A game of cat-and-mouse: do habitat structure and fire history influence native rodent foraging behaviour *

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Invasive predators have caused significant species declines and extinctions worldwide, especially in insular systems like Australia. Foxes and feral cats are responsible for the extinction of at least 22 Australian mammal species in the past 200 years. To avoid being killed by predators, prey species modify their spatial or temporal use of habitat, or the time when they undertake different activities. Giving-up-density (GUD) experiments are commonly used to test the influence of predation risk on prey species. In a controlled setting, a decrease in the GUD corresponds to a decrease in predation risk, and vice versa. The aim of this experiment was to investigate the foraging strategies of two native rodents in respect to microhabitat structure and vegetation fire history. We predicted that rodents would spend more time foraging in bush microhabitats and in unburnt habitat, and that the positive effect of bush microhabitats would be less in unburnt areas.

We studied the foraging behaviour of Mitchell's hopping mouse (*Notomys mitchellii*) and the sandy inland mouse (*Pseudomys hermannburgensis*) at Charles Darwin Reserve in the northern Wheatbelt of Western Australia. Artificial foraging patches and the GUD technique were used to measure foraging activity. We established 144 feeding trays across six burnt and six unburnt sites; half the trays were placed in 'open' microhabitat and the other half under vegetation cover ('bush'). Feeding activity was monitored for six to eight nights in February and April 2013.

The data pooled across both months indicated that both species prefer to forage in bush microhabitat, rather than in the open. Terrestrial carnivores, the dingo and feral cat, occur in the study area, as do other predators like the barn owl, albeit less commonly. Feral cats were the most common predator during the study period and are a known predator of both *P. hermannsburgensis* and *N. mitchellii*. The higher GUDs recorded in open microhabitat indicate that animals spend less time foraging in the open, which may reflect risk-aversive behaviour in the presence of predators.

The data indicated that both species prefer to forage in burnt habitat rather than unburnt. Both species spent less time foraging in unburnt habitat, which suggests that the perceived risk of predation was greater in unburnt areas. Given that feral cats prefer to hunt in open areas, we expected that native rodents would prefer to forage in the denser unburnt areas, where cats should hunt less often. However, the data did not support this. Bush microhabitats benefit rodent foraging activity; so reduced habitat structure close to the ground in unburnt habitat may be responsible for higher GUDs in these areas. Habitat measurements should reveal whether this is the case.

The positive effect of microhabitat was weaker in unburnt areas. We expected that microhabitat structure would be less important in unburnt habitat because the taller vegetation would mediate predation risk. However, this may not be the case since overall rodents foraged less in unburnt habitat. Microhabitat may have been less important in unburnt areas if vegetation was less dense close to the ground.

The findings of this study will have applied outcomes for nature conservation. Future experiments will test the effect of native and introduced predator cues on foraging behaviour. Preservation or enhancement of habitat structure may reduce the impact of introduced predators on native fauna. Land management actions like prescribed burning should be informed by ecological knowledge if native species are to be conserved.

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