Forest Webinar: Fauna monitoring insights

Coastal IFOA Monitoring Program
14 August 2025

Natural Resources Commission

Long-term monitoring of the Southern Brown Bandicoot south of Eden, NSW

2009 to 2023

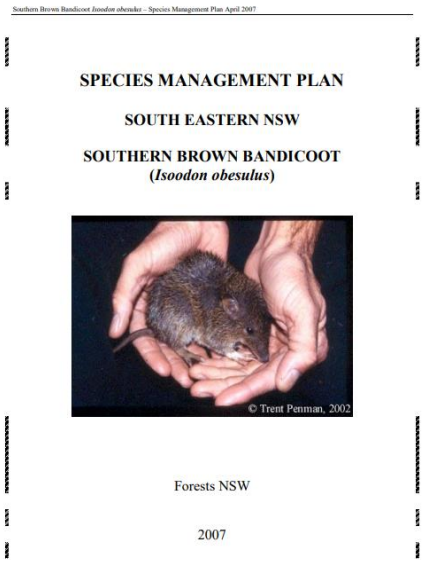
Leroy Gonsalves[1] and Chris Slade[2]

[1] NSW DPIRD, Forest Science
[2] Forestry Corporation of NSW

Southern Brown Bandicoot in forestry landscapes

- Previous IFOA (1999).
  - Considered rare with limited knowledge of threat posed by forestry.

- Between 1999-2003.
  - 15 x 200ha exclusions were established around records.



- A review of protective measures undertaken in 2003.
  - Exclusion zone (Yertchuk & scrub dominated forests) in 2006.

- Species Management Plan (SMP) established in 2007.

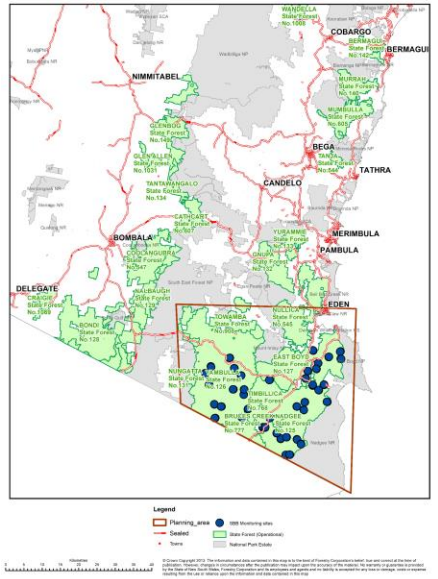
SMP aims

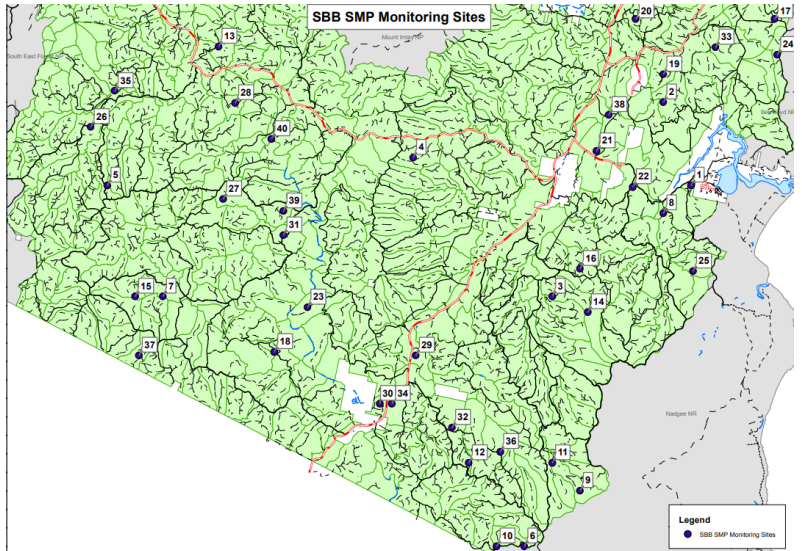
1. Monitor long-term occupancy trends of Southern Brown Bandicoots.

2. Identify environmental factors associated with occupancy.

Survey program

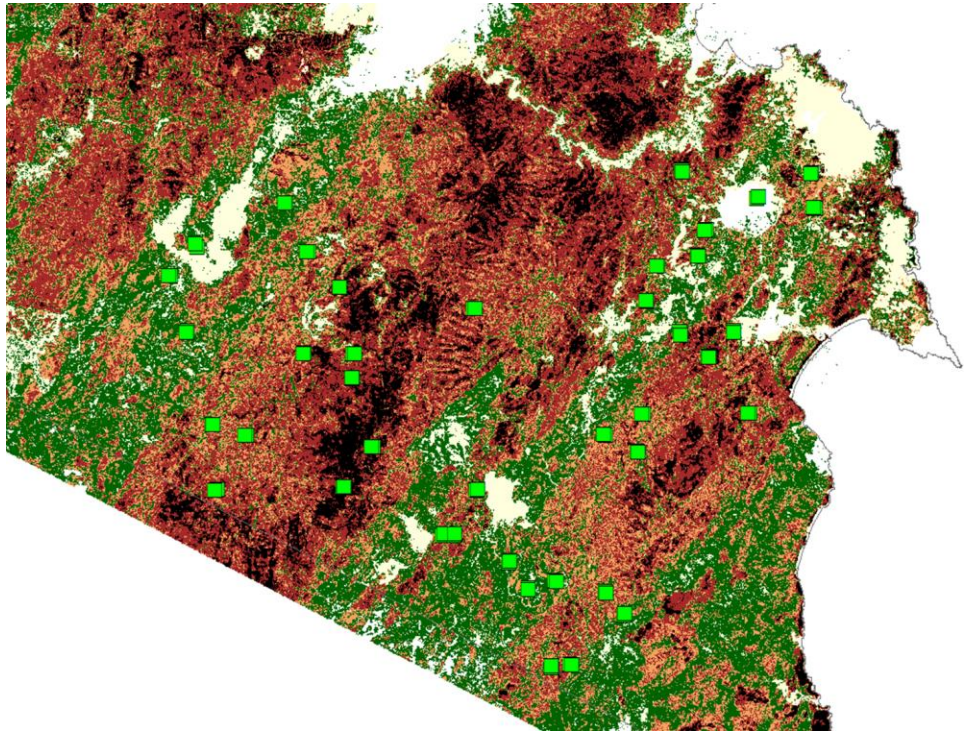
- 40 monitoring sites established.
  - 20 in ‘SBB habitat’.
  - 20 random.
- Baited cameras x 2 at each site (2009-2025).
- Autumn & Spring.





Black Summer Fires

- All sites burnt.
  - Varying fire severity across sites.
  - Understorey lost at 39/40 sites.



Dynamic occupancy modelling

- Accounts for imperfect detection associated with:
  - Seasonality.
  - Survey methods.

- Four-step-process:

1. Detection probability assessed.
2. Occupancy in the baseline period is assessed.
3. Site colonisation and extinction processes are assessed.
4. Trend is derived.

- Steps 1-3 include covariates to account for their effects.

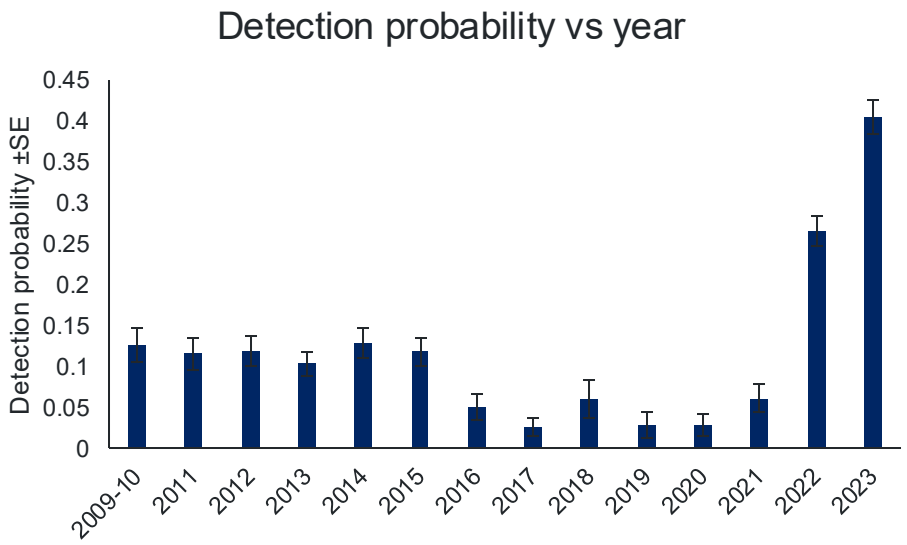
Covariates

Variable	Detection probability	Initial occupancy	Colonisation & Extinction probability
Season	✓		
Camera model	✓		
Number of cameras	✓		
Year of survey	✓		✓
Forest type		✓	
Elevation		✓	
TPI		✓	
Modelled habitat exclusion		✓	
Annual rainfall (including 1-yr lagged)		✓	✓
Extent of no harvesting		✓	✓
Extent of harvesting (<5 years, 5-10 years, >10-30 years, >30 years)		✓	✓
Extent unburnt		✓	✓
Extent fire (<5 years, 5-15 years, >15-30 years, >30 years)		✓	✓
Lidar density (0-2 m, 2-4 m, 4-6 m, 6-8 m, 8-10 m, 10-12 m, 12-14 m, 14-15 m)		✓	
Cat activity		✓	✓

Detection probability

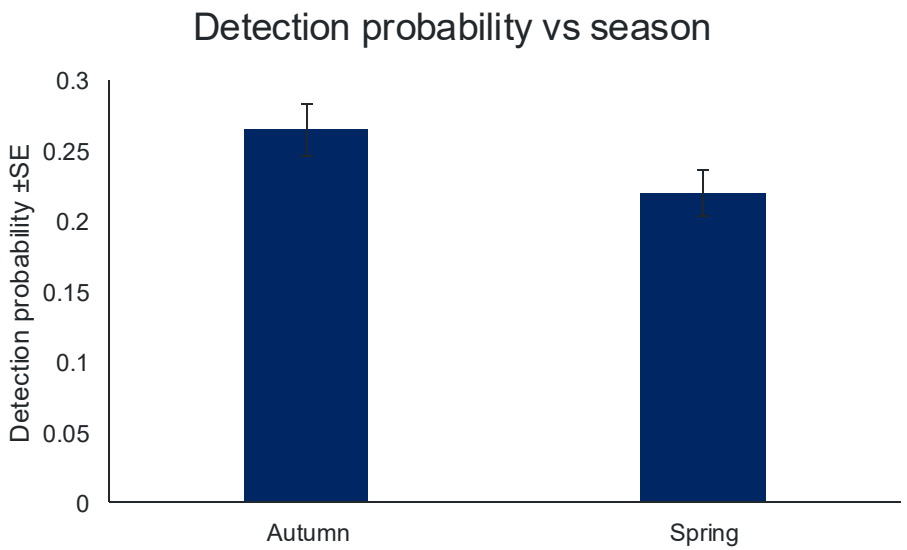
Varied with year of survey

0.03-0.40 per visit



Varied with season of survey

0.22 (spring) and 0.26 (autumn) per visit



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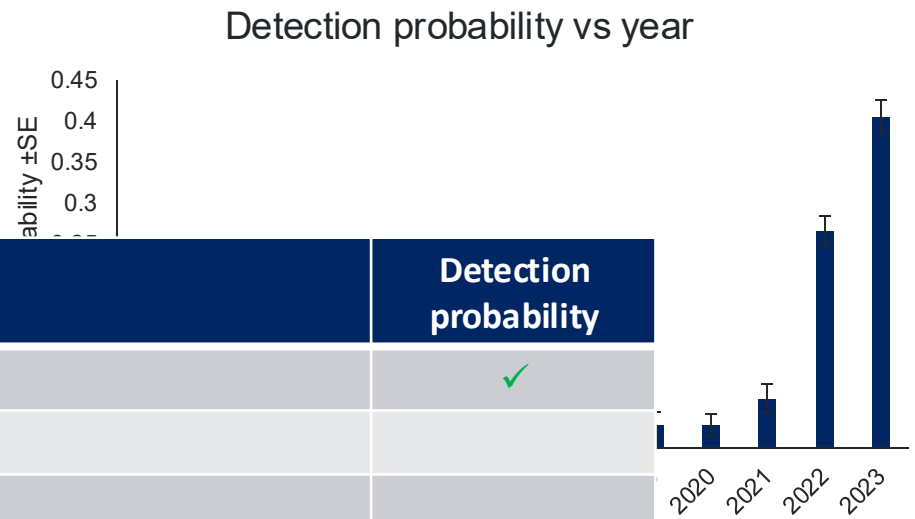

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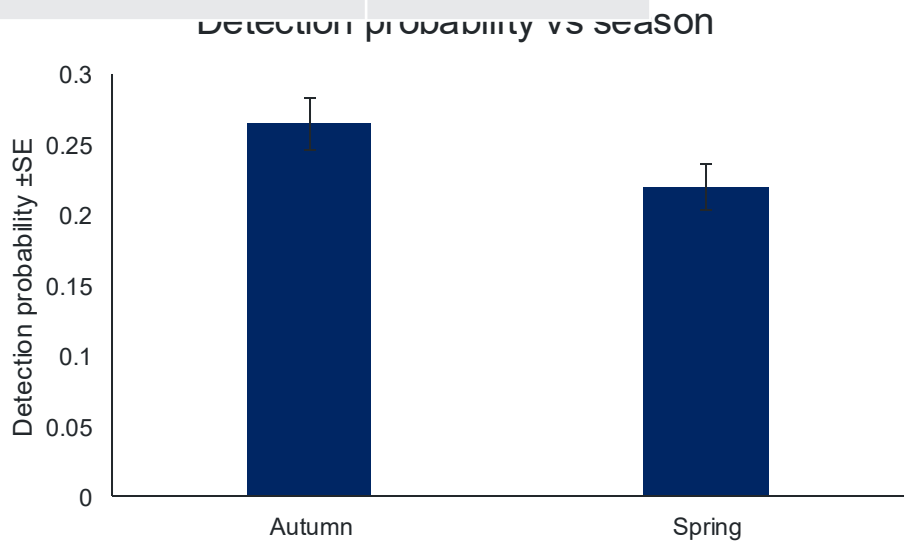
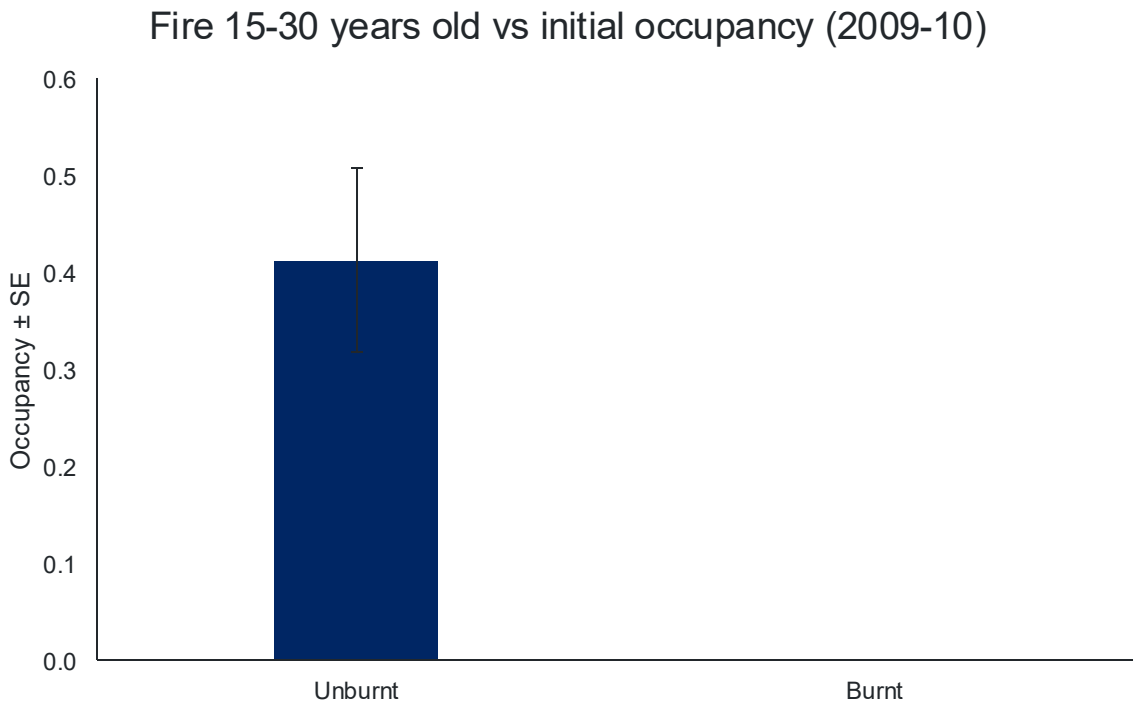
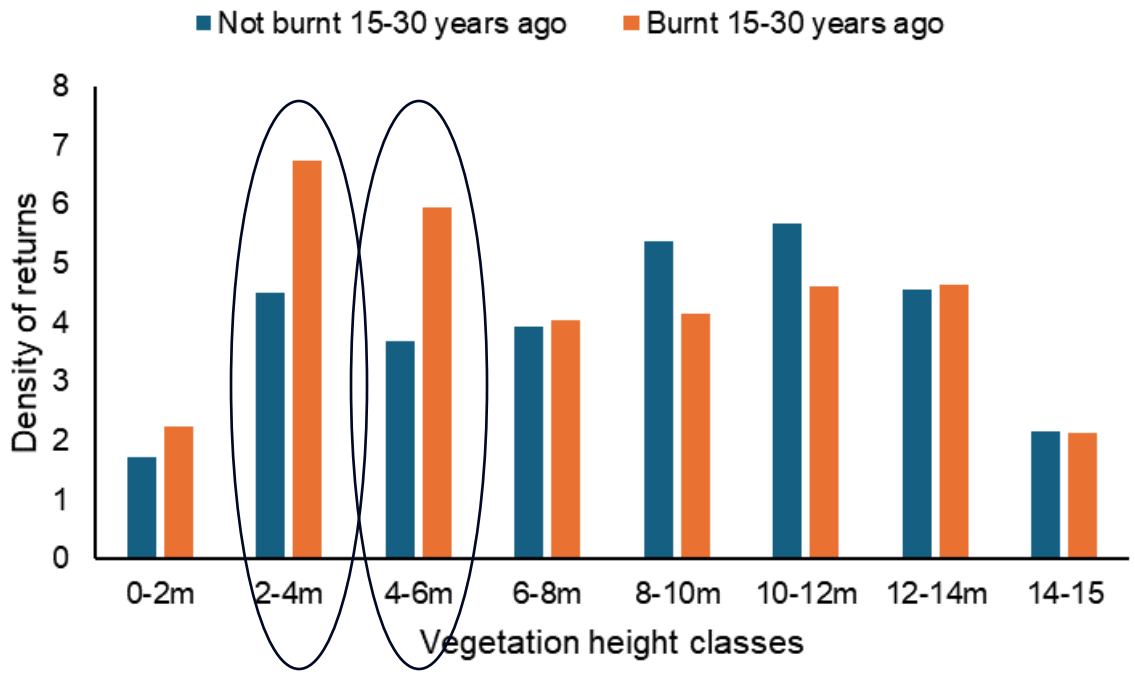


Initial occupancy

Varied with presence of fire in the 15-30 year age-class

Median occupancy was 0.41 in 2009-2010





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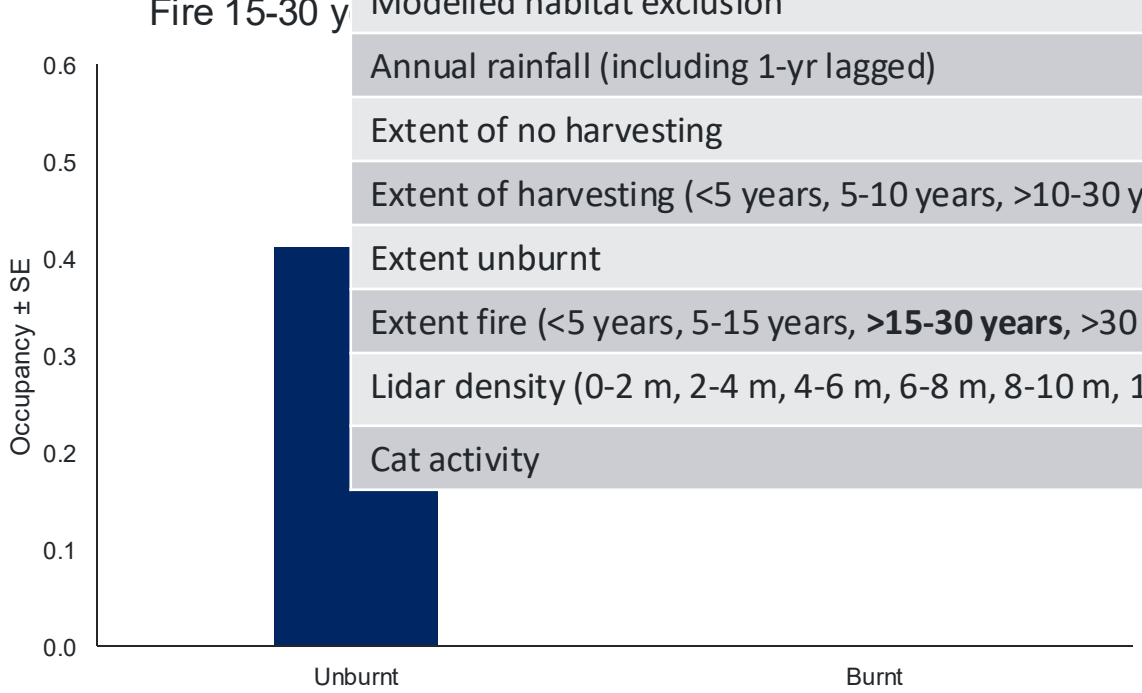
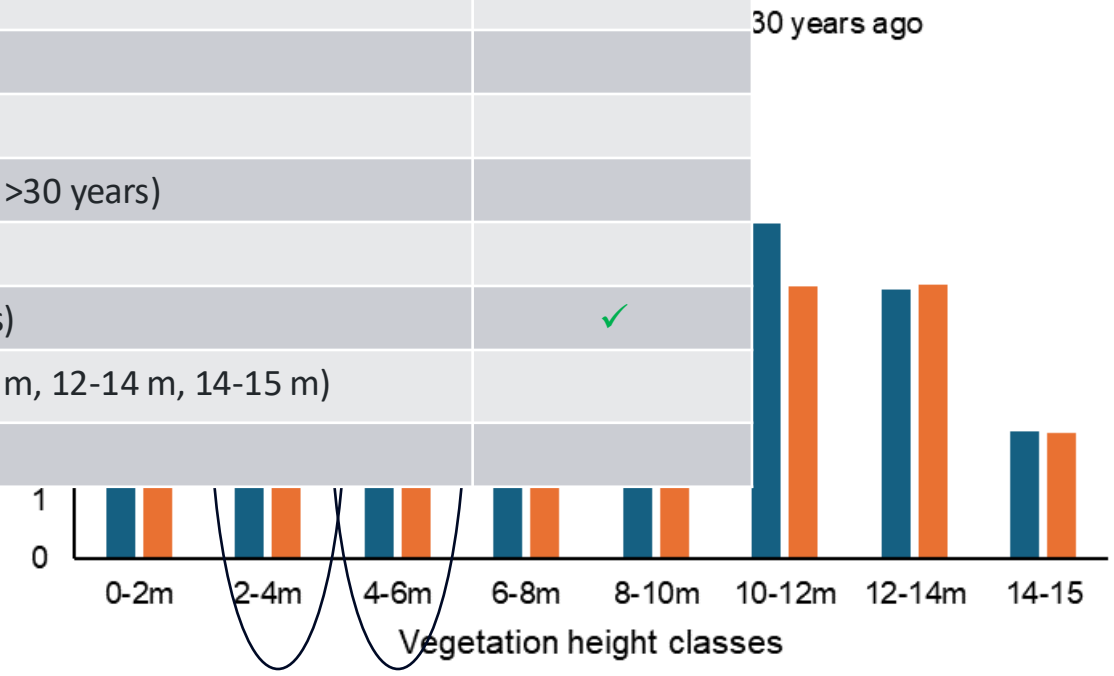
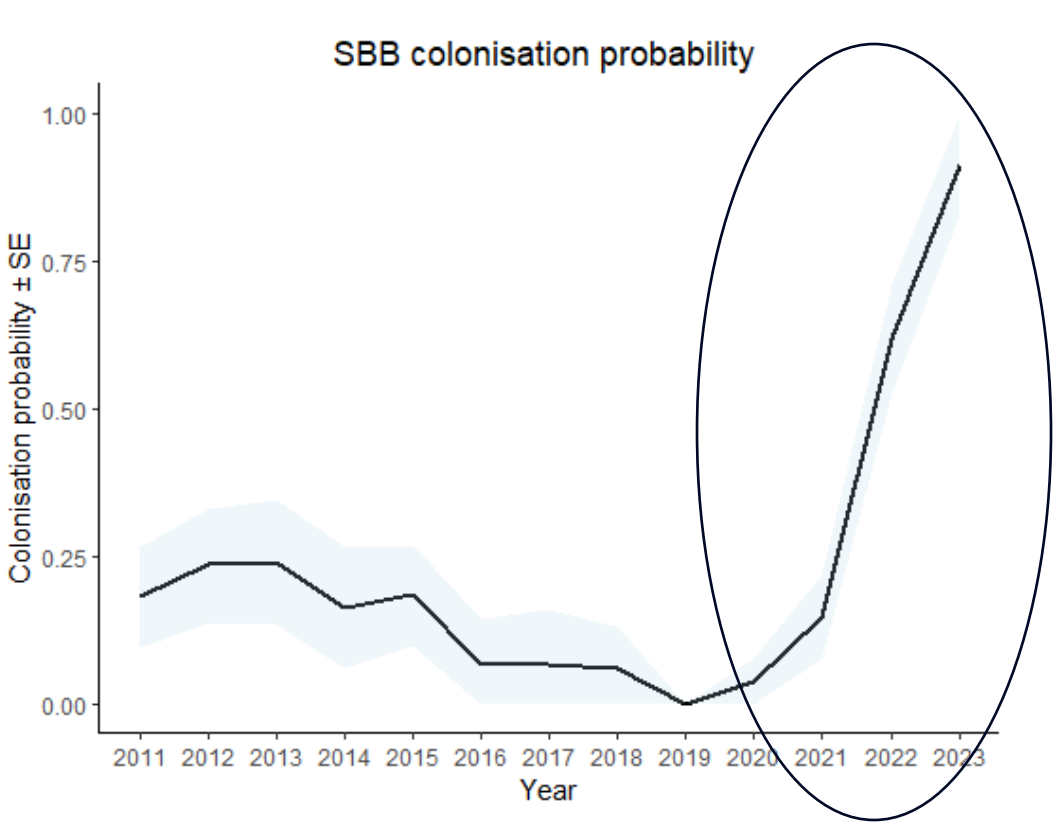
Elevation	
TPI	
Modelled habitat exclusion	
Annual rainfall (including 1-yr lagged)	
Extent of no harvesting	
Extent of harvesting (<5 years, 5-10 years, >10-30 years, >30 years)	
Extent unburnt	
Extent fire (<5 years, 5-15 years, **>15-30 years**, >30 years)	✓
Lidar density (0-2 m, 2-4 m, 4-6 m, 6-8 m, 8-10 m, 10-12 m, 12-14 m, 14-15 m)	
Cat activity	

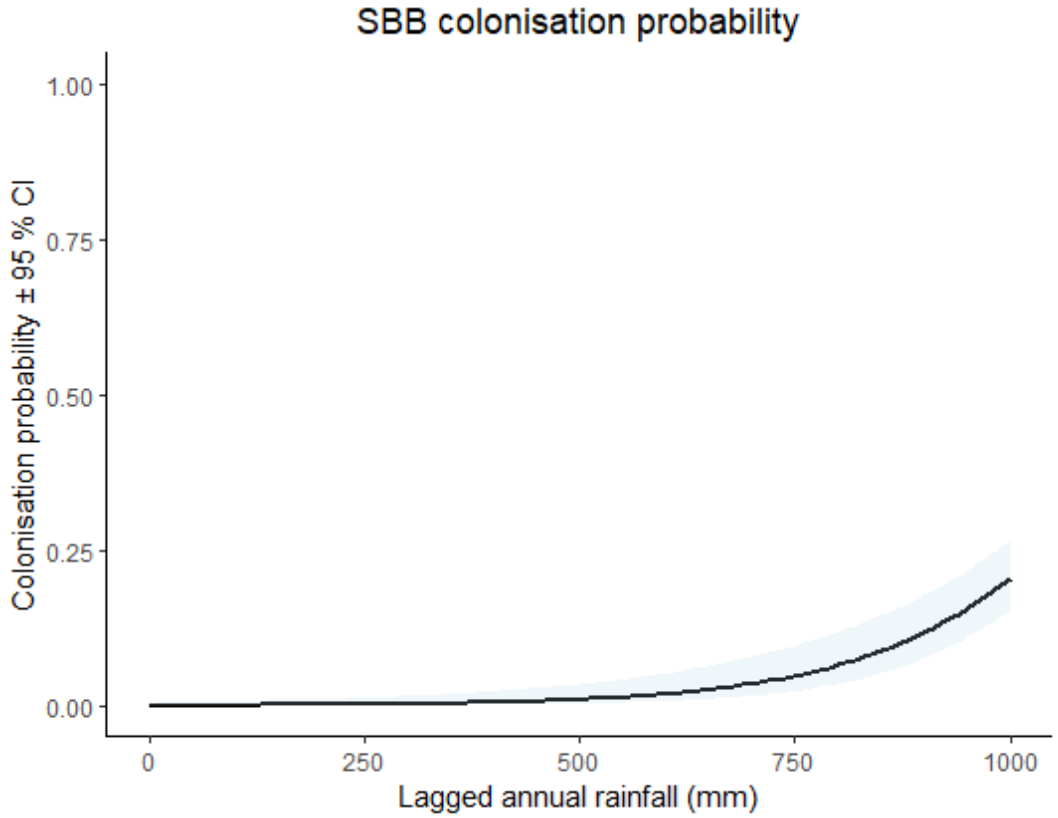




Local colonisation probability

Unoccupied sites more likely to become occupied in years with higher annual rainfall





Local colonisation probability

Unoccu

Variable	Colonisation probability
Year of survey	✓
Annual rainfall (including 1-yr lagged)	✓
Extent of no harvesting	
Extent of harvesting (<5 years, 5-10 years, >10-30 years, >30 years)	
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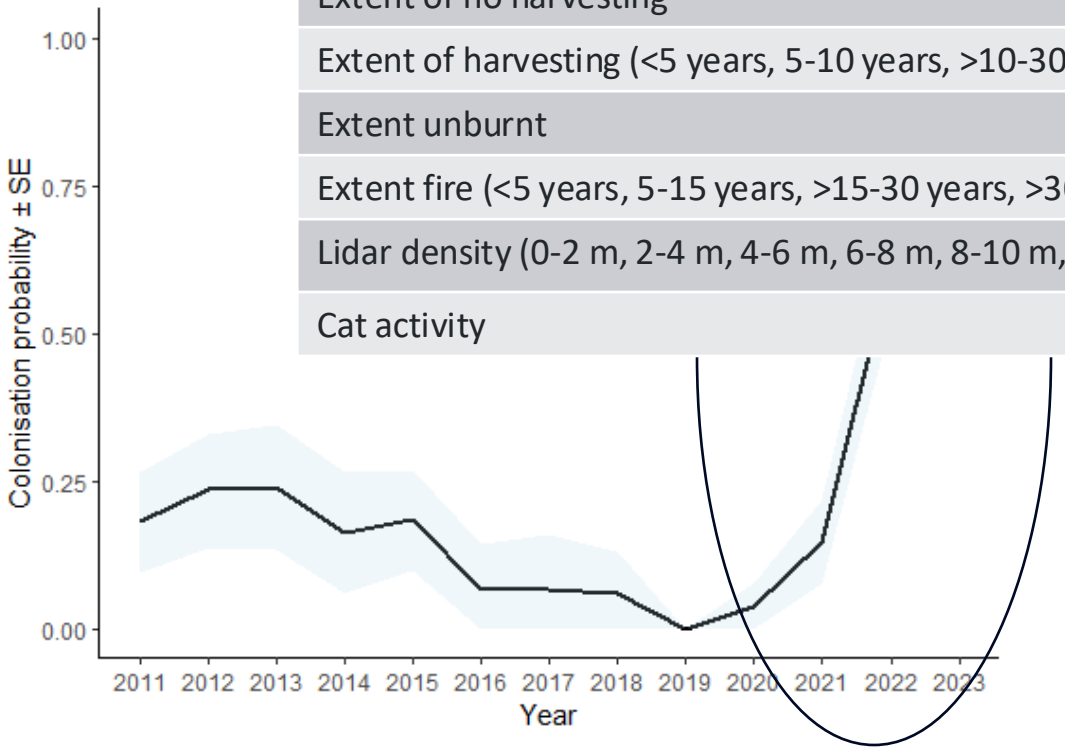
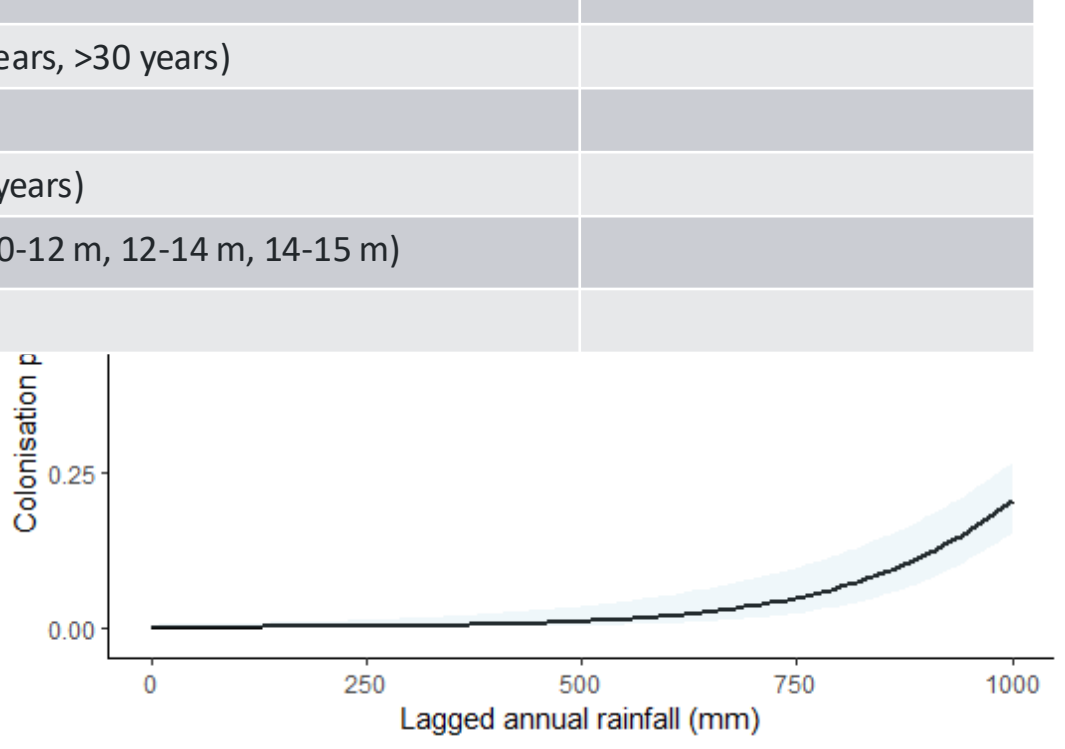
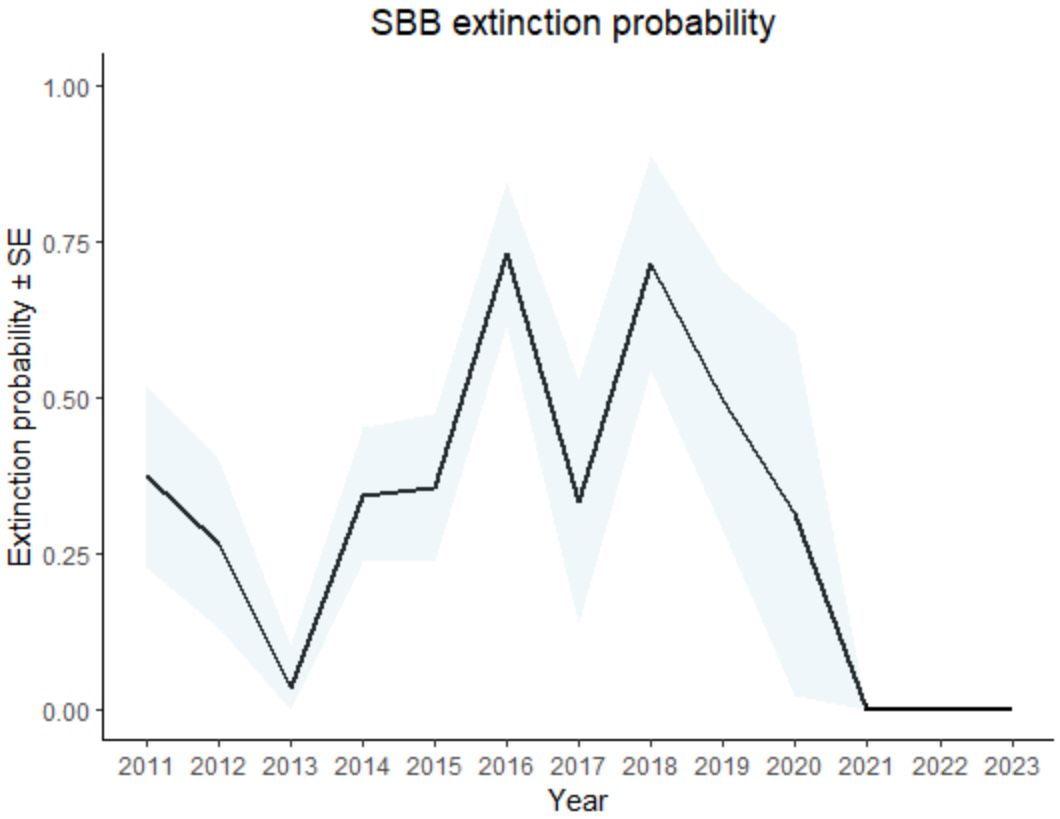
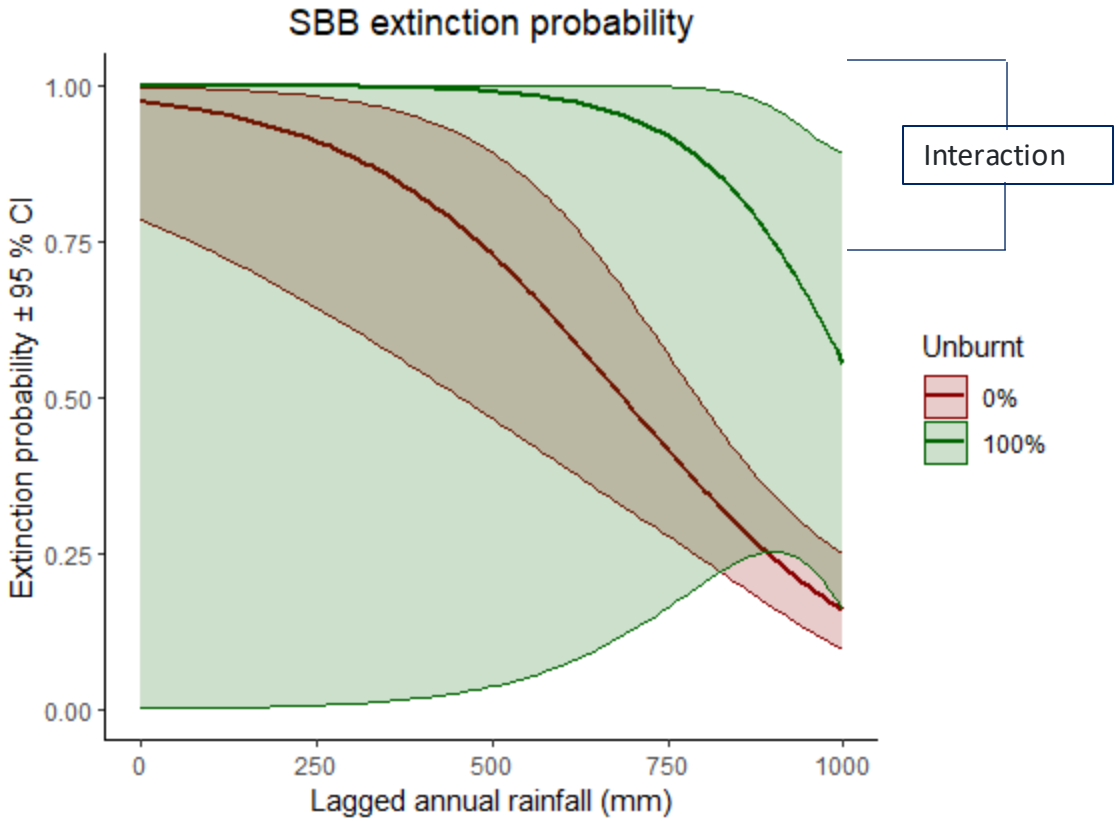




Local extinction probability

Occupied sites less likely to become unoccupied in wetter years but this is weaker if sites had burnt.





Local extinction probability

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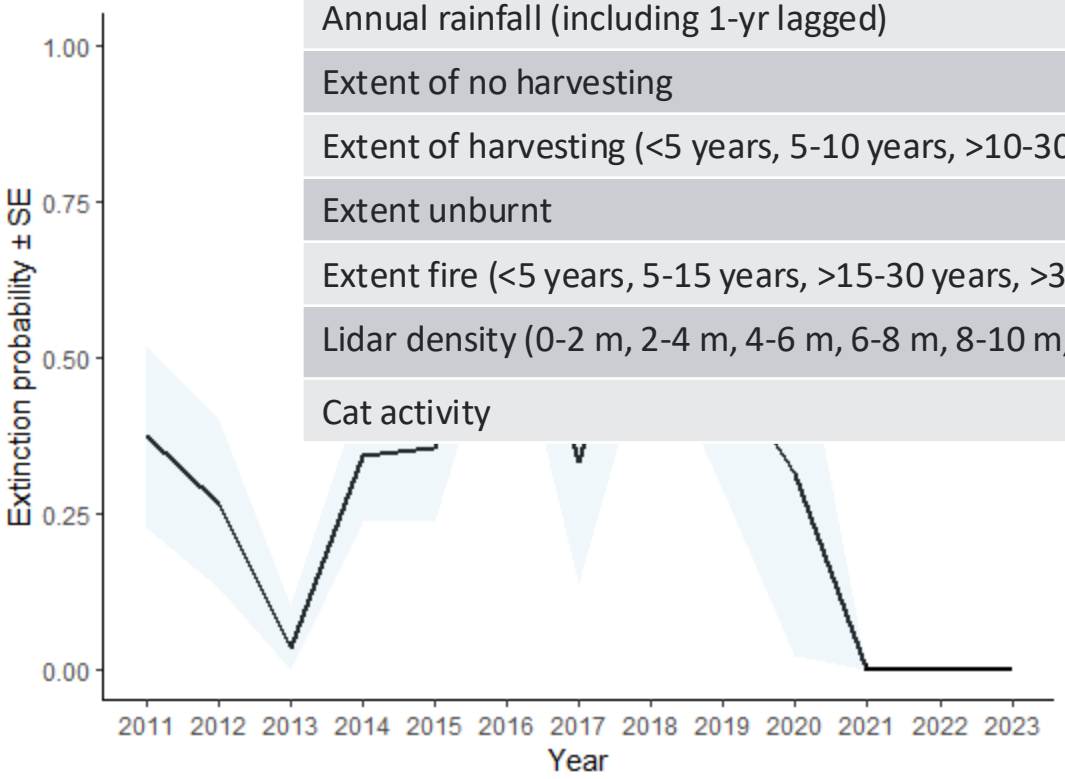
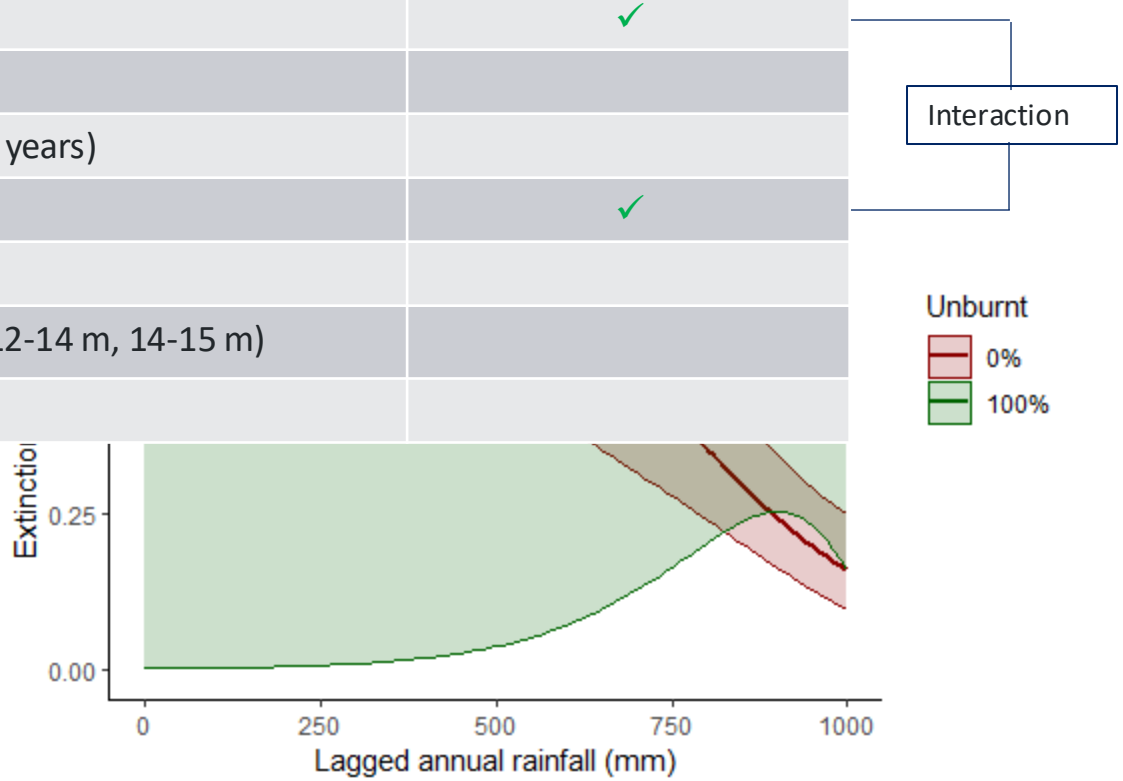
Variable	Extinction probability
Year of survey	✓
Annual rainfall (including 1-yr lagged)	✓
Extent of no harvesting	
Extent of harvesting (<5 years, 5-10 years, >10-30 years, >30 years)	
Extent unburnt	✓
Extent fire (<5 years, 5-15 years, >15-30 years, >30 years)	
Lidar density (0-2 m, 2-4 m, 4-6 m, 6-8 m, 8-10 m, 10-12 m, 12-14 m, 14-15 m)	
Cat activity	

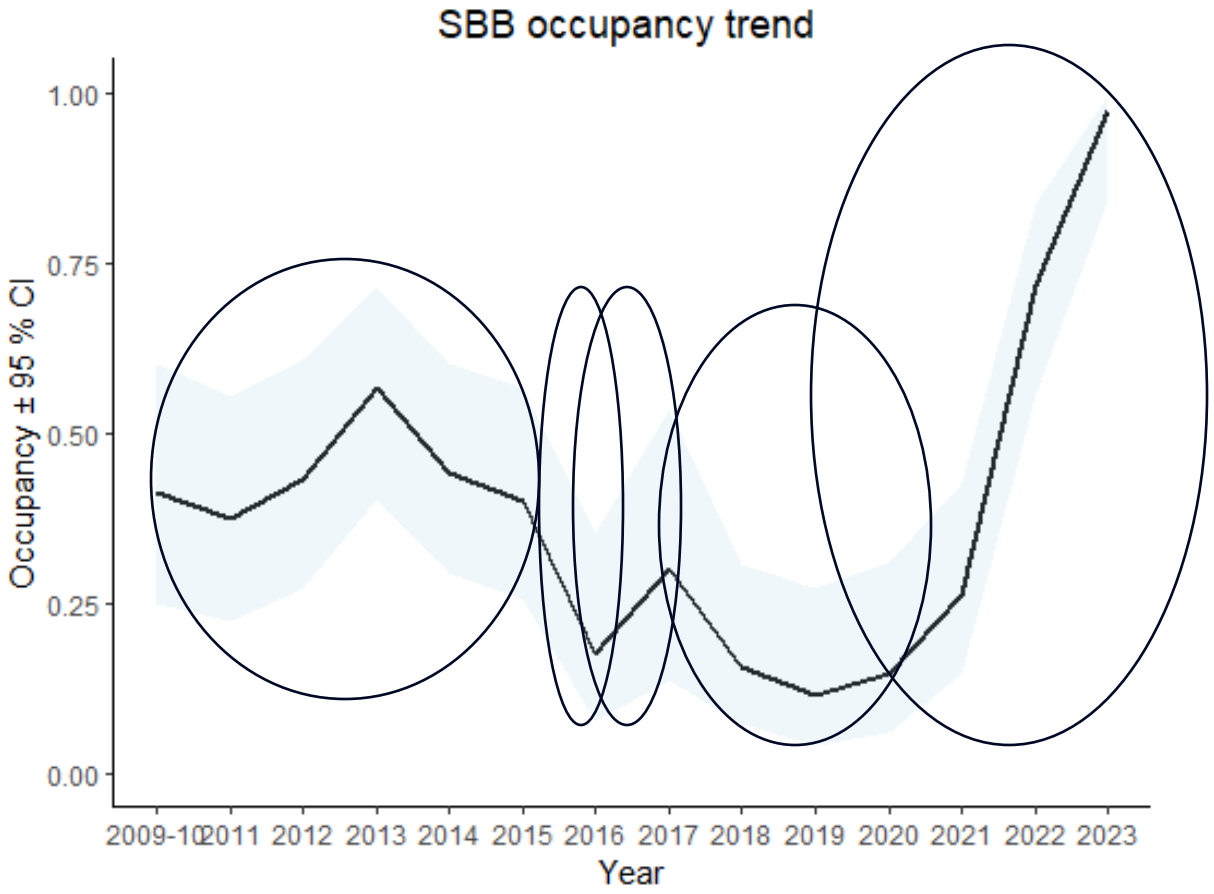
Interaction





Trend

- ~0.4-0.5 between 2009-10 and 2015.
- 53 % reduction to ~0.18 in 2016.
- A slight upward trend observed in 2017.
  - High uncertainty due to low detection probability in this year.
- 2018-2020 occupancy was low (~0.14).
- Increased rapidly after Black Summer fires and drought-breaking rain to ~1 in 2023.



Limitations

- Small number of sites sampled (n=40).
  - Low precision for occupancy estimates.
  - May not sample the range of individual covariates.

Interpretation

- Rainfall and fire were major drivers of occupancy.
  - Understorey structure may also be important.
- Black Summer fires had no impact on occupancy of this species.
- Extent of timber harvesting (all age-classes) not associated with occupancy trend.
- Habitat exclusion zones and unharvested forest were not associated with occupancy.
  - We suggest future monitoring expands the number of sites.
    - With and without exclusions to provide a more rigorous test of their effectiveness.
- Cat activity was low.
  - Need for continued monitoring and potentially cat control if activity increases.

Acknowledgements

- FCNSW staff: Peter Kambouris, Jess Peterie, Craig Dunne.
- NSW DPIRD: Brad Law, Andrew Claridge.
- NSW EPA: Peter Higgs.
- TWG and steering committee for reviewing research progress.
- ANU: Phil Gibbons.

Yellow-bellied Glider occupancy on the NSW Bago Plateau

1995 to 2023

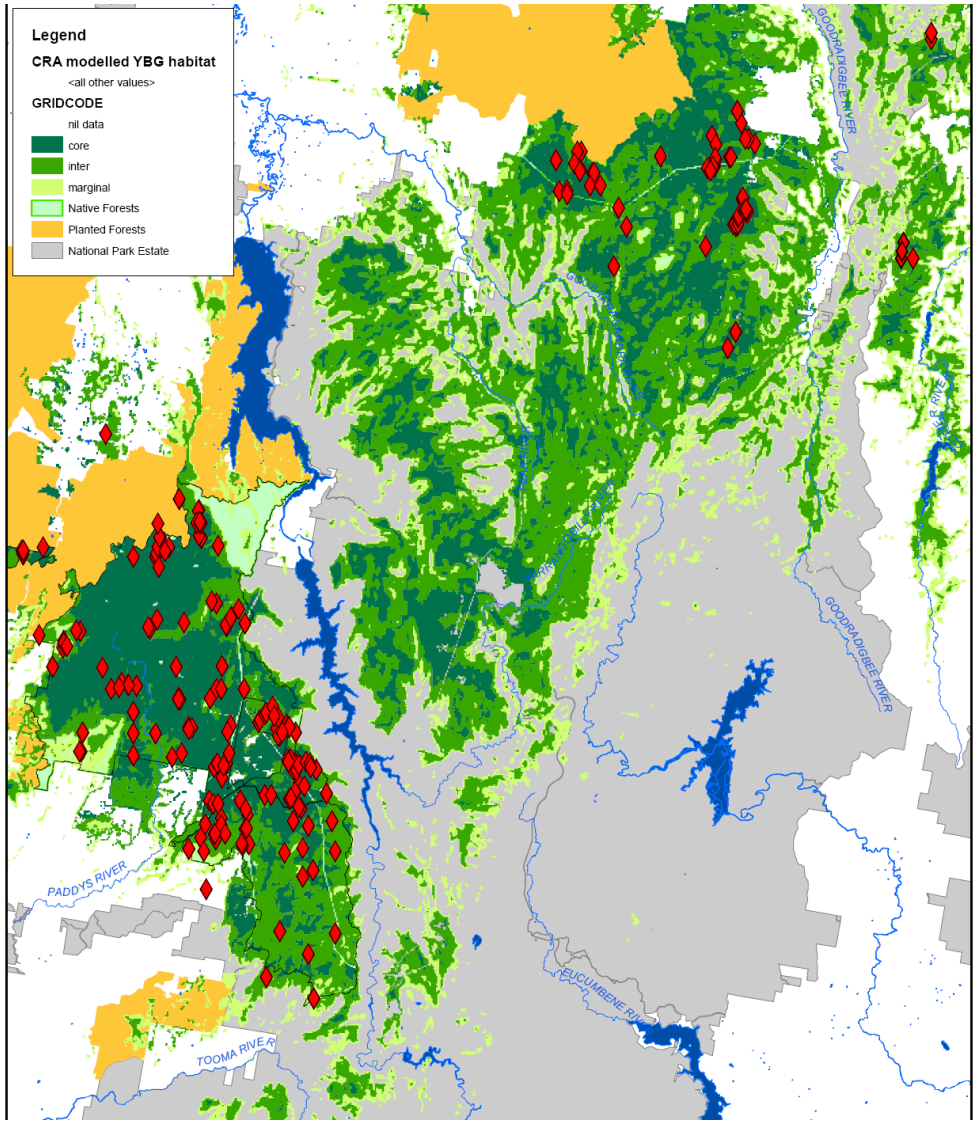
Leroy Gonsalves[1] and Chris Slade[2]

[1] NSW DPI, Forest Science
[2] Forestry Corporation of NSW

YBG on Bago Plateau

- Bago Plateau YBG population listed as Endangered in 2008.

- Population Management Plan (PMP) developed on State Forest in 2013.



PMP aims

1. Establish the long-term population trend.

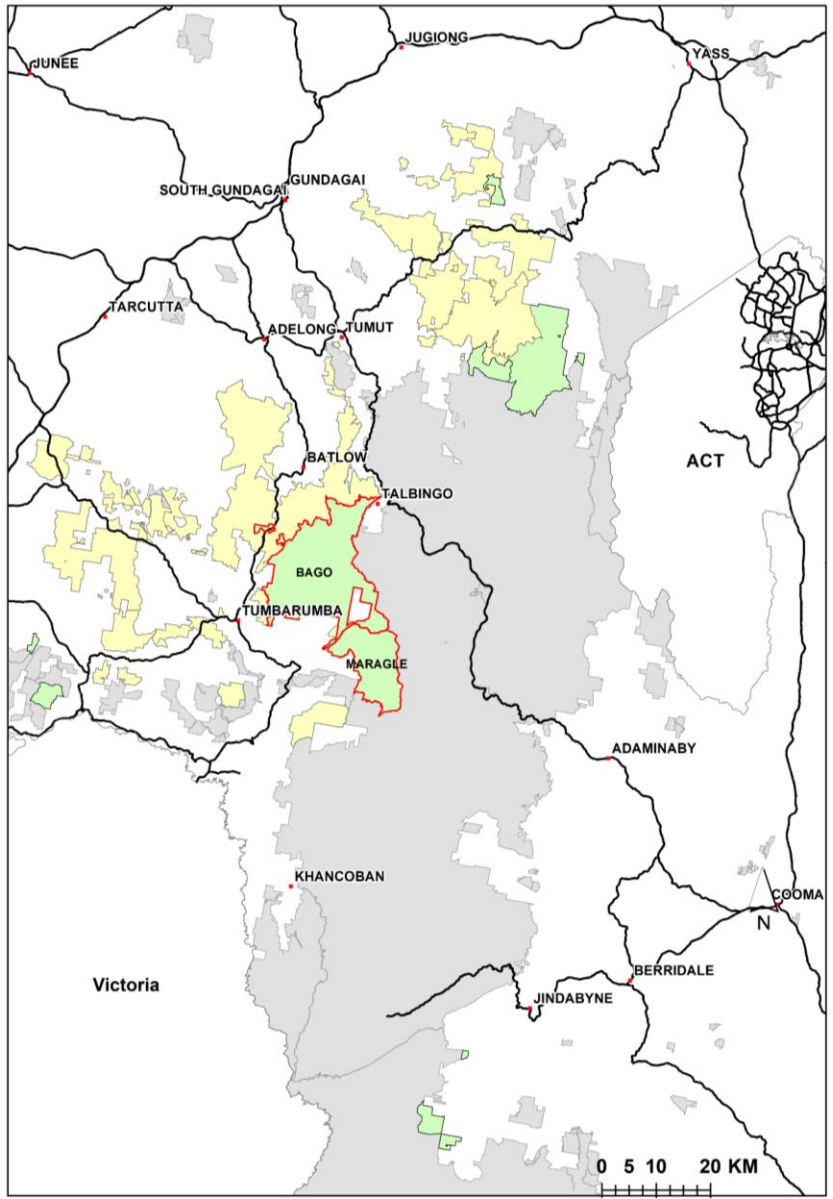
2. Assess the species response to harvesting.

Forestry Corporation

Bago Plateau

- Bago & Maragle State Forests.
  - 900-1300 m ASL.
  - 1250 mm average annual rainfall.

- Dominated by Alpine Ash, Mountain Gum, Peppermint, forest types.



Surveys

- ~126 survey sites.
- Call-playback + 1 ha spotlight (1995 – 2021).
- Passive acoustics (2022 onwards).

124 sites burnt

2020-2(

51

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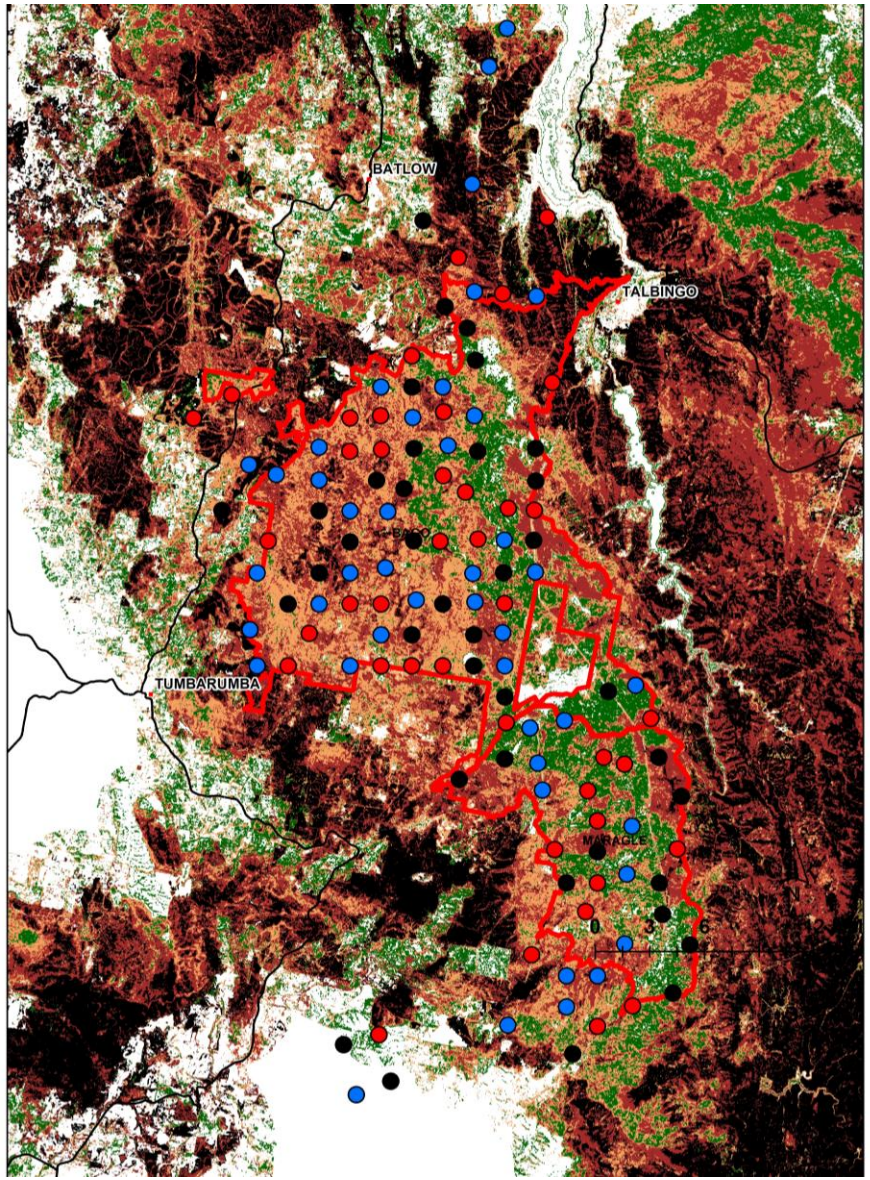

Dynamic occupancy modelling

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- Steps 1-3 include covariates to account for their effects.

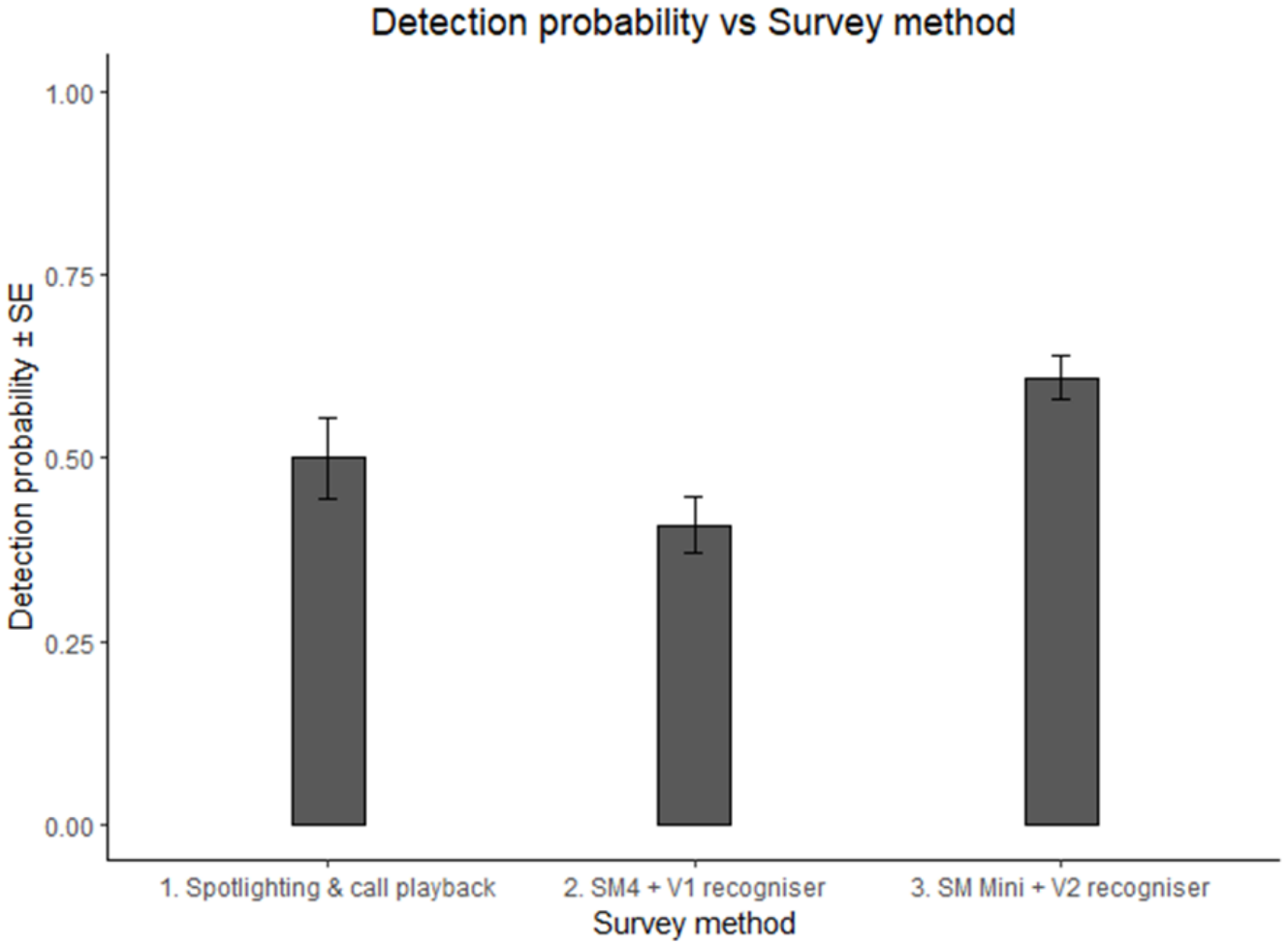
Covariates

Variable	Detection probability	Initial occupancy	Colonisation & Extinction probability
Temperature	✓		
Wind	✓		
Rain	✓		
Method	✓		
Year of survey	✓		
Forest type		✓	
Elevation		✓	
Density of hollow-bearing trees		✓	
Annual rainfall		✓	✓
Extent of no harvesting		✓	✓
Extent of recent (<5 years) harvesting		✓	✓
Extent of intermediate (5-15 years) harvesting		✓	✓
Extent of old (>15-30 years) harvesting		✓	✓
Extent of very old (>30 years) harvesting		✓	✓
Extent burnt			✓
Extent low severity fire			✓
Extent high severity fire			✓

Detection probability

Varied with survey methods

0.41-0.61 per visit



0.75 (2 visits)

0.98 (7 visits)

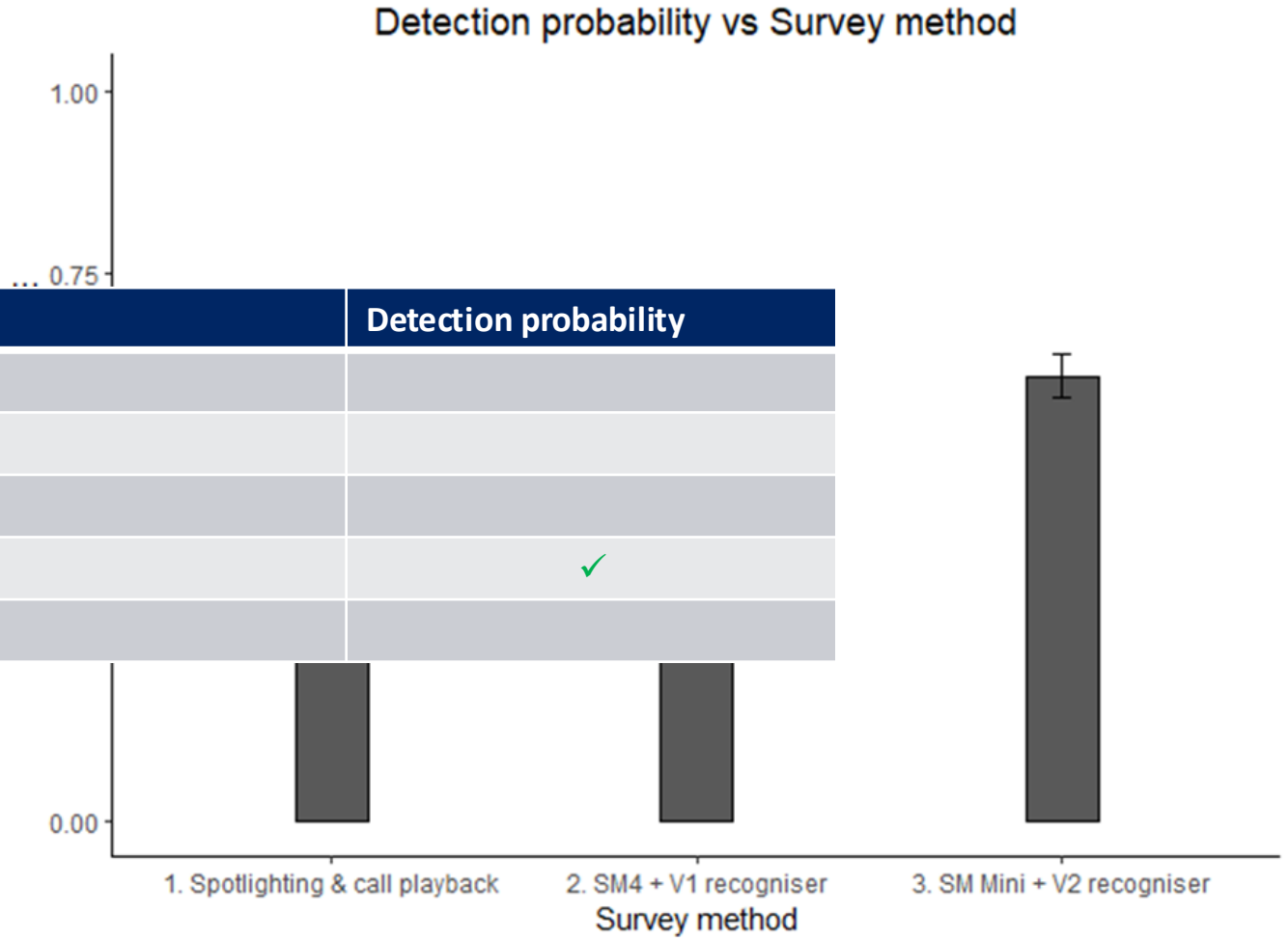
0.99 (7 visits)

Detection probability

Varied with survey methods

0.41-0.61 per visit

Variable	Detection probability
Temperature	
Wind	
Rain	
Method	✓
Year of survey	



0.75 (2 visits)

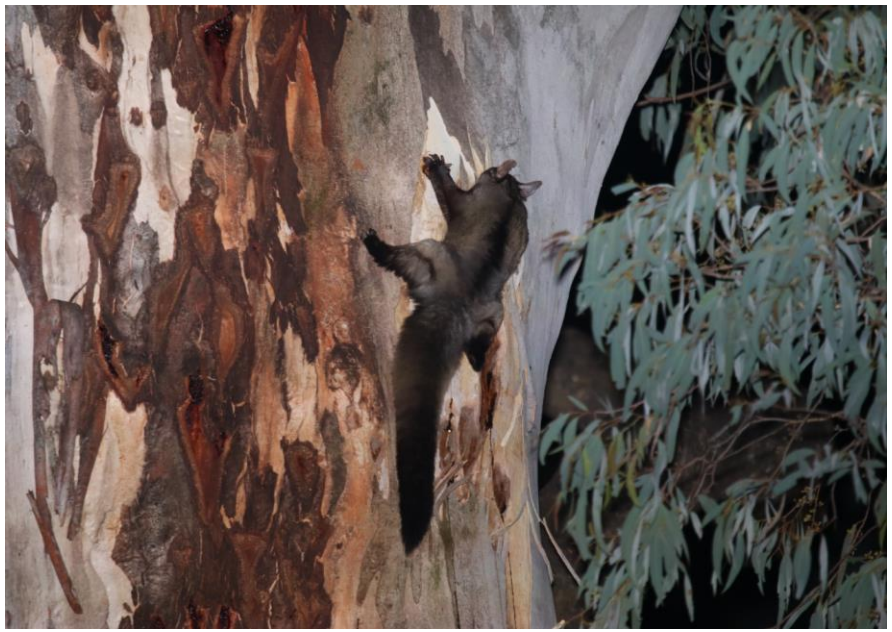
0.98 (7 visits)

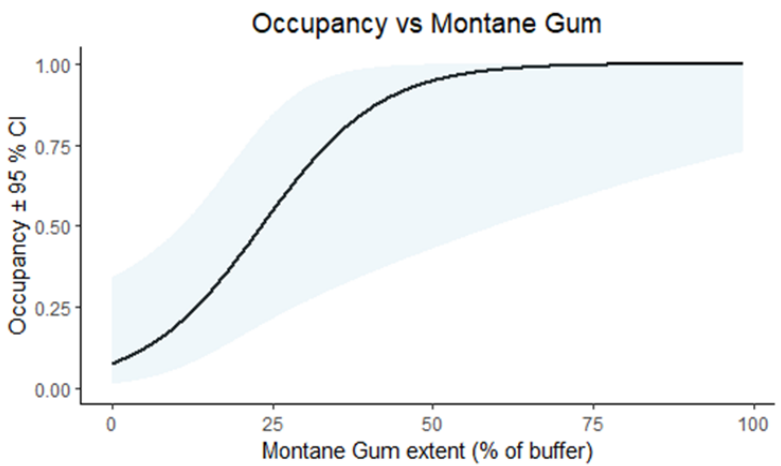
0.99 (7 visits)

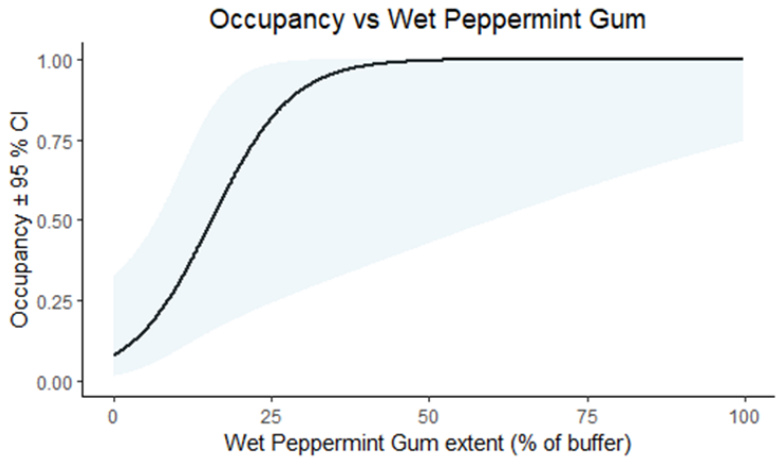
Initial occupancy

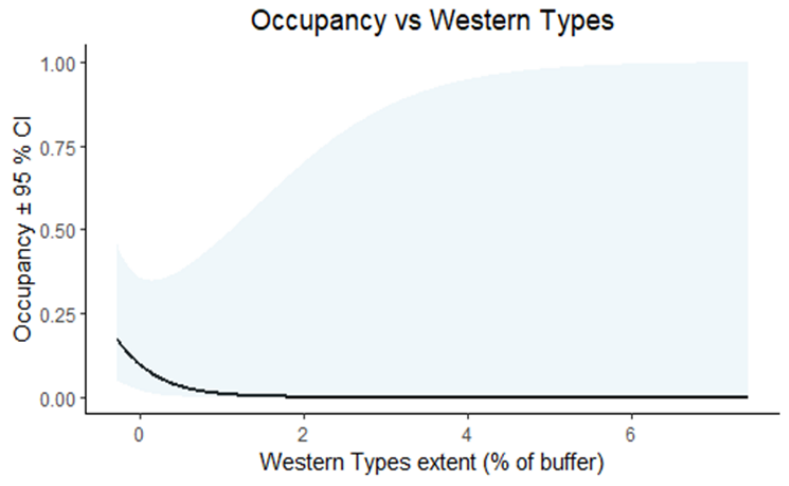
Varied with forest type groups

Median occupancy was 0.17 in 1995

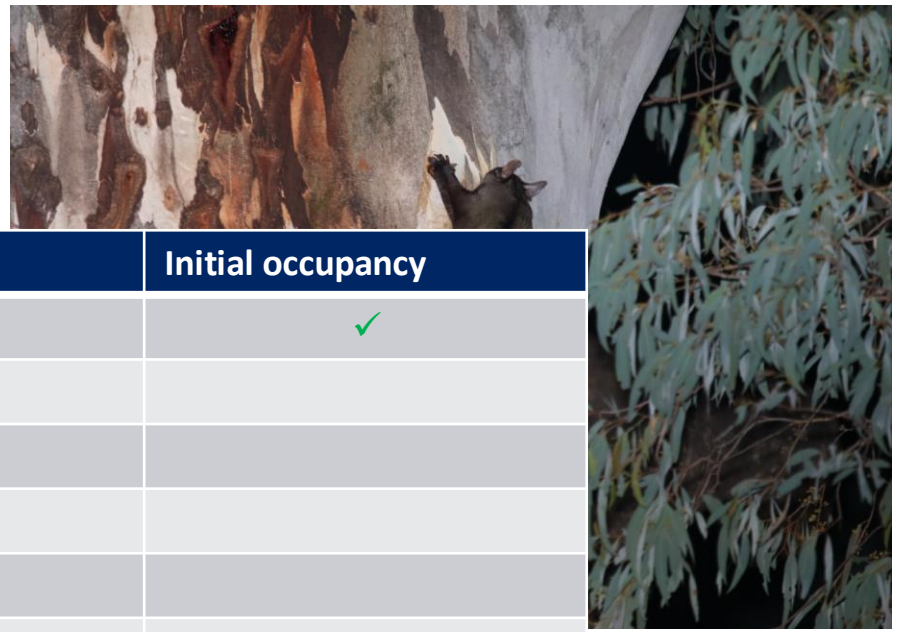








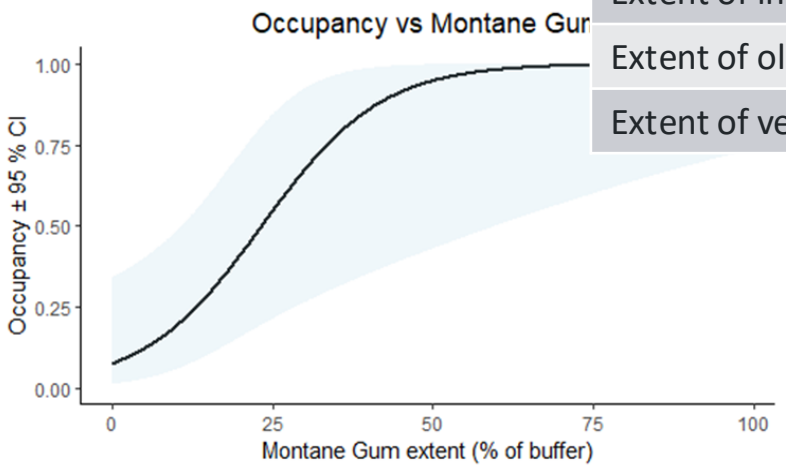
Initial occupancy

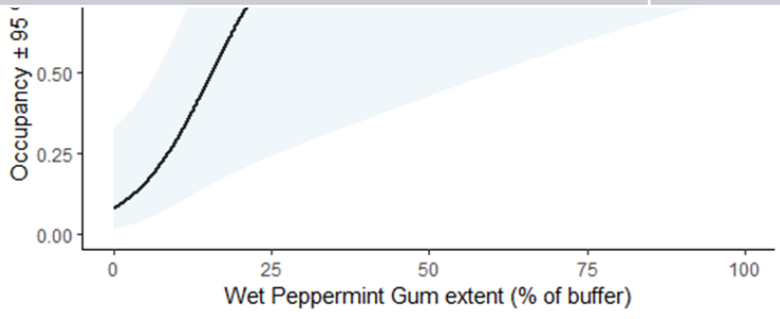


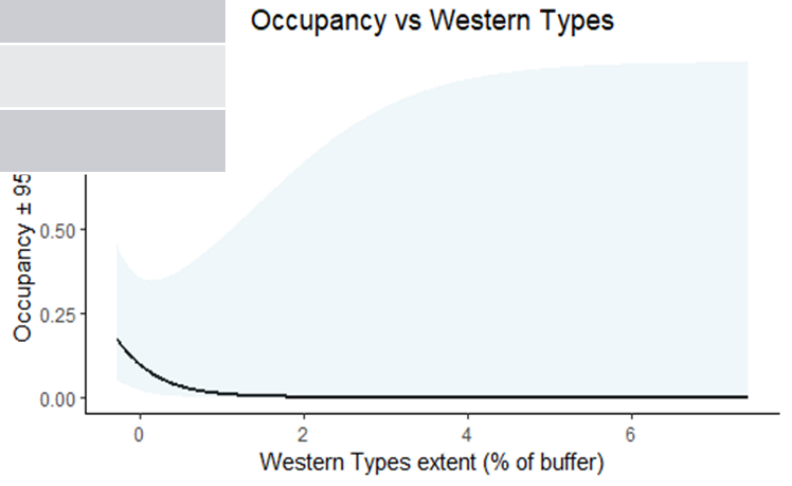
Varied with forest type groups

Median occupancy was

Variable	Initial occupancy
Forest type	✓
Elevation	
Density of hollow-bearing trees	
Annual rainfall	
Extent of no harvesting	
Extent of recent (<5 years) harvesting	
Extent of intermediate (5-15 years) harvesting	
Extent of old (>15-30 years) harvesting	
Extent of very old (>30 years) harvesting	



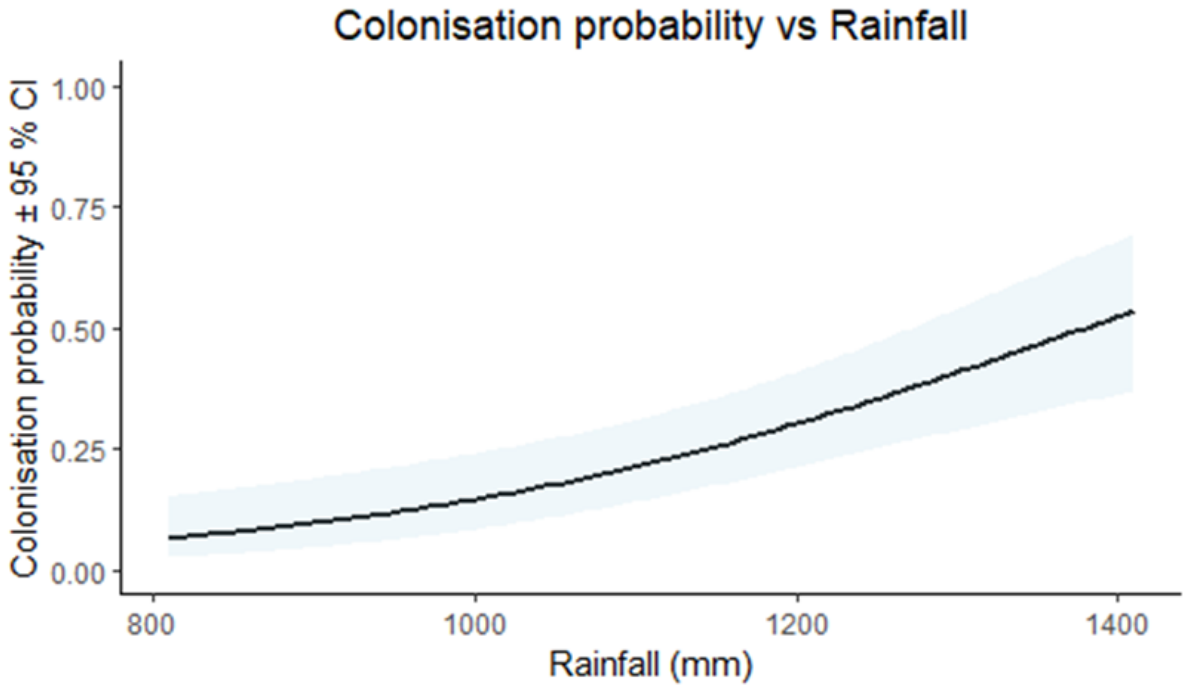


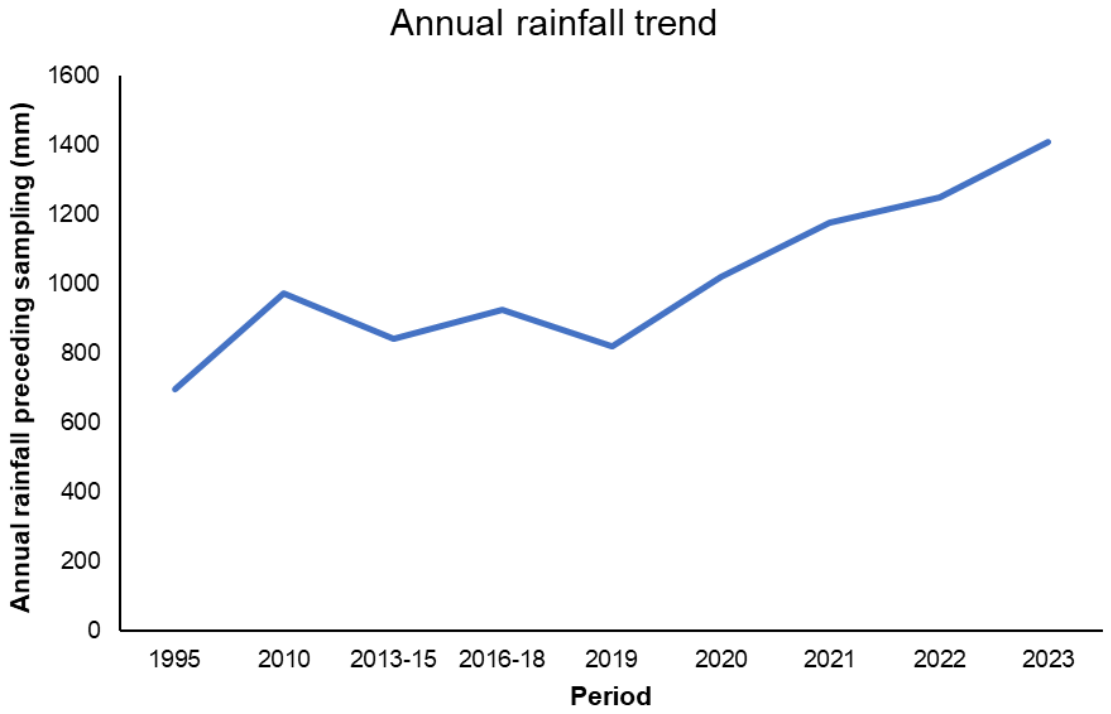


Local colonisation probability

Unoccupied sites more likely to become occupied in years with higher annual rainfall

Median colonisation probability was 0.16 ± 0.04





Local colonisation probability

Unoccupied sites more likely to become occupied in years with higher annual rainfall

Median colonisation p

Variable	Colonisation probability
Annual rainfall	✓
Extent of no harvesting	
Extent of recent (<5 years) harvesting	
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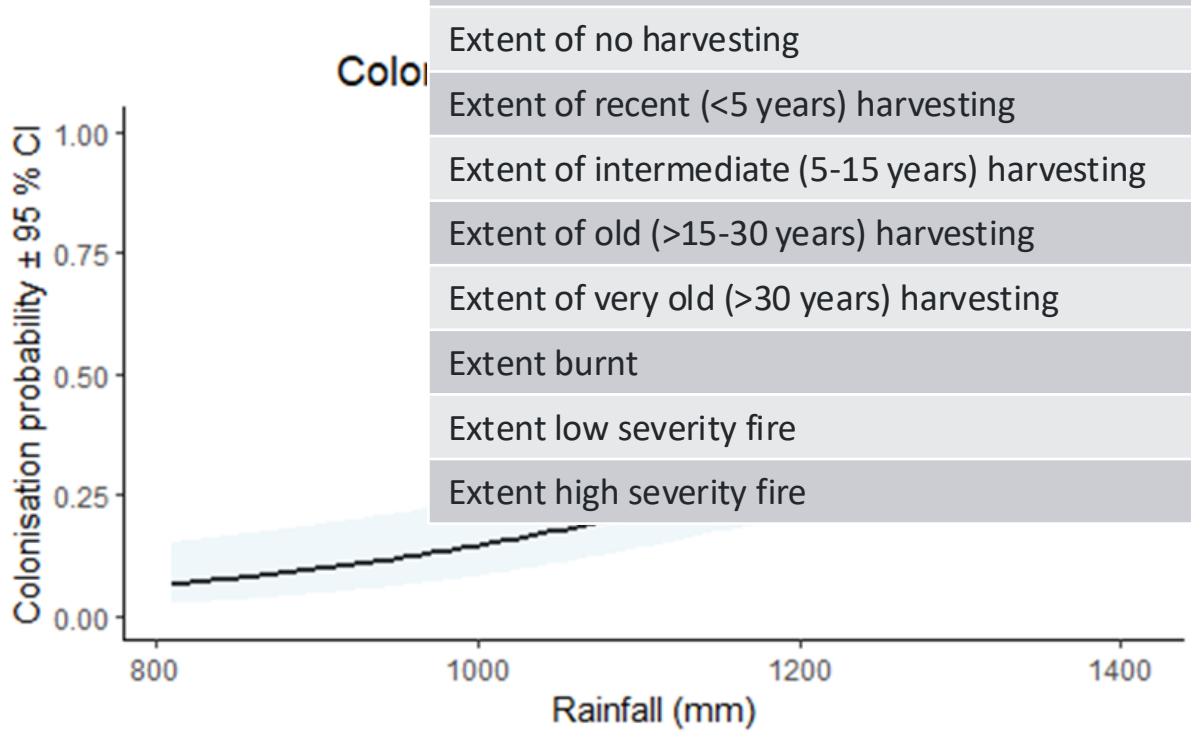
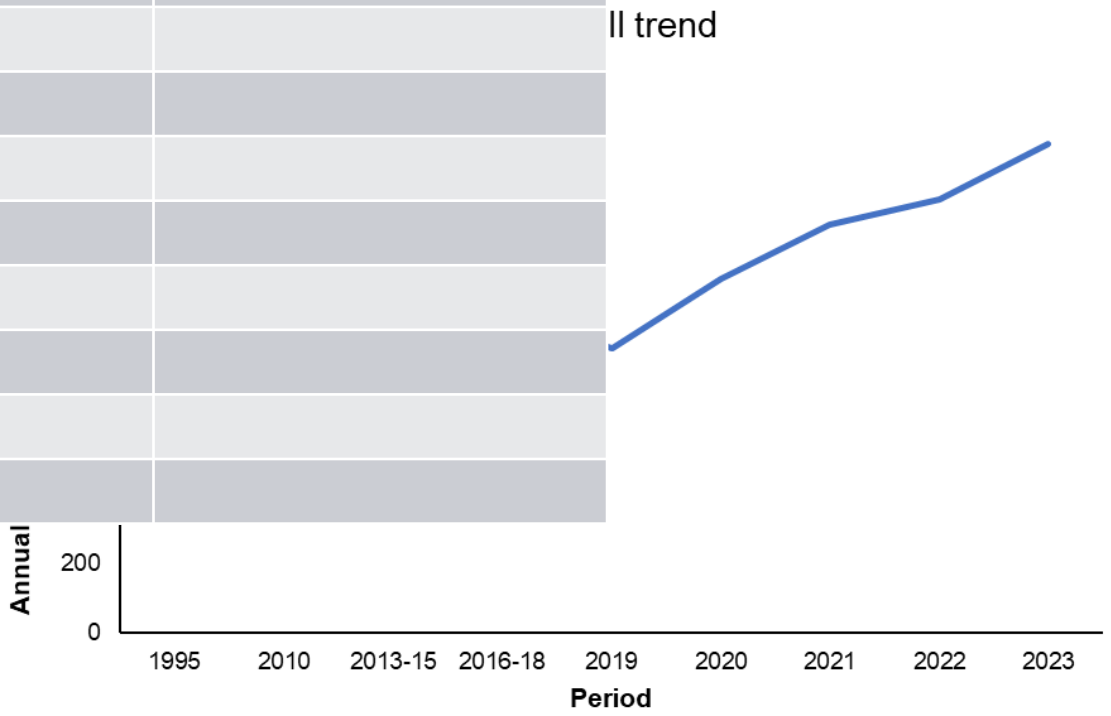
Extent burnt	
Extent low severity fire	
Extent high severity fire	

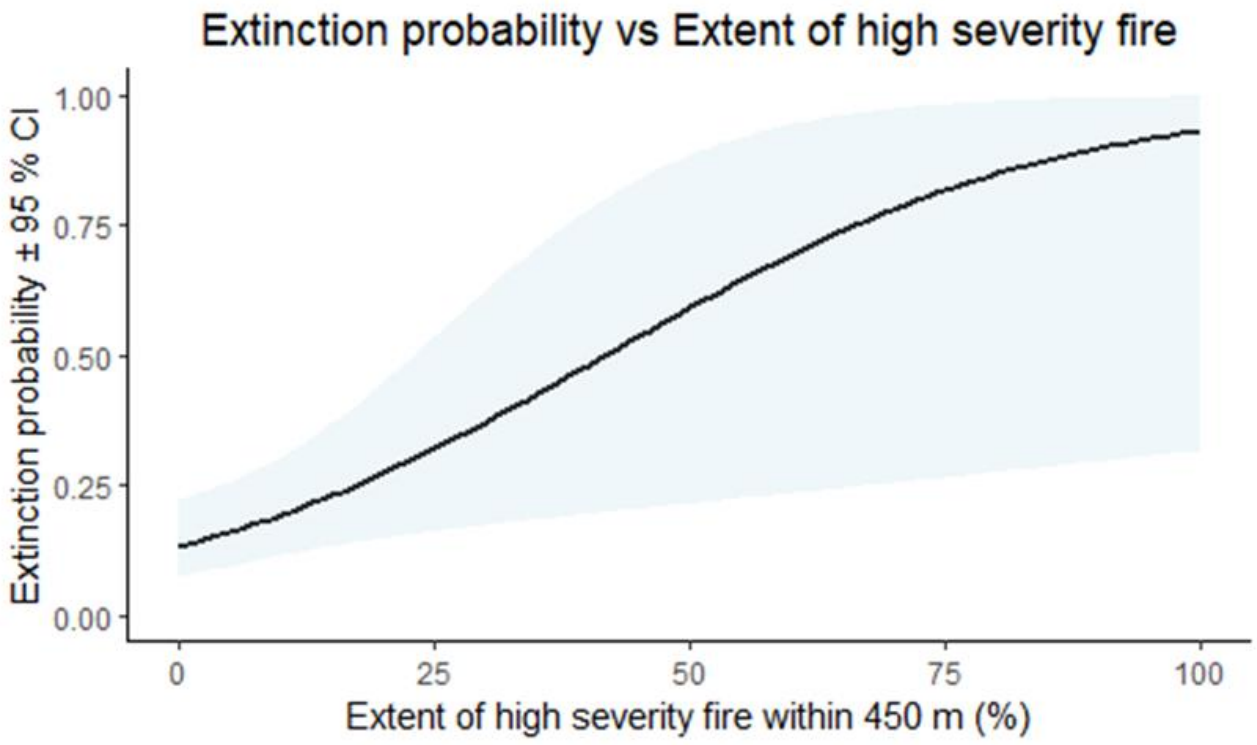




Local extinction probability

Occupied sites more likely to become unoccupied with higher extent of high severity fire

Median extinction probability was 0.13±0.04



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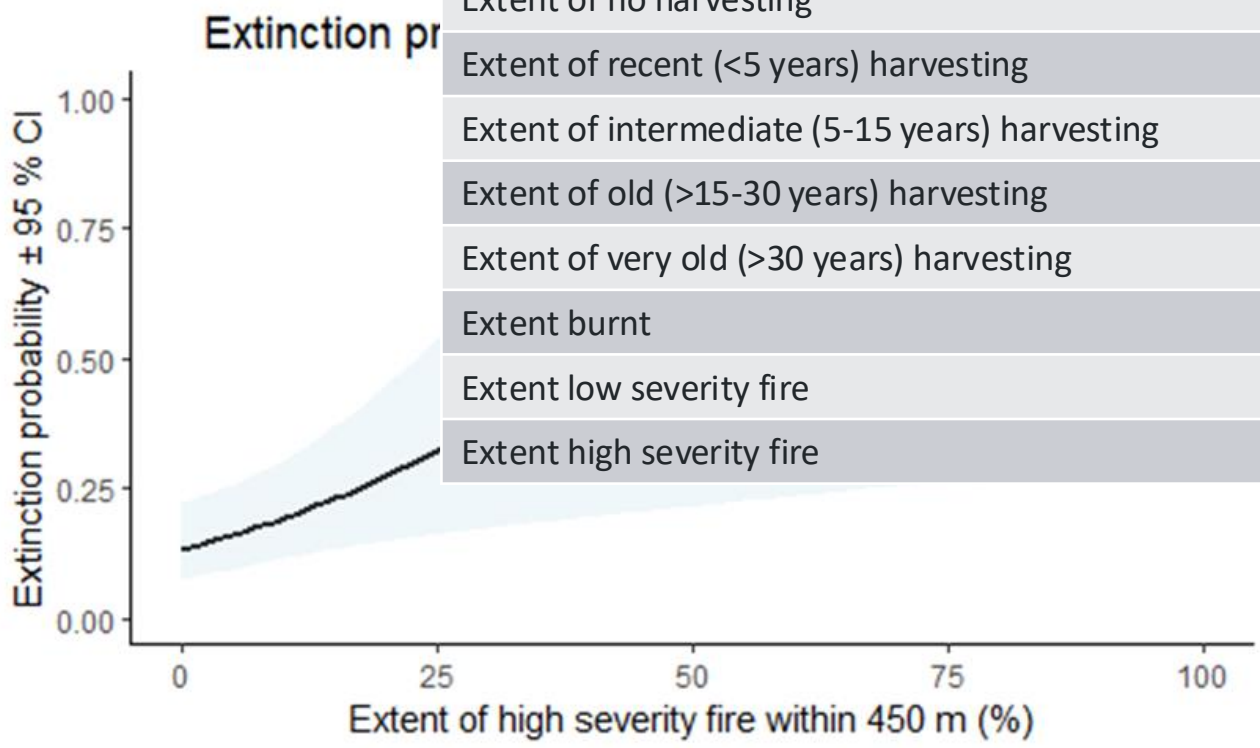
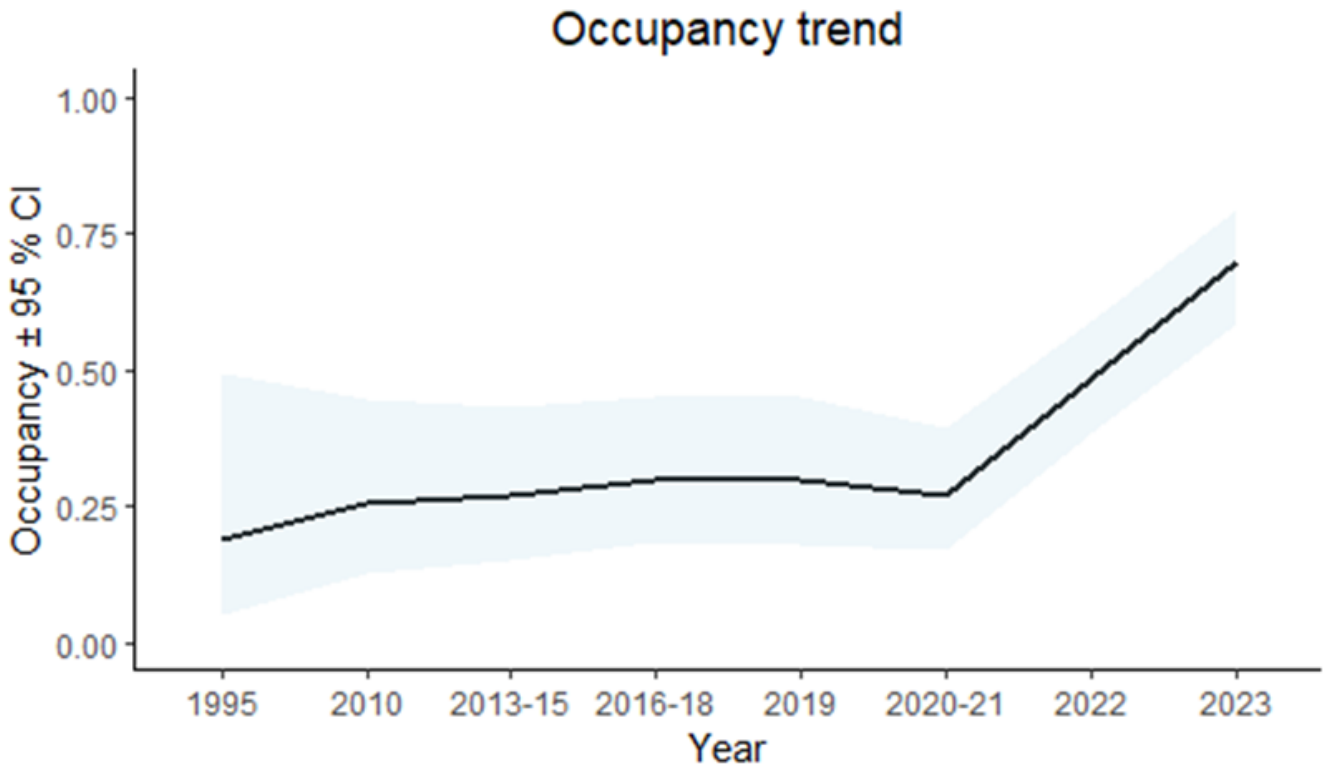
Extent low severity fire	
Extent high severity fire	✓



Trend

- Low (0.2-0.3) between 1995 and 2019.
- Reduced by 10 % following the 2019-20 fires.
- Increased to 0.7 by 2023.



Limitations

- Pre-fire (before 2019-20) surveys with only up to two nights of sampling per survey.
  - Less precise estimates of occupancy than 2022 onwards.
    - Included up to seven nights of repeat sampling.

- This is reflected in the tighter confidence intervals for the latter part of the trend.

Interpretation

- Rainfall and fire were major drivers of occupancy.

- Extent of timber harvesting (all age classes) not associated with YBG occupancy trend.
  - Harvesting mostly focused on Alpine Ash, which was not associated with occupancy.
  - Elsewhere YBG occupancy negatively associated with clear-fell harvesting of Alpine Ash and wildfire (Lefoe et al. 2022).

- Passive acoustic monitoring (PAM) was more effective at detecting YBG.
  - Demonstrated to be effective in Victoria (Whisson et al. 2021).
  - PAM should be used for the Bago Plateau program moving forward.

- Important to continue to monitor to track recovery post-fire.
  - Including potential cumulative impacts from other disturbances such as harvesting.

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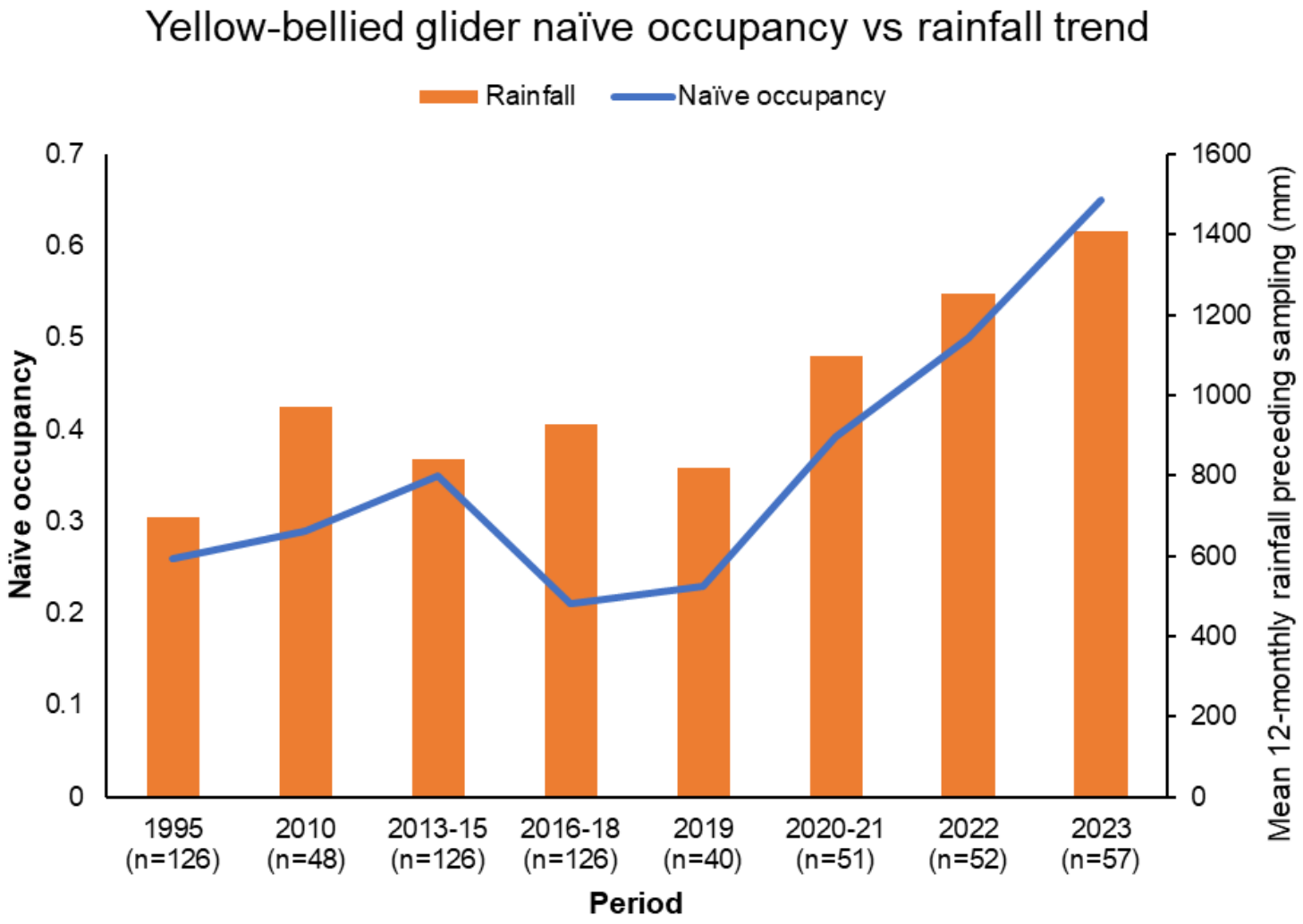
- TWG and steering committee for reviewing research progress.

- ANU: Phil Gibbons.

- Ross Goldingay.

Naïve occupancy



Monitoring the yellow-bellied glider following the 2019/20 bushfires

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Acknowledgements of Country:

Awabakal, Biripi, Bundjalung, Darkinyung, Dhanggati, Dharawal, Dharug, Dhurga, Gundungurra, Eora, Geawegal, Githabul, Gumbaynggirr, Kamilaroi, Nganyaywana, Ngarabal, Ngarigo, Ngunnawal, Wiradjuri, Wonnarua, Worimi, and Yuin

2019/20 Black Summer fires

2019-2020 ~ extreme event:

- ~ 10.4 million ha burnt across SE Australia; ~5.5 million ha in NSW, 7% of the state
- 20% eucalypt forest burnt in SE Australia
- Largest area of high severity fire (~1.8 M ha)
- High mortality, injury and displacement of wildlife
- Arboreal species particularly vulnerable
- Predicted declines of over 75% for yellow-bellied gliders (Legge *et al*. 2021)

Species traits as a predictor of response to fire

Species response ~ biological and ecological requirements + the type of fire experienced

Species with certain traits expected to be more affected

Arboreal species such as southern greater glider and the yellow-bellied glider:

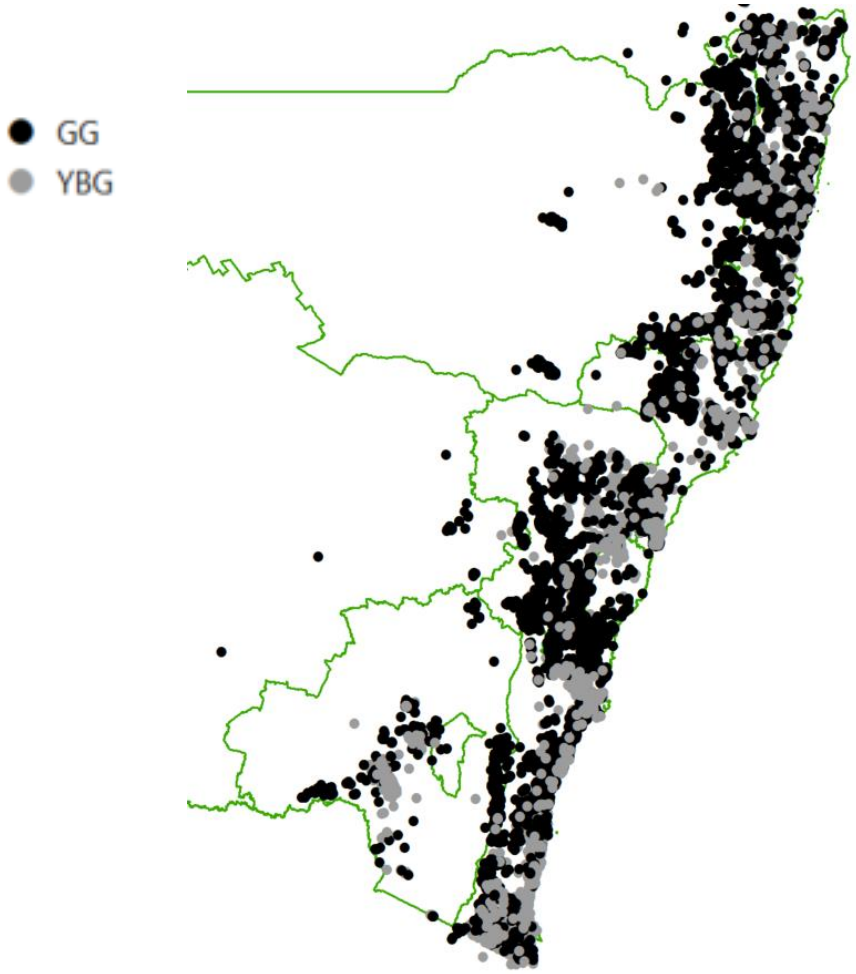
- Large parts of distribution fire affected

Species traits including:

- Limited ability to flee
- Low fecundity
- Dependence on habitat depleted by severe fire


Credit: George Lemann WWF Australia

Yellow-bellied glider
Petaurus australis in NSW



- Distributed from Queensland to Victoria, 0-1400m elevation
- Occupy tall mature eucalypt forests, with hollow-bearing trees for denning
- Large home ranges (20-85 ha)
- Highly mobile, social and vocal
- Broad diet (foliage, insect exudate, arthropods, pollen)
- Listed as Vulnerable under BC Act (2016)
  - Loss of habitat: hollow-bearing trees and feed trees

Key questions and predictions

1. What is the probability of occupancy of yellow-bellied gliders (and greater gliders) across their ranges in NSW three years after the 2019-2020 wildfires?

2. How did gliders respond to:

- Different fire severity classes (unburnt, low-moderate, high) and
- Varying spatial scales (site, 300m, 500m, 1000m)

NSW state-wide glider surveys

Site stratification

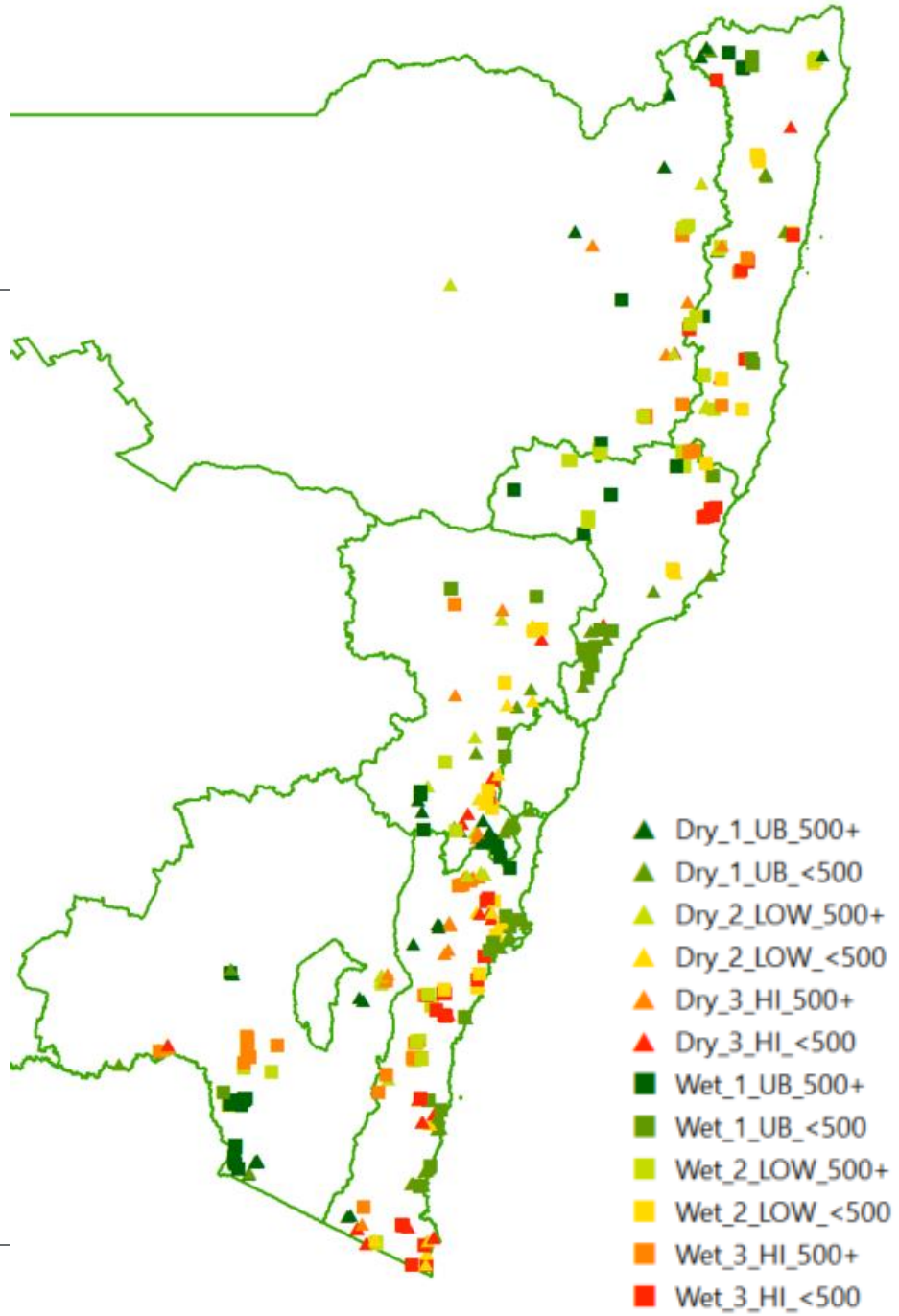
- Forest Type: wet sclerophyll, dry sclerophyll
- Fire severity (FESM): unburnt (0), low (2-3), high (4-5)
- Elevation (<500 m, >500m)

12 treatments

- Spatially represented across NSW
- Predominately on NPWS estate (plus LALC land)
- On or <100m from minor roads and tracks
- > 1km between sites

Exclusions:

- Intensive logging, fire history since 2019-2020



Methods

Surveys:

- Site assessment + spotlighting + call playback: 200m transect
- 3 repeat surveys (~ 80% detection confidence)
- Spring / summer 2022-23

Data analysis:

- occupancy-detection models of each species
- 3 stage process:

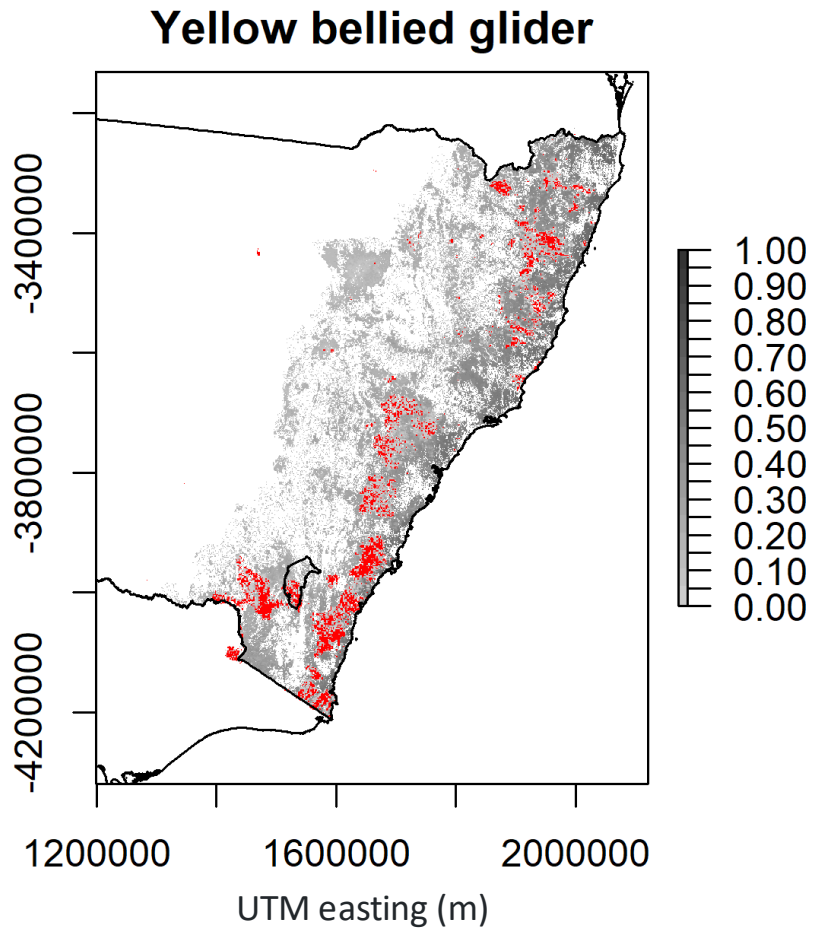
1. Detection model
2. Base model: detection and occupancy covariates (15 covariates)
3. Compare base model + each fire covariate for best overall model

Results

610 surveys, 223 sites surveyed

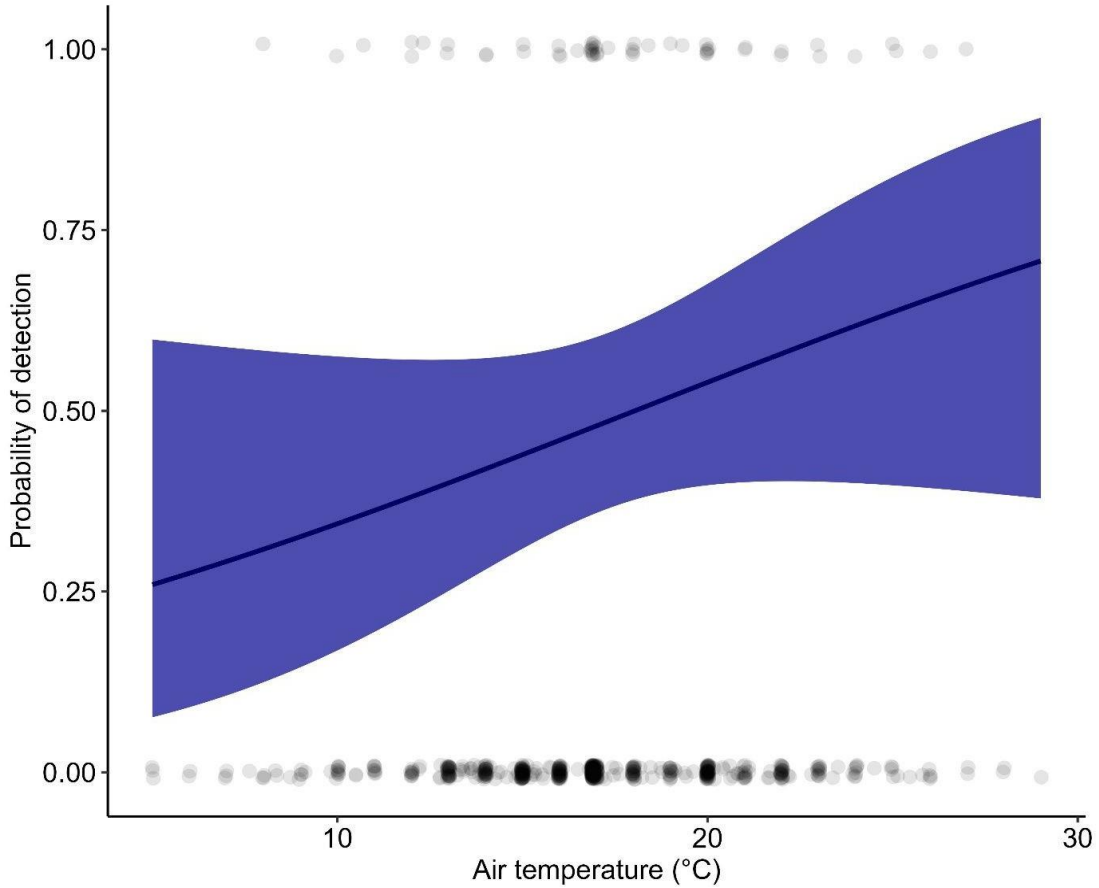
Yellow-bellied gliders

- not frequently detected (54 detections / 31 sites)
- Mean occupancy: 0.07 (95% CI: 0.03, 0.15)



Results

Detection probability for yellow-bellied gliders increased with increasing temperature



Results: Yellow-bellied Gliders

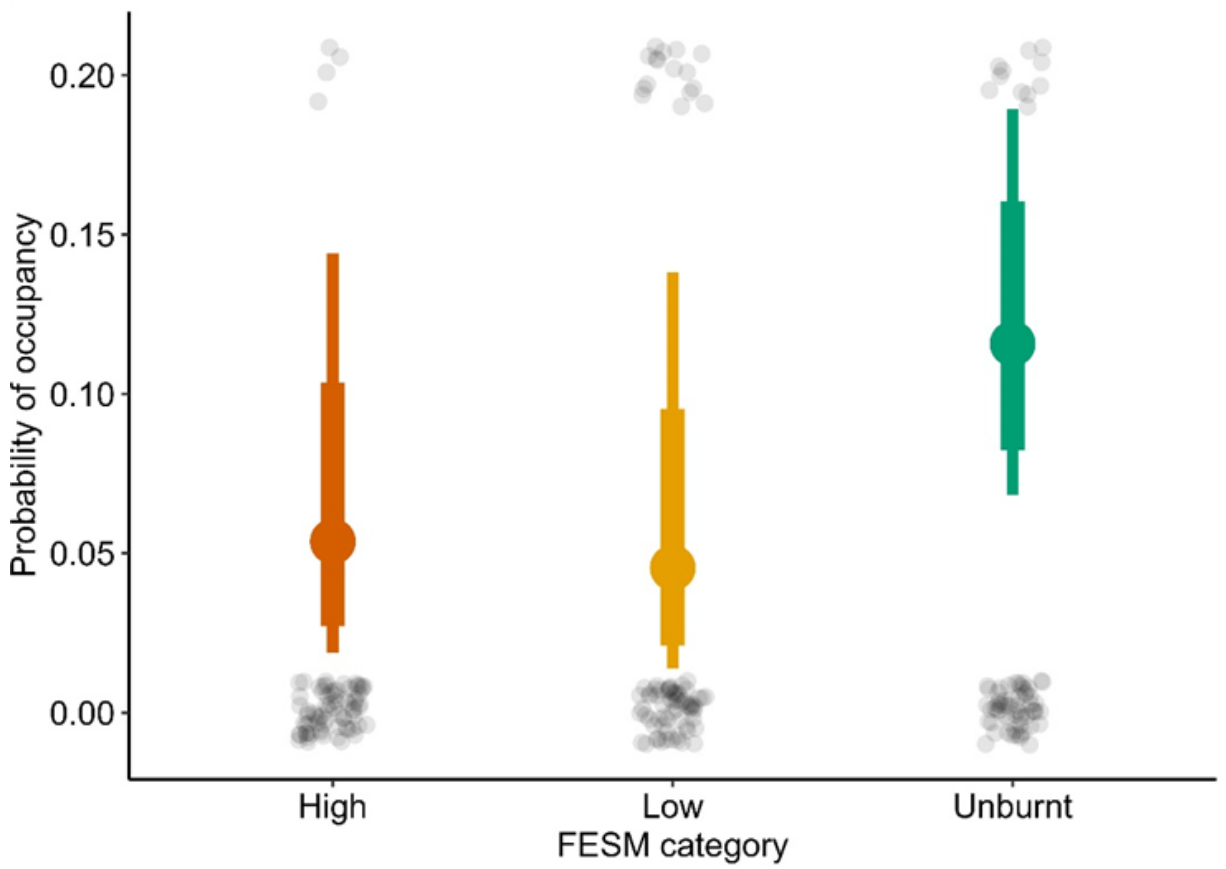
Detection: *increasing* temperature

Base model:

- Negative: EDI, annual temperature variation

Fire covariates:

- High severity + site scale
- No relationship with low-mod severity



Yellow-bellied gliders decline at severely burnt sites

Fire severity at the site scale most important

Highly mobile - preferentially seeking out unburnt resources

Spatial heterogeneity of wildfire meant that unburnt resources within typical nightly movements

Species traits to inform fire response and management

- Our results indicate that yellow-bellied gliders were:
  - vulnerable to high severity fire
  - resilient to low-moderate fire
  - more resilient than greater gliders to severe fire at landscape scale
- Preference for unburnt sites, but severely burnt forest was not a barrier to movement
- Severe fire is expected to impact on habitat quality in the short term
- With increasing time since fire forest recovery is likely to facilitate movement through severely burnt areas
- Management to support current and future glider populations:
  - minimise risk of landscape scale high severity fire
  - low-moderate fire can minimise risk of future wildfire
  - maintain essential habitat (large, mature, hollow bearing trees and feed trees)

- **Results at single-time point can be applied to inform future YBG monitoring design**

Coming soon: Robinson *et al*. Contrasting the influence of extent and severity of fire on the occupancy of two marsupial gliders in NSW. *Wildlife Research*

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Local Aboriginal Land Councils: Jerrinja, Batemans Bay, Bega, Merrimans

This project took place on many Aboriginal countries including:

Awabakal, Biripi, Bundjalung, Darkinyung, Dhanggati, Dharawal, Dharug, Dhurga, Gundungurra, Eora, Geawegal, Githabul, Gumbaynggirr, Kamilaroi, Nganyaywana, Ngarabal, Ngarigo, Ngunnawal, Wiradjuri, Wonnarua, Worimi, and Yuin

Credit: Andrew Stewart BB LALC

Thank you for joining us today

This webinar will be available shortly on the Commission's website

Any further questions or feedback please contact us at **nrc@nrc.nsw.gov.au**

Read more on the Coastal IFOA monitoring biodiversity webpage:
https://www.nrc.nsw.gov.au/ifoa-mer-biodiversity

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