

Prescribed burning benefits threatened mammals in Kimberley tropical savannas

by Ian Radford¹, Ben Corey¹, Karin Carnes¹, Richard Fairman¹ and Leigh Ann Woolley²

¹Department of Biodiversity, Conservation and Attractions ian.radford@dbca.wa.gov.au, ²Worldwide Fund for Nature-Australia.

Background

Present reported declines in threatened mammals across northern Australia's tropical savannas has implications for the Kimberley which is the last mainland area with an intact suite of these mammals. Very frequent (occurring every 1-3 years) and extensive (>1,000 km²) wildfires have been implicated in these declines, with approximately 35 percent of savannas burnt annually. In 2003, the depart-

ment initiated fire ecology research and monitoring in the Kimberley. This work included repeated mammal trapping and vegetation surveys across savanna habitats, and different tenure and land management types.



Brush tailed rabbit rat (photo P. Meyer), northern quoll (photo D. Bettini), low intensity hand burning in humid months (photo I. Radford).

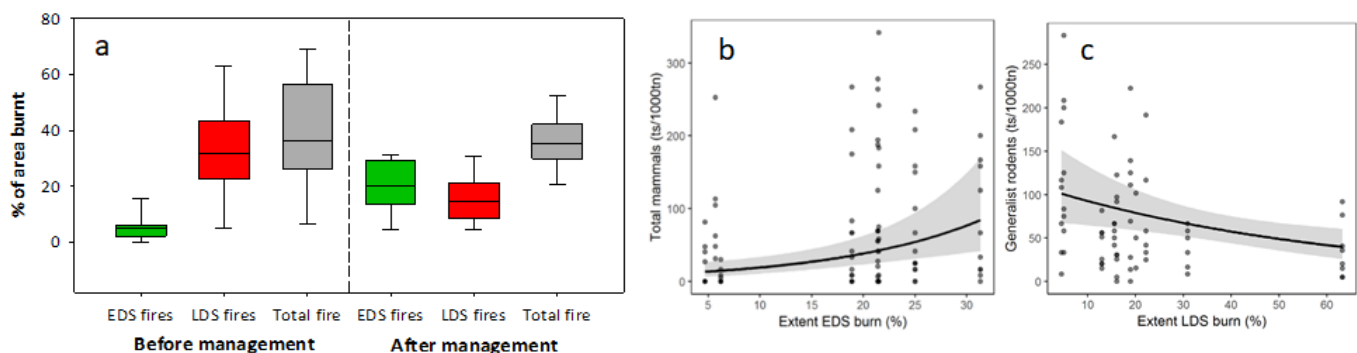
In 2010, the department commenced an adaptive management program on prescribed burning, and Kimberley Indigenous Corporations, Savanna Carbon Abatement projects and the Australian Wildlife Conservancy under Ecofire also increased fire management programs around this time. Together, these initiatives resulted in increased prescribed burning throughout the Kimberley. New fire management programs sought to apply interconnected networks of patchy, low intensity, early dry season prescribed burning to limit the negative impacts of late season wildfires.

Major increases in Kimberley fire management, combined with ongoing research and monitoring, provided the opportunity to test for the effects of fire management. Pre-management (2003 to 2010) and post-fire management (2011 to present) survey data was used to compare biodiversity outcomes.

Findings

- The increased extent of patchy prescribed early dry season burning, in up to 20-30 percent of landscapes, reduced the extent of late dry season wildfires. It also increased the number, and decreased the size, of burnt patches and led to more old-growth vegetation patches (>four years post-fire).
- Prescribed burning did not consistently reduce the mean total area burnt in the Kimberley. Total annual fire extent is dependent on wet season rainfall and soil fertility, and thus hard to change.
- Areas with increases in the extent of annual prescribed early dry season burning were accompanied by increases in the abundance of all threatened mammals, with numbers approximately doubling.
- Increased abundance of threatened species included the endangered northern quoll, the threatened brush-tailed rabbit rat and the endemic Kimberley rock rat.

- Not all mammals benefited; some species like delicate and western chestnut mice declined in some habitats. It is likely that these small rodents declined through competition with, and predation by, larger species that were increasing in abundance, including the Kimberley rock rat and the northern quoll.
- In savanna woodlands, mammals responded to increased extent of large patches of old-growth vegetation (>four years post-fire). This highlights the importance of ground cover for these mammals.
- Ground dwelling rodents were a key group that did not increase with extent of prescribed burning, but did benefit from the program overall. These species responded negatively to the extent of wildfire, but also positively to old-growth vegetation (in large patches), which is retained under good fire management. Rodents are therefore 'fire avoiders' and benefit from refuge provided by unburnt vegetation.
- Fire management combined with feral herbivore control provides the greatest gains for savanna mammals. Fire management gains described here were all made in areas where feral herbivore control was undertaken and/or where cattle impacts on vegetation were low/absent.



(a) Change in extent of prescribed burning (green), wildfire (red) and total area burnt (grey) before and after Kimberley fire management introduced. The relationship (b) between mammal trap success in non-rocky savannas and the extent of early dry season (EDS) burning and (c) between generalist rodents trap success in non-rocky savannas and the extent of late dry season wildfires.

Management implications

Due to the very high annual fire incidence (approximately 35 percent savanna burnt annually) in parts of the Kimberley receiving >1,000 mm of rain each year, low intensity, patchy prescribed burning should be applied to at least 20-30 percent of the total savanna area depending on previous wet season rainfall (higher if very wet and lower if very dry). Preferably, fire scars should be interconnected, to some extent, to reduce the spread of wildfires later in the dry season.

It was found that most species, including iconic Kimberley species such as the northern quoll, the brush-tailed rabbit-rat, Kimberley rock rats and the golden-backed tree-rat, all benefited from this level of burning. Low intensity prescribed fire up to this level promoted tree canopy development, retention of hollow-bearing trees, and growth/development of ground-level grasses and shrubs, promoting fruit and seed production. All these habitat features provide food resources and shelter for threatened mammals.

The emphasis in applying prescribed burning in savannas should be on reducing average fire scar size to less than 100 hectares (one km²). Keeping fire scars smaller and burning patchier, allows 'fire avoider' species, including the ground-dwelling rodents, to find cover for refuge from feral cats and other predators. It also allows them to find food resources including grass seeds. Retaining vegetation ground cover will allow rodents and similar species to persist in savannas after a fire, whereas after extensive non-patchy fires they can become locally extinct and have to recolonise from outside fire scars over much greater distances. Retaining rodents in landscapes leads to more stable populations of this critical group of savanna inhabitants. Monitoring is a critical component of adaptive fire management.

Further information

Radford, I.J., Woolley, L.A., Corey, B., Hatherley, E., Vigilante, T., Wunambal Gaambera Aboriginal Corporation, Fairman, R., Carnes, K., Start, A. (2020). Prescribed burning benefits threatened mammals in northern Australia. *Biodiversity and Conservation* (<http://doi.org/10.1007/s10531-020-02010-9>).

Corey, B., Andersen, A.N., Legge, S., Woinarski, J.C.Z., Radford, I.J., Perry, J.J. (2020). Better biodiversity accounting is needed to prevent bio-perversity and maximise co-benefits from savanna burning. *Conservation Letters*, 13, e12685.

Radford, I.J., Gibson, L.A., Corey, B., Carnes, K., Fairman, R. (2015) Influence of fire mosaics, habitat characteristics and cattle disturbance on mammals in fire-prone savanna landscapes of the northern Kimberley. *PLOS ONE* 10(6): e0130721. (<http://doi:10.1371/journal.pono.0130721>).