



Landcare Research
Manaaki Whenua

PREDICTING BIODIVERSITY OUTCOMES OF PEST CONTROL IN DRYLAND ENVIRONMENTS



Complex interactions



Complex interactions

- Channel Islands – feral pigs, golden eagles, island fox, spotted skunk (Roemer et al. 2002)
- Macquarie Island – cats, rabbits, parakeets (Taylor 1979)
- Little Barrier Island – cats, rats, petrels (Rayner et al. 2007)
- Non-linear, indirect effects of food web interactions can produce counter-intuitive changes (Sinclair & Byrom 2006)
- Important to better understand ecological interactions.... to avoid unwanted consequences...after the removal of particular species (Clout & Russell 2008)

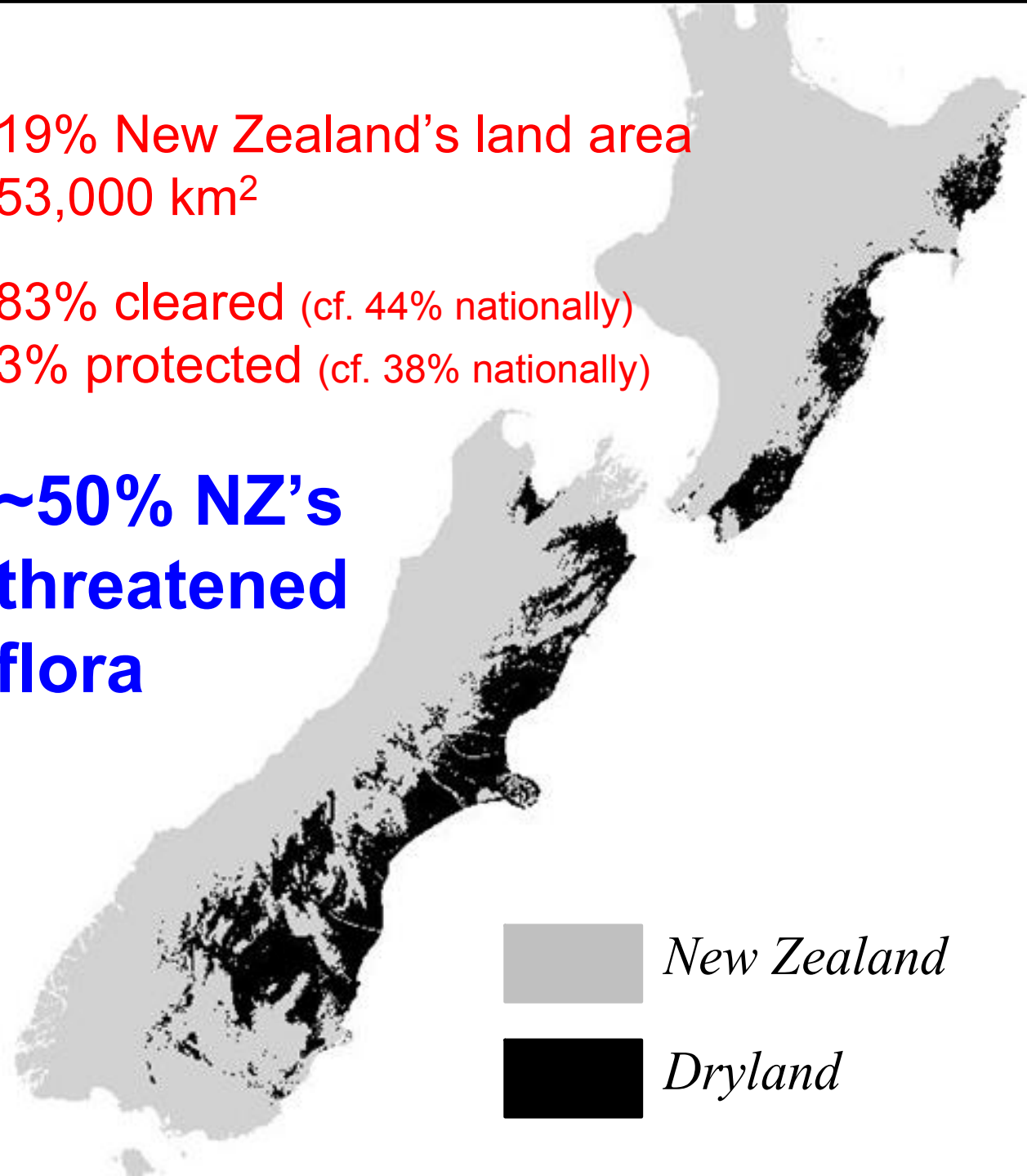


New Zealand's renowned dryland landscapes

19% New Zealand's land area
53,000 km²

83% cleared (cf. 44% nationally)
3% protected (cf. 38% nationally)

**~50% NZ's
threatened
flora**



 *New Zealand*

 *Dryland*





Native biological diversity





Predators





Top predators

HYPERPREDATION



Herbivores

Mesopredators

Invertebrates ↔ Lizards



Pasture/seed/fruit

CLIMATE

SHEEP





Top predators

Insectivores



Herbivores

Mesopredators

Invertebrates ↔ Lizards



Pasture/seed/fruit



SHEEP



CLIMATE





Top predators

Insectivores



**MESOPREDATOR
RELEASE**



Herbivores

Mesopredators

Invertebrates ↔ Lizards



Pasture/seed/fruit



SHEEP

CLIMATE



Top predators

Insectivores

TROPHIC CASCADE



Herbivores

Mesopredators

Invertebrates ↔ Lizards



Pasture/seed/fruit



SHEEP



CLIMATE





Top predators

Insectivores



Herbivores

Mesopredators

Invertebrates ↔ Lizards



Pasture/seed/fruit



SHEEP



CLIMATE





Top predators

COMPETITION

Insectivores

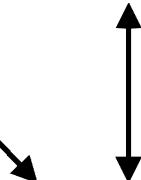


Herbivores

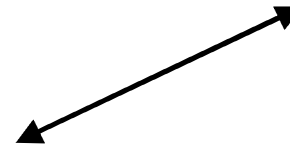
Mesopredators



Invertebrates ↔ Lizards



Pasture/seed/fruit



CLIMATE

SHEEP



Top predators

Insectivores



Herbivores

Mesopredators

Invertebrates ↔ Lizards



Pasture/seed/fruit

BOTTOM-UP

CLIMATE

SHEEP





Top predators

Insectivores



TOP-DOWN



Herbivores

Mesopredators



Invertebrates ↔ Lizards



Pasture/seed/fruit



SHEEP

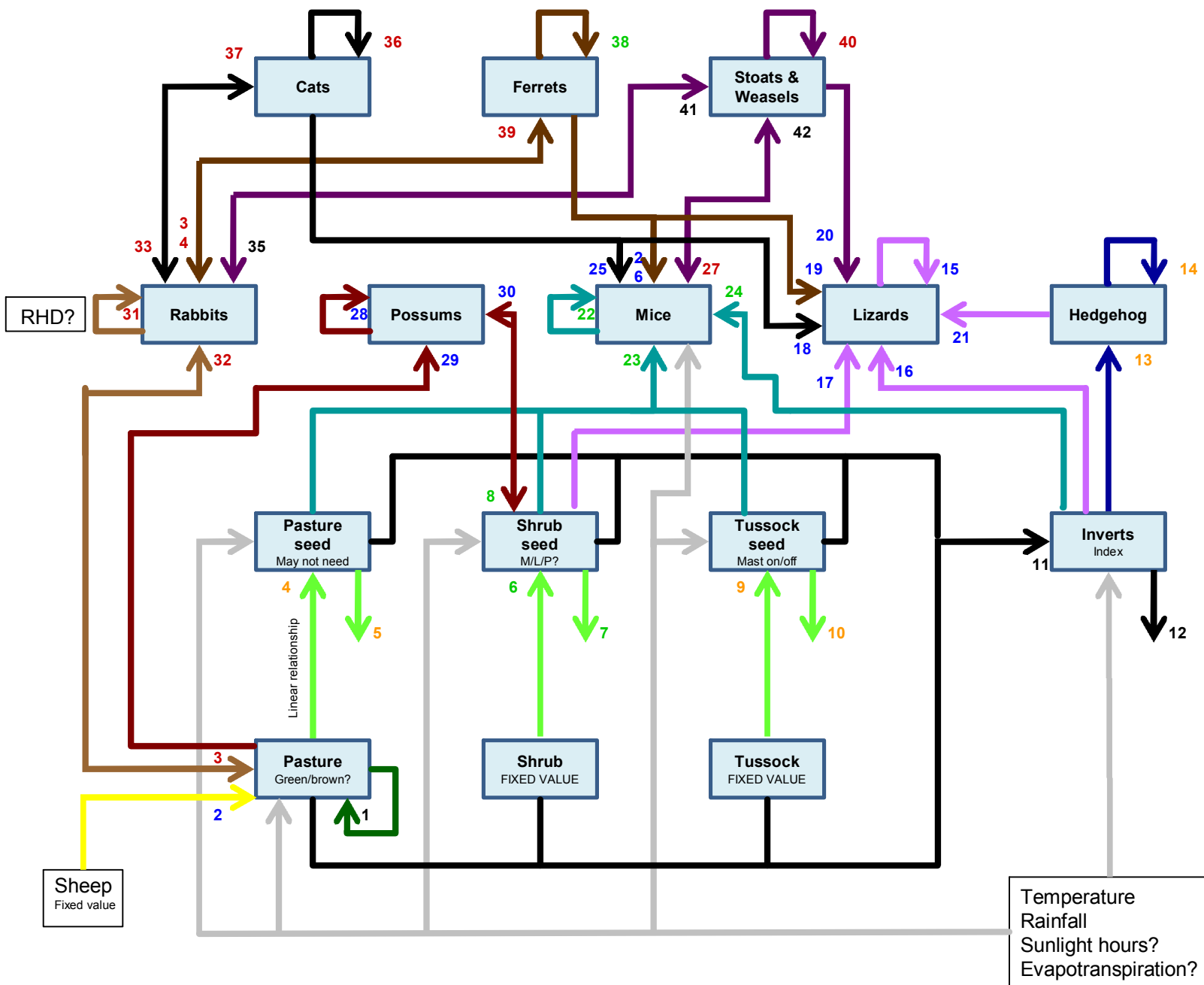


CLIMATE



Arrowhead
Number
Colour:

Dan
Roger
Andrea
Grant
James



Aims

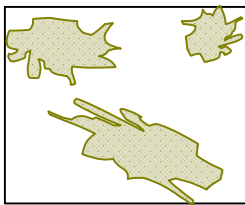
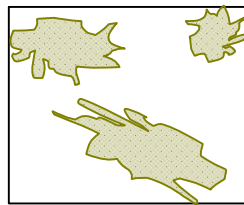
1. Understand ecosystem function so managers can predict effects of.....
  - pest control
  - de-stocking
  - habitat change
  - climatic events.....on other pests and native species
2. Identify pest management strategies that maximise benefits for a given cost

Approach

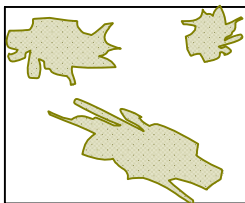
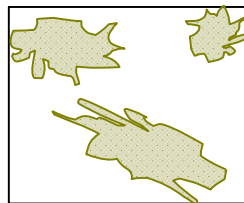
- Interactive modelling
- Existing data
- Large-scale experiment

+ Predators

– Predators



Rep #1



Rep #2

(500-ha sites)

Three management scenarios

1. Top-order predator control
2. Rabbit control
3. Sheep removal



Top predators

Insectivores



Herbivores

Mesopredators

Invertebrates ↔ Lizards



Pasture/seed/fruit



SHEEP



CLIMATE





Top predators

Insectivores



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Mesopredators

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Pasture/seed/fruit



SHEEP



CLIMATE





Top predators

Insectivores



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Invertebrates ↔ Lizards



Pasture/seed/fruit

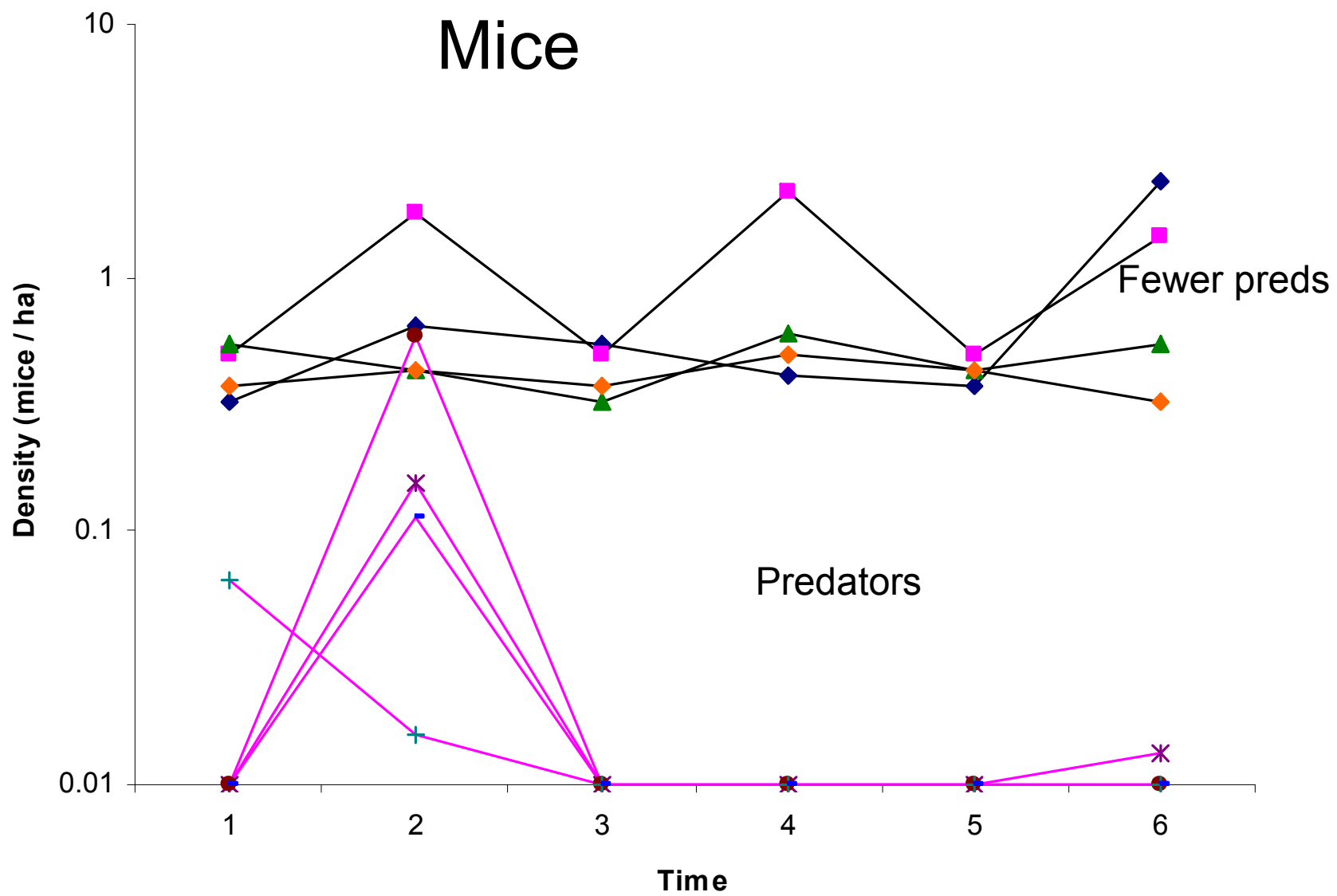


SHEEP

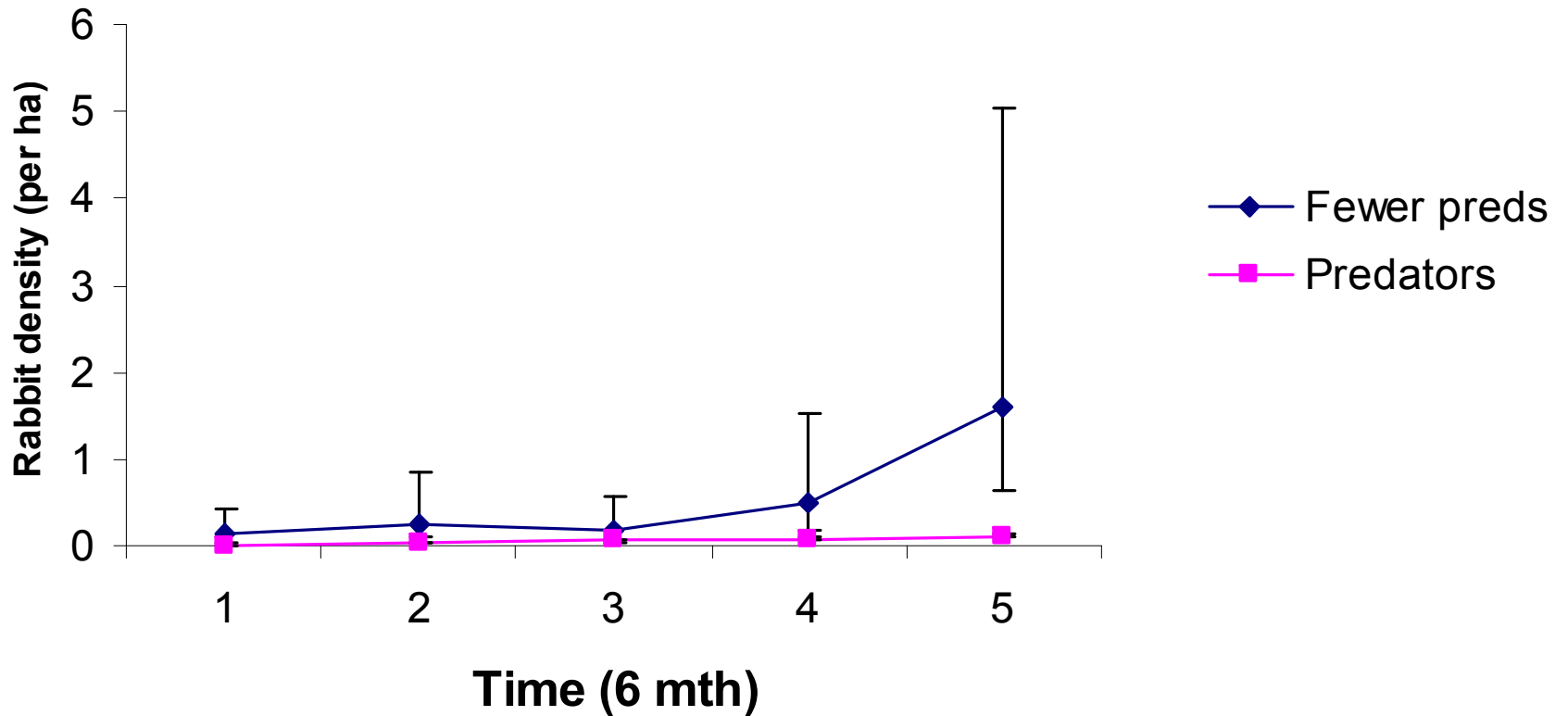


CLIMATE





Rabbits



Three scenarios

1. Top-order predator control
2. Rabbit control
3. Sheep removal



Top predators

Insectivores



Herbivores

Mesopredators

Invertebrates ↔ Lizards



Pasture/seed/fruit



SHEEP



CLIMATE



Three scenarios

1. Top-order predator control
2. Rabbit control
3. Sheep removal



Top predators

Insectivores



Herbivores

Mesopredators

Invertebrates ↔ Lizards

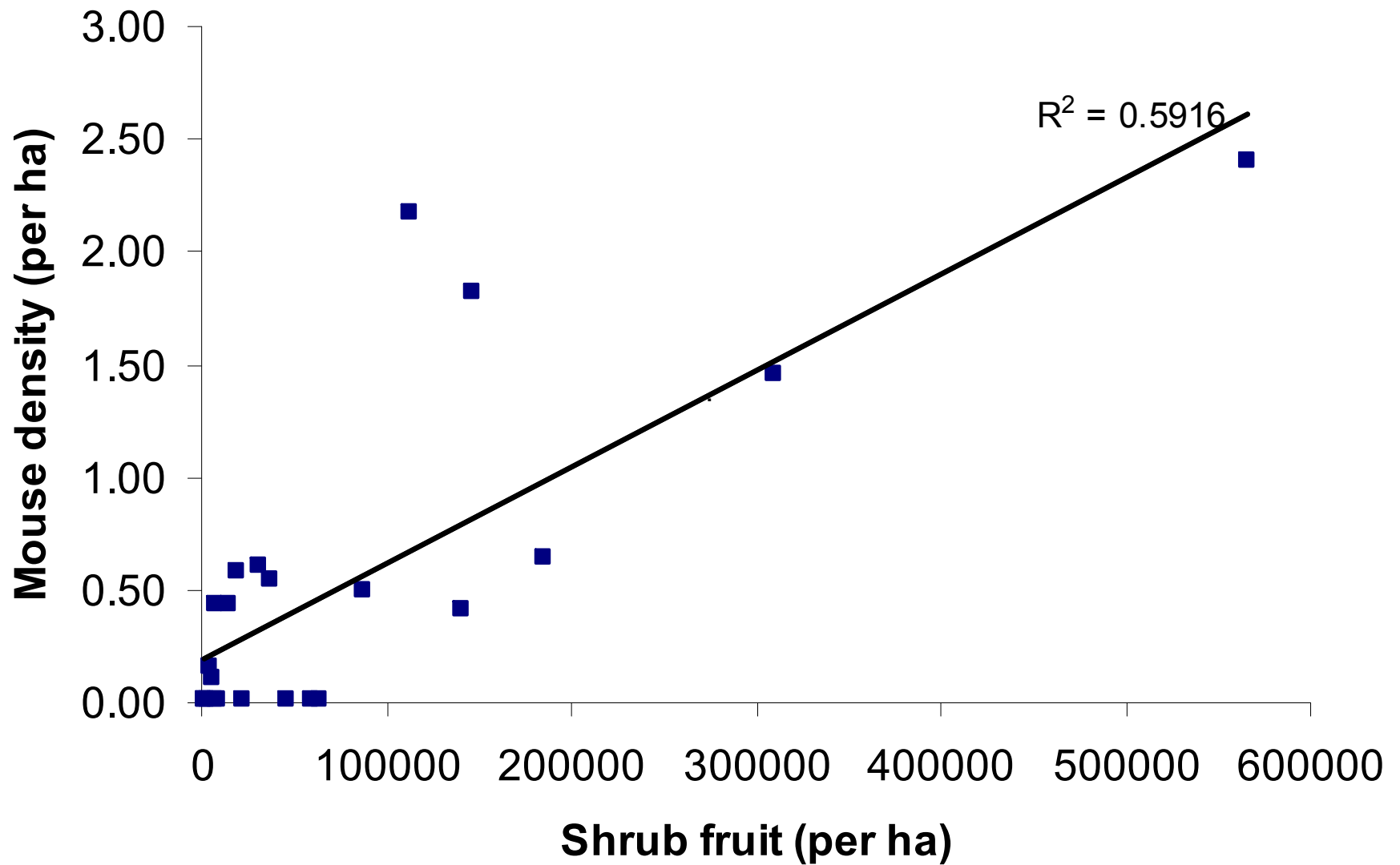


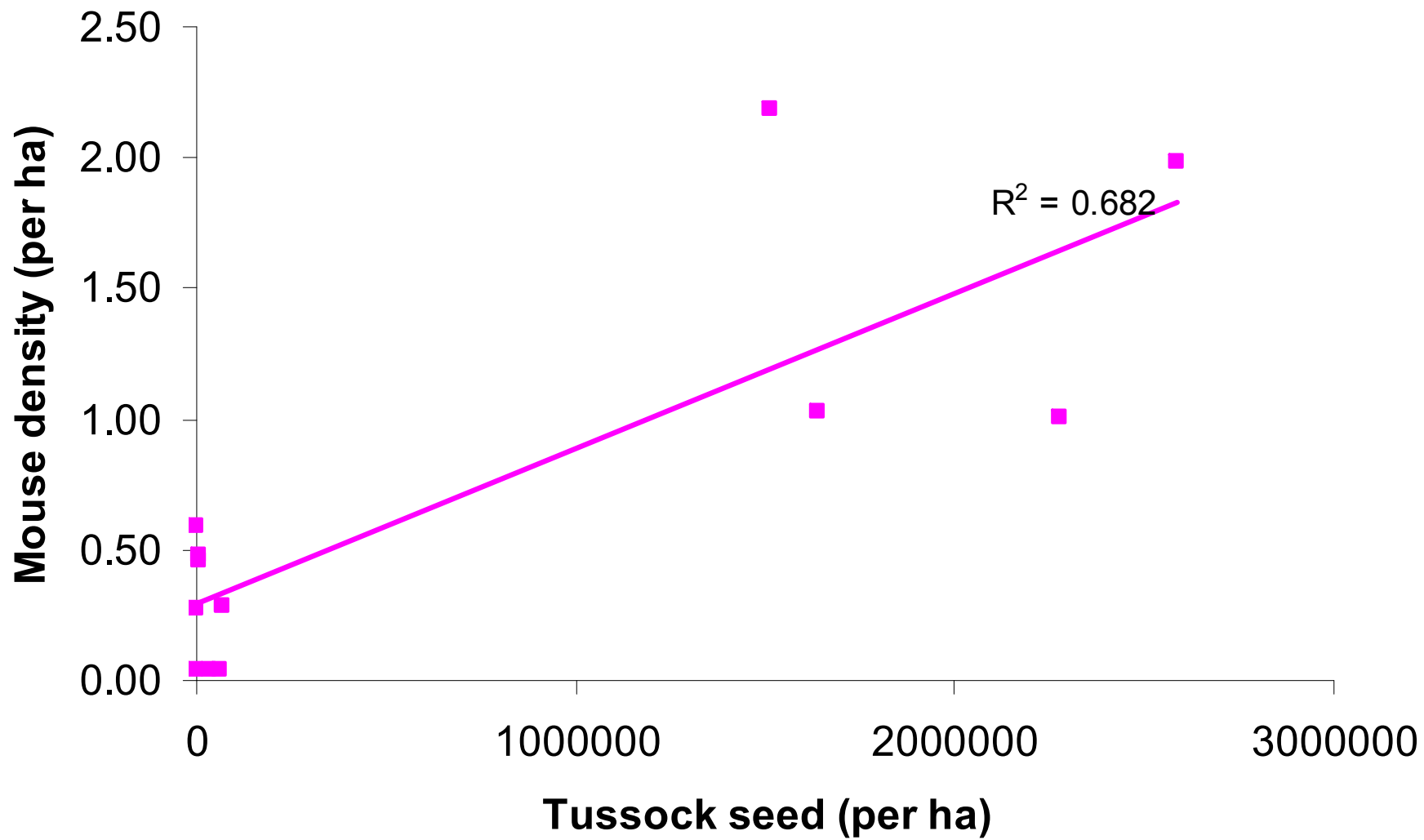
Pasture/seed/fruit



SHEEP

CLIMATE







Top predators

Insectivores



Herbivores

Mesopredators

Invertebrates ↔ Lizards



Pasture/seed/fruit

~~SHLEP~~



CLIMATE





Top predators

Insectivores



Herbivores



Mesopredators



Invertebrates ↔ Lizards



Pasture/seed/fruit

~~SHLEP~~



CLIMATE

Mana Island



Top predators

Insectivores



Herbivores



Mesopredators



Invertebrates ↔ Lizards

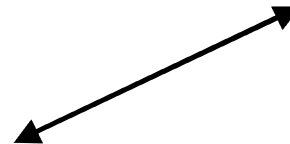


Pasture/seed/fruit



CLIMATE

~~SHEEP~~



Pukerua Bay



Top predators

Insectivores



Herbivores

Mesopredators



Invertebrates ↔ Lizards



Pasture/seed/fruit



CLIMATE

~~SHEEP~~

Lizards showing little response to removal of top predators

1. Offset by responses of other pests?
2. Treatment areas too small?

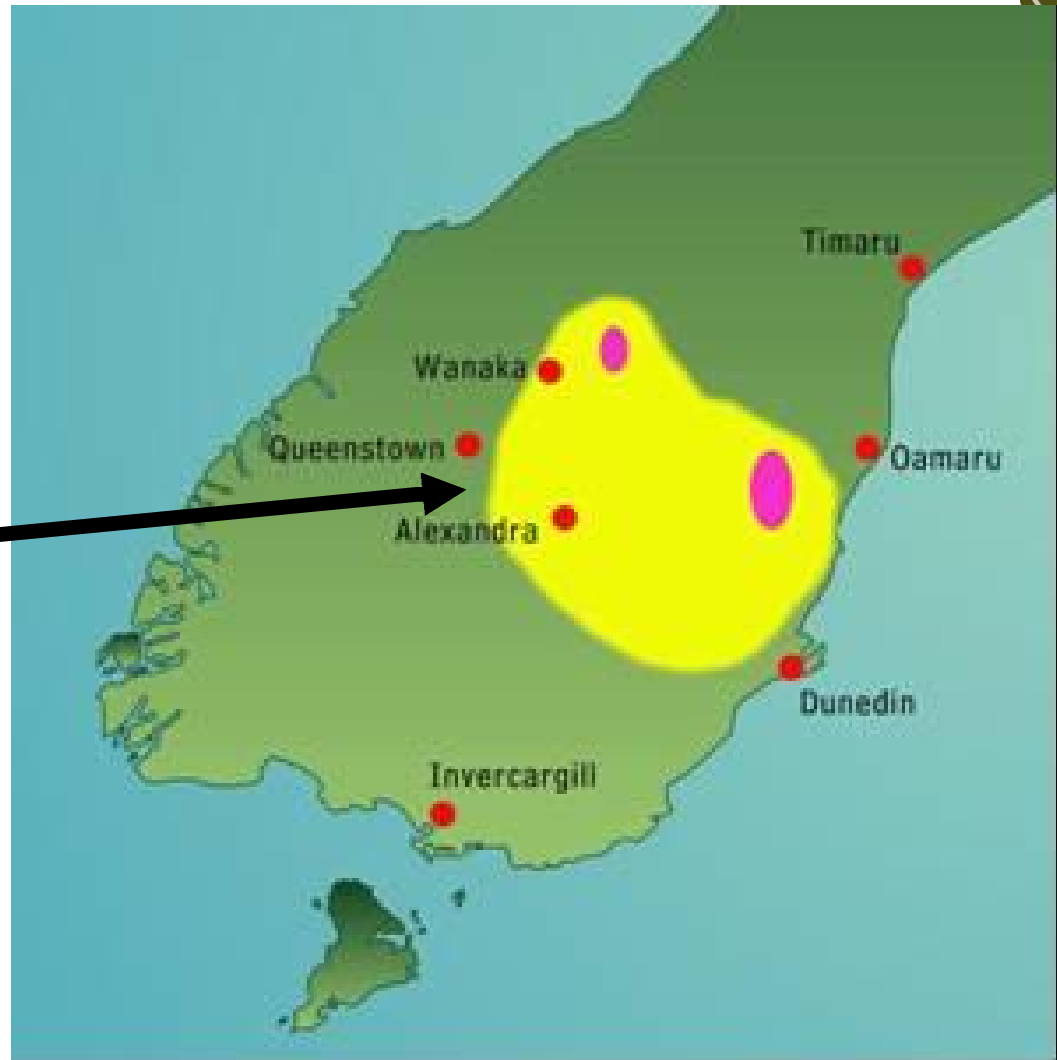


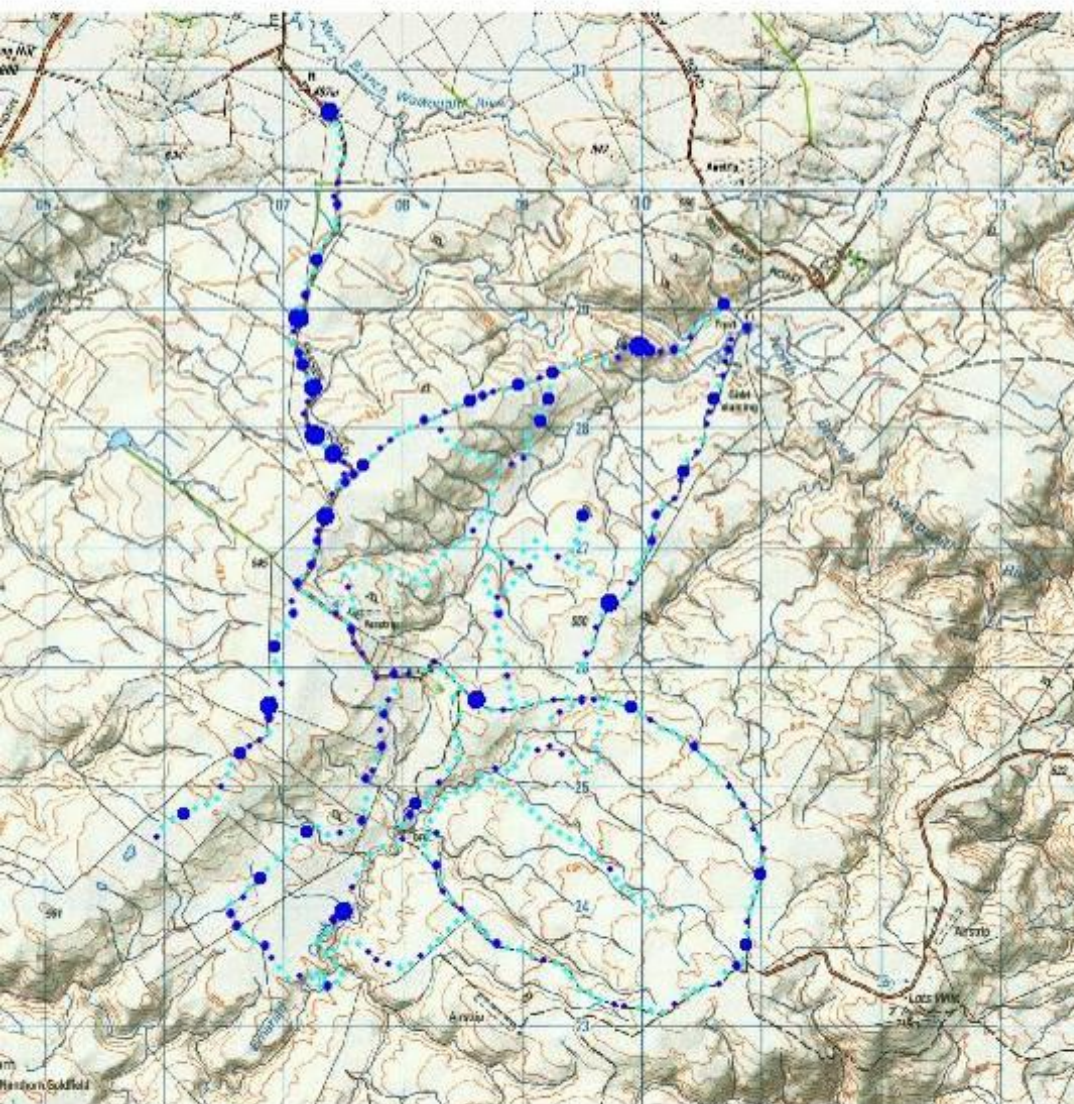
Grand and Otago Skink Recovery Programme

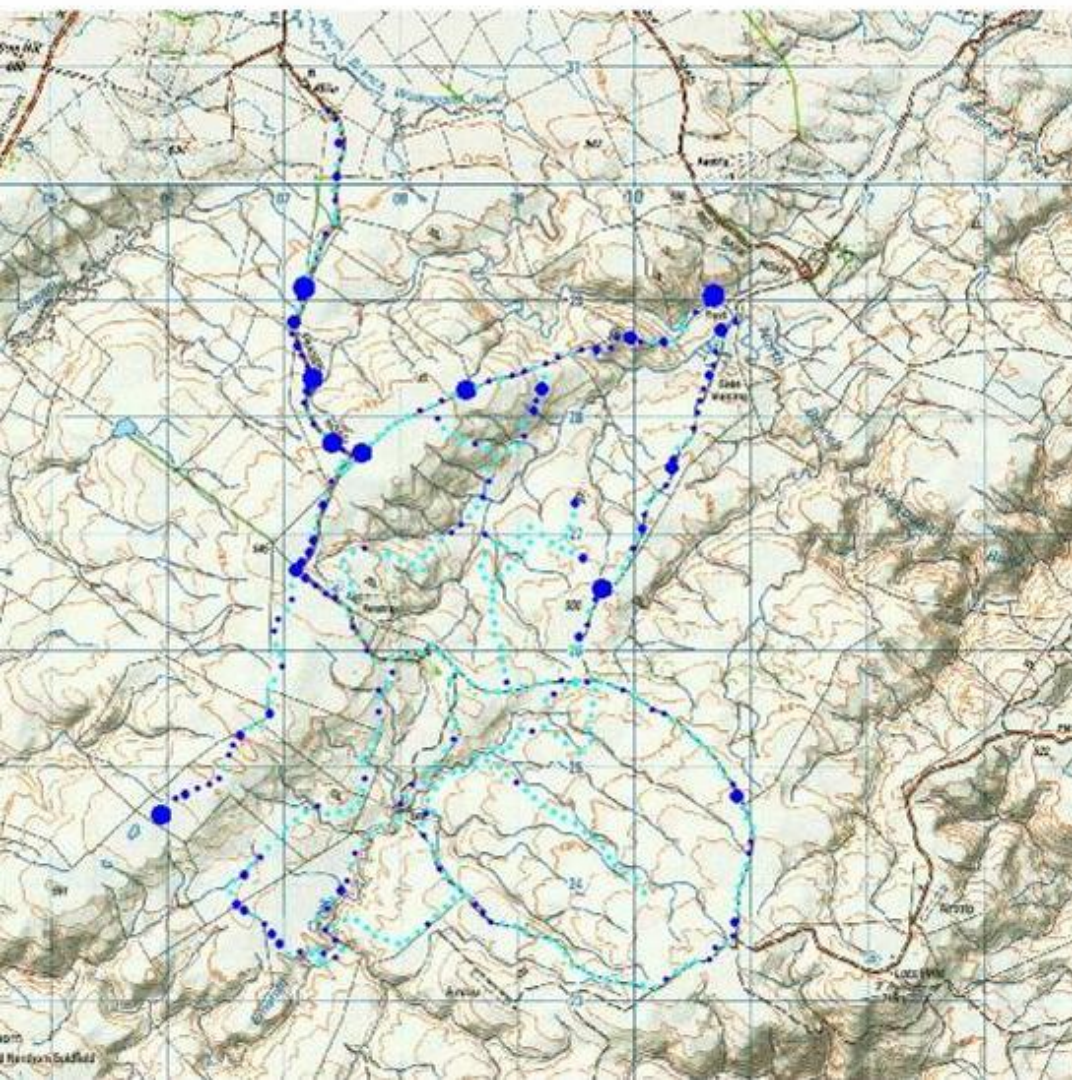


Distribution

**Extinct from
> 90% of
former range**







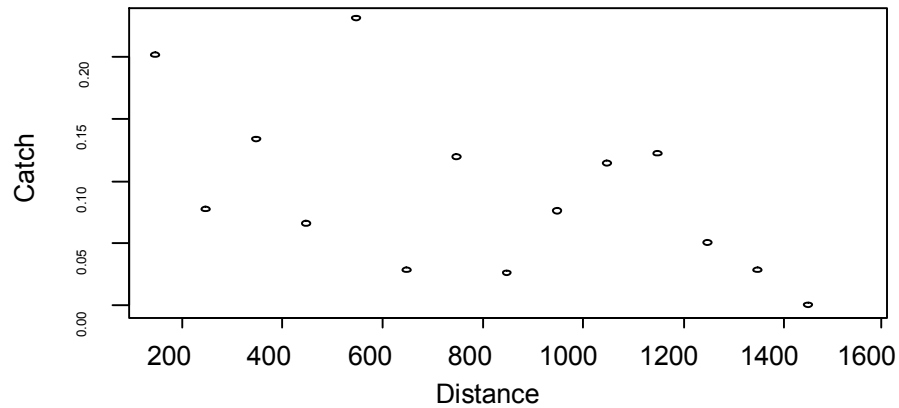
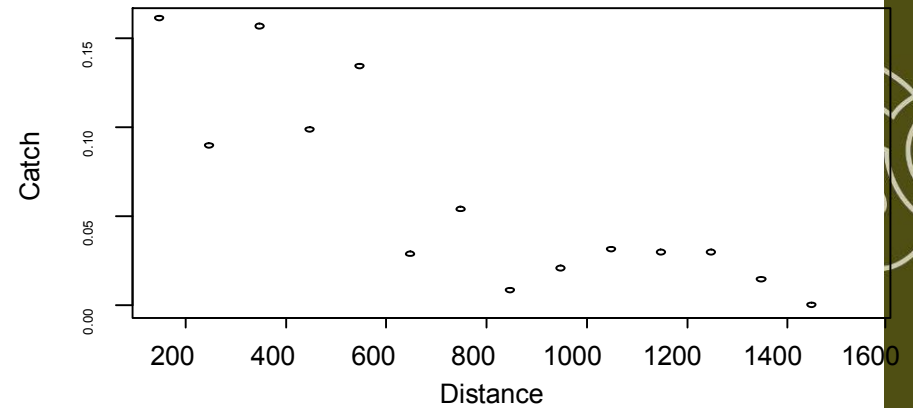
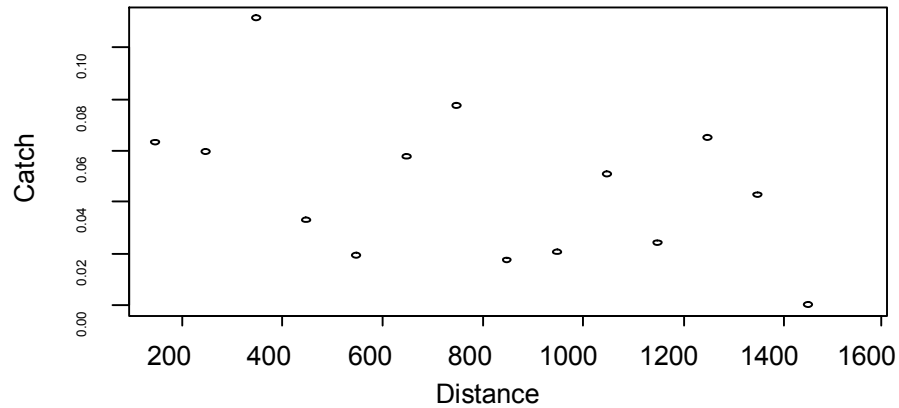
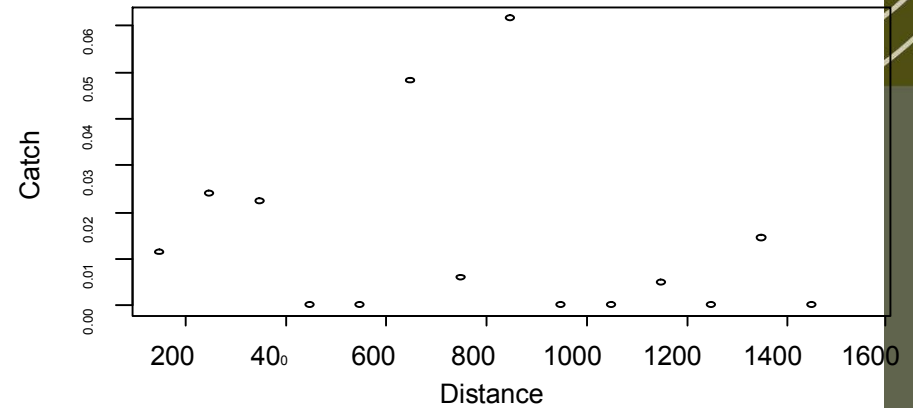
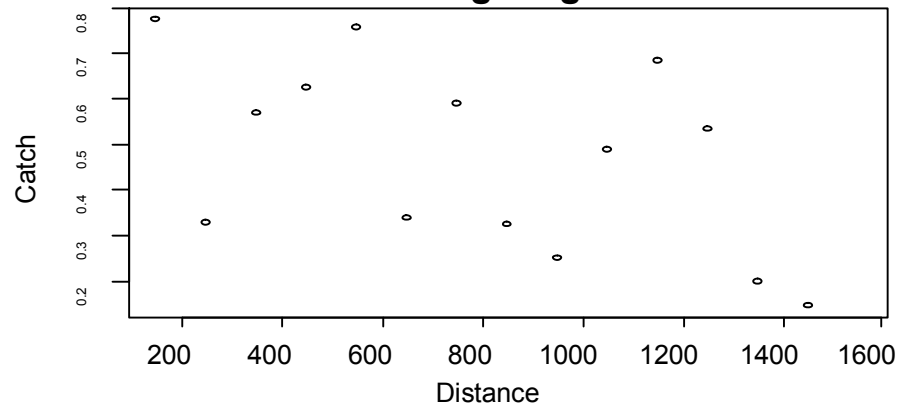
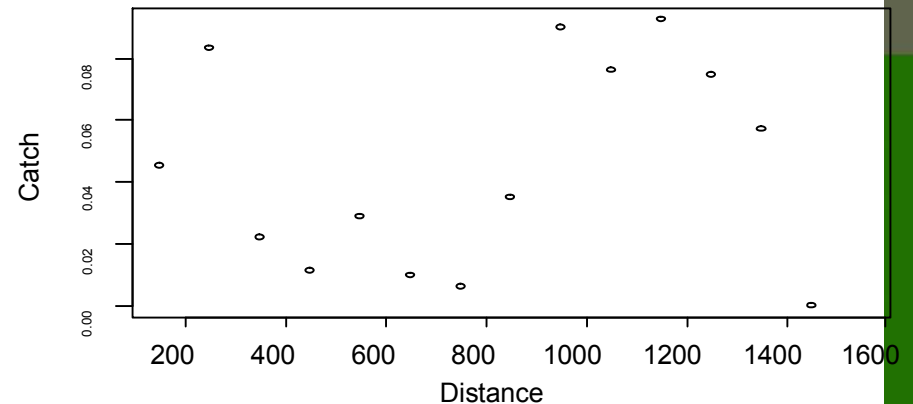
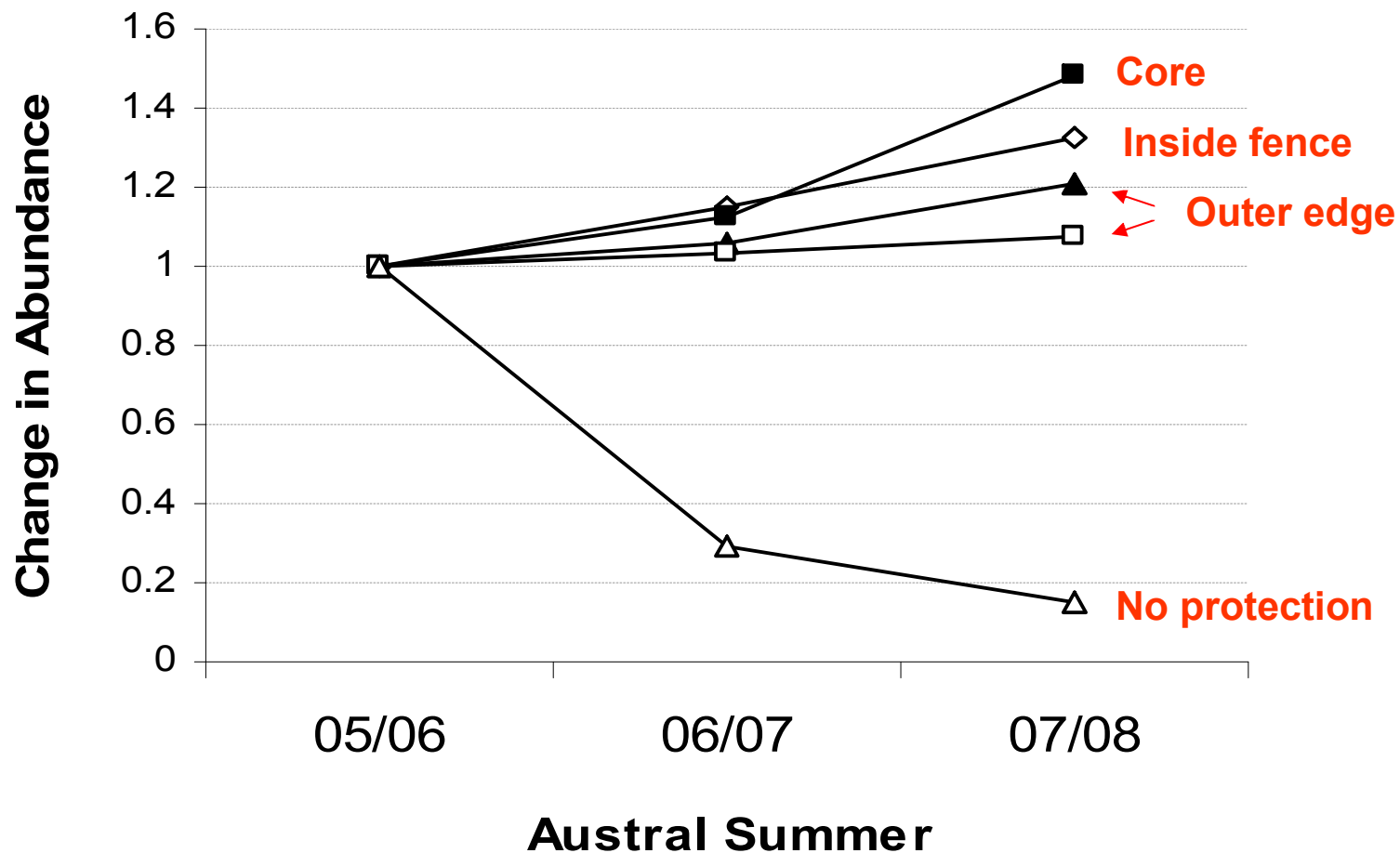
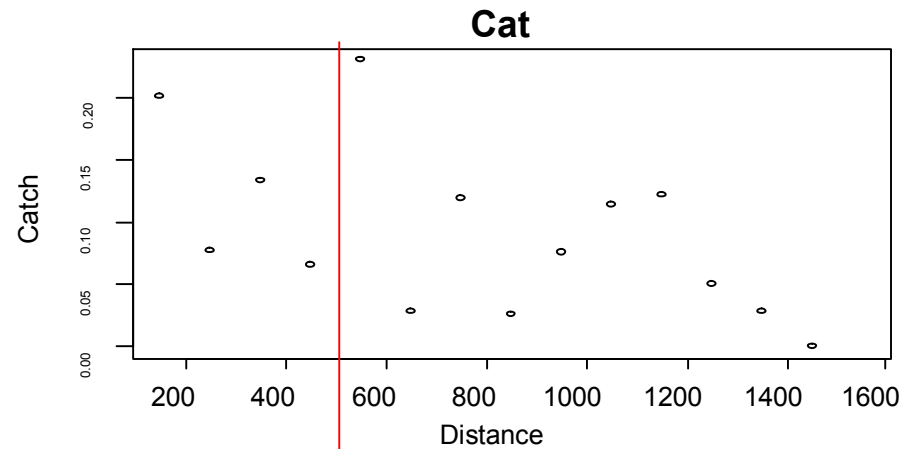
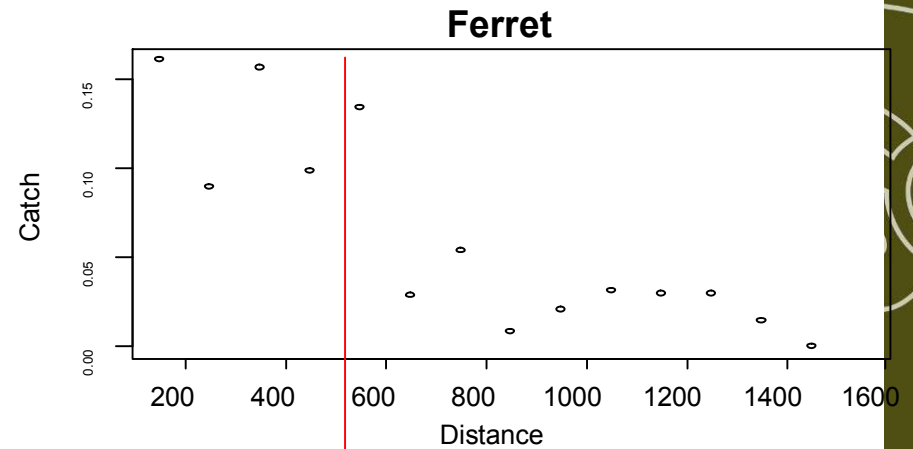
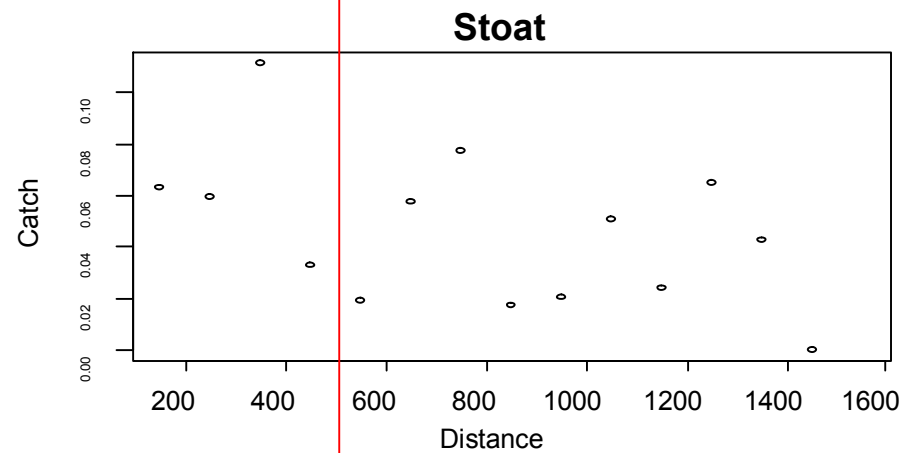
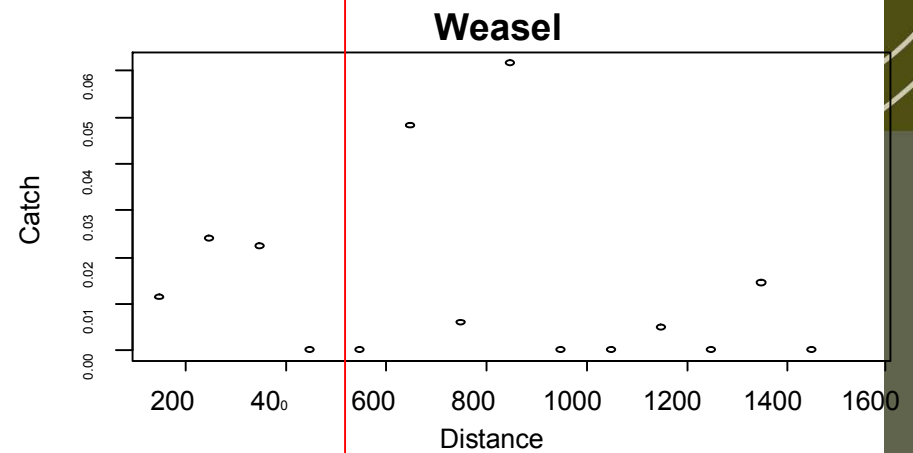
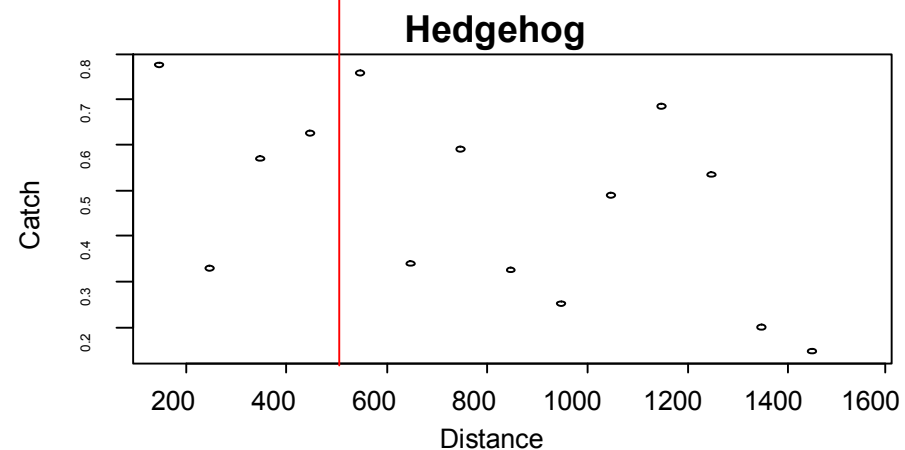
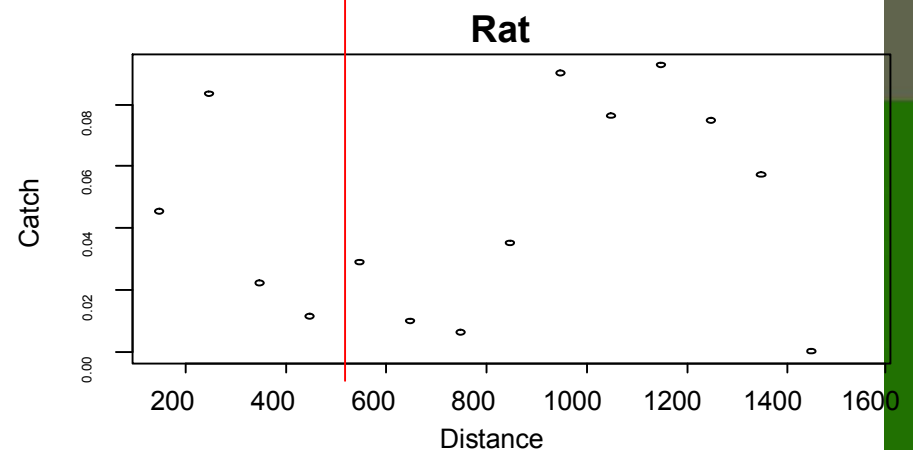
Cat**Ferret****Stoat****Weasel****Hedgehog****Rat**



Photo-resight monitoring

Grand Skink Mean Abundance as a Function of Initial Population Size





At least 1.2 km wide buffer of traps
required around skink habitat



Lizards showing little response to removal of top predators



Lizards showing little response to removal of top predators

1. Offset by responses of other pests?
2. Treatment areas too small?
3. Other processes more important in dry modified habitats?



Mokomoko Dryland Sanctuary



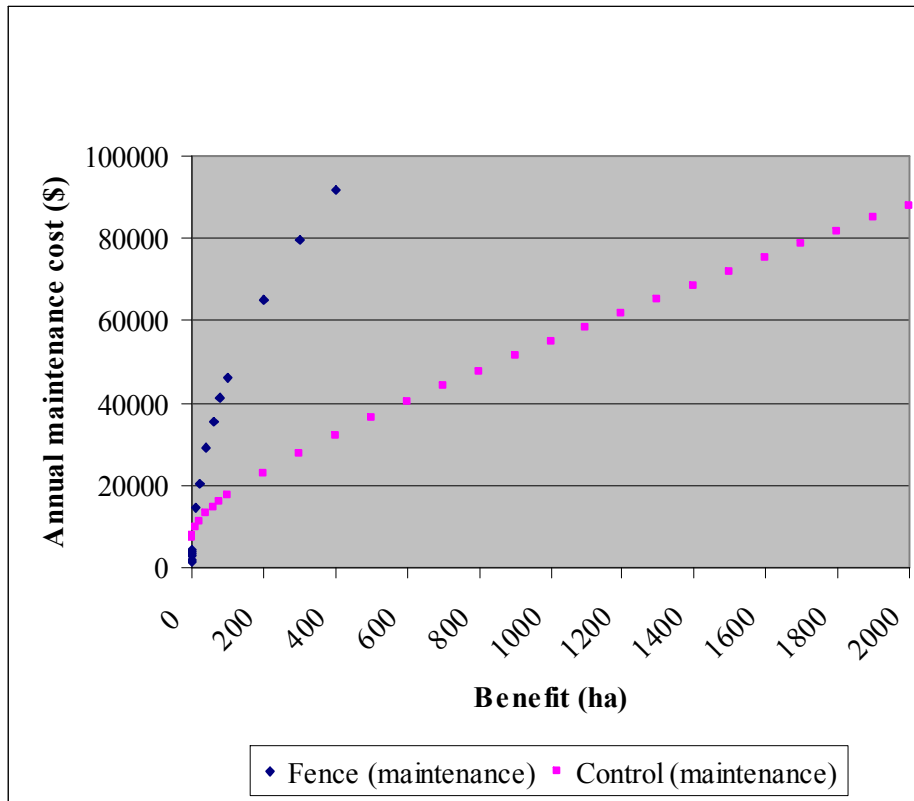






Longer-term planning

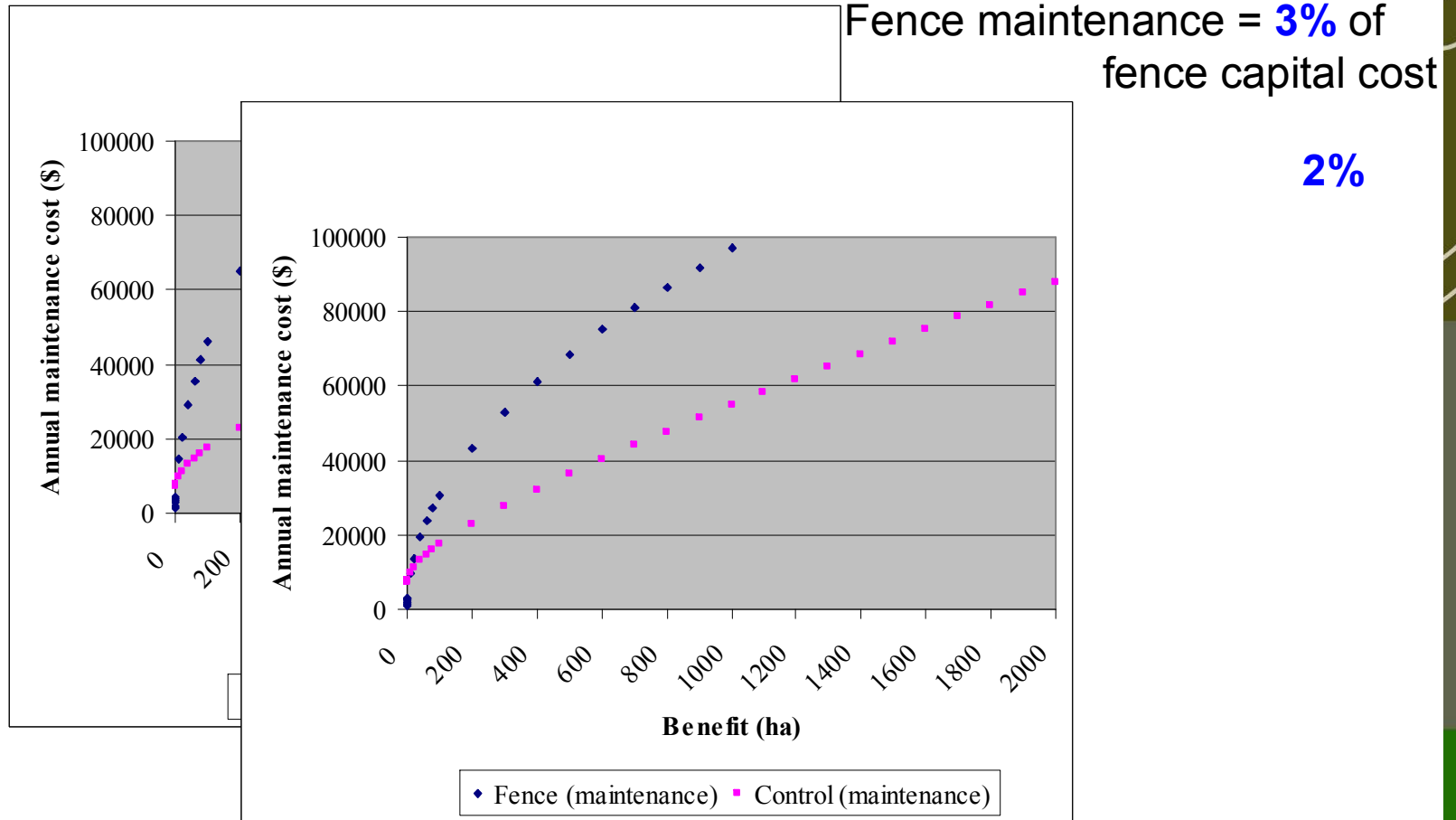
Cost-Benefit modelling



Fence maintenance = **3%** of
fence capital cost

Longer-term planning

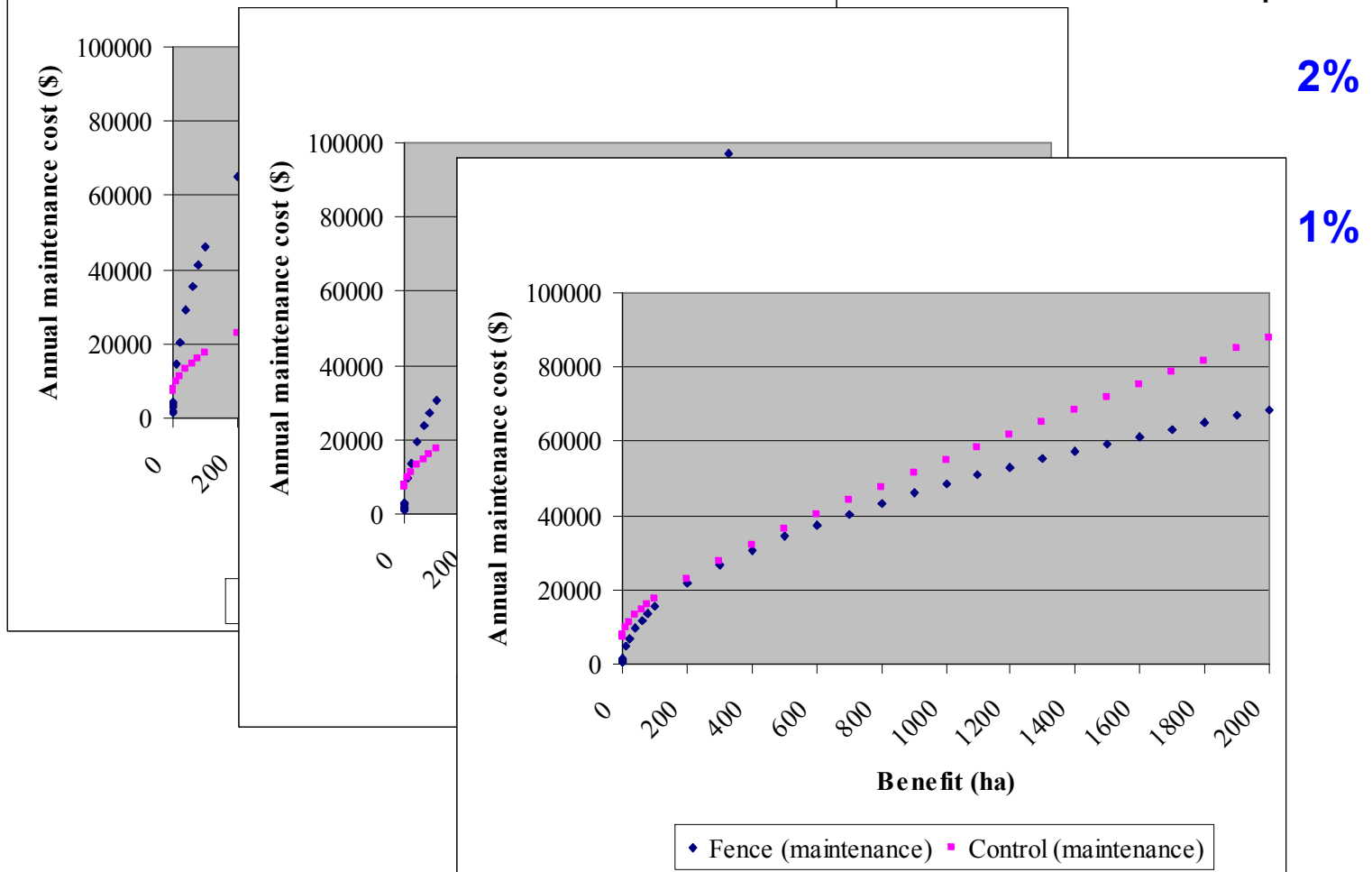
Cost-Benefit modelling



Longer-term planning

Cost-Benefit modelling

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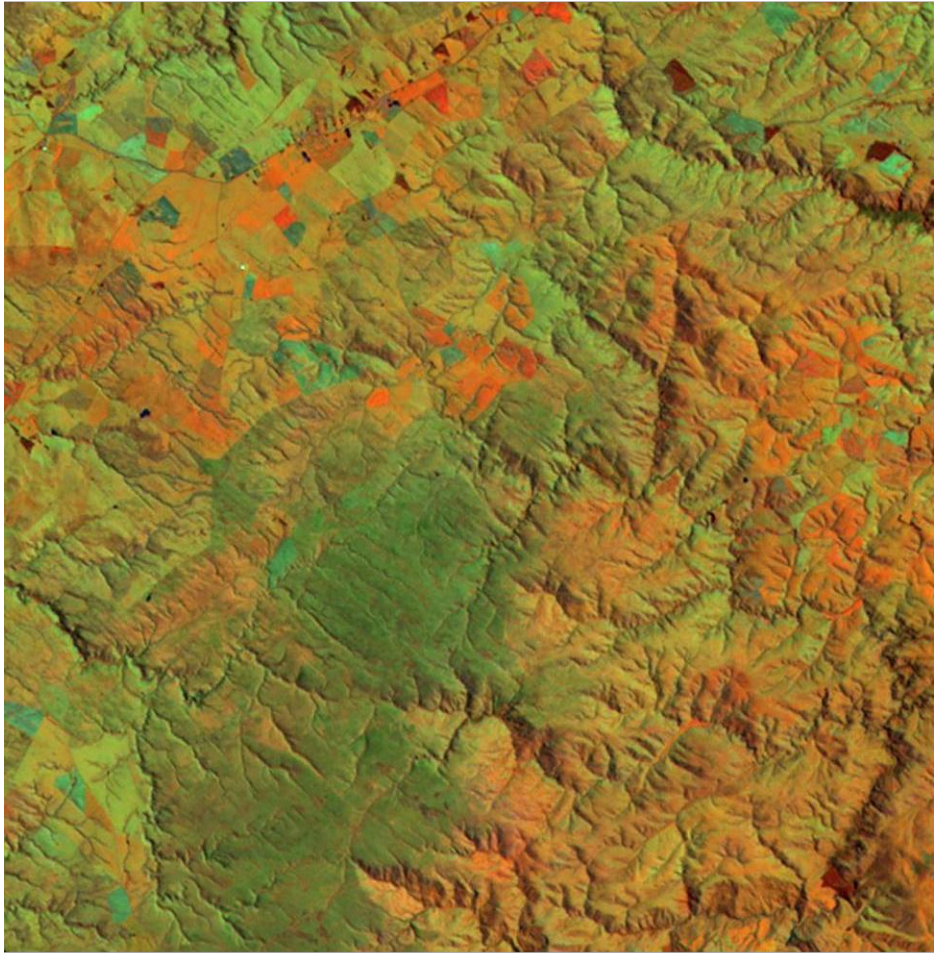
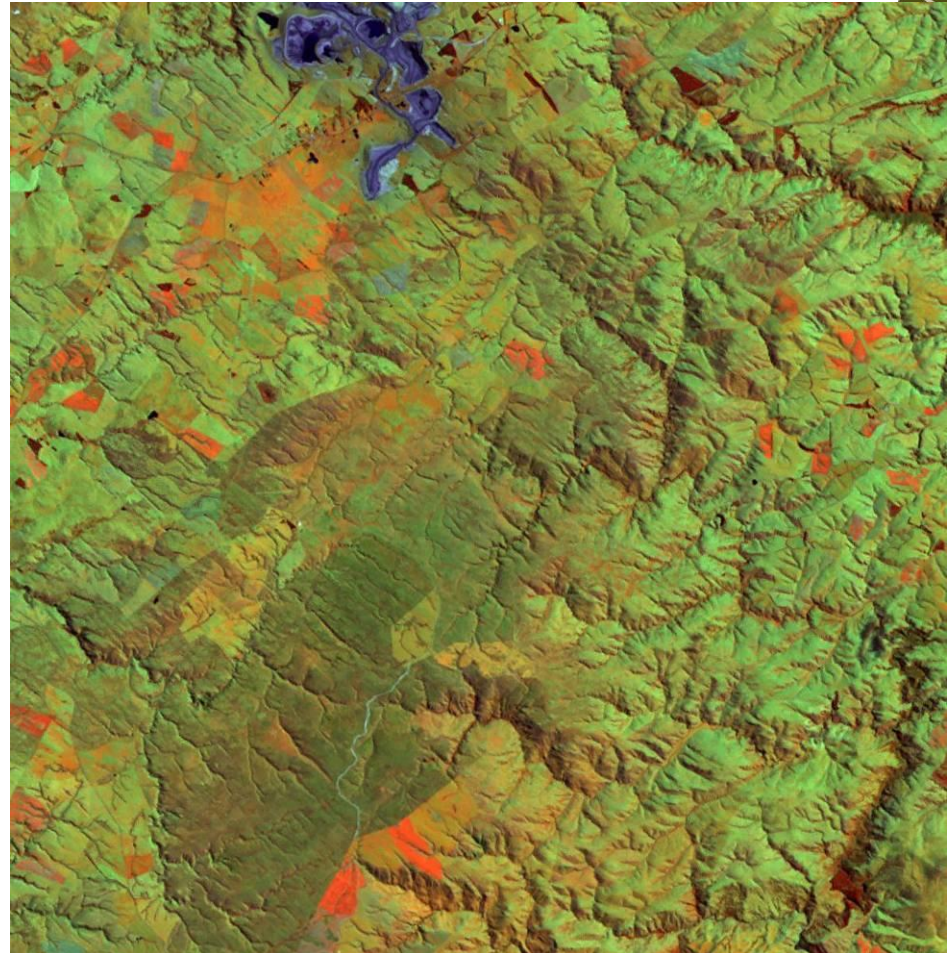


The Big Picture



1990

2003



5 km

Future of conservation pest management

1. Think beyond immediate and obvious threats
2. Understand the wider role of pests in an ecosystem context
3. Conduct pest management over appropriate scales
4. Understand the relative importance of top-down and bottom-up processes

Thankyou

