Landcare Research
Manaaki Whenua

Sustained possum control increases survival of trees in native forests.

Andrew Gormley, Pen Holland, Roger Pech, Caroline Thomson, Ben Reddiex (DoC)

Invasive mammals

Key driver of change in New Zealand ecosystems

- Biodiversity & agricultural impacts

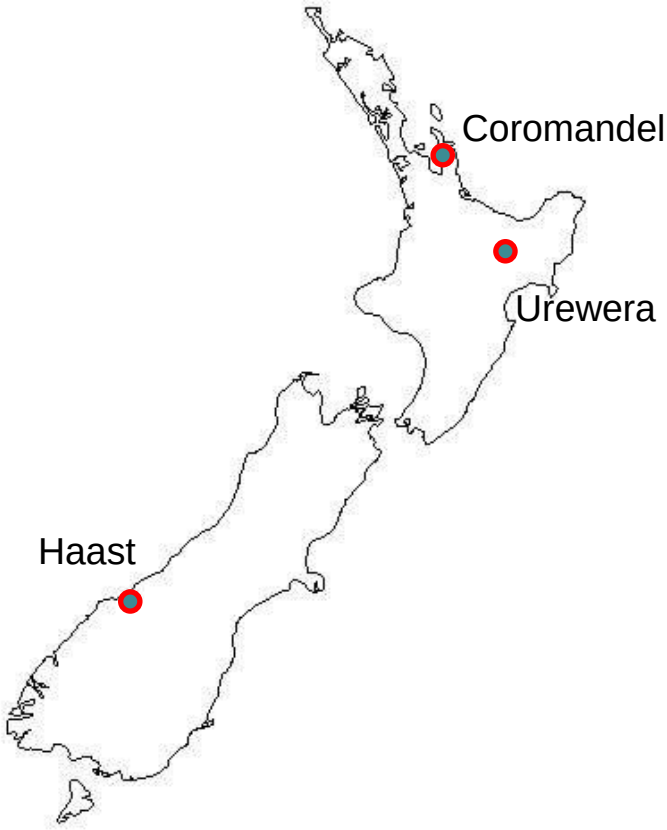
Pest control

Benefits to native trees of possum control often not measured

Experimental management of possums, 2004-2010

- Established by:
  - John Parkes (LCR)
  - Ben Reddiex (DOC/LCR)
  - Clare Veltman (DOC)
  - Caroline Thomson (LCR) and many others

- Paired sites in each area (*c.*1000 – 2300 ha)
  - **Treatment**: Extensive control prior to & during study
  - **Non-treatment**: No official control



Indicator species

- Two possum-preferred and one non-preferred species selected as indicators at each site
- 200 of each species per site

Kāmahi: *Weinmannia racemosa*

Patē: *Schefflera digitata*

Silver beech: *Nothofagus menziesii*

What was measured?

Foliar Browse Index (FBI)

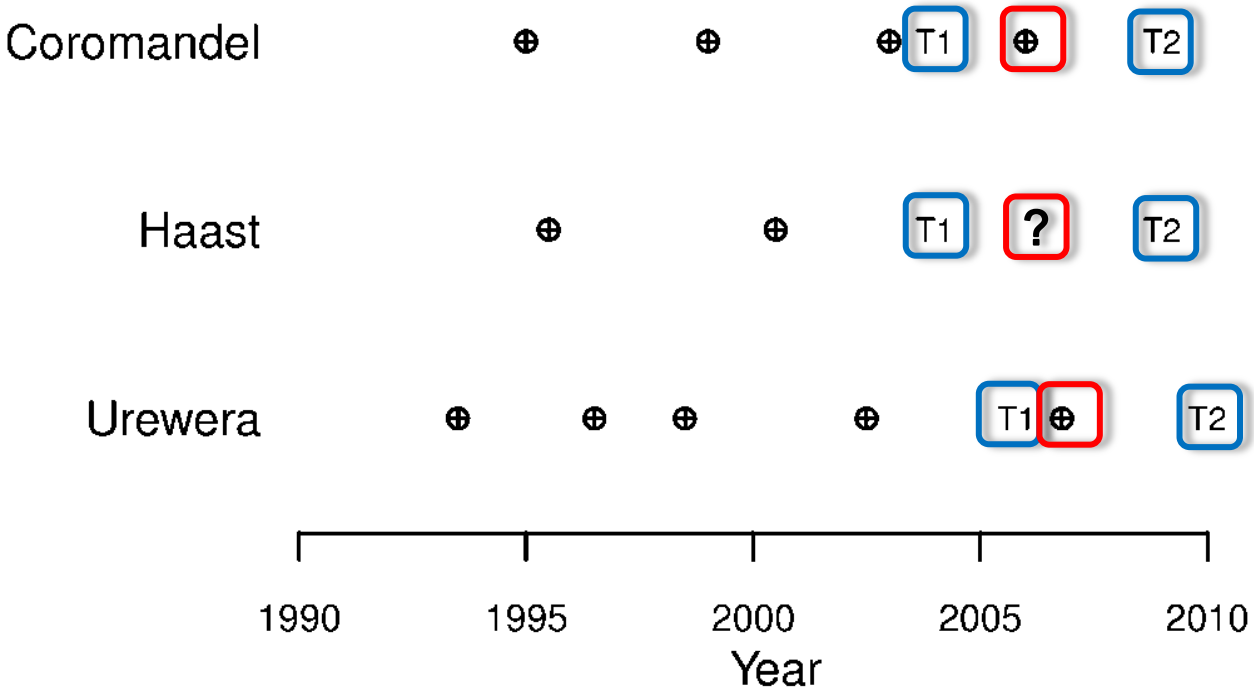
Foliage Cover Index (FCI)

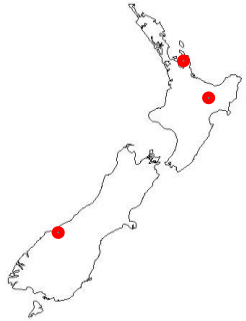
Mortality (Alive or Dead)

- Tree Size (dbh)
- Neighbouring trees

Timing

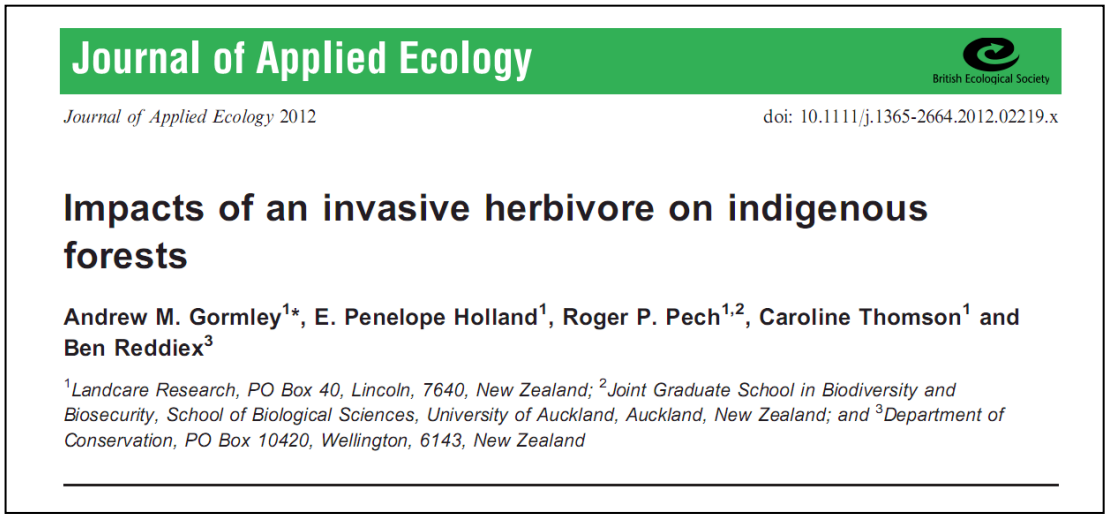
- Two measurements
  - T1: 2004/2005
  - T2: 2009/2010





Analysis

- Looked at effect of possum control on Browse, Cover and tree mortality
- Fitted hierarchical models in a Bayesian framework:
  - **Browse** with biomass of neighbourhood trees, consumed biomass, DBH, TCI
  - **Tree mortality** using FCI, DBH, Treatment, TCI



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Impacts of an invasive herbivore on indigenous forests

Andrew M. Gormley[1]*, E. Penelope Holland[1], Roger P. Pech[1,2], Caroline Thomson[1] and Ben Reddiex[3]

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Browse (FBI)

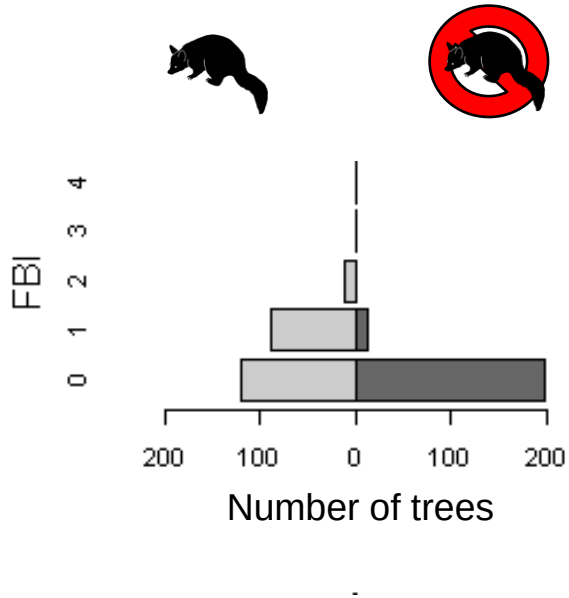
4 = Severe

3 = Heavy

2 = Moderate

1 = Slight

0 = None

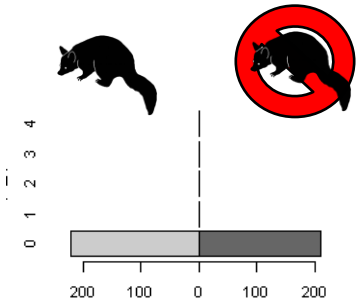


Non-preferred

K. excelsa
Rewarewa

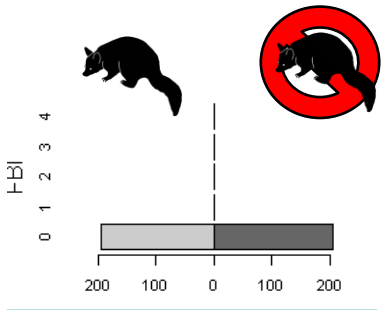
Coromandel

K. excelsa
Rewarewa



Urewera

N. menziesii
Silver beech

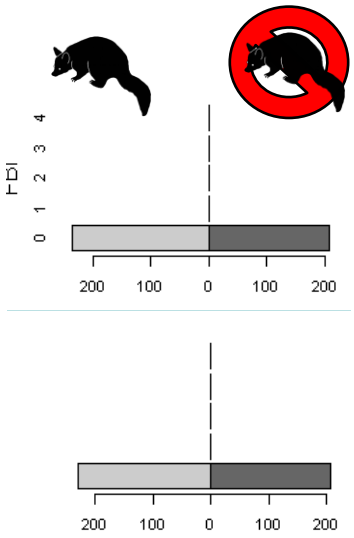


Haast

No browse

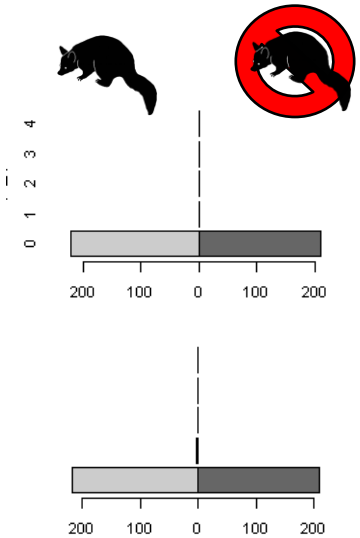
Non-preferred

K. excelsa
Rewarewa



Coromandel

K. excelsa
Rewarewa



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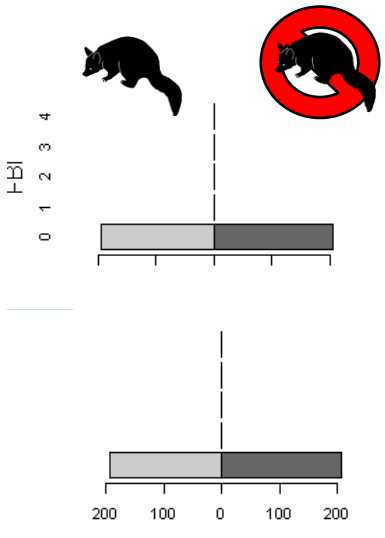
Silver beech



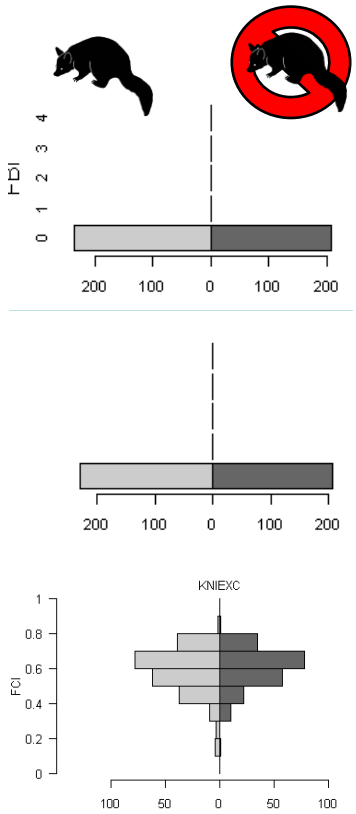
Haast

No browse

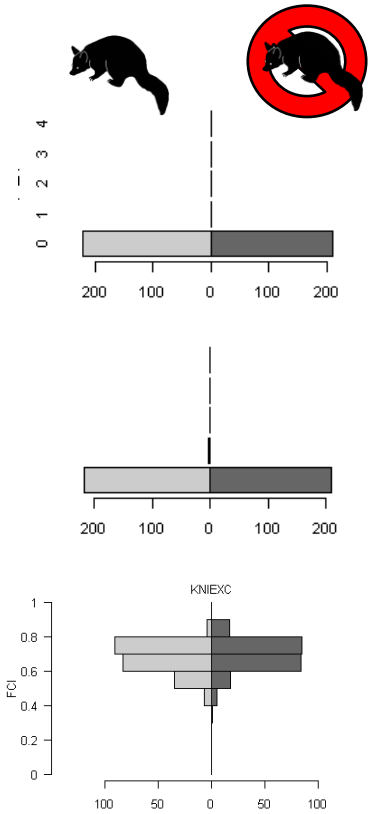
Same pattern in time 2

Non-preferred

K. excelsa
Rewarewa



K. excelsa
Rewarewa



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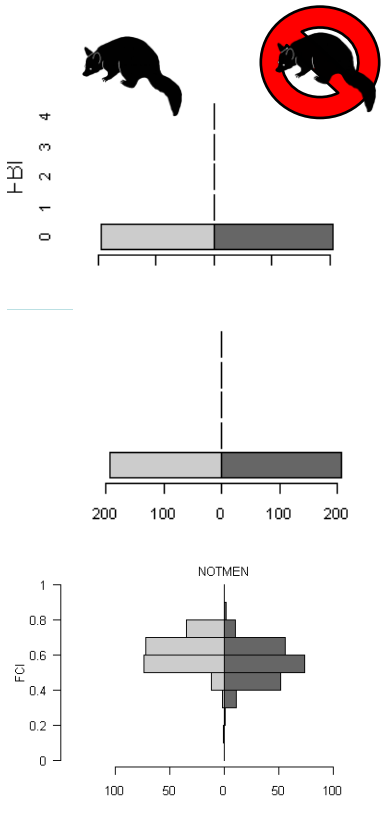
Silver beech



No browse

Same pattern in time 2

No difference in Cover

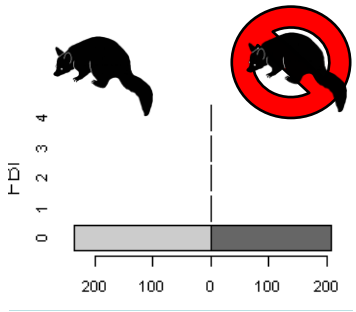
Coromandel

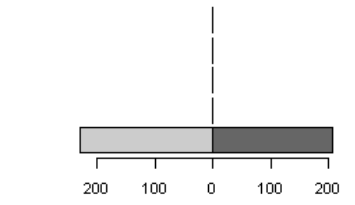
Urewera

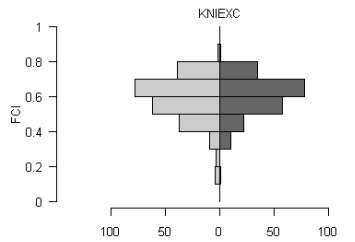
Haast

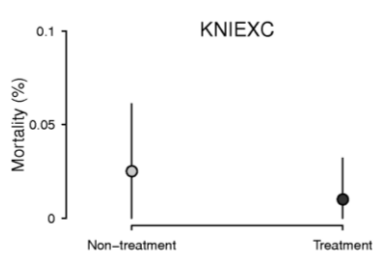
Non-preferred

K. excelsa
Rewarewa



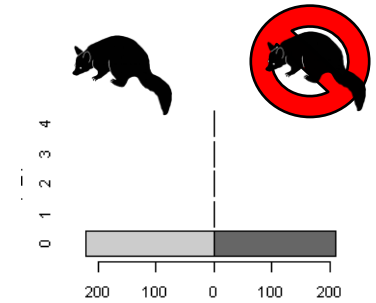


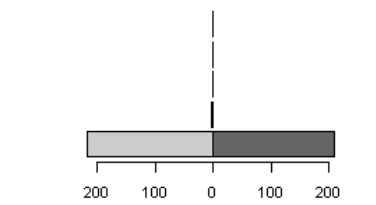


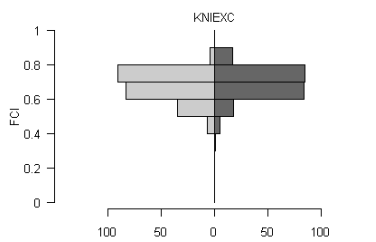


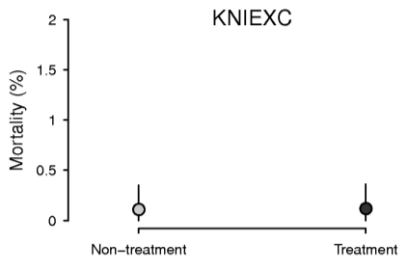
Coromandel

K. excelsa
Rewarewa



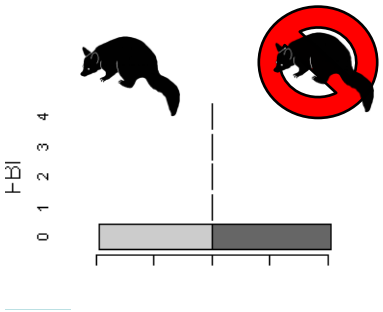


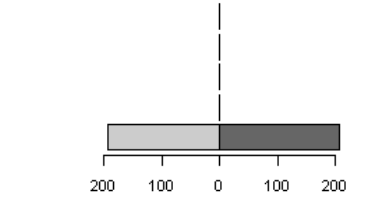


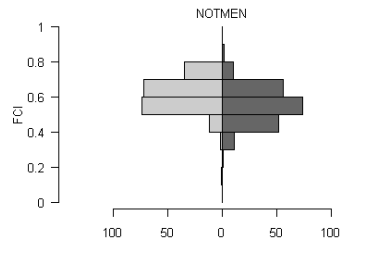


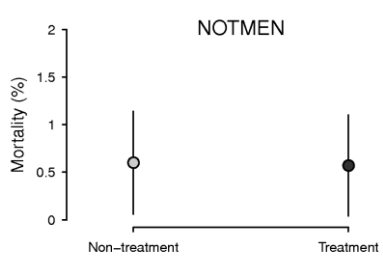
Urewera

N. menziesii
Silver beech









Haast

No browse

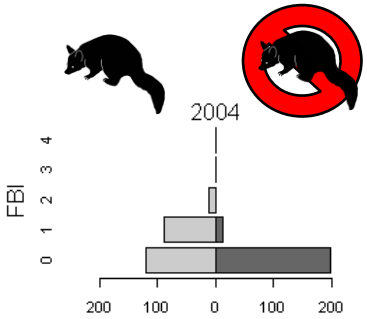
Same pattern in time 2

No difference in Cover

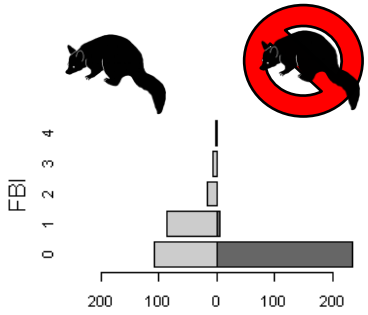
No difference in Mortality

Coromandel

W. silvicola
Towai



O. rani
Heketara



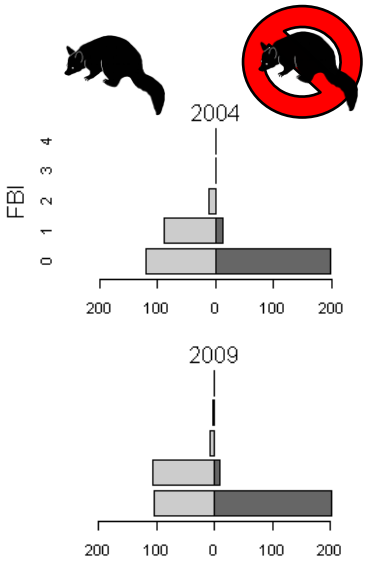
O. rani

No treatment → More Browse
- Moderate/heavy for one species
- Minor for second species

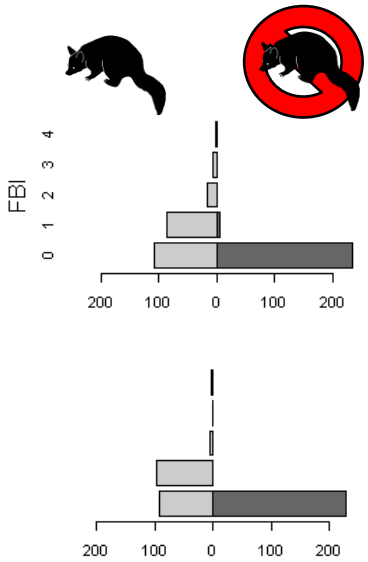
Coromandel

O. rani

W. silvicola
Towai



O. rani
Heketara



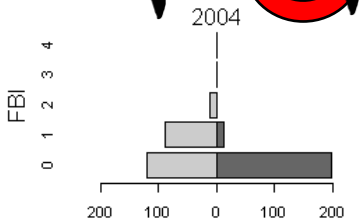
No treatment → More Browse
- Moderate/heavy for one species
- Minor for second species

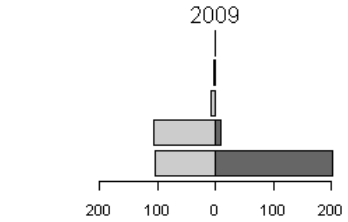
Same pattern at time 2

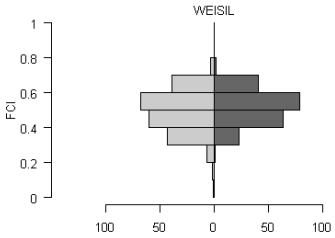
Coromandel

O. rani

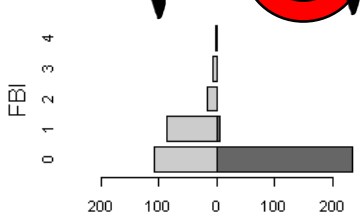
W. silvicola
Towai

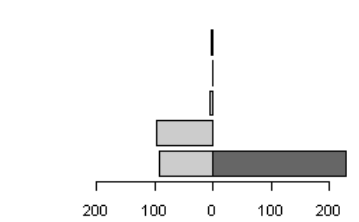


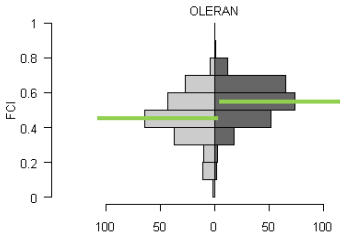




O. rani
Heketara







No treatment → More Browse
- Moderate/heavy for one species
- Minor for second species

Same pattern at time 2

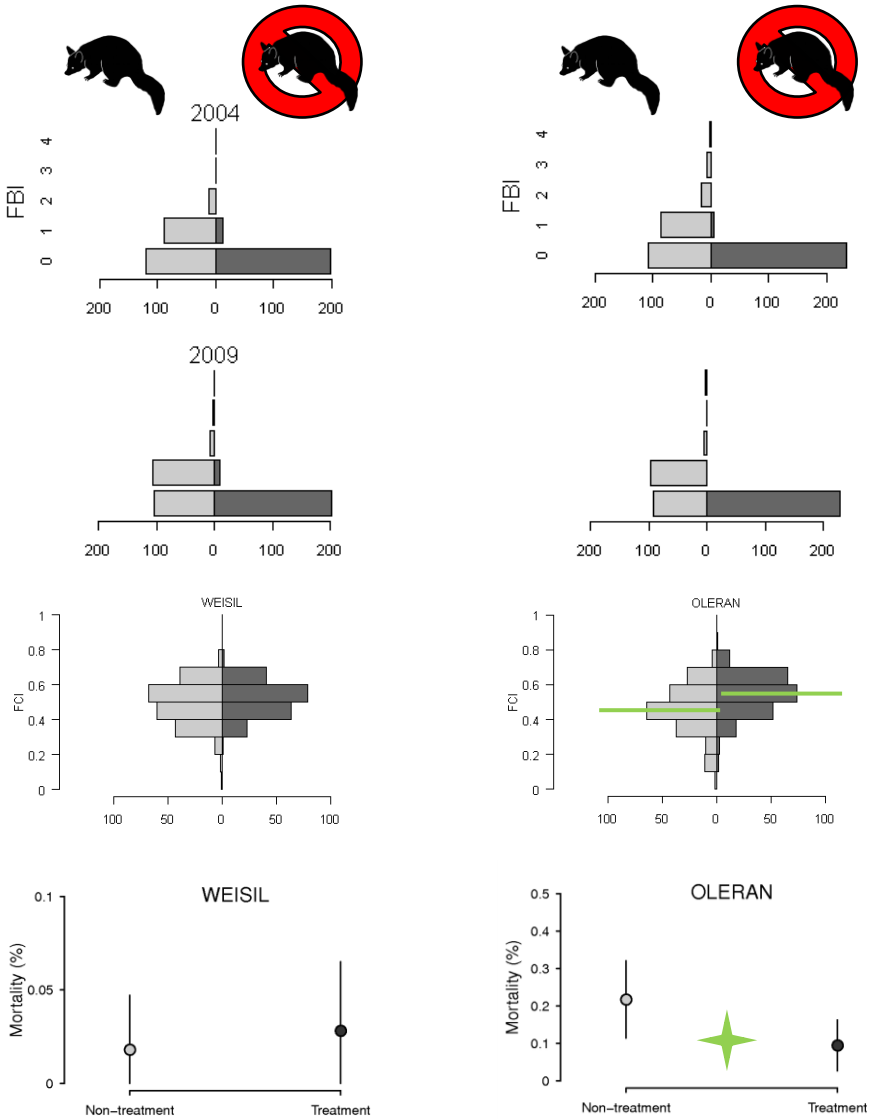
Higher browse leads to less cover for heavier browsed species

Coromandel

O. rani

W. silvicola
Towai

O. rani
Heketara



No treatment → More Browse
- Moderate/heavy for one species
- Minor for second species

Same pattern at time 2

Higher browse leads to less cover for heavier browsed species

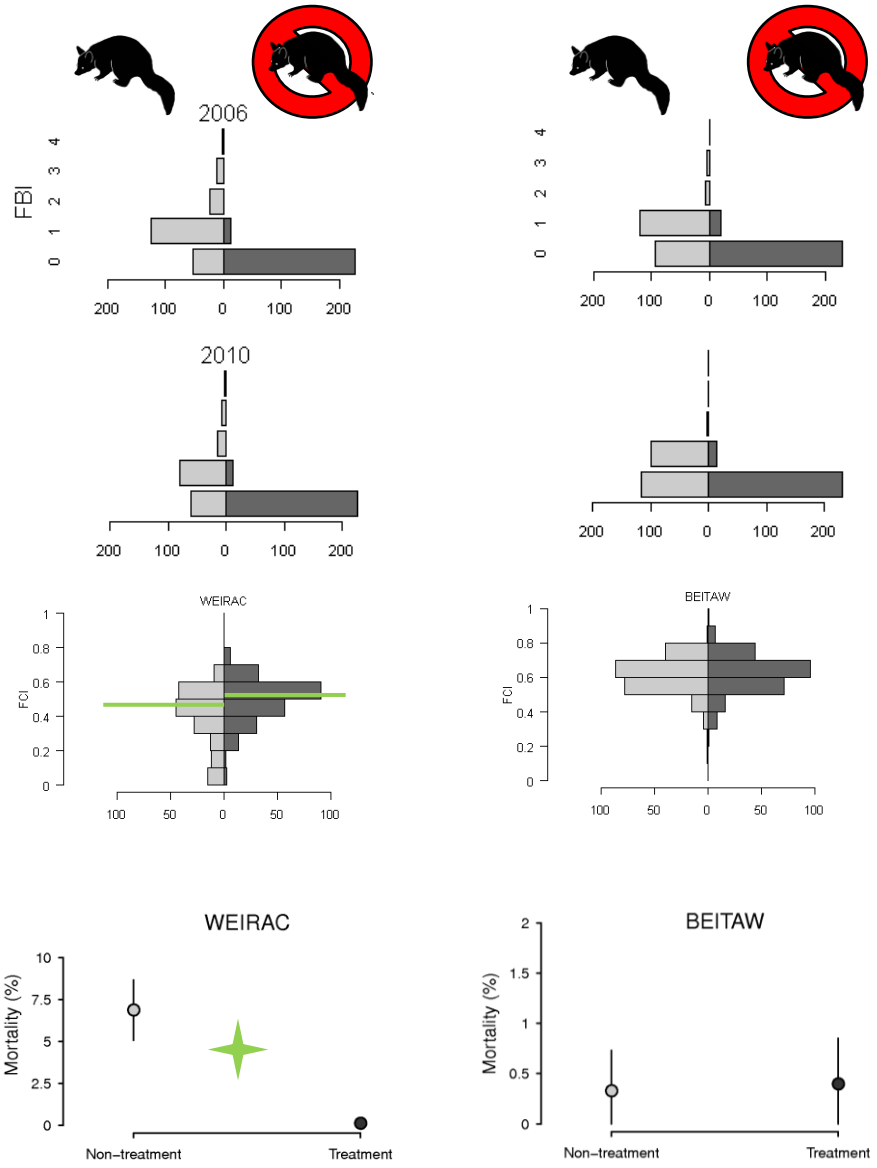
Lower mortality on treatment areas for heavier browsed species

Urewera

W. racemosa

W. racemosa
Kāmahi

B. tawa
Tawa



No treatment → More Browse
- Moderate/heavy for one species
- Minor for second species

Same pattern at time 2

Higher browse leads to less cover for heavier browsed species

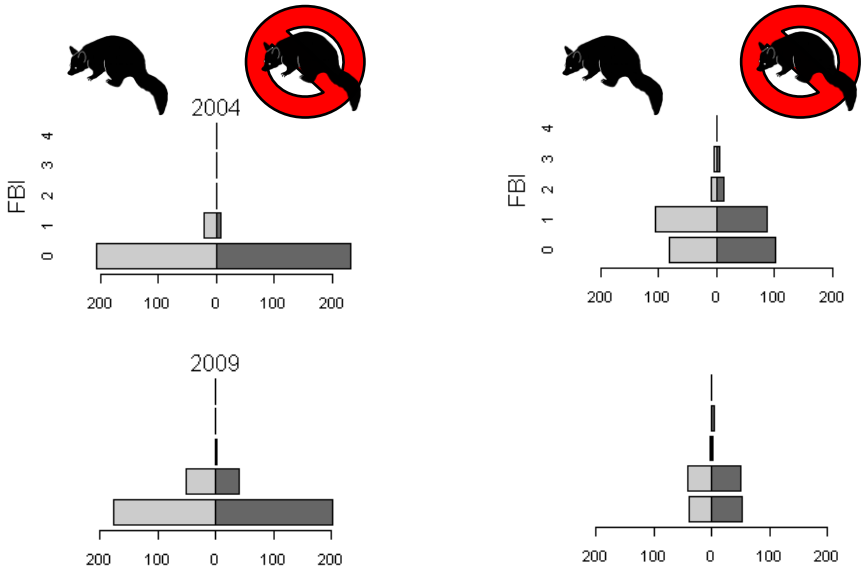
Lower mortality on treatment areas for heavier browsed species

Haast

S. digitata

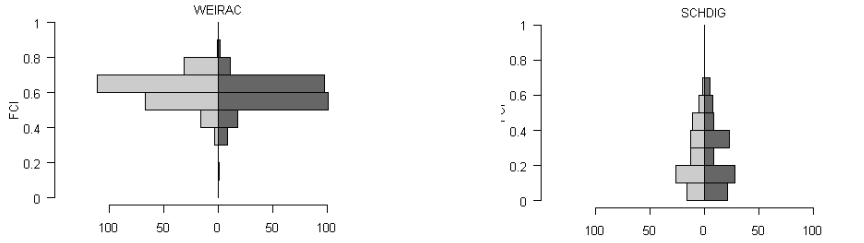
W. racemosa
Kāmahi

S. digitata
Patē

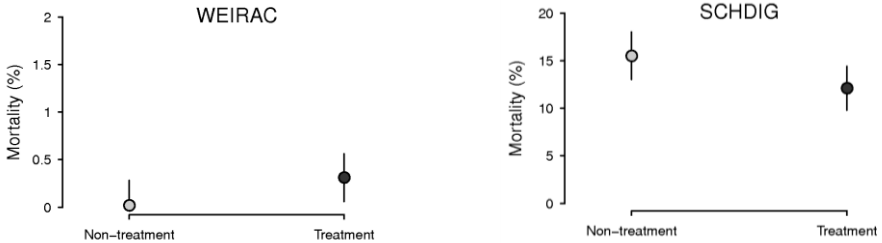


High browse on *S. digitata* in both areas

Control ceased before time 2

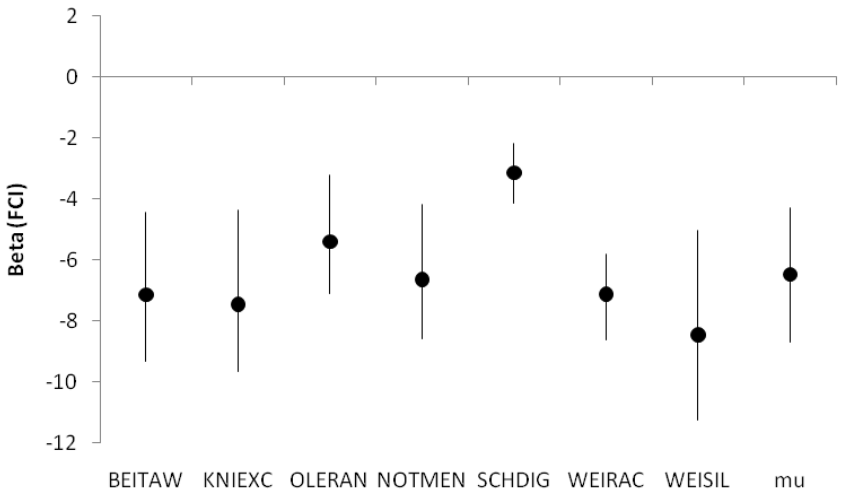


No difference in cover



High mortality in both areas for *S.digitata* *(evidence of lower in treatment area)*

Hierarchical model for tree mortality

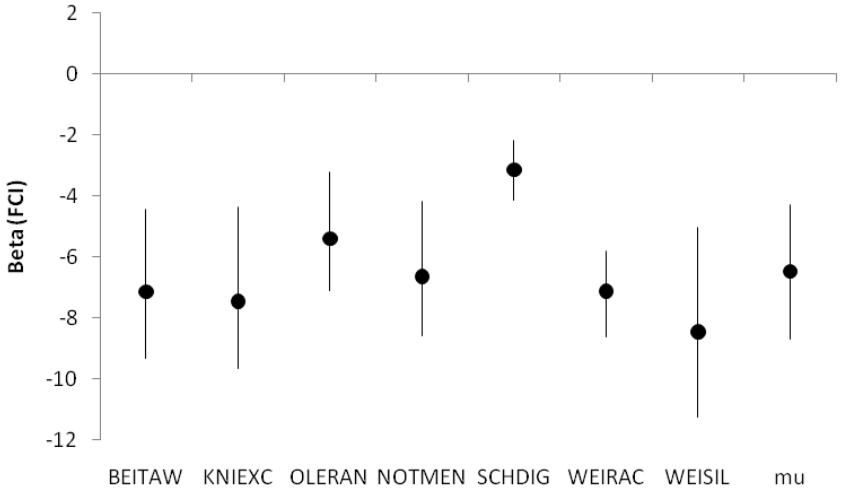


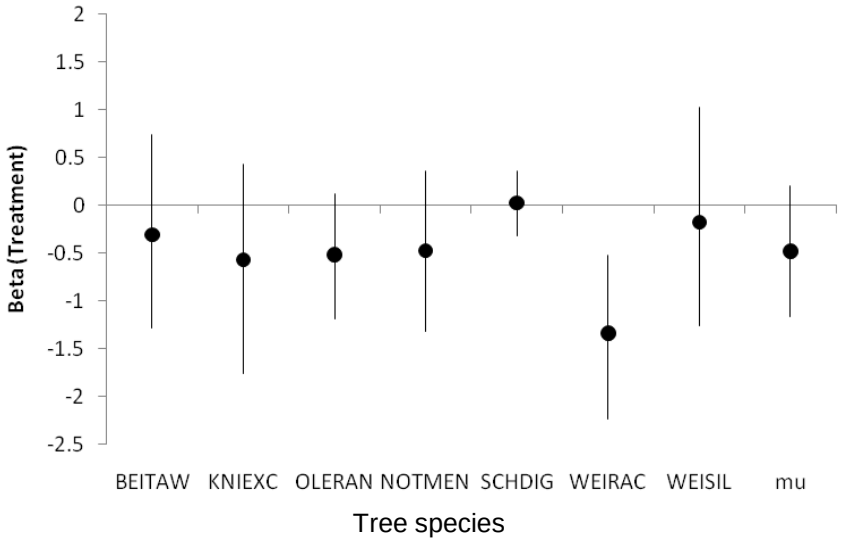
Lower tree mortality with

- Increasing foliage cover (FCI)

Co-efficient estimates and 95% credible intervals for the best model; β < 0 indicates a negative relationship

Hierarchical model for tree mortality



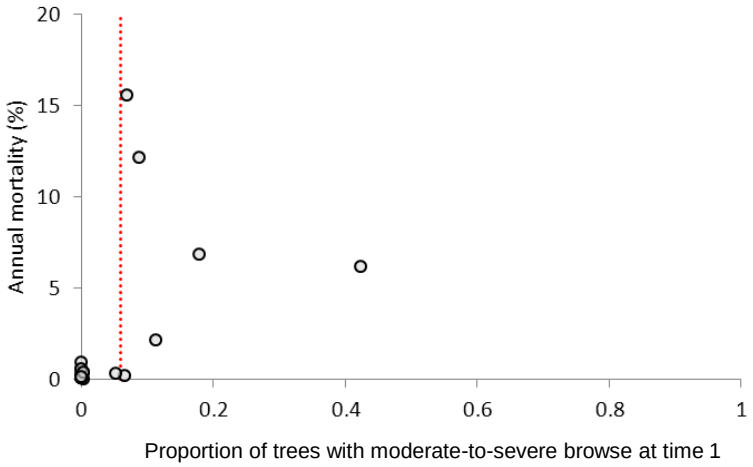


Lower tree mortality with

- Increasing foliage cover (FCI)
- Treatment

Co-efficient estimates and 95% credible intervals for the best model; β < 0 indicates a negative relationship

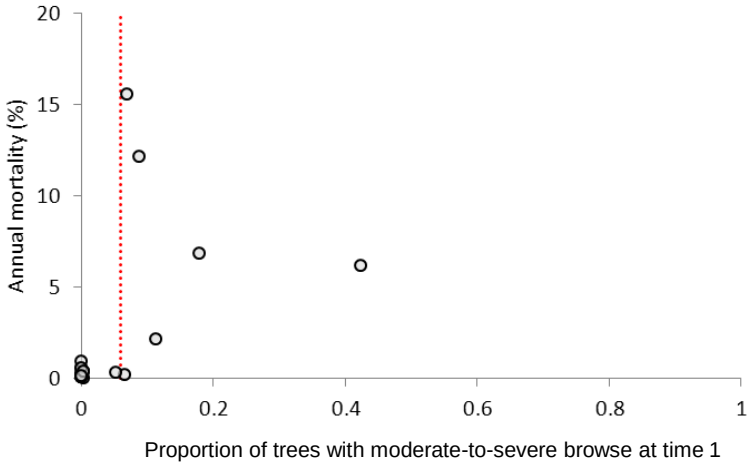
Mortality by browse (FBI) and cover (FCI)

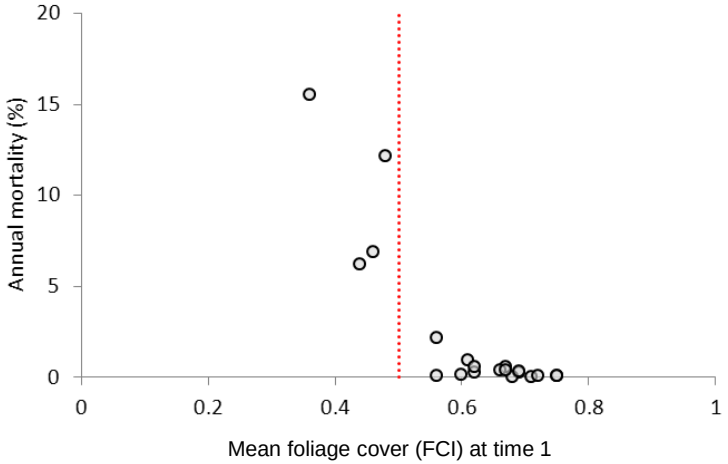


Higher tree mortality when

- Proportion of trees with ‘moderate to severe browse’ (FBI > 25%) is greater than 0.05

Mortality by browse (FBI) and cover (FCI)





Higher tree mortality when

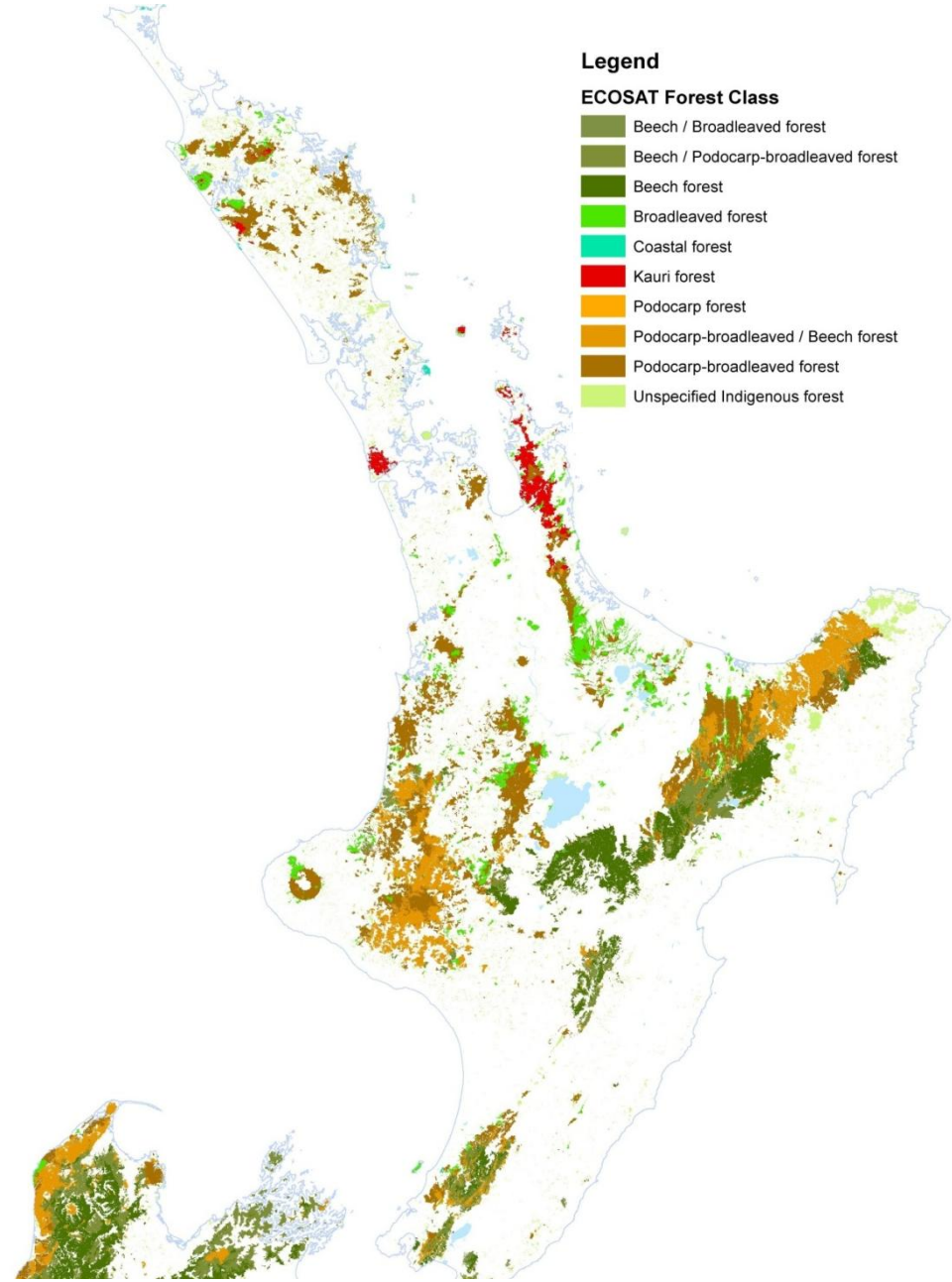
- Proportion of trees with ‘moderate to severe browse’ (FBI > 25%) is greater than 0.05
- Mean foliage cover <0.5

Conclusions

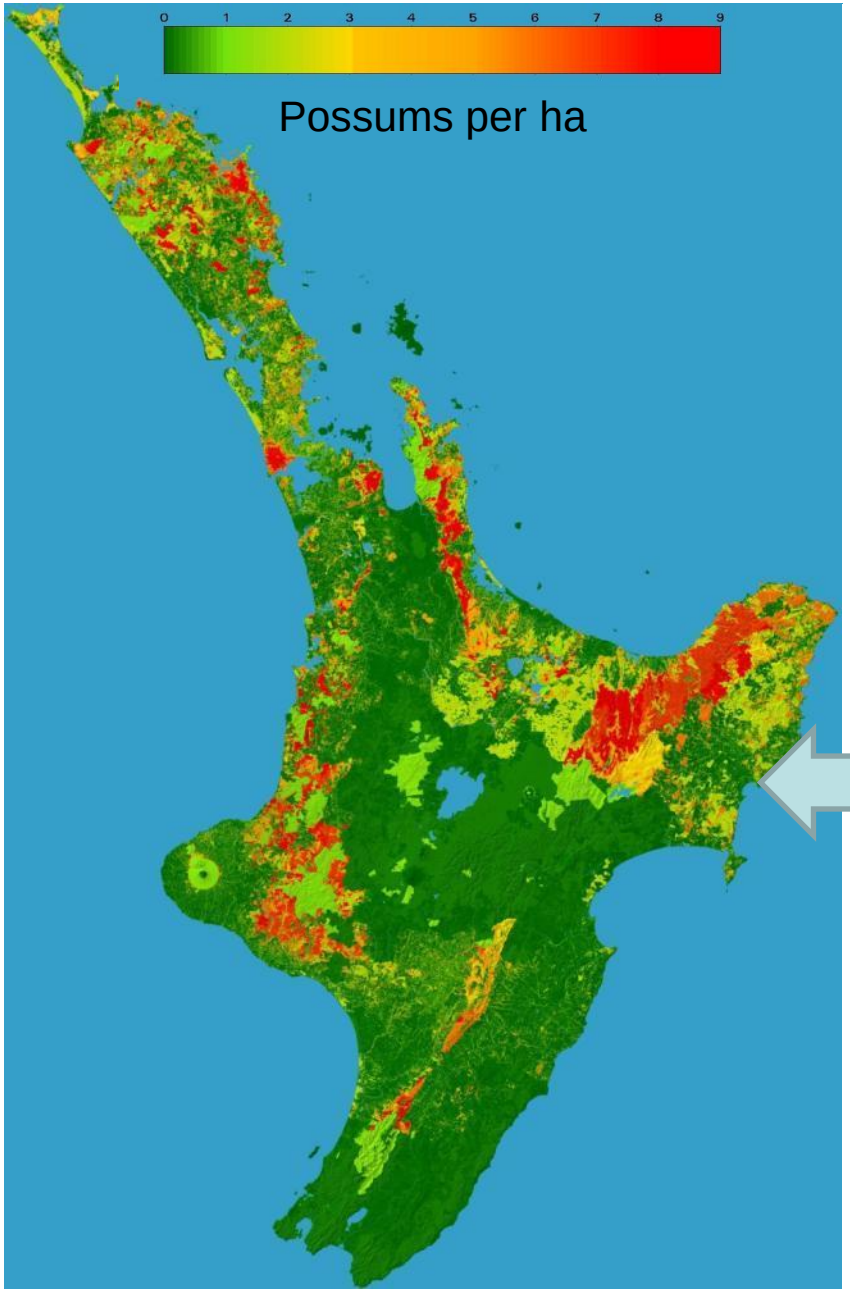
- Large-scale management experiment shows sustained control results in:
  - Decreased browse damage
  - Increased tree foliage
  - Decreased tree mortality (effect size can be large
- Browse damage is patchy between trees, sites and years
- Haast results highlights importance of continuing control during management experiment
  - Control at regular intervals required to prevent mortality increases

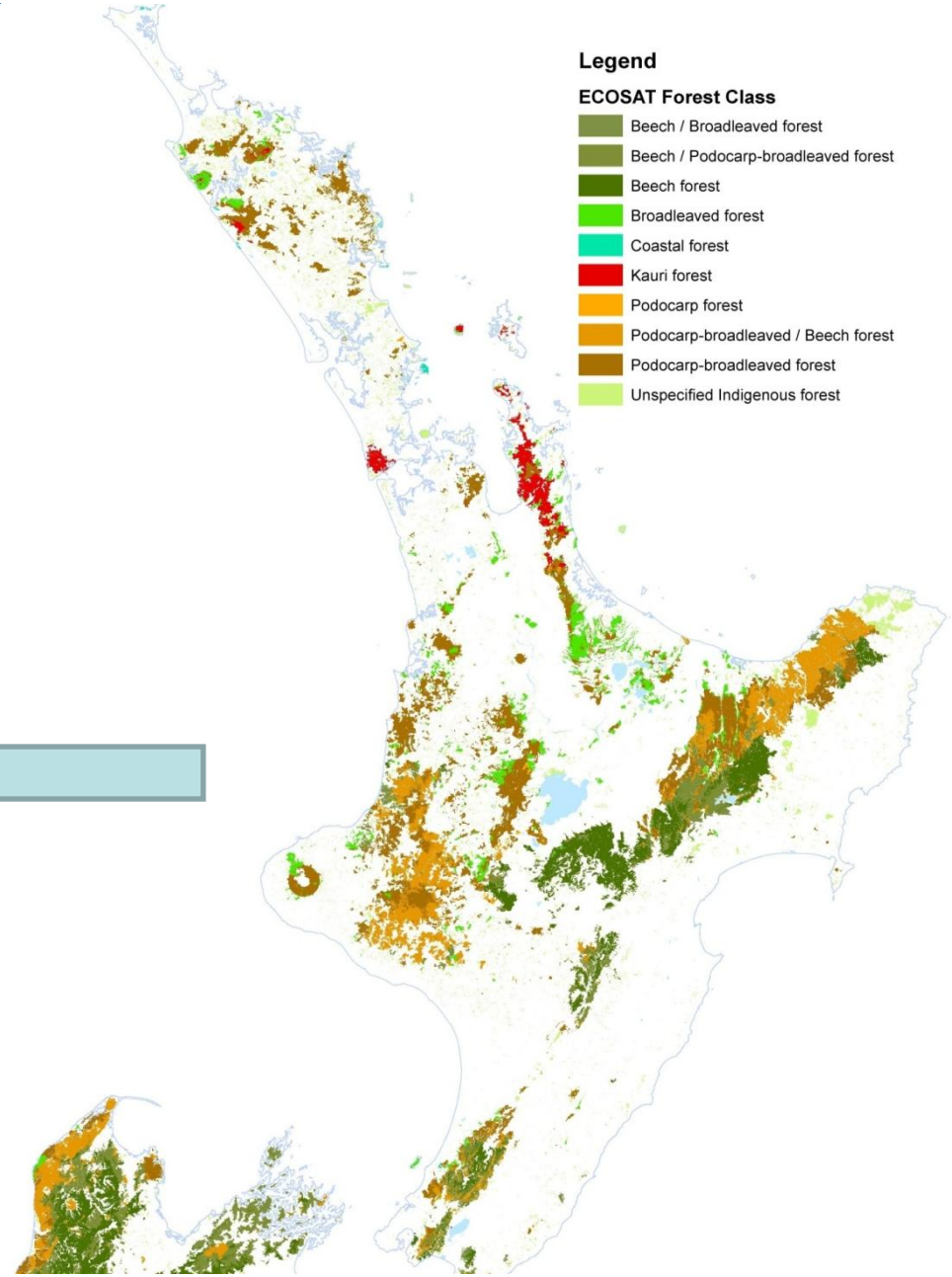
Future

- Nutritional analysis of tree foliage
  - Gain better understanding of site effects and soil fertility effects on canopy leaves
- Forest health conservation benefits of possum control (AHB + DOC)
  - Quantify and map improvements at a national scale
  - Builds on the National Possum Model and the Mechanistic Model of Possum Browse



James Shepherd et al.





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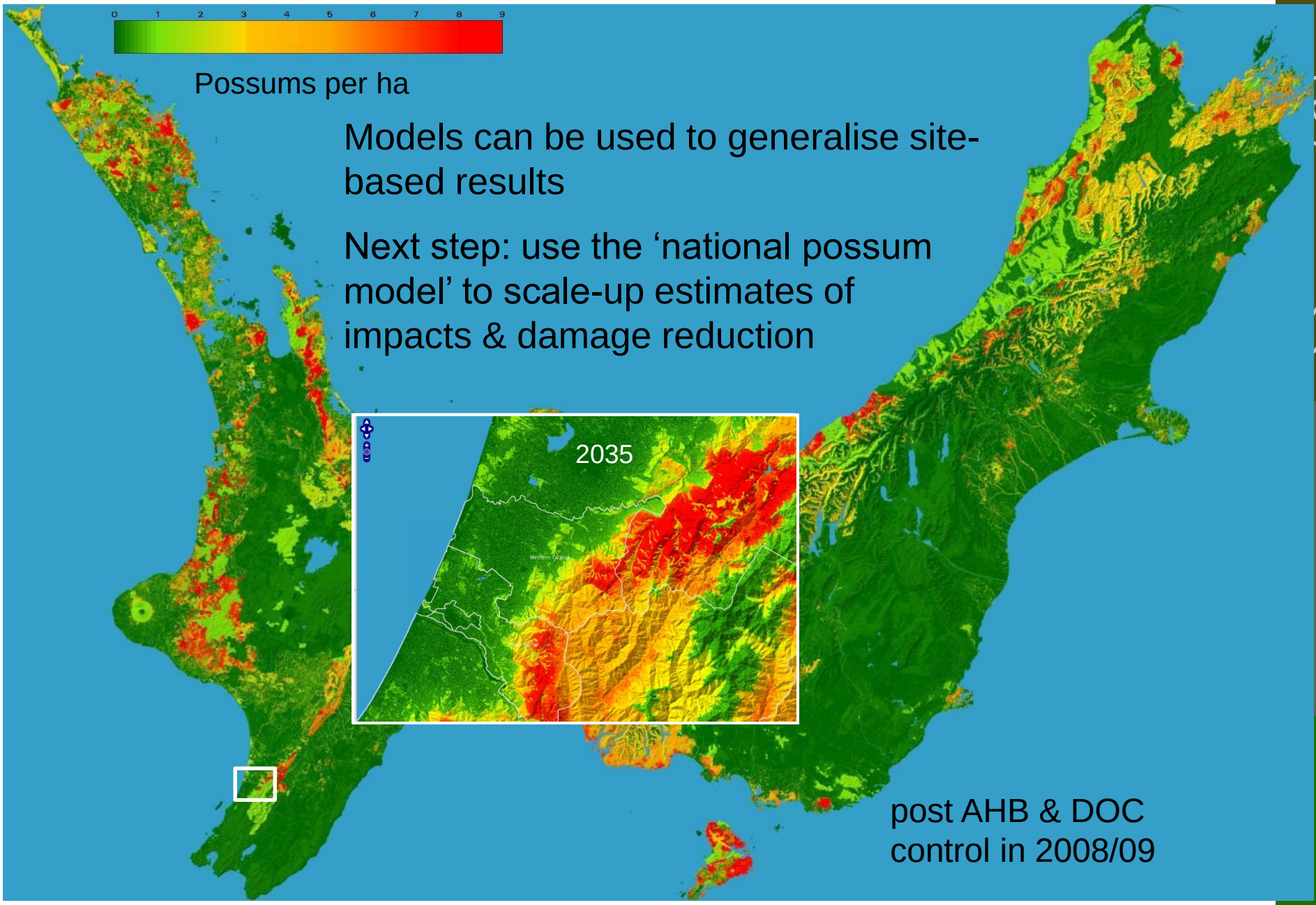
Estimated 30.3 million possums



James Shepherd et al.

Estimated 30.3 million possums

Acknowledgements

- Department of Conservation and Animal Health Board
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