Modelling kill-trap data to optimise landscape-scale pest control

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Landcare Research
Manaaki Whenua

Pest trapping

- Undertaken for a range of pest species across large chunks of NZ
- An abundant source of data that is often not fully utilised

Managers want to know

- Effectiveness of trapping at reducing pest numbers
- Best trap and lure types
- Best way to deploy trap and lure types in space and time

However, trap-catch data must be used wisely

- Trap-catch is the number of pests removed, but it says nothing about the number remaining
- Trap-catch is usually indicative of the number of pests in the system, not the impact of trapping

- We developed a modelling method that uses trap-catch data in a way that accounts for the underlying population
- The method combines trap-catch data with a pest population model, in a ‘Bayesian’ framework

The model (Stage I)

- Bayesian logic incorporates population parameter estimates from previous studies, which are subsequently updated using the trap-catch data
- The model estimates the following parameters that best describe the observed trap-catch data:
  - population size and growth rate
  - home-range size
  - probability of capture for different trap-bait types
  - immigration rate
  - reproduction rate
  - habitat preferences

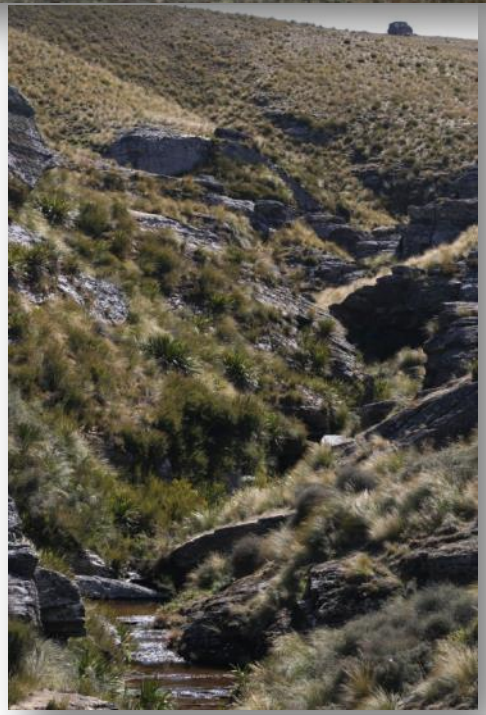
The model (Stage II)

- Simulation of different trapping scenarios on pest populations

- The biological and trapping processes are stochastic by incorporating the uncertainty in parameter estimates from the Stage I modelling

Trapping data from Macraes Flat

Macraes Flat



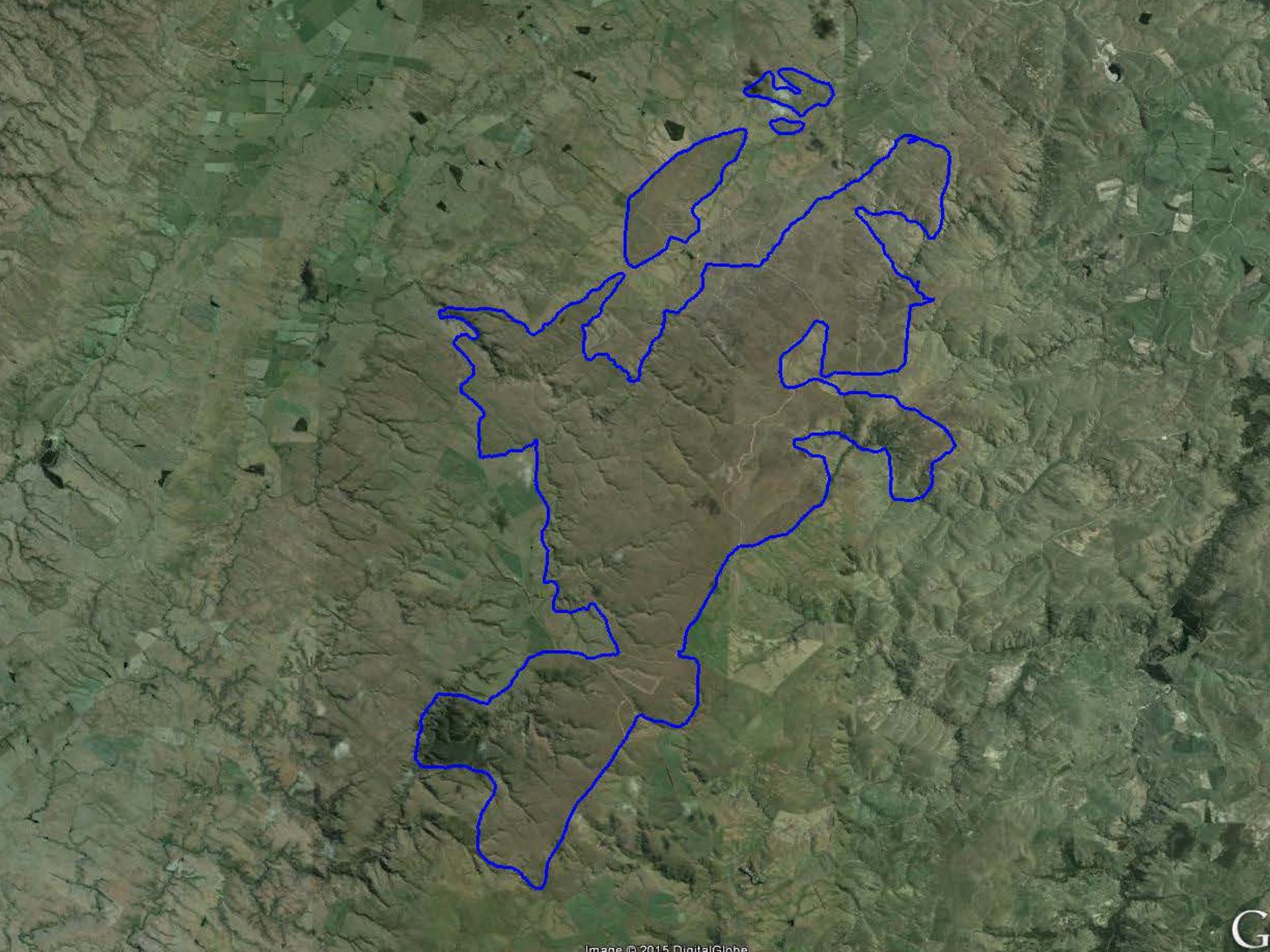
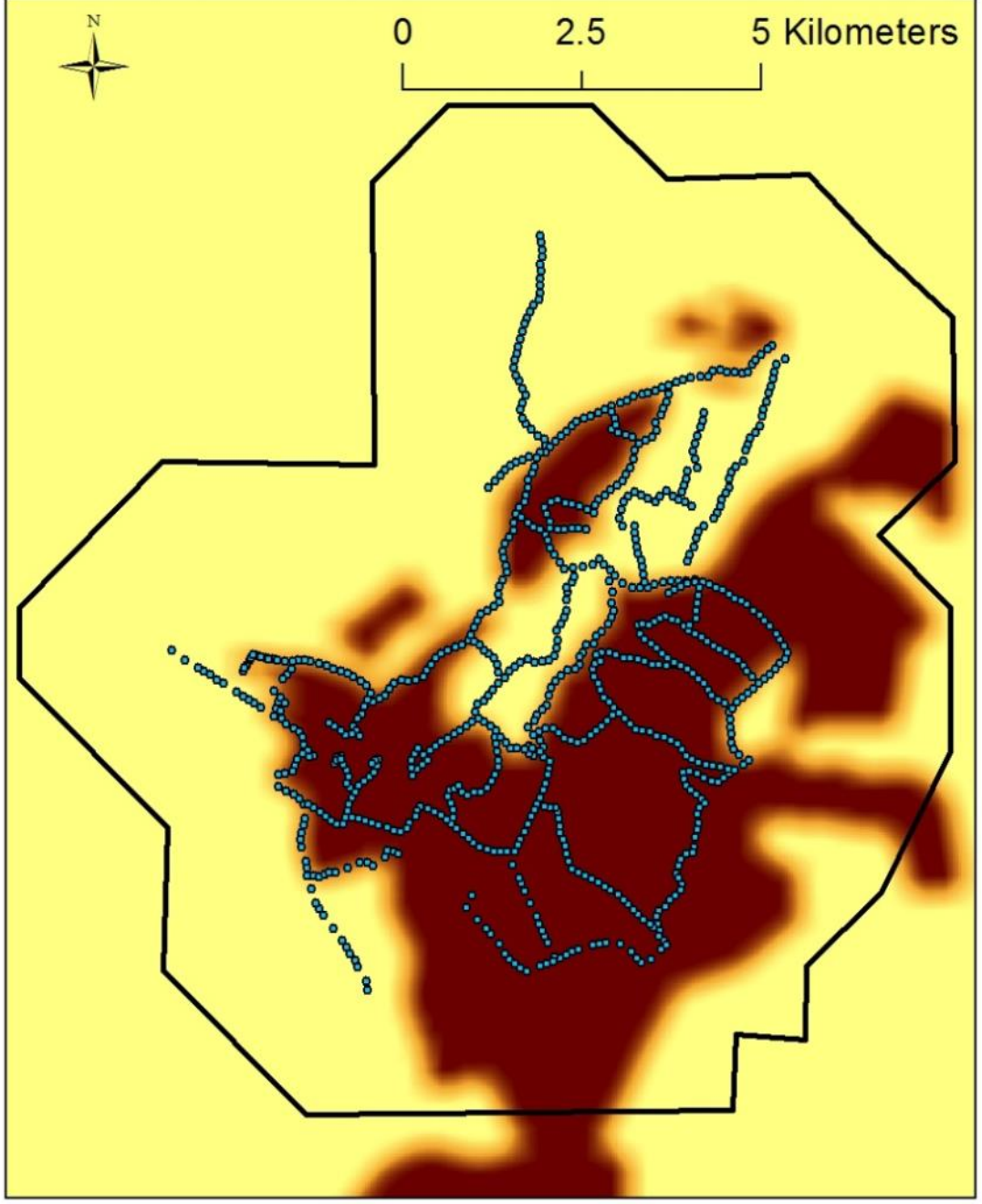
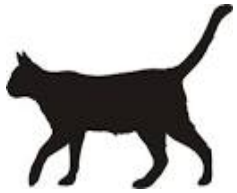


Image © 2015 DigitalGlobe


N
0
2.5
5 Kilometers

Cat data only

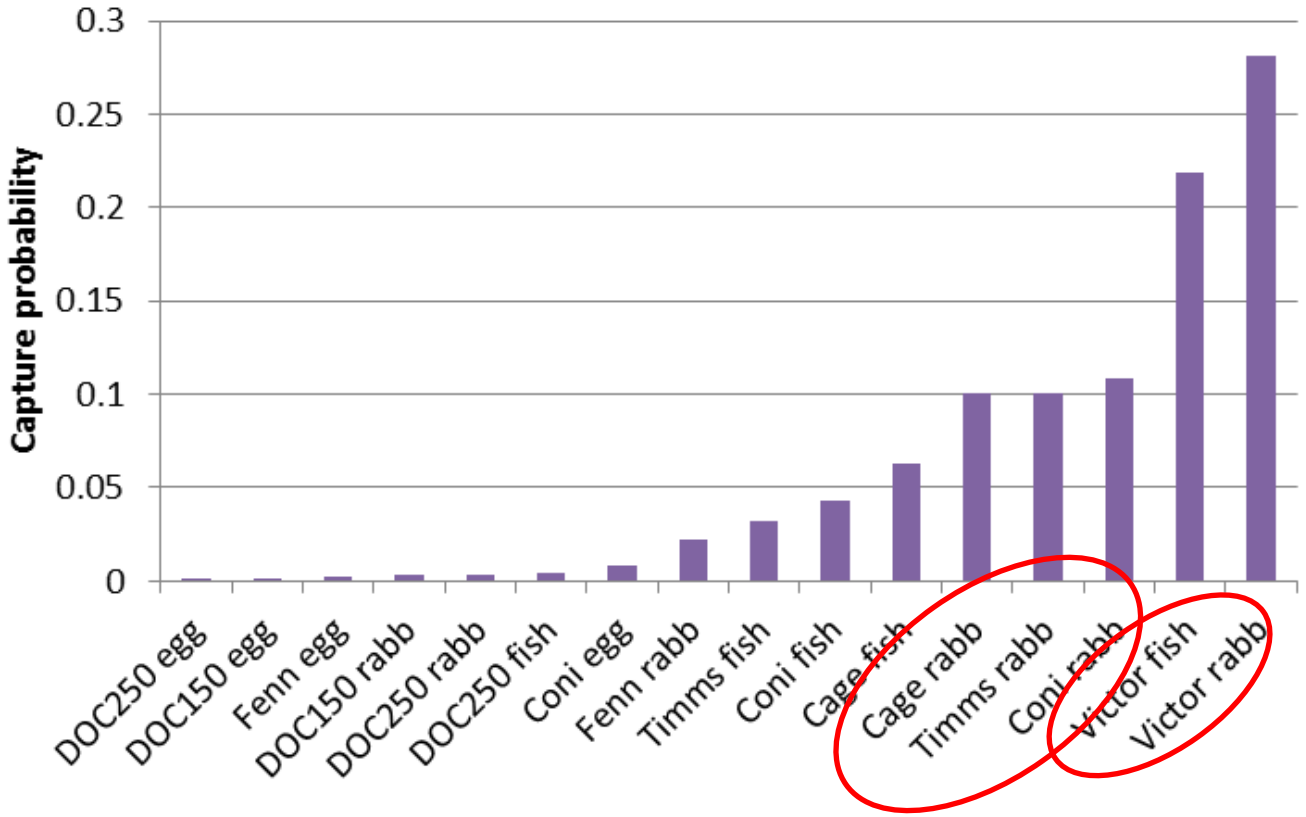


- Data collected 2005 - 2014
- 347–879 traps set over 4000 ha
- Checked weekly (victor traps daily)
- 2250 cats captured (250 per year on avge)
- 16 trap-bait combinations

	Rabbit	Fish	Egg
Cage	x	x	
Conibear	x	x	x
DOC150	x		x
DOC250	x	x	x
Fenn	x		x
Timms	x	x	
Victor	x	x	

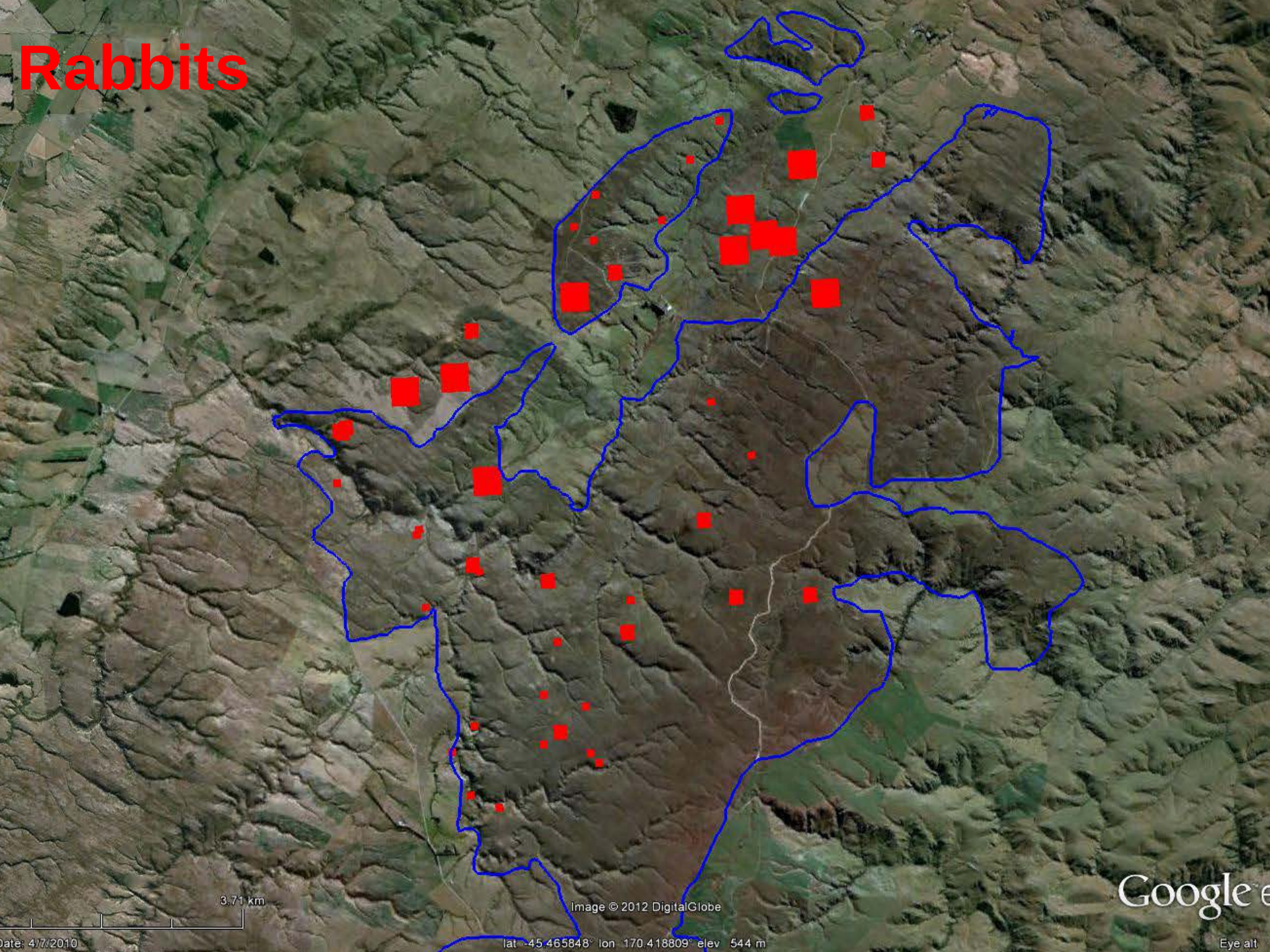
Model results

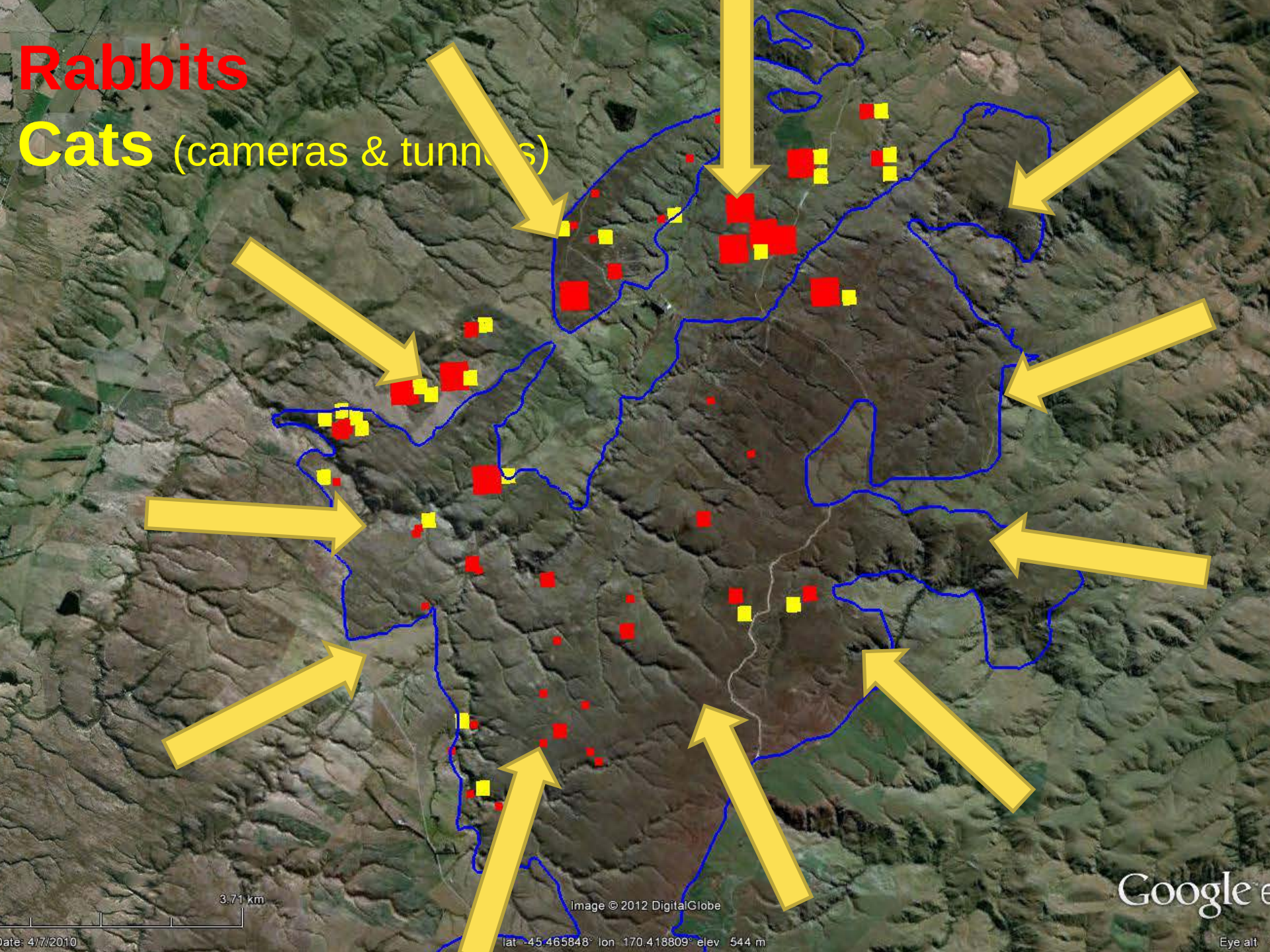
Best trap-bait combination



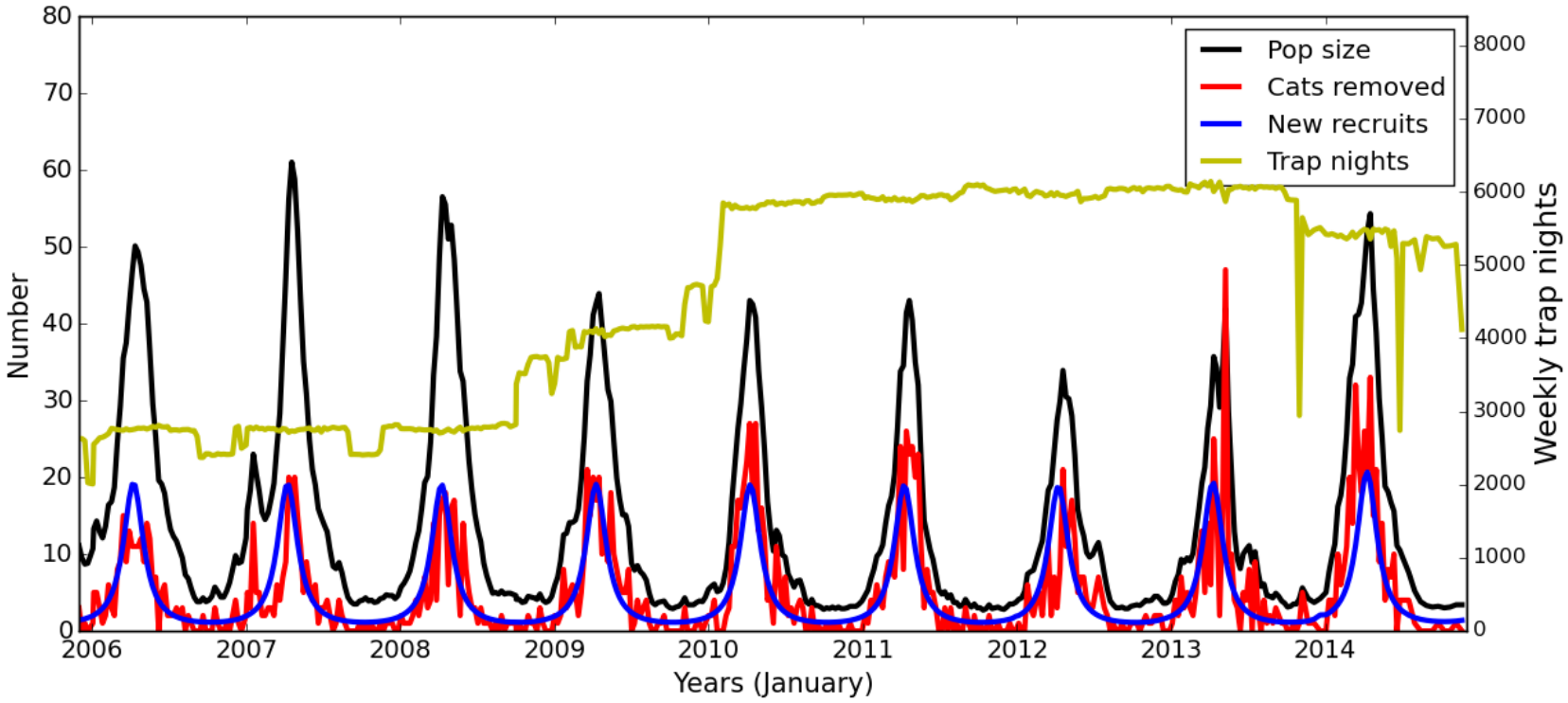
Model results
Cat ecology

- Home range size
  ~ 152 ha
- In situ breeding
  ~ 3 cats per year
- Immigration
  ~ 237 cats per year
- Distribution across landscape
  More common in open grassland vs tussock
  More common from south to north


Rabbits
3.71 km
Image © 2012 DigitalGlobe
Google
Date: 4/7/2010
lat -45.465848° lon 170.418809° elev 544 m
Eye alt

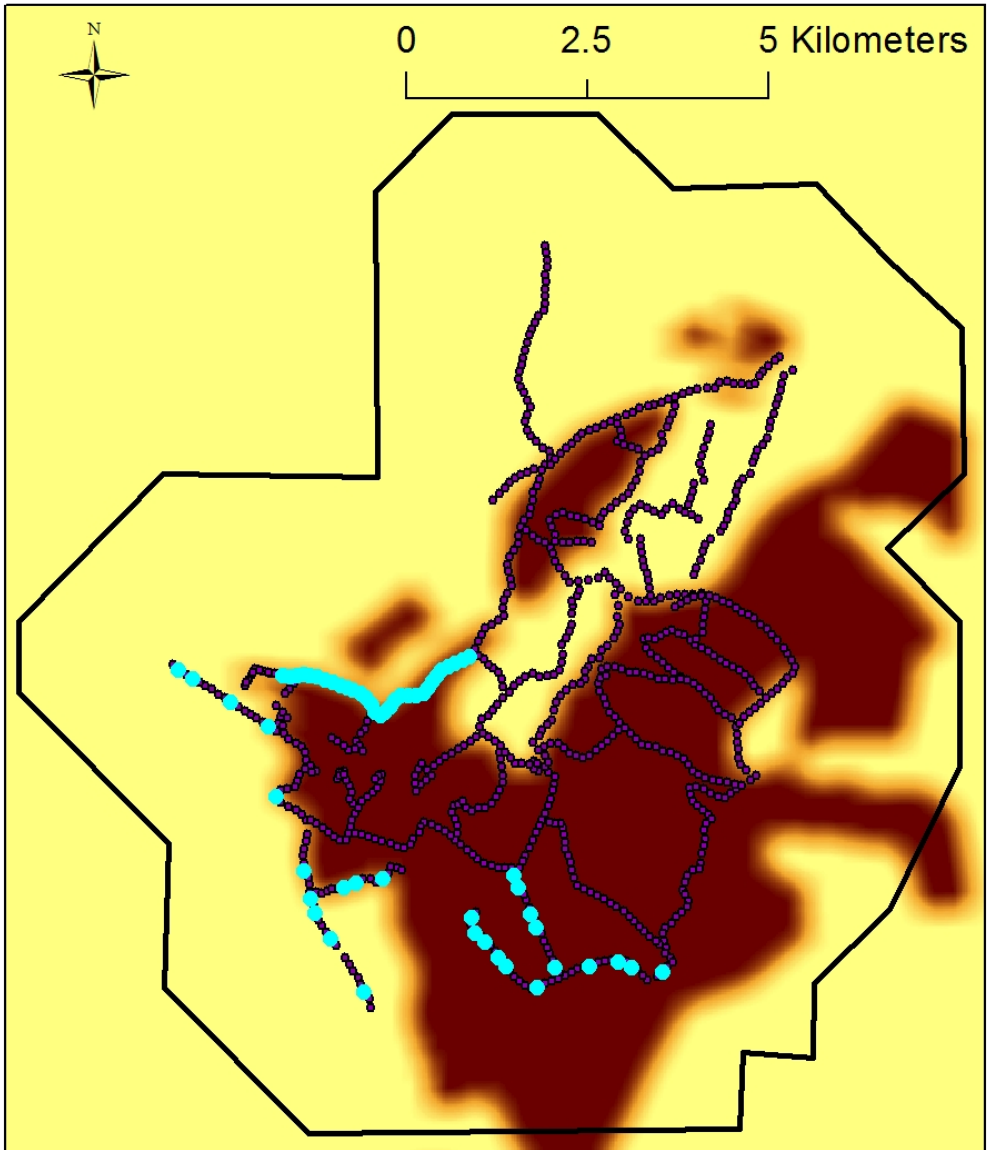

Rabbits
Cats (cameras & tunnels)
3.71 km
Image © 2012 DigitalGlobe
Google
Date: 4/7/2010
lat -45.465848 lon 170.418809 elev 544 m
Eye alt

Model results

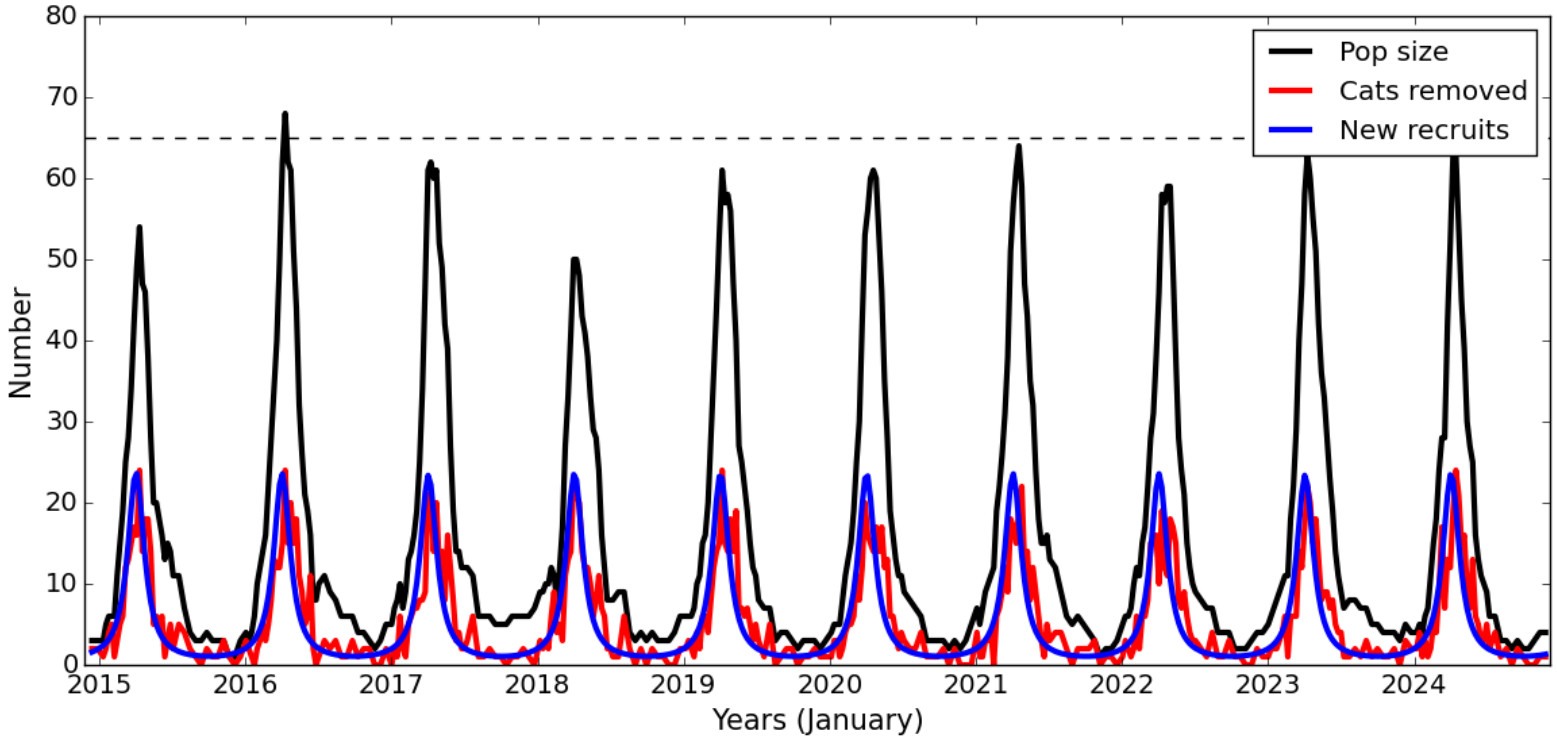


- Background population about twice that of the number removed
- Residual cat population isn't getting appreciably smaller
- Suggestion of increased trapping effect from 2009 - 2013
- Need to know the black line in the absence of control

Simulation

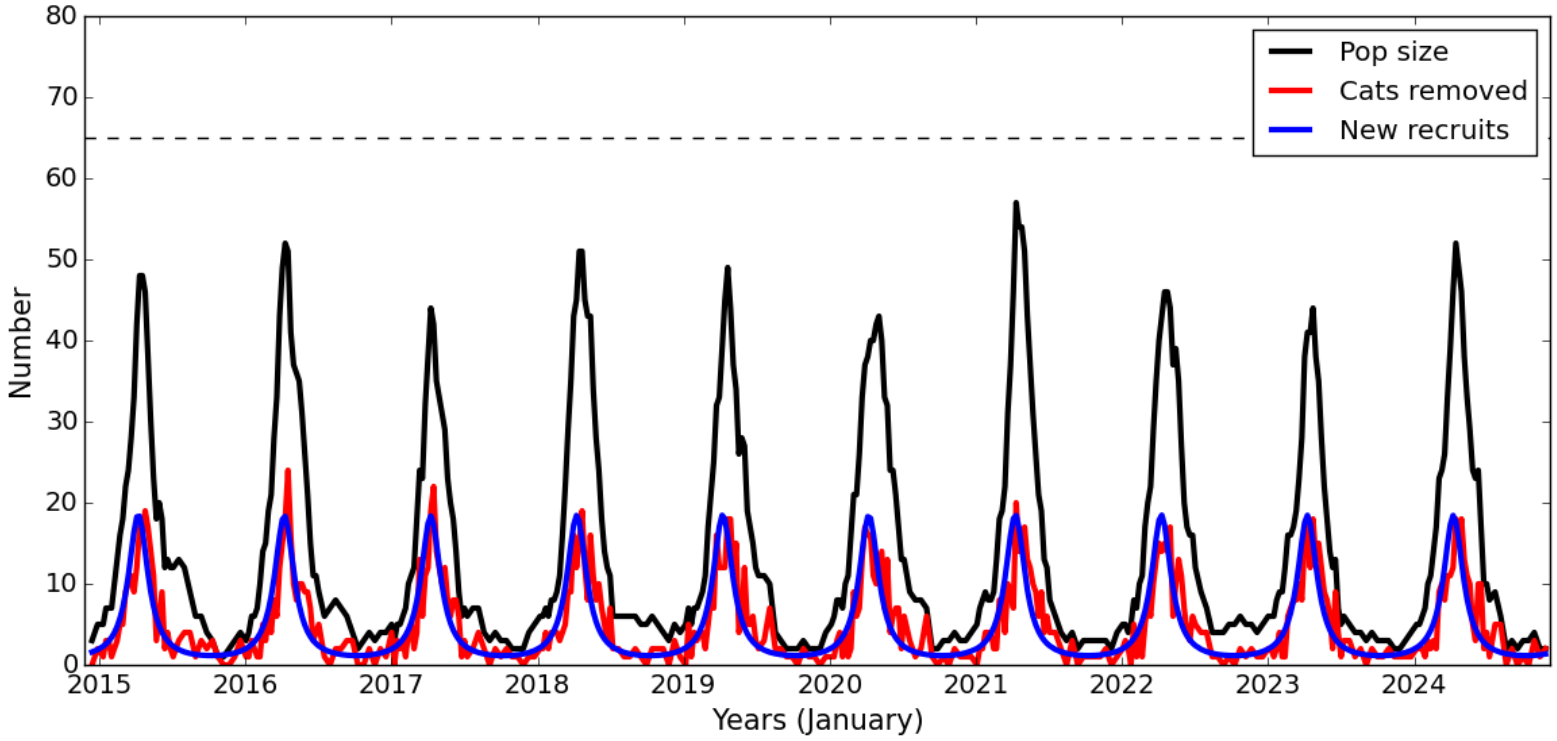


Simulation



- **Current regime**: Probability of not exceeding 64 cats = 0.69

Simulation



- **Current regime**: Probability of not exceeding 64 cats = 0.69
- **New regime**: Extra 59 kill traps. 7% increase in trap nights. Probability of not exceeding 64 cats = 0.85

Summary

- Victor traps the best
- Rabbit meat the best
- Immigration is the primary source of cats
  - Trapping should focus on perimeters
- Open habitats more preferred than tussock
  - Trapping should focus on perimeters
- Kill traps along remote borders more effective, and probably more cost-effective

Acknowledgements

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  - Andy Hutcheon, James Reardon, Patrick Liddy, John Keene
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