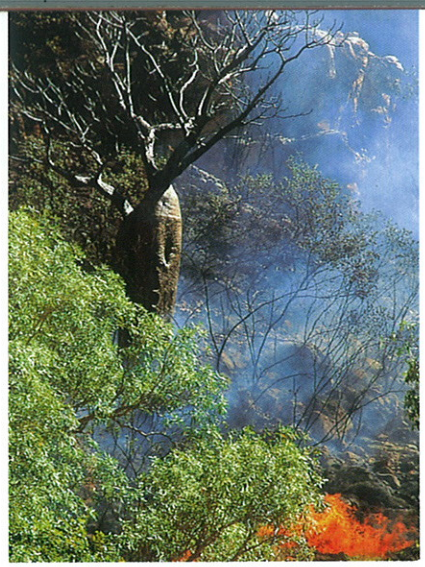
Fire in the Kimberley

natural phenomenon or natural disaster?

Fire is a natural part of tropical savannas worldwide, but are too many fires in the wrong season killing our tropical wildlife?

by Ian Radford and Kevin White



Recent global studies suggest if it were not for fire, tropical savannas throughout medium and high rainfall areas would convert to forest. Rangeland fire is an essential and natural process that has helped shape the rangelands for thousands of years. It creates and maintains a wide variety of habitat niches that enable a diverse range of plants and animals to flourish in the tropics. It reduces the accumulation of vegetation that can inhibit the establishment of some plant species and creates fresh grazing for many ground-feeding fauna. Periodic fire also stimulates growth and reproduction of plants. What's more, Aboriginal people have applied fire in these landscapes for many thousands of years to provide themselves with food and other resources.

While fire is integral to the maintenance of savanna landscapes, evidence indicates that the contemporary fire pattern of frequent, large-scale, high-intensity and late dry season fires may be the leading cause of decline for many northern Australian mammal species. Why?

Fire's role in mammal declines

There is now considerable evidence that small to medium mammals between 35 grams and five kilograms are particularly susceptible to the current, severe fire regimes in north-west Australian savannas. The most dramatic mammal declines have occurred in relatively recent times, from the 1980s to now, which coincides with unprecedented fire frequency, high fire intensity and extensive areas burnt, compared with previous times. Most fires now occur in the highly flammable mid-to-late dry season and burn for months at a time. Previously, traditional Aboriginal fire regimes involved small-scale fires ignited throughout the year or naturally occurring fires during wetter periods caused by lightning strikes. These fire regimes were much less severe than those occurring in north-west Australia today, where many modern-day fires are unauthorised or accidental and occur late in the dry season.

The other evidence suggesting that too severe fire regimes, may be driving small mammal declines is provided by scientific studies. One study, the Kapalga fire experiment conducted in Kakadu in the 1990s, clearly showed that mammal numbers were most dramatically reduced under the most severe fire regimes while mammals were most common in plots which had not been recently burnt and therefore contained a variety of habitat structures. Other ecological studies show that habitat structure, which is affected by fire, is also a strong determinant of mammal species' success. Protecting small mammals from these severe fire regimes is a major challenge for land management agencies in the north and west of Australia.

Mitchell River fire research

In the 2007 dry season, the Department of Environment and Conservation (DEC) and CSIRO Sustainable Ecosystems conducted an extensive mammal trapping study in the Mitchell River National Park and

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Main Fire amongst boab trees in the Kimberley.
Photo – Brett Dennis/Lochman Transparencies
Inset Delicate mouse feeding on grevillea.
Photo – Lochman Transparencies

Above Fire in a remote Kimberley gorge.
Photo – Jiri Lochman

Left Wet season burning in spinifex at Mitchell River Natonal Park.
Photo – Ian Radford

Above Bushfire in King Leopold Range Conservation Park.
Photo – Jiri Lochman

Right Bushfire smoke covering the Roe River area of Mitchell River National Park.
Photo – Marie Lochman

on adjacent unallocated Crown land on the Mitchell Plateau. The research was funded by *Saving our Species*, the State Government's two-year, $15 million biodiversity conservation initiative. The work was set up to see if, firstly, Kimberley mammals have the same negative responses to inappropriate fire patterns that were found during other studies conducted in northern Australia (mainly in the Northern Territory). Secondly, assuming there was a response, DEC hoped to determine how long it took for mammals to re-establish themselves in healthy populations after fire, thus providing information to help with prescribed burning programs. DEC staff selected trapping sites in sandstone and laterite-basalt landscapes in which the occurrence of the last fire varied. Large grids of Elliott traps were established and species and numbers of animals recorded. Grids were then measured for habitat characteristics that might be related to mammal numbers. These factors included soil, invertebrate communities and vegetation and other physical features that act as ground habitat, which might be affected by fire.

The study found a direct relationship between the time since fire and small mammal numbers, especially for native rodents which include the common rock rat (*Zyzomys argurus*) and the western chestnut mouse (*Pseudomys nanus*). A fire effect was found both in sandstone and laterite-basalt environments. The more recent the fire, the fewer the animals.

Even two years after a fire, mammal numbers were still recovering and, at the laterite sites, mammals were still often absent after two years' recovery time.

This suggests the small mammals need at least two years, and preferably three, for a successful breeding cycle, particularly in areas with no natural refuges from predators, such as open country without rocks. This highlights the importance of achieving longer periods between fires, or retaining older fuel patches within the landscape to enable mammal populations to function at their best. In northern Australia, modern fire frequencies can be as high as one or two a year in some areas, leaving few such older fuel areas in the modern landscape.

Explanations for fire effects

What is the explanation for this fire-related effect when fire is apparently 'natural' in these areas? The answer seems to concern the amount of ground cover, such as grass cover and

Above Pale field rat.

Left Bushfire in rugged terrain in the Kimberley.
Photos – Jiri Lochman

shrubs. Mammal numbers were highest in areas where ground cover had not been burnt for at least 18 months. This suggests that habitat structure and shelter is important in protecting Kimberley mammals. Ground cover burnt by fire leaves many Kimberley mammals vulnerable to predation by feral cats and other predators. It may be that predators, particularly the introduced cat, are the chief agents of small mammal declines in conjunction with severe fire regimes. So, while fire itself is not responsible for mammal decline, frequent, large-scale removal of suitable shelter leaves many animals vulnerable to attack.

Food scarcity after fire could also play a role in reduced mammal numbers, but food availability is unlikely to be affected by the time between fire. Further research in the Mitchell River National Park and adjoining regions will investigate the relative importance of predators versus food resources in determining mammal numbers.

Study similarities

Results of the Mitchell study are clearly mirrored in other Kimberley studies, which also reveal a relationship between fire, ground cover and mammal numbers. Thalie Partridge, a PhD student from Macquarie University in Sydney, doing research in Purnululu National Park (the Bungle Bungle Range) found that while some species like the Kimberley pebble-mound mouse (*P. laborifex*) and the delicate mouse (*P. delicatulus*) occurred in recently burnt habitats, the desert mouse (*P. desertor*) and the western chestnut mouse were restricted to areas with spinifex cover of more than 60 per cent. Such areas were only found at least five years after a fire.

Similarly, Sarah Legge from the Australian Wildlife Conservancy at Mornington Station in the Central Kimberley found that two of the three mammal species—the pale field rat (*Rattus tunneyi*) and western chestnut mouse—were restricted to older fuel patches within burnt areas. Both sets of results, plus those collected last year in the Mitchell study, emphasise the importance of patches of post-fire ground cover for the persistence and abundance of small mammals.

DEC fire strategy in the Kimberley

So what do these results mean in terms of DEC's fire management in the Kimberley Region? They indicate that fire regimes which maximise the number of older fuel patches within burnt country will promote a more rapid re-establishment of mammals by providing suitable shelter from predators

Right Burnt landscape near Kununurra.
Photo – David Bettini

Below right Aerial ignition of fuel reduction buffers in King Leopold Range National Park.
Photo – Kevin White and Ed Hatherley

within open, recently burnt country. These patches will be most effective as mammal refuges by experiencing at least three years without fire. However, achievement of such an interval is no mean feat in northern Australia.

DEC's fire strategy is designed to protect areas of high conservation value as well as enhance diversity in the fuel-age structure within the region's conservation estate. The program also has a strong focus on providing safe access to, and protection of, camping areas within the many national parks located in remote areas across the Kimberley.

DEC has deliberately developed a flexible strategy to mitigate the impact of wildfires and to enhance biodiversity conservation. The strategy is aimed at developing large management 'cells' surrounded by burnt buffers that protect the cells from large, dry season wildfire entering from outside. Such a strategy also reduces the risk of wildfires that start inside the cells from impacting on neighbouring cells. The strategic buffers are burnt early in the dry season in an attempt to break up the country into management compartments. Wet season (December to March) ground and aerial mosaic burning aims to establish and maintain the habitat mosaic within the cells to enhance biodiversity within the landscape. This wet season mosaic burning also seeks to reduce the impact of late dry season wildfires within the cells.

The early, dry season burn program is implemented while the annual grass growth is only partially cured and the cool weather conditions and moist soil profile ensure mild fire behaviour that will readily extinguish overnight or along natural barriers like grass species change or riparian zone fringes.

DEC has conducted six years of operational experimentation in the Kimberley to develop the current annual fire management practices. This experience has significantly contributed to the knowledge and understanding of fire ecology in these complex land systems. During the six years there has been only one year without a reduction in the areas lost to wildfire on DEC estate. In 2006 the total area burnt by all fire activity on DEC estate was less than 20 per cent compared with 35 per cent of area lost in the first year of operation. However, DEC only has direct management responsibility for about 2.8 million hectares of parks and reserves in the Kimberley. The vast majority of naturally vegetated land in the Kimberley is managed by pastoral or Aboriginal interests. The area lost to wildfire outside the conservation estate in the same period has continued to increase in most years.

Improving the northern fire situation

DEC is endeavouring to improve on this performance. Due to the vast, inaccessible nature of the Kimberley and limited information on local fuel and weather conditions during the wet season, there may well be burning opportunities that are being missed. Advances in remote sensing to monitor and predict the condition of fuels, more reliable local weather information and advances in aerial ignition technologies may provide opportunities to further improve prescribed burning

Above Boab tree in the Kimberley.
Photo – Bill Belson/Lochman Transparencies

Left Desert mouse.
Photo – Jiri Lochman

performance to more rapidly achieve stable, ecologically based fire regimes on the Kimberley conservation estate.

In northern Australia there is similarity in the approaches being deployed to reduce the impact of unplanned wildfire. Land and fire management agencies across the tropical north of Australia share their research findings and experiences, and frequently exchange information. There is also increasing collaboration in training, resource sharing and information management systems. Land managers in the Northern Territory use broad landscape-scale burning with external buffers to protect the conservation estate and pastoral values. In WA, DEC uses wet and early dry season mosaics supported by a buffer system. Pastoralists often use prescribed fire on their boundaries to protect themselves from wildfires and use fire on their leases to manage pasture values. And Northern Territory and Queensland land managers have undertaken collaborative fire management projects with Indigenous communities that have allowed a localised mosaic to be established in some areas and bought about a reduction in late dry season fires.

Despite such efforts, there are three major challenges to sustainable fire management and biodiversity conservation in the tropical savannah. Firstly, collaboration and partnerships need to be further strengthened between government land managers, fire management agencies, local governments, traditional owners and pastoralists. Secondly, the fire ecology knowledge that underlies sound fire management is incomplete. Fire ecology knowledge needs to be expanded to enable more confident decisions on fire management to be made for the wide variety of ecosystems in the Kimberley. And finally, the quantum of resources required to apply pro-active fire management in a vast, sparsely populated landscape such as the Kimberley needs careful consideration. Advances in aviation technology and the involvement of resident Aboriginal communities are opportunities that need to be explored and developed.

Despite such challenges and the fact that contemporary fire patterns in the Kimberley are strongly suspected of having a significant detrimental effect on the Kimberley's unique natural heritage, it is not too late to do something about it. DEC, in partnership with other stakeholders, can reduce the 'bad' fire and increase the 'good' fire. It will take hard work, a lot of good will and the focused application of resources. But it can be done.

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