shed from protective fruits between chaining and burning [3]. By contrast, recruits of obligate seeding shrubs and fire ephemeral herbs with persistent soil-stored seed banks increased [2], possibly responding to enhanced germination stimuli. Sprouters showed little difference. Chaining and burning significantly alters vegetation composition, and potentially poses a localised threat to threatened, conservation priority or narrow-range endemic obligate seeders with canopy-stored seeds.

Both chained and burnt and only burnt vegetation had less leaf litter and tall vegetation (> 25 cm) than long-unburnt vegetation, indicating a fire management benefit. The stem number of mallee *Eucalyptus* spp. was 20% less in chained and burnt strips compared to where only burnt [4], indicating that consecutive disturbances reduces resilience and may render sprouters vulnerable to subsequent disturbances.

As the probability of fire occurrence is not equal across the landscape, this indicates the value of strategic approaches to fire management. Average fire return intervals decrease from ~340 yrs in small (100-500 ha) wheatbelt remnants, to ~70 yrs in large (> 500 ha) remnants to ~40 yrs in the continuously vegetated Great Western Woodlands [5].

The utility of single-application chained and burnt strips may therefore depend on landscape context. In remnants, where fires are infrequent, the probability of unplanned fires intersecting effective single-application chained and burnt strips is low. Multiple applications will be needed for strips to be effective in fire management over the medium term. The biodiversity conservation consequences of this will need to be assessed against the potential broader benefits of the practice in managing landscape fire regimes.

References

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