Fire ecology of the spinifex hummock grasslands of central Australia

by

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Abstract

Australia's spinifex hummock grasslands are arid ecosystems that experience intermittent but widespread fires. These fires occur in response to above-average rains, which cause biomass levels to increase and allow fuel contiguity to occur. Previously, there was very little scientific understanding of the ecological effects of these wildfires on spinifex grasslands, although anecdotal evidence suggested that a recent fire 'event' (2000-02) had been catastrophic to both plant and animal populations. This thesis was concerned firstly with quantifying the contemporary fire regime of the spinifex grasslands of the Haasts Bluff Aboriginal Reserve, west of Alice Springs, and secondly, with improving our understanding of how fire regimes affect vegetation dynamics within these grasslands.

Examination of Landsat MSS satellite imagery dating from 1979 to 2003 found that contemporary fire patterns in the reserve were characterised by large-scale fires during 1982–85 and 2000–02 but with virtually no fires in other years. The mean size and total area burned by these fires was greatest during summer months, and this was believed to have been the result of higher air temperatures, lower humidity levels and higher lightning incidences during these months. Fire interval distributions during the study period were bimodal, with modes at 2-3 years occurring when multiple fires took place during fire-event periods ('82-85, '00-02), and 15-17 years occurring during the inter fire-event period ('85-99). Floristic and seed bank surveys in areas burned by these fires revealed that time-since-fire had an overriding influence on the dynamics of ephemeral grasses and herbs, with greatly increased occurrence of both vegetation and seed of these species in recently burned areas. Other functional types, such as clonal herbs and resprouting woody species were unaffected by time-since-fire. Fire season had little effect on most functional groups, although a strong effect on recruitment of woody species was observed, with increased seedling numbers following summer compared to winter fires. Fire interval had transitory effects on ephemeral plants, clonal plants and on seedlings of *Triodia* species. Surprisingly, no interval effects were observed on resprouting or obligate seeding woody vegetation.

The results of the field surveys were explored more fully in field experiments in which four species of *Acacia* were burned under differing fire intervals, seasons and 'severities'. These experiments demonstrated that the selected *Acacia* species could resprout repeatedly after short fire intervals, though high levels of mortality were observed for certain species under high severity and/or summer burns. Additionally, most woody species failed to be detected in the seed bank. This result was largely explained by seed removal and decay experiments, which revealed that seeds of these species would be removed by seed predators almost immediately after seed fall.

Overall, populations of most life history groups in the spinifex grasslands appear to be resilient to fire, with all groups possessing adaptations or life history characteristics that ensure persistence following pyric disturbance. Despite these findings, demographics of several plant groups were clearly affected under certain circumstances and it is suggested that fire, in concert with pre- and post-fire rainfall, can act as a driving force in regulating plant community dynamics in spinifex grasslands.

Certification

I certify that the substance of this thesis has not already been submitted for any degree and is not currently being submitted for any other degree or qualification.

I certify that any help received in preparing this thesis, and all sources used, have been acknowledged in this thesis.

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