



Small mammal responses to fire: genetic insights from a fire experiment

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Fire management for conservation

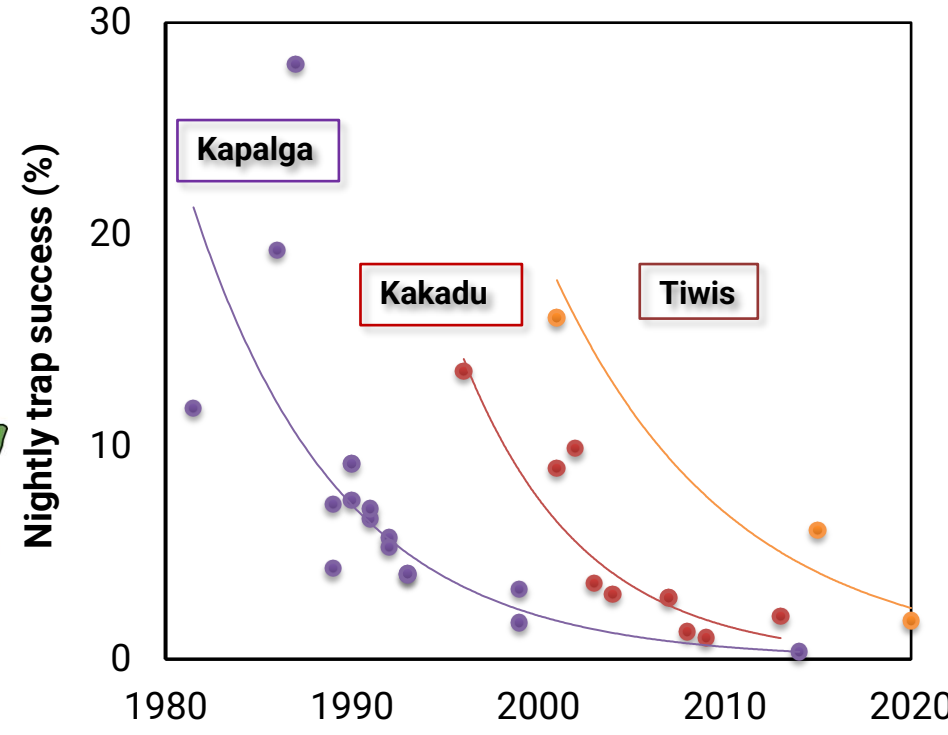
- Prescribed fire is widely used for biodiversity conservation in savannas.
- However, it is rarely underpinned by understanding the mechanisms of survival and persistence.
- Genetics can provide population level information on these mechanisms.



Tiwi islands



The Island Refuge



Compare different yet co-occurring species

- Northern Brushtail Possum

- Arboreal
- Long-lived ~10yrs
- 1 offspring
- Low-dispersal



- Northern Brown Bandicoot

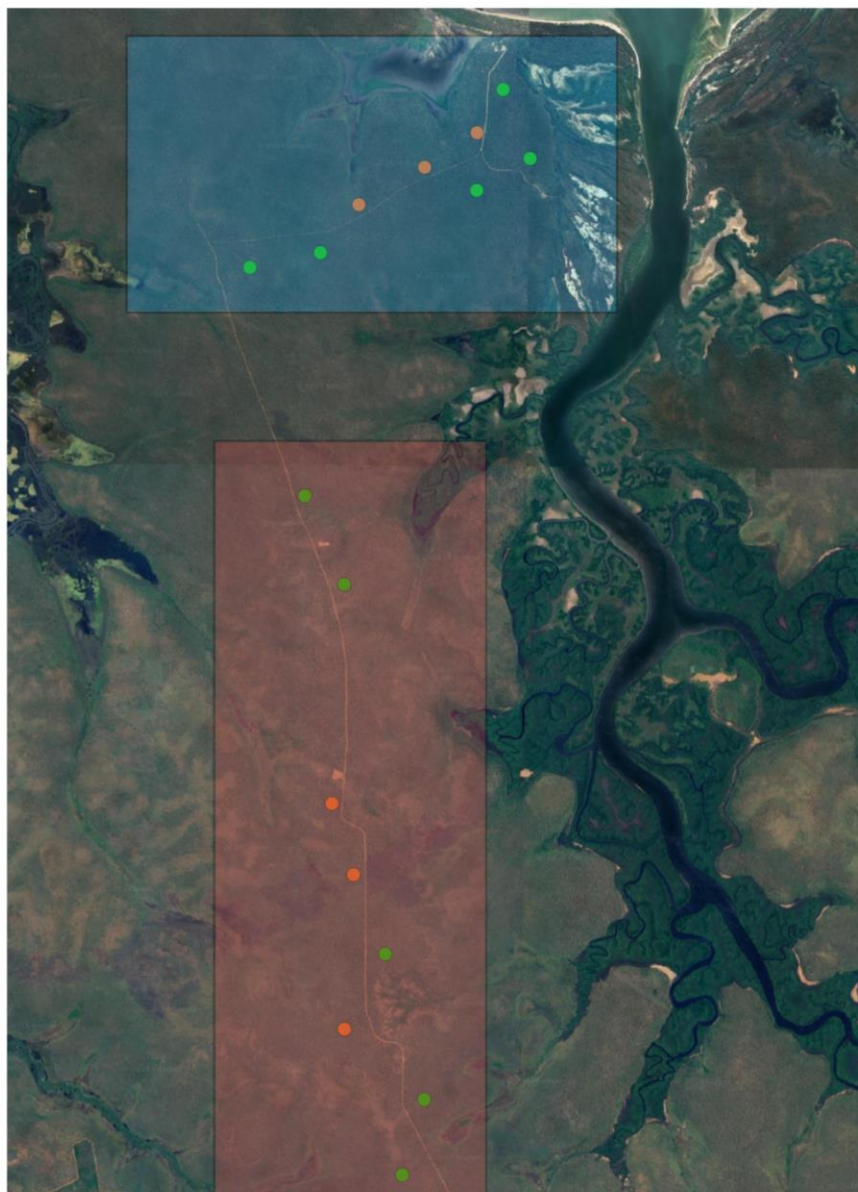
- Ground-dwelling
- Short-lived 2-3yrs
- ~6 offspring
- High-dispersal



- Black-footed Tree-rat

- Arboreal
- Short-lived 2-3yrs
- 1-3 offspring
- Large home range size





Legend

Fire treatment

● Burnt

● Unburnt

Fire frequency

■ Low frequency

■ High frequency

0 1 2 km



Fire experiment

- Low vs high fire-frequency area
- Burnt vs unburnt plots
- Three trapping sessions

Before fire trapping

After fire trapping



Fire

1 year after fire trapping


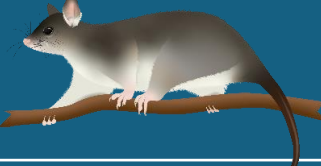
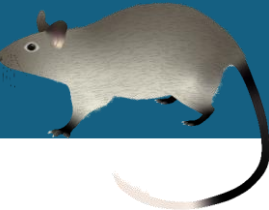
Fire experiment methods

- Are demographic and genetic patterns affected by a fire event?
- Are the effects different between species?
- Are the effects different between fire frequency areas?

Demographic analyses	
No. unique individuals	GLMM
Capture and recapture	Rmark
Survival	Rmark
Migration	Rmark

Genetic analyses	
Genetic diversity	Dartr, GLMM
Genetic structure	GenALEX
Overall relatedness	Dartr, GLMM
Spatial and temporal relatedness	Kinship, GLMM

Results summary

Species	No. unique individuals	Survival	Migration	Genetic diversity	Mean relatedness	Genetic structure	Distance between relatives
Northern brown bandicoot 	No effect of fire event Fire frequency effect	No effect of fire event	No effect of fire event	No effect of fire event	No effect of fire event	No effect of fire event Fire frequency effect	No effect of fire event Dispersed
Northern brushtail possum 	No effect of fire event Fire frequency effect	No effect of fire event	No effect of fire event	No effect of fire event	No effect of fire event Fire frequency effect	No effect of fire event Fire frequency effect	No effect of fire event Same-site
Black-footed tree-rat 	No effect of fire event Fire frequency effect	No effect of fire event	No effect of fire event	No effect of fire event	No effect of fire event	No effect of fire event Fire frequency effect	No effect of fire event Same-site

Conclusions

- Minimal effect of fire event – prescribed low-intensity
- Fire frequency differences between species
- Differing responses by species reflecting recovery strategies



Implications

- Genetic insights beyond the scope of other methods
- Tiwi mammals have pre-adapted traits to persist in frequently burnt landscapes
- Short-term fire event management targeted to species response and recovery traits
- Long-term fire regime management targeted to species habitat requirements



Sam Banks



Thank you

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- Georgina Neave
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