Implications of Kimberley fire ecology research for conservation management

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Abstract

Fire regimes dominated by frequent fires late in the dry season are implicated in critical weight range (CWR; 35g-5.5kg) mammal declines across savannas of northern Australia. However in highly flammable environments such as tropical savannas how can we manage fire for conservation? Savanna habitats burn irrespective of our management, so what can fire managers therefore do to benefit biodiversity in a highly flammable environment? Application of extensive early season prescribed burning in Kakadu and Litchfield NPs in the Northern Territory has failed to arrest biodiversity declines there. This has direct relevance to the Kimberley region in northern WA where similar flammable savanna landscapes to those in the Northern Territory dominate the region. We studied the fire responses of threatened CWR mammals and associated vegetation and fauna in the Mitchell River area of the North Kimberley where mammal communities are largely intact. CWR mammal abundance, mammal diet, vegetation structure and non-mammal fauna dynamics were documented over a 5 year period and related to the occurrence of fire events, site fire frequency and larger scale fire regime context. A model species, the north quoll, was radio-tracked to document the effects of fire events on home range and habitat use by this key species. Mammal abundance was documented across management compartments defined by differing fire frequency and number of cattle culling events to identify whether particular management regimes were conducive to maintenance of mammal communities. Observations in fire edge habitats (<200 m from edge of fire scar) showed that small scale prescribed fires had very few detectable negative impacts on mammal populations or associated ecosystems. CWR mammals showed no fire-effects in terms of habitat use or home range size following fire events, and quolls were observed to operate only in burnt habitats in some instances. Negative impacts of fire (e.g. on rodents, skinks and invertebrates) were only observed when fire events covered large areas (>10 km^2), when survey sites were situated >500 m from the nearest unburnt vegetation. This suggests that large-scale fire landscape context is more important in determining mammal habitat use and abundance than local-scale fire impacts or vegetation status. Quolls and bandicoots responded to fires by taking higher proportions of large prey items. This suggests that reduced abundance of some fauna groups after large fires may be due to increased predator impacts, or due to emigration to avoid predators. At the larger scale, mammals were most abundant in management compartments which had relatively low fire frequency (<0.57 fires per year) and had been protected from damaging late season large-scale fires through active management. There was no evidence of reduced mammal abundance relative to historical surveys, though some species have become extremely rare since 1980's surveys. This warrants particular attention for future fire management in the region as habitats such as those on laterite geology historically had high CWR mammal diversity. These data overall suggest that a strategy of applying multiple ignitions to achieve a fine-grain fire mosaic is compatible with conservation management objectives as long as the grain size is kept to a minimum compatible with mammal home range size (10 ha-100 ha). The substantial impact of large unplanned fires illustrates the vital importance of retaining small patch sizes (<1 km^2) in the majority of conservation areas. In order to achieve control over fire size, it is recommended that sandstone habitat should only be burnt during the wet season when fires will self extinguish. Similarly savanna habitats should only be burnt very early in the dry season to avoid large scale fires (>10 km^2) in this key habitat type.