Responses of Savanna Animals to Fire

Ian Radford, Department of Environment and Conservation WA; Ph: 08 9168 4200; Email: ian.radford@dec.wa.gov.au

Department of Parks and Wildlife

Fire is a natural element in the ecology of savannas. Recent evidence suggests that savannas are actually created by fire (**1**). Without fire, trees and shrubs come to dominate in savanna regions. In other words, fire actually maintains the otherwise unstable co-existence between grasses and trees which we call savanna.

Animals of the savanna respond in different ways to fire (**2**). Some species specialise in habitats created by recent fire. Others prefer long unburnt habitats. However the majority of animals prefer intermediate habitats with a combination of both recently burnt and long unburnt habitats. Problems relating to fire impacts among savanna biota are generally created by either too much fire (high fire frequency, high intensity) as in north western savannas (**2**, **3**), or too little fire as in some north Queensland savannas (**4**).

(**1**) Bond, Woodward & Midgeley.(2005) *New Phytologist* 165, 525-358. (**2**) Andersen *et al.* (2005) *Austral Ecology* 30, 155-167. (**3**) Woinarski *et al.* (2011). *Conservation Letters* 4, 192-201. (**4**) Radford, Grice, Abbott, Nicholas & Whiteman (2008) *Austral Ecology* 33, 151-167.

Closed shrub/woodland dominated savanna in Derby with *Calytrix exstipulata* after long absence of fire

spinifex savanna fire, Mitchell Plateau

Pindan savanna Curtin

Recently burnt savanna woodland, Mitchell Plateau

The brown goshawk, chestnut breated mannikin, crimson finch and double barred finch in pandanus thicket

Fauna exploiting intermediate post-fire habitat

A range of species exploit intermediate post-fire habitats, or a combination of burnt and unburnt habitats.

Grass seed eaters such as the gouldian and long-tailed finches in breeding season (**13**), rodents including the pale field rat (**14**) and the golden backed tree rat (**15**) prefer habitats where grasses have had long enough post-fire to attain the highest seed production (**16**) (2 to 5 years), but not long enough for trees and shrubs to suppress grass growth and seed production (**17**).

Other species such as the northern brown bandicoot (**18**) and the partridge pigeon (**19**) prefer access to high vegetation cover for nesting/shelter and also recently burnt habitat for foraging.

(**13**) Weier *et al.* (unpublished data) Charles Darwin University. (**14**) Radford & Fairman (unpublished data) DEC Kununurra. (**15**) Radford *et al.* (2013). DEC Kununurra. unpublished report. (**16**) Scott *et al.* (2010) *Journal of Tropical Ecology* 26, 313-322. (**17**) Woinarski *et al.* (2004) *Austral Ecology* 29, 156-176. (**18**) Pardon *et al.* (2003) *Journal of Animal Ecology* 72, 106-115. (**19**) Fraser *et al.* (2003) *Ecological Management and Restoration* 4, 94-102.

Golden bandicoot, photo by David Bettini

Predators and large herbivores love recently burnt habitats

The first animals to arrive at a fire are the birds of prey (**5**). Black kites, eagles, hawks, bustards, crows, owls and many ground foraging birds converge on burning and burnt country, picking up dead and exposed animals. Raptors and other birds remain at burnt sites for weeks to months after fire. They can have major impacts on prey species (e.g. small mammals).

We've recently found out that predatory marsupials including quolls benefit from burning by increasing their intake of larger prey (e.g. golden bandicoots, rodents) which have no shelter in burnt habitat (**6**). Fire effectively increases prey availability by removing vegetation ground cover. This increases the hunting efficiency of predators.

Another species which exploits recently burnt habitats is the feral cat. Recent studies show radio collared cats travelling 20 km out of their way to forage on the edge of burnt habitat (**7**). Predation by cats may be one of the key threats associated with extensive fires faced by native savanna wildlife (**8**, **9**, **3**).

Cattle (**10**), kangaroos/wallabies (**11**) and grass eating invertebrates (**12**) may also increase in relative abundance in recently burnt habitat due to access to high nutritional value new grass growth. Finches forage for newly exposed seeds in recently burnt areas (**13**).

(**5**) Braithwaite & Estbergs (1987-88) *Australian Natural History*. 22, 299-302. (**6**) Radford (2012) *Austral Ecology* 37, 926-935. (7) McGreggor, Johnson & Legge (unpublished data) University of Tasmania. (**8**) Johnson (2006) Australia's Mammal Extinctions. Cambridge University Press. (**9**) Radford (2010) *Conservation Science* 14, 469-479. (**10**) Ash *et al.* (1997) *Rangeland Journal* 19, 123-144. (**11**) Yibarbuk *et al.* (2001) *Journal of Biogeography* 28, 325-343. (**12**) Andersen *et al.* (2003) The Kapalga Experiment. Springer. (**13**) Crowley & Garnett (1999) *Austral Ecology* 24, 208-220.

Quoll and scaly tailed possum, Prince Regent National Park

Stalking feral cat and gouldian and painted finches

Golden backed tree rat and cat In rainforest patch, Mitchell Plateau

Ctenotus robustus, photo by David Bettini

Fauna exploiting long unburnt habitats

Some savanna species exploit long unburnt habitats. Large skinks such as *Ctenotus robustus* prefer long unburnt areas with high spinifex cover (**20**, **11**). The desert mouse also prefers long unburnt spinifex hummocks (>6 years post-fire) in semi-arid savannas e.g. Purnululu (**21**). The black-footed tree-rat (**17**), the brush-tailed rabbit-rat (**22**) and the brush-tailed phascogale (**23**) apparently prefer long unburnt, or very mildly burnt savanna woodland/forest. These areas have large trees, abundant nesting hollows and a complex 3-dimensional shrub layer which can take many years with no fire to develop (**24**, **17**, **4**). These areas contrast with areas where more frequent fires lead to open savanna with simplified vegetation structure (**25**, **17**). These latter habitats have few habitat features needed by old-growth specialists.

Over very long periods without fire, savanna fauna values can decline (for instance in long unburnt Callitris woodlands (**22**)), savannas can experience increased weed invasion (**4**), or can revert to closed forest (**17**). Under these circumstances, habitats to all intents and purposes cease to be savannas.

(**20**) Corbett *et al.* (2003) The Kapalga Fire Experiment. Springer. (**21**) Partridge (2009) PhD Thesis. Macquarie University. (22) Firth *et al.* (2006) *Wildlife Research* 33, 397-407. (**23**) Van Der Ree *et al.* (2006) *Wildlife Research* 33, 113-119. (**24**) Williams *et al.* (1999) *Austral Ecology* 24, 50-59. (**25**) Radford *et al.* (in press) *Biotropica.*